Social psychology of doping in sport: a mixed-studies narrative synthesis

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By the
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Disclaimer: The authors undertook a thorough search of the literature but it is possible that the review missed important empirical studies/theoretical frameworks that should be included. Also, judgement is inevitably involved in categorising papers into sample groups and there are different ways of representing the research landscape. We are not suggesting that the approach presented here is optimal, but we hope it allows the reader to appreciate the breadth and depth of research currently available on the social psychology of doping in sport.

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Executive Summary

Introduction: Even though the concept of doping in sport first penetrated the broader public consciousness on a global scale nearly three decades ago, the social sciences have been slow to enter the debate. However, a vision for prevention is emerging. In recent years the World Anti-Doping Agency (WADA) has made a growing investment in social science research, recognising the need to move beyond detection-deterrence approaches. Concerns about systematic doping, an era of austerity and the acceptance of an ever-growing scientific basis for intervention, demand the use of robust and cost-effective strategies to prevent sport doping.

Now, social scientists are more involved and the research landscape is developing rapidly. Social science is, in its broadest sense, the study of society and the manner in which people behave and influence the world around us. It tells us about the world beyond our immediate experience, and can help explain how our own society works. In the context of doping in sport, social science helps us to examine how and why athletes dope. The work of these researchers provides vital information for governments and policymakers, local authorities, non-governmental organisations and others. Insofar as doping in sport can be seen as having many human facets, this update to our 2007 review explores the contribution of social psychology to our understanding of doping in sport and considers recent empirical research alongside prevention programming.

Commissioned by the WADA, the review aims to build on the findings of our previous review by summarising the current evidence. The review focuses on (i) psychosocial correlates and predictors of doping in sport, (ii) knowledge, attitudes, beliefs and behaviours towards (anti-) doping, (iii) efficacy and effectiveness of anti-doping education programmes, and (iv) doping specific models and theories. The new mixed-studies synthesis provides researchers, policymakers and practitioners with a comprehensive summary of current progress in the field.

Method: The review was conducted in line with guidelines devised by the UK National Health Service Centre for Reviews and Dissemination. An extensive search of the literature was conducted using electronic resources, including PubMed, Ingenta, EBSCO (Academic Search Complete, Business Source Premier, CINAHL, Hospitality and Tourism Complete, LISTA, Medline, psycARTICLES, psycINFO, SportDiscus). The search strategy employed keywords for drug use in sport: 'doping', 'performance-enhancing drugs', 'performance-enhancing substances' and 'drugs AND sport' combined with selected terms relating to specific areas of interest, such as: 1) 'attitudes', 'beliefs', 'knowledge', 'perspectives', 'perceptions', 'opinions', 2) 'correlates', 'determinants', 'risk factors', 'predictors' 'precipitating factors', and 3) 'education', 'intervention', 'model', 'prevention'. The review was limited to peer-reviewed articles written in the English language and published from 1st January 2007 to 1st May 2015.

Findings: Using our inclusion criteria 212 peer-reviewed articles were considered. This equates to an annual average of 26 papers published each year, far exceeding the annual average of six papers per year in 2007. Thus the field has seen a rapid increase

in the quantity and quality of studies examining the social psychology of doping. The majority of studies examined doping correlates, as well as the knowledge, attitudes and beliefs of athlete support personnel, athletes (adolescent, elite and competitive), gym users, and the general public. Signalling the emerging nature of this area of work, only a handful of studies have progressed to present either the outcomes of anti-doping education programmes or to develop specific anti-doping theory/models.

The review identified multiple forms of deductively and inductively derived evidence. However, the heterogeneity of the studies means that definitive conclusions regarding the prevention of doping in sport remain elusive at this time. Still, consistent support was found for five main themes: (a) sport doping exists in a complex web of socio-demographic and psychosocial correlates and predictors, (b) critical incidents, both within sport and beyond, increase doping vulnerability, (c) social context and the role of reference groups – such as the coach, family, or peers – can facilitate and/or inhibit doping, (d) there is a perception that the likelihood of doping detection is low; often this is combined with deep doubts about the legitimacy of the current detection-deterrence system, (e) athletes' and athlete support personnels' exposure to formal anti-doping education appears insufficient and knowledge of anti-doping is moderate at best.

Studies examining the effects of anti-doping education programmes remain scarce; on average one study was published per year. The only anti-doping education programmes that continue to be monitored over an extended follow-up period are the US based programmes: ATLAS and ATHENA. Inevitably then, these data are limited to a US cultural context and focus on team-based sports. To-date, neither study has identified the most 'active ingredients' of the programmes in affecting specific outcome variables, particularly doping behaviour. Novel theoretical models have been proposed to explain doping initiation; these have placed a strong emphasis on integrative approaches that reflect the complexity of interactions between personal, situational and contextual factors. The capacity for field-testing of these new tenets and models has yet to be determined.

Conclusion: The field has generated momentum among researchers across the globe; they increasingly commit human and fiscal resources to furthering understanding of the complexities of doping in sport. Through their concentrated efforts there has been clear progress; their work has generated the strongest empirical evidence base that anti-doping has ever seen. Building on this offers the best chance of making profound in-roads into better programme delivery and outcomes.

However, this review once again reveals a patchy landscape with many gaps and uncertainties, particularly in relation to intervention design, delivery and evaluation. With such an absence of evidence, the requirement for undertaking multiple forms of enquiry will remain fundamental to identifying potential intervention approaches that have yet to be tried and tested.

Policy developments to prevent and detect doping in sport have moved rapidly and in advance of scientific research. This is important because policy informed by robust evidence is likely to be more effective and sustainable than that built on assumptions or 'common sense'. The lack of evidence on the effects of anti-doping interventions

remains a concern and highlights a significant need for investment. Indeed, funding will remain a priority to maintain and heighten the quality and impact of the outputs.

Future priorities: This research field is replete with important unanswered research questions. Most fundamentally, the questions span developments in theory, research methodology and anti-doping policy and practice. Regardless of specific research questions or contexts, a number of processes must be in-built to generate impact. By impact we mean directly influencing anti-doping policy and practice. This suggests the need for more researchers to address the policies and practices emerging from the new field of translational research. Here the challenge is to transfer into the sporting domain the scientific rigour that establishes the most extensively generalisable findings, while maintaining the essential features of the sporting experience and process (i.e., the local 'fit' of what the science says works). We therefore call for a systems approach.

Broadly, we need to:

1. Commit to building the science of programme implementation and sustainability in the field of doping prevention. Importantly, investments are needed to better understand the factors related to programme integration and acceptance across key stakeholders in the doping prevention landscape.

2. Ensure a greater degree of collaboration so that researchers can learn from anti-doping policymakers, practitioners and educators, and vice versa. Failure to do so will limit our ability to deliver relevant, acceptable and evidence-informed anti-doping policies. Moreover, researchers and policymakers need to collaborate with sports organisations to understand the supports and structures that are necessary to create sustainable change in prevention programming.

3. Continue to build long-term research programmes and collaborations across research teams. This will help to generate multi-site, multi-country empirical studies and establish cross-country and cross-cultural comparative data. In turn, this will enable the development and refinement of innovative, effective and culturally sensitive anti-doping programmes, models and theories.

4. Encourage inter-disciplinary and multi-sector working. The issue of doping in sport – and of doping in wider society – cannot be solved by one discipline alone. We need a systems based approach to prevention, drawing together researchers, practitioners and policymakers from a range of fields including behavioural science, neuroscience, law, education and public health.

At a more specific level there is a need to arrive at an international consensus on research priorities in the area of doping in sport. This will help to guide more meaningful and focused research. Agreement on research priorities may also help to guide funding allocations, inform evidence-based policy and direct postgraduate students pursuing higher degrees in the field.

Introduction

The field of anti-doping has embarked on a new era with the revised World Anti-Doping Code (WADC) that came into force in January 2015. The new Code requires "each Anti-Doping Organization to develop and implement education and prevention programmes for Athletes, including youth, and Athlete Support Personnel" (WADA, 2015, p.14). Article 18 of the WADC takes this one step further by stating that "All Signatories shall within their means and scope of responsibility and in cooperation with each other, plan, implement, evaluate and monitor information, education, and prevention programmes for doping-free sport (WADA, 2015, p. 96). However, as with previous versions of the Code, the discourse places the greatest emphasises on detection-deterrence with only three pages dedicated to education and prevention programming. However, it is now widely accepted that doping control protocols will always be a step behind the pharmaceutical industry and the advances in biomedicine (Kayser & Smith, 2008)

The 2015 Code places more stock on prevention and there is a move to reconcile the vagueness and misuse of the terms 'education' and 'information'. For example, the 2009 Code stated that anti-doping education should provide 'updated and accurate information', which essentially implies that education consists of giving information. However, Houlihan (2008) highlighted that giving information and educating are not the same...

> 'While the provision of information is generally a one-way process...delivered in a standard format, education is generally a two-way or collective process, involving teaching and learning (and variation in learning styles), is usually designed for the particular audience, and is seen as a long term or continuous process and relationship with [the] learner' (Houlihan, 2008, p. 63).

This assertion has seemingly resonated with the key stakeholders who consulted on the development of the new Code because clarification has been offered in the following way:

> 'Information programmes should focus on providing basic information to Athletes as described in Article 18.2. Education programmes should focus on prevention. Prevention programmes should be values-based and directed towards Athletes and Athlete Support Personnel with a particular focus on young people through implementation in school curricula' (WADC, 2015, p. 96).

Perhaps more importantly, the 2015 Code signals a shift towards mandatory education provision by signatories of the Code. It also emphasises the importance of evidence-based practice and these changes follow on from WADA's identification of education and research as strategic priorities. In 2005 the WADA initiated a Social Sciences Research Grant Programme to encourage research in the social sciences and generate the evidence base that is required to design effective programmes. Since 2005, 415 applications have been submitted for funding and the WADA have invested over $2.5 million USD across 73 projects (T.Cunningham, personal communication, 3 October 2015). In 2007, we were commissioned to undertake a literature review of peer-reviewed studies examining the social science of doping in sport. We concluded that the weak evidence base undermines strategic planning and limits the capacity to target appropriate and efficacious education programmes to abate doping in sport. This literature review offers an update to the earlier review by synthesising the research studies that have been published over the last eight years in this domain.

The aims and objectives of the narrative synthesis

In line with our previous review published in 2007, this update will provide a comprehensive overview of peer reviewed publications in the social sciences regarding (i) psychosocial correlates and predictors of doping in sport (ii) knowledge, attitudes, beliefs and behaviours towards (anti-) doping (iii) efficacy and effectiveness of anti-doping education programmes, and (iv) doping specific models and theories. The new mixed-studies synthesis provides researchers, policymakers and practitioners with a comprehensive summary of current progress in the field.

Search strategy

We searched for peer reviewed published studies that reported beliefs and attitudes of population groups towards doping, precipitating factors and doping correlates and anti-doping education and intervention programmes. The review was conducted in accordance with guidelines devised by the UK National Health Service Centre for Reviews and Dissemination. The final literature search was conducted on the 1st May 2015.

Data sources

An extensive search of the literature was conducted using the a wide range of databases, including: PubMed, Ingenta, Academic Search Elite, CINAHL, PsycARTICLES, PsycINFO, SPORTDiscus, Web of Science, ZETOC and Library Information Science and Technology Abstracts. Reviewing the bibliographies of articles identified through the database search identified additional publications. Among others, the main key words included: 'doping', 'performance-enhancing drugs', ''performance-enhancing substances' and 'drugs AND sport' combined with selected terms relating to specific areas of interest. Further details of the search strategy, including the strategy terms and inclusion criteria are shown in Appendix A. Following the searches, all results were exported into a reference manager (Endnote) and duplicates removed. Initially, LW screened titles and abstracts for obvious irrelevance; 10% were double checked by SB. In the next phase, full text versions of selected articles were obtained, and inclusion and exclusion criteria assessed. An Endnote database was set up to house the citation information and main abstract details for ease of storage, sorting and recall.

Review structure

This review is split into 11 sections. Section 1 presents a brief introduction and rationale for the review, before identifying its main objectives. Section 2 through to Section 7 provides a detailed account of empirical studies conducted across six key stakeholder groups: 1) Athlete support personnel, 2) Adolescent athletes, 3) Elite

athletes, 4) Competitive athletes, 5) Gym users, and 6) General public. Where possible these sections follow a standardised format, beginning with an overall synopsis of the studies undertaken with the specific target groups, before moving on to examine the descriptive studies focused on their attitudes, knowledge and beliefs in relation to drug use in sport and drug testing programmes. Where appropriate, the target group reviews then examine the empirical studies that have used inferential statistics to investigate the predictors of doping in sport. In Section 8 we turn our attention to the studies investigating anti-doping education programmes and interventions before reviewing the theoretical landscape surrounding doping in sport in Section 9. In Section 10 we briefly visit the science of behaviour change before offering our final conclusions and future directions in Section 11. An appendix details the search strategy of the literature review.

Athlete Support Personnel

The previous report presented the findings from two key groups of athletes support personnel (ASP). There were eight studies related to medical professionals (Green, 2006; Gupta & Towler, 1997; Laure, Binsinger, & Lecerf, 2003; Laure & Kriebitzsch-Lejeune, 2000; Panagiotis, Ourania, Christos, & Jannis, 2006; Perry, 1994; Salva & Bacon, 1991; Scarpino et al., 1990) and seven further studies exploring the knowledge and attitudes of coaches, athletic directors and other athlete support staff (e.g., managers) (Fjeldheim, 1992; Fung & Yuan, 2006; Laure, Thouvenin & Lecerft, 2001; Scarpino et al., 1990; Shields, 1995; Shirazi & Tricker, 2005; Starkey, Abdenour, & Finnane, 1994). In the previous report, the majority of the studies across both medical professionals and coaches explored general knowledge of and attitudes towards doping. The evidence base indicated that the majority of coaches and medical professionals report a negative attitude towards doping, including its ethical position and its potential to negatively impact upon athlete health. In general, ASP often perceived they had poor knowledge and a large proportion of ASP felt inadequately trained to engage in anti-doping actions. A need for further education and support to facilitate ASP anti-doping efforts in the future was therefore highlighted. Ensuring that ASP are effectively equipped to undertake their prescribed Code responsibilities is crucial given that both coaches and medical professionals are faced with doping-related issues in their work.

Updated searches revealed that only a small volume of further research has been conducted with coaches, medical professionals and other ASP groups over the last eight years (N=21). Therefore, all data related to ASP will be discussed together in this section. A brief descriptive overview of each study can be found in Table 1.

Geographical spread

Twenty-one studies included ASP[1]. Six were conducted in Australia (Dunn, Thomas, Swift, Burns, & Mattick, 2010; Mazanov, Backhouse, Connor, Hemphill, & Quirk, 2013; Mazanov & Huybers, 2010; Moston, Engelberg, & Skinner, 2014a, 2014b; Thomas, Dunn, Swift, & Burns, 2011) and three in Croatia (Rodek, Sekulic, & Kondric, 2012; Sajber, Rodek, Escalante, Olujić, & Sekulić, 2013) or Croatia and Serbia (Mandic, Peric, Krzelj, Stankovic, & Zenic, 2013). The remaining studies were undertaken in Austria (Blank et al., 2013), Belgium (Sefiha, 2012), Canada and the USA (Sullivan, Feltz, LaForge-MacKenzie, & Hwang, 2015), Ireland (Woods & Moynihan, 2009), India (Bhagirathi, 2009), Iran (Seif Barghi, Halabchi, Dvorak, & Hosseinnejad, 2015), Japan (Saito et al., 2013), Slovenia (Auersperger et al., 2012), Spain (Morente-Sanchez & Zabala, 2015) and Turkey (Ozbek, 2013). Ohl and colleagues (2013) considered the role of ASP in the socialisation of young cyclists across Belgium, France, and Switzerland and Aubel and Ohl (2014) presented a multinational perspective when analysing the operation of 10 professional cycling teams in the first (Pro teams) and second (Continental pro) world divisions through their project with the Union Cycliste Internationale (UCI).

Sample

The composition of the samples varied across the studies. Twelve studies comprised of ASP and athletes (Aubel & Ohl, 2014; Dunn et al., 2010; Mandic et al., 2013; Morente-Sanchez & Zabala, 2015; Moston et al., 2014a, 2014b; Ohl et al., 2013; Rodek et al., 2012; Sajber et al., 2013; Sefiha, 2012; Seif Barghi et al., 2015; Thomas et al., 2011), three studies included mixed samples of ASP (Bhagirathi, 2009; Mazanov et al., 2013; Mazanov & Huybers, 2010), one study examined coaches and applicants partaking in sport agility examinations for entry onto a university Sport and Physical Education course (Ozbek, 2013). A further three studies consisted of medical professionals, such as Pharmacy students (Saito et al., 2013), General Practitioners (GPs) (Woods &

[1] It is important to acknowledge that 178 coaches were included in a study by Morente-Sánchez and colleagues (Morente-Sanchez, Femia-Marzo, & Zabala, 2014). This study's sole aim was to adapt and validate the Spanish version of the Performance Enhancement Attitude Scale (PEAS). However, the findings were presented in aggregate form so cannot be included in this section; as analysis was not conducted across the independent data sets.

Moynihan, 2009) and both GPs and Pharmacists (Auersperger et al., 2012). One study focused on coaches only (Sullivan et al., 2015), with the final study focusing on parents only (Blank et al., 2013).

Average sample size was 192 individuals per study, although, the size of samples was variable, ranging from 10 coaches (Ozbek, 2013) to 883 parents (Blank et al., 2013). Of the studies reporting gender statistics, four had a balance of males and females (Blank et al., 2013; Mazanov et al., 2013; Mazanov & Huybers, 2010; Woods & Moynihan, 2009), six were male-dominated (>70%) (Moston et al., 2014a, 2014b; Ozbek, 2013; Rodek et al., 2012; Sajber et al., 2013; Sullivan et al., 2015) and two were dominated by females (Auersperger et al., 2012; Saito et al., 2013). It is not possible to provide an accurate average age of participants across the studies, as the necessary data were not available. However, a reasonable estimate would be 40 years old. Five studies did not give specific details regarding the composition of their final participant sample (Aubel & Ohl, 2014; Bhagirathi, 2009; Ohl et al., 2013; Sefiha, 2012; Seif Barghi et al., 2015). For example, Aubel and Ohl (2014) interacted with 10 professional cycling teams and planned to undertake eight qualitative interviews with the team manager, sport directors (x2), trainer or head of performance, riders (x2), physician or head of medicine, and the sponsor. Not all these personnel were available for interview in every team so in total they conducted 72 interviews. In addition, they conducted group interviews with three groups of 23 to 25 sport directors.

Methods

All studies utilised a cross-sectional design and self-report questionnaires were the dominant data capture method. Four studies extended our understanding through the introduction of semi-structured interviews, focus groups and observations (Aubel & Ohl, 2014; Mazanov & Huybers, 2010; Ohl et al., 2013; Sefiha, 2012), and 'big data'[2] (historical records collected by the UCI on rider transitions, performance, etc.[3]) (Aubel

[2] Defined as extremely large data sets that may be analysed computationally to reveal patterns, trends, and associations, especially relating to human behaviour and interactions.
[3] They collated four independently compiled quantitative databases established each year by the UCI: the file of punished riders (2005-2012); season results race by race for all professional riders (2010-2012); files describing demographics and employment of 2,351 professional riders" (2005- 2012); and a database describing teams (2005-2012).

& Ohl, 2014). In terms of the questionnaires used, one study (Sullivan et al. 2015) developed and validated a psychometrically robust scale to assess coaches' doping confrontation efficacy. While several researchers devised their own questionnaires, three studies (Auersperger et al., 2012; Blank et al., 2013; Woods & Moynihan, 2009) used measures that had been developed within, or based on, previous research by Laure (Laure et al., 2003; Laure & Kriebitzsch-Lejeune, 2000). Similarly, Morente-Sanchez and Zabala (2015) used Petróczi's (2002) Performance Enhancement Attitude Scale (PEAS). Both Sajber et al. (2013) and Mandic et al. (2013) used the same instrument.

Although questions posed across the studies varied, common areas of interest included knowledge and awareness of doping (Auersperger et al., 2012; Bhagirathi, 2009; Blank et al., 2013; Mandic et al., 2013; Morente-Sanchez & Zabala, 2015; Moston et al., 2014b; Rodek et al., 2012; Saito et al., 2013; Sajber et al., 2013; Seif Barghi et al., 2015), including substances on the banned list (Rodek et al., 2012; Seif Barghi et al., 2015), risk and protective factors (Mazanov et al., 2013), rules and regulations (Mazanov et al., 2013; Seif Barghi et al., 2015), and doping control processes (Mandic et al., 2013). Studies also explored attitudes and opinions towards doping and performance enhancement (Auersperger et al., 2012; Blank et al., 2013; Mazanov et al., 2013; Morente-Sanchez & Zabala, 2015), including ethical beliefs and practice (Mazanov et al., 2013), perceived incidence of drug use (Moston et al., 2014b), and perceptions of deterrents to PED use (Dunn et al., 2010; Moston et al., 2014a; Thomas et al., 2011). Beyond this, research investigated experiences with regard to doping/use of drugs (Auersperger et al., 2012; Morente-Sanchez & Zabala, 2015; Saito et al., 2013), sources of doping-related information (Rodek et al., 2012; Sajber et al., 2013; Seif Barghi et al., 2015), ideas for future anti-doping practices (Seif Barghi et al., 2015), and training requirements (Woods & Moynihan, 2009). Ohl et al. (2013) and Sefiha (2012) employed an ethnographic approach in order to understand how the interactions between athletes and support personnel in sport determine the reported attitudes towards doping and doping control. A feature of these two studies was to explore the legitimacy of current anti-doping policy and practice, along with the techniques used to neutralize doping behaviours. Also focused upon the professional

sport of cycling, Aubel and Ohl (2014) explored doping risk through three key dimensions: (1) structural factors, mainly a "political economy" dimension, that influence the precariousness of cyclists; (2) the consequences for working conditions offered to professional cyclists and (3) the specific team culture of training that is at the core of riders' everyday experiences. This study emerged from a project funded by the UCI with a view to changing its anti-doping policy.

The range of research questions addressed and the diversity of the sample composition makes it difficult to directly compare findings. However, results are summarised under broad themes of interest in order to stimulate ideas for future systematic investigation.

Table 1. Overview of descriptive studies examining the doping knowledge, attitudes and beliefs of athlete support personnel.

Authors (year)	Country	Sample	Methods	Summary
Aubel & Ohl (2014)	**Multinational**	**Cycling Team Personnel** (N not disclosed) (Inc. team manager, sport directors, trainer or head of performance, two riders, the physician or head of medicine, and the sponsor)	**Cross-sectional** (Semi-structured interviews; secondary analysis of UCI data) 72 interviews conducted across 10 professional teams	• Risk of doping varies according to three main dimensions: (1) structural factors, mainly a "political economy" dimension, that influence the precariousness of cyclists; (2) the consequences for working conditions offered to professional cyclists: and (3) the specific team culture of training that is at the core of riders' everyday experiences. • Financial accounts and career transition statistics point to the structural precariousness of employment in the professional sport, together with the vulnerability of the business model of the teams, increases the pressure on riders and their employers.
Auersperger, Topič, Maver, Pušnik, Osredkar & Lainščak (2012)	**Slovenia**	**133 General Practitioners (GPs) and 71 Pharmacists (N=204)** Response rate = 21% ~70% female 78% between age range 36-55 years old	**Cross-sectional (**Questionnaire, 59 items, based on the work of Laure 2000, 2003) [Key Themes: Attitudes, level of knowledge and experience with regard to doping]	• 8.4% reported personally knowing an athlete using doping agents. • Overall, 12% (8.7% GPs, 19.3% pharmacists) reported being directly confronted with a request for prescription of doping agents in the previous 12 months. • 37% of GPs and 46% of pharmacists had been approached for information about doping in the last 12 months, including their opinion on using products for enhancing performance (29%), as well as aiding recovery processes (24%), shortening recovery time after injury (16%), and side effects/health risks (21%). • Fewer than half (39% GPs vs. 48% pharmacists) of respondents were familiar with the formal definition of doping. Similarly, the abbreviation WADA was correctly interpreted by 42% (33% vs. 59%, p = 0.003). • More GPs than pharmacists agreed they have a role to play in doping prevention (69% vs. 31%, p = 0.005), similar proportions considered themselves to have sufficient knowledge of prevention initiatives (65% vs. 35%, p = 0.369). This is despite only 30% of respondents (60% of GPs and 40% of pharmacists) having been offered specific training on doping. • 59% felt legally obliged to report suspicions or case initiatives, including 56% of GPs and 44% of pharmacists.
Bhagirathi (2009)	**India**	**Coaches; PE teachers; Sports physiotherapists; Doctors** (N=not stated)	**Cross-sectional** (Questionnaire) [Key Themes: Knowledge and awareness]	• 54% were aware of the WADA banned substance list. • 53% were aware of Therapeutic Use Exemptions (TUEs). • 59% were unaware of the testing methods employed by WADA. • Interchangeable use of the terms 'awareness' and 'knowledge' is problematic in this study.
Blank, Leichtfried, Schaiter, Furhapter, Muller & Schobersberger (2013)	**Austria**	**883 parents of junior athletes** (aged 14-19 years) Response rate = 24.3% 46% males: Mean age = 45.95±4.98	**Cross-sectional** (Questionnaire, adapted from published surveys including Laure et al, 2004) [Key themes: Knowledge and attitudes of parents towards doping]	• 18.8% reported that they felt poorly informed, 45.5% felt moderately well informed and 31.4% felt well informed to very well informed. • 68.2% scored 80% or over on the general doping knowledge survey and 34.4% in knowledge of the side effects of doping in particular. • Male parents demonstrated significantly better knowledge about doping and its side effects and were more likely to be influenced by their own sporting careers and amounts of sports activities per week when compared to female parents. • 51.6% sought information from the Internet and 23.7% had used WADA/NADO hotlines for information.

Table 1 Continued.

Authors (year)	Country	Sample	Methods	Summary
Dunn, Thomas, Swift, Burns & Mattick (2010) Same sample as Thomas, Dunn, Swift & Burns (2011)	**Australia**	**26 Key Experts (KEs)** (N=7 retired athletes, N=5 academics, N=3 team managers, N=2 high performance managers, N=2 player association managers, N=2 head coaches, N=2 welfare managers, N=1 executive officer, N=1 national sport coordinator, N=1 team medical officer) 974 elite athletes also surveyed	**Cross-sectional** [Telephone interview] [Key themes: Perceived legitimacy of drug testing; testing as a deterrent]	• The majority of KE (n = 21) believed that drug testing was an effective deterrent to illicit drug use. Of those KE who believed that drug testing was effective, many felt that in-competition testing was more successful in deterring athlete use than out-of competition testing. • Five KE felt that the current policies in their sport were not adequate and felt that penalties should be more severe. Eleven KE believed that punishment severity was sufficient in their sport and two felt the penalties for being caught with an illicit drug should be less severe. The majority of the KE believed that there should be separate policies for ID and PED.
Mandic, Peric, Krzelj, Stankovic & Zenic (2013)	**Croatia & Serbia**	**28 Coaches** Mean age = 30.8 ±5.26 years of age Competitive athletes (N=82, 17.2±1.92 years of age) Response rate = 99%	**Cross-sectional** (Questionnaire) [Key themes: Knowledge of sports nutrition and doping, particularly prohibited substances and the doping control process]	• Coaches scored higher than their athletes on knowledge of both doping and nutrition. • Knowledge was greater among coaches who were more experienced (and older). • The coaches with higher knowledge of doping were more convinced that doping occurs in synchronised swimming. • Two-thirds of coaches declared self-education as the primary source of information about doping and sport-nutrition, with 21% reporting formal education. • 71% of coaches reported that they would not suggest doping usage, but 11% reported that they would suggest doping if they were convinced that it would help their athlete and have no negative health implications.
Mazanov & Huybers (2010)	**Australia**	**12 Athlete Support Personnel** **Coaches** (M: 3, F: 1)**, trainers, sports administrator** (M: 1)**, physiotherapists** (M: 1, F: 3)**, sports nutritionists** (F: 2) **and sport scientist** (M: 1) Athletes (M: 4, F: 4)	**Cross-sectional** (Semi-structured interviews) [Key themes: Risk and protective factors for doping, including factors categorised as performance, penalty, health, social and substance]	• One coach commented that those 'on the cusp of making it' were vulnerable to doping, as well as individuals for whom 'sport is all they have'. • One international athlete manager felt that athletes who dope to recover from injury might not feel that they are cheating. • Primary prevention of doping may be enhanced by timing it around periods of career instability, particularly when financial (e.g., salary stipend) and non-financial (e.g., training facilities) sponsorship is at stake.

Table 1 Continued.

Authors (year)	Country	Sample	Methods	Summary
Mazanov, Backhouse, Connor, Hemphill & Quirk (2013)	**Australia**	**292 Athlete support Personnel** 54% Male Mean age = 40.2 years Mean years experience in support role = 16.8	**Cross-sectional** (Questionnaire) [Key themes: Knowledge of anti-doping rules, attitudes toward performance enhancement and ethical beliefs and practice]	• Knowledge scores varied between 26 and 31 out of 35. Physicians were most knowledgeable (31/35), with family members (26), trainers (26) and nutritionists (27) the least. • Knowledge was lowest in relation to obligations of ASP under the WADC (54% to 72%, n=142 valid). • Linear regression showed that being a sports physician, providing support at the elite level, and 15 years of experience influenced anti-doping knowledge. • 27% of respondents had provided advice to athletes about anti-doping without reading the WADC. • ASP had a slightly negative attitude toward performance enhancement. This was reinforced with findings that 96.1% of respondents would 'never' encourage an athlete to dope to facilitate recovery from injury and 98% of respondents would not pressure an athlete to dope to retain sponsorship. • Despite this, some individuals reported ignoring unethical behaviour of other ASP (31.5%). 77.3% of respondents also reported 'never' talking about athlete doping with other ASP.
Morente-Sánchez & Zabala (2015)	**Spain**	**N=101 coaches** (COA), **N=68 physical trainers** (PT) and **N=68 technical staff** (RTS, including individuals such as physiotherapists, doctors, and psychologists) (N=237) Mean age = 34.45 ± 8.59 years N=88 football teams that ranged from elite to under-18 categories.	**Cross sectional** (Questionnaire: PEAS) [Key themes: Attitudes, personal use of supplements and banned substances, knowledge of WADA and the prohibited list, reasons for doping and agents responsible for doping, doping prevalence across sports, and proposed solutions for tackling doping].	• Mean PEAS score across all ASP was 31.64 ± 10.77; with **no significant differences** across groups (COA, 31.91 ± 11.42; for PT, 31.28 ± 9.44; and for RTS, 31.58 ± 11.18). • Over half of the respondents (57.6%) did not know the meaning of WADA, with the COA group showing the lowest proportion of people with this knowledge (25.3%) compared to PT (60.9%) and RTS (50.0%). • In total, 84.9% of respondents did not know the prohibited list, again, with COA demonstrating the least number of people holding this knowledge (6.1%) compared to PT (19.7%) and RTS (23.9%). • Approximately 87% of ASP reported that doping receives "differential treatment among sports" with cycling considered most affected (62.6%) and team sports least affected (27.2%, with football at 15%). • Overall, 39.2% of ASP had used/recommended supplements. • Perhaps more importantly, individuals in all three categories of ASP had used banned substances; COA - 8.1%, PT - 6%, and RTS - 1.5%. • Approximately 30-35% of all ASP knew someone who had used banned substances and between 14 and 16% of ASP had seen people inciting others or being incited to use them. • Across the total sample, the three most common individuals reported as agents responsible for doping were doctors (33%), players (11%), and coaches (10%). • Going forward, the sample proposed three solutions to combat doping in sport: 'more controls' (24.2%), 'prevention beginning at earliest ages' (6.4%), and 'education-awareness' (6.4%). • The authors concluded that 'the dangerous lack of knowledge highlights the necessity for anti-doping education and prevention programmes for all football stakeholders, not just athletes'.

Table 1 Continued.

Authors (year)	Country	Sample	Methods	Summary
Moston, Engelberg & Skinner (2014a)	**Australia**	**92 Coaches*** Mean age = 37.8 years (SD = 13.68) 76% male *Elite athletes (n = 488)*	**Cross-sectional** (Questionnaire [Online and printed]) [Key themes: Doping deterrents anti-doping policy].	• Overall deterrence scores (calculated certainty × severity, with a possible range from 0 to 100) were generally clustered around the mid-point, with coaches expressing particularly sceptical views about the deterrent effect of legal sanctions (M = 38.49). • The highest deterrence rating was the threat of material loss amongst athletes (M = 65.17). Coaches again clustered around the mid-point for material loss (M=54.51). • Coaches consistently saw the deterrence value of both forms of sanction as less effective than the athletes (P<0.05). • Coaches (47.8% agreement) were more likely than athletes (32.9% agreement) to endorse penalties for coaches when an athlete is found to have used PEDs • Coaches (43.5%) and athletes (43.9%) held similar thoughts about the criminalisation of doping • 73.9% of coaches 'agreed' or 'strongly agreed' that the problem of PEDs in sport was serious. • Both athletes (97.9%) and coaches (100.0%) shared the view that the athlete was responsible for doping.
Moston, Engelberg & Skinner (2014b)	**Australia**	**92 Coaches*** Mean age = 37.8 years (SD = 13.68) 76% male *Elite athletes (n = 488)*	**Cross-sectional** (Questionnaire [Online and printed]) [Key themes: Perceived incidence of doping].	• Coaches perceived incidence of performance enhancing drug use across all sports was 20.90% (SD: 20.02), but 9.97% (SD: 15.86) for their own sport. • Perceived incidence of illicit (recreational) drug use across all sports was 28.01% (SD: 19.16) and only 22.28 (SD: 19.75) in their own sport. • The authors combined athletes' and coaches' responses and found that the sport with the highest self-perceived incidence of performance enhancing drug use was cycling (estimated at 33.3%). In contrast, perceived performance-enhancing drug use in AFL was very low (estimated at only 3.8%). • For recreational drug use the sport with the highest self-perceived incidence was rugby union (estimated at 31.4%), with rowing offering the lowest incidence estimates (11.5%). • The majority of athletes and coaches (74.1%) estimated that performance-enhancing drug use was higher in all sports, compared to their own.
Ohl, Fincoeur, Lentillon-Kaestner, Defrance & Brissonneau (2013)	**France, Belgium, Switzerland**	**Coaches (n=6), Physicians (n=5), Team managers (n=10) Journalists or policy-maker (n=5)** (& 22 recently professional cyclists, 22 retired cyclists)	**Cross-sectional** (Qualitative semi-structured interviews & observations) [Key themes: Socialisation of young elite cyclists; economic, legal and organisational conditions]	• From the paper, it is very difficult to decipher the voice of the coach, or other athlete support personnel, so specific data cannot be summarised here.

* Same sample

Table 1 Continued.

Authors (year)	Country	Sample	Methods	Summary
Ozbek (2013)	**Turkey**	**10 Male Coaches** 148 University students (67% male)	**Cross-sectional** (Mixed method: Questionnaire & Interview) [Key themes: Opinions; Doping tests; Entry examinations PE college].	• 80% of coaches stated that they did not give any performance-enhancing drugs to candidates they coached. • 70% of coaches expressed that their trainees might be doping without their knowledge. • 50% stated that they received requests for doping • 70% were against motivating candidates by using a placebo passed off as a doping substance. • 60% thought that other coaches might have doped their trainees, 40% thought otherwise. • 90% of coaches stated that candidates of schools of physical education and sports should undergo doping tests.
Rodek, Sekulic & Kondric (2012)	**Croatia**	**34 Sailing Coaches** 97% Male Mean age = 37 ± 11.7 years [Study also include 44 Elite Sailors)	**Cross-sectional** (Questionnaire of Substance Use, QSU) [Key themes: Knowledge and opinions of doping-related factors]	• Coaches reported being well aware of the nutritional supplement (NS) practice of their athletes and 59% of coaches personally consumed NS. • The self-assessed knowledge regarding doping issues tends to be below average, with 38.2% coaches reporting poor knowledge • 14.7% of coaches favour lifelong suspension of a doping athlete, with 52.9% favouring a milder first time punishment and a lifelong ban for a second offence. • Athletes and coaches share opinions about the occurrence of doping in sailing with only 26.5% agreeing that doping does not occur in sailing. • There were no significant difference between athletes and coaches in any of the doping factors.
Sajber, Rodek, Escalante, Olujić & Sekulic (2013)	**Croatia**	**22 Coaches** 82% Male Mean age = 37 ± 7.8 years Junior and senior-level competitive athletes (N=55, F: 24, M: 31, 20.3±2.2 years of age) Response rate = 99%	**Cross-sectional** (Questionnaire) [Key themes: Knowledge of nutrition (KSN) and doping (KD); Source of information].	• 50% of athletes identified their coaches as the primary sources of knowledge about nutrition and doping. • Coaches had greater knowledge scores for both KSN and KD when compared to athletes. • Coaches' knowledge was strongest in relation to doping regulations and procedures, and weakest with regard to specific substances. • Coaches' main sources of information about doping and sport nutrition were formal education (50%) and self-education (41%). Notably, coaches who possess higher formal education scored better on KD. • 64% of coaches agreed with lifelong penalties for doping, 18% agreed with a milder punishment for a first time offence and lifelong suspension for second offence, and 18% believed there should be a financial punishment.

Table 1 Continued.

Authors (year)	Country	Sample	Methods	Summary
Saito, Kasashi, Yoshiyama, Fukushima, Kawagishi, Yamada & Iseki (2013)	**Japan**	**570 pharmacy students** (n=162 sophomore and n=408 juniors, M: 176, F: 362, Unknown: 32)	**Cross-sectional** (Questionnaire) [Key themes: Knowledge/ awareness of doping and supplements; drug use]	• 90% of trainee pharmacists had negative images regarding doping violations. • The majority reported that they were familiar with the concept of doping, including 82% who claimed to know what doping is in detail and 80% who reported they have an interest in the topic. • Yet, only 16% of the students had attended lectures by specialists on doping. • Notably, one third of pharmacy students did not know that some over-the-counter (OTC) drugs might contain doping substances.
Sefiha (2012)	**Belgium**	**Cycling Team Personnel** N=not disclosed	**Cross-sectional** Ethnography (observations and semi-structured interviews) [Key themes: Attitudes and beliefs; neutralization techniques]	• From the paper, it is very difficult to decipher the voice of the team personnel, so specific data cannot be summarised here. • Participants expressed distrust of sporting federations, law enforcement, and medical professionals, whom they viewed as exaggerating and distorting information about the dangers of PED use ('Illegitimate authority'). • Members viewed PED use as a rational means to an end.
Sullivan, Feltz, LaForge-MacKenzie & Hwang (2014)	**US and Canada**	**560 High School Coaches** 336 American Football coaches 439 coaches from US 89% males Mean age = 43 years (SD = 10.93) Coaching experience = 18.85 years (SD = 10.07)	**Cross-sectional** (Questionnaire: DCES) [Key themes: Social Confrontation Model; Bandura's efficacy measures; Doping Confrontation Efficacy Scale (DCES)]	• A 21-item version of the Doping Confrontation Efficacy Scale (DCES) showed acceptable psychometric properties, including a good fit of the data to the proposed five-factor model of the construct (Comparative fit index (CFI) = .967; Tucker-Lewis index (TLI) = .962; root mean square residual (RMSEA) = .040, standardised root mean square residual (SRMR) =.037). • Structural equation modelling revealed that coaches' confrontational efficacy is significantly predicted by coaches' perceptions of motivational climate, specifically, that it is positively related to task-involving climate and negatively related to ego-involving climate.
Seif Barghi, Halabchi, Dvorak & Hosseinnejad (2015)	**Iran**	**136 Coaches** 239 Competitive Footballers	**Cross-sectional** (Questionnaire) Randomized clustered sampling [Key themes: Knowledge and attitudes towards doping]	• Doping definitions: 15% of coaches demonstrated poor knowledge (less than 40% correct), 29% moderate knowledge (40-70% correct) and 56% good knowledge (>70% correct). • Knowledge about side effects of anabolic steroids was poor - 52% of coaches failed to score more than 40% on the survey. In terms of prohibited substances, 30% recorded 'poor' scores. • Coaches and players did not display significant differences in doping knowledge. • Athlete and coach attitude data was aggregated but overall more than 82% of participants disagreed to allow free use of all drugs. 77% were in favour of increasing the sanction for a doping offence and 80% were in agreement that doping control would be enhanced via in competition testing. • Over 90% were in favour of educating coaches about harms and side effects of PEDs.

Table 1 Continued.

Authors (year)	Country	Sample	Methods	Summary
Thomas, Dunn, Swift & Burns (2011) Same sample as Dunn, Thomas, Swift, Burns & Mattick (2010)	**Australia**	**26 Key Experts (KEs)** (N=7 retired athletes, N=5 academics, N=3 team managers, N=2 high performance managers, N=2 player association managers, N=2 head coaches, N=2 welfare managers, N=1 executive officer, N=1 national sport coordinator, N=1 team medical officer) 974 elite athletes also surveyed	**Cross-sectional** (Telephone interview) [Key themes: Information source; anti-doping education]	• Family members and coaches were identified as a source of information for athletes by 13.5% and 9.9% of the athlete respondents, respectively. The Internet was the most common source (64% of athletes). • 10 KEs believed that some athletes would not feel comfortable seeking information/advice about doping within their club/sporting organisation and 7 KEs believed athletes would be comfortable doing so. Notably, no KE felt that an athlete would feel comfortable approaching a coach or team manager for information on illicit drugs. • KEs gave recommendations for future anti-doping education for athletes, including it being brief and straight-forward, as well as it being more specific to athletes, including telling them how substances can affect recovery, performance and one's career, rather than giving general health information/consequences.
Woods & Moynihan (2009)	**Ireland**	**771 General Practitioners** 63% Male Average age = 46.2 +/- 9SD; range 28-74 years) Response rate = 37%	**Cross-sectional** (Postal questionnaire, based on Laure's work) [Key themes: Knowledge, practice and training requirements in relation to doping in sport in Ireland]	• 24% (183) were connected with a specific sport as a team doctor/advisor, but only 12% (94) of GPs had completed specific training modules in doping or sport. • 47-80% of respondents felt they had poor knowledge of the topics presented; in contrast, 14% (112) deemed their knowledge of doping agents to be good or very good. • 33% (256) of GPs possessed the current list of prohibited substances, and 25% (190) knew of the Irish Sports Council's drug-testing procedures. • 28%: (217) had been consulted for advice on doping in sport, which had related to nutritional supplementation (21%: 162), specific banned substances (17%: 130), the list of prohibited substances (12%: 95), the health risks of doping (11%: 84), regulations (8%: 59), side effects (7%: 57) and other topics (2%: 16). Additionally, 12% (89) of GPs had received a request for anabolic agents from a coach or athlete without medical indication. • 90% (690) of GPs felt they would discourage the use of prohibited substances when faced with an athlete who insisted on taking them and 92% (716) indicated that GPs had a role to play in the prevention of doping in sport. • Only 9% (66) felt adequately trained for a role in doping prevention, and over half (56%) felt the current initiatives to discourage doping in sport were ineffective.

Anti-doping knowledge and awareness

Knowledge - typically determined by the percentage of questions correctly answered - appeared to be consistently higher among a mixed sample of Australian ASP than in any other population across the studies. Mazanov and colleagues (2013) reported correct response rates of between 74% and 88%, with lowest scores in relation to obligations of ASP under the WADC (54%-72%, N=142). Beyond this, most papers reported only low to moderate levels of understanding among ASP. For instance, Morente-Sanchez and Zabala (2015) reported average scores for knowledge of 43.7% among a mixed sample of ASP. They found that coaches had lower knowledge scores (36.1%) than physical trainers (46.7%) and other technical staff (51.8%). In particular, only 6.1% of coaches (19.7% of physical trainers and 23.9% of other technical staff) reported having knowledge of the prohibited list. In this vein, Bhagirathi (2009) found that 54% of coaches (N not reported) were aware of the WADA banned substance list, 53% of respondents were aware of Therapeutic Use Exemptions (TUEs) and 41% of respondents were aware of the testing methods employed by the WADA. Self-reported knowledge corroborated these findings, as Rodek et al. (2012) found that 41% of coaches felt that their knowledge on doping was 'average' (38.2% self-determined it was poor). In Iran, 136 football coaches were surveyed on their knowledge of doping definitions, names of prohibited drugs and side effects of AAS use (Seif Barghi et al., 2015). Knowledge of the anti-doping rule violations was deemed to be 'adequate' with 56% displaying good knowledge (>70% correct) but 15% evidenced poor knowledge (less than 40% correct). However, knowledge of substances on the prohibited list and side effects of AAS use was concerning with 30% and 52% recording 'poor' scores on the questionnaire. In this study, coaches and players did not display significant differences in doping knowledge (Seif Barghi et al., 2015).

For the most part, moderate levels of knowledge continued to be evident among medical staff. The highest ratings of knowledge among medical staff were reported by Saito et al. (2013), where, although not confirmed via objective analysis, the majority of pharmacy students reported being familiar with the concept of doping, including 82% who claimed to know what doping is in detail. Ausperger et al. (2012) reported that

39% of GPs and 48% of Pharmacists were familiar with the formal definition of doping, 33% of GPs and 59% of Pharmacists correctly interpreted the abbreviation WADA and 65% of respondents (GPs and Pharmacists combined) knew that the European Commission has legislation to address doping. These findings were supported by medical practitioners' self-perceptions of their own knowledge, as Woods and Moynihan (2009) reported that 47-80% of a sample of Irish GPs felt they had poor knowledge of the topics presented, with only 14% (N=112) of respondents deeming their knowledge of doping agents to be 'good' or 'very good'. Notably, these two studies demonstrated that knowledge scores varied across a number of doping-related topics. Auersperger et al. (2012) found that GPs and Pharmacists were less aware of (i) the banned status of marijuana, genetic manipulation and diuretics, as well as (ii) the possibility that nutritional supplements (NS) can be contaminated and lead to a positive drugs test. Woods and Moynihan (2009) assessed GP's self-reported knowledge of seven specific areas related to doping in sport. They noted knowledge of masking agents and prohibited methods of administration was rated the lowest (80% and 64% rated their knowledge 'poor', respectively). Finally, Sajber et al. (2013) found that coaches' knowledge was strongest in relation to doping regulations and procedures and weakest with regard to specific substances.

In addition to variance across doping-related topics, knowledge among ASP appeared to be related to several factors, including gender, age, experience and role. For example, male parents demonstrated significantly better knowledge about doping and its side effects than female parents (Blank et al., 2013). Mandic et al. (2013) found that knowledge was greater among coaches who were more experienced (and older). With regard to role, physicians were most knowledgeable (30.8/35) and family members (26.0), trainers (26.1) and nutritionists (26.6) were the least knowledgeable (Mazanov et al., 2013). In this vein, both Mandic et al. (2013) and Sajber et al. (2013) reported that coaches scored higher than their athletes on knowledge of both doping and nutrition. Yet, this is in contrast to Morente-Sanchez and Zabala (2015) who found coaches to be less knowledgeable than physical trainers and other technical staff (including, physiotherapists, doctors and psychologists). Interestingly, the findings of Blank et al.'s (2013) study with parents signal a possible misalignment between ASP's

perceptions of their knowledge and their actual capabilities (in terms of answering questions correctly); only half (46%) of parents felt moderately well informed, despite 68.2% of them achieving scores of 80% + on the general doping knowledge survey (Blank et al., 2013). This warrants consideration in future studies that aim to capture insights into knowledge among ASP.

Doping-related education/training

The proportions of ASP who had received formal training in doping-related matters were low. Only 12% (94) of GPs had completed specific training modules in doping or sport (Woods & Moynihan, 2009) and only 16% of pharmacy students had attended lectures by specialists on doping (Saito et al., 2013). Similarly, 60% of GPs and 40% of Pharmacists reported having been offered specific training on doping (Auersperger et al., 2012). Coaches also reported low engagement in formal education (21%) (Mandic et al., 2013). Notably, two-thirds of coaches in this study declared self-education as the primary source of information about doping and sport-nutrition. The level of self-directed education was slightly lower among coaches in Sajber et al. (2013) (41%), with 50% stating their main source of information about doping and sport nutrition was formal education. However, the setting through which this formal education was received is unclear. Although most studies did not identify different methods of self-directed study, the Internet was stated as a source of information for 51.6% of parents (Blank et al., 2013). Beyond this, 23.7% had used WADA/NADO hotlines for information (Blank et al., 2013).

Contact with doping-related matters

Only two studies investigated doping-related experiences among ASP. Woods and Moynihan (2009) found that approximately one in four GPs (28%: 217) had been consulted for advice on doping in sport. These incidences related to nutritional supplementation (21%: 162), specific banned substances (17%: 130), the list of prohibited substances (12%: 95), the health risks of doping (11%: 84), regulations (8%: 59), side effects (7%: 57), and other topics (2%: 16). Notably, 12% (89) of GPs had received a request for anabolic agents from a coach or athlete without medical

indications and 6% (44) had received requests for other banned substances without medical indications. In a similar vein, Auersperger et al. (2012) reported that 12% of respondents (8.7% GPs, 19.3% Pharmacists) had been directly confronted with a request for prescription of doping agents in the previous 12 months (mainly stimulants, anabolic agents, hormones, corticosteroids). Moreover, 8.4% of respondents (predominantly GP's) reported personally knowing an athlete using doping agents. However, 8.4% is not a prevalence/incidence estimate as the respondents may be referring to the same athletes. In addition to approaches for prescribed substances, 37% of GPs and 46% of Pharmacists had been approached for information about doping in the last 12 months. Although the proportions of the approaches differ, the topic of side effects/health risks (21%) also appeared in Auersperger et al. (2012). Beyond this, GPs and Pharmacists were approached to discuss the GP's opinion on using products for enhancing performance (29%) or to aid the recovery processes (24%), including shortening recovery time after injury (16%). Corroborating these findings that medical staff are approached by sportspeople, 58% of GPs felt that team doctors might be a source of information (Woods & Moynihan, 2009).

Across the remaining studies, data from both athlete and ASP perspectives indicated that other members of ASP are likely faced with doping-related matters. For instance, Thomas et al. (2011) found that family members were identified as a source of information by 13.5% of athletes. With regard to coaches specifically, there was conflicting evidence regarding their potential to be approached by sportspeople to discuss doping-related matters. Half of the athlete sample in Sajber et al. (2013) declared their coaches as their primary source of knowledge about nutrition and doping. In contrast, only 9.9% of athletes identified coaches as a source of information in Australia (Thomas et al., 2011). Within this same study, seven 'key experts' felt that sportspeople would be comfortable seeking information/advice about doping within their club/sporting organisation, but ten individuals believed that sportspeople would not feel comfortable doing so (Thomas et al., 2011). In particular, none of the key experts believed that a sportsperson would feel comfortable approaching a coach or team manager for information on illicit drugs. In this instance, it may be the case that

intending-dopers might purposefully avoid discussing illegal behaviours with individuals they admire and respect. However, this is unlikely the case in all populations, as Ozbek (2013) found that 50% of coaches had received requests for doping. Whilst 80% of coaches stated that they did not give any performance-enhancing drugs to candidates they coached, 70% of coaches expressed that their trainees might be using doping without their knowledge (Ozbek, 2013).

Beyond ASP, the athlete population of Thomas et al. (2011) identified the Internet as the most commonly used resource (reported by 64%) (Thomas et al., 2011). Supporting this finding, 96% of GPs thought the Internet was a key source of information for sportspeople, with team-mates (94%) also rated highly (Woods & Moynihan, 2009).

Doping attitudes and beliefs

Although attitudes and opinions were investigated in different ways, several studies provided evidence that ASP self-report anti-doping attitudes. For instance, among parents average scores for attitudes towards doping were 14.0±2.4 (Max score = 19, highest anti-doping inclinations) (Blank et al., 2013). Among coaches, the problem of PED use in sport was also deemed to be a serious issue for coaches (Moston et al., 2014a). In this population, Sajber et al. (2013) reported that 91% stated that there is no chance of potential suggestion of doping to their athletes and Mandic et al. (2013) found that 71% would not suggest doping usage. Medical personnel also held anti-doping attitudes. Ninety per cent of pharmacy students held negative images regarding doping violations (Saito et al., 2013). Similarly, 90% (690) of GPs felt they would discourage the use of prohibited substances when faced with an athlete who insisted on taking them and 92% (716) indicated that GPs had a role to play in the prevention of doping in sport (Woods & Moynihan, 2009). Moreover, Auersperger et al. (2012) reported that 69% of GPs and 31% of Pharmacists agreed that they have a role to play in doping prevention, with 56% of GPs and 44% of Pharmacists suggesting that they felt legally obliged to report suspicions or ‘case initiatives’.

Anti-doping attitudes continued to emerge across ASP, as Morente-Sanchez and Zabala (2015) reported anti-doping attitudes in a mixed sample of coaches, physical trainers and other technical staff working in Spanish football (with average score on the PEAS of 31.64±10.77). Similarly, a mixed sample of Australian ASP had a negative attitude toward performance enhancement (Mazanov et al., 2013). This was reinforced with findings showing that 96% of respondents would 'never' encourage an athlete to dope to facilitate recovery from injury and that 98% would not pressure an athlete to dope to retain sponsorship. Additionally, the majority of respondents across the different ASP categories felt it was ethically sound to report an athlete who was doping, but it is unclear how sure they needed to be about the evidence of doping (Mazanov et al., 2013).

In terms of opinions regarding specific strands of anti-doping efforts, 64% of coaches agreed with lifelong penalties for doping, 18% agreed with a milder punishment for a first time offence and lifelong suspension for second offence and 18% believed there should be a financial punishment (Sajber et al., 2013). These findings appear to contrast with Rodek et al. (2012), who noted that only 15% of coaches favoured a lifelong suspension and 53% of coaches (N=18) felt that a milder sentence was appropriate for a first time offence and agreed a lifetime ban should be imposed for a second offence. Yet, some ASP think that current measures to prevent doping in sport are ineffective and that punishment for a positive test is not sufficiently severe (Auersperger et al., 2012; Dunn et al., 2010). Moreover, coaches hold sceptical views about the deterrent effect of legal sanctions (Moston et al., 2014a) and saw the deterrence value of legal - and material - sanctions as less effective than athletes did. Having said this, Australian coaches and athletes were ambivalent about criminalisation of doping (43.5% of coaches in favour) (Moston et al., 2014a). Seif Barghi and colleagues (2015) also explored coaches' views regarding legalisation of doping, doping controls and sanctions but the findings were reported in aggregate form so it is impossible to separate out the coaches' viewpoints from the athletes'.

Beyond testing and sanctions, Australian ASP felt that improvements were needed to support anti-doping education and practice among ASP (Mazanov et al., 2013). This is

particularly important because a quarter of ASP (27.1%) reported that they had provided advice to sportspeople about doping-related topics without reading the WADC. Also, only 9% (66) of GPs felt adequately trained for a role in doping prevention (Woods & Moynihan, 2009). Recommendations for future anti-doping programmes were offered in a handful of studies. For example, key experts suggest that anti-doping education for athletes should be targeted, brief and straight forward (Thomas et al., 2011). In terms of content, the experts believed that programmes should explore the effect of substance use on recovery, performance and one's career, rather than giving general health information/consequences. Similarly, Saito et al. (2013) made further calls for increased education for sports.

In addition to increasing the likelihood that ASP are providing accurate information to sportspeople, anti-doping education might be improved by addressing the fact that not all ASP had anti-doping attitudes or were willing to engage in anti-doping activities. For instance, 11% of coaches reported that they would suggest doping if they were convinced that it would help their athlete and have no negative health implications (Mandic et al., 2013). Moreover, Mazanov et al. (2013) found that some individuals reported ignoring unethical behaviour of other ASP (31.5%) and three quarters (77.3%) of respondents reported 'never' talking about athlete doping with other ASP. Notably, Morente-Sanchez and Zabala (2015) found that between 1.5 and 8.1% of ASP had personally used a banned substance. Beyond this, 2% (N=13) of GPs would prescribe or supply a prohibited substance and 10% (77) were willing to monitor a sportsperson during use of a prohibited substance (Woods & Moynihan, 2009).

Members of the professional cycling community, which included team professionals, expressed a distrust of sporting federations, law enforcement, and medical professionals, whom they viewed as exaggerating and distorting information about the dangers of PED use ('Illegitimate authority') (Sefiha, 2012). Aubel and Ohl (2014) also questioned current anti-doping policies and provided support for their argument that "doping in sport needs to be understood as a cultural practice, and not simply as an individual choice of immoral cheaters" (p.3). Indeed, in interpreting the data, the

authors call for a contractual governance approach to doping prevention whereby the structural 'precariousness of employment' in professional cycling is addressed and the vulnerability of the business model of the teams reduced in order to decrease the pressure on riders and their employers to dope.

In order to address some of the sporting structural issues highlighted by Aubel and Ohl (2014) it is important to generate a collective 'buy-in' to pursue the goal of clean sport (i.e., doping-free). Therefore, taken with the findings that some ASP and organisations claimed that doping was irrelevant to their practice, further investigation of ASP's beliefs and practice in relation to doping and performance sport are warranted. Using the psychometrically validated Doping Confrontation Efficacy Scale (Sullivan et al., 2015) might be useful here. Early findings suggest that coaches' confrontational efficacy is significantly predicted by coaches' perceptions of motivational climate. Specifically, efficacy is positively related to task-involving climates and negatively related to ego-involving climates and this has potential implications for the messages that should (or should not) be emphasised by key stakeholders in sporting environments. Furthermore, research that explores the employment conditions of professional sportsmen and women, in light of Aubel and Ohl's (2014) proposals, seems warranted.

Summary

Caution must be exercised when drawing conclusions from the studies presented in this section owing to the limited evidence base and heterogeneity of methods employed. That being said, initial insights have been gained into a number of key populations of ASP, including medical professionals, coaches and parents. Reinforcing the conclusions of the previous report, self-report data has shown that most ASP declare anti-doping attitudes and agree that doping in sport should be punished. Yet, ASP had only moderate awareness and knowledge of doping-related topics to deal with approaches from athletes and they reported a lack of engagement with, or opportunities to engage with, formal anti-doping education. Therefore, ASP should be provided with more opportunities to engage and learn about doping-related matters

in the future, particularly given that they are often underprepared to discuss some topics that interest athletes.

Future anti-doping education should address ASP's lack of knowledge of their roles and responsibilities in doping prevention. Such efforts are essential to address the passive (and even pro-doping) approach adopted by some ASP. Yet, providing appropriate educational opportunities might prove difficult due to the diverse range of populations classified under this term within the WADC. In order to ensure future education efforts are evidence based, there is an urgent need to increase research efforts with this stakeholder population. In particular, it would be beneficial to gain a better understanding of the nature of ASPs' interactions with sportspeople, including who is involved, how frequently exchanges occur, with what intentions and impact on future behaviours. At the same time, qualitative insights from professional cycling highlight the multifaceted and complex interactions that take place within a sporting system; it might not be enough to have outstanding knowledge of anti-doping rules and regulations if the wider sporting system fails to create a supportive environment, prioritising the long term health and well-being of athletes, both during and following their sporting careers. Emerging research also suggests that even those with high moral standing may give way to doping under certain risk environments and this should be acknowledged within education efforts.

This body of literature is defined by cross-sectional designs that have employed self-devised questionnaires making comparisons difficult. To illustrate, a limitation of research with ASP is the diverse ways of measuring knowledge. Some researchers asked respondents to self-report their level of knowledge, whereas others asked closed-questions to gauge knowledge through true or false answers. Future research should therefore consider what is 'knowledge' (i.e., explore 'know that', 'know how', 'know to'). Despite the methodological limitations inherent in the current evidence base, a noticeable development in research related to ASP was the addition of qualitative interviews. Qualitative research can enhance the field by providing in-depth, contextualised insights into the 'how' and 'why' of ASPs' thoughts, feelings and behaviours. Such understanding can inform appropriate education programmes and

anti-doping policy developments. Whether qualitative or quantitative, there is a real need to increase the amount and quality of research that investigates doping and anti-doping issues among ASP.

Adolescent Athletes

In the previous report, eight studies examined school childrens' knowledge and attitudes towards doping. Sample sizes varied from 604 to 16,169 and consisted of individuals from high school populations (11-18 years). Six studies were conducted in the United States (Corbin, Feyrer-Melk, Phelps, & Lewis, 1994; Naylor, Gardner, & Zaichkowsky, 2001; Stilger & Yesalis, 1999; Terney & McLain, 1990; Warner, Schnepf, Barrett, Dian, & Swigonski, 2002; Wroble, Gray, & Rodrigo, 2002), one in Canada (Melia, Pipe, & Greenberg, 1996) and one in France (Laure, Lecerf, Friser, & Binsinger, 2004). Every study was based on a cross-sectional survey design and using a questionnaire. Studies specifically focused on patterns of anabolic androgenic steroid (AAS) use and recreational or doping drug use. Prevalence rates for AAS use or other doping drug use ranged from 0.7% in pre-adolescents (Wroble et al., 2002) to 6.3% in high school American football players (Stilger & Yesalis, 1999). Overall, findings revealed that a desire to improve athletic performance was the main reason for using AAS, followed by a desire to change or improve physical appearance.

High school athletes typically self-reported negative attitudes towards doping but they suggested that they may use AAS or other doping agents if they knew their opponent was using them, to guarantee an Olympic medal or if they were offered them by a friend. Findings also demonstrated a lack of anti-doping knowledge amongst high school athletes.

The searches identified 37 published studies that investigated doping (including attitudes, beliefs, knowledge, use and intentions to use) amongst adolescent athletes. The studies were categorised into predictive studies of AAS use (N=13) (Table 2), predictive studies of performance enhancing drug use/intentions (N=16) (Table 3),

and descriptive studies (examining the knowledge, attitudes and beliefs, N=8) (Table 4).

Geographical spread

The majority of studies were conducted in the United States (Denham, 2009; Dodge & Jaccard, 2008; Dunn & White, 2011; Eisenberg, Wall, & Neumark-Sztainer, 2012; Elliot, Cheong, Moe, & Goldberg, 2007; Hua & Braddock, 2008; Humphreys & Ruseski, 2011; Ip, Barnett, Tenerowicz, & Perry, 2011; Lorang, Callahan, Cummins, Achar, & Brown, 2011; Mottram, Chester, Atkinson, & Goode, 2008; Rees, Zarco, & Lewis, 2008; vandenBerg, Neumark-Sztainer, Cafri, & Wall, 2007; Vertalino, Eisenberg, Story, & Neumark-Sztainer, 2007), while six were conducted in Australia (Chan, Dimmock, Donovan, Hardcastle, & Lentillon-Kaestner, 2014; Chan, Donovan, et al., 2014; Chan, Hardcastle, Dimmock, et al., 2014; Chan et al., 2015; Dunn & White, 2011; Moston, Engelberg, & Skinner, 2014c) and four in Italy (Lucidi et al., 2008; Mallia, Lucidi, Zelli, & Violani, 2013; Zelli, Lucidi, & Mallia, 2010; Zelli, Mallia, & Lucidi, 2010). Four of the Australian papers (Chan, Dimmock, et al., 2014; Chan, Donovan, et al., 2014; Chan, Hardcastle, Dimmock, et al., 2014; Chan et al., 2015) and two of the Italian papers (Zelli, Lucidi, et al., 2010; Zelli, Mallia, et al., 2010) reported findings from the same dataset. Other studies were conducted in Greece (Barkoukis, Lazuras, Lucidi, & Tsorbatzoudis, 2014; Barkoukis, Lazuras, & Tsorbatzoudis, 2013; Lazuras, Barkoukis, & Tsorbatzoudis, 2015) with two papers reporting findings from the same dataset (Barkoukis, Lazuras, et al., 2014; Lazuras et al., 2015), France (Laure & Binsinger, 2007; Schirlin et al., 2009), South Africa (Gradidge, Coopoo, & Constantinou, 2011; Nolte, Steyn, Krüger, & Fletcher, 2014), United Kingdom (Bloodworth, Petróczi, Bailey, Pearce, & McNamee, 2012; Bloodworth & McNamee, 2010), Austria (Fürhapter et al., 2013), Canada (Goulet, Valois, Buist, & Côté, 2010), Germany (Wanjek, Rosendahl, Strauss, & Gabriel, 2007), Ghana (Sagoe, Torsheim, Molde, Andreassen, & Pallesen, 2015), Iceland (Thorlindsson & Halldorsson, 2010), Iran (Hejabi, Manouchehri, & Tojari, 2015) and Spain (Horcajo & De la Vega, 2014). The predictive papers specifically examining AAS use (Table 2) were dominated by populations from the United States (N=10), while four of the 16 predictive studies investigating performance enhancing drug use/intentions (Table 3) were conducted in Italy. The remaining predictive studies

investigating PED use/intentions were conducted in multiple countries, along with the descriptive studies (Table 4).

Sample

Of the descriptive studies, seven included adolescent athletes and one included high school students (Gradidge et al., 2011) while 12 predictive studies investigating AAS use involved high school students and one involved high school athletes (Mottram, Chester, Atkinson, et al., 2008). In comparison, 10 predictive studies investigating PED use/intentions involved adolescent athletes while the other six involved high school students.

For the 37 studies, sample sizes ranged from 40 to 212,263. The sample sizes for the descriptive studies were generally much lower than the predictive studies and ranged from 40 (Moston et al., 2014c) to 408 (Fürhapter et al., 2013) while sample sizes for the predictive studies investigating PED use/intentions ranged from 241 (Dodge & Jaccard, 2008) to 3573 (Goulet et al., 2010) with the exception of one study (Horcajo & De la Vega, 2014) which involved 68 junior football players. In contrast, sample sizes included in the predictive studies investigating AAS use were generally much larger ranging from 404 (Mottram, Chester, Atkinson, et al., 2008) to 221,263 (Hua & Braddock, 2008).

The majority of studies included males and females while three studies focused on males (Gradidge et al., 2011; Hua & Braddock, 2008; Mottram, Chester, Atkinson, et al., 2008) and one on females (Elliot et al., 2007). Age of participants varied from 10-21 years old, with the exception of two studies that involved some participants over the age of 21 (Bloodworth & McNamee, 2010; Sagoe et al., 2015).

