Psychological and Behavioural Factors of Unintentional Doping: A Preliminary Systematic Review

Derwin King Chung Chan[1, 2]
Tracy Chor Wai Tang[1]
Daniel F. Gucciardi[2]
Nikos Ntoumanis[2]
James A. Dimmock[4]
Robert J. Donovan[4]
Sarah J. Hardcastle[2]
Martin S. Hagger[2, 3]

[1]School of Public Health, The University of Hong Kong
[2]Curtin University, Perth, Australia
[3]University of University of Jyväskylä
[4]The University of Western Australia

Correspondence concerning this article should be addressed to Derwin K. C. Chan, School of Public Health, The University of Hong Kong. Email: derwin.chan@hku.hk.

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Abstract

In some cases, doping in sport is an intentional goal-directed behavior, but research suggests that it might also occur accidentally when athletes inadvertently or unintentionally consume banned performance-enhancing drugs via food, supplements or medication. Because research into the psychological factors of unintentional doping is still emerging, this paper aims to conduct a preliminary systematic review of all the existing literature concerning the psychology of unintentional doping in sport. The systematic review was carried out via an extensive search of Medline, PsycINFO, PsycTESTS, PsycARTICLES and Web of Science, and reports from World Anti-Doping Agency. Among the 2,110 articles identified from the search, six studies met the inclusion and exclusion criteria. Evidence from these studies suggests that the avoidance of unintentional doping could be related to a number of behavioural, social and psychological factors, such as athletes' conscious awareness of, and capacity to cope with, situations where they may be exposed to performance-enhancing substances. Motivational factors from self-determination theory, social cognitive variables and beliefs from the theory of planned behaviour, and trait self-control were also related to athletes' behaviours that contribute to the avoidance of unintentional doping. On the basis of this systematic review, we propose initial evidence-based suggestions that may support sport scientists, team doctors, and practitioners to implement interventions or educational programs to increase athletes' awareness of, and ability to avoid, unintentional doping in sport.

Keywords: anti-doping; unintentional doping; doping avoidance; adverse analytical findings; supplements

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The World Anti-Doping Agency (WADA) is an important organization initiated by the international Olympic committee that aims to lead a collaborative world-wide movement in doping-free sports. With the significance of this committee, the WADA defines doping behaviour as the occurrence of one or more anti-doping rule violations. With further speculation, this means that any use of illegal performance-enhancing substances or methods in sports, is considered a serious offense (World Anti-Doping Agency, 2015). To prevent or minimise the occurrence of doping violations, WADA has provided an anti-doping code of rules, regulations, and policies, as well as an explicit list of prohibited substances, making them publically available (World Anti-Doping Agency, 2015). Despite the efforts of WADA to clearly identify prohibited drugs and encourage fair play in competitive sport, some athletes continue to use banned performance-enhancing drugs and test positive in doping controls (de Hon, Kuipers, & van Bottenburg, 2015; World Anti-Doping Agency, 2016). The subsequent report of adverse analytical findings then illustrates that there is a presence of a prohibited substance/metabolites or markers within the athlete sample (World Anti-Doping Agency, 2016). Positive tests of elite athletes still continue to receive considerable attention in the literature and media; with examples of recent high profile cases Maria Sharapova, Yuliya Stepanova, and Jon Jones.

In an attempt to shed light on doping use in sport, researchers have identified psychological variables such as social norms, attitudes towards doping, moral norms, and self-efficacy are associated with lower *intentional* doping-related outcomes (Barkoukis, Lazuras, Tsorbatzoudis, & Rodafinos, 2013; Hodge, Hargreaves, Gerrard, & Lonsdale, 2013; Lucidi et al., 2008; Ntoumanis, Ng, Barkoukis, & Backhouse, 2014; Zelli, Mallia, & Lucidi, 2010). With this in mind, much of the research literature identifies doping as a consciously-

controlled, goal-directed behaviour (Connor, Woolf, & Mazanov, 2013; Donovan, Egger, Kapernick, & Mendoza, 2002; Gucciardi, Jalleh, & Donovan, 2011; Jalleh, Donovan, & Jobling, 2013; Lentillon-Kaestner, Hagger, & Hardcastle, 2012). However, recent articles indicated that athletes can also be unwittingly and unintentionally exposed to doping when consuming unfamiliar foods, drinks, supplements and/or medications, as they are oblivious of the specific ingredient content (Chan et al., 2016; Chan, Tang, Yung, Gucciardi, & Hagger, 2017). For example, Baume and colleagues analysed 103 internet-bought dietary supplements, seventeen (16.5%) were found to contain performance-enhancing substances banned by WADA, including anabolic steroid, metadienone, and hormones or prohormones (Baume, Mahler, Kamber, Mangin, & Saugy, 2006). A recent analysis about cases of adverse analytical findings among UK Rugby Union (Whitaker & Backhouse, 2017) revealed that the claimed reasons for doping were often not for performance-enhancement, but rather for other functional use (e.g., taking nutritional supplement) or lifestyle factors (e.g., management injury or weight). These reasons indeed are hardly to be effective excuses that exempted positive tests from anti-doping rule violation (Chan, Tang, et al., 2017). These findings therefore suggest that athletes should be cautious in purchasing and subsequent consumption of dietary supplements to avoid accidental intake of illegal substances (Baume et al., 2006). Further, it was suggested that athletes should seek professional opinions or guidance prior to purchasing any dietary supplements (Baume et al., 2006). This finding is particularly important nowadays as the increasing availability and ease of purchasing dietary supplements poses an additional threat for athletes to unintentionally dope.