Methods

Studies were dominated by cross-sectional survey designs that gathered data through questionnaires. However, in addition to these cross-sectional surveys, six longitudinal studies were conducted (Laure & Binsinger, 2007; Lucidi et al., 2008; Mallia et al.,

2013; vandenBerg et al., 2007; Zelli, Lucidi, et al., 2010; Zelli, Mallia, et al., 2010), four of which were involving Italian high school students, one study gathered qualitative data via focus groups (Bloodworth & McNamee, 2010) and one study utilised an experimental design (Horcajo & De la Vega, 2014). The papers mainly focused on identifying correlates/predictors for AAS use or general PED use.

Within the predictor papers focusing on PED use, a number of theories including the theory of reasoned action (Dodge & Jaccard, 2008), theory of planned behaviour (Barkoukis, Lazuras, et al., 2014; Chan, Hardcastle, Dimmock, et al., 2014; Goulet et al., 2010; Lazuras et al., 2015), social cognitive theory (Lucidi et al., 2008; Zelli, Lucidi, et al., 2010; Zelli, Mallia, et al., 2010), self-determination theory (Chan, Donovan, et al., 2014), theory of triadic influence (Lazuras et al., 2015), the strength energy model of self-control (Chan et al., 2015), and the trans-contextual model (Chan, Dimmock, et al., 2014) were used to examine intentions to dope and/or PED use. In addition, one paper focused on doping susceptibility (Barkoukis, Lazuras, & Tsorbatzoudis, 2013).

In comparison, AAS use studies focused on identifying predictors for AAS use with the exception of one study that examined perceived risk of using AAS (Denham, 2009). Eight of these studies included data collected from large-scale projects conducted regularly (semi-annual, annual, bi-annual) on American high school students (Denham, 2009; Elliot et al., 2007; Hua & Braddock, 2008; Humphreys & Ruseski, 2011; Ip et al., 2011; Lorang et al., 2011; vandenBerg et al., 2007; Vertalino et al., 2007), whereas the predictors of PED use/intentions and descriptive studies tended to be based on single bouts of data collection. The descriptive studies clustered around four main topics: 1) attitudes towards doping, 2) beliefs associated with doping, 3) knowledge about doping, and 4) prevalence of use. In addition, one study focused on the relationship between moral functioning and estimates of PED use (Moston et al., 2014c), one was conducted to determine the reliability and validity of a doping behaviour questionnaire (Hejabi et al., 2015) while another used an emotional stroop task to investigate the relationship between self-esteem and sensitivity to doping words (Schirlin et al., 2009).

Table 2. Overview of studies that employed regression analysis to identify variables that were predictive of AAS use in adolescent athletes

Authors (year)	Country	Sample	Method	Independent (I)/ dependent (D) variables	Summary
Denham (2009)	**USA**	**2,160 High-School Students**	**Cross-sectional** (Questionnaire) Social cognitive theory Monitoring the Future study 2005	I: Sex; race; AAS availability; peer use of AAS; sensation seeking; depression; self-esteem D: Perceived risk of using AAS	• Regression analyses showed significant explanatory effects for sex, race, exposure to drug spots, steroid availability, peer use of steroids, sensation-seeking, depression and self-esteem. • Females, African Americans, and those who had seen drug spots the most frequently estimated higher levels of risk associated with steroid use, while those who indicated ease in obtaining steroids and those with close friends who had used the drugs estimated lower risk. • Also estimating lower levels of risk were sensation seekers, those who appeared depressed, and those with low levels of self-esteem.
Dunn & White (2011)	**Australia**	**21,905 High school Students** 376 schools participated in the survey (Response rate: 63%) 47% males Mean age= 14.5 years (12-15 years, n= 14304; 16-17 years, n= 7057)	**Cross-sectional** (Questionnaire)	I: Demographic variables D: AAS use	• Lifetime AAS use was reported by 2.4% of 12–17year-old students; use was more common among 12–15year olds then 16–17year olds. • AAS use was occasional rather than regular (41% of users had only used once or twice) • Regardless of age; being male, speaking a language other than English at home, not being at school on the previous school day, and rating personal scholastic ability as 'below average' were all associated with a greater likelihood of using AAS in their lifetime and in the past year. • Those who reported AAS use also reported the use of a range of other substances, suggesting that AAS use may be part of a broader experimentation with substances.
Eisenberg, Wall & Neumark-Sztainer (2012)	**USA**	**2,793 High-School Students** 20 public middle and high schools in the Minneapolis/St Paul Minnesota metro area 46.8% males Mean age= 14.4 ± 2.0 years (6^{th}-8^{th} grade= 46.1%; 9^{th}-12^{th} grade= 53.2%)	**Cross-sectional** (Questionnaire) EAT 2010 (2009-2010)	I: demographic variables, BMI, sports participation D: AAS use	• Muscle-enhancing behaviours were common amongst boys and girls • Among boys, 5.9% reported AAS use, 34.7% protein use, 10.5% used other muscle-enhancing substances and 68.5% had changed their eating to increase their muscle size or tone. • Among girls, 4.6% reported AAS use, 21.2% protein use, 5.5% other muscle-enhancing substances and 62.2% had changed their eating to increase their muscle size or tone • Those participating in sports teams were significantly more likely to report muscle-enhancing behaviours than those not involved • High school boys were 1.7 times more likely to use protein shakes (OR: 1.7; 95% CI= 1.30-2.21) and 1.73 times more likely to use other muscle-enhancing substances (OR: 1.73; 95% CI= 1.12-2.66) than middle school boys. • Asian boys were 3.51 times more likely to report AAS use than white boys (OR: 3.51; 95% CI= 1.13-10.92) and Asian girls were 3.37 times more likely to report AAS use (OR: 3.37; 95% CI= 1.29-8.80) than white girls • BMI was significantly associated with changing eating behaviours, protein powders and AAS use with overweight and obese boys more likely to report these behaviours.

Table 2 Continued.

Authors (year)	Country	Sample	Method	Independent (I)/ Dependent (D) variables	Summary
Rees, Zarco & Lewis (2008)	**USA**	**495 High-School Students** 4 high schools and 4 intermediate schools 55% males Age range = 12-19 years	**Cross-sectional** (Questionnaire)	I: Demographics; sport participation; attitudes; D: Likelihood to use AAS; Supplement use	• 7.7% see AAS use as part of their future. 21.8% took supplements regularly. • Most popular reasons for using steroids in the future were "gaining muscle mass" (16.3%), "looking better" (11%), "gaining strength" (10.5%), "losing weight' (10.2%), "play sports better" (10.1%) and "losing body fat" (9.4%). No support for future steroid use due to sensation seeking. • Reasons for supplement use mirrored those given for AAS use. • The negative attitudes about AAS use found in the fixed choice questions were also reflected in the respondents' answers to all three scenarios. Health concerns dominated the reasons why the hypothetical characteristics should not use AAS. • Regression analysis revealed that the 12-variable model had low but significant predictive value ($R2 = .11$, $F12, 383 = 4.10$, $p < .001$). Model variables that achieved significant t -values ($p < .05$) were current sports supplements use, age, grade in school, and number of days per week participating in flexibility exercises. That is, students who currently use one or more sports supplements and engage in little to no flexibility or stretching exercise are more likely to use AAS in the future as they advance in grade than their cohorts who are not currently taking sports supplements.
Sagoe, Torsheim, Molde, Andreassen & Pallesen (2014)	**Ghana**	**High school students** (N=2597) 5/17 schools randomly selected 44% males Mean age= 17.2 ± 1.4 years Age range = 11-35 years	**Cross-sectional** (Questionnaire)	I: Age; gender; living situation; SES; religious involvement; mother's education; father's education; sports participation; sports discipline D: Attitudes towards AAS use	• Lifetime prevalence of AAS use= 3.8% (males= 4.9%, female= 3.1%) • 6% had previously been offered AAS while 18.5% knew someone who had used AAS • More males believed AAS would improve their sports performance and physique than females. • Being female was significantly related to a strong belief that AAS use did not improve sports performance • Parental absence and participation in jogging significantly predicted indifference (recorded as 'not sure' on the scale) towards use of AAS for improved sports performance • Parental absence, religious involvement and participation in jogging significantly predicted nonchalance towards AAS use for enhanced physique.
Thorlindsson & Halldorsson (2010)	**Iceland**	**10,918 High School Students** 48.2% males Mean age= 17.7 ± 1.8 years Age range= 15-24 years	**Cross-sectional** (Questionnaire) Hypothesis testing	I: Demographics; sport participation; attitudes; illicit drug use, family structures; school variables D: Likelihood to use AAS; Supplement use	• Use of AAS was relatively low – 0.9% (1.6% boys, 0.2% girls) but increased with age (p= .001) • The use of AAS was not significantly related to participation in formally organised sports. Those who participate in recreational exercise and fitness outside formally organised sport 4x a week or more are almost 2.7 times more likely to use AAS compared to those who do not participate in formal sports. • A relatively strong relationship exists between the use of AAS and the use of illicit substances and a moderate relationship between AAS use and alcohol and tobacco consumption. • A significant negative relationship between AAS use and school integration and school achievement, and a significant positive relationship between AAS use and school anomie. The relation between AAS use and family-related variables was weaker. Finally, the relationship between sport participation, physical exercise, and AAS use varies across levels of anomie and integration.

Table 2 Continued.

Authors (year)	Country	Sample	Method	Independent (I)/ Dependent (D) variables	Summary
Elliot, Cheong, Moe, Goldberg (2007)	**USA**	**7,544 Female High-School Students** 83% response rate (Grades 9 through 12)	**Cross-sectional** (Questionnaire) Youth Risk Behaviour Survey 2003	I: Demographic variables D: AAS use	• Prior or on-going AAS use was reported by 5.3% of female high school students (younger students were more likely to report prior/on-going AAS use than older students). • AAS users had a marked increase in other health compromising behaviours, including past 30-day use of alcohol (odds ratio [OR], 8.83; 95% confidence interval [CI], 5.49-14.20]), cigarettes (OR, 5.14; 95% CI, 3.14- 8.42), marijuana (OR, 7.91; 95% CI, 5.20-12.04), cocaine (OR, 10.78; 95% CI, 6.18-18.81), and diet pills (OR, 4.86; 95% CI, 2.98-7.93). • AAS users were more likely to carry a weapon (OR, 7.54; 95% CI, 4.83-11.76), have had sexual intercourse before age 13 years (OR, 2.90; 95% CI, 1.58- 5.33), and have had feelings of sadness or hopelessness almost every day for at least 2 consecutive weeks (OR, 4.13; 95% CI, 2.57-7.22). • AAS users were less likely to play school-sponsored team sports (OR, 0.52; 95% CI 0.34-0.80).
Hua & Braddock (2008)	**USA**	**212,263 Male High-School students** 8th & 10th Grade	**Cross-sectional** (Questionnaire) Monitoring the Future Surveys 1991-2007	D: Lifetime steroid use; Steroid use during past 12 months; Steroid use during past 30 days. I: Pre, post and during AAS era in Major League Baseball; Sports active/inactive; Black and white males	• In Major League Baseball pre-steroids era (1991-1993) 2.8% of male students who were active in sport reported AAS use in their lifetimes. This figure increased to 3.4% during the steroid era (1994-2003) and fell to 2% during the post-steroids era (2004-2007). The difference in AAS use across eras was significantly different ($p<.01$). Similar patterns emerged for those not involved in sport. • Among all male students, participation in sports is significantly ($p<.01$) associated with higher rates of AAS use across the eras. • Racial differences: black males reporting lower rates of AAS use across the 3 eras compared to white males.
Humphreys & Ruseski (2011)	**USA**	**113,788 High-School Students** 49% males Grades 9-12 Mean age = 16.2 ± 1.23 years	**Cross sectional** (Questionnaire) Youth Risk Behaviour Surveillance System	I: Demographics, sport participation D: AAS use	• Incidence of reported steroid use (at least once) among high school students is small, but consistent over time (mean = 4.1% ±1.98, range: F=1.8-5.0%, M=4.0-7.3%). • AAS use was associated with motivations to change physical appearance and experimentation with illicit substances. Specifically, use of other substances, such as cocaine or heroin, increases the likelihood of steroid use by 8%. • Males were 1.1% more likely to use AAS than females. • Across the whole sample, Hispanic individuals are slightly more likely to take steroids than individuals from other ethnic origins, including white Americans. • Individuals who participate in only one team sport are less likely to take steroids (-0.5%) than individuals who participate in more than one team sport (+0.3%).
Lorang, Callahan, Cummins, Achar & Brown (2011)	**USA**	**4,231 High-School Students** 50.3% males Mean age= 15.9 ± 1.2 years	**Cross-sectional** (Questionnaire) California Healthy Kids Survey	I: Demographics; sport participation; other drug use; supplement use; body image D: AAS use	• Overall rates of AAS use were low (1.4%) but use was higher in males (11% vs. 1.1%) and those participating in at least one school sport (OR: 1.91; CI= 1.03-3.56). • Half (49%) believed that steroids improved athletic performance and 38% reported that use improves appearance. Recreational drug use and frequency of recreational drug use increased risk for AAS use. • More males than females believed that steroids improved athletic performance (22% more males) and physical appearance (25% more males)

Table 2 Continued.

Authors (year)	Country	Sample	Method	Independent (I)/ Dependent (D) variables	Summary
vandenBerg, Neumark-Sztainer, Cafri & Wall (2007)	**USA**	2516 Middle and high school students. 1999 (time 1) and 2004 (time 2)	**Longitudinal** (Questionnaire) Project EAT-II	I: Demographic variables, BMI, sports participation D: AAS use	• 1.5% reported steroid use at time 2. • Use differed by ethnicity but not socioeconomic status. Steroid use was not stable across time, although the risk of use at time 2 was higher for girls and (marginally) for boys who used steroids at time 1. • Predictors of use for male adolescents included wanting to weigh more and reporting higher use of healthy weight-control behaviours. • Female time 2 steroid users had higher BMIs and were less satisfied with their weight, had poorer nutrition knowledge and concern for health, and were marginally more likely to have participated in weight-related sports at time 1.
Vertalino, Eisenberg, Story & Neumark-Sztainer (2007)	**USA**	**4,746 High-School Students** 31 public middle and high schools in the Minneapolis/St Paul Minnesota area 50% males Mean age= 14.9 ± 1.7 years 34% middle school; 66% high school	**Cross-sectional** (Questionnaire) Project EAT survey (1998-1999) *Social cognitive theory*	I: Participation in a weight-related sport; BMI; school level; gender; SES D: AAS use; use of unhealthful weight-control behaviours	• More males (20.4%) than females (16.2%) reported participation in a weight-related sport (e.g., a sport or activity where it's important to stay a certain weight - wrestling, gymnastics, ballet, etc.). • Males who reported participation in a weight-related sport had an increased risk of past-week vomiting (odds ratio [OR]=5.7), laxative use (OR=6.8), as well as past-year vomiting (OR=4.9), laxative use (OR=3.4), diuretic use (OR=6.0), and steroid use (OR=3.7), compared with those males who did not report participation. • Females who reported participation in a weight-related sport had an increased risk of past week vomiting (OR=2.1), as well as past year vomiting (OR=2.0), laxative use (OR=2.6), and steroid use (OR=2.6), compared with those who did not report participation in a weight-related sport.
Woolf, Rimal & Sripad (2014)	**USA**	**Male high school athletes** (N=404) 8 large high schools from Illinois and Iowa Mean age= 16.1 ± 1.2 years Age range = 14-19 years	**Cross-sectional** (Questionnaire) Hypothesis testing	I: Age; sport; ethnicity; descriptive norms; subjective norms; outcome expectancies D: Intentions to use AAS	• Intentions to use AAS were independent of age, ethnicity or type of sport • When norms pertained to professional athletes, descriptive norms ($p < .05$), injunctive norms and outcome expectancies ($p < .01$) explained 7% of the variance in intentions. • When norms pertained to college athletes, main effects were also found for descriptive norms ($p < .05$) and outcome expectancies ($p < .01$). 8% of the variance in intentions was explained. • When norms pertained to own team members, main effects were found for descriptive norms ($p < .001$), injunctive norms ($p < .01$) and outcome expectancies ($p < .05$), 12% of the variance in intentions was explained. • When norms pertained to close friends, main effects were found for descriptive norms ($p < .001$), injunctive norms ($p < .05$) and outcome expectancies ($p < .05$) where 15% of the variance in intentions was explained. • There appears to be a rising profile of influence with increasing proximity.

Table 3. Overview of studies that employed regression analysis to identify variables that were predictive of doping intentions/doping use in adolescent athletes.

Authors (year)	Country	Sample	Method	Independent (I)/ dependent (D) variables	Summary
Barkoukis, Lazuras & Tsorbatzoudis (2014)	**Greece**	**650 Adolescent Athletes** 68.2% males Mean age= 16.1 ± 1.5 years Range: 14-20 years	**Cross-sectional** (Questionnaire) Hypothesis testing	I: NS use; attitudes, subjective norms, descriptive norms D: Doping intentions; doping use	• 4.2% self-reported doping at least once. • Athletes reporting more frequent NS use were almost twice as likely to also report doping use [OR= 2.04, 95% CI: 1.6-2.6] • NS users reported significantly stronger doping intentions, positive attitudes towards doping and perceived NS use as less risky for doping use compared with non-users. • Athletes reporting doping use reported significantly greater prevalence estimates for athletes at the same competitive level and for elite athletes in their country. • Self-reported dopers held more favourable subjective norms, stronger doping intentions and perceived more favourable team norms compared with non-users and NS users.
Barkoukis, Lazuras & Tsorbatzoudis (2011)	**Greece**	**309 Junior Athletes** 62.6% males Mean age= 16.64 ± 1.15 years	**Cross-sectional** (Questionnaire) Hypothesis testing	I: Beliefs about the causes of success; attitudes; social norms D: Doping susceptibility	• Only deception was found to be a significant predictor of doping susceptibility, over and above attitudes and social norms. • Motivation-effort and ability (conceptually resemble task and ego orientation) were not significant predictors of doping susceptibility.
Dodge & Jaccard (2008)	**USA**	**241 High School Athletes** 63.9% males Mean age= 15.8 years	**Cross-sectional** (Questionnaire) *Theory of reasoned action*	I: Attitudes towards abstaining from illegal substances; subject norms towards illegal substances D: Intentions to use illegal PED	• 2.5% of adolescents reported having tried an illegal PED and 17% reported having tried a legal PED. • Males were more supportive of PED use than females • Intentions to use illegal PED were significantly predicted by attitudes towards using illegal PED, attitudes towards abstaining from illegal PED use and subjective norms associated with abstaining from illegal PED use (R^2= 0.69, p< .01). • Results showed that attitudes and norms associated with abstinence contribute to the prediction of behavioural intentions over and above that of attitudes and norms associated with using both legal and illegal PED
Goulet, Valois, Buist & Côté (2010)	**Canada**	**3573 Junior Athletes** 56% males Mean age = 15.5 ± 2.4 years	**Cross-sectional** (Questionnaire) *Theory of planned behaviour*	I: Demographic variables D: PED use; PED use intentions	• 25.8% admitted having attempted to improve their athletic performance by using 1 or more banned substances in the last 12 months. • Multiple regression analyses showed that intentions to use were the main predictor of PED use (b=0.34). When introducing external variables, predicted variance increased from 12% to 16% where use of PED was significantly predicted by intentions to use (b=0.31), level of sportspersonship (b= -0.09) and pressure to lose weight from athletes' entourage (b= 0.09). • Attitude (b = 0.09), subjective norm (b = 0.13), perceived facilitating factors (b = 0.40), perceived moral obligation (b = -0.18), and pressure from the athlete's entourage to gain weight (b = 0.10) were positively associated with athletes' behavioural intention to use PED predicting 44% of the variance in intentions

Table 3 Continued.

Authors (year)	Country	Sample	Method	Independent (I)/ dependent (D) variables	Summary
Laure & Binsinger (2007)	**France**	**2199 Preadolescent Athletes** 53.2% males Mean age= 11.2 ± 0.6 years	**Longitudinal** (Questionnaire)	I: Self-esteem, trait anxiety, reported health hazards, perceived drug effectiveness, intention to use D: Drug use (prohibited substances, alcohol, tobacco, cannabis)	• Use of doping agents increased from 1.2% in November 2001 to 3.0% four years later. • Use of doping agents was linked to the number of hours of practice per week, intention to use, use of other drugs, self-esteem and trait anxiety. • 44% of doping users reported winning at least one sporting event as a result.
Lucidi, Zelli, Mallia, Grano, Russo & Violani (2008)	**Italy**	**1232 High School Students** Psychometric condition (7 schools randomly assigned; M: 49%; mean age= 17 ± 1.2 years; assessed 3 weeks later, n= 182/218) Longitudinal condition (35 schools assigned; M: 49%; mean age= 16.8 ± 1.5 years; 3 months later, n= 762/1014)	**Longitudinal** (Questionnaire) *Social cognitive theory* Hypothesis testing	I: Age, sport participation, moral disengagement, self-regulatory efficacy, attitude, social norms, perceived behavioural control D: PED use, PED use intentions	• 2.1% reported doping and 14.4% reported supplement use. • Intention to use doping substances increased with stronger attitudes about doping, (0.26) stronger beliefs that significant others would approve of their use (0.32), a stronger conviction that doping use can be justified (0.21), and a lowered capacity to resist situational pressure or personal desires (-0.20). • Stronger intentions (0.17) and moral disengagement (0.31) contributed to a greater use of doping substances during the previous 3 months. • Doping use was also correlated significantly to supplementation (r=0.74). • Together, this model explained 55% of variance in doping intentions and 15% variance in doping use
Mallia, Lucidi, Zelli & Violani (2013)	**Italy**	**High school students** (N = 3498 randomly selected from 52 schools) 50.9% males Mean age= 16.5 ± 1.6 years	**Longitudinal survey** (Questionnaire)	I: Sociodemographic variables; Attitudes towards PED; Supplement use D: Illegal PED use	• It is relatively rare for youths to report use of illegal performance-enhancing substances in the past three months. • Male, relatively older, and athlete students were significantly more likely to use illegal PED than their respective counterparts. • Student athletes who reported having used legal PED in the past three months were 10 times more likely to also have used illegal PED than those student athletes who did not report having used legal PED.

Table 3 Continued.

Authors (year)	Country	Sample	Method	Independent (I)/ dependent (D) variables	Summary
Wanjek, Rosendahl, Strauss & Gabriel (2007)	**Germany**	**2313 High School Students** (16 schools) 46.6% males Mean age = 15.8 ± 2.2 years 490 non-athletes (21.9%), 1254 recreational athletes (65%) and 497 competitive athletes (22.2%)	**Cross-sectional** (Questionnaire)	I: Age, sex, doping attitude, knowledge D: Prohibited substance use	• 15.1% indicated use of prohibited substances from the WADA list in the previous year (0.7% AAS, 0.4% growth hormones, 2.4% stimulants, 13.2% cannabis, 0.1% diuretics, 2.2% cocaine/heroin and 0.3% erythropoietin. • Non-athletes reported a substance use that was approximately 5% higher than that of recreational athletes and nearly three times as high as that of competitive athletes. • On average, 20 (SD = 3.8) points out of 33 points (100%) were achieved on the knowledge test. Altogether, 1.3% had substantial knowledge, 43.2 % had a moderate knowledge and 55.5% had a poor knowledge regarding doping. • Doping specific knowledge was significantly higher for competitive athletes than for recreational athletes ($p = 0.001$). • An anti-doping attitude, along with knowledge and age of the students, made significant contributions to the obvious variances ($F [3,2263] = 109.89$, $p < 0.01$, • $R2 = 0.13$). However, there was no significant variance by gender.
Zelli, Mallia & Lucidi (2010) Same sample as Zelli, Lucidi & Mallia (2010)	**Italy**	**1022 High School Students*** (10 schools) 50.6% males Mean age = 15.6 years 864 participated in second assessment (M: 49%; mean age = 16.5 years)	**Longitudinal** (Questionnaire) *Social cognitive theory* Hypothesis testing	I: Attitudes, subjective norms, behavioural control, self-regulatory efficacy, moral disengagement, D: Doping use and intentions to dope	• Adolescents reported low rates of doping use (1-2.1%). Approximately 15% used supplements. • Belief systems (stronger attitudes in favour of doping use, stronger views about others approval, greater tendency to personally justify use, weaker confidence in ability to resist social pressure) influenced adolescents' doping intentions, accounting for 47% of their variance. • Doping intentions, in turn, longitudinally influenced and accounted for nearly 75% of the variation in adolescents' doping use.
Zelli, Lucidi & Mallia (2010) Same sample as Zelli, Mallia & Lucidi (2010)	**Italy**	**1022 High School Students*** (10 schools) (50.6% males, mean age = 15.6 years) 864 participated in second assessment (M: 49%; mean age = 16.5 years)	**Longitudinal** (Questionnaire) *Social cognitive theory* Hypothesis testing	I: Sport participation, drive for muscularity, drive for thinness, doping attitudes D: Doping use and intentions to dope	• On average, adolescents did not report substantial drives for muscularity or for thinness, with mean scores of 2.25 and 2.66, respectively. Similarly, participants' attitudes ($M = 1.91$, $SD = 0.75$) and prospective intentions ($M = 1.52$, $SD = 0.82$) toward doping indicated a substantial stand against doping use. • Boys reported significantly stronger attitudes and concerns for muscularity than did girls, whereas girls reported significantly greater concerns for thinness than did boys ($p<0.05$). • Recreational and competitive athletes reported a significantly stronger drive for muscularity than did adolescent non-athletes ($p<0.05$) • Boys reported significantly stronger and more positive attitudes toward doping use than did girls ($p<0.05$). • Structural equation modelling showed that muscularity and thinness have direct effects on adolescents' intentions to engage in doping and that muscularity, but not thinness, partly exerts its effects through the endorsement of positive attitudes toward doping. • Greater drives for muscularity, as well as stronger drives for thinness, predicted stronger intentions to use doping substances (i.e., $r = 0.20$ and $r = 0.15$).

Table 3 Continued.

Authors (year)	Country	Sample	Method	Independent (I)/ dependent (D) variables	Summary
Chan, Dimmock, Donovan, Hardcastle & Lentillon-Kaestner (2014a)	**Australia**	**410 Junior Athletes *** 55.4% males Mean age = 17.7 ± 3.9 years Elite and sub-elite athletes	**Cross-sectional** (Questionnaire) *Trans-contextual model of motivation* *Theory of planned behaviour*	I: Doping avoidance (attitude; subjective norms; perceived behavioural control; autonomous motivation; controlled motivation; amotivation) motivation for sport (autonomous, controlled, amotivation) D: Intention for doping avoidance	• Self-determined motivation in sport was related to self-determination in the context of doping avoidance. • Autonomous motivation, subjective norms and perceived behavioural control in doping avoidance fully mediated the relationship between autonomous motivation in sport and intention for doping avoidance. • Athletes who participate in sport for controlling reasons rather than autonomous reasons are less likely to see doping avoidance as a behaviour they should engage in.
Chan, Hardcastle, Dimmock, Lentillon-Kaestner, Donovan, Burgin & Hagger (2014b)	**Australia**	**410 Junior Athletes *** 55.4% males Mean age = 17.7 ± 3.9 years Elite and sub-elite athletes	**Cross-sectional** (Questionnaire) *Theory of planned behaviour*	I: Behavioural belief-strength, normative belief-strength, control belief-strength D: Attitude, subjective norms, PBC, intention	• Perceived behavioural control and subjective norms predicted doping avoidance intentions but attitudes were not a predictor. • Composite scores of belief values and belief expectancies for subjective norms (motivation to comply x normative belief strength) and perceived behavioural control (control belief-power x control belief-strength) predict intentions to avoid doping which is mediated by subjective norms and perceived behavioural control respectively. • Belief expectancies had a stronger predictive power than belief values on doping avoidance intentions (mediated by subjective norms and perceived behavioural control).
Chan, Donovan, Lentillon-Kaestner, Hardcastle, Dimmock, Keatley & Hagger (2014c)	**Australia**	**410 Junior Athletes *** 55.4% males Mean age = 17.7 ± 3.9 years Elite and sub-elite athletes	**Cross-sectional** (Questionnaire) *Self-determination theory* Hypothesis testing	I: Motivation (autonomous; controlled; amotivation) D: Doping intention, self-reported adherence to doping avoidance behaviours, behavioural responses to lollipop	• Young athletes who adopted controlled reasons to avoid doping in sport report higher adherence to behaviours related to avoiding and monitoring banned substances • Autonomous motivation was more predictive of doping intention for athletes with low controlled motivation than high controlled motivation

* All same sample

Table 3 Continued.

Authors (year)	Country	Sample	Method	Independent (I)/ dependent (D) variables	Summary
Chan, Lentillon-Kaestner, Dimmock, Donovan, Keatley, Hardcastle and Hagger (2015)	**Australia**	**410 Junior Athletes *** 55.4% males Mean age = 17.7 ± 3.9 years Elite and sub-elite athletes	**Cross-sectional** (Questionnaire) *Strength energy model of self-control* Hypothesis testing	I: Self-control D: Doping intention, self-reported adherence to doping avoidance behaviours, doping attitude, behavioural responses to lollipop	• Self-control was negatively associated with doping attitude and intention • Self-control was positively associated with intention and adherence to doping-avoidant behaviours and refusal to take or eat the unfamiliar candy offered in the lollipop protocol • Athletes with low self-control were more likely to have positive attitudes and intentions to dope along with reduced intentions, adherence and awareness of doping avoidance
Horcajo & De la Vega (2014)	**Spain**	**68 Junior Football Players** 84% males Mean age = 20.2 ± 3.6 years	**Experimental** Hypothesis testing	I: Elaboration; direction of message D: Doping-related attitudes	• Attitude change was a function of message direction (those who were shown the message against legislation demonstrated significantly more unfavourable attitudes towards the legislation proposal than those who received the message in favour of the legislation). • High elaboration participants' attitude change persisted for one week after message exposure.
Lazuras, Barkoukis & Tsorbatzoudis (2015)	**Greece**	**650 Adolescent Athletes** 68.2% males Mean age= 16.1 ± 1.5 Age range = 14-20 years old	**Cross-sectional** (Questionnaire) *Theory of triadic influence* *Theory of planned behaviour* Hypothesis testing	I: Distal predictors (age, gender, self-reported doping, motivational regulations, achievement goals, sportspersonship orientation), proximal predictors (attitudes, norms, self-efficacy beliefs, anticipated regret) D: Doping intentions	• 4.2% self-reported doping use at least once • 57.2% of the variance in doping intentions was explained by the model. Step 1 explained 19.5% of doping intention variance with age, gender, self-reported doping, mastery approach goals, performance approach goals and sportspersonship orientation being significant predictors. Step 2 explained a further 34.4% of the variance in doping intentions with attitudes, subjective norms, descriptive norms and situational temptation being significant predictors. In the final step, anticipated regret explained a further 3% of the variance in doping intentions. In the final step the significant predictors of doping intentions were attitudes, subjective norms, descriptive norms, situational temptation and anticipated regret. • Mediation analyses indicated that the effects of achievement goals on intentions were mediated by self-efficacy beliefs and the effects of sportspersonshp were mediated by attitudes and anticipated regret.

Table 4. Overview of descriptive studies examining the doping knowledge, attitudes and beliefs of adolescent athletes.

Authors (year)	Country	Sample	Methods	Summary
Bloodworth, Petróczi, Bailey, Pearce & McNamee (2012)	**UK**	**403 Talented Adolescent Multi-Sport Athletes** Age range:12-21 years 67% males 24% World Class Development athletes (Most sampled: Rugby Union 27.8%; Football 13.9%; Swimming 6.7%; Athletics 4.7%; Cricket 4.2%)	**Cross-sectional** (Questionnaire) [Key themes: attitudes toward performance-enhancing substances and supplements].	• Majority of athletes disagreed with the notion that the use of supplements is necessary to be successful in sport and were generally against the use of doping substances to enhance sporting performance. • Males tended to express a more permissive attitude toward performance-enhancing methods than females. Those convinced of the necessity of supplementation for sporting success were also more likely to express permissive attitudes. • When asked whether they would take a ''magic'' drug that, while undetectable, would significantly enhance performance but shorten lifespan, 93% of athletes said ''no''. This affirmative figure fell to 66% when the "magic" drug had no health consequences. • There was a significant association between the projected use of the hypothetical drug by competitors and the individual respondent's willingness to take the hypothetically ''magic'' substance. • Results indicated a significant association between projected use and individuals' own behavioural intention to use the substance in the scenario.
Bloodworth & McNamee (2010)	**UK**	**40 Talented Adolescent Multi-Sport Athletes** 55% males Mean age= 19.6 years 13 different sports	**Cross-sectional** (12 Focus Groups) [Key themes: attitudes and opinions towards doping; pressure to dope]	• Athletes did not report a significant national doping problem in their sport, but exhibited sporting xenophobia with regard to both doping practices and the stringency of testing procedures outside of the UK. • Athletes often viewed doping as 'unnatural' and considered the shame associated with doping to be a significant deterrent. Athletes perceived no external pressure to use PEDs • In response to hypothetical questions, however, various factors were 'pressure' points: most notably injury recovery and the economic pressures of elite sport. • A significant minority of athletes entertained the possibility of taking a banned hypothetical performance enhancing drug under conditions of guaranteed success and undetectability.
Fürhapter, Blank, Leichtfried, Mair-Raggautz, Müller & Schobersberger, (2013)	**Austria**	**408 Junior Athletes** 76.5% males Mean age = 15.9 ± 1.5 years 80% Response rate	**Cross-sectional** (Online questionnaire) [Key themes: knowledge and attitudes; doping use; willingness to dope]	• 38.2 % self-reported they were informed about the WADA 2010 prohibited list, whereas 39.0 % were not informed, and 21.8 % were indifferent. • 31.4 % were convinced, doping substances are only prohibited for professional athletes, 19.9 % believed prohibited substances are allowed when agreed on by a physician, and 38.7 % indicated not to know that doping substances are generally prohibited. • 92.4% call doping unfair and 86.5% claim doping should not be legalised. • 70% perceive a high risk of getting caught while doping but 10% said they would be willing to take a banned substance if there was no risk of getting caught.
Gradidge, Coopoo & Constantinou (2011)	**South Africa**	**100 Male High School Athletes** 17-18 years, n=78 81% Response rate	**Cross-sectional** (Questionnaire) [Key themes: legal and illegal performance enhancing substance use; reasons for use; sources of information]	• 30% reported regular use of legal/illegal performance enhancing substances (i.e., vitamin supplementation, protein supplements, carbohydrates supplementation, creatine supplementation, caffeine supplementation, adrenaline/ephedrine, growth hormone, anabolic androgenic steroids) • 56% of those reporting using legal/illegal performance enhancing substances did so to improve their sports performance • Banned substances used included human growth hormone (5%), anabolic steroids (4%) and ephedrine (5%) • The Internet (74%) was the main source of information on performance enhancing substance use in sport

Table 4 Continued.

Authors (year)	Country	Sample	Methods	Summary
Hejabi, Manouchehri & Tojari (2015)	**Iran**	**373 Junior Athletes** 47% males Age range: 15-18 yrs. (15 yrs.= 42%; 16 yrs.= 22%; 17 yrs.= 23%; 18 yrs.= 13%)	**Cross-sectional** (Questionnaire) [Key themes: doping behaviour]	• The PED consumption behaviour measurement questionnaire demonstrated internal reliability (α= 0.856) • Differences exist in the doping behaviour of males and females with males reporting higher doping behaviour than females. • Differences in doping behaviour also emerged for age with 15 year olds reporting the highest doping behaviour.
Moston, Engelberg & Skinner (2014)	**Australia**	**312 Junior Athletes and Non-Athletes** 43% males 12-13 years, n=100; 14-15 years, n=97; 16-17 years, n=115	**Cross-sectional** (Questionnaire) [Key Themes: Perceived incidence of doping; beliefs; self-fulfilling prophecy; moral functioning; hypothesis testing]	• Overall estimated incidence of doping was 28.8% (range 0-100%) with athletics, weightlifting and cycling perceived to be the sports in which doping was most prevalent. • Gender effect – higher perceived incidence by females. Age effect - perceived prevalence declined with age. • Involvement in sport was not linked to perceived incidence. The perceived incidence of PED use 'in own sport' was 11.26% (less than half of the perceived incidence across all sports). • Higher levels of moral judgement were correlated with lower estimates of PED use ($p<0.05$, partial eta squared, 0.17).
Nolte, Steyn, Krüger & Fletcher (2014)	**South Africa**	**346 Junior Athletes** 60% males Mean age 16.9 ± 1.4 years	**Cross-sectional** (Questionnaire) [Key Themes: Attitudes, beliefs and knowledge]	• 3.9% of the athletes in this survey admitted to using a prohibited PED and more than 14.0% of the athletes said they would consider using a prohibited PED if they knew they would not get caught. • Ambition (46.0%) and emotional pressure (22.5%) were the primary reasons why the athletes would consider using prohibited PEDs. • Even though coaches appeared to be one of the main sources of information (on PEDs and anti-doping rules), only 42.1% of the athletes felt that they were well informed.
Schirlin, Rey, Jouvent, Dubal, Komano, Perez-Diaz & Soussignan (2009)	**France**	**97 High School Students** 55% males 11.6 years, n= 24; 12.3 years, n= 34; 13.6 years, n= 18; 14.5 years, n= 21	**Cross-sectional** (Questionnaire) [Key Themes: Attentional bias to doping; self-esteem; hypothesis testing]	• Reaction times were longer after doping words than after control words. • Larger carry-over effects were evident in participants with low physical self-esteem indicating a negative relationship ($p<0.05$) between self-esteem and sensitivity to doping words • Carry-over effects were not influenced by age or gender.

Prevalence of doping use

Reported PED use was relatively low among adolescents with prevalence typically ranging between 1% and 5%. For example, in two studies involving South African individuals, 3.9% of junior athletes reported the use of a banned substance (Nolte et al., 2014), while human growth hormone and AAS use was reported by 5% and 4% of male high school students respectively (Gradidge et al., 2011). Yet prevalence was higher when participants could choose from a selection of substances (Goulet et al., 2010; Wanjek et al., 2007). For example, 1 in 4 Canadian young athletes admitted to trying to improve their athletic performance by using one or more of 15 substances that were entirely prohibited or restricted (Goulet et al., 2010) while 15.1% of German students reported having used prohibited substances from the WADA list in the previous year (Wanjek et al., 2007). However, the high prevalence rates in these two studies can be explained partially by the use of cannabis by 13.2% of German students (Wanjek et al., 2007) and the inclusion of a number of substances that are restricted but not completely prohibited (e.g., asthma inhaler, caffeine tablets; Goulet et al., 2010). More males than females reported PED use across the studies (Laure & Binsinger, 2007; Lucidi et al., 2008; Mallia et al., 2013; Wanjek et al., 2007). PED use also appeared to increase with age (Laure & Binsinger, 2007; Mallia et al., 2013; Wanjek et al., 2007) and sports participation (Laure & Binsinger, 2007; Mallia et al., 2013).

In comparison, across the AAS specific studies, prevalence within the samples ranged from 0.2% of Icelandic females (Thorlindsson & Halldorsson, 2010) to 11% of male US high school students (Lorang et al., 2011). In addition, Sagoe et al. (2015) reported that 6% of Ghanaian high school students had previously been offered AAS whilst 18.5% knew someone who had used AAS. Overall, the studies identified that AAS use was more prevalent amongst males than females (Dunn & White, 2011; Humphreys & Ruseski, 2011; Ip et al., 2011; Lorang et al., 2011; Sagoe et al., 2015; Thorlindsson & Halldorsson, 2010; vandenBerg et al., 2007; Vertalino et al., 2007). However, findings varied with regard to the influence of age on AAS use. Some studies found younger students were more likely to report AAS use (Dunn & White, 2011; Elliot et al., 2007; Humphreys & Ruseski, 2011; vandenBerg et al., 2007) whilst others found AAS use

increased with age (Rees et al., 2008; Thorlindsson & Halldorsson, 2010). For example, Dunn and White (2011) found AAS use was more common amongst 12-15 year olds than 16-17 year olds while Rees et al. (2008) found AAS use increased as students moved up through grades at school. Yet Woolf and colleagues (2008) found no association between age and intentions to use AAS. Similarly, the influence of sports participation on AAS use differed across studies. For instance, AAS use was greater in males who participated in sport (Hua & Braddock, 2008) and individuals who participated in at least one school sport (Lorang et al., 2011). Yet Elliot and colleagues (2007) found AAS users were less likely to play school-sponsored team sports, while Humphreys and Ruseski (2011) found those who competed in one team sport were 0.5% less likely to use AAS but those who competed in more than one team sport were 3% more likely to use AAS. In addition, AAS use was not significantly related to formally organised sports but individuals were 2.7 times more likely to use AAS if they participated in fitness and physical training in informal contexts (Thorlindsson & Halldorsson, 2010). Thus, study findings are not pointing to one universal rule and at the present time there is not strong support for the utilitarian perspective, which holds that formally organised sport provides the key to AAS use among young people (Thorlindsson & Halldorsson, 2010). Further research is required to explore the possibility that participation in leisure and fitness contexts is a strong predictor of AAS use.

Doping vulnerability

Four descriptive studies included a hypothetical scenario that asked participants to indicate whether they would use a drug if it were undetectable and guaranteed success (Bloodworth et al., 2012; Bloodworth & McNamee, 2010; Fürhapter et al., 2013; Nolte et al., 2014). Of those who were part of a focus group, just under a third of participants expressed a willingness to use the drug (Bloodworth et al., 2012). In comparison, in questionnaire studies, between 7.2% and 14.9% of junior athletes reported that they would be willing to or would consider using a banned substance if it guaranteed success (Bloodworth & McNamee, 2010; Fürhapter et al., 2013; Nolte et al., 2014). When the context was changed to whether 'other' athletes would use a drug that guaranteed success and had no chance of being detected, this percentage

increased to 72.6% (Bloodworth & McNamee, 2010). Similarly, estimated incidence of PED use in sport was higher than levels reported for individual prevalence. For example, amongst Australian high school athletes, the mean estimated incidence of PED use in sport was 28.8% compared to 11.3% in their own sport (Moston et al., 2014c), while 32.4% of South African high school athletes believed 51-70% of elite athletes worldwide are using performance enhancing drugs (PEDs) (Nolte et al., 2014). Estimates of PED use were found to be related to moral functioning whereby the higher an individual's levels of moral functioning, the lower they would estimate PED use (Moston et al., 2014c). Equally, young British athletes did not perceive doping as a widespread problem on a national scale within their sport, but did perceive it as a greater problem in other countries (Bloodworth et al., 2012). Athletes self-reporting doping use also provided significantly greater prevalence estimates for both athletes at the same competitive level and those competing at elite level in their country (Barkoukis, Lazuras, et al., 2014).

Doping attitudes and beliefs

Overall, findings demonstrated that young athletes displayed negative attitudes towards doping (Bloodworth et al., 2012; Bloodworth & McNamee, 2010; Fürhapter et al., 2013; Nolte et al., 2014). For example, 92.4% of West-Austrian junior athletes thought doping was unfair (Fürhapter et al., 2013). Within the unfavourable views towards doping demonstrated by young British athletes, males demonstrated more favourable attitudes towards doping than females and those who believed using NS was necessary for success were more likely to report pro-doping attitudes (Bloodworth & McNamee, 2010). Similarly, the beliefs that participants reported were also unfavourable towards doping. For example, 69.7% believed there was a high risk of being caught (Fürhapter et al., 2013), 70.4-85.2% believed doping is harmful (Fürhapter et al., 2013; Nolte et al., 2014) and 85.2% believed doping is morally wrong (Nolte et al., 2014). In comparison, Schirlin et al. (2009) examined sensitivity to doping words through the use of an emotional stroop task. Findings indicated a negative relationship between self-esteem and sensitivity to doping words; individuals who were lower in self-esteem were more sensitive to doping words.

Predicting PED use/intentions

Numerous studies sought to examine doping predictors with the focus being on doping use (Goulet et al., 2010; Laure & Binsinger, 2007; Lucidi et al., 2008; Mallia et al., 2013; Wanjek et al., 2007; Zelli, Mallia, et al., 2010), doping intentions (Barkoukis, Lazuras, et al., 2014; Chan, Donovan, et al., 2014; Chan et al., 2015; Dodge & Jaccard, 2008; Goulet et al., 2010; Lazuras et al., 2015; Lucidi et al., 2008; Zelli, Lucidi, et al., 2010; Zelli, Mallia, et al., 2010), intentions to avoid doping (Chan, Hardcastle, Dimmock, et al., 2014; Chan et al., 2015) or doping susceptibility (Barkoukis, Lazuras, & Tsorbatzoudis, 2013). Doping susceptibility was significantly predicted by deception (i.e., a stronger faith in deception as a means to success rather than internal attributions of effort and skills or abilities) over and above attitudes and social norms (Barkoukis, Lazuras, & Tsorbatzoudis, 2013). In comparison, intentions to avoid doping were significantly predicted by subjective norms and perceived behavioural control, while belief expectancies had stronger predictive power than belief values when mediated by subjective norms and perceived behavioural control (Chan, Hardcastle, Dimmock, et al., 2014). Similarly, intentions to avoid doping and adherence to doping avoidance were positively associated with self-control (Chan et al., 2015).

Intentions to dope were significantly predicted by more favourable attitudes towards doping (Dodge & Jaccard, 2008; Goulet et al., 2010; Lazuras et al., 2015; Lucidi et al., 2008; Zelli, Lucidi, et al., 2010; Zelli, Mallia, et al., 2010) and stronger subjective norms (greater approval perceived from significant others to dope; Goulet et al., 2010; Lazuras et al., 2015; Lucidi et al., 2008; Zelli, Mallia, et al., 2010). In addition, other significant predictors of intentions to dope included; pressure to lose weight from significant others (Goulet et al., 2010), attitudes and subjective norms associated with abstaining from doping (Dodge & Jaccard, 2008), greater tendency to personally justify use (Lucidi et al., 2008; Zelli, Mallia, et al., 2010), weaker confidence in ability to resist social pressure (Lucidi et al., 2008; Zelli, Mallia, et al., 2010), descriptive norms, situational temptation and anticipated regret (Lazuras et al., 2015) and having the drive to be muscular or thin (Zelli, Lucidi, et al., 2010). Among Italian adolescents, 47% of the variance in intentions to dope were explained by more positive doping attitudes, stronger views about others approval, a greater tendency to personally justify use and

lower perceived ability to resist social pressure (Zelli, Mallia, et al., 2010). In a rare example where predictors are identified in one sample and then tested in another, findings corroborated previous work (Lucidi et al., 2008).

Equally, subjective norms and perceived facilitating factors were the main predictors of intentions to dope but attitudes, perceived moral obligation and pressure from the athlete's entourage to gain weight all contributed to explain 44% of the variation in intentions among Canadian young athletes (Goulet et al., 2010). In addition, Dodge and Jaccard (2008) found that intentions to dope were significantly predicted by attitudes towards doping, attitudes towards abstaining from doping and subjective norms associated with abstaining from doping, explaining 69% of the variance in intentions of American adolescents. Finally, Lazuras and colleagues (2015) found 57% of the variance in doping intentions amongst Greek adolescent athletes were explained by five factors; (i) their attitudes towards doping, (ii) subjective norms, (iii) descriptive norms (perceived prevalence of doping by others), (iv) anticipated regret if they were to dope, and (v) the temptation to dope under certain circumstances.

When predicting PED use, intentions were the main predictor that emerged (Goulet et al., 2010; Lucidi et al., 2008; Zelli, Mallia, et al., 2010) supporting the tenets of the TPB. Other significant predictors of PED use included sportspersonship (Goulet et al., 2010), pressure from the athlete's entourage to lose weight (Goulet et al., 2010), previous use (Zelli, Mallia, et al., 2010), and moral disengagement (Lucidi et al., 2008). For instance, 15% of the variance in doping use among Italian adolescents was explained by their doping intentions and moral disengagement (Lucidi et al., 2008). Similarly, 16% of the variance in doping use among Canadian young athletes was explained by three factors; their doping intentions, level of sportspersonship, and pressure from an athlete's entourage to lose weight (Goulet et al., 2010). Yet Zelli, Mallia and Lucidi (2010) found 74% of the variance in doping use among Italian adolescents was explained by their doping intentions and previous use three months earlier.

In addition, a number of correlates and predictors were identified which may intensify an individual's doping vulnerability. For example, Laure and Binsinger (2007) found that PED users were more likely to be boys, users of other substances, low in self-esteem, high in trait anxiety and heavily committed to high training volumes. Similarly, Mallia and colleagues (2013) identified that males were nearly four times more at risk of doping than females (OR: 3.9; CI: 1.9-8.2; $p<0.01$), while student athletes were three times more at risk of doping than non-athletes (OR: 2.9; CI: 1.2-6.7; $p<0.01$). Age was also seen as a potential risk factor with substance use increasing with age (Laure & Binsinger, 2007; Mallia et al., 2013; Wanjek et al., 2007). Moreover, the use of NS was seen as a risk factor as NS users who did not report doping were found to have significantly more favourable doping attitudes and reported significantly greater doping prevalence estimates than non-users (Barkoukis, Lazuras, et al., 2014). Equally, Wanjek and colleagues (2007) found dopers reported less anti-doping attitudes (i.e., more positive towards doping) and higher levels of doping knowledge. Furthermore, athletes who participate in sport for controlling reasons, such as to win, rather than autonomous reasons are less likely to engage in doping avoidance, (i.e., will be more vulnerable to doping; Chan, Dimmock, et al., 2014) while athletes who adopt controlled reasons to avoid doping are more likely to invest time and effort in anti-doping (e.g., by seeking professional advice; Chan, Donovan, et al., 2014). Finally, athletes with low levels of self-control were more likely to have positive attitudes and intentions to dope along with reduced intentions to avoid doping and adherence to doping avoidance (Chan et al., 2015).

The final study included in this section differs from the other studies as it did not set out to predict PED use/intentions, but instead utilised an experiment to change attitudes towards a proposal of legalising doping behaviours through thoughtful (high elaboration) versus unthoughtful (low elaboration) processes. Specifically, Horcajo and De la Vega (2014) conducted the experiment to determine whether a specific mechanism - using thoughtful processes to change attitudes - would make new attitudes more stable over time. Young football players were randomly assigned to one of four conditions where they read a persuasive message either for or against the legislation of several doping substances. They were also told that the legislation

proposal referred to either FIFA (high elaboration) or WADA (low elaboration). Findings indicated that a change in attitude occurred as a result of the message direction of the legislation (i.e., those who were shown the message that was against legislation demonstrated significantly more unfavourable attitudes towards the legislation proposal than those who received the message in favour of the legislation). However, when attitude was measured a week after exposure to the message, attitude change was only persistent for the high elaboration participants. This new evidence is valuable because it points to a promising technique that has the capacity to alter doping attitudes via a cognitive processing manipulation.

Predicting AAS use

The studies that focused on AAS use aimed to predict either AAS use or perceived risk of AAS use. A number of variables, alongside demographics, were examined including (but not limited to) sensation seeking (Denham, 2009; Rees et al., 2008), depression (Denham, 2009; Elliot et al., 2007), use of other substances (Dunn & White, 2011; Elliot et al., 2007; Humphreys & Ruseski, 2011; Rees et al., 2008; Thorlindsson & Halldorsson, 2010), social norms (Mottram, Chester, Atkinson, et al., 2008) and weight-control behaviours (vandenBerg et al., 2007; Vertalino et al., 2007). Those who reported participation in weight-related sport as part of the Project EAT were more at risk of AAS use (males OR: 3.7; females OR: 2.6) compared to those who did not report weight-related sport participation (Vertalino et al., 2007). Equally, the longitudinal data collected as part of Project EAT II demonstrated that male AAS use at time 2 was predicted by wanting to weigh more and reporting higher use of weight-controlling behaviours at time 1 (vandenBerg et al., 2007). In comparison, female AAS use at time 2 was predicted by BMI, lower weight satisfaction, poor nutrition knowledge, concern with health and participation in weight-related sports at time 1 (vandenBerg et al., 2007). BMI was also significantly associated with AAS use with overweight and obese boys more likely to report use than boys who were a normal weight (Ip et al., 2011).

Finally, in one study that utilised data from the Monitoring the Future Study 2005, (i) males, (ii) sensation seekers, (iii) those who appeared depressed and (iv) those with low levels of self-esteem all perceived lower levels of risk associated with the use of

AAS than their counterparts (Denham, 2009). In comparison, Woolf and colleagues (2008) focused on the influence of social norms on intentions to use AAS, taking into account proximal and distal referents. Although the proportion of variance in AAS intentions explained by norms and outcome expectancies was low across the models (7-15%), adolescent athletes' intentions to use AAS were influenced by social norms, which were increasingly predictive as referents became more personal (close friends versus team mates, college athletes and elite athletes).

The relationship between AAS use and other substances was also investigated in a number of studies with AAS users engaging in more health-compromising behaviours than non-users (Dunn & White, 2011; Elliot et al., 2007; Thorlindsson & Halldorsson, 2010). A strong relationship has been found between AAS use and the use of other illicit drugs (OR = 4.9) and a moderate relationship noted between AAS use and alcohol and tobacco consumption (OR = 3.2) (Thorlindsson & Halldorsson, 2010). In addition, Dunn and White (2011) found AAS users were four times more likely to have used tobacco (OR: 3.77; 95% CI: 2.94-4.83), six times more likely to have used cannabis (OR: 6.39; 95% CI: 4.86-8.41) and 30 times more likely to have used cocaine (OR:32; 95% CI: 24-42.67) or heroin (OR: 30.66; 95% CI: 22.72-41.38) than non-users in the previous year. Similarly, female AAS users were more likely to have used alcohol (OR: 8.83; 95% CI: 5.49-14.20), tobacco (OR: 5.14; 95% CI: 3.14-8.42), cocaine (OR: 10.78; 95% CI: 6.18-18.81) or marijuana (OR: 7.91; CI: 5.20-12.04) than non-users in the past 30 days (Elliot et al., 2007). Humphreys and Ruseski (2011) also found the use of other substances increased the likelihood of using AAS by eight per cent.

Anti-doping knowledge and awareness

Despite findings indicating that adolescent athletes had negative attitudes and beliefs towards doping, they also suggested that adolescent athletes have limited knowledge about doping (Fürhapter et al., 2013; Nolte et al., 2014). Of 408 West-Austrian junior athletes, 39% were not informed of the WADA prohibited substance list and 31% were convinced doping substances are only prohibited for professional athletes (Fürhapter et al., 2013). Similarly, only 42% of South African high school athletes surveyed strongly agreed that they were well informed about prohibited substances and

methods and 58.7% felt not enough was being done to educate athletes on the implications of using banned prohibited substances (Nolte et al., 2014). Their knowledge may have been influenced by their sources of information with only 11% reporting that they get their information about doping in sport from the South African Institute for Drug-free Sport compared to 30% from coaches, 19% from parents, 17% from friends and 16% from other athletes. Gradidge et al. (2011) also identified high school students accessing unreliable sources for information about PEDs with 74% reporting the Internet as their main source of information. Finally, in Germany, a knowledge test was completed and junior athletes scored on average 20 points out of a possible 33 points (Wanjek et al., 2007). Altogether, 1% had substantial knowledge, 43% had a moderate knowledge and 56% had a poor knowledge regarding doping.

Summary

Adolescents typically self-report negative attitudes towards the use of PEDs and low incidence of use, or intention to use. However, the use of AAS in particular is unevenly distributed across gender suggesting that AAS use is a 'male thing' and boys are particularly vulnerable to doping. The age at which adolescents are most at risk is still up for debate as PED use was unevenly distributed across age. Similarly, doping was found in organised sport, as well as fitness and training settings. Indeed, those who participate in recreational exercise and fitness outside formally organised sport appear to be at greatest risk of AAS use. The link between sports emphasising weight and AAS use as a weight-control method appears strong and warrants further investigation. Increasing the use of longitudinal studies will enable researchers to identify how these variables influence PED use more accurately. In addition, PED use often takes place alongside other substance use, (e.g., tobacco, alcohol, illicit drugs; Dunn & White, 2011; Elliot et al., 2007; Humphreys & Ruseski, 2011; Laure & Binsinger, 2007; Thorlindsson & Halldorsson, 2010) but there is a need to establish the predictive and causal agents of use alongside mapping concurrent use patterns. Based on the evidence available, there is a definite need to include PEDs in multifaceted drug education programmes targeted at adolescents.

Since the 2007 review, there has been an increase in the volume of research conducted on adolescents. In particular, there has been an increase in the number of studies conducted on a wide spectrum of doping agents, although 36% still focused solely on the use of AAS within this group (Denham, 2009; Dunn & White, 2011; Elliot et al., 2007; Hua & Braddock, 2008; Humphreys & Ruseski, 2011; Ip et al., 2011; Lorang et al., 2011; Mottram, Chester, Atkinson, et al., 2008; Rees et al., 2008; Sagoe et al., 2015; Thorlindsson & Halldorsson, 2010; vandenBerg et al., 2007; Vertalino et al., 2007). Furthermore, a number of researchers have used theoretical frameworks to guide their research questions (Chan, Dimmock, et al., 2014; Chan, Donovan, et al., 2014; Chan, Hardcastle, Dimmock, et al., 2014; Chan et al., 2015; Dodge & Jaccard, 2008; Goulet et al., 2010; Lazuras et al., 2015; Lucidi et al., 2008; Zelli, Lucidi, et al., 2010; Zelli, Mallia, et al., 2010), which again illustrates an appreciable strengthening of the research over the last eight years. However, within this target group, the evidence continues to be dominated by cross-sectional studies and there are inconsistencies between measures used to assess the same constructs (e.g., attitudes). This inhibits accurate comparisons being made between different studies.

Despite these methodological limitations, there are also further strengths that demonstrate how the field has progressed. For example, the inclusion of six longitudinal studies (Laure & Binsinger, 2007; Lucidi et al., 2008; Mallia et al., 2013; vandenBerg et al., 2007; Zelli, Lucidi, et al., 2010; Zelli, Mallia, et al., 2010) extends insight by identifying doping predictors that could be targeted within interventions to reduce doping amongst adolescents. Research in this area would benefit from deploying more qualitative research and experimental approaches. Equally, further longitudinal insights will aid the development of effective interventions.

Competitive Athletes

In the previous report, eighteen articles were identified that explored doping behaviours amongst college or university athletes. The majority of the studies were conducted in the United States (Albrecht, Anderson, McGrew, McKeag, & Hough, 1992; Anderson, Albrecht, McKeag, Hough, & McGrew, 1991; Bents, Powell, & Tokish, 2004; Chng & Moore, 1990; Coombs & Coombs, 1991; Coombs & Ryan, 1990; Diacin, Parks & Allison, 2003; Gray & Schoof, 1993; Hamilton & Stone, 1990; Kersey, 1996; Pan & Baker, 1998; Peters et al., 2005; Schneider & Morris, 1993; Tricker & Connolly, 1997; Yesalis et al., 1990). Sample sizes varied greatly, with a range of eight to 2282 participants and a mean of 669 participants per study. The samples were predominantly male (>60%) (Anderson et al., 1991; Bents et al., 2004; Coombs & Coombs, 1991; Coombs & Ryan, 1990; Diacin et al., 2003; Gray & Schoof, 1993; Hamilton & Stone, 1990; Kersey, 1996; Peters et al., 2005; Schneider & Morris, 1993; Spence & Gauvin, 1996; Yesalis et al., 1990); with only three studies including gender-balanced samples (40 – 60% male) (Chng & Moore, 1990; Hamilton & Stone, 1990; Paccagnella & Grove, 1997). Where reported, participants were aged 19 – 24 years (Bents et al., 2004; Chng & Moore, 1990; Diacin et al., 2003; Hamilton & Stone, 1990; Kersey, 1996; Paccagnella & Grove, 1997; Schneider & Morris, 1993). All 18 studies employed cross-sectional survey methods, while two thirds used questionnaires to gather data.

The main areas of investigation were exploring knowledge or attitudes towards 1) college drug testing (Albrecht et al., 1992; Coombs & Coombs, 1991; Coombs & Ryan, 1990; Diacin et al., 2003; Gray & Schoof, 1993; Hamilton & Stone, 1990; Issari & Coombs, 1998; Kersey, 1996), 2) AAS use and AAS users (Chng & Moore, 1990; Kersey, 1996; Paccagnella & Grove, 1997; Yesalis et al., 1990), and 3) drug or alcohol use more generally (Anderson et al., 1991; Pan & Baker, 1998; Peters et al., 2005; Spence & Gauvin, 1996; Tricker & Connolly, 1997). Across the studies, there was

evidence that the majority of college athletes held anti-doping attitudes. For instance, most individuals believed that it was unacceptable to dope. Additionally, individuals generally supported drug-testing programmes. However, the studies also revealed a lack of awareness and knowledge in some individuals that should be addressed through increased/improved education programmes.

In this updated search we have created a new group of studies called 'competitive athletes'. These studies sampled athletes participating in sport beyond the high performance context and a large number were recruited from university sports teams. The updated searches resulted in 56 studies that have explored competitive athletes from a descriptive and predictive focus. A brief descriptive overview of each study can be found in Table 5 (descriptive studies) and Table 6 (predictive studies).

Geographical spread

Fifty-six studies were conducted with competitive athletes from multiple sports. Research was geographically spread with multiple studies emerging from the United States (Buckman, Yusko, Farris, White, & Pandina, 2011; Buckman, Yusko, White, & Pandina, 2009; Dodge, Williams, Marzell, & Turrisi, 2012; Judge, Bellar, Craig, & Gilreath, 2010; Karazsia, Crowther, & Galioto, 2013; Kisaalita & Robinson, 2014), United Kingdom (Backhouse, Whitaker, & Petróczi, 2013; Boardley, Grix, & Dewar, 2014; Erickson, McKenna, & Backhouse, 2015; Petróczi, Aidman, & Nepusz, 2008; Petróczi, Mazanov, Nepusz, Backhouse, & Naughton, 2008; Whitaker, Backhouse, & Long, 2014; Whitaker, Long, Petróczi, & Backhouse, 2014; Whitaker, Long, Petróczi, & Backhouse, 2012), Croatia (Rodek et al., 2012; Sajber et al., 2013; Sekulic, Peric, & Rodek, 2010; Zenic, Peric, Zubcevic, Ostojic, & Ostojic, 2010), France (Bilard, Ninot, & Hauw, 2011; Chantal, Bernache-Assollant, & Schiano-Lomoriello, 2013; Chantal, Soubranne, & Brunel, 2009; Mohamed, Bilard, & Hauw, 2013), Australia (Gucciardi, Jalleh, & Donovan, 2010; Petróczi, Mazanov, & Naughton, 2011; Smith et al., 2010; Stewart & Smith, 2010), Germany (Brand, Heck, & Ziegler, 2014; Brand, Melzer, & Hagemann, 2011), Hungary (Petróczi et al., 2010; Uvacsek et al., 2011), Iran (Arazi, Saeedi, Sadeghi, Nastaran, & Mohammadi, 2014; Halabchi, Esteghamati, Razzaghi, & Noori, 2011; Seif Barghi et al., 2015), Italy (Tavani et al., 2012; Zucchetti, Candela, &

Villosio, 2014), Poland (Posiadala, Smorawinski, Pluta, & Andrzejewski, 2009; Sas-Nowosielski & Świątkowska, 2008; Sas-Nowosielski & Świątkowska, 2007), Serbia (Sekulic, Kostic, & Miletic, 2008; Sekulic, Kostic, Rodek, Damjanovic, & Ostojic, 2009), Spain (Morente-Sánchez, Freire-SantaCruz, Mateo-March, & Zabala, 2015; Morente-Sanchez, Femia-Marzo, & Zabala, 2014) and Turkey (Ozbek, 2013; Sefa, Erdal, Veysel, Ozden, & Neslıhan, 2010). Multinational studies were also retrieved and sampled athletes from Croatia and Serbia (Mandic et al., 2013), United States and United Kingdom (Boardley, Grix, & Harkin, 2014), Croatia, Serbia and Bosnia and Herzegovina (Rodek, Idrizović, Zenić, Perasović, & Kondric, 2013) and Bosnia and Herzegovina (Zenic, Stipic, & Sekulic, 2013).

Sample

Sample size ranged from nine (Whitaker, Backhouse, et al., 2014) to 7,039 (Vâjială, Epuran, Stanescu, Potzaichin, & Berbecaru, 2010), giving a total sample of 17,124 and an average of 387 individuals per study. Nine studies had a male-only sample (Arazi et al., 2014; Bilard et al., 2011; Boardley, Grix, & Harkin, 2014; Brand, Heck, et al., 2014; Buckman et al., 2009; Dodge et al., 2012; Karazsia et al., 2013; Mohamed et al., 2013; Petróczi, 2007) and one a female only sample (Zenic, Peric, et al., 2010). In terms of gender composition, samples from seven studies were relatively evenly distributed by gender (40 – 63% male) (Hodge, Hargreaves, Gerrard, & Lonsdale, 2013; Petróczi, Mazanov, et al., 2011; Petróczi, Mazanov, et al., 2008; Posiadala et al., 2009; Uvacsek et al., 2011; Weaving & Teetzel, 2014; Whitaker, Long, et al., 2014; Whitaker et al., 2012).

The mean age of the participants across those studies reporting this data was 24 years. Of the studies that did not report average age, athletes were identified as being in the range of 19-24 (Boardley, Grix, & Harkin, 2014), 15-45 (Posiadala, Smorawinskii, Pluta, & Andrzejewski, 2010) and 14-66 (Gucciardi et al., 2010) under the age of 25 (Dodge et al., 2012) or over the age of 18 (Rodek et al., 2013) and 19 (Kondric, Sekulic, & Mandic, 2010; Sekulic et al., 2008; Sekulic et al., 2009; Sekulic et al., 2010).

In this section, the competitive levels of the athletes often varied from local (including club and university) to international (Backhouse et al., 2013; Sekulic et al., 2008; Sekulic et al., 2009; Whitaker, Long, et al., 2014; Whitaker et al., 2012;Gucciardi et al., 2010; Smith et al., 2010). However, some studies did focus on specific competition levels, such as individuals performing in their national leagues/teams (Kondric et al., 2010; Rodek et al., 2013), individuals who were active and individuals who were formerly active (Brand et al., 2011) and individuals who participated for pleasure/'amateurishly' and individuals who participated 'professionally'/at national level (Posiadala et al., 2010). Some studies gathered data regarding years of experience in sport (Sefa et al., 2010; Zenic et al., 2013), average number of hours per week spent participating in sport or exercise (Chantal et al., 2013; Chantal et al., 2009) and specific sports in which the sample was involved (Arazi et al., 2014; Boardley, Grix, & Harkin, 2014; Brand, Heck, et al., 2014; Weaving & Teetzel, 2014; Whitaker, Backhouse, et al., 2014). Beyond these studies, either a basic overview or no details of participant sport involvement was provided.

Methods

In total, 39 studies utilised a cross-sectional survey design, and gathered data through self-report questionnaires (Arazi et al., 2014; Backhouse et al., 2013; Buckman et al., 2011; Buckman et al., 2009; Chantal et al., 2013; Chantal et al., 2009; Dodge, Stock, & Litt, 2013; Dodge et al., 2012; Gucciardi et al., 2010; Halabchi et al., 2011; Hildebrandt, Harty, & Langenbucher, 2012; Hodge et al., 2013; Judge et al., 2010; Karazsia et al., 2013; Kisaalita & Robinson, 2014; Kondric et al., 2010; Mandic et al., 2013; Neeraj, Maman, & Sandhu, 2011; Petróczi, 2007; Petróczi, Mazanov, et al., 2011; Petróczi, Mazanov, et al., 2008; Posiadala et al., 2009; Rodek et al., 2013; Rodek et al., 2012; Sajber et al., 2013; Sas-Nowosielski & Świątkowska, 2007; Sefa et al., 2010; Seif Barghi et al., 2015; Sekulic et al., 2008; Sekulic et al., 2009; Tahtamouni et al., 2008; Tavani et al., 2012; Uvacsek et al., 2011; Vâjială et al., 2010; Whitaker, Long, et al., 2014; Zenic, Peric, et al., 2010; Zenic et al., 2013; Zucchetti et al., 2014). Within the survey-based research, indirect questioning via hypothetical scenarios was commonly used (e.g., Backhouse et al., 2013; Chantal et al., 2013; Chantal et al., 2009; Dodge et al., 2012).

In contrast to the findings of the previous report, several studies employed the same questionnaire; the Questionnaire of Substance Use (QSU) (Kondric et al., 2010; Rodek et al., 2013; Rodek et al., 2012; Sekulic et al., 2008; Sekulic et al., 2009; Sekulic et al., 2010) or the PEAS (e.g., Backhouse et al., 2013; Brand, Heck, et al., 2014; Gucciardi et al., 2010; Hodge et al., 2013; Morente-Sánchez et al., 2015; Morente-Sánchez, Mateo-March, & Zabala, 2013; Neeraj et al., 2011; Petróczi, Aidman, et al., 2008; Uvacsek et al., 2011; Whitaker, Long, et al., 2014).

Beyond the survey-based questionnaires, studies deployed alternative and innovative indirect methods in order to improve the precision of reporting. Specifically, Brand et al. (2011) conducted a randomised trial to validate an Implicit Association Test (IAT) and Petróczi, Aidman, et al. (2008) designed and employed a Performance Enhancement IAT (PE-IAT), alongside two self-report measures (PEAS and 5-DST). Vangrunderbeek and Tolleneer (2011) conducted discourse analysis on media portfolios and two studies analysed phone enquiries from a doping hotline (Bilard et al., 2011; Mohamed et al., 2013). Some studies also sought the experiential view of doping in sport and conducted in-depth qualitative interviews (e.g., Boardley, Grix, & Harkin, 2014; Erickson et al., 2015; Smith et al., 2010; Stewart & Smith, 2010; Weaving & Teetzel, 2014; Whitaker, Backhouse, et al., 2014), others focused on scale adaptation and validation (Morente-Sanchez et al., 2014) while an emerging group are using multi-method approaches such as combining interview and self-report questionnaire data (Ozbek, 2013; Pedersen, 2010) and objective hair analysis and self-reports (Petróczi et al., 2010) in order to cross-reference the findings.

As in previous sections of this report, research questions varied but common areas of interest included knowledge and awareness of doping control (perceived and actual) (Arazi et al., 2014; Halabchi et al., 2011; Mandic et al., 2013; Posiadala et al., 2009; Sajber et al., 2013; Sas-Nowosielski & Świątkowska, 2007; Sefa et al., 2010; Seif Barghi et al., 2015; Vangrunderbeek & Tolleneer, 2011; Zenic et al., 2013), general attitudes towards performance enhancement and doping (Arazi et al., 2014; Brand, Heck, et al., 2014; Brand et al., 2011; Dodge et al., 2012; Halabchi et al., 2011; Judge et al., 2010; Morente-Sánchez et al., 2015; Petróczi, Mazanov, et al., 2011; Seif Barghi et al., 2015;

Smith et al., 2010; Tavani et al., 2012; Vangrunderbeek & Tolleneer, 2011), and doping control principles and processes (Arazi et al., 2014; Brand et al., 2011; Dodge et al., 2012; Halabchi et al., 2011; Judge et al., 2010; Petróczi, Mazanov, et al., 2011; Sas-Nowosielski & Świątkowska, 2007; Seif Barghi et al., 2015; Smith et al., 2010). Other studies explored psychosocial processes facilitating doping use (Bilard et al., 2011; Boardley, Grix, & Dewar, 2014; Chantal et al., 2009; Erickson et al., 2015; Karazsia et al., 2013; Kisaalita & Robinson, 2014; Mohamed et al., 2013; Neeraj et al., 2011; Rodek et al., 2013; Sajber et al., 2013; Smith et al., 2010; Stewart & Smith, 2008; Vâjială et al., 2010; Zenic, Peric, et al., 2010), correlates of doping attitudes, intentions and behaviours (Backhouse et al., 2013; Buckman et al., 2011; Buckman et al., 2009; Erickson et al., 2015; Hildebrandt et al., 2012; Judge et al., 2010; Kondric et al., 2010; Mohamed et al., 2013; Neeraj et al., 2011; Ozbek, 2013; Rodek et al., 2013; Sekulic et al., 2008; Sekulic et al., 2009; Smith et al., 2010; Tahtamouni et al., 2008; Uvacsek et al., 2011; Vâjială et al., 2010; Weaving & Teetzel, 2014; Whitaker et al., 2012; Zenic et al., 2013), and doping vulnerability, willingness and susceptibility (Backhouse et al., 2013; Dodge et al., 2013; Gucciardi et al., 2010; Karazsia et al., 2013; Kondric et al., 2010; Rodek et al., 2013; Sas-Nowosielski & Świątkowska, 2007; Sekulic et al., 2008; Sekulic et al., 2009; Smith et al., 2010; Uvacsek et al., 2011; Vâjială et al., 2010; Whitaker, Long, et al., 2014). Beyond this, a number of studies investigated social norms and perceived incidence of doping use (Judge et al., 2010; Kondric et al., 2010; Neeraj et al., 2011; Petróczi, Mazanov, et al., 2011; Petróczi, Uvacsek, et al., 2011; Rodek et al., 2013; Sekulic et al., 2008; Tavani et al., 2012; Uvacsek et al., 2011; Zenic, Peric, et al., 2010) or validated alternative ways of assessing prevalence/drug use behaviours (Brand et al., 2011; Petróczi, Aidman, et al., 2008; Petróczi, Mazanov, et al., 2008). This work also included cross-cultural adaptation (Morente-Sanchez et al., 2014). Researchers also explored the social images of dopers, including the perceptions of users and non-users (Chantal et al., 2013; Chantal et al., 2009; Dodge et al., 2012; Whitaker et al., 2012) as well as gender stereotypes associated with substance use (Weaving & Teetzel, 2014).

The dominant theoretical frameworks employed in the study designs and analyses included the prototype willingness model (Dodge et al., 2013; Whitaker, Backhouse, et al., 2014; Whitaker, Long, et al., 2014; Whitaker et al., 2012), theory of planned

behaviour and reasoned action (Dodge et al., 2013), achievement goal theory (Petróczi, 2007; Sas-Nowosielski & Świątkowska, 2008), self-determination theory (Chantal et al., 2009; Hodge et al., 2013), integrated social cognitive approach (Backhouse et al., 2013), social cognitive theory of moral thought and action (Boardley, Grix & Harkin, 2014), social ecology theory (Smith et al. 2010), gateway theory (Karazsia et al., 2013), and narrative (Stewart & Smith, 2010). The range of research questions addressed, theoretical frameworks applied and the diversity of the sample composition makes it difficult to directly compare findings. However, results are summarised under broad themes of interest.

Table 5. Overview of descriptive studies examining the knowledge, attitudes and beliefs of competitive athletes.

Authors (year)	Country	Sample	Methods	Summary
Arazi, Saeedi, Sadeghi Nastaran, & Mohammadi (2014)	**Iran**	**253 Male University Student-Athletes** Mean age = 22.45 (SD = 2.86) Wrestling, football, basketball, handball, volleyball, track and field	**Cross-sectional** (Questionnaire)	• Track and field athletes estimated their knowledge on doping drugs higher than other sports • 94.8% oppose permitting the use of doping drugs • 68.3% recognise drugs/supplements as requirements for their performance improvements • 37.8% believe most records are changed because of doping • 68.4% had used drugs and supplements at least once during their career - wrestlers (82.5%) and track and field athletes (76%) contributed most • 70.7% willing to use supplements unless they are harmful • Participants rated their doping knowledge as average (45%), deficient (15.4%), low (13.4%) and high (13%) • Students gain drug information from friends/teammates (29.8%), coaches (28.1%), Internet (19.3%), physician (10.5%), and media (5.3%)
Backhouse, Whitaker & Petróczi (2013)	**UK**	**212 Competitive athletes** (Nutritional supplement [NS] users = 96 and non-users = 116, M: 137, mean age = 21.4 ± 4.5, across 32 sports and different competition levels from club/university to international)	**Cross-sectional** (Questionnaire) Scenarios [Key themes: doping-related social cognitions and behaviours, including the Performance Enhancement Attitudes Scale [PEAS]]. *Integrated social cognitive approach*	• 3% of sample reported doping use and 10% indicated combined doping and NS use. Significantly more NS users (29%) reported doping compared with non-users (6%). • NS users presented significantly more positive attitudes towards doping (38.9, range 17-102) and a significantly greater belief that doping is effective (3.6, range 1-5) when compared to non-users (attitudes: 34.9, effectiveness: 3.1). • NS users significantly more in favour of competing in situations that allow doping compared to non-users (0.1). • NS users perceived there to be a greater percentage of doping in their sport (23%) than non-users (17.3%). • NS also perceived there to be greater pressure to dope (12.3%) than non-users (4.9%). • More males than females were dopers. Males had more positive attitudes to doping (38.6) than females (33.3), perceived there to be a greater percentage of doping in their sport (22.4% vs. 15.2%), greater pressure to dope (10.4% vs. 4.4%) and expressed a greater belief that doping is effective (3.6 vs. 2.8).
Bilard, Ninot & Hauw (2010)	**France**	**358 Competitive Athletes** **(**115 male cyclists, 203 bodybuilders and 40 footballers) (All using a substance on the prohibited list, varied levels of sport involvement from recreational to elite)	**Cross-sectional** (Phone enquiries to doping hotline - Qualitative analysis) [Key themes: Categorising motives for doping into five options: biological, psychological, cultural, relational and professional]	• Use of substances differed across sports. Seventy-seven per cent of bodybuilders used anabolic steroids, 34.4% of cyclists used glucocorticosteroids and footballers used cannabinoids (51.6%). • That being said, stimulants were used at similar rates across the sports (10.1%, 19.8% 12.9% in bodybuilding, cycling and football, respectively). • The motives for using substances also differed across the sports. Bodybuilders most commonly doped to increase muscular strength (38.9%), but were also influenced by social norms of sport (12.3%) and disturbances of body image (10.8%). Cyclists were concerned with preserving health (19.1%), as well as enhancing sports performance (13.9%) and being influenced by social norms in sport (9.6%). The most common motive in footballers was conforming to social norms in society (27.5). Beyond this they reported doping to combat anxiety (12.5%), to increase muscular strength (10.0%) and due to friends (10.0%).

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Boardley, Grix & Harkin (2014)	**UK USA**	**12 Doped Male Multi-Sport Athletes** 6 current PED users 6 former PED users (Athletics, swimming, American football, boxing, basketball, wrestling, rugby, and mixed martial arts) Aged 19 to 24 years	**Cross-sectional** (Semi-structured interviews) [Key themes: moral disengagement] *Social cognitive theory of moral thought and action*	• Evidence for 10 of the 11 constructs associated with moral disengagement (none for dehumanisation). • On average participants presented 4.25 individual moral disengagement mechanisms. • Athletes' training environment central to diffusion of responsibility. • Majority of athletes who disputed a competitive advantage through PED use were from team sports • Many team and individual-sport athletes intentionally used anodyne language (e.g. juice, gear) rather than accurate terms (e.g. drugs, steroids); suggests this may facilitate PED use. • All but one athlete suggested they were selective about who they discussed their PED use with. • Evidence supporting perceptions of a natural progression from legal supplements to more serious PED use; often motivated by plateaus in training effects; just over 50% showed evidence of this 'sliding scale'.
Brand, Melzer & Hagemann (2011)	**Germany**	**102 Student-Athletes** (Sport and Exercise Science graduates) (M: 44, F: 58, Mean age 23.6 years, grouped as former and still active)	**Cross-sectional** **(**Randomised trial – Implicit Association Test) [Key themes: Implicit attitudes; doping substance; tea blend; legal nutritional supplement]	• Although the research was focused on establishing construct validity of IATs, results pointed to a rather negative doping attitude in most athletes. • The "doping vs. supplement" IAT error rates (12%) and adaptational learning effects across test blocks were substantial (h2 ¼ .22), indicating that participants had difficulties correctly assigning the word stimuli to the respective category
Brand, Heck & Ziegler (2014)	**Germany**	**21 Handballers and 22 Bodybuilders** All male Age of bodybuilders M = 31.0, SD = 10.2 Handballers M = 25.4, SD = 7.7	**Cross-sectional** (Questionnaire (PEAS) and picture-based doping-BIAT) [Key themes: Test validation; reaction time-based attitude tests]	• In the group of bodybuilders, indirectly measured doping attitudes as tested with the picture-based doping-BIAT were significantly less negative (eta^2 = .11). • The doping-BIAT and PEAS scores correlated significantly at r = .50 for bodybuilders, and not significantly at r = .36 for handball players. • There was a low error rate (7%) and a satisfactory internal consistency (rtt = .66) for the picture-based doping-BIAT. • Body builders exhibited less negative evaluations of doping than handballers in both reaction-time based and direct attitude tests

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Chantal, Soubranne & Brunel (2009)	**France**	**182 University Students/Student-Athletes** (Studying Physical Education) (M: 103, F: 79, Mean age = 19.3 ± 1.66 years, all participants involved in sport: Mean hours per week = 6.02 ± 6.42)	**Cross-sectional** (Questionnaire) Group sessions [Key themes: Perceptions of motivation (Sport Motivation Scale), sportspersonship (Multi-dimensional Sportspersonship Orientations Scale) and aggression (Bredemeier's AAI] *Self-determination theory* *Social psychological approach to sportspersonship* *Reactive-instrumental dual characterisation of human aggression*	• On a scale of -18 (not at all like this) to 18 (exactly like this), respondents viewed an athlete using anabolic steroids as less self-determined in their motivation (i.e., participation in sport was based on feelings of pressure to obtain external rewards or avoid punishment) (M=1.48), when compared to a non-user (M=10.56). • On a scale of 1 (not at all like this) to 7 (exactly like this), respondents also viewed the steroid-using athlete as displaying weaker sportspersonship orientations (i.e., lesser concern for opponents, the social conventions of sport, and for one's own athletic commitment) (M=3.73), when compared to a non-user (M=5.4). • On a scale of 1 (not at all like this) to 7 (exactly like this), the steroid using athlete was also perceived as more likely to engage in reactive aggression (M=4.57) than instrumental aggression (M=3.67) (i.e., more prone to aggress against an opponent with intent to injure/harm v. hinder his performance), when compared to a non-user (M=5.4 and 2.44, respectively).
Chantel, Bernache-Assollant & Schiano-Lomoriello (2013)	**France**	**173 University Students/Student-Athletes** 61% males. Mean age = 19.3 years (SD = 1.65). Participants' main sports: 42.2% football, 24.9% rugby, 11% handball, and 9.2% basketball.	**Cross-sectional** (Questionnaire, group sessions & scenarios) [Key themes: Task and ego orientation; social perception; sportspersonship orientations] *Achievement goal theory*	• Participants who were subjected to the drug use (DU) condition perceived the AS using athlete much less positively than those participants who reflected upon the non-drug use (NDU) scenario. • Results indicated that the athlete accepting AS use appeared more ego-orientated than task orientated in comparison to the athlete who refused AS (for DU and NDU conditions: Ms = 6.23 and 4.95 for ego orientation, and Ms= 4.84 and 6.06 for task orientation). • AS user was also perceived as displaying weaker sportspersonship orientations [M= 3.51, as compared to 5.38 for the NDU condition]. • No significant differences pertaining to gender and the interaction (Fs<1).
Dodge, Williams, Marzell & Turrisi (2012)	**US**	**1200 Male University Students/Student-Athletes** (<25 years of age. White: 73%) Response rate = 37%	**Cross-sectional** (Questionnaire) [Key themes: Past substance use and perceptions of substance misuse – AAS use vs. Adderall use]	• <1% reported having ever used AAS and 8% reported using a prescribed stimulant without prescription. • On a scale of strongly disagree (-2) to strongly agree (2), respondents agreed that an athlete using anabolic steroids (M=1.5) was cheating in comparison to a student taking Adderall (M=-0.16). Notably, respondents who participate in sport gave higher ratings of agreement (i.e., saw the steroid user as more of a cheat) than individuals who did not participate. • Respondents felt that the steroids were less necessary to succeed in sport (M-1.05) than Adderall is necessary to succeed in an exam (-0.70). Although, both of the ratings were negative values, which indicates that respondents felt that the use of both substances was not necessary.

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Erickson, McKenna & Backhouse (2015)	**UK**	**10 Competitive Athletes** 50% male (Field hockey, boxing, football, triathlon, rugby)	**Cross-sectional** (In-depth qualitative interviews - Thematic analysis) [Key themes: Protective factors, contextual factors; interaction]	• Personal and situational protective factors were identified in the accounts. Personal factors included: (i) a strong moral stance against cheating; (ii) an identity beyond sport; (iii) self-control; & (iv) resilience to social group pressures. • Situational factors included secure attachments to people at all stages of the athlete's life. This facilitated both the promotion of moral decision-making and assisted in the development of anti-doping attitudes. • When situational factors such as a pro-doping climate arose, key attachments in the athletes' lives interplayed with personal actors to reduce the risk of doping.
Halabchi, Esteghamati, Razzaghi & Noori (2011)	**Iran**	**426 Competitive Wrestlers**	**Cross-sectional** (Questionnaire) [Key themes: Knowledge and attitudes toward doping/anti-doping; prevalence perceptions]	• Doping definitions: inadvertent and unplanned use of prohibited drugs by athletes, refusing to provide sample to doping control officers and trafficking of prohibited drugs by the coaches were regarded as doping in less than 40% of participants. • Knowledge of banned substances was also poor with only 17% and 37% selecting AAS and growth hormone, respectively, to be banned substances. Only 28.8% mentioned possibility that supplements contain prohibited substances • 35.4% and 12.5% of wrestlers estimated over 50% prevalence of drug abuse in the professional wrestlers and their own club, respectively. • Peers and friends (40.8%), coaches (13%), dieticians (6.4%) and physicians (5.2%) were main source of information. • Only 6% thought doping should be allowed and there were mixed responses regarding doping control.
Judge, Bellar, Craig & Gilreath (2010)	**USA**	**240 Track and Field Throwers** 59% males Mean age = 20.71 year (± 2.69). Range 19 – 29 years Mean competitive experience = 5.56 ± 3.55 years)	**Cross-sectional** (Questionnaire) [Key themes: Attitudes, subjective norms and intentions towards PED use and drug testing] *Theory of Planned Behaviour*	• 81.6% of participants held unfavourable attitudes towards PED use. • 98% of athletes disagreed/strongly disagreed that drug testing catches all athletes that cheat and 67.8% of athletes do not believe that current testing protocolsare fair. Yet, 58.1% agreed or strongly agreed that drug testing was the most effective method of preventing/controlling PED use in sport. • Attitudes towards sanctions revealed mixed feelings towards a two-year ban for first time offenders (56% agreement), with greater agreement for a lifetime ban for a second-time offence (71.2%). • Negative subjective norm scores indicated that track and field throwers perceived doping as a problem in elite-level (professional or post-collegiate) track and field. 73% agreed or strongly agreed that doping is a serious problem in international sports. Yet, 61.7% reported that drug use had not saturated their sport. • Behavioural intent was significantly correlated to attitude ($r=0.334$, $p=0.000$), but not related to subjective norm ($r=0.056$, $p=0.483$). • Over 80% of athletes were unwilling to use PEDs in various situations, including if their teammates or competitors were using them. That said, only half (58.3%) of athletes would report known drug users.
Kisaalita & Robinson (2014)	**USA**	**68 Competitive (non-professional) Cyclists** 90% males Mean age = 36.38 (SD = 10.35).	**Cross-sectional** (Questionnaire) [Key themes: legal, ethical, and practical considerations in choosing to use legal/not prohibited PEDs]	• Over 60 % of cyclists used non-banned PEDs while 8% used banned PEDs. Health was overall the most important factor in choosing a PED while apprehension by a doping agency was least important. • Mixed-model ANOVA analyses revealed that motivations to use banned PEDs were complex, as the importance of health, violating the spirit of the sport, performance improvement, and getting caught were differentially influenced by PED legality ($p < 0.001$) and whether a cyclist endorsed non-banned PED use ($p < 0.001$). • The importance of winning, sponsorship, and maintaining competitiveness did not influence non-banned PED use ($p > 0.05$).

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Kondric, Sekulic & Mandic (2010)	**Slovenia**	**79 Competitive Table Tennis Players** (M: 50, F: 29, aged 18 years or older, all players in the National Premier League Competition) 100% response rate	**Cross-sectional** (Questionnaire, previously used and validated by Sekulic et al. 2008, 2009) [Key themes: Substance use and misuse (SU&M) and links to religiousness, gender and sports participation)	• Over two thirds of players reported that they would never dope (F: 72.4%, M: 66%). However, one female and seven males reported that they would dope if it ensured sporting success and was not a health hazard and one female and three males would dope regardless of the consequences if it ensured success. • Perceptions of the existence of doping in table tennis were mixed, with very few individuals believing that doping happens often (F: 2, M: 4) and almost two thirds of participants reporting that doping happens rarely (F: 11, M: 15) or not at all (F: 8, M: 11). • Males were less likely to trust others than themself regarding doping issues (M: 64% and F: 27.6% trust no-one but myself). Similarly, females were more likely to trust coaches (24.2%), medics (24.1%) and friends (24.1%) regarding doping issues when compared to males (12%, 20% and 4%, respectively).
Mandic, Peric, Krzelj, Stankovic & Zenic (2013)	**Croatia & Serbia**	**82 Competitive Athletes** (17.2±1.92 years of age) Also 28 coaches (30.8 ±5.26 years of age) Synchronised swimming 99% response rate	**Cross-sectional** (Questionnaire) Groups of 3 [Key themes: Knowledge of sports nutrition and doping, particularly prohibited substances and the doping control process]	• Coaches scored higher than their athletes on knowledge of both doping and nutrition. • Knowledge was greater among coaches who were more experienced (and older). • The coaches with higher knowledge of doping were more convinced that doping occurs in synchronised swimming. • Two-thirds of coaches declared self-education as the primary source of information about doping and sport-nutrition, with 21% reporting formal education. • 71% of coaches reported that they would not suggest doping usage and 11% reported that they would suggest doping if they were convinced that it would help their athlete and have no negative health implications.
Mohamed, Bilard & Hauw (2013)	**France**	**360 Competitive Athletes** **(**124 male cyclists, 192 bodybuilders and 44 footballers) (All using a substance on the prohibited list, varied levels of sport involvement from recreational to elite)	**Cross-sectional** (Phone enquiries to doping hotline **-** Qualitative)	• Personal protective factors emerged more often than environmental protective factors (85.4% vs. 14.6%). • The same three protective factors were cited by all three groups, albeit in different orders: 1) health concerns (total: 48%, body-builders: 63.1%, footballers: 48.9%, cyclists: 21.2%), 2) respect for the law (total: 29.4%, cyclists: 42.5%, footballers: 31.1%, body-builders: 21.6%) and 3) doping controls from the environment (total: 14.6%, cyclists: 26.0%, footballers: 20.0%, body-builders: 7.0%) and the second comprised 'Doubts about the effectiveness of illicit products', 'Thinking skills' and 'Doubts about doctors'. • The ranking of the factors for the cyclists differed from that of the other athletes. The ordering of factors was 1) respect for the law, 2) doping controls from the environment, 3) health concerns 4) doubts about doctors, and 5) doubts about the effectiveness of illicit products. Rankings for footballers & bodybuilders were 1) heath concerns, 2) respect for the law. Moreover, personal factors were more prevalent than environmental and social factors for protection for body builders & footballers.

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Morente-Sanchez, Femia-Marzo & Zabala (2014)	**Spain**	18 independent datasets, mainly from cycling and football.	**Cross-sectional** (Scale adaptation & validation) [Key themes: Cross-cultural adaptation; Validation; PEAS]	• The scale showed satisfactory levels of internal consistency (α = 0.71–0.85), reliability of each item (Kappa values range 0.34-0.64) and temporal stability (r = 0.818; p < 0.001). CFA showed acceptable fit (RMSEA <0.08, mean RMSEA = 0.055; χ2/df < 3, mean χ2/df = 1.89) for all but one samples. • As expected, self-admitted doping users showed more positive attitude toward doping than non-users. Significant and strong negative relationship was found between PEAS and self-efficacy; weak negative correlation with self-esteem and positive correlation with perceived descriptive norm. • Gender did not have an effect on doping attitudes, but age did. Participants under 35 years of age showed more permissive attitudes towards doping.
Morente-Sanchez, Friere-SantaCruz & Mateo-March, Zabala (2015)	**Spain**	**271 University Students/Student-Athletes** (Mage = 22 yrs (SD = 3.3 years) 82% males	**Cross-sectional** (Questionnaire) PEAS	• Generally disagree with the use of PED in competitive sport • No difference in attitudes towards PEDs due to type of sport practiced (individual, team, or both) • No significant differences between age, gender, or frequency of practice were found
Neeraj, Maman & Sandu (2011)	**India**	**303 Competitive Athletes** (M: 277, F: 26, mean age = 24.08 ± 4.4 years, range 18-35 years of age, participating across 17 team and individual sports at various levels from university to international, average experience = 8.81 ± 5.5 years)	**Cross-sectional** (Questionnaire) PEAS, PMCSQ-2, PSS, FSSQ, TSCI, & TEOSQ [Key themes: Psychosocial factors: attitude, motivation, perfectionism, self-confidence, task/ego orientation and social support].	• Eighty-three players (M=74/277, F=9/26) had taken banned substances. Significant differences existed between users and non-users for performance enhancement attitude (69.08 vs. 49.43, p<0.001 – with higher scores indicating permissive attitudes), self-confidence (87.11 vs. 92.17, p<0.05 – with higher scores indicating greater confidence in their sport ability) and social support (27.64 vs. 34.64, p<0.001 – higher score indicating greater feeling of being supported socially). • More lenient doping attitudes were associated with concern for mistakes and having high personal standards, as well as criticism by coaches and ego involving climates. Task orientations were also correlated to attitudes. • In total, 118 (39%) of athletes personally knew someone who was taking/had taken banned substances. These individuals were at greater risk of doping themselves based on the finding that 65% of people who reported taking banned substances knew someone who took banned substances compared with 35% dopers who did not know anyone else taking substances. 29% knew someone who doped and chose not to dope themselves. • Less than 50% of athletes (n=178) had received information about banned substances in their sport. The rate of individuals who took banned substances was lower among those who had received information (22%) compared to those who had not. (31%).
Ozbek (2013)	**Turkey**	**148 University Students/Student-Athletes** (67% male) 10 Coaches (all male)	**Cross-sectional** (Questionnaire & Interview) [Key themes: Opinions; Doping tests; Entry examinations PE college].	• Sport candidates expressed that they would dope if it were not harmful to their health, and they would not tolerate the use of doping by other candidates. • It was discovered that the propensity to use doping tends to increase given the number of examinations taken by candidates. • Authors (& coaches) conclude that for a fair examination, doping tests should be administered during special ability examinations.

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Pedersen (2010)	**Denmark**	Danish doping data from different social arenas of sport and physical exercise (7,039 respondents) form the basis for analyses of the relative importance of social indicators.	**Cross-sectional** (Questionnaire) Representative population poll (telephone interviews). 5,036 participants engaged in sport and exercise in Denmark completed 5 self-administered questionnaires [Key themes: prevalence of doping, use of PEDs in gyms, pill-dependent cultures]	• More respondents from gyms admitted to having experimented with legal as well as banned performance-enhancing substances than did respondents among elite athletes, and the relative importance of education is only indicated among gym users with experience of anabolic-androgenic steroids (AAS) compared to respondents within the sphere of competitive sport. • AAS was the doping substance most commonly used by respondents, except among cyclists who reported using amphetamines. AAS use has increased from 0.6% in 1999 to 0.9% in 2002, but no further decrease has been reported, however a marginal increase in AAS use was noted. • 1.4% female gym members admitted using banned substances, compared to 7.8% of males. Significant correlation between gender ($p<0.001$), education ($p=0.007$), and training frequency ($p<0.001$).
Petróczi, Mazanov, Nepusz, Backhouse & Naughton (2008)	**UK**	**124 University Student Athletes** 63% males Mean age = 21.47 ± 5.53 years	**Cross-sectional** (Questionnaire) [Key themes: Doping use, estimated doping of others and intention to dope in hypothetical situations]	• Based on the self reported doping use and potential use, respondents were categorised into four groups: users with current and potential use (n = 9), potential users with no current use (n = 31), 'ambiguous' users with current use but denied potential use (n = 8) and non-users (n = 76). • The user group estimated more doping in general than non-users (35.11% and 15.34%, respectively). This was a significant difference ($p=0.004$). • The user group also gave higher estimates of doping than non-users in relation to the hypothetical situations (34.24% and 26.30%, respectively).
Petróczi, Aidman & Nepusz (2008)	**UK**	**111 University Students/Student Athletes** 83% male Mean age 21.59 ± 5.89 years	**Cross-sectional** (Implicit Association Attitude Test (PE-IAT) and Questionnaires (PEAS and 5-DST)) [Key themes: Validating a method to assess implicit doping attitudes using an Implicit Associations Test (IAT) approach]	• Longer response times were observed in the mixed category discrimination trials where categories 'good' and 'doping' shared the same response key (compared to 'bad-doping' combination on the same key) indicating a less favourable evaluation of doping substances. • The PE-IAT measure did not correlate significantly with the declared doping attitudes ($r = .181$, $p = .142$), indicating a predictable partial dissociation. Action-oriented self-report expressed stronger associations with PE-IAT: participants who declared they would consider using doping showed significantly less implicit negativity towards banned substances ($U = 109.00$, $p = .047$). Similarly, those who reported more lenient explicit attitudes towards doping or expressly supported legalizing it, showed less implicit negativity towards doping in the sample, although neither observed differences reached statistical significance ($t = 1.300$, $p = .198$, and $U = 231.00$, $p = .319$, respectively). Known-group validation strategy yielded mixed results: while competitive sport participants scored significantly lower than non-competitive ones on the PEAS ($t = -2.71$, $p = .008$), the two groups did not differ on PE-IAT ($t = -.093$, $p = .926$).

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Petróczi , Aidman, Hussain, Deshmukh, Nepusz, Uvacsek, Toth, Barker & Naughton (2011)	**Hungary**	**14 Competitive Athletes** (Selected from a sample of 82 in Uvacsek et al., 2009)	**Cross-sectional** (Cross-reference hair analysis with self-reported use of PEDs) Purposeful sample of individuals identified as 1) clean athletes (-ve self-report and hair screening), 2) denier (-ve self-report and +ve hair screening), 3) open users (+ve self-report and +ve hair screening) and 4) unverified/not currently using (+ve self-report and –ve hair screening)	• In self-reports, deniers have explicit attitude scores and perceived pressure scores below those who admit doping and close to those who are truly clean. • For perceived pressure, deniers claimed they feel no pressure at all (0.00), followed by clean athletes (2.50 ± 5.0) and then self-admitted users scoring 37.50 ± 37.97. • The third explicit measure, social projections were given the lowest percentage by deniers and highest estimation by those who admitted doping. All four self-admitted users believed that most high-performing athletes used PEDs in training and/or competition (n=3) or in training only (n=1). Half of the deniers (3/6) and clean athletes (2/4) agreed that PEDs are used in both circumstances. • Implicit association tests showed that deniers reacted fastest to associations of doping with positive words (i.e., doping + good) (27.48 ± 132.41), followed by admitted users (-94.98 ± 185.18), with clean athletes reacting the slowest (-255.98 ± 153.46).
Petróczi, Mazanov & Naughton (2011)	**Australia**	**46 University Student Athletes** 66% males Mean age 23.07 years ± 3.81 years	**Cross-sectional** (Questionnaire) [Key themes: general population and personal use of illicit drugs, ergogenic supplements and doping substances, as well as the effectiveness and necessity of performance enhancing substances]	• No individual reported personal doping use. However, 24 student athletes and 12 students reported illicit drug use. Usage was higher than lifetime use in the Australian general population, but was comparable to use among 20-29 year olds. • 69/86 student-athletes believed that winning is possible without doping (even at a high level). • The majority of athletes thought that prohibited performance-enhancing substances are effective. • Individuals were characterised into non-users, illicit drugs only, supplements only, and both. All groups overestimated population and sample prevalence of illicit drug use. Overestimation of doping among individuals who are not engaged in doping behaviours suggests that something other than prohibited substance use drove the estimation. Meaning that the data did not clearly support the notion of a False Consensus Effect (FCE).
Posiadala, Smorawinski, Pluta & Andrzejewskii (2009)	**Poland**	**811 University Students /Student-Athletes** 46% males Age range 19-28 years	**Cross-sectional** (Questionnaire) [Key themes: Access to knowledge about doping in sport]	• 79% state they don't have access to institutions or clubs enabling them to develop their doping knowledge. • Sources of doping knowledge: Media (46%); school (21%); acquaintances (18%); sports clubs (8%). Educational institutions play a greater part as years in university increases.

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Rodek, Idrizović, Zenić, Perasović, & Kondric (2013)	**Croatia, Slovenia, Bosnia and Herzegovina**	**293 Competitive Athletes** (188 Slovenian table tennis, tennis and badminton players, 78 Croatian sailors and 27 Bosnian/Herzegovinian weightlifters and power lifters)[4]	**Cross-sectional** (Questionnaire; 3 data-sets merged) [Key themes: Socio-demographic, health-related, and sports-related predictors with doping factors]	• Weightlifters: existence of high doping (more than half) and supplement use behaviours. High trust in coaches and physicians on doping issues and high perceptions of prevalence in their sport (more than half think doping occurs regularly). The latter was a risk factor for doping behaviours. In contrast, religiousness was interpreted as the most significant protective factor against doping behaviour, with paternity (i.e., marital/family status) also proving to be influential. • Racquet sport athletes: moderate likelihood of doping and moderate supplement use. Specifically, 10% of badminton players, 15% of table tennis players and 24% of tennis players would dope if it enhanced performance without negative health consequences. The data also revealed perceptions of moderate doping in their sport. In this regard, the data suggested a high risk of doping behaviour among those athletes who observe doping behaviour in their sport, as well as low sport achievement being a risk factor for doping. Complementing this finding, high sport achievement acted as a protective factor against doping. Notably, there were low levels of trust in coaches' and physicians' opinions on doping issues. • Sailing: Only one person reported that they might dope in the future. Additionally, the perceived prevalence of doping was low and trust in others (incl. coaches and physicians) was high.
Sajber Rodek, Escalante, Olujic & Sekulic (2013)	**Croatia**	**55 Competitive Swimmers** 44% males Mean age = 20.3 ± 2.2 years (Sample also included 22 coaches; see Athlete Support Personnel Section)	**Cross-sectional** (Questionnaire) [Key themes: Knowledge of nutrition (KSN) and doping (KD); Source of information].	• Athletes had lower knowledge scores for both KSN and KD when compared to coaches. • Athletes' KD and KSN were significantly positively related to age, education, experience, sport-achievement, DS use and the number of doping tests they had been exposed to. • 55% of athletes declared their coaches as the primary sources of knowledge about nutrition and doping, with 25% relying on self-education, 7% utilising formal education opportunities and 13% reporting having no knowledge about doping or sport nutrition. • 82% of athletes stated that they did not intend to dope. Eleven per cent reported that they were unsure if they would dope and 7% stated that they would dope if it would help them and had no negative health consequences. • 33% of athletes agreed with lifelong penalties for doping, 25% agreed with a milder punishment for a first time offence and lifelong suspension for second offence and 40% believed there should be a financial punishment. Only 2% believed that doping should be allowed. • Swimmers reported doping is used rarely (40%) or regularly (35%) in their sport. Only 4% stated doping is not prevalent in their sport.

[4] These studies have also been reviewed separately in the relevant sections.

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Sas-Nowosielski & Świątkowska (2007)	**Poland**	**830 Competitive athletes** 67% males Mean age = 20.02 ± 3.96 years, Mean competitive experience = 7.82 ± 4.04 years)	**Cross-sectional** (Questionnaire) [Key Themes: Knowledge on athletes' rights and responsibilities in relation to doping control; principles and procedures of doping control and prohibited substances and methods; effects on the body; attitudes towards doping control, sanctions, ethical foundations of anti-doping and athlete's behavioural disposition towards doping]	• Correct answers to 45.22% of items assessing knowledge. • Differences in the knowledge were observed in relation to subjects' sex, age and duration of sport career. Men answered more items correctly (46.42% v. 30.40%). Young people (18-24 years) provided more correct answers (47.78%) than adolescents (13-17 years, 41.92%) and adults (25-44 years, 43.12%). Individuals with ≤5 years of experience answered less questions correctly (41.09%) than individuals with 5-10 years of experience (46.02%) and individuals with >10 years of experience (46.59%). • Most frequently indicated source of knowledge was television (68.53% of n=769) followed by the Internet (53.97%), peers (53.84%), coach/instructor (36.80%), sports press (24.32%) and books (11.31%). • Respondents' attitudes were classified as moderately positive scores (i.e., against doping) (M=3.90 ± 0.07). The most positive was their attitude toward doping control (M= 4.12 ± 0.82), while the least positive was their attitude toward sanctions (M=3.68 ± 0.79). • Significant differences were noted between female and male athletes' attitudes (Wilks' 0.96; F(4, 780) = 8.55p = 0.000), with higher results (i.e., more anti-doping attitudes) achieved by female athletes. Differences were also observed between age groups (Wilks' 0.95; F(8, 1558) = 4.63; p = 0.000) from which the group of 18–24 year-olds achieved higher results than the remaining two age groups. • Within open-ended comments, nineteen respondents expressed concerns about the efficacy of anti-doping efforts and the existence of 'pure sport'. • Athletes with the least experience (≤5 years) had the lowest readiness to use doping according to their behavioural disposition scores.
Seif Barghi, Halabchi, Dvorak & Hosseinnejad (2015)	**Iran**	**239 Competitive Footballers** 136 Coaches	**Cross-sectional** (Questionnaire) Similar survey to Halabchi et al. 2011 Randomised clustered sampling [Key themes: Knowledge and attitudes toward doping]	• Overall knowledge of participants regarding doping definitions is good; inadvertent and unplanned use of prohibited drugs by athletes, refusing to provide sample to doping control officers and trafficking of prohibited drugs by the coaches were regarded as doping in over 70% of participants. • The knowledge about side effects of anabolic steroids was poor; more than 50% of participants were not familiar. There was not a significant difference between coaches and players in the case of knowledge. • More than 82% of participants disagreed to allow free use of all drugs. 77% were in favour of increasing the sanction for a doping offence. • More than 80% of participants supported the education of athletes about effective and safe doping methods. • 39% of athletes consider that achieving the international excellence is not probable without illegal drug use. • Main consultants for drug use: team fitness trainer (31.2%), peers and friends (26.9%), coaches (8%), dietitians (8%), club owners (6.7%) and physicians (6.4%).
Sefa, Erdal, Veysal, Ozden & Neslihan. (2010)	**Turkey**	**100 University Students/Student-Athletes** 82% males Mean age 21.83 ± 1.62 years	**Cross-sectional** (Questionnaire) [Key Themes: Knowledge of doping]	• 57% reported not having enough information about doping. • 49% felt that narcotic analgesics are used in most sports and 21% felt that anabolic agents are used in most sports. • 23% reported that stimulants are the most used substances in sport. • 85% believed doping substances are hazardous to health.

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Sekulic, Kostic & Miletic (2008)	**Serbia**	**43 Recreational Dancers** (M: 22, F: 21, >19 years of age, primarily amateur (n=33/43), but competing at all levels from local (n=1) to international (n=24))	**Cross-sectional** (Questionnaire, self-devised Questionnaire of Substance Use [QSU], delivered in group sessions) [Key themes: 1) social, cultural, educational, and sport-related factors, and 2) Substance use (SU), including alcohol, opiates, cigarettes, and doping consumption, as well as recommendations, beliefs and potential use]	• Only two females had used drugs (opiates, specifically cannabis or hashish and stated as 'rarely'). Nine dancers used painkillers 'rarely' and one person used them 'often'. The use of painkillers was related to age in female dancers (all at $p < 0.05$). • Females were less likely than males to never dope (71% vs. 90%), including being more likely than males to dope if it resulted in sporting success with no health repercussions (29% vs.10%). That being said, doping likelihood in females decreased with experience and success. In males, religiousness shared a relationship with decreased likelihood to dope. • Half of the dancers reported that doping is never used in their sport (22/43), sixteen dancers were not sure or not familiar enough to comment, three individuals felt doping was rare and two females believed that doping occurs often in dancing. • Males were less likely to trust anyone but himself or herself on doping issues (90% vs. 72%). In particular, females were more likely than males to trust their coach or physician (28% vs. 5%).
Sekulic, Kostic, Rodek, Damjanovic & Ostojic (2009)	**Serbia**			This paper reiterated the findings presented above: • Females would consider doping with less anxiety than males. • The most significant protective factors of substance use behaviours, particularly 'doping', were sport status and sport achievement in females and religiousness in males.
Smith, Stewart, Oliver-Bennetts, McDonald Ingerson, Anderson et al. (2010)	**Australia**	**11 Competitive Athletes** (Males 8, Females 3, n=6 elite and the remaining five involved in community leagues or other competitions, involved across a range of sports, including team/individual, contact/water/ball)	**Cross-sectional** (Qualitative interviews – using a narrative approach) [Key themes: Attitudes towards drugs in sport, contextual factors influencing the formation of those attitudes] *Social ecology theory*	• Seven categories of key influences on doping-related attitudes and behaviours included 1) personality and identity, 2) influential people, 3) early sporting experiences, 4) commercial pressures, 5) sporting culture, 6) attitudes to policy and 7) attitudes to substances. • All participants conceded that drug use was a feature in their chosen sport • Participants viewed the use of banned performance-enhancing substances as cheating, 'hard' non-performance-enhancing recreational or illicit substances as unwise, legal non-performance-enhancing substances as acceptable, and legal performance-enhancing substances as essential. • Attitudes were sometimes quite libertarian, and contingent upon first, the legality of the substance, and second, its performance impact. • Athletes' attitudes about drugs were fundamentally shaped by sport's culture, as well as relationships with influential people/significant others within and outside the sporting environment (i.e., coaches, peers, family, friends). • Other significant factors included its commercial scale, early experiences and critical incidents of players and athletes, and their level of performance.

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Stewart & Smith (2010)	**Australia**	**12 Competitive Athletes** (Males 8, Females 4, involved across a range of sports, including team/individual, contact/water/ball)	**Cross-sectional** (Qualitative interviews - using a narrative approach) [Key themes: Attitudes to drugs in sport and the implications of these in the formulation of effective anti-doping policy].	• The data did not support the existence of a rational cost-benefit analysis to doping-related attitudes and behaviours. • Attitudes were influenced by the context in which they are formed. Specifically, data indicated that attitudes are contingent upon the legality of the substance, its performance impact and its social impact. • For instance, athletes competing at higher levels were more understanding of doping due to pressures to perform, whereas athletes at lower levels had strong negative attitudes and this was more pronounced when the individual had no clear incentives to engage in doping. • If a substance is not illegal, provides performance support, expedites recovery, or makes the user feel better, then it is considered legitimate. • Non-elite athletes generally embraced WADA's policy platform and value system – viewing doping as morally wrong, with current policy, including punitive measures, as essential to the maintenance of parity and a 'level playing field'. • In contrast, elite athletes had a more flexible view of doping. A notable difference was the elite athletes' ambivalent attitude towards a 'level playing field', which they questioned due to access to coaches, training facilities, etc. • Banned PED were viewed as cheating, although for different reasons between elite and non-elite athletes, with non-elite being more moralistic. In contrast, recreational substances were not seen as cheating, as they do not enhance performance.
Tavani, Colombo, Scarpino, Zuccaro, Pacifici & La Vecchia, (2012)	**Italy**	**508 Competitive Athletes** **74% males** < 20 years 26% 20-30 years 43% > 30 years 30% Local 39%, Regional/inter-regional 34%, National/international 28%	**Cross-sectional** (Questionnaire – interviewer completed) [Key Themes: Beliefs about doping effects; reasons for use; accessibility; opinions on doping control; prevalence perceptions]	• Doping was widespread in the opinion of 87.4% of athletes, and 45.3% thought it was used at all competition levels. • 43.9% reported that athletes and coaches together were responsible for use, and 25.2% that it was easy to obtain substances. • About half thought that anti-doping controls should be more frequent and that they are not or poorly effective. Almost 84% thought they could be more effective, with substantial consistency among the answers of athletes at various competition levels. • 72% believed that only a small proportion of athletes using illegal doping practices are discovered during anti-doping controls. • Overall 73-79% of athletes thought that doping practices may have some adverse effects on health. • About 11-17% of athletes at local, regional and top-level reported that they had ever spoken to somebody at the same competition level and in the same sport habitually using amphetamines, or anabolic steroids, or erythropoietin, or all these substances. About 12% of athletes reported it had been proposed to them to use these substances, and 1.5% at local competition level, 2.9% at regional and 5.0% at top-level reported that they had ever used them. • The reason for use was to win competitions according to about 56% of athletes at local, 65% at regional and 67% at national/international level

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Uvacsek, Nepusz, Naughton, Mazanov, Ránky & Petróczi (2009)	**Hungary**	**82 Competitive Athletes** 45% males Mean age = 21.43 ± 2.82 years	**Cross-sectional** (Questionnaire; PEAS) [Key themes: self-reported use of performance enhancing drugs (PEDs) and recreational drugs (RDs), estimated doping in others and attitudes towards doping (using Performance Enhancing Attitudes Scale, PEAS)]	• 14.6% (n=12) admitted using PEDs and 31.7% (n=26) reported using RDs, with eight individual engaging in use of both types of substances. • Doping prevalence was estimated relatively highly (compared to official test statistics). Notably, non-users were quite accurate in their estimates (16.9%) when compared to actual use in the sample, whereas users over-estimated use (34.6%). Moreover, these findings provided support for the False Consensus Effect (FCE). This pattern was replicated in relation to RDs, as users estimated 46.83% and non-users estimated 39.61%. Therefore, users of both PEDs and RDs believe that many others are engaged in the same behaviours as they are. • PED users showed significantly more lenient attitudes towards doping than non-users (46.8 vs. 34.43 on a scale of 17 to 102). Aligned with this, a prediction model indicated that individuals with an attitude score of ≥60 had at least 70% chance of likelihood to use PED.
Vangrunderbeek & Tolleneer (2010)	Belgium	**555 Media Portfolios of University Students/Student-Athletes**	**Cross-sectional** (Discourse analysis) [Key themes: Opinions on doping in elite sport, including attention paid to doping]	• Over time, attention paid to media articles dropped from 80% of portfolios (1998-9) to 69% (2003-4) and then to 34% by 2005-6. • The proportion of portfolios presenting reviews advocating 'zero tolerance' was between 70% and 85% for 1998 to 2003, before gradually decreasing to ~45% by 2005-6. Tolerance simultaneously fluctuates between 10% and 2% between 1998 and 2003, before increasing to over 20% in 2005-6. • Students were initially concerned with doping being against fair play and harmful to health. By 2005-6, the main concern was fair play and equality in practices.
Vâjială, Epuran, Stanescu, Potzaichin, & Berbecaru (2010)	Romania	**1404 Competitive Athletes**	**Cross-sectional** (Questionnaire, including POMS) [Key themes: Motivation and temptation to use PEDs].	• It appears that 88 (6%) athletes would be tempted to dope, including those who have doped in the past and those who reported that they might dope in the future. • The authors commented that athletes externally motivated to practice sport, who present anger-hostility states with over average values, as well as those internally motivated to practice different sport disciplines, who have over average tension-depression values are tempted to use prohibited substances more than other athletes. • Sixty per cent of athletes believed that individuals dope to gain material goods (60.6%) or to be famous (60.5%). Other motives for doping included to achieve a high level of records (45.7%), the doubt (34.4%), a lack of information (23%) and the tension they feel (20.8%).
Weaving & Teetzel (2014)	**Canada**	**38 Student Athletes** 55% males (Rugby, American football, ice hockey, football, basketball, volleyball, and athletics)	**Cross-sectional** (Qualitative interviews) [Key themes: perceptions of gender and doping]	• Extensive gender stereotyping is present in understanding of femininity and masculinity in sport • Females were hesitant to use muscle building supplements (both banned and permitted) given their association with the masculine body and male athletes • Belief that female sporting success is more dependent on skill than strength; males have more pressure to be "big" to be successful • Weight loss supplements considered "feminine" • Pressure to meet 'body ideals' • Homophobia associated with female athletes and muscle development

Table 5 Continued.

Authors (year)	Country	Sample	Methods	Summary
Whitaker, Long, Petróczi & Backhouse (2012)	**UK**	**147 Competitive Athletes** 41% males Mean age = 25.51 ± 8.47 years 30 sports	**Cross-sectional** (Online questionnaire, open-ended) [Key themes: perceived prototypes of performance enhancing substance users and non-users] *Prototype Willingness Model*	• Non-users were seen as motivated, reliable, rule abiding and risk averse, as well as being role models. • PED users were thought to have a bad temperament and be rule breakers. However, they were not seen in only a negative light, as they were also perceived to be motivated, committed to performance and confident. • Athletes who perceive PED user prototypes favourably may be vulnerable to doping via motivation that is elicited from possible future selves. • The authors concluded that tailored anti-doping education programmes should address athletes' prototype perceptions to enhance the prevention of doping.
Whitaker, Backhouse & Long (2014)	**UK**	**9 Competitive Athletes** All national level from rugby league (n = 5) and track and field athletics (n = 4).	**Cross-sectional** (Qualitative interviews - thematic analysis) *Informed by Prototype Willingness Model*	• Contextual differences existed around the role that athletes perceived they would play if they became aware of doping. • Track and field athletes would adopt the role of a whistle-blower and report individuals who were doping in their sport. • Rugby league players highlighted a moral dilemma: despite disagreeing with their teammates' actions, the players would adhere to a code of silence and refrain from reporting doping. • Prevention programmes might focus on changing broader group and community norms around doping. • Developing skills to intervene (e.g., speaking out against social norms that support doping behaviour) or increasing awareness of reporting lines could enhance community responsibility for doping prevention. • A one-size-fits-all approach to anti-doping is problematic.
Zenic, Peric, Zubcevic, Ostojic & Ostojic (2010)	**Croatia**	**69 Performing Artists** 100% females 21 ballet dancers, 25 non-Olympic dance sport and 23 synchronised swimmers	**Cross-sectional** (Questionnaire of Substance Use [QSU] delivered in small groups) [Key themes: Substance use and beliefs, including doping]	• Perceptions of doping across the three disciplines varied slightly, with twice as many individuals involved in dance sport (10/25) and synchro. swimming (9/23) than ballet (4/21) stating that doping does not happen. • Approx. 1 in 5 reported that they would use doping if it would ensure professional (sport) success without negative health consequences (ballet: 4/21, dance sport: 4/25, synchro: 6/23). Those more convinced that doping habits are present in their sport (or art) have a certain tendency toward doping usage. • A small number of performers in all three disciplines were using marijuana/cannabis (ballet: 3/21, dance sport: 2/25, synchro: 7/23). Only the dance sport performers recognised this as a violation of anti-doping rules. • Analgesic use correlated with a tendency towards potential doping usage in ballet dancers. • Most of the performers reported that they did not rely on physicians' and/or coaches' opinions regarding doping, with a large proportion of performers reporting that they would trust no one (ballet: 88%, dance sport: 71%, synchro: 53%). That said, 25% of dance sport performers would trust their coach and 35% of synchro. swimmers would trust their physician.

Table 6. Overview of studies employing inferential statistics to identify variables that were predictive of doping intentions/doping use in competitive athletes.

Authors (year)	Country	Sample	Method	Independent / dependent variables	Summary
Buckman, Yusko, Farris, White & Pandina (2011)	**USA**	**392 University Students/ Student-Athletes** Mean age = 19.9 years (*SD*=1.3 years)	**Cross-sectional** (Questionnaire)	I: Sensation seeking, mood, perceptions of peer use, motivations for use, and stress related to body image and academics in athletes. D: Past-year marijuana use	• For athletes and non-athletes of both genders, being White, being past-year cigarette smokers, having higher sensation-seeking scores, and having exaggerated perceptions of student use norms were associated with past-year marijuana use. • Enhancement motivations for use were higher among athletes compared with their same-gender non-athlete peers.
Buckman, Yusko, White & Pandina (2009)	**USA**	**234 Male University Athletes** Mean age = 20.1 years	**Cross-sectional** (Questionnaire)	I: Past alcohol use; past cigarette use; alcohol and drug related problems; stress; sensation seeking; protective behaviours; mood D: Past PED use (stimulants, hormone precursors, NS)	• Male athlete PED users (n = 73; 31%) compared with nonusers (n = 160; 69%) reported more problematic alcohol-use behaviours and more alcohol- and drug-use-related problems. • PED users compared with non-users were more likely to report past-year use of tobacco products, marijuana, cocaine, psychedelics, and prescription drugs without a prescription. • PED users demonstrated higher sensation seeking, and greater coping and enhancement motivations for drinking and marijuana use than non-PED users.
Dodge, Stock & Litt (2013)	**USA**	**132 Male University Athletes**	**Cross-sectional** (Questionnaire) *Theory of reasoned action & prototype willingness model*	I: illegal-is-effective heuristic thinking; attitudes; norms and prototypes D: willingness and intentions to use illegal performance-enhancing substance	• 75% reported lifetime PED use (protein supplements and creatine most commonly used). None of the participants reported using illegal PED. • Willingness to use PED was predicted by more favourable prototypes (b = .02, p<.05), greater perceptions of normative approval (b = .44 p<.01), more positive attitudes (b = .46 p<.01 and greater agreement with the illegal-is-effective heuristic ((b = .20 p<.01) • The illegal-is-effective heuristic was a significant predictor of willingness but was not a significant predictor of intentions.

Table 6 Continued.

Authors (year)	Country	Sample	Method	Independent / dependent variables	Summary
Gucciardi, Jalleh & Donovan (2010)	**Australia**	**224 Multi-Sport Athletes** 137 males, 87 females, aged between 14 and 66.	**Cross-sectional** (Questionnaire)	I: Performance enhancement attitudes, social desirability D: Doping susceptibility	• No significant correlations between age and social desirability (Spearman's r = 0.02, p=0.76), attitudes to doping (Pearson's r = 0.09, p= 0.17), doping susceptibility (Spearman's r=0.05, p=0.42). • Social desirability was no significantly related to attitudes to doping (Spearman's r= -0.03, p=0.06), or doping susceptibility (Spearman's r = 0.10, p=0.13), whereas there was a moderate relationship between attitudes to doping and doping susceptibility (Spearman's r=0.29, p <0.001). • Correlation between doping attitudes and doping susceptibility was positive (but not significant) for all three levels of social desirability. • Attitudes to doping explained 17% of the variance in doping susceptibility.
Hildebrandt, Harty & Langenbucher (2012)	**USA**	**201 University students** 50% males Mean age = 19.17, SD = 1.99	**Cross-sectional** (Questionnaire)	I: Gender, beliefs about appearance and performance enhancing drugs (APED) D: nutritional supplement and APED use	• Participants had used supplements an average of 4.24 years (SD = 2.34) • Illegal drug use was reported by 74 participants in the sample (36.8%). Of this, 31 (15.4%) reported some illicit drug use in the past 28 days, with the most commonly reported drug being marijuana (n=26, 12.9%). • Men were more likely to use muscle-building supplements (MB-S) than women (86 vs. 20; odds ratio [*OR*] = 24.89, 95% confidence interval [CI] = 11.11-56.80, *p*<0.001). Whereas women were more likely to use weight-fat-loss supplements (WFL-S) (75 vs. 35; *OR* = 4.19, 95% CI = 2.23-7.92, *p*<0.001). • 32 participants reported current illicit AEPD use, which all 32 reporting some form of AAS use. • Study suggests that regular supplement use may be an important factor in the development and risk for illicit APED use among college students, independent of sports participation, body image disturbance, or other illicit drug use.
Hodge, Hargreaves, Gerrard, & Lonsdale (2013)	**New Zealand**	**224 Competitive Athletes** 59% female M age = 20.3 M experience = 10.2 years in sport	**Cross-sectional** (Questionnaire) PEAS, CCBS, BRSQ-6, MDSS-S *Self-determination theory*	I: Moral disengagement, motivational basis D: attitudes towards using PEDs & PED use susceptibility	• Overall athletes reported high scores on coach & teammate autonomy scales • Autonomous motivation scores were also high • Levels of moral disengagement, positive attitudes toward PEDs, and PED susceptibility were low • Hypothesis, regarding the positive relationships among controlling climates and controlled motivation and PED attitudes and PED susceptibility, was largely supported, and moral disengagement was a strong predictor of positive attitudes toward PEDs. • The proposed negative influence of autonomous climate and autonomous motivation on moral disengagement, PED attitudes, and PED susceptibility was not supported. • Hypothesis 3 was partially supported, with athletes in the "high" positive attitudes toward PEDs group (n = 74) reporting higher levels of controlling coach climate and moral disengagement and athletes in the "high" PED susceptibility group (n = 45) reporting higher levels of controlled motivation and moral disengagement.

Table 6 Continued.

Authors (year)	Country	Sample	Method	Independent / dependent variables	Summary
Karazsia, Crowther & Galioto (2013)	**USA**	**448 Male University Athletes** Multi-sport Mean age = 19.54 years (*SD* = 2.21).	**Cross-sectional** (Questionnaire) *The Gateway Hypothesis*	I: illegal-is-effective heuristic thinking; attitudes; norms and prototypes D: willingness and intentions to use illegal performance-enhancing substance	• Age of first protein use (M = 16.64 years) preceded first creatine use (M = 17.19), which in turn preceded first use of Androstenedione (M = 17.90) and Anabolic Steroids (M = 20). • Among the 26 participants who reported illicit PED use, 96.2% and 84.6% reported a history of protein and creatine use, respectively. • A series of hierarchical logistic regression analyses revealed that the strongest predictor of current illicit substance use was previous use of legal performance-enhancing substances, although sociocultural variables were significant predictors in each analysis. • Odds of currently using creatine were 6.45 times greater among previous protein users than individuals with no history of protein use. • Odds of engaging in testosterone supplement use were 8.03 times greater among previous users of creatine than nonusers. • Social body comparison was the only psychological risk factor that predicted use of a testosterone supplement, whereas internalisation or muscle-oriented body dissatisfaction predicted protein and creatine use.
Petróczi (2007)	**USA**	**199 Male University Students/Student Athletes**	**Cross-sectional** (Questionnaire)	I: Personal traits (e.g., competitiveness, win and goal orientation) D: Sport orientation and doping attitudes	• Among the 199 participants, 7.5% reported having personal experience with doping, and an additional 4.5% claimed to have used doping substances for medical reasons. Figures for performance enhancing substance use were slightly lower, 2.5% and 0.5% respectively. • Self-reported doping behaviour had a significant relationship with doping belief ($p<0.001$). Sport orientation is not strongly related to doping behaviour, or doping attitude. However, the only exception was win orientation, which showed a significant relationship with doping attitude ($p<0.05$). • Small negative, but not significant, relationship between goal orientation and doping behaviour ($p=0.465$) was a logical connection because among the three sport orientation measures; goal orientation reflects an orientation to personal standards, regardless of the situation.
Sas-Nowosielski & Świątkowska (2007)	**Poland**	**830 Competitive athletes** 68% Males Competitive experience – 7.82 years (*SD* 4.04)	**Cross-sectional** (Questionnaire) *Achievement goal theory*	I: Achievement goal orientations; Gender D: Doping attitudes	• Females declared significantly more favourable attitudes than males ($p<0.001$). • Athletes who were high task/low ego oriented declared the most favourable attitudes, while athletes who were low task/high ego oriented declared the least favourable attitudes. • Multiple regression analyses confirmed that ego orientation was significantly negatively related to, and task orientation was significantly positively related to attitudes toward doping.

Table 6 Continued.

Authors (year)	Country	Sample	Method	Independent / dependent variables	Summary
Tahtamouni, Mustafa, Alfaouri, Hassan, Abdalla & Yasin (2008)	**Jordan**	**503 University Students/Student Athletes** (and 154 bodybuilders)	**Cross-sectional** (Questionnaire)	I: Socio-demographic, attitudes D: AAS use	• Prevalence of AAS use was 4.2% in University students and 26% for the bodybuilders. • Majority of users in the 18-29 year old age group. 57% began using AAS when they were between 15-18 years old. • Significant difference in the monthly income between users and non-users • Two main reasons for using AAS for students and bodybuilders were improving athletic performance (44 and 62% respectively) or enhancing their physique (56 and 39% respectively). • 77% of the users used more than one AAS at any given time.
Whitaker, Long, Petróczi & Backhouse (2014)	**UK**	**729 Competitive Athletes** Mean age = 28.8 ± 10.1 years 63% male	**Cross-sectional** (Questionnaire) *Prototype Willingness Model*	I: Attitudes; norms, prototype perceptions; outcome expectancies D: Willingness to dope	• Using hierarchical multiple regression analysis, 54.4% of the total variance in willingness to dope was explained. Specifically, past doping, attitudes, and favourability of performance enhancing substance user prototypes were the strongest unique predictors of willingness to dope. Athletes appeared most willing to dope if they were to suffer an injury, a dip in performance, or think others are doping and getting away with it. National-level athletes displayed significantly greater willingness to dope (Kruskal-Wallis $\gamma 2 = 35.9$, $P < 0.001$) and perceived themselves as significantly more similar to a doper (Kruskal-Wallis $\gamma 2 = 13.4$, $P = 0.004$) than athletes competing at any other level.
Zenic Stipic & Sekulic (2013)	**Bosnia and Herzegovina**	**162 University students** Age range 18 – 25 years 69% male	**Cross-sectional** (Questionnaire)	I: Gender, doping behaviours D: Social, educational, sport, and religious factors	• Multiple regression calculations revealed religiousness as the most significant predictor of the social, health, sport and legal factors of hesitation against doping behaviours in both genders. • However, the differential influence of the social, educational, sport and religious factors in relation to negative consequences of the doping behaviours is found for men and women. Such differential influence must be emphasised in tailoring the anti-doping policy and interventions. • Religiousness is most significant predictor of hesitation against doping behaviour in females.
Zucchetti, Candela & Villosio (2014)	**Italy**	**109 Competitive Athletes** Aged 15 to 45 (M = 31.5; SD = 13.78 Hypothesis testing.	**Cross-sectional** (Questionnaire)	I: Psychological and social constructs; type of sport (e.g., resistance vs. non-resistance sport), athlete participation in competitive sport (i.e. agonistics) or in non-competitive sport (i.e. amateurs) D: Doping attitudes	• Hierarchical multiple regression showed that both psychological (i.e., extrinsic motivation, perfectionism) and social variables (i.e., athletes' contact with doping users) were associated with athletes' attitudes towards doping. • Hierarchical multiple regression model shows significant relationships between attitude towards doping and perfectionism (β=0.25, p<0.05); extrinsic motivation (β=0.38, p<0.05); and contact with people who engage in doping (β =0.23, p=0.06). • Athletes with high extrinsic motivation have a positive attitude towards doping. Attitudes towards doping were also significantly associated with perfectionism. • Athletes who have contacts with doping users have a positive attitude towards doping.

Prevalence of doping use

Self-reports of PED use were highly variable across studies and this inconsistency could have been a symptom of measurement variability. While some studies found no self-declared PED use (Chantal et al., 2013; Dodge et al., 2013; Hodge et al., 2013; Petróczi, Mazanov, et al., 2011; Petróczi et al., 2010), or concluded such use was rare among recreational dancers (Sekulic et al., 2008; Sekulic et al., 2009) and professional ballet dancers (Sekulic et al., 2010) other studies offer doping prevalence statistics in excess of 1%. In a sample of competitive US athletes, 7.5% reported personal experience of doping, and an additional 4.5% claimed to have used doping substances for medical reasons (Petróczi, 2007). Also in the US and drawn from samples of competing and non-competing undergraduate students, one study indicated that 15.4% reported some form of AAS use as part of their appearance and performance enhancing drug (APED) use (Hildebrandt et al., 2012), and another found less than 1% reported having ever used AAS, with 8% reporting using a prescribed stimulant without prescription. In the UK, a survey of over 700 competitive athletes found that 2.3% admitted currently using PEDs, while 4.5% reported previous use (Whitaker, Long, et al., 2014). Although a smaller sample, Backhouse et al. (2013) reported very similar statistics with 3% of UK-based athletes declaring that they were doping/had doped in their lifetime. When the focus shifts to specific sports, prevalence rates are higher with 8% of non-professional competitive cyclists (N=68) in the US self-reporting the use of banned PEDs (Kisaalita & Robinson, 2014). In Jordan, self-reported prevalence of AAS use was 4.2% in a sample of university students and 26% in a sample of bodybuilders (Tahtamouni et al., 2008). Among 82 competitive Hungarian athletes, 14.6% admitted using PEDs and 31.7% admitted to the use of recreational drugs (Uvacsek et al., 2011). In India, the use of banned substances was declared by 27% of surveyed athletes (university level and above), but the definition of a 'banned substance' was not clear. Descriptive data drawn from a French anti-doping phone-help service highlighted the percentages of prohibited substances used by cyclists, bodybuilders, and footballers. Specifically, 77% of bodybuilders used AAS, 34% of cyclists used glucocorticosteroids and 52% of footballers used cannabinoids (Bilard et al., 2011). Stimulants were used at similar rates across the sports (10.1%, 19.8% 12.9% in bodybuilding, cycling and football, respectively) and the majority of

the substances recorded were prohibited by the WADA. From this sample, 6.7% of the callers (cyclists and footballers, with 79% being cyclists) had tested positively in doping controls.