It is also essential to note that taking significant others' advice regarding the use of dietary supplements does not completely safeguard athletes from unintentional doping, as it is possible that the former does not have adequate knowledge or good intentions to help athletes in avoiding banned substances. To avoid unintentional doping, it is essential for athletes to be

aware of the risk associated with unintentionally taking banned substances(Chan, Donovan, et al., 2014). The sport drug control model (Donovan et al., 2002) and its related research findings (Gucciardi et al., 2011; Jalleh et al., 2013) have shown that athletes' threat appraisal is an important predictor of their doping attitude and intention. Threat appraisal arises from the risk of being tested positive (i.e., adverse analytical findings) and the severity of sanctions or other negative consequences resulting from adverse analytical findings (Donovan et al., 2002). The threat appraisal process may also apply to unintentional doping because unintentional doping could also lead to positive test results and sanctions in sport (Chan, Tang, et al., 2017) . Hence, athletes should be aware of the risk of unintentional doping in their daily life, understand its negative consequences, and learn to handle situations where unintentional doping is likely. For example, it has been reported that sometimes athletes may feel obligated and/or pressured in consuming unfamiliar substances provided by their coaches, team doctors, managers, parents, or other social agents in the sporting context, without questioning the specific ingredient content and subsequently ignoring their threat appraisal of the situation (Chan, Hardcastle, et al., 2014; Chan et al., 2016; johnson, Butryn, & Masucci, 2013; Ntoumanis, Barkoukis, Gucciardi, & Chan, 2017). For instance, in investigating patterns of dietary supplement use in Korean and Japanese Judoists, it was observed that Korean Judoists (mean age = 20.81) tended to take advice from parents, whereas Japanese Judoists (mean age = 22.31) were more likely to take advice from coaches, when seeking recommendations on dietary supplement use (Kim et al., 2012). In this case, if significant others are not knowledgeable or are inattentive in identifying prohibited ingredients from the recommended supplements, or if they have bad intentions (e.g., the Essendon doping scandal in Australia; Smith, 2016), the risk of unintentional doping can be substantially heightened, as athletes are not in direct control of what they are consuming.

Other than social influences and dietary supplements, modern elite athletes also spend a considerable amount of time travelling and visiting foreign countries where they may consume unfamiliar foods that do not have labels or descriptions of ingredients. Further, even if listed, the names of the banned performance-enhancing substances on the ingredients list may appear differently compared to the descriptions with which the athlete may be familiar with (e.g., Ephedra Sinica is labelled as Ma Huang in some countries). Thus, the above problems may further increase the risk of doping unintentionally (Chan et al., 2016; Guddat et al., 2012; Somerville & Lewis, 2005; Thevis et al., 2013).

Although an athlete who doped unintentionally may claim that the adverse analytical findings were accidental, WADA's strict liability policy legally states that "ignorance is no excuse", and a violation of the anti-doping policy irrespective of whether it was intentional or not, will still result in the same punishment (Chan, Tang, et al., 2017; World Anti-Doping Agency, 2015). As such, unintentional doping can end in serious consequences, such as sanctions against participation in sport, fines, a loss of personal endorsements and salary, as well as the tarnishing of an athlete's reputation.

The Present Study

The literature regarding the risks and consequences of accidently taking banned performance-enhancing substances, indicates that athletes who wish to "stay clean" should actively engage in a set of behaviours that can reduce the risk of unintentional exposure to, and subsequent consumption of, banned performance-enhancing substances (Chan et al., 2016). Given the importance of protecting athletes from unintentional doping and adverse analytical findings, the purpose of this study was to conduct the first systematic review to evaluate existing research findings regarding key behavioural, psychological, and social processes in the avoidance of unintentional doping within athletes. Although research in this area is still in its infancy, we believe that this systematic review may serve as an interim

report that helps stimulate future research about the psychology of unintentional doping by addressing the strengths and limitations of prior work in this area.

Method

Literature Search

We identified all research articles related to our topic of interest through a search of multiple electronic databases, including Medline, PsycINFO, PsycTESTS, PsycARTICLES and Web of Science. The key terms searched were "anti-doping" or "unintentional doping" or "inadvertent doping" or "accidental doping" or "non-intentional doping" or "adverse analytical findings", along with "psychology". The resource database of the WADA was also used in identifying additional research. To maximise coverage of the literature search, snowballing was carried out by manually searching the reference list of eligible articles, detecting any further studies that were not identified via the search engines.

Inclusion and Exclusion Criteria

Only empirical research papers that were written in English and published as peer-reviewed journal articles, or scientific reports endorsed by the WADA, were included in this review. Furthermore, the topic of interest must have been related to the psychology of unintentional doping or behavioural factors associated with accidental doping among athletes. We excluded papers that focused solely on (1) intentional doping (Ntoumanis et al., 2014), (2) methods of doping control procedures and (3) general reviews/ discussions about adverse analytical findings or accidental doping. In order to be as inclusive as possible in this new area of research, we placed no restrictions in terms of year of publication, with all papers up to April 2016 considered.

Data Extraction and Quality Assessment

Data was extracted from eligible studies and all findings irrelevant to the behavioural/ psychological processes of unintentional doping were filtered out. Apart from study findings

that are relevant to the scope of this review, we additionally coded study design, sample size, sport level, theoretical framework, independent variables, and relevant outcome measures for each eligible study. Furthermore, the quality of the studies was also examined. For quantitative studies, we adopted the Risk of Bias Assessment (Higgins, Altman, & Sterne, 2008) criteria developed in the recent meta-analysis of the personal/ psychological factors of doping (Ntoumanis et al., 2014). If the ratings of all assessment criteria regarding sampling and measurements indicated 'low risk', a study was classified as having a low risk of bias; otherwise, it was considered as having 'potential risk' of bias (Ntoumanis et al., 2014). For qualitative studies, we evaluated the quality of eligible studies using the checklist of Critical Appraisal Skills Programme (CASP, 2016), following the protocol of a recent meta-synthesis of qualitative research in sport psychology (Anthony, Gucciardi, & Gordon, 2016). This checklist deems a study as appropriate when the 10 questions of the criteria have been met and agreed upon (i.e. when none of the assessment criteria report an answer of 'no').