Perceived incidence of doping

Relatively few participants across the studies self-reported doping behaviours but this was not reflected in athletes' perceptions of doping prevalence. Among university students 49% believed that narcotic analgesics are used in most sports; using this same 'used in most sports' criterion, stimulants scored 23% and anabolic agents 21% (Sefa et al., 2010). Two studies explored the potential connection between prevalence perceptions and being a user via the False Consensus Effect (FCE). Petróczi and colleagues (2008) categorised individuals as 'users' in two distinctive ways, (i) through conventional self-identification and (ii) derived from responses to hypothetical doping scenarios. This approach identified that users estimated more doping in general (35%), as well as in relation to hypothetical situations (34%) when compared to non-users (15% and 26%, respectively). Based on this study, the authors suggested that the FCE may be an avenue for developing an indirect self-report mechanism for doping behaviours in epidemiological studies. However, a subsequent study (Petróczi, Mazanov, et al., 2011), found an overestimation of doping among individuals who were self-reported supplement users, rather than dopers. Therefore, the authors suggested that the scenario approach and/or its scoring may be being driven by factors unrelated to using prohibited substances.

Data showed that many athletes believe that the majority of professional, elite performers are using PEDs (Judge et al., 2010; Pappa & Kennedy, 2012). Indeed, athletes feel that a variety of substances have been used in sport over a long period and that the doping phenomenon has recently 'exploded exponentially' (Stewart & Smith, 2010). Quantitative data showed that at least half of a sample of athletes believed that doping occurs in both training and competitive environments (Petróczi et al., 2010). Additionally, 38% of student-athletes reported that most records are changed because of doping Arazi et al. (2014). Further, Neeraj et al. (2011) noted 39% of athletes in their study personally knew someone who was taking, or had previously

taken, banned substances. Within the specific sport of track and field, 73% of US track and field throwers perceived doping as a problem in international sport. Yet, almost two thirds (62%) also reported that doping had not saturated their own sport. Similarly, almost two thirds of table tennis players felt that doping occurred only rarely or not at all within their sport (Kondric et al., 2010). Also illustrating the perception variability across sport types and levels, athletes from individual sports in the UK perceived more athletes in their sport to use PED than athletes from team sports (Whitaker, Long, et al., 2014) and club/university athletes perceived more athletes in their sport used PED than county, national and international athletes (Whitaker, Long, et al., 2014).

In terms of gender effects, mixed results are noted with a multi-sport study finding that males perceived there to be a greater percentage of doping in their sport compared to females (Backhouse et al., 2013) and a sport specific study (table tennis) (Kondric et al., 2010) reporting that females are more likely to believe that doping is prevalent in their sport than males That said, two thirds of the sample (60%) perceived doping to occur rarely or not at all. Prevalence perceptions also appear to differ across sports and there is even wide ranging views within sports (Sekulic et al., 2008; Zenic, Zubcevic, Ostojic, & Ostojic, 2010; Zenic, Peric, et al., 2010).

Doping attitudes and beliefs

Although each study asked different questions or included different tasks (e.g., responding to hypothetical scenarios vs. responding directly to questions about their own behaviour), there was a prevailing anti-doping attitude across studies and respondents (Brand et al., 2011). For example, student-athletes saw AAS use in sport as cheating (Dodge et al., 2012) and disagreed with PED use in competitive sport (Morente-Sanchez et al., 2014). Building on the latter point, student-athletes also reported that winning is possible without PEDs (Petróczi, Mazanov, et al., 2008). This declaration was in contrast to another study which noted a strong belief by student-athletes that drugs and supplements were necessary for improved performance (Arazi et al. 2014).

Dopers continue to be seen in a negative way or as having a negative social image (Chantal et al., 2013; Chantal et al., 2009). In particular, when compared to a 'non-user', an athlete using AAS was more ego-oriented and less self-determined in their motivation (i.e., participation in sport was based on feelings of pressure to obtain external rewards or avoid punishment) The steroid-using athlete was also seen as having weaker sportspersonship orientations (i.e., lesser concern for opponents, the social conventions of sport, and for one's own athletic commitment). Moreover, steroid using athletes were believed to be more likely to engage in reactive aggression, i.e., more prone to intentionally injure/harm an opponent, rather than simply hinder his performance (Chantal et al., 2013; Chantal et al., 2009) and be more likely to break rules (Whitaker et al., 2012). On the other hand, non-users were seen as more motivated, reliable, rule abiding, and risk averse, as well as being role models, than PED users (Whitaker et al., 2012).

Notably attitudes towards dopers were influenced by participation in sport, where those involved in sport saw an AAS user as more of a cheat than those participants not involved (Dodge et al., 2012). Equally, the type of sport participated in appears to influence attitudes, with bodybuilders maintaining a more favourable doping attitude than handballers (Brand, Heck, et al., 2014). Although the majority of findings indicated anti-doping attitudes, media portfolios (Vangrunderbeek & Tolleneer, 2011) showed a trend for some individuals to suggest that doping could be a way to even the playing field. Moreover, athletes do report the perceived performance effectiveness of prohibited PEDs, even without reporting personal doping use (Petróczi, Mazanov, et al., 2011).

The majority of athletes were against the use of PEDs in sport. For instance, 82% of competitive athletes from a variety of sports felt that doping was 'unfavourable' (Judge et al., 2010). Similarly, attitudes scores among Hungarian competitive athletes were between 34 and 46.8 on a scale of 102, where higher scores indicate more lenient attitudes towards doping (Uvacsek et al., 2011). In comparison, attitudes towards doping were more lenient among individuals who used PEDs (Backhouse et al., 2013; Neeraj et al., 2011; Uvacsek et al., 2011). Furthermore, even athletes who had doping

contacts held a more positive attitude towards doping than those with no such contacts (Zucchetti et al., 2014). In this vein, doping deniers – people engaged in doping, as verified through hair analysis, but who do not acknowledge this in self-reports – reported stronger anti-doping attitude scores than confirmed-admitted dopers; their values were also close to the score of confirmed-clean athletes (Petróczi et al., 2010).

With regard to age and/or experience, athletes competing at higher levels appear more understanding of doping due to pressure to perform and greater incentives to win, compared to athletes at lower levels (Stewart & Smith, 2010). Although some studies have found more negative attitudes towards doping at lower participation ranks (Stewart & Smith, 2010), others have highlighted a vulnerability to doping at lower levels with one study showing that national-level athletes displayed significantly greater willingness to dope and perceived themselves as more similar to a doper compared to athletes at all other levels (Whitaker, Backhouse, et al., 2014). In terms of sports type, few studies have examined this directly, but those that have noted no difference in attitudes across student-athletes from team sports, individual sports, and those practising both (Morente-Sanchez et al., 2014).

Although the majority of athletes surveyed declared anti-doping views and opposed the use of drugs in sport (Arazi et al., 2014; Morente-Sánchez et al., 2015; Sajber et al., 2013; Smith et al., 2010), a small proportion commented that doping should be legalised (Judge et al., 2010; Sas-Nowosielski & Świątkowska, 2007) and others doubted that sport can be 'pure' (Sas-Nowosielski & Świątkowska, 2007). Individuals competing at higher levels appeared to be ambivalent towards the notion of a 'level playing field' (Stewart & Smith, 2010). Of 240 track and field throwers, 98% felt that testing does not catch all dopers (Judge et al., 2010). Despite this, 58% - a small majority - of throwers still believed that testing is the most effective way to address doping in sport (Judge et al., 2010). In relation to sanctions, half of track and field throwers stated that a two-year suspension was appropriate for a first-time offence, while 71% agreed justified lifetime bans (Judge et al., 2010).

Although the majority of athletes reported anti-doping attitudes, only 58% would report known dopers (Judge et al., 2010). Comparatively, Whitaker et al. (2014) established contextual differences around the role that athletes perceived they would play if they became aware of doping behaviours. Specifically, track and field athletes were more likely to take on the role of whistle-blower and report individuals who were doping in their sport, whereas rugby league players highlighted a moral dilemma; although they believed doping was cheating they were more likely to adhere to a code of silence and refrain from reporting.

On the topic of contextual differences, Stewart and Smith (2010) found that attitudes were influenced by the context in which they are formed. Specifically, data indicated that attitudes are contingent upon the legality of the substance, its performance impact and its social impact. For instance, athletes competing at higher levels were more understanding of doping due to pressures to perform, whereas athletes at lower levels had strong negative attitudes and this was more pronounced when the individual had no clear incentives to engage in doping. Drawing upon a social ecological perspective, Smith et al. (2010) highlighted seven key influences on predicting PED use in sport; 1) personality and identity; 2) influential people; 3) early sporting experiences; 4) commercial pressures; 5) sporting culture; 6) attitudes to policy; and 7) attitudes to substances.

Predicting PED use/intentions

From an individual 'risk' perspective, Pedersen (2010) drew together research from across different training environments (7,039 respondents) to define a PED using prototype as being: (i) male, (ii) member of a gym, (iii) an elite sports athlete involved in cycling or in disciplines requiring great physical strength, (iv) an individual who engages in sports or physical exercise five times a week or more and (v) an individual who uses other performance-enhancing substances (such as creatine, ginseng and painkillers that are not on the banned list). A number of studies corroborated these predictors of doping use, particularly male gender, gym exposure and legal PED use (e.g., Hildebrandt et al., 2012; Tahtamouni et al., 2008).

Nutritional supplements: The unique role that legal performance enhancement may play in influencing PED use has been evidenced across a number of studies. Examining the Gateway theory of drug use (Kandel, 2002), hierarchical logistic regression analyses revealed that the strongest predictor of current PED use was previous use of legal performance-enhancing substances, although sociocultural variables were significant predictors in each analysis (Karazsia et al., 2013). Among the 26 participants who reported illicit PED use, 96% and 85% reported a history of protein and creatine use, respectively. In fact, age of first protein use (M = 16.64 years) preceded first creatine use (M = 17.19), which in turn preceded first use of Androstenedione (M = 17.90) and Anabolic Steroids (M = 20). This led to the odds of engaging in testosterone supplement use being 8.03 times greater among previous users of creatine than non-users. In this study, beyond NS use, social body comparison was the only psychological risk factor that predicted use of a testosterone supplement, whereas internalisation or muscle-oriented body dissatisfaction predicted protein and creatine use (Karazsia et al., 2013). In another US study, 32 out of a sample of 201 participants reported current illicit APED use, with all 32 reporting some form of AAS use. The study suggests that regular supplement use may be an important factor in the development and risk for illicit APED among college students, independent of sports participation, body image disturbance, or other illicit drug use. Additionally, Backhouse et al. (2013) found that significantly more nutritional enhancement users reported doping than non-users, leading to the tentative conclusion that athletes who engage in legal performance enhancement appear to be an at risk group for the transition towards doping. This was further supported by another group of competitive athletes in the UK as they evidenced a 'sliding scale' amongst current and former doping athletes (Boardley, Grix, & Harkin, 2014), with a natural progression from legal supplements to more serious PED use which was often motivated by plateaus in training effects. Similarly, Kisaalita and Robinson (2014) found further support for the Gateway Hypothesis in their study of competitive cyclists.

Training status: The evidence on training status and sport type appears inconclusive due to limited investigations to date. In Denmark, Pedersen (2010) noted that AAS were the most commonly used substance by respondents across contexts, although cyclists reported using amphetamines most commonly. Furthermore, more gym users

reported experimenting with both legal and illegal PEDs than competitive and elite athletes. One study noted that doping was more common in sports categorised as CGS (sports measured by the centimetres – gram – second system of unit) than games-based sports (Pitsch & Emrich, 2011). Another study reported that the majority of AAS users were from individual sports (Posiadala et al., 2009). From a sport-specific perspective, one study found that bodybuilders most often take steroids (77%), while footballers engaged in recreational drug use (52%) and cyclists most commonly consumed glucocortisoids (34%) (Bilard et al., 2011). Yet, the use of stimulants was somewhat similar across the sports (between 10 and 20%).

Doping vulnerability

In a sample of Australian athletes 58% were considered vulnerable or susceptible to doping (based on them not strongly rejecting the use of substances or methods in response to a hypothetical scenario[5] (Gucciardi et al., 2010). In contrast, over 80% of US track and field throwers were unwilling to dope (Judge et al., 2010), while one in five ballet dancers (N=21), synchronised swimmers (N=23) and non-Olympic dancers (N=25) said they would engage in doping behaviours if it would guarantee success with no negative health consequences (Zenic, Zubcevic, et al., 2010). Similarly, one female and seven male (from a sample of 79) table tennis players would dope if it ensured success and had no negative health effects; a further one female and three males would dope regardless of any negative consequences (Kondric et al., 2010). In contrast, 29% of female and only 10% of male recreational dancers might dope if it ensured success and resulted in no negative health effects (Sekulic et al., 2008; Sekulic et al., 2009) and 10% of badminton players, 15% of table tennis players, and 24% of tennis players would dope if it enhanced performance without negative health consequences (Rodek et al., 2013). Stewart and Smith (2010) corroborated the health links as some athletes believed that doping can be justified if there are no risks to

[5] Doping susceptibility determined by presenting athletes with the following scenario: "If you were offered a banned performance-enhancing substance under medical supervision at low or no financial cost and the banned performance-enhancing substance could make a significant difference to your performance and was currently not detectable," and asking: "How much consideration would you give to the offer?" (response categories: 1 = *none at all*, to 7 = *a lot of consideration*) (Gucciardi et al., 2010).

health. Among a sample of 1404 Romanian athletes doping vulnerability was found to be evident amongst 6% of the sample (Vâjială et al., 2010) and in the US over 80% of US track and field throwers self-reported an unwillingness to dope (Judge et al., 2010).

Various psychosocial factors have been found to predict athletes' willingness to dope. Applying the prototype willingness model, Dodge et al. (2013) and Whitaker et al. (2014) demonstrated that willingness to use PEDs was predicted by more favourable doping user prototypes and positive attitudes towards doping. Where athletes self-reported past doping use, this was also found to be a unique predictor of willingness to dope (Whitaker, Long, et al., 2014). Dodge et al. (2013) also reported that greater perceptions of normative approval and agreement with the 'illegal-is-effective' heuristic predicted doping willingness. In contrast, the 'illegal-is-effective' heuristic did not predict doping intentions. In terms of critical incidents that promote doping vulnerability, athletes appeared most willing to dope if they were to suffer an injury, a dip in performance, or think others are doping and getting away with it (Whitaker, Long, et al., 2014). In relation to the competitive level, national-level athletes displayed significantly greater willingness to dope and perceived themselves as significantly more similar to a doper than athletes competing at any other level (Whitaker, Long, et al., 2014).

With a focus on the outcome variable doping susceptibility (Gucciardi et al. 2010), Hodge and colleagues (2013) reinforced a common finding amongst studies examining doping intentions that levels of PED susceptibility were low. Similarly, scores for moral disengagement and positive attitudes toward PEDs were also low. Such floor effects are problematic in the doping field (Ntoumanis, Ng, Barkoukis, & Backhouse, 2014). Having said this, Hodge et al. (2013) corroborated the role of the motivational climate in shaping doping attitudes. Further, moral disengagement was shown to be a strong predictor of positive attitudes toward PEDs. The proposed negative influence of autonomous climate and autonomous motivation on moral disengagement, PED attitudes, and PED susceptibility was not supported. Finally, there was partial support for the final hypothesis of the study with athletes in the "high" positive attitudes toward PEDs group (n = 74) reporting higher levels of controlling

coach climate and moral disengagement and athletes in the "high" PED susceptibility group (n = 45) reporting higher levels of controlled motivation and moral disengagement.

Research supports the assertion that the nature of the sport in which a performer is involved has an influence on vulnerability to doping. For example, the likelihood of doping was increased in sports considered 'highly energetic and demanding' (Rodek et al., 2013). Specifically, this research concluded that the risk of doping was lower in sailing than in racquet sports and weightlifting. Arazi et al. (2014) found that male track and field (76%) and wrestling (82.5%) athletes had used drugs/supplements in their career more than football, basketball, handball and volleyball athletes. In addition to the influence of type of sport, experience can influence vulnerability to doping (Sas-Nowosielski & Świątkowska, 2007); least experienced athletes (<5 years) had the lowest readiness to dope based on behavioural dispositional scores. Another study (Vâjială et al., 2010) - and this was subsequently reiterated (Sekulic et al., 2008) - suggested that individuals become more vulnerable to engaging in doping behaviours as they age, especially males. At the same time, and in stark contrast to this idea, Sekulic et al. (2009) found that the most significant protective factors of doping were sport status and sport achievement, i.e., the more successful the performer, the less likely they were to dope.

Reasons and motives driving doping behaviours differ across sports. For instance, cyclists doped to preserve their health, bodybuilders doped to build strength and footballers doped due to the impact of societal norms (as they engaged primarily in recreational substance use) (Bilard et al., 2011). In Romania, athletes' perceived athlete's doped largely to gain material goods (60.6%) or to be famous (60.5%). To counter these reasons, a number of protective factors have emerged against doping in sport. Emerging from calls to a national anti-doping hotline, were three main protective factors (i) health concerns, (ii) respect for the law and (iii) doping controls from the environment (Bilard et al., 2011; Mohamed et al., 2013). Conversations with university student-athletes led to the emergence of five alternative protective factors. They were: (i) a strong moral stance against cheating; (ii) self-control; (iii) an identity

beyond sport; (iv) resilience to social group pressures and (v) secure attachments throughout the lifespan (Erickson et al., 2015). Rodek et al. (2013) attempted to rank protective factors with the most powerful protective factors being religiousness and paternity (i.e., marital/family status). In another study, religiosity was also found to be the most significant predictor of hesitation against doping behaviour in females (Zenic et al., 2013).

Anti-doping knowledge and education

A number of studies have sought to explore competitive athletes' knowledge and understanding of doping control processes and consequences (i.e., Arazi et al., 2014; Mandic et al., 2013; Sajber et al., 2013; Sas-Nowosielski & Świątkowska, 2007; Seif Barghi et al., 2015). Many athletes surveyed had not received doping-related information or thought they had received insufficient information (Neeraj et al., 2011; Sefa et al., 2010) and access to opportunities to develop their knowledge was found to be an issue (Posiadala et al., 2009). Where studies directly assessed doping knowledge, athletes scored in the poor to moderate range (Halabchi et al., 2011; Sajber et al., 2013; Sas-Nowosielski & Świątkowska, 2007; Seif Barghi et al., 2015). To illustrate, athletes provided correct answers to 45% of items assessing knowledge, with scores highest in relation to athletes' rights and responsibilities (51%) and lowest in relation to anti-doping principles and procedures (42%). Knowledge of doping-related factors (and knowledge of supplements or nutrition) has been shown to be linked to age, education, experience and sport-achievement, as well as previous doping behaviours and the number of doping tests they had undertaken (Sajber et al., 2013). Noteworthy, AAS users often knew about the possibility of addiction and negative health effects, meaning that increased knowledge does not convert to effective prevention (Posiadala et al., 2009).

Studies that explored knowledge also tended to examine sources of doping-related information and the findings were mixed. In two studies the media was a key source of information (>45% agreement) (Posiadala et al., 2009) whereas this source was not as salient amongst Iranian student-athletes (only 5% agreement) (Arazi et al., 2014). Friends/teammates, coaches and the Internet were noted more frequently than

physicians as a source of doping-related information (Arazi et al., 2014; Sas-Nowosielski & Świątkowska, 2007). Furthermore, over 66% of swimming coaches declared self-education as the primary source of doping and sport-nutrition information, with only 21% reporting any form of formal education (Mandic et al., 2013).

Trust in the sources of information was also an important issue. A large proportion of artistic performers, including ballet (88%) and non-Olympic dancers (71%), reported not trusting anyone other than themselves in relation to doping matters (Zenic, Peric, et al., 2010). A lesser proportion of synchronised swimmers (53%) reported not trusting anyone else (Sekulic et al., 2008). In addition to these sports differences, 90% of male athletes were less likely to trust anyone other than themselves on doping-related matters; the figure for females was 72%. Almost five times more female athletes (28%) than males (5%) reported that they would trust their physician. Kondric et al. (2010) provided further evidence of this difference between males and females but noted higher rates of trust in others on doping related matters. Also in contrast to Sekulic's findings, Kondric et al. (2010) showed that similar proportions of males and females would place trust in medics, although values remain modest (20% and 24%, respectively). That said, there were differences in the proportion of individuals who would trust other parties, including coaches (males: 12%, females: 24.2%) and friends (males: 4%, females: 24.1%). The trend for male mistrust remains.

Summary

Across the 56 studies reviewed, researchers have sought to examine athletes' knowledge, attitudes and beliefs regarding PED use, predict their doping attitudes, intention and behaviours and illuminate their perceptions of doping prevalence and the doping control process. At the same time, they have made a notable shift away from the dominant focus on doping attitudes and intentions to a research agenda that seeks to further our understanding of athletes' doping vulnerability and susceptibility. In addition, a greater variety of methods have been used to investigate these doping-related factors including the use of IATs and qualitative interviews. However, the

landscape is still heavily dominated by the use of cross-sectional research using self-report questionnaires and would benefit from the inclusion of longitudinal research in order to identify risk factors for doping.

From the studies reviewed, researchers have identified a number of personal and psychosocial factors that can predict attitudes and beliefs towards doping including task/ego orientation, perfectionism and body image disturbance. The use of NS was also identified as a predictor of PED use while findings involving training status as a predictor were inconclusive. Self-reported PED use was lower than perceptions of the prevalence of PED use, although several studies reported doping use greater than the 2% average number of positive tests uncovered by the WADA each year.

Overall, few studies examined competitive athletes doping-related knowledge and exposure to anti-doping education. However, those that did pointed to a partial knowledge base and limited engagement with formal anti-doping interventions. Instead, a major source of doping related information for this target group was the media. Taken together, these findings suggest that athletes at this level are at risk of inadvertent doping. At the same time, studies highlight a prevailing belief that the success of current detection-deterrence approaches is questionable. Although athletes at this level do not generally favour a permissive approach to PED use in sport, they recognise a need to act to address the shortcomings of the system.

Elite Athletes

In the previous report, fourteen peer-reviewed papers were identified that examined elite and/or competitive athletes doping knowledge and attitudes (Alaranta et al., 2006; Ama, Betnga, Ama Moor, & Kamga, 2003; Anshel, 1991; Anshel & Russell, 1997; Chester, Reilly, & Mottram, 2003; Laure & Reinsberger, 1995; McCardle, 1999; Ohaeri, Ikpeme, Ikwuagwu, Zamani, & Odejide, 1993; Ozdemir et al., 2005; Peretti-Watel et al., 2004; Scarpino et al., 1990; Somerville & Lewis, 2005; Striegel, Vollkommer, & Dickhuth, 2002; Waddington, Malcolm, Roderick & Naik, 2005). Sample size varied from 12 (McCardle, 1999) to 1231 (Scarpino et al., 1990) (*M*sample = 428) and multi-sport papers were commonplace (Alaranta et al., 2006; Anshel, 1991; McCardle, 1999; Ohaeri et al., 1993; Ozdemir et al., 2005; Peretti-Watel et al., 2004; Scarpino et al., 1990; Somerville & Lewis, 2005; Striegel et al., 2002). The majority of respondents were aged 18 – 30 years (Alaranta et al., 2006; Ama et al., 2003; Anshel, 1991; Anshel & Russell, 1997; Chester et al., 2003; Ohaeri et al., 1993; Peretti-Watel et al., 2004; Scarpino et al., 1990; Somerville & Lewis, 2005; Striegel et al., 2002; Waddington et al., 2005) and males dominated (> 60%) (Ama et al., 2003; Anshel, 1991; Anshel & Russell, 1997; Laure & Reinsberger, 1995; McCardle, 1999; Ohaeri, 1993; Peretti-Watel et al., 2004; Scarpino et al., 1990; Striegel et al., 2002). Articles were retrieved from a range of countries; four from the UK (Chester et al., 2003; McCardle, 1999; Somerville & Lewis, 2005; Waddington et al., 2005), two from France (Laure & Reinsberger, 1995; Peretti-Watel et al., 2004) and Australia (Anshel, 1991; Anshel & Russell, 1997) and one each from Cameroon (Ama et al., 2003), Finland (Alaranta et al., 2006), Germany (Striegel et al., 2002), Italy (Scarpino et al., 1990), Nigeria (Ohaeri et al., 1993) and Turkey (Ozdemir et al., 2005).

The majority of studies examined attitudes towards all classes of doping and/or recreational drugs, with two focusing specifically upon AAS (Anshel & Russell, 1997; Ohaeri et al., 1993). Cross-sectional survey designs were used in all studies and self-

report questionnaires were deployed in all but two studies, where semi-structured interviews were used (McArdle, 1999; Scarpino et al., 1990).

The proportion of respondents admitting to personal use of banned substances ranged from 1.2% (Ohaeri et al., 1993) to 8% (Ama et al., 2003); reports of "others'" use of banned substances were consistently higher than self-reported use. The percentage of respondents indicating that they knew of another athlete using banned substances ranged from 6% (Waddington et al., 2005) to 72% (Anshel, 1991) elite athletes' reasons and motives for doping were primarily concerned with maintaining or improving physical functioning, coping with social or psychological pressures or striving for social or psychological goals. Deficits in knowledge were identified across the studies that assessed this issue (Laure & Reinsberger, 1995; Ohaeri et al., 1993; Ozdemir et al., 2005; Somerville & Lewis, 2005). Most athletes acknowledged the need for work to be undertaken in doping prevention and, in principal, supported the use of drug testing (McCardle, 1999; Scarpino et al., 1990; Striegel et al., 2002). Despite the generally positive attitude towards doping prevention, athletes harbour deep concerns over the integrity and effectiveness of current drug testing methods (Laure & Reinsberger, 1995; McCardle, 1999; Scarpino et al., 1990; Striegel et al., 2002; Waddington et al., 2005)

This updated search identified 61 published studies investigating the social psychology of doping amongst elite level athletes[6]. The studies were categorised into descriptive studies (examining doping knowledge, attitudes and beliefs, N=48) (Table 7) and predictive studies of PED use/intentions (N=13) (Table 8).

Geographical spread

Elite athletes from Australia were the most sampled (Chan, Hardcastle, Dimmock, et al., 2014; Dunn et al., 2010; Dunn, Thomas, Swift, & Burns, 2011; Dunn, Thomas, Swift, & Burns, 2012; Dunn & Thomas, 2012; Engelberg, Moston, & Skinner, 2014; Gucciardi,

[6] It is important to note that other studies may have also sampled elite level athletes but aggregated the findings from this population within a larger sample of competitive athletes. In such instances, studies are reviewed in the competitive athlete section (e.g., Hodge et al., 2013; Pedersen, 2010)

Jalleh, & Donovan, 2011; Jalleh, Donovan, & Jobling, 2013; Huybers & Mazanov, 2012; Mazanov & Huybers, 2010; Mazanov, Huybers, & Connor, 2011; Moston, Engelberg & Skinner, 2014a; 2014b; Outram & Stewart, 2015; Thomas, Dunn, Swift, & Burns, 2010; Thomas et al., 2011). Multiple papers also originated from Greece (Barkoukis, Lazarus, & Harris, 2015; Barkoukis, Lazuras, Tsorbatzoudis, & Rodafinos, 2011, 2013; Georgiadis & Papazoglou, 2014; Lazuras, Barkoukis, Rodafinos, & Tsorbatzoudis, 2010), Denmark (Elbe & Overbye, 2013; Overbye, Elbe, Knudsen, & Pfister, 2015; Overbye, Knudsen, & Pfister, 2013; Overbye & Wagner, 2013a, 2013b), Croatia (Rodek et al., 2012; Sekulic, Bjelanovic, Pehar, Pelivan, & Zenic, 2014; Sekulic et al., 2010), Switzerland (Lentillon-Kaestner, 2013; Lentillon-Kaestner & Carstairs, 2010; Lentillon-Kaestner, Hagger, & Hardcastle, 2012; Stamm, Lamprecht, Kamber, Marti, & Mahler, 2008; Stamm, Lamprecht & Kamber, 2014), France (Hauw & Bilard, 2012; Hauw & Mohamed, 2013), Norway (Breivik, Hanstad, & Loland, 2009; Hanstad, Skille, & Thurston, 2009), and the UK (Allen, Taylor, Dimeo, Dixon, & Robinson, 2015; Kirby, Moran, & Guerin, 2011; Pappa & Kennedy, 2012).

Studies drawing respondents from across countries and continents are now emerging (Aubel & Ohl, 2014; Bhambhani et al., 2010; Filiault & Drummond, 2010; Johnson, Butryn, & Masucci, 2013; Kondric, Sekulic, Uljevic, Gabrilo, & Zvan, 2013; Mottram, Chester, Atkinson, et al., 2008; Ohl et al., 2013; Pappa & Kennedy, 2012). For example, 65 elite tennis players were recruited from 13 European Countries, US, Thailand and Brazil (Kondric et al., 2013), 99 Paralympic athletes with spinal cord-injury were surveyed via the International Paralympic Committee network (Bhambhani et al., 2010) and the operation and views of riders from 10 professional cycling teams in the first (Pro teams) and second (Continental pro) world divisions were analysed (Aubel & Ohl, 2014). The same data set was examined in five Australian papers (Dunn et al., 2011, 2012; Dunn et al., 2010; Thomas et al., 2010, 2011), four Danish papers (Overbye et al., 2015; Overbye et al., 2013; Overbye & Wagner, 2013a, 2013b), three papers from Greece (Barkoukis et al., 2011; Barkoukis, Lazuras, Tsorbatzoudis, et al., 2013; Lazuras et al., 2010) and two papers from Switzerland (Stamm et al., 2008; Stamm et al., 2014).

Sample

Across the reviewed papers, sample size varied from five (Georgiadis & Papazoglou, 2014; Kirby et al., 2011) to 1664 (Dunn & Thomas, 2012), with a mean of 366 participants per study. Studies also sampled additional populations, such as ASP (Aubel & Ohl, 2014; Mazanov et al., 2011; Ohl et al., 2013) and the general public (Breivik et al., 2009; Stamm et al., 2008; Stamm et al., 2014), alongside elite athletes. There was a fairly even split of studies comprising samples evenly distributed by gender (40 – 60% male) (Allen et al., 2015; Barkoukis et al., 2011; Barkoukis, Lazuras, Tsorbatzoudis, et al., 2013; Connor, Woolf, & Mazanov, 2013; Georgiadis & Papazoglou, 2014; Gucciardi et al., 2011; Jalleh et al., 2013) and comprising male-only (Ćorluka, Gabrilo, & Blažević, 2011; Filiault & Drummond, 2010; Lentillon-Kaestner, 2013; Lentillon-Kaestner & Carstairs, 2010; Lentillon-Kaestner et al., 2012; Loraschi, Galli, & Cosentino, 2014; Sekulic et al., 2014). One study explored doping in sport with female triathletes (Johnson et al., 2013).

The majority of elite athletes were aged 18 – 30 years; with an estimated mean age of 22 years. Multiple studies sampled cyclists only [7](Aubel & Ohl, 2014; Lentillon-Kaestner, 2013; Lentillon-Kaestner & Carstairs, 2010; Lentillon-Kaestner et al., 2012; Morente-Sánchez et al., 2013; Ohl et al., 2013; Outram & Stewart, 2015) and single studies targeted elite athletes from tennis (Kondric et al., 2013), table-tennis (Kondric et al., 2010), track and field (Pappa & Kennedy, 2012), triathlon (Johnson et al., 2013), football (Ćorluka et al., 2011), rugby union (Sekulic et al., 2014), martial arts (Manouchehri & Tojari, 2013), and professional ballet (Sekulic et al., 2010). The remaining studies drew participants from a range of sports, including track and field, cycling, swimming, baseball, rowing, cricket, and rugby.

Within the last four years, seven published studies have explored the lived experience of current or former PED users (Engelberg et al., 2014; Georgiadis & Papazoglou, 2014; Hauw & Bilard, 2012; Hauw & Mohamed, 2013; Hoff, 2012; Kirby et al., 2011;

[7] Note: The three studies published by Lentillon-Kaestner and colleagues (Lentillon-Kaestner, 2013; Lentillon-Kaestner & Carstairs, 2010; Lentillon-Kaestner et al., 2012b) present data from the same sample of elite cyclists (N=16).

Pappa & Kennedy, 2012). The majority of studies were based on samples of <10 (range 5 – 18 participants), reflecting the inherent challenge of recruiting participants willing to personally disclose doping behaviour.

Methods

Similar to findings in 2007, cross-sectional research designs prevailed and 70% of studies gathered data through questionnaires. However, in a significant shift from the last review, these studies were complemented by 17 studies utilising a qualitative methodology (typically semi-structured interviews and focus groups) (Chan, Hardcastle, Lentillon-Kaestner, et al., 2014; Engelberg et al., 2014; Filiault & Drummond, 2010; Georgiadis & Papazoglou, 2014; Hauw & Bilard, 2012; Hauw & Mohamed, 2013; Hoff, 2012; Johnson et al., 2013; Kirby et al., 2011; Lentillon-Kaestner, 2013; Lentillon-Kaestner & Carstairs, 2010; Lentillon-Kaestner et al., 2012; Mazanov & Huybers, 2010; Ohl et al., 2013; Outram & Stewart, 2015; Pappa & Kennedy, 2012; Sefiha, 2012). Only one study (Barkoukis et al., 2015) deployed an experimental design; this examined the effects of a self-affirmation manipulation on doping use decision-making.

The inherent differences in the sample characteristics and methods of assessment across the studies weaken our ability to draw meaningful conclusions from the current data. Indeed, it has already been suggested that methodological variation could explain inconsistencies in findings across elite populations (Backhouse, McKenna, Robinson, & Atkin, 2007; Gucciardi et al., 2011). For example, in assessing attitudes towards doping some studies have used the PEAS (Petróczi, 2002) (e.g., Allen et al., 2015; Morente-Sánchez et al., 2013) whereas other studies employ stem propositions that are scored on a Likert scale. For example, athletes might respond to the proposition "the use of prohibited substances to enhance my performance this season is…" via four semantic differential evaluative adjectives such as good/bad; useful/useless; harmful/beneficial; unethical/ethical (Lazuras et al., 2010). As with the PEAS, the higher scores reflect more positive attitudes toward doping. Similarly, quantitative studies have focused on different independent variables with some studies focusing on doping intention, whereas others examine doping attitudes,

doping use and/or doping susceptibility.

Studies sought to understand athletes' attitudes towards drug use (Allen et al., 2015; Bhambhani et al., 2010; Chan, Hardcastle, Lentillon-Kaestner, et al., 2014; Huybers & Mazanov, 2012; Johnson et al., 2013; Lentillon-Kaestner, 2013; Morente-Sánchez et al., 2013; Outram & Stewart, 2015; Soltanabadi, Tojari, & Esmaeili, 2015; Stamm et al., 2008; Stamm et al., 2014) and/or doping control (Breivik et al., 2009; Ćorluka et al., 2011; Dunn et al., 2010; Elbe & Overbye, 2013). Doping control was also explored by focusing on knowledge, experience and perceived legitimacy of procedures (Amatya, 2009; Ćorluka et al., 2011; Johnson et al., 2013; Lentillon-Kaestner, 2013; Loraschi et al., 2014; Moston et al., 2014a; Mottram, Chester, Atkinson, et al., 2008; Overbye & Wagner, 2013a, 2013b; Rodek et al., 2012; Valkenburg, de Hon, & van Hilvoorde, 2013), as well as deterrent effects (Moston et al., 2014a; Overbye et al., 2015; Overbye et al., 2013). Knowledge and perceptions of the side effects of PEDs were examined (Amatya, 2009; Bhambhani et al., 2010; Chan, Hardcastle, Lentillon-Kaestner, et al., 2014; Filiault & Drummond, 2010; Hoff, 2012; Loraschi et al., 2014; Thomas et al., 2010, 2011) along with the lived experience of doping bans via interviews with sanctioned athletes (Engelberg et al., 2014; Georgiadis & Papazoglou, 2014; Hauw & Bilard, 2012; Hauw & Mohamed, 2013; Hoff, 2012; Kirby et al., 2011).

Researchers examined personal, team-mates or competitors use of performance enhancing or recreational drugs (Amatya, 2009; Bhambhani et al., 2010; Ćorluka et al., 2011; Kondric et al., 2011; Kondric et al., 2013; Lentillon-Kaestner & Carstairs, 2010; Loraschi et al., 2014; Moston et al., 2014b; Outram & Stewart, 2015; Pappa & Kennedy, 2012; Rodek et al., 2012; Sefiha, 2012; Sekulic et al., 2010). A number of studies examined social agents and their influence on doping behaviour (Chan, Hardcastle, Lentillon-Kaestner, et al., 2014; Lentillon-Kaestner & Carstairs, 2010; Pappa & Kennedy, 2012), sources of doping information (Kim et al., 2011; Kondric et al., 2011; Kondric et al., 2013; Loraschi et al., 2014; Sekulic et al., 2014; Sekulic et al., 2008; Sekulic et al., 2010; Zenic, Peric, et al., 2010), and socialisation of young cyclists (Ohl et al., 2013).

Researchers also sought to descriptively illuminate the motivations and reasons for doping, with a focus on critical periods of instability (e.g., injury, career transitions) (Aubel & Ohl, 2014; Ćorluka et al., 2011; Engelberg et al., 2014; Georgiadis & Papazoglou, 2014; Hauw & Bilard, 2012; Hauw & Mohamed, 2013; Hoff, 2012; Kirby et al., 2011; Lentillon-Kaestner & Carstairs, 2010; Mazanov et al., 2011). Surprisingly, only a handful of studies explored elite athletes' exposure and experiences of anti-doping education (Amatya, 2009; Johnson et al., 2013; Kim et al., 2011).

Across the studies that employed inferential statistics to predict doping attitudes/intentions/susceptibility and use, a number of theoretical 'lenses' were employed. They include the theory of reasoned action and planned behaviour (Barkoukis et al., 2015; Chan, Hardcastle, Dimmock, et al., 2014; Dodge & Jaccard, 2008; Goulet et al., 2010; Lazuras et al., 2015), achievement goal theory (Allen et al., 2015; Barkoukis et al., 2011; Barkoukis, Lazuras, Tsorbatzoudis, et al., 2013; Manouchehri & Tojari, 2013), social cognitive theory (Lucidi et al., 2008; Zelli, Lucidi, et al., 2010; Zelli, Mallia, et al., 2010), self-determination theory (Chan, Donovan, et al., 2014), theory of triadic influence (Lazuras et al., 2015), and the trans-contextual model (Chan, Dimmock, et al., 2014). Finally, the Sport Drug Control Model framed multiple studies (Gucciardi et al., 2011; Jalleh et al., 2013; Sekulic et al., 2014).

In the only experimental design with elite athletes, Barkoukis et al. (2015) delivered a self-affirmation intervention to examine and manipulate the doping decision-making process.

Table 7. Overview of descriptive studies examining the doping knowledge, attitudes and beliefs of elite athletes.

Authors (year)	Country	Sample	Methods	Summary
Amatya (2009)	**Nepal**	**121 Elite Multisport Athletes** Boxing; karate; weightlifting; gymnastics; bodybuilding No demographics	**Cross-sectional** (Questionnaire & Interview) [Key themes: Knowledge of side effects; food habits; doping education; doping control]	• Educational attainment low in the sample of Nepalese athletes. • 65% of athletes did not know they could be tested for doping. • 61% confirmed their ignorance of doping sanctions from over the counter substances. Only 41% of athletes asked if their prescribed medicines are banned. • 26% of athletes admitted use of diuretics for the reduction of body weight prior to competition. • 93% of respondents believe they need doping education from their sports governing body.
Aubel & Ohl (2014)	**Multinational**	**Professional cyclists** (N not disclosed) (also team manager, sport directors, trainer or head of performance, physician or head of medicine, and the sponsor)	**Cross-sectional** (Semi-structured interviews; secondary analysis of UCI data) 72 interviews conducted across 10 professional teams	• Risk of doping varies according to three main dimensions: (1) structural factors, mainly a "political economy" dimension, that influence the precariousness of cyclists; (2) the consequences for working conditions offered to professional cyclists: and (3) the specific team culture of training that is at the core of riders" everyday experiences. • Accounts and career transition statistics point to the structural precariousness of employment in the professional sport, together with the vulnerability of the business model of the teams, increases the pressure on riders and their employers
Bhambhani, Mactavish, Warren, Thompson, Webborn, Bressan et al. (2010)	**Multi-national**	**99 Paralympic Athletes with Spinal Cord Injuries** 88% male 31.3% aged between 34-39 years 44% of sample had been injured for 16 years or more	**Cross-sectional** (Questionnaire) [Key themes: Knowledge, incidence and attitudes towards prohibited method]	• 54.5% had previously heard of autonomic dysreflexia (AD; a banned method) while 39.4% were unaware. • 16.7% (all males) had used AD to enhance performance. Nine indicated they had used AD during competition and/or training. Males were more likely to use boosting than females (p=0.000). • Use of boosting highest in wheelchair rugby players (55.5%). • 27.1% of respondents reported that boosting was commonly used in their sport (34.5% unsure). • Participants reported that AD was somewhat dangerous (48.9%), dangerous (21.3%) or very dangerous (25.5%) to health. • Results were not influenced by age, injury level or injury duration.
Breivik, Hanstad & Loland (2009)	**Norway**	**234 Elite athletes** Within registered testing pool; 65% males; 16-51 years of age; >90% between 18-35, 45% Olympic or World Champions Response rate = 80.8% [428 General public]	**Telephone Survey** (Questionnaire, athlete survey delivered by mail and email) [Key Themes: Attitudes towards existing legal and illegal means of performance enhancement in sport].	• The public were significantly more eager (59.2%) to increase anti-doping efforts than the athletes (31.6%) (p=0.026). • Notably, men believed more strongly that anti-doping work should be increased (52.9%) compared to women (42.9%) (p=0.026). • General public more accepting than athletes with regard to the use of ways of enhancing performance or appearance in other domains of life outside sport. • Males were more positive about the use of performance enhancement means in general, whereas females were more positive about body modification techniques.

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Chan, Hardcastle, Lentillon-Kaestner, Donovan, Dimmock & Hagger (2014)	**Australia**	57 Elite Athletes from 7 different sports 16-25 years Athletics – track & field, 10; Basketball, 6; Hockey, 9; Netball 8; Swimming, 9; Water polo, 15	**Cross-sectional** (8 focus groups) [Key themes: Personal attitudes, control beliefs and social influence in relation to doping in sport] *Social cognitive theory*	• Thematic content analysis of interview transcripts revealed 9 lower-order themes emerging under the 3 global social cognitive themes: personal attitudes (reputation and getting caught, health effects, and financial incentives and rewards), social influences (coaches, parents, and medical staff and sport scientists), and control beliefs (i.e., insufficiency of doping testing, resource availability, and sport level and type). • The main concern of athletes when asked about the disadvantages of taking banned performance enhancing substances was the potential harm to their reputation. Some participants also mentioned moral reasons for the opposition of doping, although they were in the minority. • Few cited or even made reference to negative health effects; majority held beliefs that using banned performance-enhancing substances may enhance their own physical and psychological qualities that would, in turn, lead to better performance in sport. • For some, financial rewards in sport may supersede any beliefs regarding morality or health concerns using banned performance-enhancing substances. • Three significant social agents, namely, coaches, parents and team doctors were frequently viewed as the significant others who could exert social pressure that influenced athletes' motivation and intentions to use banned performance-enhancing substances.
Ćorluka. Gabrilo & Blažević (2011)	**Bosnia and Herzegovina**	**181 Professional Footballers** Roughly equal split of ethnic Croats, ethnic Serbs & ethnic Bosniaks RR was 97% Mean age = 23 years	**Cross-sectional** (Questionnaire) [Key themes: Ethnicity; knowledge; source of information; demographics; doping scenarios]	• Almost half of the Croats and Serbs do not rely on their physician's and/or coach's opinion and expertise about doping. The Bosniaks achieved the best results for doping knowledge. • 19% of Croats, 46% of Serbs and 29% of Bosniaks had NO knowledge about doping. • There are no significant ethnic differences regarding opinions on doping habits in football, the likelihood of personal doping and anti-doping penalties. • More than half of players believe that doping occurs in football (no ethnic differences). • Among the Serbs, more experienced players are more prone to potential doping behaviour. • Those Croats and Bosniaks who are more convinced about doping practices in their sport are more likely to use doping in the future. • Approximately 20% to 30% of the players will engage in doping if assured that such behaviour will not bring potential negative health consequences, 3% to 12% will engage in it without regard to the health risks. • None of the players declared that doping in football should be allowed.
Dunn, Thomas, Swift, Burns & Mattick (2010)	**Australia**	**974 Elite athletes** (& 24 Key experts) 75.6% Males	**Cross-sectional** (Questionnaire and semi-structured telephone survey) [Key themes: Perceived legitimacy of drug testing; testing as a deterrent].	• The athletes endorsed testing for banned substances as an effective way of deterring drug use (76% agreed/strongly agreed) & believed that the current punishments for being caught using a banned substance was of the appropriate severity (63% agreed/strongly agreed; 10% strongly disagreed) • Majority believed there should be separate policies regarding illicit drug and performance enhancing drug use. • In past 2 years, 66% of sample reported that they had been tested during competition and 41% reported they had been tested out of competition. Only 29% believed they certainly would be tested in the forthcoming year.

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Elbe & Overbye (2013)	**Denmark**	**400 Elite Multi-Sport Athletes** Mean age = 24.3 years (SD = 5.67) 61% male 39.8% participated in team sports (e.g. football, handball), 26.8% in power and speed sports (e.g. powerlifting, sprint), 22.5% in endurance sports (e.g. cycling, triathlon) and 13% in motor skill sports (e.g. shooting, golf).	**Cross-sectional** (Questionnaire) [Key themes: Perceptions of urine doping controls]	• 30.5% (122) of the participants had not been tested in the past 12 months. The majority, 222 athletes (55.5%), were tested between one and three times in the last year, whereas 56 (14.0%) were tested more times in the past year • The results showed that athletes approve of doping testing and that the majority of them are careful to report all substances they have consumed. • Fear of a false positive test result despite not having taken forbidden substances is of concern for about half of the athletes, and significantly more for female and younger athletes. • A third of the athletes report about experiencing stress caused by urination difficulty during the control, and approximately one out of seven feel their personal integrity is violated because someone is watching them urinate. • A quarter of the athletes feel that urine-doping controls performed at their home are an invasion of privacy.
Engelberg, Moston & Skinner (2014)	**Australia**	**18 Sanctioned athletes** Bodybuilding (n=8); Powerlifting (n=3); Cricket (n=3); Basketball (n=1); Rugby League (n=1); Sprint Kayak (n=1); Swimming (n=1) 15 Males. Mean age 26.6; range 19-50 yrs.	**Cross-sectional** (Semi-structured Interviews) [Key themes: Type of violation, factors influencing decisions to dope including motivation, initiation & maintenance of doping, detection and consequences; sanctions]	• For most athletes doping has started early in their career, with no clear single event or critical incident as a starting point. • Many athletes, particularly bodybuilders, had normalised the use of banned substances within the sport. • Several moral disengagement techniques were identified in the decision to dope, including advantageous comparison, minimising or ignoring the consequences and displaced responsibility. • Athletes acknowledged that their motivations changed with time, and that they were often guided by pragmatic concerns e.g. injury return. • Negative side effects were not addressed by any of the athletes • Athletes estimated that the incidence of drug use in their sport was higher than all other sports combined, supporting 'false consensus effect'.
Filiault & Drummond (2010)	**USA, Canada and Australia**	**16 Elite Gay Male Athletes** Age range 18-52 years Caucasian *Hegemonic aesthetic theory (Filiault & Drummond, 2007)*	**Cross-sectional** (Qualitative semi-structured interviews & online follow-up questionnaires) [Key themes: Substances and cheating the body; muscles and masculinity; steroids, cheating and individual freedom; supplementation]	• Research informed by queer phenomenology • None of the sample reported using AAS • AAS is viewed as un-masculine, unhealthy, and as a form of cheating in the sample. • AAS users are branded as cheaters and vein • Muscularity is central to realising the ideal body form. Frequent association between muscularity, physical size, and masculinity. • Overwhelming reason why athletes chose not to use AAS was the health risks related to use of AAS. • All athletes used ergogenic aids (e.g. creatine) and viewed this as a natural way to gain the ideal body type/hegemonic aesthetic.

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Georgiadis & Papazoglou (2014)	**Greece**	**5 Elite Sanctioned Athletes** Male, n=3 Participants had won Olympic and European titles Age range 22-29	**Cross-sectional** (Qualitative semi-structured interviews) [Key themes: shock; victimisation, social impact; emotional disturbance; financial problems; identity crisis; clinical psychological symptoms] *Social projection theory (Krueger, 2012)*	• Athletes were interviewed 8-10 months after the competition ban. • None of the athletes admitted they were taking illegal substance during the period of testing • Narratives included the following themes: a) initial shock, b) striving for an explanation, c) social impact of the experience, d) financial impact and e) psychological impact of the experience. • Athletes believed they were victims of a situation that was out of their control; felt confused and helpless. Some blamed coaches, others the content of their vitamin formula. Feelings of injustice. • Athletes were unable to estimate the social impact of their actions; particularly regarding the reaction of family members. • Social identity and public image were associated with feelings of disappointment, betrayal and distrust over their own countries treatment of the athletes. • Athletic identity was affected with most feeling empty and lost leading to significant stress and depressive symptoms. Social isolation and withdrawal was identified as a normal reaction.
Hanstad, Skille & Thurston (2009)	**Norway**	**223 Elite Athletes in Norway's Registered Testing Pool** RR = 81% Male, 64% 79% competed in Olympic Sports	**Cross-sectional** **(**Questionnaire) [Key themes: Registered Testing Pool; Opinions about anti-doping generally and whereabouts specifically]	• 70.6% agreed that doping was a problem in elite sport in general, but only 17.5% agreed that doping was a problem in their own sport. Males most likely to agree. • Four in ten (43%) of the athletes agreed that the whereabouts information system made a contribution to a "cleaner" sport. • 68.5% stated they had confidence in the system, whereas 34.7% stated they were not able to update their whereabouts information due to technical problems. • One third of athletes were unsure as to whether there were international variations in the implementation of the WADA code (unfamiliarity with policies and procedures across countries).
Hauw & Bilard, (2012)	**France**	**10 Elite track and field athletes** (5 Dopers & 5 non-dopers) > 20 years sport practice Male 24-34 years	**Cross-sectional** Semi-structured interviews [Key themes: Critical moments in athletes' careers; Life disturbance; legal supplement use]	• Results showed that during the use of prohibited substances, doping athletes appeared (1) to be closed to all external environmental offers except training and performance, (2) to experience changes in their sporting results and (3) to be experiencing disturbances in their lives. • Suggests doping athletes are suffering athletes • Doping appeared after (4) a specific number of years of sporting activity (i.e. 17 years), (5) a specific path had been followed (i.e. a shorter time spent in "open focus" during the development of activity), (6) 2 years of regular legal substance use, (7) a change in training and (8) a period of personal distress.

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Hauw & Mohamed (2013)	**France**	**12 Doping Athletes** (5 sanctioned; 7 had used banned substances) Tennis (n=2); track and field (n=2); cycling (n=2); volleyball (n=2); football (n=2); rugby (n=2)	**Cross-sectional** Secondary sources e.g. website, newspapers; Biographical Interviews; Self-confrontation interviews. [Key themes: Life-course; experiences of doping; sporting context] *Activity theory*	• Six key activities were identified; agree to use, drop out of a non-viable state, return to former state, prevent deficiency, maintain acquired state and balance sporting life with substance use. • Each of these types of activities was associated with various phases of the athletes' careers. • Agree to use consisted of taking a substance without being actively involved in the decision (e.g., use of nutritional supplements provided by medical team at a football club). • Dropout of non-viable state was often related to a problem such as resolve a health problem, constraints of training programme (e.g., injury). • Return to a former state was about using substances to make up for lost time (e.g., following injury). • Choices were often dictated by the situation dynamics and key themes surrounded substance consumption as a consequence of sporting constraints across a career.
Hoff (2012)	**Sweden**	**11 Male Elite Athletes Sanctioned for Doping** Ten respondents were powerlifters and one was a weightlifter	**Cross-sectional** Semi-structured interview [Key themes: AAS use; health risks; risks of being caught in a doping control and other risk behaviours]	• Most have not experienced any serious negative side effects due to AAS use, and report several positive effects. They were using moderate doses to avoid health risks, and their use was characterised by conscious risk management to avoid being caught in doping control. The only respondent to report serious side effects in the interviews (cardiac arrest, liver problems, aggression, violence, depression and suicidal tendencies) also used high doses for a long time. • Most experienced distinct positive effects; they became stronger, were able to exercise more, influenced condition, improved endurance, and diminished pain • Most were not abusing substances other than AAS, and did not perceive themselves as risk-takers.
Huybers & Mazanov (2012) (See theoretical framework section for a more detailed overview of this paper)	**Australia**	**259 Elite Multi-Sport Athletes** 40% males 76% competed Australian, Worlds or Olympic level 15.9% response rate	**Cross-sectional** (Questionnaire: Discrete Choice Modelling experiment) Key themes: Attitudes towards doping; rational decision-making; choice]	• Estimated model predicts the correct choice in around 62% of all cases • Athletes are more willing to dope when urged to do so by a coach or more senior athlete or feel that there is little chance of being caught. They are less willing when they feel that doping may be fatal, will not result in financial gain, and may lead to large fines. • The overall pattern of results suggests that athletes see others as more likely to consider the use of banned performance enhancing drugs when there is a perceived low cost and high benefit trade. If an elite athlete can be convinced by their coach or a senior athlete that the use of a banned drug will be consequence-free and lead to a disproportionate gain, they are more likely to consider using that banned drug.
Johnson, Butryn & Masucci (2013)	**Canada & U.S.A.**	**12 Elite Female Triathletes** **(**6 Canadian; 6 American) 18-28 years	**Cross-sectional** 2 focus-group interviews [Key themes: doping knowledge, practices and sources of information on doping; knowledge and feelings about doping control; education]	• Doping was viewed as a serious transgression and giving an unfair advantage over those not doping, and ultimate corruption of the sport itself. • Overall knowledge of doping and anti-doping efforts was fragmented and incomplete. • Message received by athletes from education was avoiding the substances on the banned list and this was typically via workshops or online tutorials. Limited education from coaches on doping. • There was a lack of understanding as to why some substances or procedures were considered doping whilst others did not. • Education experiences contributed minimally to deterrence.

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Kim, Lee, Kim, Ki, Yoon & Lee (2011)	**Korea**	**479 Elite Multisport Student-Athletes** Male, 72%	**Cross-sectional** (Questionnaire) [Key themes: Anti-doping education exposure]	• The rate of doping education in all participants was 76%; typically one time per year (66%). Periodical AD education provided by anti-doping agency (KADA) was deemed the most effective anti-doping education method (71%). • Coach AD delivery was also deemed effective before a game (40%) and periodically (33%) • Top ranked anti-doping informants were NADO (43%) and coaches (41%).
Kirby, Moran, & Guerin (2011)	**Ireland**	**5 Elite Admitted Dopers** All male 29-46 years From Ireland, Scandinavia, USA Road Cycling (N=3) MTB (N=1) Weightlifting (N=1)	**Cross-sectional** (Semi-structured interviews) [Key themes: attitudes; personal ambitions; morality; mental toughness; social/contextual factors of influence, deterrent factors; doping control]	Doping Deterrents: • Morality was consistently cited as an important consideration despite athletes not considering their use to be cheating due to its pervasiveness in sport • Lack of consideration for health side effects • Most doped simply to stay in sport longer • Athletes spoke more of internal than external factors as contributing to decision to dope • Culture of the athlete's team or training group and 'critical incidents' during the athletes' careers were often influential in precipitating drug use. • Guilt and shame were predominant.
Kondric, Sekulic, Petróczi, Ostojic , Rodek & Ostojic (2011)	**Slovenia**	**187 Elite Racket Sport Athletes** Mean age = 22 ± 2.3; 64% Male Table tennis (N=78) Badminton (N=83) Tennis (N=27)	**Cross-sectional** (Questionnaire) [Key themes: Substance use misuse in the context of educational, socio-demographic and sport-specific factors]	• A significant proportion of athletes (46% for both sexes) reported using nutritional supplements. • Between 10% and 24% of the studied males would use doping if the practice would help them achieve better results in competition and if it had no negative health consequences; a further 5% to 10% indicated potential doping behaviour regardless of potential health hazards. • Females were generally less oriented toward SUM than their male counterparts with no significant differences between sports, except for badminton players. • Athletes' trust in their coaches and physicians is low.
Kondric, Sekulic, Uljevic, Gabrilo & Zvan (2013)	**13 European Countries, USA,Thailand and Brazil**	**65 Elite Tennis Players** 66% females Mean age 22 years	**Cross-sectional** (Questionnaire) [Key themes: Knowledge and attitudes; nutritional supplements]	• Almost all the females and 80% of the males using NS at least occasionally. • The athletes showed a low tendency regarding future doping usage, although most of them are convinced that doping does exist in tennis. • Athletes declared that their coaches are their main source of information about NS and doping. • Males are found to be more prone to doping than females.

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Lentillon-Kaestner & Carstairs (2010)	**Switzerland**	**8 Elite Adolescent Cyclists** All Male 21-27 years Best cyclists in Switzerland	**Cross-sectional** (Semi-structured interviews) [Key Themes: career, training, competitions, business contacts, family & social life, health, use of legal/illegal PEDs]	• All of the young cyclists interviewed took nutritional supplements and believed that they improved their performance • Cyclists believed that doping at the professional level in cycling was acceptable but did not approve of it at the amateur level. • Cyclists were open to using doping substances themselves if it was the key to continuing their cycling career, but only after they became professional. Team staff, doctors, parents and friends helped to create a ''clean'' environment that prevented the young cyclists from doping before becoming professional. • Temptation to dope was strongest when cyclists felt they couldn't reach their goals without doping. A significant setback also led to temptation. • Strength of temptation to dope was linked to place granted cycling in their life • The more experienced cyclists, who doped or used to dope, transmitted the culture of doping to the young cyclists, teaching them doping methods and which substances to use. Young cyclists viewed doping as part of sport and the wider social environment seems important in use of banned substances
Lentillon-Kaestner, Hagger & Hardcastle (2011)	**Switzerland**	**8 Elite Adolescent Cyclists** **8 Former Elite-level Cyclists** All male From Switzerland	**Cross-sectional** (Semi-structured interviews) [Key Themes: Developmental; training & competitions, family & social life, health, use of legal/illegal PEDs]	• Although an evolution was observed in the organisation of doping and perceptions of doping over the last decade, the perceived health hazards did not influence, most of the time, decisions to use banned substances among the sample of cyclists. • Evolution from organised doping to individualised doping. There was a systematisation of exogenous substance use in the cycling environment and a trivialisation of the side effects of the banned substances. • Younger cyclists were not concerned about the long-term health consequences of banned substances; they were more focused on the short-term performance-enhancing benefits. • Experienced cyclists had a strong influence on current cyclists' doping behaviours • Cyclists were socialised in an environment where they were isolated from info regarding health risks/damaging effects of banned substances • Wider social environment was important factor in use of banned substances. Felt it was more dangerous to cycle without taking banned substance than using them under medical supervision
Lentillon-Kaestner, (2013)	**Switzerland**	**16 Elite cyclists** 8 current 8 former cyclists	**Cross-sectional** (Semi-structured interviews) [Key themes: Psychosocial approach; Organisation of doping; doping attitudes/practices]	• Results show that although the fight against doping in the last decade has reduced doping use in high-level cycling, anti-doping measures have also had unexpected effects. • Former cyclists felt they couldn't win without doping; current cyclists know they can win without doping • Doping practices have become more individualised, resulting in reduced medical supervision and a consequent increase in cyclists' health risks • An underground market by way of the Internet has emerged for PEDs • Current cyclists are curious about doping agents and obtain information easily from former cyclists, the Internet, books, articles and television • Former cyclists were not tested often so they were not afraid of doping control as they thought it was infrequent and inefficient. Current cyclists are a little more afraid of doping control as since the Festina scandal in- and out-of-competition tests are more frequent.

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Loraschi, Galli & Cosentino (2014)	**Italy**	**40 elite under-23 male cyclists** 19 to 23 years Practicing for 14 to 30 h/wk.	**Cross-sectional** (Questionnaire) [Key themes: Use; Knowledge; Attitudes]	• Knowledge about doping agents was very limited. On average, respondents could only name 3 doping agents and on average, only 50% of banned substances on a fixed list were correctly identified. • 95% of respondents believed doping agents were dangerous with potentially serious consequences. Only 5% tried to minimise the risk of doping. • Doping knowledge correlated with prescription medication use (r2 = 0.1614; P = 0.01). • Participants deemed doping prevalence high among cyclists in general but not in their own team (P = 0.0001) [Doping denial]. • The majority reported the main source of information on doping to be the Internet (82.5%), followed by newspapers/radio/television (60%).
Mazanov, Hubyers & Connor (2011)	**Australia**	**12 Elite Athletes** (M=4) 12 Support personnel (M=6)	**Cross-sectional** Re-analysis of qualitative interviews and focus groups [Key Themes: Motivation to dope; performance, penalty, health, social, substance]	• Timing primary prevention around periods of career instability where athlete vulnerability to doping may increase as a function of winning or losing sponsorship may enhance intervention efficacy. • Suggestion: liberalising access to legitimate performance-enhancing technologies (e.g. training techniques or nutritional supplements). • Suggestion: delay access to financial sponsorship (beyond living expenses) until retirement, with monetary gains (e.g. prize money) deposited into an account where penalties are debited if the athlete is caught doping.
Mazanov & Hubyers (2010) (see theoretical framework section for a more detailed overview of this paper)	**Australia**	**8 Elite Athletes** (Olympic, Paralympic, international, professional, national and state) & 4 coaches, 2 dieticians/ sports nutritionists, 1 sports administrator and 1 sports scientist.	**Cross-sectional** Semi-structured interviews and focus groups [Key Themes: Choice modelling; grounded model of doping]	• Ten factors, organised around four themes (objective of PESM use, about the PESM, the deterrence system and consequences if prosecuted) emerged. • Results suggest that anti-doping policy may do well to convey the impression that the chances of getting caught and prosecuted are very high. This may be achieved by changing the incentive structures around detection and prosecution. • Support was offered for the assertion that doping in sport is the result of rational decision-making but further research is necessary to explore the processes underpinning that decision. • The findings of this qualitative study were followed up in Huybers and Mazanov (2012).

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Morente-Sánchez, Mateo-March & Zabala (2013)	**Spain**	**72 Elite Cyclists** M (N=51) F (N=21) Mean age: 19.7 years MTB (n=18); BMX (n=12) TRACK (n=9); ROAD (n=33)	**Cross sectional** (Questionnaire (PEAS): Fixed and open-ended questions) [Key themes: Doping attitudes; Doping contexts]	• BMX and Track athletes were a little more permissive towards use of banned substances than mountain bike and ride cyclists. • For the open-ended qualitative questionnaire, the most mentioned word associated with ''doping'' was ''cheating'' (48.83% of total sample), with ''responsible agents of doping'' the word ''doctor'' (52,77%), and with the ''main reason for the initiation in doping'' the words ''sport achievement'' (45.83%). • The major proposed solution was ''doing more doping controls'' (43.05%). • 48.67% stated that there was ''a different treatment between cycling and other sports''. • The MTB cyclists (youngest group) showed very low scores which could mean the new generations are more aware of doping • 7% have been suggested to dope, largely by other cyclists (6%).
Moston, Engelberg & Skinner (2014a)	**Australia**	**488 Elite Multi-Sport Athletes*** Mean age = 24.2 years 76% male 92 Coaches AFL (15.1%), athletics (2.6%), cycling (3.4%), football (14.9%), rowing (2.8%), rugby league (16.1%), rugby union (9.9%), and surf lifesaving (5.9%).	**Cross-sectional** (Questionnaire [Online and printed]) [Key themes: Perceived incidence of doping]	• Athletes' perceived incidence of performance enhancing drug use (all sports) was 18.34% (SD 19.16). Perceived use in own sport was 9.83% (SD 16.39) • The authors combined athletes' and coaches' responses and found that the sport with the highest self-perceived incidence of performance enhancing drug use was cycling (estimated at 33.3%). In contrast, perceived performance-enhancing drug use in AFL was very low (estimated at only 3.8%). • For recreational drug use the sport with the highest self-perceived incidence was rugby union (estimated at 31.4%), with rowing offering the lowest incidence estimates (11.5%). • Further examination of the data revealed that the majority of athletes and coaches (74.1%) estimated that performance-enhancing drug use was higher in all sports, compared to their own.
Moston, Engelberg & Skinner (2014b)	**Australia**	**488 Elite Multi-Sport Athletes*** Mean age = 24.2 years 76% male 92 Coaches	**Cross-sectional** (Questionnaire [Online and printed]) [Key themes: Doping deterrents anti-doping policy]	• Overall deterrence scores (calculated certainty × severity, with a possible range from 0 to 100) were generally clustered around the mid-point, with coaches expressing particularly sceptical views about the deterrent effect of legal sanctions (M = 38.49). • Highest deterrence rating was the threat of material loss amongst athletes (M = 65.17). • Coaches consistently saw the deterrence value of both forms of sanction as less effective than the athletes ($P<0.05$). • Views on the effectiveness of the current anti-doping regime were also moderately positive: 62.9% of athletes and 47.8% of coaches 'agreed or strongly agreed' • 44% of athletes 'agreed' or 'strongly agreed' with criminalisation of doping. • Athletes and coaches (77%, 73%) 'agreed' or 'strongly agreed' problem of PEDs in sport was serious. • Athletes (97.9%) and coaches (100.0%) shared the view that the athlete was responsible for doping.

* Same sample

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Mottram, Chester, Atkinson & Goode (2008)	**UK Australia Canada USA**	**557 elite athletes representing 10 Olympic sports** Demographics not presented	**Cross-sectional** (Questionnaire) [Key Themes: Knowledge and understanding of over the-counter medication]	• Around half (50.5%) knew the penalty incurred following a doping violation involving a banned OTC stimulant. • 43.3% and 67.5% of respondents understood the terms 'Monitoring Programmes' and 'Specified Substance List', respectively. • The status of substances in relation to the Prohibited List was correctly identified in just 35.1% cases. • As a whole, athletes were of the opinion that OTC stimulants posed a risk to health, were performance enhancing and that their use was against the spirit of sport.
Ohl, Fincoeur, Lentillon-Kaestner, Defrance & Brissonneau (2013)	**France, Belgium, Switzerland**	**22 recently professional cyclists, 22 retired cyclists** Coaches (n=6), Physicians (n=5), Team managers (n=10) Journalists or policymaker (n=5)	**Cross-sectional** (70 qualitative semi-structured interviews & observations) [Key themes: Socialisation of young elite cyclists; economic, legal and organisational conditions]	• Interviewees perceived the way they are socialised to cycling as different, depending on the type of team they belong to. The way in which interactions with former athletes are reported varies as well, while the older riders seem to play a role in supplying doping products to the younger ones. • A culture of using authorised products, mainly dietary supplements, has thus developed, even in strong supportive teams • All the members of 'strongly supportive' teams expressed anti-doping views. Some also expressed concerns about the possible long-term effects on their health • Cyclists from 'affirmed values' teams also express anti-doping attitudes and provide more detailed descriptions of the drug culture. Finally, among cyclists from teams with low supervision, the views are more diverse, sometimes condemning doping or developing an unclear discourse characterised by recurrent references to how cyclists circumvent the regulations • The reported attitudes towards doping and the culture of drugs vary depending on the three supervision styles that were identified
Outram & Stewart (2015)	**Australia**	Eleven elite amateur cyclists All from Melbourne	**Cross-sectional** (Semi-structured interviews) [Key themes: Attitudes to doping in sport; experiences as cyclists; use of training technologies, supplements and other substances; knowledge of doping]	• Cyclists' training schedules extremely demanding and frequently necessitates the use of substances such as caffeine, anti-inflammatory medications, and energy boosters. • Some distanced themselves and their use of supplements and substances from doping and condemned such practices as unethical and objectionable. Others appeared to empathise with professional cyclists' use of doping substances given that they rely on cycling for their income and made comparisons between doping and their own licit (not WADA-prohibited) substance use. • The perception of professional cycling as a sport intimately tied to drug taking places those nearest to professional cycling into a practical and moral predicament. While elite amateur cyclists do not appear supportive of drug deregulation in sport they are not necessarily fully supportive of current anti-doping policy.

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Overbye, Elbe, Knudsen & Pfister (2015)	**Denmark**	**645 Elite Multi-Sport Athletes** Mean age = 22.12 years 59% males Response rate: 43% Representing 40 sports	**Cross-sectional** (Questionnaire) [Key themes: Deterrence; social, self-imposed, financial sanctions]	• 78% of athletes regarded the ban from sport as a deterrent. Older male athletes, however, did so to a lesser degree. • 77%, regardless of gender, age, sport type and previous experience of doping testing, viewed social sanctions as a greater deterrent than the ban. • Many also considered self-imposed sanctions (54%) and financial consequences (47%) a greater deterrent. Four per cent considered neither the ban nor the presented alternatives a deterrent.
Overbye, Knudsen & Pfister (2013)	**Denmark**	**645 Elite Multi-Sport Athletes** Mean age = 22.12 years 59% males Response rate: 43% Representing 40 sports	**Cross-sectional** (Questionnaire) [Key themes: Hypothetical considerations of whether to dope or not; gender, age and sport type effects]	• The most effective deterrents were related to legal and social sanctions, side effects and moral considerations. • The inability to continue their sporting career due to a penalty was the greatest deterrent (84%), followed by anticipated condemnation by people in the social environment outside their sport (79%) and within their sport (75%); fear of side-effects such as unknown long-term side-effects (72%) or reduced fertility (66%); or personal (moral) considerations such as a guilty conscience (72%) and believing doping to be an unnatural form of performance-enhancement (71%). • Female athletes and younger athletes evaluated more reasons as deterrents than older, male athletes. • Top incentives to dope were related to qualified medical assistance, improved health or faster recovery from injury, the low risk of being caught and the threat posed to an elite career.
Overbye & Wagner (2013a)	**Denmark**	**645 Elite Multi-Sport Athletes** Mean age = 22.12 years 59% males Response rate: 43% Representing 40 sports	**Cross-sectional** (Questionnaire) [Key themes: Legitimacy; experiences and attitudes towards therapeutic use exemptions (TUE); opinions; anti-doping policy]	• 19% had been granted a therapeutic use exemption (TUE). 85% of athletes granted a TUE regarded their use of the TUE system as necessary to compete on equal terms with other athletes. Athletes currently granted a TUE were more likely to have evaluated their TUE as necessary to compete equally with other athletes (OR 3.87, p = 0.004). • Administrative hurdles for TUE prevented 7% of athletes from applying, even though there was a medical need. • 49% believed that only athletes with a therapeutic need were granted a TUE in their sport, while the other half (51%) believed that some athletes obtained permission to use medicine without a therapeutic need (Athletes granted TUEs had more than twice as high odds to distrust the efficacy of the system than athletes never granted a TUE). • The belief that TUEs was misused was especially common among endurance athletes, regardless of their experience with TUEs. 4% believed it would be okay to receive a TUE without a medical need.

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Overbye & Wagner (2013b)	**Denmark**	**645 Elite Multi-Sport Athletes** Mean age = 22.12 years 59% males Response rate: 43% Representing 40 sports	**Cross-sectional** (Questionnaire) [Key themes: Legitimacy; experiences and attitudes whereabouts reporting; anti-doping policy]	• Ambivalent perceptions were noted. A majority of athletes seemed to accept the system as a necessity, a duty or a compliment to their sporting level. • On the other hand, the system did, to a greater or lesser degree, interfere negatively in everyday life: three quarters of the athletes felt reporting whereabouts was too time-consuming; fear of a warning was a concern for more than half of the athletes; four in ten found their joy of being an elite athlete was reduced; and four in ten experienced the system as surveillance. • Athletes' trust in the system was remarkably low when it came to questions concerning how it operated in other countries and its ability to catch doped athletes. A particularly remarkable finding is that distrust seemed to increase once athletes had a personal experience of reporting whereabouts.
Pappa & Kennedy (2012)	**European**	**15 Track and Field Athletes** Age range 19-26 years	**Cross-sectional** (In-depth qualitative interviews) [Key themes: perceptions of prevalence and the relationship between doping and elite sport, as well as feelings about anti-doping policy (including testing procedures) and PED use (including types of substances, reasons for use, involvement of significant others)].	• 13/15 athletes confirmed that they had used PEDs, with 12/13 still using them. The remaining 2/15 had been offered substances but refused. The most commonly used substances were steroids (9/12). • Almost all users had seen positive effects from doping, including increased strength and more positive responsiveness to training, as well as feeling better psychologically. However, the majority of dopers also experienced negative effects, including mood changes (e.g., aggression) and acne. Despite this, they did not perceive there to be major health risks for the long term. • The athletes presented doping as a normalised part of competitive sport, whereby they perceived it as necessary and it was accepted ('common secret'). Athletes reported that the main reason they and other people doped was to improve performance. • A clear theme through the interviews was that doping often involved the participation of coaching staff (otherwise they would train with someone else who did accept their doping practices). Yet, athletes maintained that they alone were responsible for the decision to use PEDs. • Athletes saw doping control as symbolic (conducted to influence public perception) and hypocritical (given that doping is accepted in sport.
Pitsch & Emirch (2011)	**Germany**	**1556 National and Olympic Squad athletes** Hypothesis testing based on replication of 2005 study.	**Cross-sectional** (Questionnaire - Randomised Response Technique) [Key themes: Doping prevalence; Gender]	• The largest proportion of athletes (65.2%) were classed as 'honest non-dopers: • The discipline in which athletes compete influences doping behaviour. Cgs sports (sports measured in cm, grams & seconds) had greater statistical likelihood with 16.16% 'honest dopers' found to be significantly larger than zero (x^2=52.2;d.f.=1; p<0.001). • Significant differences were found between those competing internationally vs. nationally. With those competing at national level having a higher prevalence (lower limit: t=18.84;d.f.=1; p<0.05; upper limit: t=18.84;d.f.=1; p<0.05). • Gender estimations indicated a significant effect of gender for both the course of the career as well as the current season, with males more likely to be doping (17.1% vs. 2.9% across career)

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Rodek, Sekulic & Kondric (2012)	**Croatia**	**44 Elite Sailors** (Croatian National Team) 39 males Mean age 24 ± 6.7 yrs. + 34 sailing coaches	**Cross-sectional** (Questionnaire) [Key themes: Doping perceptions]	• 1 out of 3 believed doping occurs to some extent, 25% didn't think doping was used in sailing and 41% didn't know. • The main problem of doping was that it was against fair-play (59.1%), with health-threatening behaviour at 38.6% • 46% of athletes' self-reported poor or no knowledge on doping. • 52.3% of athletes did not have trust in their coaches regarding doping and 32% reported no trust in physicians. • Over half the sample had never been tested for the use of doping substances. • In terms of sanctions, 39% were in favour of first time milder punishment, second time lifelong suspension. 18% supported a lifelong suspension and 2.3% thought doping should be allowed. • 82% of athletes reported no intention to dope but 16% were unsure and 2% would use if there was no 'health hazard'
Sefiha (2012)	**Belgium**	**Elite Cyclists** Team personnel (N=not disclosed; 8 informal semi-structured interviews conducted)	**Cross-sectional** Ethnography (observations and semi-structured interviews) [Key themes: Attitudes and beliefs; neutralisation techniques]	• Nearly all riders believed PED use was common among professional & some elite cyclists ("Everyone else is doing it: PED use as rampant') • Participants most frequently adopted accounts in which they 'condemned the condemners', viewing as hypocrites those labelling PED use as deviant, and arguing that all manner of PED use is commonplace throughout society. Society characterised as unhealthy. • Participants expressed distrust of sporting federations, law enforcement, and medical professionals, whom they viewed as exaggerating and distorting information about the dangers of PED use ('Illegitimate authority'). • Riders claimed that PED use was for many professional cyclists nearly an 'occupational necessity'. • Members viewed PED use as a rational means to an end
Sekulic, Peric & Rodek (2010)	**Croatia**	**25 Professional Ballet Dancers** (F: 16, M: 9, involvement in ballet for <5 years (n=1) to >15 years (n=9))	**Cross-sectional** (Questionnaire) [Key themes: prevalence perceptions and use of substances, including actual and potential doping behaviours]	• 19% of females and 11% of males reported that doping does not happen in ballet. A third of women (32%) and almost half of the men (44%) believed that doping happens rarely or often. Notably, a third of men (33%) and half of women (50%) were unsure how prevalent doping is in ballet. • 63% of females and 44% of males would never dope. However, 25% of females and 22% of males would dope if it ensured successful ballet performance, regardless of negative health consequences and a further 13% of females and 33% of males would dope if it ensured success and had no negative health repercussions. • In males, the risk of potential doping behaviour increased with age. In both genders, religiousness was the factor negatively related to potential doping behaviour and a belief that doping exists in professional ballet. • The majority of males (78%) and females (88%) did not trust anyone regarding doping issues, with 22% of males and 13% of females trusting their physician.

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Soltanabadi, Tojari & Esmaeili (2015)	**Iran**	**200 Professional Athletes** 57% males Mean age ~ 23 years	**Cross-sectional** (Questionnaire) [Key themes: Sport motivation; doping attitude; doping use]	• Significant difference between male and female athletes in doping attitude • Doping attitude has the highest mean (2.65) among national athletes and lowest mean (1.35) among international athletes and doping behaviour variable has the highest mean (0.59) in national athletes and the lowest (0.00) in international athletes. • Conflicting results according to sport type and level of performance.
Stamm, Lamprecht, Kamber, Marti & Mahler (2008)	**Switzerland**	**369 Elite athletes** 5650 General public	**Cross-sectional** (Questionnaires to elite athletes 2005/06) [Key themes: Beliefs about doping and anti-doping]	• Athletes rank themselves as being the person who should take more responsibility in the fight against doping. Medical doctors were second ranked, followed by coaches and then sports federations. • Over 95% of athletes agreed with the statements: ‘‘Doping damages sport’s image’’ ‘‘Doping produces bad role models’’ and “Doping contradicts the principle of fair play’’ • Athletes less inclined to support the statements “doping means equal opportunities” (4.4%) and “doping belongs to sport as does training” (9.4%) but there was still support nonetheless.
Stamm Lamprecht, Kamber (2014)	**Switzerland**	**1,038 Elite athletes** 1013 General public (15-74 years) Data from Stamm et al. 2008 also included for comparison	**Cross-sectional** Online questionnaire to elite athletes by Anti-Doping Switerland (2010) [Key themes: Public awareness; Perception of doping and anti-doping]	• Vast majority of general public and elite athletes advocate the strict prohibition of doping but there is a signicant difference between the general population (83% in favour of strict prohibition) and elite athletes (91%). • Over 95% of the general population and elite athletes agreed that ‘Doping creates bad role models’ • 68% of the general public and 49% of elite athletes agreed that ‘Doping is part of a performance society’. • Elite athletes now report greater agreement that ‘Doping damages my respect for elite GP sports’ (2001 = 50%; 2011 = 81%)
Thomas, Dunn, Swift & Burns (2010)	**Australia**	**974 Elite Multi-Sport Athletes*** Mean age = 23.1 years 75.7% Male	**Cross-sectional** (Questionnaire) [Key themes: Perceptions regarding the effects of illicit drug use on athletic performance; Beliefs concerning the effects of recreational drug use on athletic performance]	• The majority of athletes believed that illicit drug use would impact negatively on athletic performance. • The main perceived effects of illicit drugs on athletic performance were physical and mental functioning. • Minority of athletes indicated that drug use would not impact on physical performance when taken during the offseason or in moderation. • The main risks perceived in association with illicit drug use were short-term consequences, such as physical and mental functioning, rather than long-term health consequences.

Table 7 Continued.

Authors (year)	Country	Sample	Methods	Summary
Thomas, Dunn, Swift & Burns (2011)	**Australia**	**974 Elite Multi-Sport Athletes*** **26 Key experts** 80% RR Mean age = 23.1 years 75.7% Male	**Cross-sectional** (Questionnaire for athletes; semi-structured interviews with key experts) [Key Themes: Illicit drug use; Confidence in knowledge; Information seeking behaviours]	• Athletes were confident in their knowledge of the effects of illicit drugs such as cannabis and meth/amphetamine, but less confident (25% of sample) in their knowledge of the effects of illicit drugs such as GHB and ketamine. • 23% acknowledged looking for information about illicit drugs. Most common sources were Internet (64%), a friend (24.8%) and information sheet (23.9%). • 40% of athletes felt that athletes in their sport would benefit from more information concerning illicit drugs. 13.6% believed they would not benefit. • Preferred format of education: Presentation (38.8%) or pamphlet (38.2%). KEs responded that athletes may respond better to a peer or retired athlete. Lowest preference was for online education (9%).
Valkenburg, de Hon & van Hilvoorde (2014)	**Netherlands**	**129 Elite Multi-Sport Athletes** Registered in national/international testing pool 26% response rate 32 sports surveyed 100 perform top-8 level in the world	**Cross sectional survey** (Questionnaire) [Key themes: Perspectives on the current whereabouts system; importance of privacy; development of whereabouts system]	• The main risks perceived in association with illicit drug use were short-term consequences, such as physical and mental functioning, rather than long-term health consequences. • Findings indicate widespread dissatisfaction with the whereabouts system. • Nearly half of the athletes felt that the '1-hour time slot' limits their freedom, but on the other hand, most athletes disagreed with the statement that the distinction between their sport and private life is disturbed. • For almost one in three respondents, the whereabouts system has a negative influence on the pleasure they experience in being an elite athlete. • In terms of informational privacy, almost all athletes had confidence in the confidential treatment of their whereabouts information. Almost all athletes would accept giving their phone number to Doping Control Officials, but only half of the athletes would accept sharing their location on their mobile phone. • Almost two in 10 of the athletes would accept wearing a permanent wrist or ankle bracelet or accept being implanted with a GPS chip in order to facilitate future anti-doping testing.

Table 8. Overview of studies that employed regression analysis to identify variables that were predictive of doping intentions/doping use in elite athletes.

Authors (year)	Country	Sample	Method	Independent / Dependent variables	Summary
Allen, Taylor, Dimeo, Dixon, & Robinson (2015)	**UK**	**177 Scottish Elite Multi-Sport Athletes** 34 different sports Response rate = 30% Mean age = 23.29 years (SD = 8.27). 46% males 93% of athletes had represented GB/Scotland at International level	**Cross-sectional** (Questionnaire) Hypothesis testing *Achievement Goal theory; Motivational climate*	I: Doping attitudes (PEAS) D: Task orientation, ego orientation, mastery climate and performance climate	• Athletes' attitudes towards drug use in sport scores ranged from 9 (lowest possible score) to 28 and all scores were below the theoretical PEAS mean (31.5). • Hierarchical regression analysis revealed that task and ego goals and mastery motivational climate were predictors of attitudes to PED use ($P < .01$) and accounted for 27% of the variance in attitudes. Task orientation (-), ego orientation (+) and mastery climate (-) were significant predictors of attitudes to PED use. • Compared with individual athletes, team athletes were significantly lower in attitude to PED use and ego orientation scores and significantly higher in perceptions of a mastery motivational climate ($P < .01$). However, the effect sizes were small (<0.19)
Barkoukis, Lazuras, Tsorbatzoudis & Rodafinos (2011) Study utilised same sample as Barkoukis et al. 2013 & Lazarus et al. 2010	**Greece**	**1075 Elite Multisport Athletes** Mean age = 23 years (SD. 6.39) 63% male Football (n=79); Basketball (n=156); Volleyball (n=148); Handball (n=148); Athletics (n=128); Swimming (n=96); Archery (n=96); Tae Kwon Do (n=90); Rowing (n=137)	**Cross-sectional** (Questionnaire) Hypothesis testing	I: Past use PEDs; doping intentions D. Sportspersonship; motivation and theory of planned behaviour variables.	• 8% (n=85) of athletes reported doping use; 4% had used once but never since; 3% occasional use and 1% systematic use of prohibited PED's. • Intrinsically motivated athletes reported significantly lower scores on past doping use and intentions to use in the future compared to other groups. • Mastery orientated athletes showed significantly lower scores on past doping use and intention to use compared to other groups • Sportsmanship groups did not significantly predict past doping use or intention for future use.
Barkoukis, Lazuras, Tsorbatzoudis & Rodafinos (2013) Same sample as Barkoukis et al. 2011 & Lazarus et al. 2010	**Greece**	**750 Elite Multisport Athletes** (9 different sports) Mean age = 25 ± 5.89 years 64% male	**Cross-sectional** (Questionnaire) Hypothesis testing	I: Use and intentions to use. D: Group; Intrinsically motivated; amotivated and extrinsically motivated athletes; mastery orientated, approach oriented; high achievers. Cluster Analysis by groups in motivation, orientation and sportspersonship	• 9.9% (n=74) reported past or current doping use. Lifetime ever dopers held significantly stronger intentions to use doping during the season in comparison to non-lifetime dopers. • In non-dopers, mastery approach and performance avoidance goals predicted doping intentions. Self-determination was not predictive. Indirect effects: sportspersonship orientations fully mediated the effect of mastery approach goals on doping intentions. • In lifetime ever dopers; sportspersonship orientations did not predict doping intentions. Whereas situational temptation partially mediated the effects of mastery avoidance goals on doping intentions. • Psychosocial predictors of doping intentions in lifetime ever dopers predicted 78% of the variance; in non-users 41% of the variance.

Table 8 Continued.

Authors (year)	Country	Sample	Method	Independent / Dependent variables	Key Findings
Barkoukis, Lazuras & Harris (2015)	**Greece**	**60 Elite Multisport Doping Athletes** 75% male Doping users Age not reported as potential threat to anonymity	**Experimental Design** (between subjects)	I: Group D: Attitudes; social and moral norms; self-efficacy belief; anticipated regret. Between-Subject Experimental Intervention: Self-affirmation manipulation *vs.* none.	• Independent samples t-tests showed that self-affirmed participants reported significantly lower intentions to dope (t)58) = -2.43, p =<0.01) and temptation to engage in doping under risk-conducive situations (t)58) = -3.71, p =<0.001). • Multiple regression analysis showed that, whereas self-affirmation manipulation, attitudes, moral norms and anticipated regret predicted doping use intentions (67.9% of variance), the effects of self-affirmation were not mediated by these social cognitive predictors of doping intentions. • In the process of decision-making, self-affirmation exerts a significant influence on doping intentions independently of doping-related beliefs, such as attitudes, moral and social norms, and anticipated regret. Hence, self-affirmation can be seen as an independent predictor of doping intentions that exerts a significant influence on intentions, on top of other correlates.
Connor, Woolf & Mazanov (2013)	**Canada**	**212 Elite Multisport Athletes** Male, 56% Mean age = 20.89 years, SD = 2.5	**Cross-sectional (**Questionnaire) Goldman Dilemma	I: Consequences (death *vs.* non-death); legality (legal *vs.* illegal); gender; competition level; sport type D: Acceptance of dilemma	• Only two of a sample of 250 reported they would take an undetectable, illegal performance enhancing substance 'that guaranteed you would win an Olympic Gold Medal, but would kill you in five years'. • If a drug 'was legal, but still guaranteed you would win Olympic Gold but it would still kill you in 5 years', 6% were willing to accept the dilemma. • Regression analysis highlighted when consequences were most severe (e.g., death) then participants are 0.07 times more likely to accept the dilemma. When substance is identified as illegal 0.14 are more likely to accept the dilemma. Proportion of athletes willing to take bargain has changed significantly since the last test (1982-1995)
Dunn, Thomas, Swift & Burns (2011)	**Australia**	**974 Elite Multisport Athletes** 76% Male Mean age: 23.1 years 80% response rate	**Cross-sectional** (Questionnaire)	I: Age; gender; knowing other athletes who use drugs; having been offered/had opportunity to use; education; athletic status; sport; frequency of drug testing D: Illicit drug use	• One-third of the sample had been offered or had the opportunity to use illicit drugs in the past year; despite this, the self-reported prevalence of all six drugs under investigation was lower than that reported by the general population. • 16% of athletes believed that there was a drug of concern in their sport, with ecstasy, cocaine and alcohol being nominated. 24% personally knew athletes using illicit drugs • Knowing other athletes who use illicit drugs, being offered or having the opportunity to use drugs and identifying as a 'full-time athlete' were significant predictors of recent drug use.

Table 8 Continued.

Authors (year)	Country	Sample	Method	Independent / Dependent variables	Key Findings
Jalleh, Donovan & Jobling (2013)	**Australia**	**1237 Elite Multisport Athletes** Mean age = 23 years (SD =7.8 yrs.) 49% male (22 not specified) Sports: Athletics (8.4%); Swimming (7.8%); Hockey (7%); rowing (6.3%); football (5.7%); basketball (4.7); netball (4.1%), cycling (3.5%); softball (3.3%); AFL (3.3%); weightlifting (3.1%)	**Cross-sectional** (Questionnaire) Model Testing *(Structural equation modelling)*: *Sport Drug Control Model*	D: Doping behaviour; Attitudes towards PEDS I: Attitudes towards PEDS; reference group opinion; affordability; availability; benefit appraisal; threat appraisal; legitimacy; personal morality; personality]	• 6.9% reported ever using a banned substance, with 3.4% using in the last 12 months. 1.1% reported testing positive for a banned PEDS. • A large proportion reported not knowing whether the six substances were accessible (47.3-61.8%) or affordable (58.6-69.8%) • A favourable attitude towards PEDS use was associated with actual use of a banned substance. • The model accounted for 81% of the variance in attitudes towards PEDS use; but only 13% in use of PEDS. • Standardised parameter estimates indicated a significant and strong relationship between attitude towards PEDS use and personal morality (0.64, $p<0.001$), significant and moderate relationship with legitimacy (0.25, $p<0.05$) and a significant relationship with reference group opinion (0.19, $p<0.05$). All other relationships were non-significant. • PEDS use was significantly associated with attitudes towards PEDS use.
Lazuras, Barkoukis, Rodafinos & Tsorbatzoudis (2010) Same sample as Barkoukis et al. 2011, 2013	**Greece**	**750 Elite Multisport Athletes** (9 different sports) Mean age = 25 ± 5.89 years 64% male	**Cross-Sectional (**Questionnaire) Model & hypothesis testing: *Social cognitive theory*	D: Doping Intentions I: Doping behaviour; attitudes, subjective norm; descriptive norm; perceived behavioural control; situational temptation; age; gender; type of sport.	• One out of ten athletes reported doping use (n=74; 9.9%) with 32 athletes stating they used doping substances once but never since and 27 reporting occasional use of doping substances and 15 reporting systematic use of prohibited PEDS. • The model predicted a total of 69.2% of the variance. • Theory of planned behaviour variables significantly predicted doping intentions and fully mediated the effects of age and gender. Specifically, attitudes and PBC retained significant effects even after controlling for the effects of other predictors such as situational temptation. • Past and current doping behaviour was largely mediated by situational temptation and attitudes with subjective norms and PBC having a weaker effect. • Social desirability had a minimal impact on associations between PED use intentions and TPB variables.

Table 8 Continued.

Authors (year)	Country	Sample	Method	Independent / Dependent variables	Key Findings
Dunn & Thomas (2012)	**Australia**	**1,684 Elite Multisport Athletes** 72% Male Mean age: 22 years 88% response rate	**Cross-sectional** (Questionnaire)	I: Age; gender; knowing other athletes who use drugs; having been offered/had opportunity to use; education; athletic status; sport; frequency of drug testing D: Illicit drug use	• 8% (n=134) of the sample reported use of at least one of the six illicit drugs under investigation (ecstasy, cannabis, cocaine, meth/amphetamine, ketamine and GHB) in the past year. • Being male, older, knowing other athletes who used illicit drugs and had been offered or had the opportunity to use illicit drugs in the past year and identifying as a 'full-time athlete' were significant predictors of past-year illicit drug use, while having completed secondary education or a post-school qualification was associated with a lower likelihood of past-year illicit drug use. • Athletes are part of a sportsnet that includes family, coaches, support staff and other athletes, and these relationships may encourage the use, supply and demand for drugs.
Dunn, Thomas, Swift & Burns (2012)	**Australia**	**974 Elite Multisport Athletes** 76% Male Mean age: 23.1 years (range 18-44)	**Cross-sectional** (Questionnaire)	I: Age; gender; knowing other athletes who use drugs; having been offered/had opportunity to use; education; athletic status; sport; frequency of drug testing D: non-user; lifetime user; recent user. *False consensus effect*	• 7% (CI=5-9%)of the sample reported the use of at least one of the six illicit drugs under investigation (ecstasy, cannabis, cocaine, meth/amphetamine, ketamine and GHB) in the past year. • Participants tended to report that there was a higher prevalence of drug use among athletes (16% overestimation) in general compared with athletes in their sport,(28% overestimation) and these estimates appeared to be influenced by participants' drug use history. • While overestimation of drug use by participants was not common, this overestimation also appeared to be influenced by athletes' drug use history.
Gucciardi, Jalleh & Donovan (2011)	**Australia**	**643 Elite Multisport Athletes** Mean age: 23.75 ± 8.49 (range 14-66 years) 44% male 33% response rate Sports: Equestrian; shooting, hockey, weightlifting, basketball, archery, curling, table tennis; lawn games	**Cross-sectional** (Questionnaire) Model Testing *(Structural equation modelling)*: *Sport Drug Control Model*	D: Doping Susceptibility; attitudes towards doping I: Attitudes to doping; morality; benefit appraisal; threat appraisal; self esteem; perceptions of legitimacy; reference group opinion.	• Only 5 out of 643 athletes reported a non-abstinence state (referred to as doping susceptibility) • Morality (.4, $p<0.001$), benefit appraisal (.25, $p<0.001$), and threat appraisal (.14, $p<0.05$) evidenced the strongest relationship with attitudes to doping, which was positively associated with doping susceptibility. Reference group opinion, legitimacy and self-esteem yielded non-significant paths to doping attitudes. • The model accounted for 30% of variance in attitudes to doping and 11% of variance in susceptibility to doping. • Athletes who believe they can get away with doping if tested and that PED's are beneficial for performance, and are willing to cheat to perform have more favourable attitudes to doping. • Lack of consistency in the relationship between reference group opinions, legitimacy and personality are at odds with previous research. Authors caution this could be down to sampling characteristics and methods of assessment.

Table 8 Continued.

Authors (year)	Country	Sample	Method	Independent / Dependent variables	Key Findings
Manouchehri & Tojari (2013)	**Iran**	160 Elite Martial Arts Athletes 75% males	**Cross-sectional (**Questionnaire)	D: Doping attitude (PEAS) I: Sport orientation (competitiveness, goal orientation, win orientation - SOQ), doping use beliefs (DUB)	• Structural equation modelling noted a significant relationship between competitiveness, goal orientation and doping attitude. • Win orientation and doping beliefs did not exert a significant influence on doping attitude. • Doping belief and sport orientation had significant impact on doping behaviour, however, competitiveness, goal and win orientation did not significantly influence doping behaviour. • Limited data presented in the paper which makes it difficult to interpret the findings. The mean PEAS score is also questionable at 0.34.
Sekulic, Bjelanovic, Pehar, Pelivan & Zenic (2014)	**Croatia**	**105 Elite Male Rugby Union players** Mean age = 23.4 ± 4.1 years	**Cross-sectional (**Questionnaire)	D: Potential doping behaviour I: Perceptions of doping in rugby; rugby experience; smoking; nutritional supplement use	• High alcohol consumption, with more than 30% of the athletes binge drinking at least once per week, 25% were daily smokers. • Approx. 52% of the subjects used dietary-supplementation (DS) and 23% reported potential doping behaviour (PDB) • Approx. 20% of players were tested for doping • 55% believed that doping is present in rugby and only 9% perceived rugby as a doping-clean sport, while almost 20% believe that doping is common in rugby. • Half of the players stated no likelihood to dope, 26% were unsure and 23% admitted to potential doping behaviour. Those with a doping tendency were more likely to trust their coaches and strongly believed doping is present in rugby. • Forward conditional logistic regression revealed that less rugby experience (OR: 1.286; 95% CI:1.058–1.563; $p < 0.05$), less smoking (OR: 2.034; 95%CI:1.100–3.760; $p < 0.05$), higher DS usage (OR:5.543;95%CI:1.666–18.444;$p < 0.01$), and a stronger belief that doping is present in rugby (OR:0.305; 95%CI:0.066–0.638; $p < 0.01$) were significant predictors of PDB.

Prevalence of doping use

The percentage of athletes who test positive for banned substances has consistently hovered around 2% year-on-year (Outram & Stewart, 2015). Yet, research evidence questions official WADA statistics as higher prevalence rates are consistently documented (e.g., Backhouse et al., 2007; Petróczi, Mazanov, et al., 2011; Pitsch & Emrich, 2011; Uvacsek et al., 2011). Prevalence estimates from studies with elite athletes range from 10% (Barkoukis, Lazuras, Tsorbatzoudis, et al., 2013; Lazuras et al., 2010) to 35% (Pitsch & Emrich, 2011). In Greece, one out of 10 elite athletes reported doping use (N=74; 10%). Of those, 32 athletes said they used doping substances once but never since, 27 reported occasional use of doping substances and 15 reported systematic use of prohibited PEDs (Barkoukis et al., 2011; Lazuras et al., 2010). Using the randomised response technique the upper limit of the rate of dopers was 35% in a sample of German squad athletes (Pitsch & Emrich, 2011).

Perceived incidence of doping

Although potentially inflating estimates of doping, perceived incidence studies may reflect the 'doping climate' within the population sampled (Moston et al., 2014b). This, in turn, can shape future behaviour through the workings of the self-fulfilling prophecy (an initial expectation, even if false, may come to fulfilment; Moston et al., 2014b). Corroborating the findings of self-declared PED use, Moston and colleagues (2014b) demonstrated that estimates of PED use exceeds prevalence statistics from laboratory testing. Indeed, across all sampled sports, athletes' perceived incidence of PED use was 18%, whereas perceived use in own sport was 10% (Moston et al., 2014b). Cycling was the sport with the highest self-perceived incidence of PED use (estimated at 33%). In contrast, in the Australian Football League (AFL), perceived performance-enhancing drug use was low (estimated at 3.8%). For recreational drug use the sport with the highest self-perceived incidence was rugby union (estimated at 31%), with rowing offering the lowest incidence estimates (11.5%).

Studies consistently note athletes' beliefs that the majority of professional, elite athletes are using PEDs (Pappa & Kennedy, 2012), while self-declared dopers discuss

doping as normalised in sport (Pappa & Kennedy, 2012). The use of PEDs is perceived to be less common among those involved in team sports and when competitive levels were low (Chan, Hardcastle, Lentillon-Kaestner, et al., 2014). Overall, it can be reasonably concluded that those with a strong belief that others in their sport are using PEDs are at risk of doping. Such perceptions might justify PED use as a necessary practice, which in turn drives doping behaviour (Kondric et al., 2011; Rodek, Sekulic, & Pasalic, 2009; Sekulic et al., 2009; Zenic, Peric, et al., 2010).

Although athletes acknowledge that doping is an issue in sport, they are less likely to acknowledge that it prevails in their sport or team (Hanstad et al., 2009; Loraschi et al., 2014). Among cyclists, while doping was deemed to be prevalent in their sport in general, it was not acknowledged in their own team. Thus, doping denial exists (Loraschi et al., 2014). Yet, when the lived experience of doping was studied, the perceived incidence of drug use within their own sport was higher than all other sports combined (Engelberg et al., 2014). When asked to predict others' use of PEDs, self-declared PED users typically offered higher estimates of drug use than non-users (Moston et al., 2014b; Petróczi, Mazanov, et al., 2008). The 'false consensus effect' (FCE) principle has been used to explain individuals' overestimates of the extent to which others behave the same way as they do (Petróczi, Mazanov, et al., 2008). This effect is particularly salient when the behaviour in question is deemed to be socially questionable or unacceptable (Petróczi, Mazanov, et al., 2008). However, Lazarus et al. (2010) caution that conclusions about FCE effects should be tentative because - as highlighted earlier - causal relationships can be bi-directional with biased judgements of other peoples' behaviour serving as predecessors of personal involvement (Lazuras et al., 2010). However, Moston and colleagues (2014b) posit that because estimates of the incidence of PED use are not commonly known and doping control statistics remain questionable, athletes own experiences and media reports inform perceived incidence estimates.

Predicting PED use/intentions

An increasing numbers of studies have drawn upon hypothetical scenarios to predict doping use attitudes, intentions and behaviour. A relatively complex web of predictors of (potential) doping behaviour has been identified, with correlates spanning (i) individual characteristics and attributes (socio-demographic, psychological), (ii) situational conditions (interpersonal relationships), and (iii) environmental context. At this stage, beyond acknowledging its complexity, the myriad of items used to assess the dependent variables of doping attitudes, intentions, willingness, susceptibility and behaviour limits our ability to draw meaningful conclusions.

Corroborating the conclusions of the 2007 review, males are more prone to doping than females. This is evidenced across prevalence statistics, expressed attitudes and behavioural willingness (Breivik et al., 2009; Dunn & Thomas, 2012; Kondric et al., 2011; Kondric et al., 2013; Overbye et al., 2013; Pitsch & Emrich, 2011; Sekulic et al., 2010; Soltanabadi et al., 2015). For example, among elite German athletes, males were nearly six times more likely to be doping (17.1% vs. 2.9% across career) (Pitsch & Emrich, 2011). By way of explanation, Overbye et al. (2013) observed that male athletes – especially those in team sports and speed and power sports – were more likely to consider an increase in muscle mass to be a reason to use PEDs.

Pitsch and Emrich (2011) found that sport discipline influences doping behaviour. Specifically, CGS sports (i.e., those measured in centimetres (C), grams (G) & seconds (S)) had a greater statistical likelihood of doping, with 16% of 'honest dopers' found likely to dope. The use of banned PEDs was less common in team sports compared to individual sports (Chan, Hardcastle, Lentillon-Kaestner, et al., 2014). The authors argue that this pattern of behaviour is in line with the tenets of the life-cycle model of performance enhancement (Petróczi & Aidman, 2008), because winning in individual sports such as track and field and cycling, is highly dependent on speed, power and endurance. However, Chan, Hardcastle, Lentillon-Kaestner, et al. (2014) acknowledge that it would be foolish to think that players from team sports are immune from doping risk; the sporting culture and context sets the stage for doping behaviour (Lentillon-

Kaestner, 2013; Lentillon-Kaestner & Carstairs, 2010; Ohl et al., 2013). Indeed, Overbye et al. (2013) observed that males athletes from team sports who emphasised speed and power were more likely to consider an increase in muscle mass to be a reason to use PEDs. Potential doping habits were examined across a series of studies in Croatia, Serbia and Slovenia. Weightlifters/powerlifters were most likely to dope if the practice would help them achieve better results in competition and if it had no negative health consequences (40% agreement); sailors (2%) and swimmers (7%) were least likely to dope (Kondric et al., 2010; Kondric et al., 2011; Kondric et al., 2013; Rodek et al., 2012; Rodek et al., 2009; Sajber et al., 2013; Sekulic et al., 2014; Sekulic et al., 2008). It should be noted that these studies reflected small sample sizes, meaning that the results should be interpreted with caution.

Findings have been inconsistent in relation to the influence of participation level on doping behaviour. Some studies have noted that national level competitors report a higher prevalence of doping compared to those involved in international competition (Pitsch & Emrich, 2011). Using the random response technique, Pitsch and Emrich (2011) found that doping is to a large extent a problem among athletes competing up to the national level as the rate of 'honest dopers' was significantly higher than among athletes competing at international levels. Studies suggest that athletes competing at lower levels are less likely to dope (Chan, Hardcastle, Lentillon-Kaestner, et al., 2014). Although the financial incentives are typically more substantial in elite sport (Bloodworth & McNamee, 2010), evidence questions the idea that this drives doping in competitive athletes (see relevant report section).

While some studies identify changing patterns of PED use – from legal aids through to banned PEDs – over the developmental cycle (Hauw & Bilard, 2012; Lentillon-Kaestner & Carstairs, 2010), the impact of chronological age on doping risk is yet to be determined (Overbye et al., 2013).

Tenets of achievement goal theory (Nicholls, 1989) have been explored in the context of doping in sport. Hierarchical regression analysis revealed that task and ego goals and mastery motivational climate were predictors of attitudes to PED use; these variables accounted for 27% of the variance in attitudes. Specifically, task orientation (-

), ego orientation (+) and mastery climate (-) were significant predictors of attitudes to PED use (Allen et al., 2015). In an earlier study of elite Greek athletes, Barkoukis et al. (2011) found that athletes with a stronger mastery achievement goal reported lower past doping use and lower intention for use.

In relation to the indirect effects, mediation analysis showed that sportspersonship orientations fully mediated the effects of mastery approach goals on doping intentions. Further analysis showed that sportspersonship orientations had the potential to be transformed into pro-doping attitudes and self-efficacy beliefs, which, in turn, predict doping intentions. Thus, Barkoukis et al. (2011) concluded that distal variables, such as achievement goals, lead to doping intentions through the formation of moral beliefs (i.e., sportspersonship). Moral beliefs, in turn, shape specific attitude and self-efficacy beliefs, which appear to be immediate antecedents of doping intentions.

Focusing on doping attitude, studies generally reflect anti-doping attitudes across the elite athlete samples (i.e., Allen et al., 2015; Bhambhani et al., 2010; Johnson et al., 2013; Stamm et al., 2008). For example, over 95% of Swiss athletes agreed with the statements ''Doping damages sport's image'', ''Doping produces bad role models'' and "Doping contradicts the principle of fair play'' (Stamm et al., 2008). Thus, elite athletes publicly declare doping as transgressive (Johnson et al., 2013). Yet, other studies have identified differences in doping attitudes across and within sports (Morente-Sánchez et al., 2013), with significant differences between male and female athletes (Soltanabadi et al., 2015).

Personal morality also exerts a strong association on attitude towards PED use; athletes with a weaker self-declared moral stance against PED use had a more favourable attitude towards such use (Gucciardi et al., 2011; Jalleh et al., 2013). Examining the tenets of the sport drug control model (SDCM) (Donovan, 2002), Gucciardi et al. (2011) also noted strong relationships between attitudes to doping and (i) benefit appraisal and (ii) threat appraisal; which in turn, was positively associated with doping susceptibility. This was defined as the absence of a firm resolve not to engage in doping activities or to give any consideration at all to an offer to do so. In examining

the SDCM, Gucciardi et al. (2011) acknowledged that the non-significance of hypothesised relationships (specifically reference group opinion, legitimacy of doping law and agencies and personality) are at odds with previous research. They conclude that this could be due to the opportunistic nature of the study and the fact that the survey items were not specifically designed to measure the constructs of interest.

Although studies note that athletes align with the view that doping is cheating and distance themselves from the behaviour (Outram & Stewart, 2015), research has indicated that this is not a universal belief. Examined via the multidimensional sportspersonship scale, Barkoukis et al. (2011) found that groups reporting low morality were no different to the high morality group in their previous doping use nor their future doping intentions. In this understanding, athletes may not view PED use as unethical and immoral (Barkoukis et al., 2011). Yet, morality (assessed via "I would cheat if I thought it would help me win", "If other people are cheating, I think I can too" and "I cheat if I can get away with it") has been shown to produce strong associations with doping attitudes (Gucciardi et al., 2011). Personality has not been found to be a significant predictor of attitude towards PEDs (Gucciardi et al., 2011; Jalleh et al., 2013). Researchers caution that this could be due to the fact that existing studies deploy single measures of personality (e.g., personality inferred from risk taking propensity (Jalleh et al., 2013) and self-esteem (Gucciardi et al., 2011).

Several moral disengagement techniques have also been identified in the decision to dope, including (i) advantageous comparison, (ii) minimising or ignoring the consequences, and (iii) displacing responsibility (Engelberg et al., 2014). Sefiha (2012) used the term 'neutralization' (based on work of Sykes and Matza, 1957) to describe how elite and professional cyclists justify and excuse PED use. In that work, nearly all riders believed PED use was common among professional and some elite cyclists ("Everyone else is doing it: PED use as rampant'). Cyclists condemned the condemners, viewing as hypocrites those labelling PED use as deviant, and arguing that all manner of PED use is commonplace throughout society. Further, cyclists argued that society should not create and enforce rules to which it does not adhere itself. A 'defence of necessity' was used when PED use was regarded as an

occupational necessity for many professional cyclists; PED use was a rational means to an end.

To date, studies have tended to examine isolated individual motivational variables (Kirby et al., 2011), meaning that findings might not accurately reflect the individual characteristics and attributes of the doping athlete. Explorations of the doping athletes' lived experience showed strong task orientation – this is typically considered to be advantageous and central to positive sport experiences - as they spoke about their love of their sport (Kirby et al., 2011). Delving deeper, the majority of dopers were not driven by a desire to win competitions or to become famous, but simply to stay in the sport for as long as possible (Kirby et al., 2011). Thus, uni-dimensional athlete-centric models alone cannot explain the complexity of doping in sport.

The consumption of NS was found to increase the risk of using prohibited substances (Hauw & Bilard, 2012; Lentillon-Kaestner & Carstairs, 2010; Outram & Stewart, 2015; Sekulic et al., 2014) and a culture of supplementation has been noted in cycling in particular (e.g., Ohl et al., 2013). In their study of doping athletes, Hauw and Bilard (2012) highlighted that they were all regular consumers of NS for no fewer than two years before doping activities commenced. Studies have illustrated that amongst elite amateur cyclists the distinction between supplement use and PED use and the ethical issues underpinning this distinction are acknowledged (Ohl et al., 2013; Outram & Stewart, 2015). Contrary to other findings, Kondric and colleagues (2011) found that most respondents reporting current NS use do not trend towards potential doping use.

Focusing on situational conditions, the sporting culture in which athletes operate is a strong determinant of doping attitudes (Smith et al., 2010). Extending work employing the tenets of the theory of planned behaviour, situational temptation has been examined in a bid to capture contextual behavioural control mechanisms linked to doping (Lazuras et al., 2010). Drawing upon an integrated social cognitive perspective, situational temptation was a stronger predictor of intention for doping than individual factors, such as perceptions of normative beliefs, behavioural control and attitudes.

Situational temptation was also the strongest mediator of the effects of achievement goal orientations on intentions, in both ever and never dopers.

Doping vulnerability

Perhaps owing to the difficulty in obtaining reliable admissions of athletes' PED use, few studies have employed interview-based methodologies to investigate the causes of doping in sport (Kirby et al. 2011). Only a handful of studies have captured the 'real-life' experiences of athletes who have admitted to taking PEDs. In the largest study of this kind, 18 sanctioned elite multi-sport athletes noted that, mostly, doping was initiated early in athletic careers, but with no clear single event or critical incident as a starting point (Engelberg et al. 2014). Instead a series of events precipitated doping use and across the studies elite athletes acknowledged that their motivations and reasons changed with time (Hauw & Bilard, 2012). Moreover, they were often guided by pragmatic concerns and critical incidents (Hauw & Bilard, 2012; Kirby et al., 2011) such as injury, career transitions, a set back or competitive failure and entering a new training environment (Lentillon-Kaestner & Carstairs, 2010). Mazanov and Huybers (2010) also pointed to 'performance tipping points' and signalled potential team selection or de-selection as a doping temptation factor. Consequently, these tipping points may encourage doping as a coping strategy in response to these incidents (Overbye et al., 2013).

The temptation to dope in sport was evidenced through interviews with young cyclists who were attempting to secure a professional contract or who recently transitioned to professional status;all cyclists, bar one, had been tempted to dope (Lentillon-Kaestner & Carstairs, 2010). This temptation was heightened when cyclists felt they couldn't reach their goals without doping or faced a significant setback, such as losing a race. Corroborating that athletic identity is important in any individual's doping risk, the strength of temptation to dope was linked to importance that sport success was afforded. In elite athletes, temptation to dope has been linked with periods of personal distress for athletes. These periods characterise large parts of elite athletes' lives, including, but not limited to, (i) coping with injuries or a difficult training programmes (Mazanov et al., 2011), (ii) recovering from a past physical state or preparing for a

specific event (Hauw & Bilard, 2012), (iii) securing or renewing a professional contract (Aubel & Ohl, 2014; Lentillon-Kaestner & Carstairs, 2010), (iv) losing sponsorship (Aubel & Ohl, 2014; Mazanov et al., 2011), (v) protect themselves from risks caused by their intense activity (Bilard et al., 2011), (vi) responding to specific problems in current lives that they have not been able to solve (Hauw & Bilard, 2012), and (vii) career transitions (Hauw & Bilard, 2012).

Hauw and Bilard (2012) also noted that in addition to experiencing a period of personal distress and suffering, athletes who resorted to doping appeared (1) to be closed to all external environmental offers, except training and performance, (2) to experience changes in their sporting results, and (3) to be experiencing disturbances in their lives. They were also defined by a specific number of years of sporting activity (i.e. 17 years), early specialisation in sport and two years of regular legal substance use. From a socialisation perspective, Lentillon-Kaestner and Carstairs (2010) found that more experienced cyclists, who doped or used to dope, transmitted the culture of doping to younger cyclists by teaching them about doping methods and the substances to use. As a result, young cyclists viewed doping as part of sport and the wider social environment seems important in use of banned substances. Indeed, individual psychological factors were not salient in the qualitative accounts of doping users. Aubel and Ohl (2014) pointed to the business model of professional cycling, noting that – as for most employees - the employment conditions were key determinants of behaviour. Recognising the power of the 'environment' on shaping behaviour, recent studies emphasise the need to examine the athletes' entire social milieu when studying doping (e.g., Aubel & Ohl, 2014; Lentillon-Kaestner & Carstairs, 2010).

A common finding across the studies was that elite athletes can normalise the use of doping so that it was no longer seen as cheating – particularly in those sports where drug use was perceived to be high (e.g., bodybuilding) (Kirby et al., 2011). Teammates or training partners seemed to have a big influence on the athletes' dope decisions. In the study of Kirby and colleagues (2011) three of the five athletes claimed that this was the greatest source of external influence on their initial decision to dope. Typically,

such ‘social pressure’ stemmed from a desire to fit in and remain an integral part of the group set-up. Further, athletes did not believe they could compete at that level without doping.

Although not focused on doping users, Chan, Hardcastle, Dimmock, et al. (2014) deployed focus groups to explore 57 elite athletes’ beliefs about, and attitudes toward, taking banned performance-enhancing substances. While results were generally consistent with, and complementary to, research adopting quantitative approaches based on social–cognitive models (e.g., theories of reasoned action and planned behaviour; Ajzen, 1985; Ajzen & Fishbein, 1980), many of the beliefs and perceptions within the global and lower order themes (personal attitudes - reputation and getting caught, health effects, and financial incentives and rewards; social influences - coaches, parents, and medical staff and sport scientists, and control beliefs - i.e., insufficiency of doping testing, resource availability, and sport level and type) deviated substantially from those identified in previous research. Chan and colleagues (2014) highlight that:

> “previous theory-driven studies did not develop the sets of beliefs derived from in-depth interviews with athletes, and if there was any athlete-driven input into the development of their instruments, it was limited by the constraints of the approach in the individual theory and failed to capture the breadth and complexity of beliefs likely to affect doping behaviour” (p.252).

Even now, few studies have sought to examine the short- and long-term consequences of doping in sport. Instead, the focus remains on profiling doping athletes. In a break from this norm, Georgiadis and Papazoglou (2014) retold stories of sanctioned athletes who experienced adverse psychological, social and financial consequences of doping. For example, sanctioned athletes felt empty and lost as they described signs of personality crisis (e.g., looking for meaning in their lives). Indeed, the majority of athletes experienced stress and depression symptoms, along with feelings of shame due to the social condemnation that ensued. With this in mind, anti-doping policy and practice might profitably draw on the social consequences to deliver more effective prevention of PED use (Bloodworth & McNamee, 2010; Ehrnborg & Rosen, 2009).

Doping deterrents

Empirical evidence consistently confirms that pointing to long- and short-term health implications of PED use has a weak deterrent effect. Typically, elite athletes deny these health risks and reject the health rationale for prohibiting PED use (Engelberg et al., 2014; Kirby et al., 2011; Lentillon-Kaestner & Carstairs, 2010; Lentillon-Kaestner et al., 2012; Overbye et al., 2013; Sefiha, 2012). Indeed, athletes assert that it is more health-risky to take nothing than to ingest a banned PED (Lentillon-Kaestner & Carstairs, 2010) due to the inherent dangers of an elite sport lifestyle (Lentillon-Kaestner et al., 2012; Ohl et al., 2013; Sefiha, 2012). Few sanctioned Swedish athletes experienced any serious negative side effects of moderate AAS use; several *positive* effects were reported (Hoff, 2012).

The performance effects of PED use are acknowledged in this population and these benefits appear to outweigh any potential threats to health (Chan, Hardcastle, Lentillon-Kaestner, et al., 2014; Lentillon-Kaestner et al., 2012). Yet, Overbye et al. (2013) found that the majority of Danish athletes would worry about the severe health risks incurred by doping. Recent studies applying the "Goldman Dilemma"[8] suggest that athletes would not be willing to use a banned PED to ensure Olympic success if it would lead to death (Connor et al., 2013). However, if the drug use was not associated with a fatal condition (death in five years' time) and no legal consequences would ensue, a considerable number of athletes reported that they would use illegal drugs to achieve an Olympic gold medal. Similarly, the overwhelming reason why elite gay athletes chose not to use AAS was the potential health implications associated with their use (Filiault & Drummond, 2010). Paralympic athletes were aware of the risks to health of athletes with spinal cord injury 'boosting' in a bid to improve their performance (Bhambhani et al., 2010).

These findings notwithstanding, the weight of the evidence questions the value of the 'health' message in trying to prevent doping. Furthermore, elite and professional cyclists have expressed a distrust of sporting federations, law enforcement and

[8] Athletes asked if they would use a drug that would bring them an Olympic medal but it might kill them five years later (Goldman, Bush, & Klatz,1984).

medical professionals; they were viewed as exaggerating and distorting information about the dangers of PED use (Sefiha, 2012).

Testing for prohibited substances and the risk of sanctions is intended to deter athletes from doping (Donovan, 2009) and some studies support this proposition (e.g., Dunn et al., 2010; Overbye et al., 2013). Fear of being banned from sport was the deterrent that affected most athletes, in particular females (Elbe & Overbye, 2013; Overbye et al., 2013); this threat appears more salient than the threat to health (Lentillon-Kaestner & Carstairs, 2010; Lentillon-Kaestner et al., 2012). However, this deterrent effect may well be undermined among elite level athletes by a low perceived likelihood of being detected - due to limited doping controls (i.e., sample collections) (Chan, Hardcastle, Lentillon-Kaestner, et al., 2014; Gucciardi et al., 2011; Mazanov & Huybers, 2010; Moston et al., 2014a; Overbye et al., 2013).

Low levels of testing were reported amongst elite Croatian sailors (0%) (Rodek et al., 2012) and rugby union players (~ 20%) (Sekulic et al., 2014). In Australia, only one-third of athletes perceived the certainty of 'being caught by the drug testing authorities' to be ' high' on the scale they employed (Moston et al., 2014a). This perception of a low likelihood of being caught may lead to willingness among athletes to explore using performance-enhancing substances. However, if they were to be tested, over two-thirds of athletes perceived that being caught would have a high impact on their sporting career. Thus, Moston and colleagues (2014a) showed that sanctions linked to material loss (i.e., negative potential impact on earning) were perceived as more influential than legal deterrents which might halt an athletic career. Mazanov and Huybers (2010) also corroborated the need to jointly ensure the perceived threat of detection is high while also highlighting the reputational consequences of being caught (e.g., public humiliation, ostracised by peers).

Few studies have examined perceptions of current doping control sanctions and of those, most are supportive of controls. In relation to current sanctions, Croatian elite athletes are not inclined to allow doping with only 2.3% of Sailors (Rodek et al., 2012) and 2.9% of rugby union players (Sekulic et al., 2014) favouring a permissive approach.

However, it is important to recognise that for some athletes doping controls have been deemed to be hypocritical and symbolic (Pappa & Kennedy, 2012) and athlete contradictions do exist with some calling for a zero-tolerance approach through lifetime bans, whereas others favoured a two year sanction (Kirby et al., 2011). Further, there is evidence to suggest that athletes have developed negative attitudes towards anti-doping work because they perceive parts of it, such as the whereabouts information system, to be inconvenient, frustrating and unfair (Hanstad et al., 2009). Although based on a limited sample of elite athletes to date, a number of areas for improvement are identified in order to increase athlete satisfaction and buy-in to anti-doping controls (Valkenburg et al., 2013). Of paramount importance is the need to ensure athletes themselves are engaged in this process of improvement (Valkenburg et al., 2013) and anti-doping authorities acting with full transparency and fairness (Kirby et al., 2011; Sefiha, 2012).

Anti-doping knowledge and education

Few studies have examined elite athletes' opinions on the current provision of anti-doping education (Amatya, 2009; Dunn et al., 2010; Johnson et al., 2013; Kim et al., 2011). Those that are available suggest a lack of understanding of the decisions underpinning current rules and regulations (i.e., why some substances are on the Prohibited List, when others are not) and the view that current education experiences make little contribution to doping deterrence (Johnson et al., 2013). In a study of 974 elite Australian athletes and 26 key experts on illicit drug use, Thomas and colleagues (2011) recognised that there may be stigma attached to any information seeking within a sports club or organisation. Therefore, they call for improvements in the accessibility to creditable information via the Internet. They cautioned against workshop delivery of illicit drug education as there was a specific plea for "no more workshops please!" (Thomas et al. 2011).

Overall, studies have exposed incomplete knowledge and understanding of the anti-doping rules and regulations (Bhambhani et al., 2010; Loraschi et al., 2014; Mottram, Chester, Atkinson, et al., 2008). This leaves elite athletes at increased risk of committing anti-doping rule violations. A recent multinational study observed poor

knowledge and understanding of over-the-counter medications in relation to anti-doping (Mottram, Chester, Atkinson, et al., 2008).This finding is particularly concerning given 66% of the survey respondents had been subject to in- or out-of-competition testing. On average, elite Italian cyclists could only name three doping agents in response to an open-ended question and correctly identify 50% of banned substances on a fixed item list (Loraschi et al., 2014). Similarly, in a sample of high level sailors (N=44) 46% self-reported poor or no knowledge on doping (only 2% self-reported their knowledge to be excellent) (Rodek et al., 2012). A lack of knowledge on the risks inherent to NS use has also been highlighted (Chan, Hardcastle, Lentillon-Kaestner, et al., 2014). Further studies considered broader experiences of athletes' involvement with doping controls; these will be examined later.

Source of doping/anti-doping information

Studies showing a fragmented (anti-) doping knowledge base are in line with observations that elite athletes mostly learn about doping from non-medical sources. Numerous studies have also demonstrated athletes' mistrust regarding physicians' knowledge of doping and doping-related problems (Sekulic et al., 2008; Sekulic et al., 2010; Sekulic et al., 2014; Zenic et al., 2010). Consequently, and notwithstanding questionable methodological reliability, numerous studies show that elite athletes place considerable trust in the Internet as a key source of doping-related information (e.g., Lentillon-Kaestner & Carstairs, 2010; Loraschi et al., 2014; Ohl et al., 2013; Sas-Nowosielski & Świątkowska, 2007; Thomas et al., 2011), followed by newspapers, radio and television (Lentillon-Kaestner & Carstairs, 2010; Loraschi et al., 2014).

While coaches were also cited as a key source (Johnson et al., 2013; Kim et al., 2011; Kirby et al., 2011; Kondric et al., 2013; Rodek et al., 2012), athletes have declared mistrust with their coaches on doping-related matters (Kondric et al., 2013: Rodek et al., 2012). Further, Johnson and colleagues (2013) raised the idea that rumours and hearsay dominate mass media information. Meanwhile, Lentillon-Kaestner and Carstairs (2010) raised fears that media attention may make athletes more interested in doping.

In addition to being a source of information, coaches, parents and team doctors are viewed as significant agents who *could* exert social pressure and influence athletes' motivation and intentions to use banned performance-enhancing substances (Chan, Hardcastle, Lentillon-Kaestner, et al., 2014; Huybers & Mazanov, 2012; Pappa & Kennedy, 2012). Equally, when athletes move away from the positive role modelling of a coach who has a strong anti-doping stance, they may succumb to the temptation to dope (Pappa & Kennedy, 2012) to comply with a new coach's instructions even if they were told to use banned PEDs (Chan, Hardcastle, Lentillon-Kaestner, et al., 2014; Lentillon-Kaestner & Carstairs, 2010). Early career athletes may be particularly sensitive to coach instruction (Huybers & Mazanov, 2012). Other work has questioned the role of the coach in shaping doping attitudes and behaviour (Kirby et al., 2011) and further research is justified. Finally, from the point of view of harm-minimisation, two of five sanctioned athletes noted the value and importance of having medical practitioners involved in the design of their doping programme; one drew upon their own medical training when preparing their doping regime (Georgiadis & Papazoglou, 2014).

Athletes receiving anti-doping education cited a variety of sources of support, including online tutorials from national anti-doping/sport organisations, Internet, media sources and physicians (Johnson et al., 2013). Typically, the content of official workshops or tutorials was heavily weighted towards raising awareness of substances on the prohibited list. Delivery was typically in workshops or online tutorials (Johnson et al., 2013). Yet, with elite female triathletes, anti-doping education was regarded as a formality rather than a serious education and means of learning about doping (Johnson et al., 2013). Probably, when athletes perceive anti-doping education as a 'tick-box exercise', effectiveness is undermined.

Summary

Although studies have sought to illuminate athletes' knowledge, attitudes and beliefs regarding PED use, as well as perceived use and doping control processes, the methods used to examine the variables are diffuse. This limits our ability to draw meaningful conclusions. However, studies point to a limited knowledge and

understanding of some of the key matters directly affecting athletes' abilities to avoid inadvertent and unintentional doping. Similarly, when studies directly assess knowledge over behavioural practices, they are favouring a certain type of knowing; 'knowing that'. This form of knowing is distinctive from behaviour repertoires linked to 'knowing how' and the actual routines that are deployed in 'knowing to'. Studies are needed that address the links between these three types of 'knowing' in elite athletes. Given the legal and social consequences of committing an anti-doping rule violation, it is paramount that elite athletes are not ignorant to the anti-doping rules and regulations as they risk becoming a 'dopey-doper'.

Research highlights the existence of critical incidents or tipping points (e.g. career transitions, injuries, de-selection, etc.) in an athlete's career that renders them vulnerable to doping in sport. Anti-doping education can draw upon this evidence-base to ensure that interventions are offered appropriately during periods of stress and vulnerability. For example, an injured athlete could be offered a brief intervention at the point of injury. This might comprise an awareness programme that emphasises risks of inadvertent doping through the use of medication. At the same time, it would include lifestyle and psychological support ('know how' plus 'know to') to ensure athletes have the necessary resources to enable them to cope with the potentially overwhelming situations. Finally, elite athletes question and challenge the legitimacy of current doping controls. If the detection-deterrence approach is to remain, much work is needed to increase the perceived risk of detection and elite athletes' buy-in to current surveillance systems. This is particularly important given the findings that the media are a key source of information on doping in sport; stories of doping behaviour and corruption regularly feature in the news and perceptions of doping are higher than official estimates suggest.

Gym users

In relation to bodybuilders, power-lifters and/or gym users, 13 papers met the selection criteria and examined knowledge and attitudes (Ardito, Goldstein, Bahrke, & Sattler, 1994; Curry & Wagman, 1999; Kersey, 1993; Lindstrom, Nilsson, Katzman, Janzon, & Dymling,1990; Maharaj et al., 2000; Monaghan, 2002; Olrich, 1999; Olrich & Ewing, 1999; Pope, Kanayama, Lonescu-Pioggia, & Hudson, 1999; Schwerin & Corcoran, 1996a; Van Raalte, Cusimano, & Brewer, 1993; Wagman, Curry, & Cook, 1995; Wright, Grogan, & Hunter, 2001) with a specific focus on AAS. In these studies AAS users typically self-report being knowledgeable on doping-related matters, including the negative consequences, but for them the perceived and experienced benefits outweigh the potentially detrimental effects. Individuals reported having first-hand experience of steroids contributing to increasing muscle mass, enhancing performance and improving self-efficacy. Aligned with this, reasons for using steroids included increasing body size (Kersey, 1993; Wright et al., 2001) and strength (Ardito et al., 1994), improving performance/overcoming a plateau (Olrich & Ewing, 1999; Wagman et al., 1995) and physical appearance (Maharaj et al., 2000). Unlike elite athletes, who had been supportive of current testing approaches and called for more education in relation to doping, bodybuilders and power-lifters (especially AAS users) reported that existing prevention and doping control (i.e., testing) strategies were both ineffective (Ardito et al., 1994; Curry & Wagman, 1999; Wagman et al., 1995).

The new searches identified 24 published studies that investigated doping (including attitudes, beliefs, knowledge, use and intentions to use) among bodybuilders/weightlifters and gym users. The study designs were categorised into either descriptive (examining the knowledge, attitudes and beliefs, N=14) (Table 9) or predictive (of performance enhancing drug use/intentions, N=1 and AAS use, N=8) (Tables 10- 11).

Geographical spread

Three studies were conducted in the United States (Ip et al., 2010; Ip et al., 2011; Pope, Kanayama, & Hudson, 2012) and two in the UK (Boardley & Grix, 2013; Boardley, Grix, & Dewar, 2014), Germany (Brand, Heck, et al., 2014; Brand, Wolff, & Thieme, 2014), Canada (Goldfield, 2009; Goldfield & Woodside, 2009), Denmark (Bojsen-Møller & Christiansen, 2010; Christiansen & Bojsen-Møller, 2012), Sweden (Leifman, Rehnman, Sjoblom, & Holgersson, 2011; Skarberg, Nyberg, & Engstrom, 2008), and Iran (Allahverdipour, Jalilian, & Shaghaghi, 2012; Razavi, Moeini, Shafiei, & Bazmamoun, 2014). The remaining studies were conducted in Iraq (Habeeb, Kasim, Khamees, Hawi, & Khashoom, 2012), Jordan (Tahtamouni et al., 2008), United Arab Emirates (Al-Falasi et al., 2008), Bosnia and Herzegovina (Rodek et al., 2009), Poland (Posiadala et al., 2010), Brazil (Santos, da Rocha, & da Silva, 2011), Netherlands (Wiefferink, Detmar, Coumans, Vogels, & Paulussen, 2008), Cyprus (Kartakoullis, Phellas, Pouloukas, Petrou, & Loizou, 2008), and Australia (Dunn, Mazanov, & Sitharthan, 2009).

Sample

Of the descriptive studies, nine centred on bodybuilders (Boardley & Grix, 2013; Boardley, Grix, & Dewar, 2014; Brand, Heck, et al., 2014; Brand, Wolff, et al., 2014; Habeeb et al., 2012; Ip et al., 2010; Ip et al., 2011; Razavi et al., 2014; Santos et al., 2011), one focused specifically on weightlifters/powerlifters (Rodek et al., 2009) and the remaining six studies were with gym users more generally (Al-Falasi et al., 2008; Bojsen-Møller & Christiansen, 2010; Kartakoullis et al., 2008; Posiadala et al., 2010; Skarberg et al., 2008; Christiansen & Bojsen-Møller, 2012). In the predictive studies, all but one (Wiefferink et al., 2008) focused on the use of AAS. In this section there was a relatively even sample spread of gym users (Allahverdipour et al., 2012; Dunn et al., 2009; Leifman et al., 2011), bodybuilders (Goldfield & Woodside, 2009; Tahtamouni et al., 2008), weightlifters (Pope et al., 2012), and bodybuilders and weightlifters (Goldfield, 2009). Since definitions of bodybuilders, weightlifters and gym users are not offered as standard across the studies reviewed, the findings will be aggregated from this point on.