Results and Discussion

The search across the four databases (k = 1,873), together with archives of WADA's scientific reports (k = 5) and snowballing techniques (k = 430) identified a total of 2,308 articles that matched the search terms. After removing duplicated articles (k = 198), we manually screened the remaining 2,110 articles according to the inclusion/exclusion criteria. A total of 2,104 articles did not meet the inclusion criteria; the remaining six papers were eligible for inclusion in the review. The flow diagram of the literature search procedure can be seen in Figure 1. Among the six studies, two were qualitative studies using focus group interviews and four were quantitative survey-based studies with a cross-sectional design. Table 1 displays the individual characteristics of the studies and summarizes the study findings. In the Risk of Bias Assessment (Higgins et al., 2008; Ntoumanis et al., 2014), the quantitative studies were rated "no or low risk" on all the bias criteria of sampling and

measurement, demonstrating that the study results had no potential risk of bias. The Critical Appraisal Skills Programme's checklist (CASP, 2016) also demonstrated that the two qualitative studies were considered as appropriately conducted as none of the assessment criteria received a rating of 'no'. Appendix 1 displays the criteria and results of the Risk of Bias Assessment (for quantitative studies) and Appraisal Skills Programme's checklist. In the following sections, we review and discuss the research findings with respect to their theoretical knowledge and practical implications.

Behavioural Evidence

Cumulative published articles investigated a potential scenario where a food product contains banned performance enhancing substances and highlights that unintentional doping of athletes may result as lack of awareness and/or understanding of prohibited substances in foods, supplements and/or medications (Baume et al., 2006; Chan, Donovan, et al., 2014; Curtis, Gerrard, Burt, & Osborne, 2015; Guddat et al., 2012; Thevis et al., 2013). For example in Baume and colleagues (2006) they found that internet supplements are widely available to athletes, however, some of which contains banned performance enhancing substances. Equally in the Chan and colleagues (2015) study, it was found that athletes, when offered an unfamiliar product, did not actively check the ingredients list printed on the package. With this, it is emphasised that education is a central component to any doping prevention programme, as it could raise athletes' cautiousness when consuming foods, supplements or medications with suspicious substances/ingredients. As such, athletes should behaviourally seek out reliable and understandable doping information to determine whether a substance does or does not contain banned performance-enhancing substances. This extra knowledge can also further empower athletes to critically analyse doping information/substances and debate or reflect on existing anti-doping issues provided by other sports personnel, peers or even sporting agencies (johnson et al., 2013).

Other than seeking correct information about doping, a specific behaviour that may reduce the risk of unintentional doping is checking the ingredients list. Chan, Donovan and colleagues (2014) found that young athletes were unaware of the need to read the ingredients list of unfamiliar food products and engage in strategies to avoid unintentional doping in daily life. In that study, an experimenter offered young elite and sub-elite athletes in Australia (N = 410) an unfamiliar brand of lollipop (disguised as a treat to thank them for their participation) and measured their subsequent behaviour. It was revealed that less than half (40.6%) refused to take or eat the lollipop, and only 16.1% read the ingredients list prior to consumption (Chan, Donovan, et al., 2014). This finding questions the rate and risk of unintentional doping, as a majority of the participants did not check the specific ingredient content prior to consumption, even when offered an unfamiliar brand of lollipop by an unacquainted experimenter. Although the lollipop did not contain any banned substances, the study demonstrated the vulnerability and susceptibility of young athletes to unintentional doping towards foods of a regular daily context, and how important it is to actively check the ingredients list prior to consumption (Chan, Donovan, et al., 2014). It is therefore suggested that anti-doping education programs could focus on enhancing athletes' awareness of the risk of unintentional doping and encourage them to check the ingredients list before consumption. Furthermore, educational programmes should emphasise the need to check the ingredients lists of foods even when given by significant others (i.e. family, peers, teammates) or authority figures (e.g., coaches, team captain/managers) as they are personally responsible for any adverse analytical findings (Ntoumanis et al., 2017), even if doping was unintentional. This self-initiated responsibility is critical for athletes in learning, updating and applying correct knowledge in screening for banned substances.

In spite of this behavioural recommendation, athletes might find it challenging in identifying banned substances from the ingredients table anyway. In the focus-group

interviews of Johnson, Butryn and Masucci (2013) and Chan, Hardcastle, Lentillon-Kaestner, and colleagues (2014), athletes (with age range 18-28 and 16-25 respectively) reported that they felt challenged in understanding the ingredients lists printed on the packing of food, drinks, supplements, or medications with the educational information provided. Furthermore, as there are numerous banned performance-enhancing substances on the WADA list, athletes had to be vigilant in avoiding all ingredients that could cause unintentional doping. In discussing how they went and checked the ingredients, athletes responded that they would check online or seek advice from sport medicine professionals (Chan, Hardcastle, et al., 2014). As such, Chan and colleagues (2014) suggested that the prevention of unintentional doping could be facilitated by enhancing athletes' accessibility to necessary information and resources in recognising banned performance-enhancing substances on the WADA prohibited list. It was also suggested that an increased awareness of banned performance-enhancing substances should be accompanied with content that underscores ethical, moral and professional conduct of athletes so that the information provided does not lead to athletes seeking out, rather than avoiding doping (Chan, Hardcastle, et al., 2014).