For the studies examining bodybuilders and gym users, sample sizes ranged from six (Skarberg et al., 2008) to 1752 (Leifman et al., 2011). Across the descriptive and predictive studies, there was a male bias with nine studies drawing their findings from all-male samples (Boardley & Grix, 2013; Boardley, Grix, & Dewar, 2014; Brand, Wolff, et al., 2014; Dunn et al., 2009; Habeeb et al., 2012; Ip et al., 2011; Razavi et al., 2014; Rodek et al., 2009; Santos et al., 2011). Ages of participants varied and it is not possible to offer a precise age range using the information provided in the study methods.

Method

As in the 2007 review, self-report cross-sectional surveys remain the method of choice across the new studies of gym users. Of the different study designs, two employed computerised measures of implicit attitude to assess their validity (Brand, Heck, et al., 2014; Brand, Wolff, et al., 2014), three deployed semi-structured interviews (Boardley & Grix, 2013; Boardley, Grix, & Dewar, 2014; Skarberg et al., 2008) and two studies applied content analysis to examine hundreds of enquiries made to the Anti-Doping Denmark website (Bojsen-Møller & Christiansen, 2010; Christiansen & Bojsen-Møller, 2012).

Studies predominantly focused on identifying correlates and determinants for AAS use or general PED use. Within the predictive papers that focused on PED use, the theory of planned behaviour (Allahverdipour et al., 2012; Wiefferink et al., 2008) and social cognitive theory (Wiefferink et al., 2008) were used to examine intentions to use AAS or PED use in general. Bandura's (1991) theory of moral thought and action guided both qualitative studies with bodybuilders (Boardley & Grix, 2013; Boardley, Grix, & Dewar, 2014). In sum, the descriptive studies covered five main topics in relation to AAS use: 1) attitudes, 2) beliefs, 3) knowledge, 4) socio-demographic correlates and 5) prevalence of use. Extending the line of enquiry within this population group, two studies explored the emergence of moral disengagement in relation to doping use (Boardley & Grix, 2013; Boardley, Grix, & Dewar, 2014) and two studies tested the validity of the brief implicit association test (BIAT) (Brand, Heck, et al., 2014; Brand, Wolff, et al., 2014).

Table 9. Overview of descriptive studies examining the doping knowledge, attitudes and beliefs of gym users.

Authors (year)	Country	Sample	Methods	Summary
Al-Falasi, Al-Dahmani, Al-Eisaei, Al-Ameri, Al-Maskari, Nagelkerke & Schneider (2008)	**United Arab Emirates**	**154 Gym users** 44% response rate 18 randomly selected gyms in Al-Ain city	**Cross-sectional** (Questionnaire) [Key Themes: knowledge, attitudes and use of AAS among gym users]	• High prevalence of AAS use (22%) among gym users in Al-Ain city. All users were male and had a lower level of education than non-users (p=0.008) • Main sources of AAS were fitness stores (53%) followed by trainers (26%) and friends (24%). • Almost all users (94%) had been taking nutritional supplements in addition to AAS for body building purposes, and 88% of the users thought that it's easy to obtain AAS and knew at least someone using it. • Main source of knowledge was friends (50%) followed by media (35%). • 7% of non-users were planning future use of AAS; 17% were unsure. 27% of the sample considered that the benefits of AAS use outweighed the risks. • 57% of study population considered use of AAS increased their masculinity. AAS users were more in agreement that AAS makes you a stronger athlete, more masculine, have bigger muscles, helps win competitions and to look physically better (all P<0.001). • Only 44% of the participants believed that AAS users should be punished.
Boardley & Grix (2013)	**UK**	**9 Bodybuilding AAS users** 8 Males, 1 Female Age range 20-30 years	**Cross-sectional** (In-depth semi-structured interviews) [Key Themes: eight mechanisms of moral disengagement] *Bandura's (1991) Theory of moral thought and action*	• Six mechanisms of moral disengagement were identified: (i) moral justification, (ii) euphemistic labelling, (iii) advantageous comparison, (iv) displacement of responsibility, (v) diffusion of responsibility and (vi) distortion of consequences (no support for dehumanisation or attribution of blame). • Three emergent themes related to (i) the routinisation of doping, (ii) discussing doping with family and friends, and (iii) progression from supplement use to doping • Considerable evidence that moral disengagement exists in bodybuilders using PEDs • Many participants had followed a consistent trajectory from supplement use to injectables-all supported by social agents within the gym environment.
Boardley, Grix & Dewar (2014)	**UK**	**64 Male Bodybuilders** Age range, 19 to 65 years (Mean = 32.26) 45 PED users	**Cross-sectional** (In-depth semi-structured interviews) [Key themes: Moral disengagement; deductive reasoning; Bandura's theory]	• Frequency analyses revealed six of the eight moral disengagement mechanisms, and two ('Sliding scale' and 'family and friends') of the three additional themes identified in Boardley & Grix (2013) were common across the sample. • Distortion of consequences (i.e., "Steroids made to help sick people get better") was the most frequently recorded moral disengagement mechanism (54/64 bodybuilders). • Moral disengagement may help athletes circumvent health- and morality-based deterrents to doping, describe a process linking supplement and PED use and detail how some athletes may actively avoid social censure for doping by only discussing PED use with other known PED users from within their training environment.
Brand, Heck & Ziegler (2014)	**Germany**	**21 Bodybuilders** and 22 Handballers Mean age = 31 years for the bodybuilders (SD = 10.2)	**Cross-sectional** (Questionnaire and picture-based doping-BIAT) [Key themes: Test validation; Implicit attitudes]	• In the bodybuilders, indirectly measured doping attitudes were significantly less negative (eta^2 = .11). • The doping-BIAT and PEAS scores correlated significantly at r = .50 for bodybuilders, and not significantly at r = .36 for handball players. • There was a low error rate (7%) and a satisfactory internal consistency (rtt = .66) for the picture-based doping-BIAT.

Table 10. Overview of descriptive studies examining the correlates, reasons and motives for AAS use in gym users.

Authors (year)	Country	Sample	Methods	Summary
Brand, Wolff & Thieme (2014)	**Germany**	**61 Male Competitive Bodybuilders** Mean age = 30.36 ± 9.29 years old	**Cross-sectional** (Picture-based doping-BIAT) [Key themes: Reaction time-based attitude tests; biochemical tests; attitude-behaviour link]	• Prohibited substances were found in 43% of all tested urine samples. Dopers had the more lenient attitudes to doping (Hedges's g = −0.76). D-scores greater than −0.57 (CI95 = −0.72 to −0.46) might be indicative of a rather lenient attitude to doping. • In urine samples, common evidence of (i) using combinations of substances, (ii) complementary use of substances to treat side effects and (iii) use of stimulants to promote loss of body fat.
Bojsen-Møller & Christiansen (2010)	**Denmark**	**Gym users** (1398 enquiries to Anti-Doping Denmark's (ADD) web-based email service from AAS users or potential users)	**Secondary Analysis** (Content analysis of ADD counselling service enquiries over 18 months) [Key themes: Socio-demographic correlates of ADD enquirer; doping intentions]	• ADD information service is generally used by males in their mid-20s who exercise in gyms and are not engaged in competitive sports. • Approx. 15% of the enquirers were users of AAS or other substances banned within elite sports by the World Anti-Doping Agency. An additional 15% had considered using such substances. • The present results suggest that there is a pronounced interest in the use of AAS and other APEDs among Danish gym members.
Christiansen & Bojsen-Møller (2012)	**Denmark**	**Gym users** (611 enquiries to Anti-Doping Denmark's (ADD) web-based email service from AAS users or potential users)	**Cross-sectional** Content analysis (ADD counselling service enquiries over 18 month period) [Key themes: Motives, interests, concerns about PED]	• AAS: Four different types of approaches were identified and inquirers' concerns analysed: (a) those that lacked knowledge on anabolic steroids, (b) those that had experienced side effects, (c) those that expressed knowledge of anabolic steroids, and (d) those that presented potential harm reduction dilemmas for the service. • Supplements: Lack of knowledge on the legal status of the supplements enquirers are consuming. • Based on the content of enquiries, the authors call for a harm-reduction approach in adjunct with zero tolerance approach.
Habeeb, Kasim, Khamees, Hawi & Khashoom (2012)	**Iraq**	**172 Male Bodybuilders** Age range approx. 19-44 years (41.9%= 20-24 years)	**Cross-sectional** (Questionnaire) [Key themes: AAS use; Substance use perceptions; relationship between substance use and socio-demographic characteristics]	• Two fifths of those who used AAS were 19 years old or younger, less than one half were overweight (body mass index = 25-29.9), two fifths of participants enjoyed exercise/training to an extreme level, two fifths of study participants highly perceived the improvement of athletic performance, two fifths strongly endorsed the importance of improving athletic performance. • Less than half of the participants used AAS and more than one third of AAS users were taking them as both oral tablets and intramuscular injection. • ¼ of participants using AAS had been influenced by their bodybuilding coach to use them.
Ip, Barnett, Tenemwicz, Kim, Hong & Perry (2010)	**USA**	**12 Female Bodybuilding AAS users** Mean age= 32.3 ± 11.7 years (range- 16-55) Drawn from a larger cohort of 1,519 strength training individuals recruited from web discussion boards	**Cross-sectional** (Questionnaire) [Key Themes: Socio-demographics; AAS use]	• Females reported using an average 8.8 APEDs. • Users tended to rate ''increase muscle mass,'' ''increase strength,'' and ''improve physical appearance'' as ''important'' or ''very important'' reasons for AAS use • Female AAS users practice poly-pharmacy. • Compared to males users and female non-users (larger study) female AAS users are more likely to have qualified for substance-dependence disorder, been diagnosed with a psychiatric illness (i.e., bulimia nervosa and attention deficit hyperactivity disorder) and/or have a history of sexual abuse. • Users experienced clitoral enlargement (75.0%) and irregular menses (50%). • More than 90% of AAS users reported plans to continue future AAS use.

Table 10 Continued.

Authors (year)	Country	Sample	Methods	.Summary
Ip, Barnett, Tenemwicz & Perry (2011)	**USA**	**1277 Male Bodybuilders** (506 self-reported AAS users; 771 self-reported non users)	**Cross-sectional** (Questionnaire - Anabolic 500, a 99-item Web-based survey) [Key Themes: AAS use; substance dependence disorder]	• Most (70.4%) AAS users were recreational exercisers who reported using an average of 11.1 performance-enhancing agents in their routine. • Primary motivations for initiating AAS use: Increase muscle mass, improve physical appearance and increase strength. • 55% of users obtained their AAS supply from local sources (friends, training partners, dealers). • Compared with nonusers, the AAS users were more likely to meet criteria for substance dependence disorder (23.4% vs. 11.2%, $p<0.001$), report a diagnosis of an anxiety disorder (10.1% vs. 6.1%, $p=0.010$), use cocaine within the past 12 months (11.3% vs. 4.7%, $p<0.001$), and report a history of sexual abuse (6.1% vs. 2.7%, $p=0.005$).
Kartakoullis, Phellas, Pouloukas, Petrou & Loizou (2008)	**Cyprus**	**532 Gym users** 59.6% Male Sampled from 22 gyms in Cyprus	**Cross-sectional** (Questionnaire) [Key Themes: Relationships between socio-demographic variables and doping; Opinions on issues concerning doping control]	• 8.3% had used or were using prohibited substances to improve their gym performance. • Higher frequency of prohibited substance use in males and amongst competitive sport participants and bodybuilders. No differences noted across socio-economic status • Use of prohibited substances most common in those undertaking 10+ hrs. exercise per week. • Nearly 82% of participants agree that doping control discourages athletes from using prohibited substances and 93.9% agreed that all professional athletes should undergo doping control. • 23% of PED users and non-users reported knowledge of other people who use PED (averaging 8 others). • 9.4% have been approached by someone who recommended the use of PED.
Posiadala SmorawiŃSki, Pluta & Marcin (2010)	**Poland**	**50 Gym users/ recreational athletes** (200 General public) (Age range 19-45 years)	**Cross-sectional** (Questionnaire) [Key Themes: Public perceptions of doping in elite v. recreational sport]	• The majority of AAS users were from individual sports/activities, particularly amateur weight-lifters/bodybuilders or martial artists. • Users were aware of the possible side effects, including addiction and contraindications to health and some users had experienced health problems. • Almost 90% of those who dope do it without supervision from a medical professional, although they are interested in receiving medical support (72%), particularly to deal with negative side effects.
Razavi, Moeini, Shafiei & Bazmamoun (2014)	**Iran**	**250 Male Bodybuilders** Age range- 15-45 years Mean age- 25.52 years	**Cross-sectional** (Questionnaire) [Key themes: AAS use; knowledge of AAS; side effects of AAS]	• 28.8% (n= 72) reported AAS use • 54% of AAS users were 25 years old or younger • 56.9% of users did not report side effects • AAS use showed significant association with exercise duration (in years) with users exercising for longer durations than non-users • AAS were recommended by peers (43.1%), coaches (36.1%), magazines (9.7%) and the Internet (6.9%) • There was no significant association between AAS knowledge and AAS use.

Table 10 Continued.

Authors (year)	Country	Sample	Methods	Summary
Rodek, Sekulic & Pasalic (2009)	**Bosnia and Herzegovina**	**27 Male Weightlifters/Power lifters** Age range 20-37 years	**Cross-sectional** (Questionnaire) [Key themes: Religiousness, socio-demographics, supplements; doping use]	• More than half believe doping is used regularly in their sport. • 2/3 use doping 'regularly' or 'occasionally' • Religiousness can be considered as a potential protective factor against actual and future doping behaviours (but not alcohol consumption) • Participants with a religious affiliation tend to deny and give low estimates of the doping behaviours in their sport.
Santos, da Rocha & da Silva (2011)	**Brazil**	**123 Male Bodybuilders** 52% had been practicing for more than 1 year	**Cross-sectional** (Questionnaire) [Key themes: AAS use; correlates of use; health effects; socialisation; motives]	• 66.6% had never used AAS and 33.3% were currently using or had previously used, AAS (with 95.1% between the ages of 18 and 35 years) • Use of PED was heavily weighted on more than 8 years and 10 + weekly hours of exercise. Participation in competitive sport and bodybuilding revealed significantly (almost three-fold) higher use of PED than participation in leisure and health/fitness. • 34.9% said it was a damaging drug and 32.5% related the use of AAS to specific treatments used to boost muscle development. • 35% of AAS users learned about AAS from other members in the fitness clubs. • Physical development (41%), improving aesthetics/appearance (26.5%) and to address health concerns (24%) were the main reasons for using AAS.
Skarberg, Nyberg & Engstrom (2008)	**Sweden**	**6 Weight Training AAS users** M (n=4) F (n=2)	**Cross-sectional** (In-depth qualitative interviews) [Key themes: AAS; Social background, development of total drug use and subjective experienced psychological and physical side effects]	• Significant variation in development of drug use in relation to social background, onset of drug use, relationship to AAS use and experience of AAS effects. • All began using AAS (typically in late teens) in association with gym training and had initially experienced positive effects from AAS. Over time, the negative experiences had outweighed the positive effects. • All were dedicated to excess training and took AAS in combination with gym training. • Common reason for AAS use was experience of reaching a plateau in training, leading them to seek possibilities for enhancement. Others started to increase body size and muscle strength. • 2 of 6 participants began using AAS because they wanted to compete in bodybuilding and they believed AAS use was essential for success in that field. • Use of multiple drugs was common either in parallel with AAS use or serially. • Most described their early experiences of AAS as definitely positive

Table 11. Overview of studies that employed regression analysis to identify variables that were predictive of doping intentions/doping use in gym users.

Authors (year)	Country	Sample	Method	Independent (I) / Dependent (D) variables	Key Findings
Allahverdipour, Jalilian, & Shaghaghi (2012)	**Iran**	**253 Male Gym Users** Mean age, 22.2 years (range 15 - 28 years) 83% response rate	**Cross-sectional** (Questionnaire) *Theory of planned behaviour*	I: Attitude, subjective norms and perceived behavioural control D: AAS use intentions	• Nearly 53% and 54% of participants reported that their coaches and friends were AAS users (86% of AAS users had coaches with history of AAS use, while among non-users it was 43%) • Achieving attractiveness (68%) and improving athletic performance (31%) were the main motives for AAS use. • The three predictor variables of (1) attitude, (2) subjective norms, and (3) perceived behavioural control accounted for 63% of the variation in the intention to use AAS.
Dunn, Mazanov & Sitharthan (2009)	**Australia**	**214 Male Gym Users** Mean age, 30 years; range, 17-61 years	**Cross-sectional** (Questionnaire)	I: Body image; Patterns of exercise D: AAS use; AAS use intentions	• 16% reported they would use AAS in the future • Reasons for future use included increasing muscle size (80%), improving appearance (74%) and increasing strength (57%) • 80% reported use of NS and 52% reported using illicit drugs in the preceding 6 months • Significant predictors of AAS use intentions included past 6 month use of creatine (OR= 2.9; 95% CI: 1.4-6.0, p= 0.03) and knowing AAS users (OR= 4.1, 95% CI: 1.8-9.6, p= 0.001)
Goldfield (2009)	**Canada**	**20 Female Bodybuilders** Mean age 26.3 ± 3.6years **25 Female Weight trainers** Mean age 27.3 ± 5.7 years	**Cross-sectional** (Questionnaire)	I: Weight training Discipline D: Eating pathology; AAS use	• High rates of weight and shape preoccupation, body dissatisfaction, bulimic practices, and anabolic steroid use were reported among competitive female body-builders and to a lesser degree, recreational female weight-training controls. • Differences between groups on general psychological factors were not statistically significant and effect sizes were small. • Competitive female body-builders appear to share many eating-related features with women with bulimia nervosa but few psychological traits.

Table 11 Continued.

Authors (year)	Country	Sample	Method	Independent (I) / Dependent (D) variables	Key Findings
Goldfield & Woodside (2009)	**Canada**	**50 Male Bodybuilders**	**Cross-sectional** (Questionnaire)	I: Body image, psychological characteristics, weight and shape preoccupation D: Eating pathology; AAS use	• Ten subjects were classified as currently using anabolic-androgenic steroids, 12 were former users, and 28 had never used steroids. • Compared with former users and non-users, current steroid users reported higher scores on weight and shape preoccupation, body dissatisfaction, drive for increased muscle tone, depression, ineffectiveness, perfectionism, and interpersonal distrust. No differences emerged between former users and non-users.
Leifman, Rehnman, Sjoblom & Holgersson (2011)	**Sweden**	**1752 Gym users** Mean age: 33 years 68% Male	**Cross-sectional** (Questionnaire and observations) [Key themes: Prevalence of AAS use; Risk factors for AAS use]	I: Socio-demographic variables; supplement use D: AAS lifetime use	• 3.9% of men reported lifetime use of AAS, 1.4% use during the past 12 months and 0.4% AAS use during past 30 days. For females, 0.2% reported lifetime use but no use in past 12 months or 30 days. • Analyses of individual predictors showed that AAS users were almost always young men, regular weight trainers and more often users of drugs and nutritional supplements. • The higher prevalence of AAS use among gym users than in the general population makes the former an appropriate target group for AAS prevention.
Pope, Kanayama & Hudson (2012) Monitoring the Future Surveys 1991-2007	**USA**	**233 Male Weightlifters** Age range: 18-40 years 77% had over 5 years weightlifting experience	**Cross-sectional** Cohort design (Structured clinical interviews and computerised questionnaires)	I: Childhood and family attributes; Demographics; Adolescent attributes D: AAS use	• 102 (44%) reported lifetime AAS use • Many attributes showed little association with AAS use, but conduct disorder and body image concerns showed strong associations. • For individuals with prior conduct disorder versus those without, the hazard ratio (95% confidence interval) for subsequent AAS use was 2.2 (1.5, 3.4). • For individuals in the middle versus lowest tertile of scores on a retrospective adolescent muscle-dysmorphia scale, the hazard ratio was 1.5 (.84, 2.6); for the highest versus lowest tertile, the hazard ratio was 3.3 (2.0, 5.3).

Table 11 Continued.

Authors (year)	Country	Sample	Method	Independent (I) / Dependent (D) variables	Key Findings
Tahtamouni, Mustafa, Alfaouri, Hassan, Abdalla & Yasin (2008)	**Jordan**	**154 Bodybuilders** 503 University Students Gender not stated	**Cross-sectional** (Questionnaire)	I: Socio-demographic, attitudes D: AAS use	• Prevalence of AAS use was 26% for the bodybuilder (4.2% in University students). • Majority of users were in the 18-29 year old age group. 57% began using AAS between 15-18 years old • Two main reasons for using AAS for students and bodybuilders were improving athletic performance (44 and 62% respectively) or enhancing their physique (56 and 39% respectively). • 77% of the users used more than one AAS at any given time. • Sources of AAS were mainly a friend (35.7%) or a coach (42.9%).
Wiefferink, Detmar, Coumans, Vogels & Paulussen (2008)	**Netherlands**	**144 Gym users** 84% Male Age range: 14–65 years, with a mean age of 32 years	**Cross-sectional survey** (Questionnaire) *Theory of planned behaviour* *Social cognitive theory*	I: Attitudes; Social influences; Self-efficacy; Satisfaction with appearance; knowledge D: Intentions; Past use	• The most important predictors were personal norms, beliefs about performance outcomes and the perceived behaviour of others. • Non-users held more restrictive norms about using performance-enhancing drugs, were less optimistic about the performance-enhancing outcomes and believed that fewer significant others used performance-enhancing drugs than users and ex-users.

Prevalence of doping use

In the studies exploring prevalence among gym users and bodybuilders, rates ranged from 1% to 100% (in the studies that specifically sampled AAS users). In studies that did not target doping users, lifetime use ranged from 3.8% in a sample of 1752 gym users in Sweden (Leifman et al., 2011) to 45% in a sample of bodybuilders recruited from a private gym setting in Iraq (Habeeb et al., 2012). In a study comparing PED use in Jordanian college students and bodybuilders, 4.2% of college students were current users, while the percentage rose to 26% among bodybuilding athletes (Tahtamouni et al., 2008). However, the authors of the Jordanian paper suggest that conversations with coaches embedded within the gyms sampled proposed a higher figure. Studies also highlighted the dynamic nature of AAS use behaviour; Wiefferink et al. (2008) reported that 29% of their sample intended to use PEDs in the future. Al-Falasi et al. (2008) found that 17% of the male gym users were unsure whether or not they would use AAS in the future and 7% self-reported their positive intention to use.

Doping attitudes and beliefs

In advancing the science of attitude measurement and responding to the challenges of socially desirable responding when addressing a taboo subject such as doping in sport, Brand and colleagues (2013, 2014) have developed and validated a picture-based doping BIAT to indirectly measure athletes' attitudes towards sport. Drawing from a sample of bodybuilders and handballers, indirectly measured doping attitudes were significantly less negative ($eta^2 = .11$) in the bodybuilder group compared to the handball group, indicating that bodybuilders are at increased risk of doping compared to handballers (Brand, Heck, et al., 2014). Bodybuilders' explicit attitudes, as measured by the PEAS, were also significantly correlated with the doping-BIAT ($r = .50$) but not among the handballers. The authors concluded that because the picture-based doping-BIAT constitutes a psychometrically tested method, the international research community should adopt this method to help advance understanding. Importantly, Brand, Heck, et al. (2014) have made all the test material available "open source" so they are freely available.

In terms of doping controls, less than 50% of male bodybuilders believed that AAS users should be punished. However, Kartakouillis and colleagues (2008) found greater support for punitive doping controls, as 94% of gym users in Cyprus believe that all professional athletes should undergo doping control. Nearly 82% of participants agree that doping control discourages athletes from using prohibited substances. Only 27% agreed that if an athlete is found to be using PEDs, then his/her whole team should face charges.

In a focused line of inquiry beyond doping attitudes, and through the integration of Bandura's (1991) social cognitive theory of moral thought and action, Boardley and colleagues (2013, 2014) have started to explore the presence of moral disengagement among bodybuilders. Initial findings offer support for the existence of moral disengagement and provide helpful insight into the mechanisms/socialisation processes that might facilitate moral disengagement. Through qualitative inquiry Boardley and colleagues have found support for six (moral justification, euphemistic labelling, advantageous comparison, displacement of responsibility, diffusion of responsibility & distortion of consequences) of the eight mechanisms. Diffusion and displacement of responsibility might be key mechanisms in the promotion of doping in the gym environment (Boardley et al. 2013). According to Bandura (1991) these mechanisms lead the user to believe that their actions are the result of social pressure and not something for which they are personally responsible (displacement) and in turn these actions are socially diffused in situations where there is a relatively large group of users (diffusion). Indeed, emerging from the participant narratives was a strong sense that the gym environment makes it acceptable to use PEDs because the behaviour is accepted and normalised. However, it is not yet clear which is the cart and which is the horse. Studies demonstrate that unspecified individuals who feature in the gym environment appear to influence the initiation of PED use.

Predicting PED use/intentions

The majority of studies focused on male-only populations and Pope et al. (2012) justified this decision based on previous research identifying that males are at greater risk of doping than females. In the few studies that compared male and females' use of PEDs (Bojsen-Møller & Christiansen, 2010; Kartakoullis et al., 2008; Wiefferink et al., 2008), findings once again justified purposive sampling; males self-reported higher prevalence rates than females. Despite a heightened risk amongst males, Ip et al. (2010) and Skarberg et al. (2008) showed that the practices, experiences and motives of female AAS using bodybuilders were not too dissimilar to males as they also reported concomitant use of multiple appearance and PEDs.

AAS using bodybuilders in the US were typically clustered in the 18 to 35 year age range (Santos et al., 2011; Tahtamouni et al., 2008). Equally, 57% of bodybuilding males in Jordan began their use between 15-18 years of age (Tahtamouni et al., 2008) and two fifths of UAE bodybuilding AAS users also reported first initiation earlier than 19 years (Al-Falasi et al., 2008). Similarly, AAS use was found to be particularly common among 15-25 year olds with 54% of bodybuilders who used AAS in Iran being 25 years old or younger (Razavi et al., 2014). In contrast, Pope et al. (2012) found that only 6% of their sample of AAS users initiated use before 17 years; they reported a user age range spanning 15-53 years (mean 22.8 yrs). Bodybuilders in Ip et al.'s (2011) study had a mean AAS initiation age of 24.5 years but again the age range was considerable (range 13-69 years). In the largest study in the field to have examined the behaviours of male bodybuilding AAS users (Ip et al., 2011), an average user is a 29-year-old single Caucasian male who attends college and has acquired at least a bachelor's degree. Similarly, the main users of the Anti-Doping Denmark enquiry service were also males in their mid-20s who exercise in gyms and who were not engaged in competitive sports (Bojsen-Møller & Christiansen, 2010). Together, these findings highlight that initiation of APEDs within a gym environment can vary considerably; this has significant consequences for doping

prevention as a primary prevention approach in isolation will not reach the middle-aged males who appear equally vulnerable to doping use.

The impact of competitive level is still to be carefully determined because few studies have systematically examined PED use across competitive levels. While Ip et al. (2011) found that the majority of AAS bodybuilding users in the US classified themselves as recreational exercisers rather than competitive bodybuilders, Kartakoulis et al. (2008) reported a higher frequency of PED use amongst competitive sport participants and bodybuilders in their sample of 532 Cypriot gym users. Related to competitive performance, Skarberg et al. (2008) noted that two out of the six AAS using weight-trainers that they interviewed initiated use to compete in bodybuilding as they believed AAS use was essential for success in that field. Further, reaching a plateau in training was also documented as a reason for initiating AAS use among weight-trainers (Skarberg et al., 2008).

Excessive training status typically defined the habits of PED users across these studies. To illustrate, all the patients who had sought treatment at an addiction clinic for AAS-related problems were dedicated to excess training and took AAS alongside gym training (Skarberg et al., 2008). Users seem to enjoy exercise to an 'extreme level' and use of prohibited substances is heavily weighted towards those undertaking more than 10 hours exercise per week (Kartakoullis et al., 2008; Posiadala et al., 2010; Santos et al., 2011; Tahtamouni et al., 2008). In addition to weekly thresholds, Posiadala and colleagues (2010) reported a threefold higher use of PEDs by those who had also undertaken more than eight years of participation in competitive sport and bodybuilding, compared to leisure, health and fitness participation. As a result, there appears to be a dose-response element to PED use and the use of AAS in particular is closely related to exposure to competitive gym training environments (Boardley & Grix, 2013; Boardley, Grix, & Harkin, 2014; Skarberg et al., 2008). Thus, there are multiple correlates of doping use and these factors are both acute and chronic.

The predictive studies on AAS use/intention have used inferential statistics to predict either current or lifetime AAS use or intention to use AAS based on a variety of demographic, lifestyle and social psychological variables. Beyond standard demographic assessments, these variables included (but were not limited to) attitudes (Allahverdipour et al., 2012), personal norms (Wiefferink et al., 2008), perceived behavioural control (Wiefferink et al., 2008), beliefs about performance improvement (Wiefferink et al., 2008), use of other illicit substances (Dunn et al., 2009; Leifman et al., 2011), supplementation behaviour (Dunn et al., 2009; Leifman et al., 2011), perceived use by others (i.e., subjective norms) (Allahverdipour et al., 2012; Wiefferink et al., 2008), knowing other users (Dunn et al., 2009), body image and physical attractiveness (Pope et al., 2012; Tahtamouni et al., 2008), weight-control/eating behaviours (Goldfield & Woodside, 2009; Pope et al., 2012), weight training behaviour (Leifman et al., 2011) and health and well-being compromising effects (Dunn et al., 2009; Goldfield & Woodside, 2009; Wiefferink et al., 2008).

Utilising a cross-sectional cohort design, Pope and colleagues (2012) calculated hazard ratios that showed men were at increased risk for subsequent AAS use if they reported (1) negative childhood relationships with their fathers, (2) rebellious risk behaviours, (3) lower self-reported adolescent physical attractiveness and athleticism, and (4) muscle dysmorphia. More specifically, those with a preoccupation with muscular body appearance demonstrated a 3.3-fold increased hazard risk for using AAS. Corroborating this risk factor, studies examining the motives for AAS use also noted that improving appearance and attractiveness were highly cited motives for gym users and body builders across the descriptive and the predictive studies (Al-Falasi et al., 2008; Allahverdipour et al., 2012; Dunn et al., 2009; Goldfield & Woodside, 2009; Ip et al., 2010; Ip et al., 2011; Santos et al., 2011).

Similarly, muscle modification (i.e., increasing size or improving tone) was also found to be a compelling goal for using AAS (Allahverdipour et al., 2012; Dunn et al., 2009; Goldfield & Woodside, 2009; Ip et al., 2011). Indeed, Allahverdipour et al. (2012) and Dunn et al. (2009) noted participants were twice as likely to endorse body aesthetics modification as a

reason for using AAS over athletic performance enhancement. Similarly, Ip and colleagues (2011) also noted that the importance of increased muscle mass and improved physical appearance outweighed the perceived importance of improved sports performance in a large sample of strength training males. These findings are, however, in contrast to those found in Jordanian bodybuilders (Tahtamouni et al., 2008) whose primary self-reported motive for AAS use was improved athletic performance (62% agreement) followed by physique enhancement (39%). Alongside these physique modification findings, Dunn and colleagues (2009) observed a 6-fold increased risk of future AAS use by those reporting frequent weight training (>3-4 times per week). Consistent with this, Pope et al. (2009) also found that AAS users had lifted weights for longer and were more muscular and Wiefferink et al. (2009) offered further strength to the association between weight training and PED use.

In addition to the pursuit of body modification and the drive to improve appearance and attractiveness, the use of NS continues to be identified as a strong predictor of current/lifetime use of AAS and AAS intentions. Descriptive analyses illustrated that AAS users reported an increased frequency of supplement use compared to non-users (Allahverdipour et al., 2012; Dunn et al., 2009; Goldfield & Woodside, 2009; Leifman et al., 2011). For example, 98% of AAS users in Allahverdipour et al.'s (2012) study reported supplement use compared to 76% of non-users. Similarly, when examining the predictors of lifetime AAS use, Leifman and colleagues (2011) found that the use of supplements (more than twice a week) increases this risk almost three-fold. Shifting to future AAS users, they are also over two and a half times more likely to report the use of creatine and amino acids compared to those self-reporting no intention to use AAS (Dunn et al., 2009). Extending this relationship further, studies consistently demonstrate that exposure to the gym environment supports the transition from supplement use to oral PED use and then to injectables (Boardley & Grix, 2013; Boardley, Grix, & Dewar, 2014). Peers within the gym setting are known to advise those currently using NS to add AAS and other hormones to enhance the effects of their training (Skarberg et al., 2008). In addition, significant

predictive effects of such exposure were also noted for narcotic use (Dunn et al., 2009) and for smoking and alcohol use (Allahverdipour et al., 2012).

Perceived use of AAS and PEDs by others also emerged as possible determinants for current and future AAS/PED use. To illustrate, future AAS users were over four times more likely to indicate that they knew others using AAS (Dunn et al., 2009). Beyond AAS use, perceived use by others also significantly predicted more general gym user PED intentions (Wiefferink et al., 2008). In sum, the argument that the presence, or even the *suggestion* of presence, increases the likelihood of doping use holds across multiple studies.

Sources of doping/anti-doping information

Santos et al. (2011) recorded that 35% of AAS users learned about AAS from other members in the fitness clubs and 12% of users also obtained their information from fitness centre instructors. Coach influence has also been acknowledged with 26% of male bodybuilders identifying that their bodybuilding coach had influenced their decision to use AAS and 64% of users signal that the coaching staff in their gym environment knew of their AAS use (Habeeb et al., 2012). Coaches and gym trainers were also identified as a key source of AAS information and supply across the studies reviewed (Habeeb et al., 2012; Santos et al., 2011; Tahtamouni et al., 2008; Wiefferink et al., 2008). Indeed, one study noted that 44% of AAS users obtained their supplies from their gym environment (members 24%, 'salesman' in gym 11% and instructor 9%) (Santos et al., 2011).

Again, the pivotal role of the Internet as an easy-to-access source of information was highlighted (Boardley & Grix, 2013). Acknowledging the Internet can be a source of factually incorrect information which poses a risk to PED users, Anti-Doping Denmark have embraced the positive potential of the Internet by offering an anonymous counselling service via their website. To identify and analyse differences in concerns and approach to the counselling service, two studies have over an 18-month period examined enquiries

made to the service (Bojsen-Møller & Christiansen, 2010; Christiansen & Bojsen-Møller, 2012). Approximately 15% of the enquirers were users of AAS or other WADA prohibited substances and another 15% were considering using such substances (Bojsen-Møller & Christiansen, 2010). Together, these studies underscore the interest in using PEDs among gym users shown elsewhere. Among enquirers the dominant themes addressed: (1) side effects of AAS and (2) concerns about receiving a positive doping test after the use of NS (Christiansen & Bojsen-Møller, 2012). A lack of detailed knowledge on AAS was again exemplified and the legal status of supplements was also a source of concern. In light of the enquiries related to the side effects of AAS use, a harm-reduction approach as an adjunct to the current zero tolerance approach to PED use was called for (Christiansen & Bojsen-Møller, 2012). If enacted, this approach would have the safeguarding of health and wellbeing of APED users at its core and would lessen the risk of naïve administration.

Summary

The highest prevalence rates for PED use have been identified among gym users and bodybuilders. As such, this group can be described as particularly high-risk for PED use; studies highlight such use is accepted and normalised by those within the gym environment. In particular, men in their 20s and 30s who undertake excessive training alongside clinical or sub-clinical body image concerns are at greatest risk of PED use. However, users do not always fit this prototype and longitudinal designs are now necessary to examine any causal relationships between socio-demographic variables, identified correlates/predictors and PED use. Currently, the role of competitive level is also difficult to determine due to the research designs employed to date.

At the same time, existing evidence suggests that the non-competitive gym environment elicits the greatest prevalence rates for PED use. Within this setting, socialisation processes appear to support the transition from habitual NS use to oral PED use and then to injectable PED use. In light of the study findings within this section, competitive athletes accessing this setting to legitimately improve their sporting performance may become

vulnerable to using PEDs. No studies have assessed how well these athletes can be supported to reduce the susceptibility to doping inherent in exposure to this high-risk environment. Similarly, individuals who regularly use NS are another discrete group that may benefit from targeted interventions, given their high-risk for future doping use. Indeed, the connection between NS, illicit drugs and PEDs suggests that effective prevention programmes may best focus on several determinants of PED use.

Since the 2007 review, there has been an increase in the volume of research conducted on gym users and bodybuilders who self-report doping. Once again, exploring the use of AAS prevails while the application of theoretical frameworks to guide research questions remains limited. Equally, in the absence of established doping models and frameworks, there remains an absence of data-driven studies. The dominance of the theory of planned behaviour in the field is underscored once more as it shaped two of the four studies underpinned by a theoretical framework. Cross-sectional self-report questionnaires remain the method of choice; idiosyncratic and bespoke surveys make it difficult to accurately compare study findings. Still, novel methods have been developed in this target group (i.e., IATs). The emergence of qualitative studies exploring the lived experience of PED users is enriching understanding of this phenomenon. Indeed, future research in this area would benefit from more qualitative research with stronger commitments to longitudinal designs. An absence of longitudinal research designs makes it impossible to firmly establish causal relationships among the risk and protective factors identified in research to date. At best such relationships, where they occur, are concurrent. This limits our ability to develop effective interventions to reduce doping amongst gym users and bodybuilders. Finally, in light of the fact that many users examined in this section are not governed by the WADA Code (as they do not take part in organised competitive sport), multi-sector agencies could work together to consider the role of alternative policies and practices (i.e., harm-reduction) in addressing the use of PEDs. To protect competitive athletes entering the gym environment to support their training programme, it may be necessary to intervene in these risky environments by making PED use more problematic and unacceptable.

General Public

The previous report included four published studies examining the views held by the general public. Sample sizes ranged from 139–399 and consisted of non-athletic undergraduate students (all aged 18 + years). Three studies were conducted in the United States (Schwerin & Corcoran, 1992, 1996b; Van Raalte et al., 1993) and one in Australia (Grove & Paccagnella, 1995). All studies employed a cross-sectional survey design based on questionnaires to explore attitudes towards AAS users as compared with other drug users or athletes subject to other forms of stigmatisation (Grove & Paccagnella, 1995; Schwerin & Corcoran, 1992, 1996b; Van Raalte et al., 1993). The general findings indicated that AAS users were typically perceived to have more negative characteristics than non-users around trustworthiness, rule-orientation, integrity, honesty and self control, as well as their intelligence, happiness, confidence, relaxation and social assertiveness (Schwerin & Corcoran, 1992). There was also some evidence to suggest that the way in which an AAS user is presented might influence how they are perceived. Specifically, users are perceived in a less negative way when respondents are presented with a visual image, rather than a written description only (Schwerin & Corcoran, 1992, 1996b).

Searches resulted in the identification of 15 peer-reviewed published studies that examined correlates, attitudes and opinions towards doping in the general public. Six studies were conducted in Australia (Connor & Mazanov, 2009; Engelberg, Moston, & Skinner, 2012; Mazanov, Huybers, & Connor, 2012; Moston, Skinner, & Engelberg, 2012; Partridge, Lucke, & Hall, 2012; Partridge, Lucke, & Hall, 2014), with two papers reporting findings from the same data set (Engelberg et al., 2012; Moston et al., 2012). Two studies were conducted in Norway (Breivik et al., 2009; Solberg, Hanstad, & Thøring, 2010), two in Denmark (Singhammer, 2012, 2013) and Switzerland (Stamm et al., 2008; Stamm et al.,

2014). Single studies emerged from Poland (Posiadala et al., 2010), Sweden (Hakansson, Mickelsson, Wallin, & Berglund, 2012) and Finland (Mattila, Rimpela, Jormanainen, Sahi, & Pihlajamaki, 2010). A brief descriptive analysis of each study can be found in Table 13.

Sample

All studies included members of the general public and some included athletes (Breivik et al., 2009; Stamm et al., 2008; Stamm et al., 2014) or gym users (Posiadala et al., 2010) for comparison. Sample size ranged from 55 (Partridge et al., 2014) to just over 22,000 arising from a national household survey (Hakansson et al., 2012). Moston et al. (2012) and Engelberg et al. (2012) reported findings from the same sample of 2520 members of the Australian general public and Singhammer (2012; 2013) drew from the same sample when examining attitudes towards PEDs and methods. Eight studies reported gender details. Two studies only sampled males (Mattila et al., 2010; Singhammer, 2013) and a further study focused their statistical analysis on male respondent data only, due to the low number of females reporting AAS use (Hakansson et al., 2012). The remaining studies demonstrated a balance of males and females, as males comprised between 49% (Engelberg et al., 2012) and 64% (Breivik et al., 2009) of the samples. Seven studies reported the age range of respondents, with most ranges beginning at 18 years of age. The three studies that reported average age were in the range 46-54 years (Mazanov et al., 2012; Moston et al., 2012; Partridge et al., 2012).

Methods

All studies employed a cross-sectional survey design, gathering either data by closed questionnaire, or open-ended survey. With this population, interviewer-administered telephone interviewing dominated data collection; nine of the studies collected data in this way (Breivik et al., 2009; Connor & Mazanov, 2009; Engelberg et al., 2012; Moston et al., 2012; Partridge et al., 2012, 2014; Solberg et al., 2010; Stamm et al., 2008; Stamm et al., 2014). In these instances, doping themes were often drawn from a larger survey of the general public (e.g., Partridge et al, 2012). In an extension of an earlier study (Partridge et

al. 2012), Partridge et al. (2014) also conducted telephone interviews using an open-ended question format. The sentences or paragraphs of text obtained were then coded, using an unspecified analytical technique. Across these surveys, the dominant focus was on public perception of and attitudes towards doping, particularly its acceptability (Breivik et al., 2009; Engelberg et al., 2012; Partridge et al., 2012, 2014; Singhammer, 2012, 2013; Solberg et al., 2010; Stamm et al., 2008; Stamm et al., 2014).

Some researchers also investigated public perceptions of doping control, such as the appropriateness of sanctions (i.e., bans) and financial punishments (e.g., loss of sponsorship), as well as efforts to educate and provide information to athletes and support personnel (Breivik et al., 2009; Engelberg et al., 2012; Moston et al., 2012; Solberg et al., 2010; Stamm et al., 2008; Stamm et al., 2014). Beyond this, one study explored only one question, which presented members of the general public with the Goldman dilemma (Connor & Mazanov, 2009). Another study focused on public perceptions of the extent to which they believed doping was a problem in elite and recreational sport (Posiadala et al., 2010). Yet another study invited members of the public to rank the principles of the WADA Code "Spirit of Sport" statement in order of importance (Mazanov et al., 2012). The final two studies used logistical regression to analyse correlates of AAS use in Swedish (Hakansson et al., 2012) and Finnish males (Mattila et al., 2010).

Table 12. Overview of descriptive studies examining the doping knowledge, attitudes and beliefs of the general public.

Authors (year)	Country	Sample	Methods	Summary
Breivik, Hanstad & Loland (2009)	**Norway**	**428 General public** 64% males 18-35 years of age Also, 234 Elite athletes (within Registered Testing Pool, M: 151, F: 83, 16-51 years of age – >90% between 18-35, 45% Olympic or World Champions)	**Cross-sectional** (Telephone survey & athlete survey delivered by mail and email) [Key Themes: Attitudes towards existing legal and illegal means of performance enhancement in sport and hypothetical means of performance enhancement in sport, mental and social activities, as well as attitudes towards body modifications].	• The general public rejected the use of doping substances, as respondents reported that the use of substances to increase endurance (e.g., EPO) (79%), substances to increase strength (e.g., Anabolic Steroids and Growth Hormones) (93.1%) and substances that increase tolerance of hard training and pain during contests (e.g., Amphetamines) (95.7%) was unacceptable. • The public were significantly more eager (59.2%) to increase anti-doping efforts than the athletes (31.6%) (p=0.026). • Men believed more strongly that anti-doping work should be increased (52.9%) compared to women (42.9%) (p=0.026). • General public more accepting than athletes with regard to the use of ways of enhancing performance or appearance in other domains of life outside sport. However, 60-77% of respondents were not willing to engage in these practices, except for tattooing (48.7% not willing). • Males were more positive about the use of performance enhancement means in general, whereas females were more positive about body modification techniques.
Connor & Mazanov (2009)	**Australia**	**250 General public** 18+ years of age	**Cross-sectional** **(**Telephone survey) [Key Themes: Goldman dilemma]	• Only two respondents reported they would take the bargain offered by the dilemma - to take an illegal performance-enhancing drug that guaranteed an Olympic gold medal, but would kill you in five years' time. No analysis by demographic or sports engagement due to low rate of positives.
Engelberg, Moston & Skinner (2012) Same sample as Moston, Engelberg & Skinner (2012)	**Australia**	**2520 General public** Nationally representative sample Mean age = 46 years	**Cross-sectional** **(**Telephone interviews) [Key Themes: Attitudes and opinions on anti-doping policy and practice]	• 79.2% believed positive drug tests by athletes should be made public. • 68.5% agreed clubs should be penalised if their athletes were found using PEDs (54.3% agreed for recreational drug use), 91.2% agreed that companies should stop sponsoring athletes found guilty of using PEDs (75.8% agreed for recreational drug use) and 91.4% agreed the Government should stop providing financial assistance (78% agreed for recreational drug use). • Opinions were mixed regarding whether PED use should be criminalised and policed (53% in favour). • When asked why performance-enhancing drugs are banned, 77% of respondents stated that drugs give an unfair advantage, 20% stated negative health/side effects and 15% felt that drugs create false results/misrepresent skill.

Table 12 Continued.

Authors (year)	Country	Sample	Methods	Summary
Mazanov, Huybers & Connor (2012)	**Australia**	**168 General public** 50.3% males Mean age = 46.5 ± 16.7 years	**Cross-Sectional** (Questionnaire) [Key Themes: Opinions regarding a legalistic v. a harm-minimisation approach]	• The 11 Spirit of Sport attributes were ranked as follows in the aggregate model (Used Best-Worst Scaling): 1) ethics, fair play and honesty, 2) respect for self and other participants, 3) respect for rules and laws, 4) team work, 5) dedication and commitment, 7) health, 8) excellence in performance, 9) character and education, 10) community and solidarity and 11) courage. • With the authors focused on health, they reported that only those who did not follow sport prioritised health (2/11), with other demographic models failing to show a meaningful departure from the aggregate model.
Moston, Engelberg & Skinner (2012) Same sample as Engelberg, Moston & Skinner (2012)	**Australia**	**2520 General public** Nationally representative sample Mean age = 46 years	**Cross-sectional** (Telephone survey) [Key Themes: Perceptions of incidence and seriousness of drug use in sport, consideration for both performance enhancement and recreational use]	• 90.5% of respondents believed that performance enhancing drugs use in sport is a serious problem, with higher ratings from males than females. • Estimated prevalence of banned performance-enhancing drugs was 26.1% (±22.65, Median 20%) and use of banned recreational drugs was 33% (±22.88, Median 30%). Estimates were higher by females than males. • Performance enhancing drug use was most commonly associated with athletics (20.3%), weightlifting (19.4%) and cycling (17.8%). Recreational drug use was associated with Australian Football League (35.3% and rugby league (31.6%). • 99.2%/98.8% believed that athletes should take responsibility for PED and recreational drug use, respectively, as well as coaches (66.7%/49.2%), the club (65.2%/50.2%) and the governing body (61.6%/41.9%) to a lesser extent.
Partridge, Lucke & Hall (2012)	**Australia**	**1265 General public** 50% males Mean age = 53.7 years	**Cross-sectional** (Telephone survey; The Queensland Social Survey) [Key Themes: Perceived acceptability of, and familiarity with, the use of prescription drugs for cognitive enhancement v. PEDs in sport]	• 7% agreed that cognitive enhancement is acceptable; 2.4% of the total sample said they had taken prescription drugs to enhance their concentration or alertness in the absence of a diagnosed disorder, and a further 8% said they knew someone who had done so. • Only 3.6% (n=45) of participants agreed that people who play professional sport should be allowed to use performance-enhancing drugs if they wanted to. • 93% disagreed with legalised doping to any extent. • Gender, age and education were not significant predictors of agreement with legalised doping but attitude toward the acceptability of cognitive enhancement was. Participants who found cognitive enhancement acceptable were 9.5 times more likely to agree with legalised doping.

Table 12 Continued.

Authors (year)	Country	Sample	Methods	Summary
Partridge, Lucke & Hall (2014) Drawn from same sample as Partridge, Lucke & Hall (2012)	**Australia**	**55 General public** 50% male Mean age = 53.7 years	**Cross-sectional** (Telephone survey - open-ended questions) [Key Themes: Reasons underling public attitudes towards enhancement drugs]	• Participants held unfavourable attitudes towards both the use of drugs for cognitive enhancement (45/55) and "legalised doping" (53/55) • The reasons underlying attitudes towards both contexts overlapped and reflected four main themes: (1) regard for authenticity; (2) concerns about safety and side effects; (3) unfairness; and (4) proper use of medicines.
Posiadala, Smorawinski, Pluta & Andrzejewski (2010)	**Poland**	**200 General public** Also, 50 gym users aged 19-45	**Cross-sectional (Questionnaire)** [Key Themes: Public perceptions of doping in elite v. recreational sport]	• 82% believed that elite athletes dope, compared to 24% for recreational sport. The results and discussion of the paper focused on data from gym users so please refer to Table 9 for further information.
Singhammer (2012)	**Denmark**	**1703 General public** 15-60 years of age Response rate = 34%	**Cross-sectional** (web-based and postal, questions) [Key Themes: Age and gender variation in PED attitudes]	• Self-reported negative attitudes to drugs and methods enhancing cognitive abilities, performance and modifying appearance. More favourable attitudes on drugs for restoring physical functioning conditions. • Attitudes varied nonlinearly across age. Lenient attitudes peaked at age around 25 and subsequently decreased. Lenient attitudes to use of drugs against common disorders decreased in a linear fashion. • No gender differences were observed and attitude did not vary with level of education, self-reported health or weekly hours of physical activity.
Singhammer (2013) Same sample as Singhammer (2012; male only)	**Denmark**	**1045 General public** 100% males 15-60 years of age Response rate = 34%	**Cross-sectional** (web-based and postal, questions) [Key Themes: Attitudes; intentions to use AAS; type of sport]	• Average attitude scores were -1.16 (±0.89), on a scale of totally disagree (-2) to totally agree (2). • Individuals who had considered the use of AAS had more positive attitudes towards doping (1.8% used/had used of AAS and 5.3% had considered using AAS). • There were no significant differences in attitude scores across participants from different types of sports (Athletics, Ball, Rackets, etc.).

Table 12 Continued.

Authors (year)	Country	Sample	Methods	Summary
Solberg, Hanstad & Thøring (2010)	**Norway**	**925 General public** (M: 50.9%) Response rate = 16%	**Telephone Survey** [Key themes: Public attitudes and opinions towards doping]	• Doping was perceived to be more common among international athletes compared to domestic athletes (p<0.01) across 14 sports listed. • Among international athletes, doping was perceived most common in cycling (7.27), athletics (6.21) and boxing (6.07), where 1 is rare and 10 are very common. • Use of substances to increase endurance (e.g., EPO) (94.5%), substances to increase strength (e.g., Anabolic Steroids and Growth Hormones) (98.6%) and substances that increase the ability to tolerate hard training and pain during contests (e.g., Amphetamines) (98.7%) were unacceptable. • Largely in favour of tough responses to athletes and sports involved in doping. • Regression analyses showed the older people were most negative group in their attitude towards doping. In contrast, people who were interested in sport were most willing to accept doping.
Stamm Lamprecht, Kamber, Marti & Mahler (2008)	**Switzerland**	**5650 General public** 369 Elite athletes	**Telephone Survey (1995, 1998, 2001, 2004)** Questionnaires to elite athletes (1995, 2000, 2003, 2005/06) [Key themes: Public awareness; Perception of doping and anti-doping]	• Growing public awareness of doping issues 1995 to 2004 • Support for a comprehensive anti-doping strategy in Switzerland also increased, as 60% of respondents were for prohibition in 1995 and this rose to 86% in 2004. • General public held anti-doping attitudes. At all time points, over 90% of respondents viewed doping as damaging to sport's image, believed doping produces bad role models and felt that it contradicts the principle of fair play. • Despite this, a number of individuals reported that doping enables equal opportunities (1998=49.1%, 2001=33.6% and 2004=23.7%) and that doping is an inherent part of sport along with training (1998=22.3%, 2001=12.7% and 2004=13.9%). • The vast majority (90%+) of the Swiss population and top-level athletes support an anti-doping strategy that combines strict prohibition and sanctioning with informational and educational efforts.
Stamm Lamprecht, Kamber (2014)	**Switzerland**	**1013 General public (15-74 years)** **1,038 Elite athletes** Data from Stamm et al. 2008 also included for comparison	**Telephone Survey (2011)** Online questionnaire to elite athletes by Anti-Doping Switerland (2010) [Key themes: Public awareness; Perception of doping and anti-doping]	• Vast majority of general public and elite athletes advocate the strict prohibition of doping but there is a signicant difference between the general population (83% in favour of strict prohibition) and elite athletes (91%). • Over 95% of the general population and elite athletes agreed that 'Doping creates bad role models' • 68% of the general public and 49% of elite athletes agreed that 'Doping is part of a performance society'. This percentage has declined from 81% in 1998. • Proportion of respondents who claim that doping reduces their respect for sports has increased from 50% in 1998 to 80% in 2001 where it has more or less remained since then.

Table 13. Overview of studies employing regression analysis to identify sport/training specific predictors of AAS use in the general public.

Authors (year)	Country	Sample	Methods	Independent / dependent variable	Summary
Mattila, Rimpela, Jormanainen Sahl & Pihlajamaki (2010)	**Finland**	**10, 396 Military personnel** 96% response rate Median age 19 (range, 18-29 years)	**Cross-sectional** (Questionnaire) Finnish Conscript Health Survey	I: 13 Socioeconomic, health, and health behavioural background variables D: Lifetime non-medical AAS use Logistic regression	• Eighty-nine (0.9%) respondents reported having used AAS. In addition, 26 (0.3%) respondents reported that they would use AAS if they could obtain them. • The strongest associated factors were weight training at fitness centres more than three times a week [odds ratio (OR) 11.8; 95% CI: 7.1-19.6], low educational status (OR 3.7; 95% CI: 2.0-7.0), and weekly drunkenness as drinking style (OR 2.4; 95% CI: 1.4-4.5). • No sports other than weight training were associated with AAS use.
Hakansson, Mickelsson, Wallin & Berglund (2012)	**Sweden**	**22,095 General male population** 38% response rate 15 – 64 years	**Cross-sectional** (Postal and Online Questionnaire) National household survey	I: Demographic, financial situation, physical training, substance use D: Lifetime non-medical AAS use Logistic regression	• In hierarchical logistic regression analyses, lifetime users of AAS (males n = 240; females n=18,) were compared to all nonusers (n = 13,920) and to nonusers who reported that they had been offered AAS (males n = 487; females n=47). • Male only analysis calculated as weighted numbers, 46% of AAS users were 30 years or older & 35% were 40 years or older. 41% of AAS users regularly went to the gym or undertook physical training, compared to 22% of the non-user group. • AAS use was most strongly associated with a lifetime history of illicit drug use and the misuse of prescription drugs. • When controlling for substance use, AAS was associated with regular gym or other physical training and lower education • Illicit drug use and misuse of prescription drugs separated AAS users from nonusers who had been offered AAS. • Negative association between AAS use and higher education. Lifetime use of AAS appears to share common characteristics with illicit substance use. Both substance use variables and physical training remained associated with AAS use when controlling for one another.

Doping attitudes and beliefs

All the recent studies assessing attitudes towards doping concluded that the majority of the general public report anti-doping attitudes (Breivik et al., 2009; Connor & Mazanov, 2009; Moston et al., 2012; Partridge et al., 2012, 2014; Singhammer, 2012, 2013; Solberg et al., 2010; Stamm et al., 2008; Stamm et al., 2014). In addition, Partridge et al. (2012) found that only 3% of respondents agreed that PEDs should be allowed in professional sport and 93% disagreed with the idea of legalising doping at any level. Two years later, the same authors corroborated this attitude when they noted that almost all (53/55) participants believed that legalised doping would be unacceptable (Partridge et al., 2014). Only four of their 55 participants agreed that cognitive enhancement was acceptable, but even they drew the line at Ritalin, over fears of addiction risk. Beyond this, large proportions of the general public felt that it was unacceptable to use substances to increase endurance (e.g., EPO), strength (e.g., AAS) and tolerance for hard training and pain during contests (e.g., amphetamines) (Solberg et al., 2010; Breivik et al., 2009). Similarly Danish members of the general public reported more favourable attitudes towards drugs that restore physical functioning compared to drugs and methods to enhance cognitive or performance capabilities (Singhammer, 2012). In other studies, respondents believed that doping damaged the image of sport (Stamm et al., 2008; Stamm et al., 2014) and gave performers an unfair advantage (Engelberg et al., 2012; Partridge et al., 2014). Indeed, the general public reported the importance of fair play, ethics and honesty (Stamm et al., 2008; Stamm et al., 2014), as well as having respect for sport rules and laws (Mazanov et al., 2012).

Almost all survey respondents from the general public samples perceived doping as a serious problem (Moston et al., 2012; Posiadala et al., 2010). For example, 90.5% of respondents believed that PED use in sport is a serious problem (Moston et al., 2012). Notably, the perceived scale of the doping problem varies across different sporting contexts and grew over time (Stamm et al., 2008; Stamm et al., 2014). Amongst the general population of Switzerland, the view that doping reduces their respect for sports has increased from 50% in 1998 to 80% in 2001 where it has more or less remained since then (Stamm et al., 2014). With regard to different contexts, doping was perceived as more common in elite sport versus recreational environments (Posiadala et al., 2010), international levels over domestic (Solberg et al., 2010),

while PED use was perceived as more common in sports such as cycling, athletics, boxing and weightlifting (Moston et al., 2012; Solberg et al., 2010).

When discussing anti-doping efforts, two thirds of the general public were keen to increase anti-doping efforts (Breivik et al., 2009). For example, members of the general public (79.2%) called for more transparency by making public all positive drug tests by athletes (Engelberg et al., 2012). They also believed that individuals, clubs or sports that have proven involvement in doping should be punished, including sponsors or the government withdrawing financial support (Engelberg et al., 2012; Moston et al., 2012; Solberg et al., 2010; Stamm et al., 2008; Stamm et al., 2014). In addition, they agreed that education must complement the prohibitive and punitive measures (Stamm et al., 2008). Reinforcing the public's opinion that more needs to be done to address doping in sport, only 54.5% of respondents felt that Australia's current anti-doping regime was effective in deterring athletes from engaging in doping behaviours (Moston et al., 2012).

While the majority of individuals expressed anti-doping attitudes, some were ambivalent and expressed empathy for those who dope (Stamm et al., 2008). Older people appear to hold more negative attitudes towards doping (Solberg, Hanstad et al. 2010; Singhammer, 2012) and Singhammer (2012) noted that doping attitude changes nonlinearly with age, with lenient attitudes peaking around 25 years. There was conflicting evidence regarding the role of sport. While Singhammer (2012) noted no influence of hours of physical activity on doping attitudes, Solberg, Hanstad et al. (2010) found people who were interested in sport were more willing than others to accept doping.

Correlates of AAS use among general public

With a focus on the correlates of AAS use in the general population, Hakansson et al. (2012) and Mattila et al. (2012) noted that the lifetime prevalence of AAS use was relatively low among Swedish (0.7%, weighted data) and Finnish (0.9%) males. Further, Mattila et al. (2010) found the AAS use was strongly associated with weight training at fitness centres, but not with other sports (walking, running, swimming, team sports, tennis, skiing and ice hockey). Specifically, in the age-adjusted models of health behaviours, weight training at fitness centres more than three times a week was the strongest associated factor for AAS use (OR 9.0; 95%

CI: 5.5-14.7). In this sample, lower educational status, frequent drunkenness and daily smoking increased AAS use even after adjusting for age. Similarly, in Sweden, regular gym or other physical training was associated with AAS use, even after controlling for illicit drug use and the misuse of prescription drugs (Hakansson et al. 2012). A negative association was once again noted between AAS use and attending higher education.

Summary

The body of research conducted with populations of the general public has increased since 2007. In particular, larger and more varied samples have been consulted which have moved beyond an earlier reliance on student populations to include a broader age range, balanced for gender. Nevertheless, the dominance of closed-question, cross-sectional surveys remains. Only Moston et al. (2012), Engelberg et al. (2012) and Partridge et al. (2014) included open questions although none reported in-depth, contextualised qualitative insights in their papers. Across the studies, the primary focus was on exploring attitudes and opinions. Overall, studies highlighted broadly intolerant views, favouring anti-doping policy and punishing those who fall foul of the rules. There were calls for more to be done to prevent doping in sport and a policy shift to legalising drugs in sport was not welcomed as such use was deemed to be unfair and unauthentic. In the future it might be beneficial to examine anti-doping knowledge as public perceptions might be influenced by the degree to which individuals are familiar with or knowledgeable of the topic of doping/anti-doping. In relation to AAS use in the general public, the importance of targeting prevention at those males participating in weight training at fitness centres was regularly emphasised. Interestingly, the preventative role that the general public might play regarding doping in sport and society was not considered and warrants investigation.

Intervention Studies

In the previous report, nine published studies reported the effects of anti-doping education or intervention programmes (Elliot et al., 2006; Goldberg et al., 1996; Goldberg et al., 2003; Goldberg, Bents, Bosworth, Trevsian, & Elliot, 1991; Goldberg, Bosworth, Bents, & Trevisan, 1990; Goldberg et al., 2000; Grossman & Gieck, 1992; Trenhaile, Choi, Proctor, & Work, 1998; Tricker & Connolly, 1996). All nine studies were conducted in the high school setting in the US and the majority sought to improve knowledge and attitudes and reduce intentions towards AAS use. Most were also involved in male power-related sports. It was evident that programmes that focus solely upon providing information on the effects of AAS are ineffective in reducing risk factors for use. Established intervention strategies – such as Goldberg and colleagues' Adolescents Training and Learning to Avoid Steroid (ATLAS) programmes - have adopted a comprehensive, multi-faceted approach to drug use prevention, addressing a range of psychosocial variables including peer and media resistance training, body image and self-esteem issues and alternatives to drug use.

In this updated review, eight papers were retrieved that described anti-doping education or intervention programmes; two studies present data from the Athletes Targeting Healthy Exercise and Nutrition Alternatives (ATHENA) programmes (Elliot et al., 2008; Ranby et al., 2009), one study assesses the effects of the Student Athlete Testing Using Random Notification (SATURN) – a mandatory random high school drug and alcohol testing programme (Goldberg et al., 2007), one presents a tutor perspective (showing the deliverer's viewpoint) on the United Kingdom 100% ME anti-doping programmes (Mottram, Chester, & Gibson, 2008), one evaluates the effectiveness of a training programme to enhance young athletes' ethical anti-doping decision-making skills (Elbe & Brand, 2014), and three evaluate brief interventions (Jalilian, Allahverdipour, Moeini, & Moghimbeigi, 2011; James, Naughton, & Petróczi, 2010; Laure, Favre, Binsinger, & Mangin, 2009).

Geographical spread

Three of the studies were conducted in the US (Elliot et al., 2008; Goldberg et al., 2007; Ranby et al., 2009), two in the UK (James et al., 2010; Mottram, Chester & Gibson, 2008) and one in France (Laure et al., 2009), Germany (Elbe & Brand, 2014) and Iran (Jalilian et al., 2011). An additional intervention study – conducted with Iranian bodybuilders – was also identified, but it was excluded from the review as it was only available as an abstract. Similar to Goldberg and colleagues, this education-based intervention promoted balanced nutrition and safe supplement use.

Sample

Across the eight studies (Table 15) the total sample was approximately 4438, with a mean of 556 participants per study. However, sample size varied from 69 (Elbe & Brand, 2014) to 1668 (Ranby et al., 2009). Four papers report on interventions conducted with high school athletes (Elliot et al., 2008; Goldberg et al., 2007; Laure et al., 2009; Ranby et al., 2009) and one study also focused on the youth level, but at the elite end of the participation spectrum (Elbe & Brand, 2014). Of the remaining three papers, two describe brief interventions with male recreational gym users (Jalilian et al., 2011; James et al., 2010) and the other represents an evaluation of the UK 100% ME anti-doping education programmes, from the perspective of 215 accredited tutors involved in programme delivery (Mottram, Chester, & Gibson, 2008).

Research design

Six studies used random assignment designs (Elbe & Brand, 2014; Elliot et al., 2008; Goldberg et al., 2007; Jalilian et al., 2011; Laure et al., 2009; Ranby et al., 2009). While the randomisation procedures were not clearly articulated, all these studies employed a control group to compare intervention effects. Employing designs with control groups adds an important level of scientific rigour and elevates these studies to a higher position in the evidential hierarchy. Across these studies, self-report questionnaires assessed behaviour, knowledge, attitudes and/or intentions before and after intervention delivery. In the case of the evaluation of the tutor network (Mottram, Chester, & Gibson, 2008), self-report data was gathered on the tutor training itself, the workshops that respondents had run as accredited

tutors, and on the tutors' opinions of the 100% ME programmes and UK Sport (who oversaw the programmes at the time). To determine the effects of the single exposure, knowledge-based information intervention James et al. (2010) combined a self-report questionnaire with a BIAT and used a repeated measures design. The effects of the single exposure, knowledge-based information intervention (James et al., 2010) were determined by a self-report questionnaire and a BIAT, using a repeated measures design. The ethical decision-making training programme for young elite athletes was examined via a change in self-reported doping attitude (as measured by a short-version of the PEAS) (Elbe & Brand, 2014)

Two studies specifically targeted females and addressed drug use in a wider context to include recreational substance use (alcohol, tobacco, marijuana), diet pill use and eating behaviours (Elliot et al., 2008; Ranby et al., 2009). Goldberg et al. (2007) evaluated the effects of non-punitive mandatory, random drug and alcohol testing programmes in a 2-year prospective randomised controlled study. Two studies recruited male gym users in a bid to address AAS use and erythropoietin (EPO) use, respectively (Jalilian et al., 2011; James et al., 2010). Elbe and Brand (2014) focused their ethical decision-making intervention in a German Elite Sport School.