Athletes should also seek advice or knowledge from reliable sources of information in regards to doping as the current understanding of doping may be fragmented. It was reported by Johnson and colleagues that a common way for athletes to check for banned performance-enhancing ingredients is through their national governing body website (i.e., United States Anti-Doping Agency), "where you can just go in and type in anything you're taking … and see if it's good" (johnson et al., 2013, p. 660). Although simply inputting different names of foods on reliable multi-media platforms is an efficient way to check for banned performance-enhancing substances, it is suggested that athletes themselves should also establish an updated general knowledge of banned performance-enhancing ingredients through reliable sources of information. In so doing, they can not only check for banned performance-enhancing

substances without relying on internet availability, but they can also keep up to date in regards to what is banned by WADA in the relevant year.

Coaches, team managers, teammates, family and and friends are often regarded as common sources of anti-doping knowledge, but it is important that athletes seek advice, information and support from reliable sports physicians or doping control professionals with good intentions who are equipped with the most up-to-date knowledge of WADA's banned list (Chan, Donovan, et al., 2014; Curtis et al., 2015; johnson et al., 2013). It has been highlighted previously that athletes receive relatively little and often inaccurate doping information (johnson et al., 2013), and that up to 40% of sports support personnel received no prior specific doping-information training (Curtis et al., 2015). Hence, asking sports support personnel may serve as an additional vulnerability factor as athletes may be given false information by them (Curtis et al., 2015). In order to prevent such occurrences, athletes can learn from qualified, trained sports physicians and gain knowledge about banned performance-enhancing substances and items on the prohibited WADA list.

Motivation

Although the above mentioned behavioural strategies (i.e., seeking reliable doping knowledge and checking ingredient lists) are important in preventing unintentional doping, research in social psychology has indicated that raising awareness of desired behavioural changes is often insufficient to change behaviour itself (Bohner & Dickel, 2011). Therefore, information-providing initiatives should also consider the inclusion of content that enhances motivation to actively engage in anti-doping behaviour (Chan, Hardcastle, et al., 2014). With this in mind, it is important that research investigates the psychological processes of motivation and engagement in anti-doping behaviours.

The literature search identified motivation as an important psychological construct that is central to behaviour change in many health contexts (Chan, Fung, Xing, & Hagger, 2014;

Hagger & Chatzisarantis, 2009; Quested, Ntoumanis, Thøgersen-Ntoumani, Hagger, & Hancox, in press). However, little research has been conducted in identifying the specific types of motivational factors that contribute to the avoidance of unintentional doping through the adoption of, and adherence to, various behaviours. Initial research within this field applied self-determination theory (Deci & Ryan, 1985) to examine athletes' motivation in avoiding unintentional doping. Self-determination theory is a prominent theory of motivation (Deci & Ryan, 1985) which differentiates between autonomous (doing something because it is fun, challenging, aligns with personal values, or with life goals) and controlled (doing something due to external contingencies, social pressure, feelings of guilt, or for want of social approval) types of motivation.

The lollipop-decision making paradigm study by Chan, Donovan, Lentillon-Kaestner, and colleagues (2014) included measures of motivation based on the self-determination theory. These authors examined whether motivation in the avoidance of unintentional doping was related to young athletes' behavioural response when offered a suspicious food product (i.e., the lollipop), and whether it was linked to self-reported doping intention and behavioural adherence to the avoidance of unintentional doping. It was found that athletes with high autonomous motivation for the avoidance of unintentional doping (i.e., because such an avoidance is consistent with their life goals, personal values and responsibilities) were more likely to check whether or not the ingredients list of the lollipop specified banned performance-enhancing substances, and they were also more likely to report lower doping intention (Chan, Donovan, et al., 2014). In contrast, athletes who held high controlled motivation for the avoidance of unintentional doping (i.e., because of the negative consequences, or feelings of guilt or social disapproval resulting from unintended doping use) were more likely to avoid doping by refusing to take or eat the lollipop, and were more likely to report higher behavioural adherence to the avoidance of unintentional doping. Overall, the

results showed that both autonomous motivation and controlled motivation for the avoidance of unintentional doping were positively related to certain anti-doping behavioural outcomes. From a practical point of view, autonomous motivation is deemed favourable as athletes who hold this type of motivation are motivated to understand and learn about the specific banned ingredients in the WADA prohibited list (Chan, Donovan, et al., 2014). Through this initial finding, it demonstrates that different types of motivation do play a role in adopting and carrying out anti-doping behaviour.

Social-Cognitive Factors

Researchers in the field of doping behaviour have also applied social cognitive models to understand interpersonal factors implicated in doping (Barkoukis et al., 2013; Lucidi et al., 2008; Zelli et al., 2010). Prominent among these approaches is the theory of planned behaviour (Ajzen, 1985, 1991). The theory of planned behaviour is a belief-based model that examines predictors of social behaviours, based on previous social-cognitive research and theory on attitudes and processing of information (Ajzen, 1985, 1991). Central to the model is the construct of an individual's intention to engage in a specific behaviour. These intentions are proposed to be a function and combination of three sets of beliefs: (a) attitudes and behavioural beliefs, (b) subjective norms and normative beliefs, and (c) perceived behavioural control and control beliefs. Briefly summarizing, (a) attitudes and behavioural beliefs reflect an individuals' assumption that the behaviour will lead to a certain favourable or unfavourable outcome, (b) subjective norms and normative beliefs represent the extent to which significant others are perceived to encourage or pressure individuals to engage in the behaviour, and (c) perceived behavioural control and control beliefs are the individuals' beliefs that certain factors will facilitate or hinder behavioural engagement. These social cognitive variables (i.e., attitude, subjective norm, and perceived behavioural control) are regarded as global or *direct* measures that reflect underlying sets of behavioural, normative,

and control beliefs respectively (Ajzen, 1985, 1991). Given the laboriousness of completing measures of salient beliefs and problems surrounding their analysis (French & Hankins, 2003), researchers have utilised the corresponding global measures (Ajzen, 1991) in predicting athletes' intention toward taking banned performance-enhancing substances(Lucidi et al., 2008; Ntoumanis et al., 2014; Wiefferink, Detmar, Coumans, Vogels, & Paulussen, 2008; Zelli et al., 2010). Only two identified studies have applied the theory of planned behaviour to understand the avoidance of unintentional doping in athletes (Chan, Dimmock, et al., 2015; Chan, Hardcastle, et al., 2015).