Theoretical framework: Laure and colleagues (2009) considered the feasibility of increasing high school athletes' assertiveness, reasoning that these interpersonal skills could protect against doping in sport. Developing resistance skills is also a feature of the ATHENA programmes and Jalilian and colleagues (2011) have followed suit. Social learning theory informed the development of the ATHENA study (Elliot et al. 2008), a life skills perspective guided the study of Laure et al. (2009), while the theory of planned behaviour provided the theoretical framework for the study of Jalilian et al (2011). Elbe and Brand (2014) drew upon a method of dilemma discussion (Blatt & Kohlberg, 1975) in order to train ethical reasoning in the doping context. All remaining interventions were informed by previous research but did not refer to a particular theory or framework.

Timeframes: Duration of intervention and follow-up varied greatly from 24 hours to approximately 2 years. One study (James et al., 2010) completed baseline testing, intervention and post-testing within a 24-hour period, with no long-term follow-up. Laure et al. (2009)

undertook baseline testing before providing 2 x 2 hour education sessions, delivered 3-months apart, evaluating their effectiveness at the conclusion of the second session. Two interventions comprised six sessions of 60 min (Jalilian et al., 2011) and 30 min (Elbe & Brand, 2014). In both instances a pre-post test design was utilised with no follow-ups. Two studies (Elliot et al., 2008; Ranby et al., 2009) considered the long-term effects of the ATHENA programmes; Ranby and colleagues (2009) reported on the mechanisms by which the intervention produces changes in intentions for unhealthy behaviours. Overall, there have been few attempts to determine the optimum duration for an intervention programme and only a minority of studies have assessed effectiveness over an extended period of follow-up. In contrast, Mottram, Chester and Gibson (2008) did not deliver an intervention but instead explored the perspectives of those delivering on the former UK Sport 100% ME anti-doping education programmes.

Intervention Components

Long-term prevention programmes sought to improve participants' knowledge by providing information through coach-led, peer-facilitated, classroom-based sessions (Elliot et al., 2008; Ranby et al., 2009) and booklets all centred on providing advice on appropriate nutrition and weight training practices (Elliot et al., 2008; Ranby et al., 2009). Jalilian et al. (2011) adopted a similar approach to Goldberg and colleagues (2007) by focusing on healthy nutrition, training resistance exercise and the side effects of AAS abuse. Their intervention was also peer-led, emphasising group discussion. They provided a printed leaflet and an audio-visual CD to facilitate learning. Healthy nutrition also underpinned the brief intervention of James et al. (2010). This intervention provided participants with an information pamphlet on the beneficial effects of nitrate (found in the functional food beetroot) as a contrast to the synthetic, and banned, substance EPO.

ATHENA was the focus of two papers (Elliot et al., 2008; Ranby et al., 2009). The ATHENA programme is described as a gender-specific harm reduction and health promotion programme which addresses the association between females athletes, disordered eating behaviours and body-shaping drug use (Elliot et al., 2008). Targeted at team sports, ATHENA is a multi-component programme comprising 8 x 45-min classroom-based sessions facilitated by a coach, and led by a peer. The curriculum specifically targets modifiable risk and

protective factors associated with disordered eating and body-shaping drug use. Each classroom session comprises three to five activities to address issues like depression prevention, self-esteem, norms of behaviour, effects of media depictions of women, perceptions of healthy body weight, and societal pressures to be thin. Participants share healthy behavioural expectations, practice refusal skills, and create and present public service campaigns to discourage drug use and disordered eating practices. In their single exposure, knowledge-based information intervention, James and colleagues (2010) provided fact-based information on the comparable physiological effects of nitrate rich foods, such as beetroot, and synthetic EPO. Goldberg et al. (2007) considered the long-term effects of the drug and alcohol testing policies supported by the US federal government. Finally, the tutor network programmes of the now obsolete[9] UK Sport 100% ME anti-doping programmes formed the context of a UK-based evaluation (Mottram, Chester, & Gibson, 2008). UK Sport's 100% ME programmes was athlete-centred, focused on information dissemination and was compliance-driven.

Adopting a different approach to doping prevention, Elbe and Brand (2014) sought to establish and evaluate the effectiveness of a training programme to enhance athletes' ethical decision-making as it pertains to doping in sport. Each ethical decision-making session comprised three ethical dilemmas, with each dilemma presented in 5 – 10 sentences. Participants were asked to read each dilemma and then respond to a series of questions. An example dilemma involves an U16 footballer experiencing little time to recover and is suffering from a heavy practice load. One of his team members suggests taking a substance that increases the rate of recovery, leading the young footballer to think. Once the participants in the ethical decision-making training programme had read the dilemma, they were then asked to (i) consider if they would take the substance, (ii) write down as many arguments that support their decision, and (iii) rank their arguments. In the knowledge-based approach, participants completed a training programme that also comprised six sessions and was based on the German National Anti-Doping Agency's High Five Programmes (Elbe & Brand, 2014).

[9] UK Anti-Doping (UKAD) was formed in 2009 and this organisation is now charged with the responsibility of delivering ant-doping education in the UK. The 100% ME tutor network has given way to the UKAD Education Delivery network that comprises three tiers of deliverers; National Trainers, Educators and Advisors.

Efficacy and effectiveness

Effect size statistics (Eta-squared, Cohen's d10) were employed by Ranby and colleagues (2009) in their evaluation of the ATHENA programmes. They noted that the programmes produced small effect sizes in decreasing immediate post-test intentions to (i) use steroids (β =.123, z = - 3.09, p<.01, Cohen's d=.15) and (ii) to engage in unhealthy weight loss (β.148, z = -2.77, p<.01, d=.19), compared to participants in a control condition. Mediational analysis found that these effects were most strongly mediated by knowledge of AAS effects, social norms (perceived injunctive norms from the coach and from magazine advertisements) and self-efficacy for healthy eating to become a better athlete. Whilst intentions were influenced by the programmes, behaviour was not; at the 9-month follow-up ATHENA had a non-significant effect on AAS and creatine use (β =.001, z = 0.11, ns; ATHENA, M = 0.02,SD = 0.2; Control, M = 0.02, SD = 0.2, d = 0) and on unhealthy weight loss behaviours (β.=.020, z = -0.55,ns; ATHENA, M = 0.3, SD = 0.7; Control, M = 0.3,SD = 0.6, d = 0). Additionally, the intervention did not change peer norms or reported ability to resist unhealthy weight loss practices. Yet, the low post-test intentions were maintained 9-months later and predicted subsequent behaviour in a positive direction.

Elliot and colleagues (2007) also investigated the long-term outcomes of the ATHENA programme, finding that intervention participants had significantly less marijuana use (p<.05 for both last year and lifetime use). Further, reduced alcohol use indexed as 3-month (p<.01) and last year use (p<.05) was identified 1 to 3 years following high school graduation. However, the long-term effects were limited to these substances; there were no observed differences between the intervention and control groups in relation to self-reported use of other substances (e.g., legal highs, ecstasy, GHB, LSD) or overall use of diet pills, diuretics, laxatives or self-induced vomiting.

Random drug and alcohol testing has been considered as a way to deter potentially harmful behaviours. However, findings of the first prospective randomised control trial – SATURN – questioned this. Goldberg and colleagues (2007) found no differences between the

[10] Cohen suggested that d=0.2 be considered a 'small' effect size, 0.5 represents a 'medium' effect size and 0.8 a 'large' effect size. This means that if two groups' means don't differ by 0.2 standard deviations or more, the difference is trivial, even if it is statistically significant.

intervention versus control groups at any of four follow-up time points for 'in the past month' indices of illicit drug use, or a combination of drug and alcohol use. Furthermore, some substance abuse mediators also appeared to worsen over the intervention. More specifically, drug and alcohol tested (DAT) athletes were less convinced of (i) the benefits of testing ($p<.05$) and (ii) the idea that testing was a reason not to use drugs ($p<.01$). Therefore, the intervention appears to have called into question the legitimacy of the drug testing policies in schools. Clearly, further research is warranted.

Two of the studies significantly improved experimental participants' self-reported knowledge of the side effects of AAS use and benefits of nitrate (beetroot) supplementation (Jalilian et al., 2011; James et al., 2010). The double-edged sword of interventions was also highlighted (James et al., 2010) when an unanticipated change in knowledge pertaining to EPO was found. In particular, the intervention increased participants' knowledge of the effects of EPO, alongside the functional alternative nitrate (beetroot), following the intervention. The authors suggested that this could be due to their direct comparison used in the pamphlet provided. In this understanding, the intervention may have inadvertently alerted the participants to EPO as a potential PED. Jalilian et al. (2011) also reported significant changes in attitude amongst intervention subjects together with a decline in intention to use AAS. Attitude changes related to perceived improvements in sports performance and five other items, which were not described in the paper. This study found no significant behavioural effects in relation to AAS use following the intervention, although a significant decline in NS use was noted.

Also reporting unanticipated effects, Elbe and Brand (2014) noted a significant increase in PEAS doping attitude scores following the ethical decision-making training programme (there was no change in attitude scores in the knowledge-based intervention or control group). The authors conclude this finding could be an indication that the ethical decision-making training was successful in breaking up the athletes' "stereotypical style of reasoning about doping" (p.1) as they had been forced to think through issues that are not necessarily 'black and white'. Alternatively, and in line with the conclusions drawn by James et al. (2010), to account for the unintended consequences of their intervention, it is plausible that the intervention may have stimulated the young athletes' interest in PED use, leading to a positive change in doping attitudes. Having said this, it should be noted that prior to, as well as after the intervention, the

mean doping attitudes of the young athletes were low to very low (mean score of this six-item PEAS version was 8.77, SD = 3.68). Thus, doping was negatively evaluated across groups and it was almost impossible to further lower the PEAS scores (Elbe & Brand, 2014).

Laure and colleagues (2009) did not focus their attention on knowledge and attitudes; their dependent variable was assertiveness, as examined by the Rathus Assertiveness Schedule (Rathus, 1973). In their study the experimental group were exposed to a series of activities that aim to build self-assertiveness and participants responded with significant increases in assertiveness at the 3-month follow-up stage. The exact nature of this intervention is not fully explained in the article, making data interpretation challenging.

Finally, Mottram, Chester and Gibson (2008) offer an evaluation of a national anti-doping education programmes tutor network. The tutors delivered the UK Sport 100% ME campaign (contributing 334 workshops in total), with most tutors expressing a high or moderate degree of satisfaction with their training. Yet, only 63% of tutors felt competent to run a workshop after receiving the tutor-training course. Many requested more information concerning the action and use of the drugs most likely to be used in illicit performance enhancement.

There continues to be little research on anti-doping interventions and this creates an absence of evidence on intervention efficacy and effectiveness. Two studies presented further data from the ATHENA trials, meaning that the findings of only six novel interventions were disseminated through the academic community between the years 2007-2015. This represents a publication rate of less than one intervention study per year. Given the global reach of anti-doping policy and practice, these statistics are disappointing. However, given the challenges of recruitment and the high cost of intervention design, delivery and evaluation this situation is perhaps unsurprising. With the increased funding available to social science research via the International Olympic Committee's Anti-Doping Fund, we might find that this situation changes over the next decade or so.

Table 14. Overview of studies investigating doping prevention programmes.

Authors (Year)	Intervention Components	Summary
Elbe & Brand (2014) Programmes: Ethical Decision-making Training Programme Location: Germany	Quasi-experimental, pre-and post measurement design (2 weeks) Ethical-decision-making training programme: Six 30-min online sessions in which the participants had to work through 18 ethical dilemmas (five to 10 sentences) related to doping. Knowledge-based anti-doping programmes (German NADA's High-Five Programmes): Six 30-min online sessions N=69 Young elite athletes 34 males, 35 females 15.5 ± 2.4 years old Ethical training group (ET) (n= 30) Knowledge group (KT) (n=22) No-treatment control group (CT) (n=17, not randomly allocated) Short version of PEAS was administered to measure the effects of the trainings on doping attitude	• Prior to as well as after the intervention, the mean doping attitudes of the young athletes were low to very low, indicating that doping is evaluated negatively in all groups. Specifically, the mean score of this six-item PEAS version was 8.77 (SD = 3.68). Observed scores ranged from 6 to 24 (theoretical scale range = 6–36). • Descriptive group statistics for the dependent variable doping attitude indicate a statistically significant Group x Time interaction effect, F (2, 66) = 3.41, p < .05. • Post hoc contrast analyses (Scheffé) show that the observed interaction effect is driven by a significant increase of doping attitude scores in the ET, compared with the CG. This gives evidence that an intervention effect was reached neither in the KT nor in the CG • The observed slight increase in the doping attitude score was in the opposite direction than what was expected. Yet, the average PEAS values before and after the intervention are still in the bottom range of the scale. • The authors conclude this finding could be an indication that the ethical decision-making training was successful in breaking up the athletes' 'stereotypical style of reasoning about doping'.
Elliot, Goldberg, Moe, DeFrancesco, Durham, McGinnis & Lockwood (2008) Programmes: ATHENA Location: USA	Eight 45 min coach led, peer facilitated sessions integrated into team meetings. Females only. Intervention group (9 schools, n=368) - ATHENA curriculum delivered: Sports nutrition, strength training techniques, drug refusal skills, anti-steroid media messages. Response rate: 55% Control group (9 schools, n=389): Pre-printed materials: disordered eating, drug use and sports nutrition information. Response rate: 51% - Follow-up 1 to 3 years following high school graduation [Initial pre to post-season follow up reported in Elliott et al. 2004 and Elliott et al. 2006].	• 1 to 3 years following high school graduation, ATHENA intervention participants had significantly less marijuana use ($p < 0.05$ for both last year and lifetime use) and reduced alcohol use indexed as 3-month ($p < 0.01$) and last year use (($p < 0.05$). • No differences observed between the intervention and control groups in relation to self-reported use of other substances (e.g., club drugs, ecstasy, GHB, LSD: low baselines of <5%) or overall use of diet pills, diuretics, laxatives or self-induced vomiting. • More ATHENA programme participants know their daily energy requirement than individuals in the control group (66% intervention, 40% control, $p < 0.0001$). • The intervention group indicated a significantly heavier body image when asked to select the healthiest and the most attractive female physiques ($p < 0.05$ and $p < 0.01$, respectively).

Table 14. continued

Authors (Year)	Intervention Components	Summary
Goldberg, Elliot, MacKinnon, Moe, Kuehl, Yoon, Taylor Williams (2007) Programmes: SATURN: Student Athlete Testing Using Random Notification Location: USA	2-year prospective randomised controlled study Intervention group: Five intervention high schools with a random drug and alcohol policy (DAT Schools) (n=653) Control group: Six schools with a deferred policy (n=753). Measurement instrument: 121 item questionnaire	• Student-athletes from intervention and control schools did not differ in past 1-month use of illicit drug or a combination of drug and alcohol use at any of the four follow-up periods. • At the end of the initial school year and after 2 full school years, student-athletes at DAT schools reported less drug use during the past year ($p < .01$) compared to athletes at the deferred policy schools. • Combining past year drug and alcohol use together, student-athletes at DAT schools reported less use at the second and third follow-up assessments ($p < .05$). • DAT athletes across all assessments reported less athletic competence ($p < .001$), less belief authorities were opposed to drug use ($p < .01$), and indicated greater risk-taking ($p < .05$). • At the final assessment, DAT athletes believed less in testing benefits ($p < .05$) and less that testing was a reason not to use drugs ($p < .01$).
Jalililian Allahverdipour, Moeini & Moghimbeigi (2011) Location: Iran	- Longitudinal randomised pre-test - post-test series control group design. Theory of planned behaviour - 120 male gym users participated in this study as intervention (n=60) and control group (n=60). - Six 1 hour-sessions were delivered over a 2-month intervention period. Refusal skills against AAS use; proper nutrition and resistance training via group discussion printed leaflet, and audio-visual CD. The intervention was peer-led.	• At baseline, 20% of gym users reported that they had used AAS components • Participants also reported that 53.3% of their friends had used AAS and about 48.3% reported that their coach had used AAS. Of all respondents, 4.2% reported using of testosterone (4.2%) (Anadrol, 3.3%; Dianabol, 1.7%; Durabolin, 0.8%) • Significant improvements in average response for knowledge about side effects of AAS ($P<0.001$), attitude toward, and intention not to use AAS. • After intervention, the AAS use did not significantly decline, but supplement use did among the intervention group.
James, Naughton & Petróczi (2010) Location: UK	Brief intervention - Single exposure knowledge-based information intervention. - 115 male recreational gym users. - Information leaflet provided fact-based information on nitrate (beetroot) and erythropoietin as a comparison. - Self-report questionnaire (knowledge, beliefs) and brief implicit association test.	• The information based intervention significantly increased knowledge ($p < 0.001$), changed explicit beliefs in specific functional foods (FF) as a performance enhancer ($p < 0.001$) shifted the automatic association of FF with health to performance ($p < 0.001$). • The Internet (54/115) appears to be the dominant source of nformation on enhancement, followed by training partners (47/115) and friends (44/115).

Table 14 continued.

Authors (year)	Intervention Components	Summary
Laure, Favre, Binisinger, & Mangin (2009) Location: France	Brief intervention - Randomised controlled trial. - Pupils aged 10-16 of school sporting clubs. - Experimental (EXP) group: 2 x 2 hours, at three month intervals (M0 and M+3): law recall, information on self-medication, series of activities that build self-assertion (n=49). Control (CON) group, n=49. - Self-report questionnaire at M0 and M+3.	• At M0, mean Rathus' scores were similar in EXP and CON groups (4.9 – 4.3). They both rose three months later, but the increase was more significant in EXP (6.2) than in CON (4.5) group ($p<0.001$), especially among pupils aged 10-11 years, in sporting clubs made up of fewer than 20 pupils, and among pupils who practiced more than 10 hours of sports per week.
Mottram, Chester & Gibson (2008) Programmes: 100% ME Location: UK	Principal objective of 100% ME programme: provide accurate and up-to-date anti-doping information and education using outreach, ambassadors and accredited tutors. -Questionnaires delivered to 100% ME tutors (n = 215; 50.7% response rate). -Data analysis was largely limited to the 67 tutors who had run one or more workshops at the time of the survey.	• Reasons for taking on tutor role: Having a tutorship role as part of their job description, personal interest in the subject of doping in sport and continuing professional development. • Most tutors expressed a high or moderate degree of satisfaction with their training. • Only 63.3% of tutors felt competent to run a workshop after the tutor-training course. • Many requested more information concerning the action and use of the drugs liable to be employed for performance enhancement. • Approx. two thirds of tutors had been unable to accept some invitations to run workshops, with other commitments, timing and distance to travel to the venue as being the main barriers to education delivery. • Of the tutors who had run workshops, 85% were satisfied that they had fulfilled the educational needs of the audience.
Ranby, Aiken, Mackinnon, Elliot, Moe, McGinnis & Goldberg (2009) Programmes: ATHENA Location: USA	Randomised trial of 1668 female athletes who took part in 8 x 45 min coach-led peer-facilitated sessions integrated into team meetings during the sport season. ATHENA curriculum delivered: Depression prevention, mood and self-esteem, norms of behaviour, effects of media depictions of women, perceptions of healthy body weight, and societal pressures to be thin. Participants provided pre-test, immediate post-test, and 9-month follow-up assessments	• **Immediate effects:** ATHENA produced small effect size decreases in immediate posttest intentions to use steroids (β =.123, z = -3.09, p<.01, Cohen's d=.15) and to engage in unhealthy weight loss (β.148, z = -2.77, p<.01, d=.19) relative to control participants. • These effects were most strongly mediated by knowledge of steroid effects, social norms (injunctive) and self-efficacy for healthy eating to become a better athlete. • **9 month follow up:** No effect of ATHENA on steroid and creatine use (β =.001, z = 0.11,ns; ATHENA, M = 0.02,SD = 0.2; Control, M = 0.02, SD = 0.2, d = 0) and unhealthy weight loss behaviours (β.=.020, z = -0.55,ns; ATHENA, M = 0.3, SD = 0.7; Control, M = 0.3,SD = 0.6, d = 0). • Low post-test intentions were maintained 9 months later and predicted subsequent behaviour. The intervention did not change peer norms or reported ability to resist unhealthy weight loss practices

Doping Prevention Programmes

Reiterating the conclusions of the previous review, successful intervention strategies have adopted a comprehensive, multi-faceted approach to drug use prevention, addressing a range of psychosocial variables including resistance training, body image and self-esteem issues and functional alternatives to drug use. From a long-term perspective, the ATLAS and ATHENA programmes remain the most researched and monitored initiatives to date. However, the first meta-analysis in the field (Ntoumanis et al., 2014) quantitatively analysed the published findings of these interventions and showed a very small yet still significant, reduction in doping intentions, but no changes in doping behaviour. Ntoumanis and colleagues (2014) pointed to the content of the interventions and posited that floor effects might be in operation to explain the limited effectiveness of these programmes. For example, recruiting so many non-users leaves little room for improvement, making it very difficult to establish strong intervention effects. This signals the need for more sensitive/refined testing of intervention effectiveness. The findings of Elbe and Brand (2014) further collaborate this assertion in view of the low self-declared doping attitudes before and after their ethical decision-making training programme, leaving little room for improvement in the intervention outcome variable (attitudes). This represents a challenge to the field in general as self-declared attitudes, intention and doping behaviours are typically low across the studies evaluated and this should be taken into account when developing outcome-based measures to evaluate anti-doping intervention programmes.

Moving beyond ATLAS and ATHENA, Goldberg and colleagues (2007) also undertook the first prospective trial of the SATURN programmes in the US. Their findings raise questions on the efficacy of this detection-deterrence approach. Contrary to expectations, and instead of having positive effects on illicit substance and alcohol use, random drug and alcohol testing appeared to increase some of the risk factors associated with future substance use. Future research should consider the perceived legitimacy of doping control because that approach remains at the forefront of anti-doping policy and practice at a global level.

Overall, the conclusions of the previous review are corroborated; few have either been extended or challenged. Thus, with such limited strong new evidence, it is relevant to reiterate

the conclusions of Backhouse et al. (2007) that programmes which are effective in changing behaviours, attitudes or intentions relating to PEDs are characterised by:

- Delivery over longer periods (2-10 weeks) and comprising a number of teaching sessions rather than those delivered on a 'one shot' basis.
- Addressing a range of topics including drug and alcohol related issues, alternatives to drug use (e.g., nutrition, training methods) and media / peer pressure resistance.
- Increasing participant involvement and ownership in the programmes through peer-led teaching.

The limitations that were acknowledged in the 2007 report continue to be relevant to the few studies identified in this new review. Specifically, the assessments used to indicate past drug use were based on self-report measures and therefore some participants may have underreported use. Intervention effectiveness in relation to reducing drug use behaviours is limited and the main effects appear to be restricted to modifying attitudes or intentions related to drug use (sometimes in an unintended direction). Finally, interventions were affected by sizeable attrition rates (e.g., Goldberg et al., 2007) along with the low baseline levels of substance misuse (<5%).

In addition to the narrow evidence base, few studies included long-term follow-ups to determine whether intervention effects persist over time and whether they translate into reduced drug usage. However, the overall conclusion of this section is that there continues to be a significant 'absence of evidence' in relation to the design, development and evaluation of anti-doping intervention programmes.

In addition to increasing the volume of research in this area, a useful recommendation, drawn from the alcohol and drug misuse domains, would be to establish an international register of anti-doping interventions (Foxcroft, Ireland, Lister-Sharp, Lowe, & Breen, 2002) so that the scale of education/intervention delivery can be clearly assessed. We accept the limitation of only including studies published in peer-reviewed journals but it remains important to establish the rigour of these interventions. Therefore, such a register might also include established criteria for rating prevention interventions in terms of safety, efficacy and

effectiveness (Foxcroft et al., 2002). Such a development might help to optimise the return on investment of limited resources while also enhancing the development of anti-doping interventions and policies.

Theoretical Perspectives on Doping Behaviours

Theories provide complex and comprehensive conceptual understandings of things that cannot be pinned down (Reeves, Albert, Kuper, & Hodges, 2008). For example, the reasons why athletes use banned substances in sport seems to represent a complex conceptual challenge. Theories also provide researchers and practitioners with alternative "lenses" for looking at complicated problems and social issues. In turn, this helps to design clear research questions that focus data collection and analysis and help to illuminate the findings (Reeves et al., 2008). For instance, a qualitative researcher might draw upon theories such as narrative or phenomenology, whereas a quantitative researcher might design their interventions based on social cognitive theory. Indeed, it has long been acknowledged that theories are important in the planning and delivery of health improvement services because they guide programme planning, and in turn, programmes based on theory are more likely to succeed than those developed without the benefit of a theoretical perspective (National Cancer Institute, 2005). However, problems can still emerge if interventions are based on defunct theories or frameworks; as evidence by the ineffectiveness of the 'Just say no' campaigns of the 90s (Backhouse, McKenna, & Patterson, 2009).

Evidence-based theories could help us to understand the doping phenomenon by identifying the relationships between the elements that influence doping behaviours. Further, the application of models and theories can facilitate the identification of influences to target through interventions and education programmes aimed at preventing doping. Yet, this updated review of literature once again highlights a major limitation of the current body of knowledge – the application and empirical validation of doping models and theories in sport remains scant. Moreover, the empirical studies reviewed continue to be heavily descriptive and there is an absence of qualitative studies that seeks to gain an *understanding* of the behaviour of interest. Instead, quantitative frames dominate as researchers seek to *explain* the phenomenon. In light of the limited variance in behaviour explained by some conceptual

models, one might argue that a hybrid approach to data collection might be appropriate whereby the tenets of specific theories are integral to the process of deductive analysis while also allowing themes to emerge direct from the data using inductive coding (Fereday & Muir-Cochrane, 2006).

Revisiting the early models

In 2007, the literature relating to models of PED use was limited. Only two theoretical perspectives had been proposed to aid our understanding of doping behaviours; The sport drug control model (SDCM) (Donovan, Eggar, Kapernick, & Mendoza, 2002) and the drugs in sport deterrence model (DSDM) (Strelan & Boeckmann, 2003). The first model, the SDCM, has subsequently been modified (Figure 1; Donovan, 2009), but was founded upon criminal deterrence theory. The DSDM emanates from a health promotion / injury prevention perspective, drawing upon concepts from the health belief model (Becker, 1974) and the theory of planned behaviour (Ajzen, 1991). Both models draw upon the social cognitive approach as they attempt to theorise how athletes think about doping in order to frame the development and delivery of more efficacious anti-doping educational campaigns.

Both models are based on the assumption that doping is a rational decision-making process involving a cost- or threat-benefit analysis – on the part of the doper - assumed to result in the choice that is in the decision-maker's best interests. Both models accepted that key influences in the cost-benefit appraisal included psychosocial factors such as the individual's attitudes towards doping and personal morality, as well as situational or environmental factors such as the beliefs and behaviours of significant others and the availability or affordability of prohibited substances or methods.

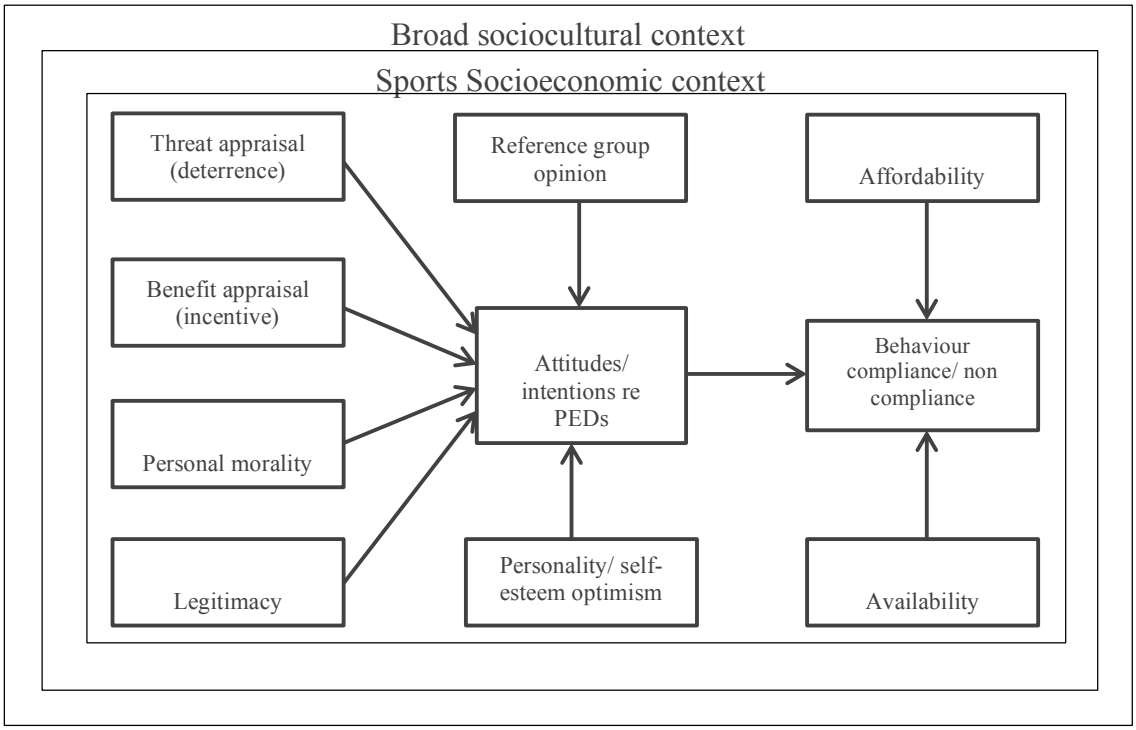

Figure 1. Modified sport drug control model (Donovan, 2009)

Although not published in time to be included in the previous review, Strelan and Boeckmann (2006) investigated the influence of deterrents within their model through a self-report survey with male Australian Rules football players (N=32) and football (soccer) players (N=84). Their methodology presented respondents with hypothetical decisions about using PEDs. Participants were asked to report the perceived certainty and severity of consequences and the likelihood that they would dope in respective circumstances. Each of the deterrents had a significant relationship with decision to dope: the more severe and certain an individual perceived the consequences to be, the less likely they would be to dope. The factors, in order of effect, were; threats to their moral beliefs (r=0.59) (including how guilty they would feel), health concerns (r=0.50), material loss (r=0.43) (i.e. threats to their earning potential), legal sanctions (r=0.38) (e.g. a ban from competition), social sanctions by the general public (r=0.41), by a teammate (r=0.41) or another 'important other' (r=0.34). Overall, these seven factors accounted for 48% of variance in the decision to use human growth hormone. In the second part of the study, participants were presented with a hypothetical scenario in which they were assured that there would be no legal repercussions from engaging in use of human growth hormone. This resulted in an increased likelihood of use. However, individuals' ratings

still indicated they believed they could be caught, so the perception of the threat/consequences had been reduced but not removed.

Since the 2007 review, research conducted in Australia has started to empirically examine the SDCM. An 'opportunistic' survey of elite multi-sport Australian athletes (N=643, age range = 14-66 years) revealed no statistically significant relationships between doping-related attitudes and personality, legitimacy or reference group opinions. In contrast, threat ($r=0.14$, $p<0.05$) and benefit appraisals ($r=0.25$, $p<0.001$), as well as personal morality (i.e. perceptions of right and wrong of doping) ($r=0.40$, $p<0.001$), were significantly related to doping-related attitudes. However, the effects were small and the model explained only 30% of variance in doping-related attitudes (Gucciardi et al., 2011).

Similarly, although the findings showed that attitudes were related to doping susceptibility, the effects were small ($r=0.33$, $p<0.001$) and only 11% of the variance in behaviour was explained. In this vein, it should be noted that 'doping susceptibility' ('the absence of a firm resolve not to engage in doping activities or not to give any consideration at all to an offer to do so') (p.5), was used instead of actual doping behaviours. Despite this, the authors concluded that doping was more likely when individuals (i) are willing to cheat, (ii) believe that doping will be beneficial for performance, and (iii) question the legitimacy of the testing programmes through a belief that they will not be caught if tested.

Acknowledging the opportunistic nature of Gucciardi et al.'s (2011) study, Jalleh and colleagues (2013) 'purposefully' investigated the SDCM with a large sample of elite multi-sport Australian athletes (N=1237, 603 male and 612 females, 23±7.8 years of age). Their cross-sectional survey revealed that morality ($r=0.64$), legitimacy ($r=0.25$) and reference group opinion ($r=0.19$) had significant ($p<0.05$) relationships with attitudes towards the use of PEDs, with 81% of the variance in attitudes explained. The predictive power of the model was found to be far greater in this study compared to Gucciardi and colleagues' (2011) previous research. Additionally, attitude was significantly related to doping behaviours ($r=0.36$, $p<0.001$), though only 15% of variance was explained; a finding not too dissimilar to that of Gucciardi et al. (2011). Contrasting the findings of Gucciardi et al. (2011), there was no significant relationship between attitudes and threat or benefit appraisals. While the authors

concluded that the appropriateness of using the SDCM to understand doping-related behaviours was supported, they also cautioned that further research across a broader range of participants and cultures was necessary.

The life-cycle model of performance enhancement

Maintaining the view that doping-related decisions are rational, Petróczi and Aidman (2008) presented The life cycle model of performance enhancement (LCMPE) (Figure 2). Like many others, this work draws on the theories of planned behaviour and reasoned action, including the influence that attitudes and subjective norms may have on intentions, which may subsequently influence behaviour. The LCMPE emphasises the influence of situational factors, suggesting that doping-related decisions are affected by a complex combination of trait, systemic and situational factors. A key tenet of their theoretical perspective is that the behaviour is strategic and/or functional towards goal achievement (Petróczi & Aidman, 2008).

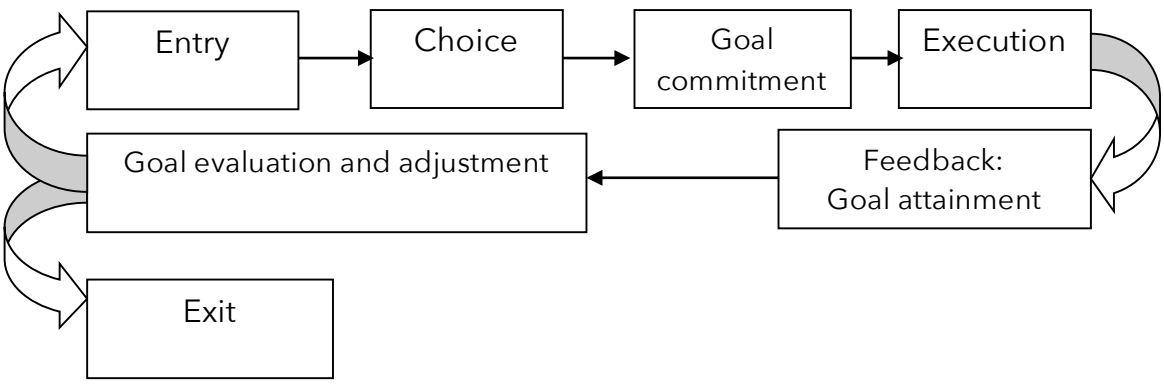

Figure 2. The life-cycle model of performance enhancement (Petróczi & Aidman, 2008)

Working cyclically, an individual enters the cycle when a goal is self-selected or prescribed by another (e.g., a coach). The individual is required to choose how they will achieve (or attempt to achieve) the goal with their choice mediated by vulnerability (facilitating) factors and inhibiting factors, categorised as 1) Individual/Personality differences and 2) Systemic factors. Both individual and systemic factors are constantly influenced by situational factors. Petróczi and Aidman (2008) suggested that doping is more likely to occur when habitual use of acceptable (licit) performance enhancing substances (e.g., use of NS), fails to help the individual attain their goal.

A growing body of evidence supports the potential link between NS use and doping behaviours (e.g., Lucidi et al, 2008; Hauw & Bilard, 2011; Backhouse et al., 2013); offering support for the gateway theory of substance use (Kandel, 2002). Once a permissive attitude is adopted towards NS in adolescents, this heightens the likelihood of progression to using banned PEDs (Ntoumanis et al., 2014; Backhouse et al. 2013; Petróczi, 2014). Indeed, research has demonstrated a strong relationship between NS use and illegal PED use. For example, Backhouse et al. (2013) found athletes were 3.5 times more likely to use banned substances if they used NS and Mallia et al. (2013) found they were 10 times more likely.

The LCMPE has moved the field forward in at least three ways. First, it categorised variables into the levels at which they operate (i.e., personality, systemic and situational). Second, the model emphasises that the use of PEDs 'does not happen in a vacuum' with social, economic, political and cultural environmental contexts influencing behavioural choices. A third contribution of the LCMPE, when compared with others, is the consideration given to the individual's developmental stage. During different phases of an athlete's career and in the transitions between them, an athlete will enter the cycle with different goals and the influence that the various factors identified in the model will exert on the 'choice' element of the model may increase or decrease (Petróczi & Aidman, 2008).

Despite these strengths, empirical research directly testing the concepts of the LCMPE is unavailable. Notably, Petróczi and Aidman (2008) suggested that testing the model as a whole is unlikely, instead proposing that a series of studies should be executed, each examining specific parts of the model. They recommended undertaking this using simulated cases (hypothetical situations) involving different combinations of personality, systemic, situational and environmental factors leading to various behavioural outcomes. More recently, Petróczi (2013) has proposed the incremental – functional model of doping (Figure 3). In this model, a functional rather than a moralistic view is adopted, whereby performance enhancement is seen as a motivated, goal-oriented and progressive practice where the goal is not gaining unfair advantage but is to maximise one's own performance.

Incremental model of doping behaviour

Recognising the incongruence between athletes' lived experience of doping in sport and the 'doping is cheating and morally incomprehensible' heuristic, the incremental model of doping (IMDB) (Petróczi, 2013) has been offered in a bid to progress our thinking of doping in sport beyond the dominant moral frame. This hypothetical framework has yet to be tested but it has been developed from the gateway theory (Kandel, 2002) and the LCMPE (Petróczi & Aidman, 2008). It postulates that doping is a learned, goal-oriented behaviour that develops over time out of habitual use of accepted performance enhancing strategies (e.g., the use of NS). In addition, the IMDB has emerged from experiential findings underscoring that athletes who dope are not necessarily looking to cheat and outperform others but may simply see doping as another way to maximise their own performance. Previous research has suggested that doping use appears to be associated with NS use more than illicit drug use (Petróczi, Mazanov, et al., 2011), meaning athletes may perceive doping as an ergogenic behaviour/action rather than an illegal behaviour/action. In addition, the IMDB suggests that assisted performance enhancement is not logical or linear and is influenced by a number of vulnerability factors (e.g., accessibility, perceptions, norms, experiences). As a result, it may be that NS use alone does not act as a gateway to doping but instead a gateway arises when NS use occurs alongside other risk factors (e.g., body image issues, doping-related perceptions and norms, critical incidents). Thus, future research is required to explore the tenets of the model with the Petróczi, (2013) asserting: "Quantitative investigations into doping-related social cognition should capture the moral-functional duality and acknowledge functionality to make meaningful contributions to anti-doping efforts" (p.153).

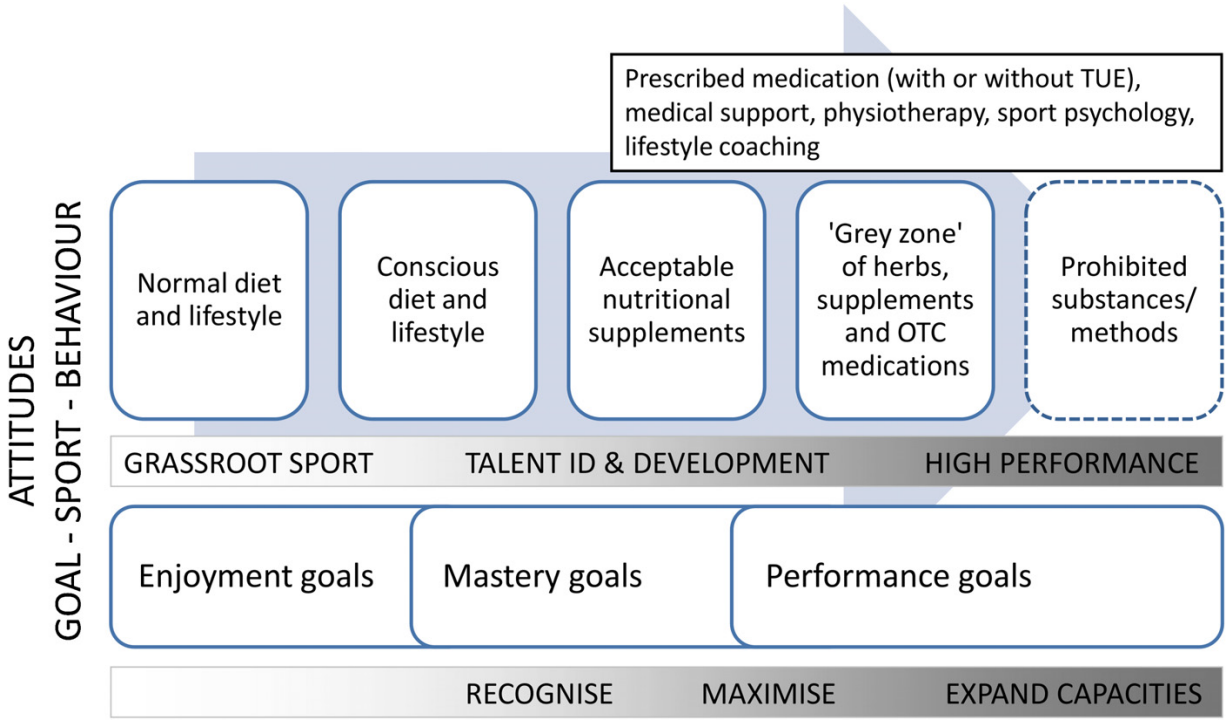

Figure 3. Incremental model of doping behaviour (IMDB; Petróczi, 2013).

A contextual conceptual model of doping in sport

Like Petróczi and Aidman (2008), several theoretical perspectives emerging since 2008 have emphasised the importance of situational influences. Stewart and Smith (2008) utilised a 'holistic' systems approach to present a wide range of factors that might impact upon decisions to use or not use PEDs and proposed three broad categories: 1) intrapersonal constraints (psychological issues), 2) interpersonal constraints (social issues), and 3) structural constraints (systems within sport) (Figure 4). Importantly, this work proposed that doping-related decisions are not always rational, nor bound by clear intentionality. Instead, they proposed that the influence from the context is dynamic (i.e., things change), unspoken or subconscious (i.e., the individual is not aware of the influence that such factors have on their decision-making process). This development mirrored the sequence of developments that occurred within other behaviour-change research domains, such as physical activity; early research was dominated by the borrowing of social cognitive and behavioural theories from parent disciplines (e.g., social psychology and sociology) with a later move away from the intrapersonal/psychological elements towards a broader acknowledgement of the importance of the environment.

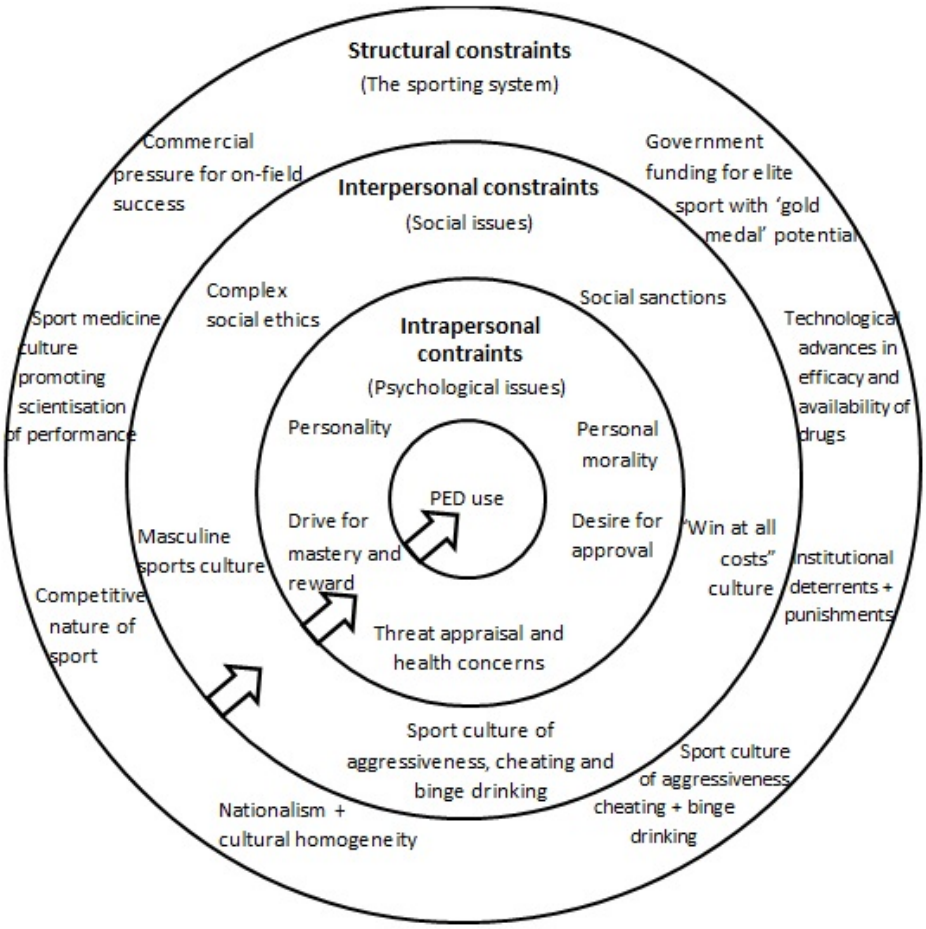

Figure 4. Factors influencing PED use in sport (Stewart & Smith, 2008)

While Stewart and Smith's (2008) model had many variables in common with previous perspectives, they highlighted several 'new' variables. These included the culture within which athletes develop their sporting prowess, theories of masculinity and how they affect athlete identity and behaviour in a highly competitive sport environment, and globalisation, commercialisation, and nationalism. However, a weakness of the work is that the framework remains a theoretical framework; it has not been developed using empirical research and has not been tested using such research since its creation. That said, in 2010, Smith et al. continued their work by qualitatively exploring doping-related decisions through 11 narrative-based case histories. Again, they adopted a systems theory – the social ecology theory - and found that numerous factors operating at different levels contribute to doping-related attitudes and behaviours. While their investigation provided support for several of the factors they had identified in their model (Figure 4), there were sufficient new lines of evidence to present a new representation (Figure 5).

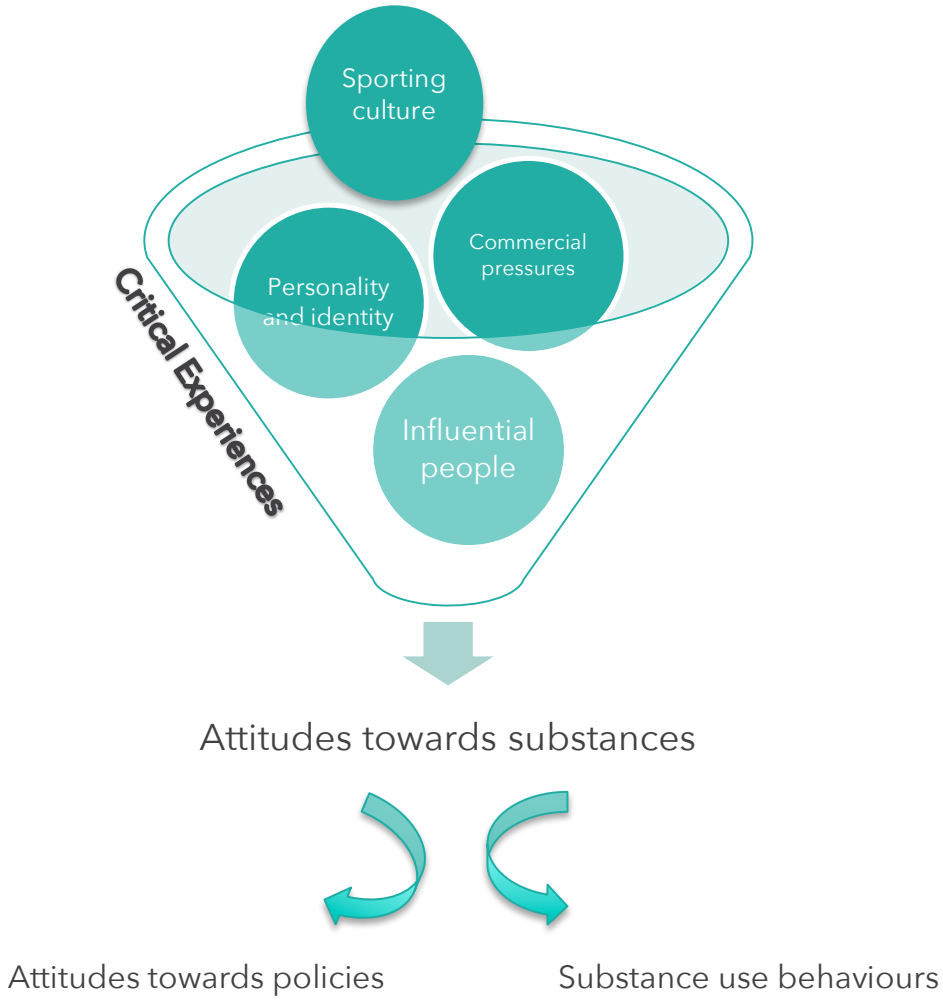

Figure 5. Conceptual model of contextual variables and attitudes towards substances in sport (Smith et al., 2010).

This new representation carries forward many elements from the previous model. For example, the commercial pressures of Figure 5 are similar to an element of the outer circle of the earlier model (Figure 4). Further, while personality and identity represent some of the factors within the smaller circle, influential people represent or interlink with several factors from several circles, and sporting culture may span all levels. Some of the elements of the earlier model have been condensed into higher order variables and others were removed entirely due to not featuring in the narrative case studies. Similarly, it is possible that the authors moved away from the limitations imposed by a traditional spherical social ecological diagram to represent the process of making doping-related decisions. In this vein, the 'critical

experiences' variable (e.g., early experiences and critical incidents) was added. Notably, based on their empirical data, the model reiterates that doping-related decisions might be unplanned, rather than rational, fully intended or reflective of a risk assessment (cost-benefit appraisal).

Perhaps one of the strengths of this research was to emphasise the differential influence of factors on an individual's decision to use or to not use PEDs by identifying that some factors may inhibit use and some may promote use. Establishing this directionality (inhibiting/promoting) for each variable is vital to translate the model into practice (i.e., the design of universal prevention programmes). Further strengths emerge from the range of experiences that were considered; and that accounts were derived from males and females, from various competitive levels and numerous sports. While it is important not to over-generalise the findings to other individuals and situations (contexts), the accounts represent in-depth insights that inform on processes of decision-making. However, this work still needs to be expanded to address the link between attitudes and behaviour, which was not undertaken in the interviews.

Empirical choice modelling

Alongside the work of Stewart and Smith (2008), a number of other theorists have begun to diverge from the view of doping as a rational choice. Informed by random utility theory (Louviere, Hensher & Swait, 2000), which suggests that decisions can be divided into a systematic/observable component (reflecting a decision strategy used by an individual) and a random/unobservable component (reflecting unobserved influences), Mazanov and colleagues (2010; 2011; 2012) underwent a three stage process of random choice modelling to illuminate the variables that are most likely to influence the decision to dope or not.

The first phase of the project involved a literature review and this was then followed up by qualitative interviews (N=20) with athletes, coaches, sports nutritionists, physiotherapists, sports administrators, and sport scientists, to generate a set of draft 'choice sets' from the factors identified in stage one (Mazanov & Huybers, 2010). Additionally, the authors conducted three follow-up focus groups with athletes (N=29) to validate and finalise the choice sets. Figure 6 presents the ten resulting factors or 'choice determinants' ordered

around four themes that were proposed to influence decisions to use (or not use) PEDs. Subsequently, Mazanov et al. (2011) re-analysed the interview data (N=20) and reiterated the importance of stage of career in doping-related decisions. In particular, they highlighted periods of instability (e.g., acute or chronic injury) as leading to vulnerabilities with regard to doping and related this to security of sponsorship (both financial salary stipends and non-financial access to training facilities). This provides support for emphasising stage of development (Petróczi & Aidman, 2008) and for recognising critical experiences (Smith et al., 2010).

In the final stage of the project, Huybers and Mazanov (2012) then tested these concepts with 259 elite Australian athletes (N=155 females and N=104 males). Their experiment involved presenting athletes with hypothetical doping-related scenarios. Based on different combinations of factors (taken from Figure 6), athletes were asked to consider how potential influencing factors offset or are traded against one another to influence 'Kim's' decision to dope. The experiment provided evidence for several factors proposed in Figure 6. The 'expected outcomes' (from Theme 1) that showed a significant pro-doping influence on 'Kim's' decision included (i) trying to fast-track to the top of the sport (r=0.33) and (ii) dealing with an injury sustained on the day of the performance (r=0.36). In contrast, there was a deterrent influence (Theme 3) from (i) doping to stay at the current level (r=-0.48) and (ii) to maintain solid performances at the current level (r=-0.39). With regard to other objectives of doping, higher financial gains increased likelihood of doping (r=0.53), while lower (AU$5,000 - $150,000) or no financial gains (r=-0.14 and r=-0.34, respectively) had deterrent effects. Contract contingency (e.g., sponsorship or prize money) had no significant impact.

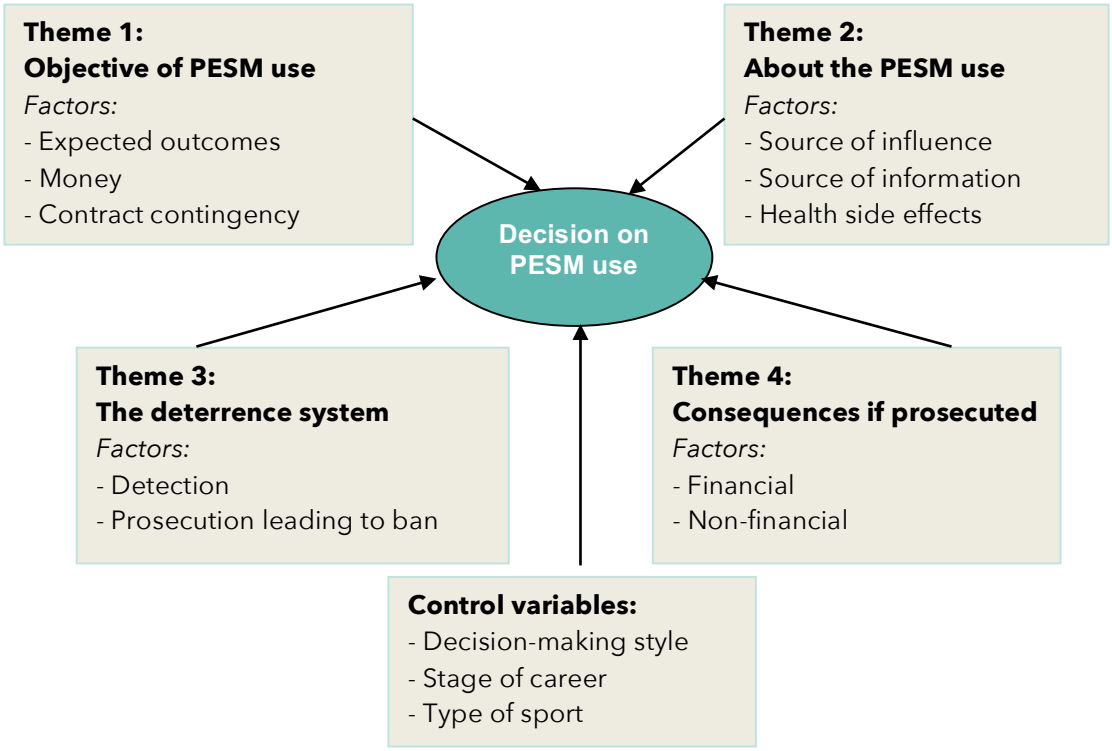

Figure 6. Determinants of performance enhancing substances and methods (PESM) use (Mazanov & Huybers, 2010).

Under theme two of Figure 6, coaches and senior athletes were reported as 'significant' sources of influence in electing doping behaviours (r=0.20, p=0.084 and r=0.21, p=0.077, respectively), whereas sports administrators' influence was as a deterrent (r=-0.31). Also under this theme, pharmaceutical companies were identified as a 'significant' source of information that encouraged doping (r=0.11, p=0.081), whereas information gleaned from 'underground handbooks' were significant deterrents (r=-0.149). The final variable under theme two, health side effects, proved to be one of the largest influences on Kim's hypothesised doping-related decisions. Specifically, perceived risk of death within 'two' and 'ten years' acted as a deterrent (r=-1.27 and r=-0.32, respectively). In contrast, permutations of risk for injury significantly increased the likelihood of 'Kim' doping; (i) risk of minor injury in one year (r=0.30), (ii) major injury in 10 years (r=0.38), and (iii) no health effects (r=0.68).

With regard to the deterrence system, individuals' reports demonstrated that the chance of being caught at the event itself reduced the likelihood that Kim would dope (r=-0.24). The same effect was found where the individual perceives a chance of getting caught in the future through retrospective testing (r=-0.12) or if there was a higher possibility of being prosecuted

and banned as a result of a positive test (r=-0.16). Some of the consequences of being prosecuted also significantly influenced doping-related decisions. In particular, doping was facilitated if there were no or modest ($5,000) financial consequences, such as fines (r=0.14 and r=0.18 respectively) and doping was deterred if greater fines of $50,000 to $150,000 would result from being caught (r=-0.33). Other, non-financial, consequences with a significant influence on doping-related decisions included (i) the deterrent effect of an individual being publicly humiliated (e.g., by the media) (r=-0.20) and (ii) the reported significant facilitative effects of being shunned by peers within the sport (r=0.11, p=0.056), and (iii) letting down family and friends (r=0.17).

Although the combination of factors is complex, this 'choice model' study provided evidence that doping-related decisions were rational and systematic (which links to 'decision-making style' in Figure 6). Specifically, doping is more likely to occur when individuals conclude that the benefits outweigh the costs, including the balance of high financial sanctions with high potential gains and a willingness to risk minor or major injuries versus being deterred by death in two or ten years. That said, it should be noted that the study investigated these issues from a hypothetical stance. Consequently, it is not possible to rule out a contribution of random/unobservable components. The authors conclude their 2012 paper by suggesting that the degree to which doping-related decisions are rational warrants further investigation.

A systemic model of doping behaviour

Johnson (2011) suggested that an individual's decisions to dope or not dope are influenced by interactions between their cognitive maturity (e.g., intelligence), psychosocial development (e.g., risk taking) and their environment (and experiences) (Figure 7). Informed by Bronfenbrenner's (1977, 1979) bioecological theory of human development and Bandura's (1986) social learning theory, Johnson (2011) emphasised the importance of social influences and, like others before (e.g., Smith et al, 2010), discussed the dynamism of the interactions between an individual and their environment over time. With regard to bioecological theory, Johnson (2011) acknowledged the notion that individuals mature and develop in a 'non-linear' fashion. Reflecting this, doping-related decisions are not bound to be rational or well planned, but are more likely to reflect the implicit/tacit, dynamic and/or reciprocal influences at play.

Although environmental or cultural influences have been discussed in other theoretical perspectives, Johnson's consideration of historical doping-related events as a cultural influence on current practices ('social epigenesis') is novel. A further unique element of this work was the introduction of the contribution of genetics and genetically mediated personality traits in decisions to dope. Integrating 'theory of the mind', Johnson suggests that an individual's mental state, which guides or causes behaviours, develops in hand with particular structures of the brain, which develop in response to distinctive environmental factors (e.g., parents, experience with language and culture). This theoretical position was informed by relevant literature and certainly has logical coherence. Despite its unique contributions, the model has yet to be subjected to empirical investigation.

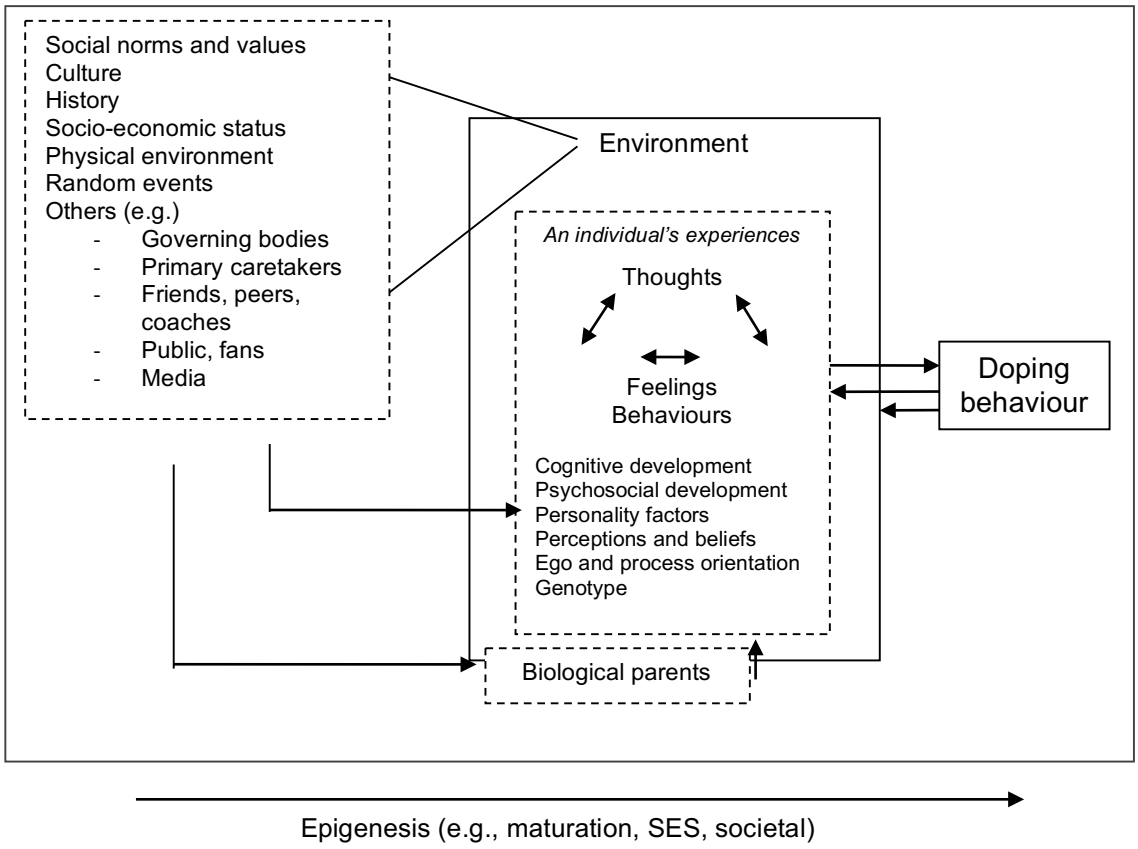

Figure 7. Systemic model of doping behaviour (Johnson, 2011).

In 2012, Johnson acknowledged that the first iteration of the systemic perspective lacked a coherent theoretical framework, meaning that operationalising and testing it would be challenging. Therefore, Johnson (2012) updated the model, integrating social cognitive

theory to understand individual's doping-related decisions (Figure 8). The importance of the interaction between individuals and their environment remained salient. Additionally, the paper reiterated that since an individual's behaviours are influenced by the way that they feel and think (whether consciously or not), those behaviours might help them to achieve their goals. Indeed, Johnson (2012) discussed the notion that individuals' behaviours are affected by their subjective perceptions, including the consequences/outcomes, likelihood of the consequences and influential environmental factors. The implicit and explicit environmental factors discussed included perceived sources of authority and environmentally mediated brain development, as well as social expectations (e.g., stereotypes) and reinforcements (e.g., winning a gold medal).

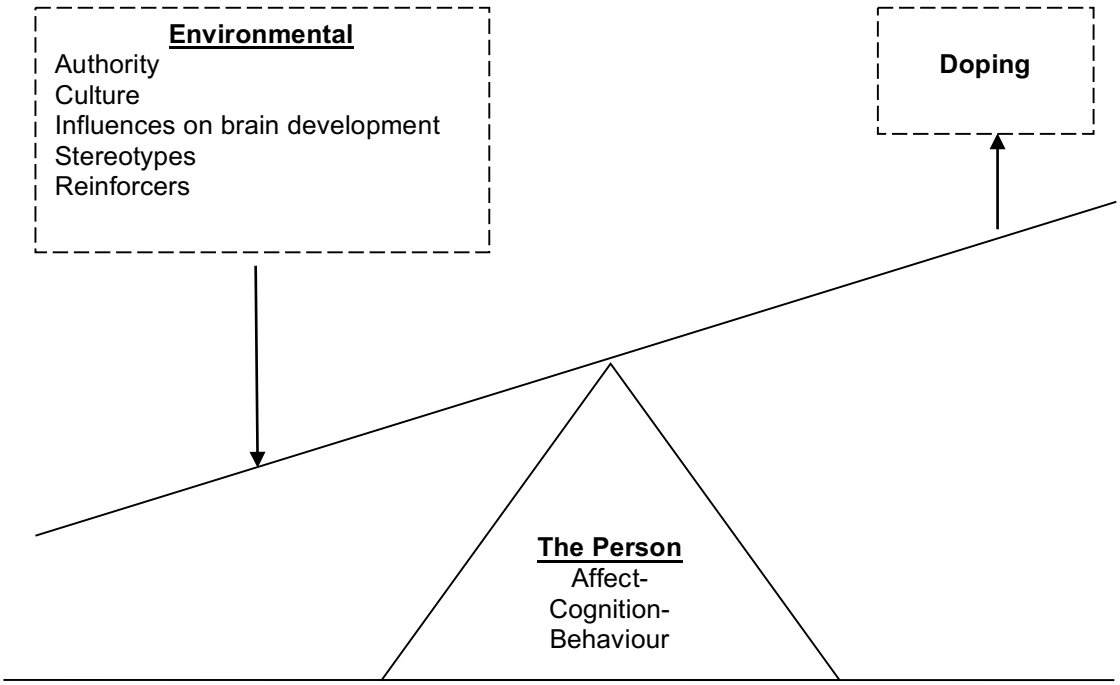

Figure 8. A conceptualisation of the relationship among the person, the environment and doping (Johnson, 2012)

Several premises of Johnson's (2011) original work remained in the updated theoretical perspective (Johnson, 2012), including considering doping to be a risk-taking behaviour, the

potential impact of historical events and the concept of 'theory of the mind'. 'New' factors introduced into the model's second iteration were stereotypes (including stereotype threat) and reinforcement. Johnson (2012) posited that stereotype threat occurs 'when a person who identifies with a particular group internalises a negative perception about his or her group', explaining that if a person is stereotyped 'then there are certain situations that could influence [their] motivation to dope' (p. 320). This led to the proposal that the influence of stereotypes/stereotype threats might be greater when there are intrinsic or extrinsic reinforcers (e.g., reduced perceived responsibility to others and success/winning, respectively). Notwithstanding the strengthening of the original model by creating a theoretical grounding, this systemic perspective is yet to be supported with empirical investigations.