In one of these studies, Chan, Hardcastle, and colleagues (2015) focused on associations between social cognitive variables, modal salient beliefs, intentions and avoidance of unintentional doping among young elite and sub-elite athletes. In line with prediction of the theory of planned behaviour (Ajzen, 1985, 1991), direct, global measures of attitudes, subjective norms, and perceived behavioural control could be tapped using the indirect, belief-based measures including behavioural, normative, and control beliefs respectively (Chan, Hardcastle, et al., 2015). Applying each of these beliefs in context, athletes' behavioural beliefs reflect the extent to which they believe the avoidance of unintentional doping might lead to a number of positive (e.g., exhibiting their true potentials, fair play, health, less anxiety) or negative outcomes (e.g., impairing sport performance or recovery). Normative beliefs represented the extent to which athletes perceive significant social agents in their environment (e.g., coaches, teammates, family, doctors, and supporters) influence athletes' perceptions of social appropriateness for the avoidance of unintentional doping (e.g., poorer performance, impaired recovery; Chan, Hardcastle, et al., 2015). Control beliefs refer to the strategies that would facilitate or inhibit their behaviours in avoiding unintentional doping (e.g., knowledge and awareness of banned performance-enhancing substances, and readiness to refuse taking suspicious substances; Chan, Hardcastle, et al.,

2015). Chan, Hardcastle, and colleagues (2015) found that modal salient beliefs were positively linked to athletes' attitude, subjective norm, and perceived behavioural control. It was found that these social cognitive variables, apart from attitude, were then positively associated with intention for the avoidance of unintentional doping. Regarding the unexpected finding of the relationship between attitude and intention, Chan, Dimmock, and colleagues (2015) suggested that the significant association between the indirect measure of attitude (i.e., behavioural beliefs) and intention were more effective in capturing the essence of athletes' beliefs towards anti-doping behaviours, as opposed to attitude more broadly, as the items for the salient beliefs are more specific (Chan, Hardcastle, et al., 2015). Nevertheless, from this study, it was suggested that both subjective norms and perceived behavioural control were significant predictors of anti-doping behaviour. These findings imply that athletes are more likely to be actively aware of the risk of unintentional doping when they realise that others view anti-doping behaviour as beneficial and achievable. This finding can serve as a target for future anti-doping programmes for the avoidance of unintentional doping.

Integrating Self-Determination Theory and the Theory of Planned Behaviour

Despite its prominence in the literature and the respective studies supporting it, the theory of planned behaviour does not provide detail regarding the origin (driving factors) of an individual's attitude, subjective norm, and perceived behavioural control. Similarly, the self-determination theory also has limitations, insofar as it does not comprehensively outline individuals' belief systems, planning, and decision-making processes (Chan & Hagger, 2012a, 2012b). In order to resolve these theoretical gaps and provide further evidence, Chan, Dimmock, and colleagues (2015) sought to apply a model that integrated self-determination theory (Deci & Ryan, 1985) and the theory of planned behaviour (Ajzen, 1985, 1991) to explain athletes' motivational and social cognitive processes in regards to the avoidance of

unintentional doping. This integrated theoretical framework proposes that the effects of motivation from self-determination theory (Deci & Ryan, 1985) on intention and behaviour are not direct, but are mediated by social-cognitive variables from the theory of planned behaviour (Ajzen, 1985).

The merit of such theoretical integration is that self-determination theory provides an explanation of the distal origins in terms of behaviour, whereas the theory of planned behaviour articulates the proximal decision-making and planning process of behaviour (Chan & Hagger, 2012c; Hagger & Chatzisarantis, 2009). In context, this integrated model characterises individuals with high autonomous motivation, as opposed to controlled motivation (measured via questionnaires), are intrinsically inclined towards engaging in anti-doping behaviours in future. Furthermore, theoretical integration explains why athletes are willing to strategically align their social and cognitive antecedents of future behaviours, namely, their beliefs and intentions, with their motives (Chan & Hagger, 2012c; Hagger & Chatzisarantis, 2009). Applying the integrated model to an anti-doping context, Chan, Dimmock, and colleagues (2015) found that the effect of autonomous motivation on intention to avoid unintentional doping was indeed mediated by subjective norms and perceived behavioural control (Hagger & Chatzisarantis, 2016; McLachlan & Hagger, 2011). This finding indicated that autonomous motivation for the avoidance of unintentional doping was positively related to the formation of intentions to avoid unintentional doping, as participants believed that the avoidance of unintentional doping was under their control and socially appropriate. Controlled motivation and amotivation were also significantly related to subjective norm and perceived behavioural control respectively, but the magnitudes of the associations were smaller than those for autonomous motivation, and they did not display any significant indirect effects on intention. Therefore, the theoretical integration highlighted the importance of autonomous motivation as athletes tended to align their social cognitive beliefs

with autonomous motivation in the avoidance of unintentional doping. This finding is consistent with previous research in applying an integrated model of self-determination theory, and the theory of planned behaviour in predicting other health behaviours (Barkoukis, Hagger, Lambropoulos, & Tsorbatzoudis, 2010; Jacobs, Hagger, Streukens, De Bourdeaudhuij, & Claes, 2011; Standage, Gillison, Ntoumanis, & Treasure, 2012).

In addition to the integrative model of motivation and social cognitive variables, another important model, termed the trans-contextual model, can explain the mechanism whereby motivation in one context, such as sport motivation, is transferred to another related context (Chan & Hagger, 2012a, 2012c; Chan, Hardcastle, et al., 2015). The trans-contextual model may offer additional insights on the role of motivation as a psychological factor for the avoidance of unintentional doping.

Trans-Contextual Model

Research based on this aspect of the model by Chan, Dimmock, and colleagues (2015) proposed that the type and magnitude of motivation athletes experience in the avoidance of unintentional doping are closely related to their sport motivation. Their research focused on whether autonomous motivation (i.e., "doing sport because I want to") or controlled motivation (i.e., "doing sport because I have to") in sport would link to the avoidance of unintentional doping (Chan, Dimmock, et al., 2015). This question is important as motivational factors in sport, such as autonomous motivation and achievement motivation, have been shown to predict *intentional* doping-related outcomes, such as doping attitude, doping intention, and moral disengagement (Barkoukis, Lazuras, Tsorbatzoudis, & Rodafinos, 2011; Barkoukis et al., 2013; Hodge et al., 2013). However, the processes underpinning the effects of sport motivation on anti-doping behaviours to avoid unintentional doping, specifically, have been unclear.

In their investigation, Chan, Dimmock, and colleagues' supported the tenets of the trans-contextual model, in that athletes driven by autonomous motivation in sport tended to hold higher autonomous motivation with respect to the avoidance of unintentional doping, whereas athletes holding controlled motivation in sport were more likely to report higher controlled motivation for avoiding unintentional doping (Chan, Dimmock, et al., 2015). This finding suggests that athletes who were motivated in sport for autonomous reasons were more likely to avoid unintentional doping because they felt that achieving negative analytic results was important and meaningful, and hence autonomously motivated to do so. Whereas athletes who played sport for controlled reasons avoided unintentional doping because they felt they had to, as they were pressured by internal and/or external forces and contingencies (Chan, Dimmock, et al., 2015). Chan, Dimmock et al. (2015) also reported that autonomous motivation and controlled motivation in the avoidance of unintentional doping were both significant positive predictors of intention to avoid unintentional doping. This is consistent with findings from the study of Chan, Donovan, and colleagues (2014) and the trans-contextual model.

The authors also noted that those with controlled forms of motivation triggered doping-avoidance behaviours only as long as the controlling contingencies were present which is in accordance with self-determination theory (Deci & Ryan, 1985; Moller & Deci, 2014; Ryan & Weinstein, 2009). Additionally, according to the trans-contextual model, when doping control is perceived to be absent or ineffective, or the perceived health side-effects of doping are unsubstantial, there will be greater susceptibility in unintended doping for controlled motivated individuals (Jalleh et al., 2013; Lentillon-Kaestner et al., 2012; Stewart & Smith, 2008). In contrast, autonomous motivation is a better predictor of long-term intentions to avoid unintentional doping, as such motivation is based on athletes' intrinsic values and internalised beliefs, which are likely to be omnipresent and unlikely to be

disrupted by social or external factors (Chan, Dimmock, et al., 2015; Quested et al., 2013). Hence, based on these findings and the theoretical basis of the research, a practical recommendation would be to encourage athletes' significant others (e.g., coaches, trainers, governing body representatives, anti-doping campaigners, and, in the case of young athletes, parents and guardians) to foster athletes' autonomous reasons (e.g. goals and life values) for engaging in and adhering to anti-doping behaviours.

Self-Control

Although it is ideal for athletes to constantly engage in anti-doping behaviours, a prominent perspective on self-control provided by the strength-energy model (Baumeister, Bratslavsky, Muraven, & Tice, 1998; Baumeister, Gailliot, DeWall, & Oaten, 2006; Ginis & Bray, 2010; Tangney, Baumeister, & Boone, 2004) suggests that it is not as easy as it seems. The current literature search identified a plausible barrier, self-control depletion, which may prevent athletes' adherence to anti-doping behaviours (Chan, Lentillon-Kaestner, et al., 2015). The strength-energy model (Baumeister et al., 1998; Baumeister et al., 2006; Ginis & Bray, 2010; Tangney et al., 2004) conceptualises self-control as a limited pool of mental resource which differs across individuals and determines their capacity to engage in a goal-directed behaviour in order to achieve a distal outcome. In this sense, an individual's 'reserve' of self-control depletes when they engage in goal-oriented behaviour. A long period of time without recovery, can lead to depletion and lead to a state of self-regulatory failure which results in behavioural relapse or non-compliance to long-term goal behaviour.

The strength-energy model and its application in the sport-athlete context has been investigated by Chan, Lentillon-Kaestner, and colleauges (2015), who tested whether trait self-control (an individual difference variable reflecting general self-regulatory resources) predicted a number of factors related to doping and anti-doping behaviours. Unsurprisingly, results revealed that trait self-control was a negative predictor of doping attitudes and

intention, but was a positive predictor of intention and adherence to avoid unintentional doping (Chan, Lentillon-Kaestner, et al., 2015). Additionally, trait self-control was positively linked to the physical refusal to take or consume an unfamiliar food (Chan, Lentillon-Kaestner, et al., 2015). This result supports the tenets of the strength-energy model and research findings on self-control in other behavioural contexts (Baumeister et al., 1998; Baumeister et al., 2006; Ginis & Bray, 2010; Tangney et al., 2004), in that low or insufficient self-regulatory resources are associated with an increased intention to dope and poorer adherence to behaviours that are linked to the avoidance of unintentional doping. These subsequent behavioural links of self-control can illustrate the importance of self-regulation in anti-doping purposes (e.g., checking foods with unknown ingredients, reading ingredients lists on foods and supplements) and can prevent athletes from falling back on well-learned habits that are not conducive to the avoidance of unintentional doping.