Integrated models of motivation and social cognition

A number of research teams have recognised and responded to the espoused limitations of a single theory, such as the theory of planned behaviour (Goulet et al., 2010), in explaining complex doping behaviours. To illustrate, the theory of planned behaviour is a theory that has been *applied to* doping rather than a model *developed to explain* doping behaviour. Yet, it is the most utilised model when framing doping research and doping attitudes and subjective norms have been shown to predict doping intentions, and to a lesser effect, doping behaviour (e.g., Lucidi et al., 2008; Wiefferink et al., 2008; Lazuras et al., 2010; Goulet et al., 2010).

Whilst the theory of planned behaviour has contributed to the prediction of athlete doping behaviour, it was developed to explain attitude-behaviour relationships, which has resulted in little consideration being paid to the influence of situational and normative factors (Rivis & Sheeran, 2003). Nevertheless, the inclusion of descriptive norms has attempted to overcome the neglect of normative influences and they have been found to significantly predict doping intentions among gym users (Wiefferenk et al., 2010) and elite level athletes (Lazarus et al., 2010). Similarly, situational temptation has also been incorporated into integrated social cognitive models and Lazarus et al. (2010) noted an increase in the predicted variance of doping intentions over and above the theory of planned behaviour variables by 13%. Other research has also included additional variables in an attempt to increase the amount of variance of doping behaviour explained. For example, moral obligations and justifications for

using PED have been found to significantly predict doping intentions among young and adolescent athletes (Goulet et al., 2010; Zelli, Mallia, et al., 2010) and in a sample of competitive athletes moral disengagement was a strong predictor of positive attitudes toward PEDs, which, in turn, was a strong predictor of PEDs susceptibility (Hodge et al., 2013). Together, these findings suggest that factors other than attitudes play an influential role in an athlete's decision to use PED. Therefore, it is important to consider additional factors that may explain further variance in doping use, rather than focusing solely on the theory of planned behaviour variables.

Research teams are therefore developing hybrid approaches that synthesise and extend existing motivational, social cognitive and sportspersonship theories to increase the explained variance in behavioural outcomes, giving rise to integrated models (e.g., Barkoukis, Lazuras, Tsorbatzoudis, et al., 2013; Chan, Hardcastle, Dimmock, et al., 2014; Lazuras et al., 2015). Figure 9 offers an illustration of a hypothesised integrative model of doping intentions put forward in a study by Lazarus and colleagues (2015). Here, it is expected that the effects of distal predictors on doping intentions (i.e., sportspersonship orientation and achievement goals) will be mediated by social cognitive variables (proximal predictors) (i.e., outcome expectancy beliefs). Meta-theory merges single models, allowing researchers to investigate and accommodate for multiple processes simultaneously. Considering that no single theory has been accepted as valid for explaining doping behaviour, the potential for combining theories poses a new and possibly more encompassing means for understanding the doping phenomenon. However, although studies currently suggest *potential* benefits for merging single theories within the doping literature, simply noting connections is not the same as validating the connections. Therefore, evidence-based arguments specifying which theories can be combined effectively and appropriately are warranted (Barkoukis et al., 2013). Such an approach might help us better explain doping intentions and ultimately doping behaviour (Barkoukis, Lazuras, Tsorbatzoudis, et al., 2013) and it is anticipated that in the long term, a meta-theory perspective on doping behaviour will begin to emerge (Barkoukis, Lazuras, Tsorbatzoudis, et al., 2013). At the same time, in light of the experiential understandings coming from qualitative studies, we should expect to see more data-driven 'exploratory investigations' where the theoretical framework is guided by the epistemological approach to

knowledge acquisition, rather than a pre-determined singular theory (i.e., Chan, Hardcastle, Lentillon-Kaestner, et al., 2014; Erickson et al., 2015; Overbye et al., 2013).

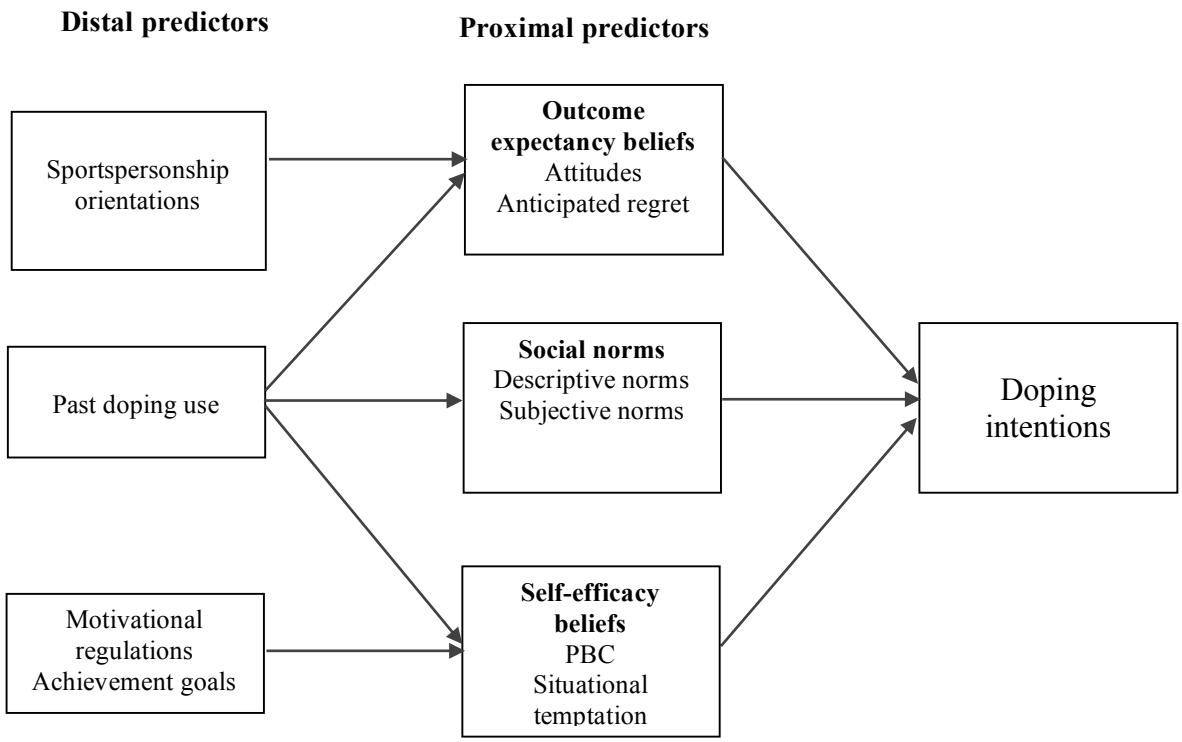

Figure 9. A hypothesised integrative model of doping intentions (Lazarus et al., 2015).

Prototype willingness model

Acknowledging that decisions to use PEDs might not be entirely rational, Whitaker et al. (2012) and Dodge et al. (2013) proposed applying the prototype willingness model (citing Gibbons, Gerrard, Blanton & Russell, 1998) to the anti-doping field. The prototype willingness model (Figure 10) is a dual-processing model, featuring two pathways that account for both reasoned actions and social reactions (i.e., spontaneity and responses to risk-conducive situations). In the reasoned action pathway, two variables contribute to intentions: attitudes and perceived norms (where a focus on what significant others think the person ought to do is replaced with what significant others actually do). The social reaction pathway considers the impact of social norms, as well as prototype perceptions, on an individual's willingness to

perform a behaviour. The social pathway also acknowledges that a person's willingness in relation to, and undertaking of, some behaviours is a response to a circumstance (i.e., their openness to opportunity and that it is not necessary to have previous intentions of performing the behaviour).

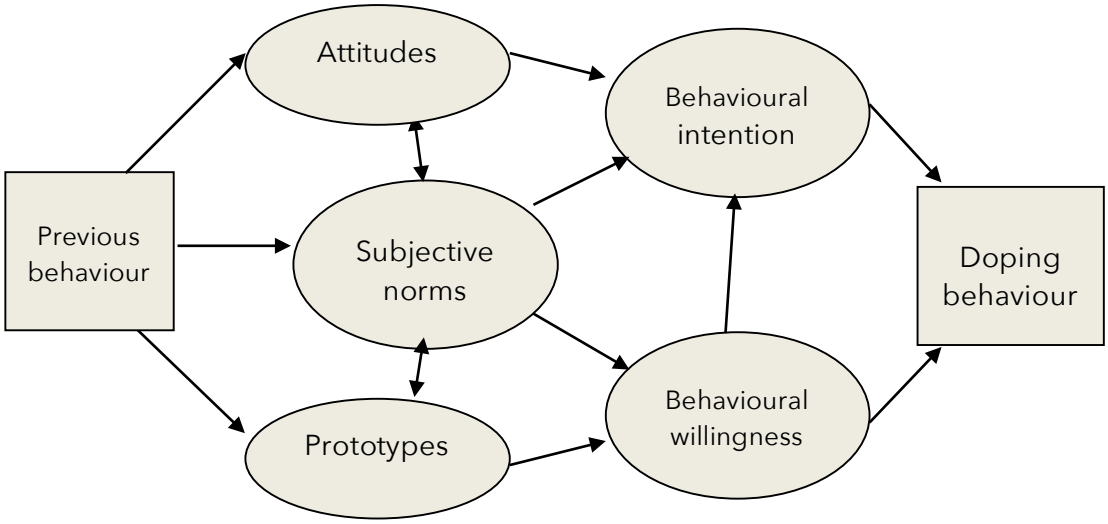

Figure 10. Prototype willingness model applied to doping behaviours (Gibbons et al., 1998)

In a cross-sectional survey of 729 competitive athletes, Whitaker et al. (2014) explored the relationship between attitudes, norms (including descriptive and subjective), outcome expectancies, prototype perceptions and behavioural willingness. The study provided empirical evidence to support the application of prototype willingness model to understanding decisions to use PEDs. Building on the conclusions of a previous study (Whitaker et al., 2012), data showed that the favourability ($\beta=0.186$, $p<0.001$) and similarity ($\beta=0.128$, $p<0.001$) of PED user prototypes were a strong predictor of willingness to dope.

Additionally, willingness to dope was influenced by attitudes ($\beta=0.220$, $p<0.001$), subjective norms ($\beta=0.143$, $p<0.001$), level of competition ($\beta=-0.073$, $p<0.05$), previous doping behaviours ($\beta=0.240$, $p<0.001$) and social desirability ($\beta=-0.098$, $p<0.05$). These factors explained 54% of variance in behavioural willingness to dope. Overall, the findings suggested that athletes who were male or competed at national-level were more vulnerable to doping. Equally, athletes might be more willing to use PEDs if they believe others are using them

without being caught, as well as if an individual suffers a dip in their performance levels or becomes injured. With regard to the latter two situations, this provides evidence for the dynamicity of doping-related decisions and the social reaction pathway of the prototype willingness model.

Dodge and colleagues (2013) also applied the prototype willingness model to doping-related behaviours. With a similar focus to that of Whitaker et al. (2014) – exploring the potential influence of attitudes, norms and prototypes to influence willingness – they discussed the two pathways in slightly different terms; 'analytic-deliberative', reflected in behavioural intentions, and 'heuristic-reactive', resulted in behavioural willingness. Additionally, they investigated the influence of these factors on intentions and explored if willingness is affected by an individual's belief that illicit PEDs are more effective than permitted substances (e.g., over-the-counter dietary supplements). Their cross-sectional survey of 132 male athletes (primarily competing within the NCAA Division III and 44% or whom were baseball players) provided further empirical support for the prototype willingness model to understanding PED use.

Consistent with Whitaker et al. (2014), attitudes ($\beta=0.46$, $p<0.01$), norms ($\beta=0.44$, $p<0.01$) and favourability of prototype ($\beta=0.02$, $p<0.05$) significantly influenced willingness. Willingness to dope was also influenced by a history of PED use (albeit licit means) ($\beta=0.39$, $p<0.05$) and a belief that illicit PEDs are more effective than permitted substances ($\beta=0.20$, $p<0.01$). Overall, 50% of variance in willingness was explained by these factors. In relation to the 'analytic-deliberate', or reasoned action pathway, both attitudes ($\beta=0.38$, $p<0.01$) and norms ($\beta=0.16$, $p<0.01$) represented a significant influence. In total, these factors explained 34% of variance in intentions. Therefore, the research suggested that both reasoned and reactive pathways must be considered to understand decisions to use performance-enhancing substances.

Application of other theoretical perspectives

In an attempt to assist strength and conditioning professionals to better understand the use of PEDs (specifically AAS), Leone, Gray, Rossi and Colandreo (2008) discussed the potential application of the transtheoretical model (Prochaska & DiClemente, 1982). At each stage of behavioural change (pre-contemplation, contemplation, preparation, action, maintenance) an

individual's behaviour will be influenced by their self-efficacy and decisional balance. Therefore, the transtheoretical model offers another model that reflects the rational choice perspective; decisional balance represents a 'lay' cost-benefit analysis where individuals weigh the balance of the pros and cons of engaging (or not engaging) in the target behaviour. According to the transtheoretical model, using cognitive and/or behavioural strategies can address both self-efficacy and decisional balance to facilitate an individual's 'processes of change' towards the desired behaviour (including abstinence). According to the theory, behaviour change is most likely when an individual perceives that the benefits of changing outweigh the challenges/disadvantages of the existing situation. This 'balance' is then tipped – or not – depending on how much the individual holds the self-belief that they can achieve the desired outcome.

A unique contribution of this work is Leone et al.'s (2008) suggestion that strength and conditioning practitioners can use the transtheoretical model in practice to predict, educate and change negative health behaviours associated with AAS use – rather than employing the model for 'understanding' behaviour. Specifically, they propose that the theory can be used to identify the stage at which individuals are currently and form an action plan to intervene or provide advice. The transtheoretical model also offers further domains for practitioners to exert influence. These factors are integral to the model, expressed through the processes of change and the levels of change. However, while the application of this 'stages of change' theory in the anti-doping field is novel, the notion is neither based on, nor supported by, direct empirical evidence from research conducted by these authors. Rather, it was informed by extrapolating from literature in related areas. In this understanding the utility of this body of work is limited in relation to our understanding of how individuals might change their behaviour toward doping behaviour. Without empirical evidence the theory also has limited value for guiding intervention design and delivery.

Also with a focus on practical application and transferability of findings to the 'real world ' of sport and anti-doping education programmes, Hauw and colleagues (Hauw & Bilard, 2012; Hauw & Mohamed, 2013) have developed their understanding of doping behaviour within the framework of situated activity theory and course-of-action theory (Theureau, 2003) . This framework takes into account: "(1) the entire process that progressively builds towards a final

doping decision, (2) the interactions between athletes' activity and the use of prohibited substances and (3) the meaningful world (i.e. situation) of athletes that provides many clues to athletes' specific concerns" (Hauw & Mohamed, 2013, p.3). Therefore, the entire sporting life course of athletes who have received a doping sanction and those that haven't are compared and contrasted with the sporting career providing the linkage from which to review the meaningful experiences. This approach allowed Hauw and Mohamed (2013) to characterise the activity components that were specifically linked to doping use and to identify the trajectory that led to this use. The findings point to doping athletes as 'suffering athletes' who may be experiencing distress in sport due to the way the sporting activity is experienced and the plenitude of resources required to maintain full commitment to training and competition. The need to mobilise resources in order to meet the demands of sport was seemingly linked to athletes' use of prohibited drugs (Hauw & Mohamed, 2013)

Strulik (2012) created several formulae based on economic principles that can be used to investigate doping-related decisions (d). While these formulae will not be covered in detail, the variables included in the formulae will be discussed in relation to other theoretical perspectives in the anti-doping field. Factors that are common to other perspectives included the effect of using drugs (α) (which will depend on the individual's sport), the costs of using drugs (c) (including financial, employment and health consequences), the length of a participation ban (η) and the rate at which doping history of the sport is depreciated in the 'backward-looking mind' of individuals (δ). Emphasising the importance of social influences, Strulik (2012) highlighted the impact of the individual's competitors' doping (θ) in a season ($_t$), the individual's experiences of approval/disapproval by peers (S), the degree to which they are influenced by this (σ), the relative importance of approval experienced from peers (β) (e.g., cohesion and closeness of the individual's community) and disapproval of doping from spectators, the press and society at large (φ) ('stigma costs'). Novel variables were the individual's ability (A), their rank (R) and their rank loss if they stay clean (λ).

Strulik (2012) discussed the contribution of community dynamics (e.g., social norms) and the need for collective action facilitated by external help (such as through a change in the rules). Specifically, the need to reduce group cohesion and a 'drastic' increase in individual costs (including stigma costs) were stressed. A move away from systems whereby qualification levels

are set by the best performers (e.g., stage disqualification cut-offs or Olympic qualifying markers) and more balanced sharing of money or television appearances across the ranks were also endorsed. Through economics, Strulik (2012) captured the complexity of doping behaviours. However, the proposed formulae have not been tested through empirical investigation at this time and, given the complexity of the formulae and their premises, how this might be done is not clear.

Summary

Since 2007, further theoretical perspectives have been offered to aid our understanding of doping behaviours. Despite an initial focus on the athlete as an individual driver of doping behaviour, greater emphasis is being placed on the complexity (including the strength and the directionality) of multiple interactions between manifold personal, situational and contextual factors. Future efforts might focus on investigating concepts that are common to a number of the existing theoretical perspectives. For example, researchers are encouraged to consider the degree to which an individual's decision to dope (or not) is rational and well planned or if situational influences can cause a more dynamic and situated reaction. However, it is important to acknowledge that whilst models are useful for helping us to understand doping in sport, they are only useable if they represent the myriad of factors that can account for this complex behaviour. At the present time, we are not in a position to offer a comprehensive list of doping correlates or influencers, as research has been largely top-down rather than data driven. Moreover, the absence of empirical evidence to support or refute the propositions limits our ability to apply the findings to inform anti-doping policy and practice. We must also admit that it might be difficult to 'test' some of the principles of the theoretical perspectives, as it is unclear if/how some variables or constructs within the models can be measured. As such, a greater emphasis on qualitative research could prove beneficial to investigate variables that are deemed 'immeasurable' and we should test the ideas put forward in the field with athletes and their support personnel.

When gathering evidence to support or challenge existing theoretical perspectives, researchers in the field might be encouraged to pay greater attention to protective factors, rather than risk factors. This is in line with the premise of positive psychological approaches to prevention. In addition, existing theoretical perspectives typically focus on the use of

performance enhancing substances or methods, but the WADA Code and Prohibited List also forbids the use of 'recreational' drugs. In theory, to be true to 'anti-doping' efforts, prevention programmes should also be targeting individuals' use of these drugs. To do this requires an understanding of these processes, whether or not they involve conscious decisions. Finally, theoretical perspectives to understand doping-related decisions have predominantly focused on elite or performance level athletes. Yet, doping behaviours have permeated the sporting environment far beyond this, including young sportspeople in schools, non-competing amateurs and recreational gym users. Thus, theoretical perspectives and investigations into doping-related decisions might be extended to understand how this phenomenon manifests in broader society.

The Wider Science of Behaviour Change

Background

The science and understanding of behaviour change continues to develop. While academic attention continues to focus on 'why' any approach is deployed, and to what effect, a recent shift emphasises the concurrent need to provide evidence around the 'how' of making interventions more effective. This concept is referred to as implementation effectiveness and it relies on paying closer attention to developing studies that – from the outset – are strongly centred on translating effective interventions into effective services (Glasgow, 2003; Lobb & Colditz, 2013). In post-recessionary times the desire is to support effective, sustainable interventions delivered within existing, or even shrinking, resources (Fineberg, 2012). This new set of issues imposes new demands on intervention designers. Now they must address the 'fidelity' that science values, alongside the 'fit' that practitioners will demand before they will respond to scientific developments (Ammerman, Woods Smith, & Calancie, 2014).

This disciplinary 'turn' confirms the value being placed on new – and/or rediscovered - ideas for designing, delivering and evaluating intervention approaches. For example, developments established through the 'Decade of the Brain, 1990-1999' have recently elucidated the previously unknown biological basis of learning (i.e., myelination). Ancillary work has also helped to more fully grasp how emotions – particularly those mediated by dopamine - are fundamental to establishing the crucial pathways of brain remodelling that underpin behaviour change. These pathways include (i) 'attention-that-leads-to-learning' and, building on that first pathway, (ii) 'learning-that-leads-to-performance'. If negative emotions can be considered 'opposite' to positive emotions, their role in restricting brain development in the long-term and in restricting behavioural choices in the short-term, has clear relevance to how anti-doping interventions might work (or not). These discoveries also endorse a greater focus on to how the attention potential of recruits is achieved (and for how long). Expressed differently, and thinking of core notions of behaviour change, these issues may be termed

adoption and adherence; these are the lynchpins of every evaluation, referring to them as recruitment and retention.

Practitioners understand these notions as they are recurrent in all behaviour change approaches, irrespective of the target behaviour(s), or if the focus is on primary, secondary or tertiary prevention. In the account that follows, the aim has been to offer 'candidates' that interventionists might consider, wherever that intervention will be located. These candidates are not intended to reflect a comprehensive, systematic review of all that has happened in behaviour change science. Neither do they show only what seems important in the current evidential landscape. In the spirit of innovation and creativity, any new themes or approaches - as much as established themes - can be pursued and refined, possibly even combined, to establish their overall worth.

While it is important to establish where things are right now, it is also helpful to appreciate the stages of progression that have brought us here. Their residue remains in practitioners' routines, in intervention designs and across research approaches. Andreasson (1993) charted the progression of behaviour change science through four eras. This began with an Educational approach, where 'knowing matters' and where teaching 'the facts' was thought to be sufficient to influence behaviour. Clearly this was always going to be an incomplete approach, not least because it confirmed what has become known as the 'Knowledge-Behaviour gap' (Rogers, 2003). This simplistic understanding clearly omits the potential contributions of values, self-efficacy, social norms and so on. Equally, this implies that attitudes and values are the precursors to behaviour, whereas growing evidence suggests that the opposite is more often the case.

With practitioners and theorists being reluctant to lose attention on the importance of 'knowledge' in driving behaviour, and building on the Educational approach, attention then fell to Persuasion. This underpinned the development of Social Advertising approaches, of which the famous 'Just say no' campaign is a good example. Unsurprisingly, this was quickly understood as having major shortcomings, especially in scenarios where social norms, routines and expectations were powerfully loaded against isolated individuals. However, part of what makes this approach attractive is that it is often relatively easy for individuals to adopt

positive behaviours when many people from the group demonstrate the same behaviours. Further, groups often demonstrate particular social norms and behaviours that can inoculate them from otherwise common and harmful influences; these elements can feature in programmes design.

The third era in Andreassen's (1993) account addresses Behaviour Modification, which is underpinned by the notion that individuals can act to make a difference. By focusing on 1-to-1 interventions these approaches were expensive and quickly deemed unsustainable. Notwithstanding the idea that every individual can, and often does, make decisions to enhance their own situation, this approach was seen as broadly irrelevant to establishing widespread social change. A growing body of literature points to the relatively high cost of changing an individual's mind over changing their living environments. In anti-doping terms this may involve moving an athlete away from a setting where drug taking may be a risk to one where it is not.

The final of Andreassen's (1993) four-part framework identifies the emergence of Social Influence approaches. In this understanding, behaviour results primarily from social factors. This approach also has its problems, including how well social norms are understood or accepted. There were also concerns about the idea of 'conforming', about who was driving such pressure and to what end; the Lance Armstrong case illustrates the downside of social influence very well. Another set of concerns lies in assuming that behavioural targets are socially important, visible and/or have no competition; this is clearly not the case for athletes who take drugs. For researchers and practitioners alike, this notion of 'competition' is especially challenging. For example, while direct competitor behaviours – like the effect of television watching on snacking behaviour – may be obvious, other competitor behaviours may exert their influences indirectly or after considerable time lags.

Current concerns

There are numerous new strands of development in behaviour change science. Each offers interesting opportunities for developing and delivering better interventions. Much of this is being driven by post-recessionary issues that may be best improved by widespread change in behaviour (e.g., Fineberg, 2012). Interestingly, while the catalysts for these developments are

contemporary, they reflect understanding that was established in the early days of modern psychology; in many ways we are living with a real-life case of 'back to the future'. More specifically, they reaffirm that behaviour is the result of the person-environment 'fit' (Lewin, 1951). As a result, interventionists' and practitioners' increasingly focus on elements of the respective three components of Lewin's summation; the person, the environment and the 'person x environment' interaction. There is also a growing interest in clarifying the directionality of the most influential pathways in this triumvirate.

Opportunities are now emerging from the massive changes taking place in our social environments. These developments link to the widespread adoption of persuasive technologies. The idea runs that exposure to these technologies - which include social media agents, such as Facebook, and the various agents of 'electronic entertainment - are so compelling to humans that they are changing brain function (Fernadez, Goldberg, & Michelon, 2013). Central to these effects are the attractions of using this technology to the human brain; they appeal to our interest in what is novel, moves, and is colourful and highly functional.

These brain changes are confirmed by the alignment between what educators and neuroscientists are saying; each confirms that humans expect similarly sensory-rich educational programmes in everyday life. This creates the central challenge to all modern-day education; how to command the attention of potential respondents. Further, because of repeated deployment of short-term blocks of concentrated thinking, there is the subsequent challenge of helping individuals to integrate their new learning with what they already know. This is central to achieving the more sophisticated cognitive, intra-personal and inter-personal skill outcomes that will support long-term behaviour change.

To achieve the learning associated with any programme, deliverers need to be able to alter recruits' alertness, personal orientation and engagement. These three elements are all important in any intervention aimed at generating behaviour change and/or powerful positive decision-making. Happily, recent evidence suggests that many of these techniques are not only teachable to adults (Flook, Goldberg, Pinger, Bonus, & Davidson, 2013), but also effective in helping even very young people to acquire functional brain processing (Weng et al., 2013).

Importantly, these studies show that appropriate interventions - and ways of evaluating them - can be applied across the life course, especially to relatively young children, and across an array of scenarios.

Since each generation has a distinctive experience of exposure to brain-moulding (aka neuroplasticity) influences, evidence is accumulating to justify deploying more generation-based intervention approaches. These exposures – especially to media - are now so extensive that they exert powerful brain modifying effects on attention and engagement. Further, there is an emerging evidence-base showing the impact of alternative delivery modes and ways of understanding what these exposures 'mean' to individuals (Abroms & Maibach, 2008). In terms of age groupings, Chapman-Bond (2013) identifies five population groups, each with their own distinctive patterns of brain processing. The groups are Immediate's (aged 13-24), Finder's (25-35 years), Seeker's (36-45 years), Thinker's (46-65) and Knower's (65+). In each group, brain processes profoundly influence how and where attention is deployed, how experiences are interpreted and the extent to which they cause integrated reasoning. Importantly though, there is every suggestion that most pre-existing brain functions will change given sufficient exposure to in the right environments (Fernadez et al., 2013).

From a practitioner perspective, these developments may help to explain why groups do not respond to interventions in expected ways. It is highly likely that these interventions may rely on brain processing that simply may not yet exist in the target audience (Siegel, 2014) or depend on functions that are under-developed and, therefore, fickle (Medina, 2008; Siegel, 2008). For example, for developmental reasons, the skills of risk management are slow to develop in adolescents, making them more drawn toward valued outcomes without considering the downside of that pursuit.

Importantly this evidence justifies shifting attention away from addressing group deficits, toward capitalising on the ways that characterise how each group has learned to use their collective brains. In this understanding, a standard intervention may need to be refined to complement the cognitive preferences of the target audience. Therefore, programmes being introduced to experienced coaches – who may have excellent recall of 'facts' and experience -

would be differentiated when delivered to adolescent athletes – who may demonstrate limited recall and concentration, but have outstanding information-tracking skills.

These differences also play out in important ways for how – indeed, for how long - humans can be encouraged to repeat given thoughts or actions. Even though repetition remains central to the process of habit-building (Medina, 2008), many agents of change – teachers and coaches for example - are afraid to require it for fear of generating disengagement. Central to this anxiety is the modern preference for 'continuous partial attention' (a term recently attributed to Linda Stone; http://lindastone.net/qa/continuous-partial-attention). The processes that underpin this overall level of inattentiveness are the direct interest of another group of scientists-cum-interventionists who focus on mindfulness, e.g., Siegel (2008, 2014) and Davidson (investigatinghealthyminds.org). Indeed, preliminary outcomes from their corrective interventions seem to positively influence an array of types of defective cognitive functioning. This work highlights how programmes not overtly centred on (anti-) doping behaviour may establish 'habits of mind' that reduce the likelihood of engaging in doping-related behaviours.

Returning to the issues proposed by persuasive technologies, it is now clear that the ubiquity of mobile phone technology is such that any intervention delivered through this medium has the potential to be 'global'. Recent worldwide estimates are for the existence of billions of mobile phone subscriptions, indicating the potential audience of anything that 'goes viral'. Where interventions meet the knowledge mobilisation standards for being useful, useable and used, they are more likely to ensure fuller engagement of users. Fogg (Retrieved from http://behaviormodel.org/index.html) details distinctive concerns in the development of mobile phone applications that meet aspirations for 'social good'. Future work should consider how mobile phone technologies can be developed to deliver and/or enhance anti-doping work.

Fogg also identifies that the most important facet of being useful, useable and used is that use is 'easy'. 'Ease' requires two key features; (i) any actions are within an individual's range of daily accomplishments and (ii) they experience many – and often powerful - prompts ('triggers') to remind individuals to undertake the behaviours. These behaviours will be most widely adopted in any given group. For this reason, so the logic goes, they should assume priority in

planning and delivery. In Fogg's understanding, it is only once these issues have been addressed that any attention needs to fall to the influence of motivators. This represents another innovative feature of this framework; 'motivators' – as opposed to 'motivation' - encompasses notions stemming from socially-oriented emotions that are not widely operationalised, including inclusion, pain and fear. Adding even more options, triggers can be applied to any one of three periods of change (i.e., change for a single event, for a specific duration, or change permanently). Further, Fogg specifies five 'types' of change (e.g., complete cessation, cutting back, through to permanent adoption), giving 15 behaviour change scenarios (i.e., 3 x 5). It will be interesting to see how anti-doping programmes can be developed around any of these scenarios.

Another body of evidence suggests the importance of intervention sequencing (this has parallels with the notion of stage-matching which is central to intervention approaches derived from the popular Transtheoretical Model; Prochaska & DiClemente, 1982). Project Zero (http://www.pz.harvard.edu), an educational research programme from Harvard University, highlights the developmental importance of being alert since alertness precedes either affirming or questioning any new ideas. Once individuals are engaged enough to care, they amplify engagement by thinking of new solutions and/or future directions. Thus, there is a required order for any intervention with young people; deployment of abilities follows attention and engagement.

Once the processes of human attention are addressed, it may be important to consider how learning dispositions play out in responding to interventions (Perkins, 2012). Far from requiring individuals to be well suited for a given programme, it is no longer acceptable to expect this, nor to 'blame' those unaligned participants for poor programme outcomes. In a world preferring ideas related to differentiated learning, the suggestion is increasingly being made that successful interventions must in-build the capacity to differentiate according to pre-existing client learning preferences. Although we can dispense with ideas of learning styles within this discussion, this says much about the importance of programmes being designed, if not delivered, by highly skilled practitioners.

Consistent with addressing factors beyond personal motivation, behavioural economics has emerged. Based on the ideas of Kahneman (2011) and Thaler and Sunstein (2008), they have become embodied in notions of 'choice architecture', expressed as Nudge and MINDSPACE (http://www.instituteforgovernment.org.uk). 'Nudge' acknowledges that much of what drives human behaviour relates to sub-conscious information processing. This work also draws on new understanding of human decision-making, especially its shortcomings. For example, Kahneman (2011) describes how human behaviours are the product of system 1 (fast and responsive) and system 2 thinking (slow and deliberative). System 1 thinking is the more likely option for deployment in a busy daily life, which explains why so much of daily action can be 'explained' by faulty decision-making; fast-acting heuristics and rules of thumb ensure functioning amid busy daily routines. While this set of understandings has yet to be tested in any fulsome way, they offer intriguing possibilities for mass behaviour change.

Beyond the practical differences proposed by these new approaches, other approaches, exemplified by Mitchie, van Stralen and West (2011), aim to integrate change approaches to lever all the major influences on behaviour. Drawing on early social marketing approaches (Andreassen, 1993), and depicted by concentric circles showing micro-system effects at the centre to macro-system effects on the outer, the term 'ecological' seems to cover the collective aspiration. One recent depiction of an ecological approach (Mitchie et al., 2011), involves three concentric circles, this time with segments in each. There are three inner segments on the central ring ('Sources of behaviour'; motivation, opportunity, capability), nine segments on the middle ring ('Intervention functions'), ending with seven 'Policy category' segments on the outer ring. Importantly, this framework supports the alignment of (i) the intervention type together with (ii) features to the behavioural target, (ii) the target audience and (iv) intervention context. Inevitably, each of these approaches will generate distinctive research approaches.

Still other 'ecological' approaches, such as that of Glasgow (2003) and Glasgow, Vogt and Boles (1999), focus attention on generating evidence that can inform both policy and practice. The Reach, Effectiveness, Adoption, Implementation and Maintenance (RE-AIM) framework builds on earlier conceptual work, including that of Diffusion of Innovation (Rogers, 2003) and PRECEED-PROCEDE (Greene & Kreuter, 2005). It has been used to successfully identify

programme effects across domains, including those of sport (Zwolinsky et al., 2012). RE-AIM is well-suited to identifying specific elements of service success and to linking these to the processes that enhance success, making it appropriate for identifying the 'active ingredients' in any programmes delivery.

Importantly, these developments link with calls for better quality research evidence. Such calls cover Education and Public Policy (Goldacre, 2013; Haynes, Service, Goldacre, & Torgerson, 2012), in the understanding that better quality evidence provides guidance about how to develop evidence-based practice. Driven by concerns about wasted investment in interventions (and evaluation designs) that cannot confirm which approach works best, Haynes et al. (2012) propose that the ideal development of evidence based policy follows a sequence of 'test, learn, adapt'.

Conclusion

The field of behaviour change is moving fast. Recent developments in understanding are refining understanding regarding how to capture and retain human attention and to support short-, mid- and longer-term behaviour. Equally, developments in understanding about what meets the needs of contemporary society are directing researchers, evaluators and service commissioners, to place a high value on 'science' that offers a serious chance of being effective in community settings. This casts new light on what will 'count' as evidence in twenty-first century societies.

Synthesis and Future Focus

By applying a mixed-studies approach we have provided a comprehensive overview of the latest evidence on the social psychology of doping. Since 2007 there has been a rapid increase in the quantity and quality of studies examining doping in sport. Collectively, they further our understanding of the myriad of personal and psychosocial processes underpinning doping in sport. However, research directions appear to be pursued in a reactive and uncoordinated manner, which can lead to a high degree of study repetition. While the majority of research remains largely descriptive and atheoretical, new programmes of research and international research collaborations are emerging. Further progress is also evidenced through the diverse methodologies that are being applied across key stakeholder groups.

The review identified multiple forms of deductively and inductively derived evidence. However, the heterogeneity of the studies means that definitive conclusions regarding the prevention of doping in sport remain elusive at this time. Still, consistent support was found for five main themes: (a) sport doping exists in a complex web of socio-demographic and psychosocial correlates and predictors, (b) critical incidents, both within sport and beyond, increase doping vulnerability, (c) social context and the role of reference groups - such as the coach, family, or peers – can facilitate and/or inhibit doping, (d) there is a perception that the likelihood of doping detection is low; often this is combined with deep doubts about the legitimacy of the current detection-deterrence system, and (e) athletes' and ASP exposure to formal anti-doping education appears insufficient and knowledge of anti-doping is moderate at best.

A complex web of doping correlates and predictors

Doping is not confined to high performance sport but rather its use permeates all participation levels. Presently, it remains an aspiration to accurately identify doping rates within sport and society. This is one of the biggest challenges facing researchers and policymakers in the field. Although this review did not focus on analysing the literature on

doping prevalence, the studies appraised clearly demonstrate higher percentages of athletes engaging in doping than official WADA laboratory statistics depict (i.e., Pitsch & Emrich, 2012). Self-report studies also validate this claim where athletes declare higher rates of personal use of banned substances. This pattern is repeated – and intensified - when the frame of reference is beyond the athletes' own immediate social context, sport or country.

In general, athletes across all competitive levels report negative attitudes towards doping in sport. They typically regard doping as unfair, harmful, morally wrong and/or cheating. As one might expect, self-declared users of PEDs hold more lenient attitudes to doping than non-users. Regarding the legalisation of drugs in sport, most surveyed athletes were not in favour of a permissive approach; athletes typically assign dopers a negative social image/prototype. Paradoxically, in response to hypothetical situations, adolescent, competitive and elite athletes do not always reject the use of prohibited substances or methods. This proposes that athletes at all levels might be willing, vulnerable, susceptible, or even intending, to dope under certain conditions (i.e., if a drug was undetectable and guaranteed success without negative health consequences). However, scores derived from instruments assessing these variables are typically low; such 'floor effects' are problematic, particularly when it comes to evaluating anti-doping intervention outcomes (Ntoumanis et al., 2014).

A number of personal and psychosocial factors correlate with and/or predict athletes' self-declared PED use, expressed attitudes, doping intentions, behavioural willingness and doping susceptibility. These include: male gender, participation in sports that depend on speed, power and endurance, heavy training loads (i.e., >5 times per week), gym environment exposure, identifying as a full-time athlete, NS use, weight control behaviours, having the drive to be muscular or thin, personal morality and sportspersonship, situational temptation, more favourable doping user prototypes, low self-esteem, high trait anxiety, self-efficacy to refrain from doping, sensation seeking, greater perceptions of normative approval, weaker confidence in ability to resist social pressure, controlled motivation, ego orientation, perfectionism, low levels of self-control and the belief that everyone else is doping (Figure 11).

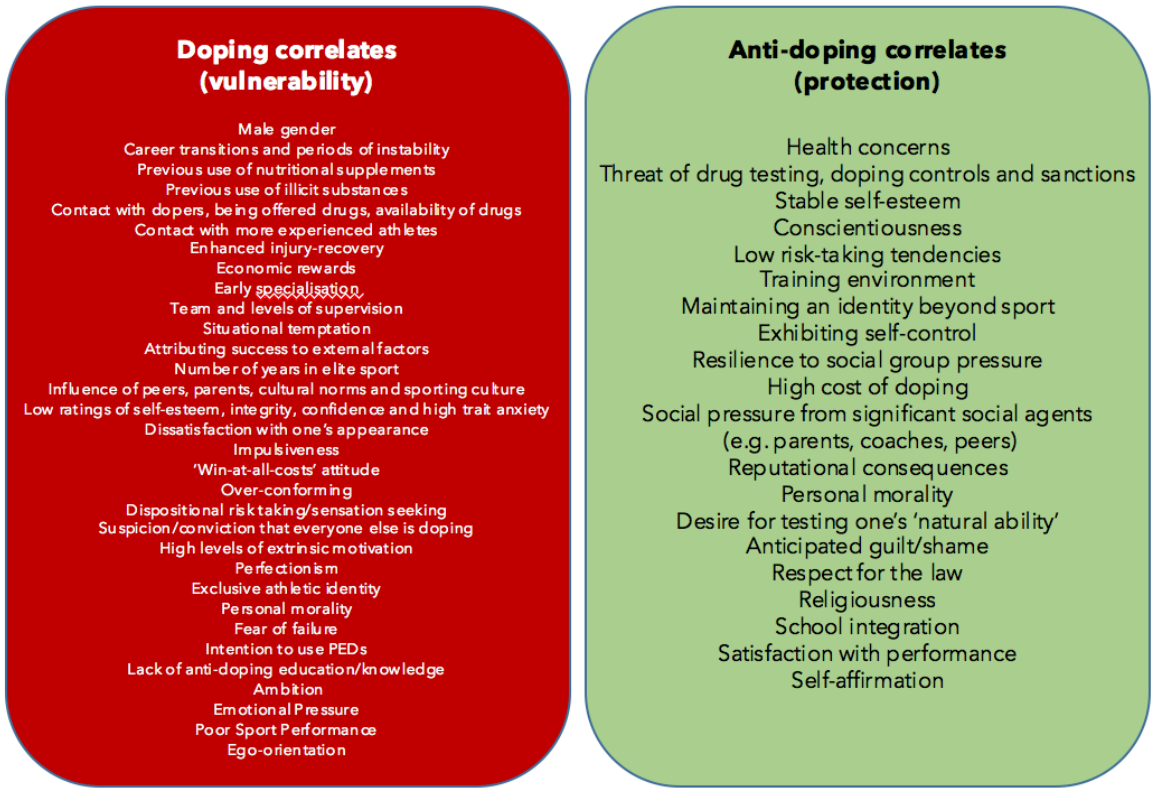

Figure 11. Doping and anti-doping correlates

As a narrative synthesis we have not quantified the magnitude of the effects of these predictors on doping attitudes, intentions and behaviour. However, in another WADA funded review, Ntoumanis and colleagues (2014) quantitatively synthesised the evidence on the personal and psychosocial predictors of doping use and intentions. They found that the three strongest positive correlates of doping intentions and behaviours were; (i) using legal supplements, (ii) perceived social norms, and (iii) positive attitudes towards doping. In contrast, morality and self-efficacy to refrain from doping had the strongest negative association with doping intentions and behaviours. Although these effects were significant, the effect sizes were small to moderate.

The correlational nature of the studies included in the meta-analysis was also reiterated as a limitation of the extant literature (Ntoumanis et al., 2014). This is deemed to be a limitation because such designs are not capable of establishing cause and effect relationships. As a result these kinds of studies will do little to inform high quality policy and practice. Furthermore, correlates can only be regarded as 'risk factors' when they precede doping.

Therefore, longitudinal and/or experimental designs are needed to provide insightful information on the causal effects of the influential variables already identified in existing studies. In addition, the current emphasis on person-specific correlates indirectly places responsibility for doping at the door of the doper. However, as with bullying and torture, it is important to move beyond relying on assumptions of simple causality when the problem is multifaceted. A consensus has emerged that no single factor predisposes an individual to use PEDs in sport; rather, factors accumulate to act individually, collectively and/or in sequence to support the decision to dope. Greater attention should now be afforded to investigating what it is about sport that promotes, and in some instances condones, doping in sport.

Doping vulnerability and critical incidents

It is posited that the sporting culture and context sets the stage for doping behaviour. Studies deploying qualitative methodologies identify some of the personal and psychosocial correlates and predictors of doping use while pointing to practical concerns and 'tipping points' that increase doping vulnerability and temptation. Among studies with sanctioned athletes, and with competitive and elite athletes, these 'tipping points' include (i) dealing with an injury or challenging training programmes, (ii) recovering from a dip in performance, (iii) being anxious about securing or renewing a professional contract/sponsorship, (iv) concerns about team selection or de-selection, (v) going through career transitions, (vi) entering a new training environment, and (vii) perceiving that others are doping and getting away with it (Hauw & Bilard, 2012; Kirby et al., 2011; Lentillon-Kaestner & Carstairs, 2010; Mazanov et al., 2011). Thus, these periods of personal distress – whether this is due to athletic and/or non-athletic stressors - may encourage doping as a way of managing these situations (Hauw & Mohamed, 2013; Overbye et al., 2013). Early specialisation in sport may exacerbate this vulnerability by encouraging athletes to exclusively identify with the 'athletic identity' and focus solely on training and performance (Hauw & Bilard, 2012).

Social context and the role of reference groups

Findings from qualitative studies in particular highlight the importance of wider sporting and societal support in establishing a culture that promotes 'clean' sport. At a theoretical level, Petróczi and Aidman (2008) emphasise the influence of shared norms within a social group on

doping behaviours. Similarly, Donovan and colleagues (2009) signpost 'reference group opinion' and identify coaches as a primary contact group. Indeed, empirical research corroborates the influence of individuals who are 'close' to or 'important' to athletes in facilitating or inhibiting doping behaviours (e.g., Erickson et al., 2015; Goulet, et al., 2010; Hodge et al., 2013; Kirby, et al., 2011; Smith & Stewart, 2010). If we take coaches as an example, theoretical perspectives suggest that they must be conscious of the environment they create (Smith et al, 2010). More specifically, the motivational climate, which is shaped by the achievement expectations of external others (including coaches, parents, and peers), has been proposed as a systemic factor in doping (Petróczi & Aidman, 2008). Early findings provide support for the notion that coaches who are controlling and create a 'win at all costs' culture foster doping vulnerability amongst their athletes (Barkoukis et al., 2011; Hodge et al., 2013).

Despite the acceptance that ASP can be complicit in doping, current anti-doping policy and practice is heavily weighted towards the individual athlete, as evidenced by the core anti-doping concept of strict liability. However, athletes do not live in isolation (Dunn & Thomas, 2012); they are surrounded by a complex network of influential others (Pappa & Kennedy, 2012; Thomas et al., 2011). Consequently, a myriad of interpersonal, intrapersonal, social, and environmental factors interact systematically; these interactions in turn guide behaviour (Johnson et al., 2010; Smith & Stewart, 2010). It is for these reasons that doping needs to be considered within the specific sporting and societal culture in which it exists (Hauw, 2013). Accordingly, research has increasingly argued for the importance of preventive messages and efforts targeting athletes' social networks (Overbye et al., 2015; Stewart & Smith, 2010). Likewise, athletes themselves have argued for the importance of punishment extending to those complicit in promoting or facilitating doping (Engelberg et al., 2014). In response to the growing informal and formal evidence supporting the significance of athletes' wider environments (Pappa & Kennedy, 2012), the revised Code (WADA, 2015) now includes notable punishments for ASP found to be complicit in doping behaviours.

Given the potential consequences of ASP failing to fulfil their policy prescribed anti-doping roles and responsibilities, ASP's lack of knowledge and awareness of these matters is striking. Further, low levels of engagement, or opportunities to engage, with formal anti-doping

education have also been recorded. Taken together, ASP are at risk of committing an anti-doping rule violation and as a source of doping-related information, they also transfer this risk to their athletes. However, insights from the field suggest it might not be enough to have outstanding knowledge of anti-doping rules and regulations if the wider sporting system fails to create a supportive environment that prioritises the long-term health and well-being of athletes and ASP.

Legitimacy of the current detection-deterrence system

Alongside an emergent focus on intelligence and investigations, drug testing remains a prominent strategy in the revised WADA Code (WADA, 2015). Yet, existing evidence increasingly questions its utility and sensitivity. Tests are often administered infrequently and many athletes know ahead of time when they are going to be tested (Breivik et al., 2009; Pitsch & Emrich, 2011). This should concern anti-doping agencies whose approach draws on the belief that the risk of getting caught is one of the strongest motives for an athlete not to use doping agents (Donovan, 2009; Overbye et al., 2013). Until testing is regarded as offering a legitimate and consistent threat – both in and out-of-competition – it is only likely to deliver weak preventive results. Exacerbating the weak legitimacy of the doping control procedures is the belief that doping is widespread throughout sport (Erickson et al., 2015; Lazuras et al., 2010; Ohl et al., 2013; Pappa & Kennedy, 2012) and this belief is further reinforced by the frequency of stories of doping in the media. This is potentially problematic as research highlights the power of the media to frame knowledge and perceptions of doping in sport (Johnson et al., 2013; Sas-Nowosielski & Świątkowska, 2007).

As well as reporting prevalence or willingness to dope, some studies also included reasons for use. The main identified reasons for PED use included to improve sports performance (Gradidge et al., 2011), ambition, financial pressure and emotional pressure (Nolte et al., 2014). Although not discussing their own reasons for using PEDs because they felt no pressure to dope, young British athletes identified maintaining a current standard of living and injury as potential pressure points that might lead to doping (Bloodworth et al., 2012). In comparison, Rees and colleagues (2008) identified their most popular reasons for using AAS; gaining muscle mass (16.3%), looking better (11%), gaining strength (10.5%), losing weight (10.2%), play sports better (10.1%) and losing body fat (9.4%). One study also reported that

49% of US high school students believed that AAS improve athletic performance, while 38% thought that AAS use improves appearance (Lorang et al., 2011). Similarly, more males believed AAS would improve sports performance and physique than females (Lorang et al., 2011; Sagoe et al., 2015).

Compounding the weaknesses of the detection-deterrence approach, doping controls are uncommon and unsystematic beyond the level of high performance sport (Lentillon-Kaestner, Hagger, & Hardcastle, 2012). Additionally, drug testing will always be a step behind the advances in biomedicine (Lentillon-Kaestner, 2013). Although athletes and ASP call for an improvement in the precision and reach of drug testing, the costs associated with the control process render this extension impractical and unaffordable (Huybers & Mazanov, 2012). Further, relying on the threat of drug tests and subsequent bans as a main deterrent is questionable. Recent research (e.g., Engelberg et al., 2014; Overbye et al., 2015; Overbye et al., 2013) highlights that although it is still perceived as a deterrent amongst elite athletes, other factors (e.g. self-imposed sanctions that constrain doping behaviour by anticipation) might be more influential and cost-effective.

Towards a systems-based approach to doping prevention

In light of the limitations of detection-deterrence approaches, there is growing recognition that prevention through education is the most promising strategy for obstructing doping in sport. However, evidence is notably absent regarding the evaluation of anti-doping education. Few innovative educational approaches have been proposed, developed and tested. Such interventions need to consider multiple factors, across multiple levels, to optimise doping prevention and to deliver on the aspiration that athletes can compete in 'clean' sport. Current anti-doping education is concerned with compliance and a certain degree of reform will be required in order to shift from a compliance culture to one that prioritises learning and athlete welfare.

At the same time, establishing the feasibility and sustainability of intervention strategies will be important. Questions of cost, cost-effectiveness and comparative effectiveness will always be important and need to feature more strongly. Our search identified no studies addressing the

cost or cost-effectiveness of contemporary anti-doping education programmes or academic-led interventions. Generating clear evidence of what works - and when - will be important for delivering more effective provision. This is an essential area of future research.

Given the limited number of studies that have evaluated anti-doping programmes, it is timely to reflect on the dominant approaches to behaviour change intervention design. Accepting that any behaviour is influenced by its context; understanding the behaviour is the key to changing it (Mitchie et al., 2011). Although this review has demonstrated that the field is progressing our understanding of doping in sport, there is still a need to establish a robust evidence base that guides and improves intervention planning. In contrast, there is a well-established body of evidence on the science of behaviour change. The anti-doping community has much to learn from the latest thinking in that field, not least because it draws on decades of empirical research on addressing the latest threats to public health such as smoking cessation, drink driving, transmission of sexual disease, etc. Such research has confirmed the power of simultaneously and consistently intervening at many levels of influence.

Drawing upon the latest understanding from behavioural science, Mitchie and colleagues (2011) propose eight steps in the intervention design process. These relate well to anti-doping design. The eight intervention design steps span three specific areas of need: (i) understanding the behaviour, (ii) identifying intervention options, and (iii) identifying implementation options. Understanding the behaviour relies on establishing a clear view of the problem that is to be solved and in what way. Establishing what will bring about the desired behaviour change is also important. Once these issues are resolved, the types of intervention that are likely to bring about the desired change can be addressed. Mitchie et al. (2011) argue strongly that sufficient time and resources are dedicated to the first phase in order to select, specify and fully understand the behaviour to be altered. Rushing to action is only likely to produce under-effective programmes. Once a multifaceted understanding of the behavioural target is established, the types of intervention that are likely to bring about the desired change can be addressed. The final phase will consider the specific intervention content and how it is best implemented. Problematically, doping prevalence rates are clearly underpinned by a range of behaviours. Thus, behaviour change targets may vary. These

targets may include (i) inadvertent doping through the use of a contaminated NS or over-the-counter medication and (ii) effective use of ADAMS to provide accurate whereabouts information.

This level of detail is important. Behaviour change is not achieved easily, nor is it a one-off event; policymakers, educators and researchers must not underestimate the inherent challenge of such a task. While the sport domain, like many others, is continually expected to deliver 'better, with less', the problem of doping in sport will never be resolved by sitting in a 45-minute anti-doping education session. Preventing doping in sport will involve a combination of modifying the strong psychosocial and environmental factors that promote doping behaviours.

Reflections on research design

Doping-related research is diffuse. This heterogeneity spans study contexts (e.g., specific sports, levels, disciplines), outcome variables (e.g., doping attitude, intention, use, vulnerability and susceptibility) and study instrumentation. The use of inconsistent definitions and measures of personal, situational and environmental factors has made it difficult to compare studies. Additionally, self-report measures continue to prevail even though these findings can be confounded by the tendency to respond in socially desirable – and thus unreliable – ways (Gucciardi et al., 2010). Although some studies have controlled for social desirability, many do not. Given the politically sensitive nature of doping in sport and the dominance of the 'cheating narrative', respondents are likely to offer heavily self-censored responses when asked about their attitudes toward doping, past/current doping use or doping willingness/intentions in fear of sanction or punishment (Lazuras et al., 2010). Consequently, procedures are needed that will validate self-reported measures of past doping use and future intentions (Barkoukis et al., 2011).

Over the review period, there has been an increase in the use of indirect research methods, such as hypothetical scenarios (Gucciardi et al., 2010) and the development of measurement approaches drawing upon the random response technique (Brand, Heck, et al., 2014; Brand et al., 2011; Brand, Wolff, et al., 2014; Petróczi, Aidman, et al., 2008; Pitsch & Emrich, 2011). These methodological advances help to address self-reporting biases. Looking ahead, it is

crucial that the perspectives of athletes and ASP are accurately documented to ensure that appropriate intervention strategies can be implemented.

To further understanding of personal experiences, we have witnessed an emergence of studies located in the interpretivist paradigm. A growing body of qualitative research has moved towards a concern with meaning and interpretation (Bruner, 1990). This shift has begun to establish a more in-depth exploration of doping, has shed new light on theory driven by quantitative findings and has highlighted the complexities that are revealed by applying a cultural lens. Research findings point to the powerful role that a combination and interaction of sport-environment factors play in influencing doping. This has helped to shift attention away from the pre-existing, unhelpful and crude focus on single athlete characteristics. Qualitative studies have also addressed the experiential understandings of doping and anti-doping and the experience of humans navigating these domains.

It is clear that there is much to learn from the idiosyncratic and deeply personal stories that people will tell. At the same time, for many athletes and ASP, qualitative interviews represent their first meaningful discussion about the issue of doping beyond doping control procedures (Johnson, 2012; Dimeo et al., 2012; Erickson et al., 2015). This finding was stark; the process of interviewing – which typically involves talking to strangers about difficult themes – can facilitate education in its own right.

In a bid to understand doping decision-making researchers have deployed various theoretical approaches. Consistent with wider trends in studies of health behaviour, the social cognitive approach dominates psychological explanations of doping behaviour. While researchers might prefer frequently used scales because it seems easier to publish those in peer-reviewed journals, the assumptions of these 'linear expectancy-value' approaches have been questioned. Authors increasingly argue that there is no evidence that the assumed rationality translates to doping (Hauw & Bilard, 2012; Hauw & Mohamed, 2013; Stewart & Smith, 2008).

Moreover, the salient focus on doping attitudes has been questioned, not least because they describe only a small part of the range of psychosocial variables affecting the use of PEDs (Lazuras et al., 2010). Consequently, a shift in approach towards meta-theory perspectives has taken place regarding understanding of doping attitudes, intentions, vulnerability and

behaviour. Research groups driving this agenda have proposed meta-theories that derive variables and concepts from motivational theories (e.g., achievement goal theory, self-determination theory), social cognitive theories (e.g., theory of planned behaviour) and self-regulatory processes (Barkoukis, Lazuras, Tsorbatzoudis, et al., 2013; Chan et al., 2015; Hodge et al., 2013; Lazuras et al., 2015; Lucidi et al., 2008). From an evidence-informed policy perspective, keeping the model simple is also important. There is likely to be an inverse relationship between the complexity of the model (making its workings incomprehensible to most readers) and its uptake by policymakers who have a reasonable understanding of modelling but do not trust black box models (Whitty, 2015).

Future focus

This research is replete with important unanswered research questions. Most fundamentally, the questions span developments in theory, research methodology and anti-doping policy and practice. Regardless of specific research questions or contexts, a number of processes must be in-built to generate impact. By impact we mean directly influencing anti-doping policy and practice. Developing research that influences policy is essential (Whitty, 2015) and the easiest way to do this is to ensure that research outputs are relevant and accessible to policymakers. This synthesis confirms that the research required to inform anti-doping policy has not yet been published, and may not have been conducted. Whitty (2015) argues that many research scientists continue to describe a problem in greater detail – typically using progressively more complex terms – for years after policymakers have 'clocked it', without progressing to the next phase of designing and testing interventions. Although academics are primed to respond to the gaps in the evidence base, work is continually needed to integrate practitioners and policymakers to help prioritise key questions. Paying more attention to the principles of 'translational research', the integration with different stakeholder groups to ensure both scientific integrity with contextual 'fit' needs to be prioritised at every stage of the research process. Here the challenge is to transfer into the sporting domain the scientific rigour that establishes the most extensively generalisable findings, while maintaining the essential features of the sporting experience and process (i.e., the local 'fit' of what the science says works).

Broadly, we need to:

1. Commit to building the science of programme implementation and sustainability in the field of doping prevention. Importantly, investments are needed to better understand the factors related to programme integration and acceptance across key stakeholders in the doping prevention landscape.
2. Ensure a greater degree of collaboration so that researchers can learn from anti-doping policymakers, practitioners and educators, and vice versa. Failure to do so will limit our ability to deliver relevant, acceptable and evidence-informed anti-doping policies. Moreover, researchers and policymakers need to collaborate with sports organisations to understand the supports and structures that are necessary to create sustainable change in prevention programming.
3. Continue to build long-term research programmes and collaborations across research teams. This will help to generate multi-site, multi-country empirical studies and establish cross-country and cross-cultural comparative data. In turn, this will enable the development and refinement of innovative, effective and culturally sensitive anti-doping programmes, models and theories.
4. Encourage inter-disciplinary and multi-sector working. The issue of doping in sport – and of doping in wider society – cannot be solved by one discipline alone. We need a systems based approach to prevention, drawing together researchers, practitioners and policymakers from a range of fields including behavioural science, neuroscience, education and public health.

At a more specific level, there is a need to arrive at an international consensus on research priorities in the area of doping in sport. This will help to guide more meaningful and focused research. Agreement on research priorities may also help to guide funding allocations, inform evidence-based policy and direct postgraduate students pursuing higher degrees in the field. Until this consensus is reached, many of the research recommendations put forward by Backhouse et al. in 2007 still apply today. Therefore, they are reiterated or progressed, where appropriate, in the bulleted list below.

Research design

- Quantitative research designs should progress toward longitudinal, experimental and controlled studies to examine causality. Longitudinal research may contribute to a better understanding of the doping process and aid development of doping prevention initiatives. Where questionnaires are to be administered, they must be subject to prior psychometric testing.
- Qualitative research is encouraged to open a window on the culture of doping in sport and the influence of emerging personal, situational and contextual factors.
- Studies with a strong theoretical base are needed. This is justified by the wide diversity of doping correlates and predictors already identified.
- Researchers are encouraged to employ innovative and rigorous methods of data collection. This is especially important given the sensitive nature of the behaviour of interest. To move this forward, working groups could establish conceptual clarity around the core dependent variable(s) for anti-doping research. This could address compliance, susceptibility and actual drug use. Moreover, the field is defined to some degree by a disparate body of work with few established academics engaging in scientific debate. Developing forums and networking opportunities will help here.
- Multi-site, multi-country studies, employing the same research design and administering the pre-validated research instruments will establish cross-country and cross-cultural comparative data.

Sampling

- All participant groups reviewed in this document require further systematic investigation. However, studies on ASP remain scarce. Due to the complexities of doping in sport, we must consider the perspectives of those surrounding the athlete (e.g., coaches, parents, sport and exercise science/medicine personnel). For example, there is an absence of evidence on the lived experience of ASP who have prescribed roles and responsibilities in the Code. Future research should explore the challenges and dilemmas that may be encountered in fulfilling their obligations alongside their professional duties (e.g., medical doctors).

Education and intervention

- Using the available evidence, develop, test and refine anti-doping education programmes for key stakeholder groups.
- Conduct long-term follow-up of intervention effects to assess their persistence over time and determine programme effectiveness.
- Explore strategies for preventing the use of a range of performance enhancing and recreational drugs in athletes.

Conclusion

A growing body of research suggests that human behaviour is not only driven by deliberation (e.g. knowledge, attitudes and beliefs) but also can be automatic, cued by environmental stimuli (Marteau, Hollands, & Fletcher, 2012). These environmental factors may be physical (e.g. physical structures and facilities), social (e.g. social support and social norms) or institutional (e.g. within sports rules and policies). This is consistent with ecological approaches to behaviour change. In this understanding, environments restrict the range of behaviour by promoting - and sometimes demanding - certain actions and by discouraging or prohibiting others (Green, Richard, & Potvin, 1996). Qualitative research shifts attention to acknowledge the interplay of factors and conditions that may foster doping across sports and performance levels. At the most fundamental level, understanding the behaviour is central to intentionally acting to change it. This requirement is not yet met and therefore remains a priority for the field.

As researchers, it is important to acknowledge and respond to the multifaceted and complex nature of doping to improve the quality of the evidence base that will inform prevention approaches. Thus, interventions to promote 'clean' sport should address the multiple layers of influence and recognise how features of sport's physical, social and policy environments interact and influence each other to shape performance and image enhancing behaviours. Modifying these features is likely to require on-going deployment of a broad range of policy measures across multiple agencies and sectors.

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Appendix: Search Strategy

Search strategy

The search strategy employed keywords for drug use in sport: 'doping', 'performance-enhancing drugs', 'performance-enhancing substances' and 'drugs AND sport' combined with selected terms relating to specific areas of interest:

1) 'attitudes', 'beliefs', 'knowledge', 'perspectives', 'perceptions', 'opinions'
2) 'correlates', 'determinants', 'risk factors', 'predictors' 'precipitating factors'
3) 'education', 'intervention', 'model', 'prevention'.

Inclusion criteria

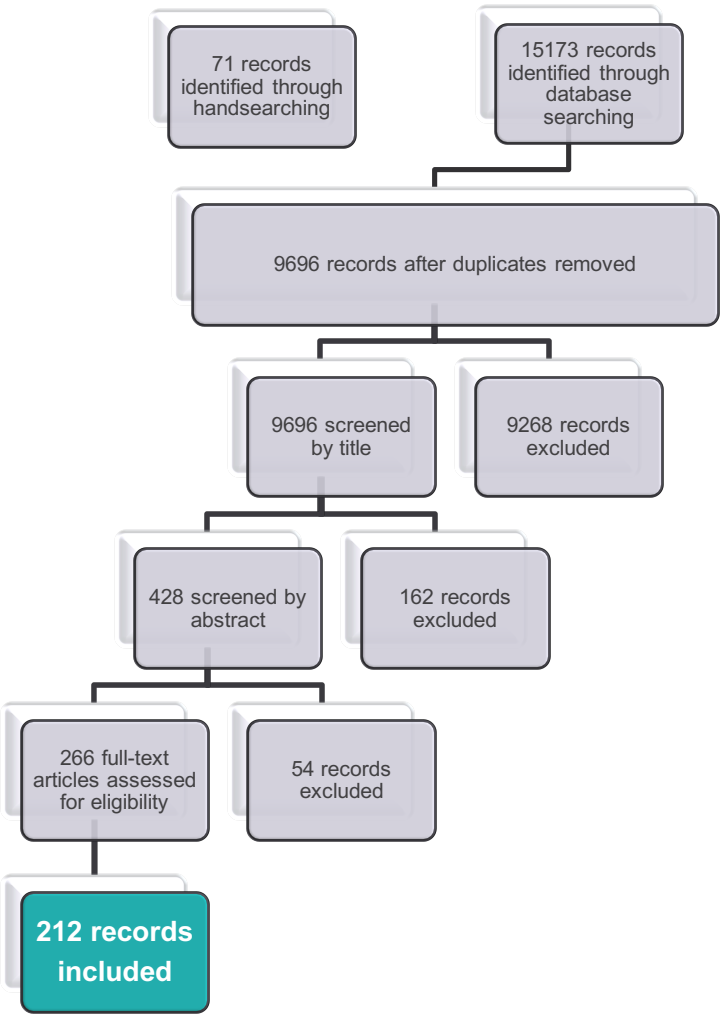
Articles were included in the review if they:

- Investigated the attitudes, beliefs, values, opinions or knowledge of (anti-) doping in sport amongst athletes, gym users, general public and ASP.
- Examined psychosocial correlates and predictors of doping in sport.
- Developed or progressed doping specific models and theories.
- Examined the efficacy and effectiveness of anti-doping education programmes.

LW conducted the main search that was limited to articles published in the English language since January 2007. Manual searches of personal files and reference lists of primary research articles and reviews were also carried out. In addition, calls for researchers to send details of their latest published empirical research were made via the research teams networks (e.g., International Network of Doping Research; INDR). Studies that investigated alcohol or other drug use (performance-enhancing or recreational) without specific reference to sport were excluded. Studies that only reported prevalence rates were also excluded. The final search was undertaken on the 1st May 2015.

Search stages

Sifting of search 'hits' consisted of three stages, as recommended by Lloyd Jones (2004). Papers were first reviewed by title, then by abstract and, finally by full text; excluding those at each stage that did not satisfy inclusion criteria. Searching revealed 15,173 potentially relevant search 'hits'. After duplicates were removed and handsearches were included, this left 9696 potential 'hits'[11]. In cases of uncertainty, LW and SB evaluated papers and a consensus was reached by discussion.



[11] Please contact the authors for a more detailed breakdown of the search stages.

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