Evidence-Based Recommendations

Overall, unintentional doping is an issue of high importance when it comes to minimising the threat of adverse analytical findings (i.e., positive tests) in doping controls. Engaging in a set of key behaviours, such as seeking reliable doping information and checking the ingredients list, is essential in avoiding consumption of banned performance-enhancing substances in foods and drinks. Engagement in these behaviours has also been predicted by a number of psychological variables such as motivation, social-cognitive factors, a combination of both, and self-control. Therefore, these psychological factors could, and should be considered when developing strategies to facilitate athletes' adoption and maintenance of behaviour to avoid unintentional doping.

The use of legislation, detection, and penalties in doping control has created a controlled environment by WADA in preventing athletes from taking banned performance-enhancing substances (Chan, Dimmock, et al., 2015). Athletes in such controlled

environments often adopt controlled motivation for the prevention of unintentional doping and hence might have poorer behavioural adherence to anti-doping when the external reasons of anti-doping are not salient (e.g., “doping control is not present in my sport or in this competition”; Chan, Dimmock, et al., 2015; Stewart & Smith, 2008).Our current review has shown that, both autonomous and controlled motivations are linked to anti-doping behavioural intentions. However, it is advised that athletes should further endorse autonomous motivation in the avoidance of unintentional doping as they are associated with higher persistence and tendencies in adhering to anti-doping behaviours (Hagger, Chatzisarantis, Barkoukis, Wang, & Baranowski, 2005; Hagger, Chatzisarantis, Culverhouse, & Biddle, 2003; Hagger, Chatzisarantis, et al., 2009). Further, our review has shown that fostering athletes’ positive beliefs (e.g., the advantages and ease of engaging in anti-doping behaviours) and downplaying negative beliefs (e.g., the potential risks and obstacles such as time cost and fear of stigma) with respect to avoiding unintentional doping should be instigated concurrently with the promotion of autonomous motivation in sport. Lastly, our review demonstrates the importance of monitoring or training athletes’ psychological capacity of self-regulation and subsequent engagement and persistence of anti-doping behaviours (Chan, Dimmock, et al., 2015).

From a theoretical integration perspective (Chan & Hagger, 2012c; Hagger & Chatzisarantis, 2009), developing interventions that target multiple psychological variables has also been shown to both directly and indirectly affect intention and behaviours in the avoidance of unintentional doping (Chan, Dimmock, et al., 2015; Chan et al., 2016). Such interventions can systematically identify the techniques that enhance autonomous motivation (e.g., autonomy supportive persuasion, enhancement of personal agency), positive attitudes and beliefs (e.g., provide information regarding advantages of anti-doping behaviours and downplaying the disadvantages), self-control (e.g., self-control training) in managing

situations where athletes might be vulnerable (e.g., low self-control) through greater awareness and self-monitoring. These techniques should be incorporated into behavioural modification programs and maximise the intervention effects on athletes' anti-doping behaviours (see Table 2).

Limitations and Future Directions

Existing research of the psychology of unintentional doping has used various methodologies and offered preliminary evidence on the applications of a number of theories, however, researchers should be cautious in the level of evidence. We highlight the limitations of existing research in this area, and we hope the findings of this review can illustrate the need to investigate this new area of psychological research and inspire other researchers in the field.

The quality assessments generally showed that the six included studies had no or low risk of bias, and were conducted appropriately. However, the quantitative studies were only conducted by cross-sectional surveys in Australia among elite and sub-elite level athletes, and the qualitative studies were only conducted by focus-group interviews in Australia and US/ Canada. This homogeneous sport background and geographical location of the sample may reduce the generalisability of the study findings to other populations and cultures.

Additionally, certain classified "athletes" included in the current investigation are not required to have regular anti-doping knowledge in regards to WADA's regulation as they are only competitive within school, club or social sporting contexts, which do not require (if any, regular) doping tests. Hence, researchers should also be cautious when using the term 'athletes', as the results from the reviewed studies may not necessarily apply to professional athletes who take doping seriously (Donovan et al., 2002).

Existing studies in the avoidance of unintentional doping literature have tended to adopt qualitative, correlational designs, or used questionnaires, hence causal inferences cannot be drawn (Chan, Yang, et al., 2015; Hagger, Lonsdale, & Chatzisarantis, 2012).

Further, responses obtained from self-reported survey measures in the assessment of unintentional doping related variables could be subjected to social desirability and common method variance (Chan, Ivarsson, et al., 2015; Gucciardi, Jalleh, & Donovan, 2010). Recent studies have shed light into the use of implicit association test to assess athletes' implicit attitude or automatic response towards doping (Chan, Keatley, Tang, Dimmock, & Hagger, 2017; Chan, Lee et al., 2017), future studies should explore the possibility of using implicit test to measure psychological variables of unintentional doping. Moreover, future studies should also use interventions to examine if changing key psychological factors would lead to increased awareness of and engagement in avoidance of unintentional doping. It is important that future intervention studies use full-factorial, randomised controlled designs so that the effect of individual techniques from each component theory can be supported within the correct intervention arms.

Apart from methodological limitations, there are also theoretical limitations in the current research. The concept of self-control has not been fully incorporated into a tested, reliable psychological model in the avoidance of unintentional doping. Findings in other health contexts suggests that self-regulatory failure is linked to reduced motivation and lower perceived behavioural control (Hagger et al., 2013; Hagger, Wood, Stiff, & Chatzisarantis, 2009, 2010a, 2010b). Additionally, a number of other predicted psychological theories and models, such as achievement goal theory (Barkoukis et al., 2011; Barkoukis et al., 2013; Harwood & Chan, 2010), the drugs-in-sport deterrence model (Strelan & Boeckmann, 2003), the life-cycle model of performance enhancement (Petroczi & Aidman, 2008), and the sport drug control model (Donovan et al., 2002; Gucciardi et al., 2011; Jalleh et al., 2013), as well as psychological factors including moral disengagement (Hodge et al., 2013), sportspersonship (Barkoukis et al., 2011), and self-affirmation (Barkoukis, Lazuras, & Harris, 2015), have been theorised to be useful in predicting athletes' *intentional* doping intention.

Future research can aim to empirically test whether these additional variables, together with those identified in our review, are relevant for the avoidance of unintentional doping.

Conclusion

The psychology of unintentional doping is an emerging area of research that has been investigated by a limited number of studies. However, current evidence suggests that a number of psychological variables associated with motivation, such as social-cognitive variables, beliefs, and self-control are related with behaviours in avoiding unintentional doping. Empirical research in this area has been informed by self-determination theory (Deci & Ryan, 1985), theory of planned behaviour (Ajzen, 1985, 1991), integrated model (Hagger & Chatzisarantis, 2009), trans-contextual model (Hagger, Chatzisarantis, et al., 2009) and the theory of self-control (Tangney et al., 2004). Interventions based on the reviewed constructs may be effective in preventing athletes from unintentionally taking banned performance-enhancing substances. We hope the research reviewed and the recommendations presented in this interim systematic review raises researchers' attention into this important topic, and inspire further studies in increasing the level of evidence and utility of anti-doping education and practice.

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874 Table 1

875 *Summary of the Studies Included in the Systematic Review*

	Authors	Study Design	Samples	Theoretical Framework	Independent Variables	Relevant Outcome Measures	Relevant Findings
1	Chan, Hardcastle et al. (2014)	Cross-sectional	410 elite young athletes in Australia	Theory of Planned Behaviour	Modal salient beliefs (i.e., behavioural beliefs, normative beliefs, and control beliefs of the avoidance of doping	Attitude, subjective norm, perceived behavioural control and intention the avoidance of doping	Modal salient beliefs were linked to athletes' respective attitude, subjective norm, and perceived behavioural control. These subsequent social cognitive variables, apart from attitude, were then positively associated with intention in the avoidance of unintentional doping.
2	Chan, Hardcastle et al. (2014)	Qualitative focus-group interview	57 athletes in Australia	Theory of Planned Behaviour	N/A	Athletes' personal attitudes, social influence and perceived barriers/ facilitators towards the use of banned performance-enhancing drugs.	From the three global themes of personal attitudes, social influences and control beliefs that corresponded to the theory of planned behaviour, athletes reported the risk of unintentional doping in daily life, and how their awareness, knowledge, and team doctors are important to the prevention of unintentional doping.
3	Johnson et al. (2013)	Qualitative focus-group interview	12 elite female athletes in Canada and US	Sport Drug Control Model, Constructivist Theory of Learning	N/A	Athletes' doping knowledge, doping practices, doping sources of information, feeling towards anti-doping knowledge, actions, and educational interventions.	The themes identified athletes' interpretations and general knowledge of doping and anti-doping. Consistent with the sport drug control model, it was found that online tutorials and workshops were short and undermined the legitimacy and seriousness of governing bodies.

4	Chan, Dimmock et al. (2015)	Cross-sectional	410 elite and sub-elite young athletes in Australia	Trans-Contextual Model of Motivation	Autonomous motivation, controlled motivation, and amotivation in sport.	Autonomous motivation, controlled motivation, amotivation, attitude, subjective norm, perceived behavioural control and intention in the avoidance of doping	The findings support the trans-contextual model, suggesting that motivations in sport are related to the corresponding types of motivations in the avoidance of doping as well as social cognitive factors, and intention in the avoidance of doping.
5	Chan, Lentillon-Kaestner, et al. (2015).	Cross-sectional	410 elite and sub-elite young athletes in Australia	Strength Energy Model of Self-Control	Trait self-control	Intention and self-reported adherence to the avoidance of doping, attitude and intention to doping.	Trait self-control was positively related to athletes' intention and adherence to the avoidance of doping.
6	Chan, Donovan et al. (2014)	Cross-sectional	410 elite and sub-elite young Australian athletes	Self-Determination Theory	Autonomous motivation, controlled motivation, and amotivation in the avoidance of doping.	Avoidance of taking or eating unfamiliar foods or substances, reading ingredient list of unfamiliar food, self-reported adherence to the avoidance of unintentional doping.	Autonomous motivation in the avoidance of doping was positively related to reading the ingredients list of an unfamiliar food. Controlled motivation in the avoidance of doping was positively related to not taking and eating unfamiliar food, and adherence to the avoidance of unintentional doping.

Table 2

Practical Recommendations in the Avoidance of Unintentional Doping

Theory	Adaptive Constructs	Possible Strategies
General principles (Barkoukis et al., 2015)	Avoidance of unintentional doping	• Athletes should be aware of the presence of banned performance-enhancing substances in food, supplement, and drugs. • Regularly update athletes' knowledge about banned performance-enhancing substances. • Remind athletes to refuse eating/ingesting anything suspicious (e.g., mixed drinks, roll-up tobacco products, supplements without ingredient information). • Ask athletes to consult team doctors or medical professionals before using any unfamiliar medication. • Athletes should make use of anti-doping website smartphone applications developed by recognised organisations. • Remind athletes to be extra careful or avoid being in the situation (e.g., social drinks) where unintentional doping is likely.
Self-Determination Theory (Chan, Hardcastle, et al., 2015; Chan, Hardcastle, et al., 2014; Geyer et al., 2008; Lamont-Mills & Christensen, 2008; World Anti-Doping Agency, 2011)	Autonomous motivation toward the avoidance of unintentional doping	Create a psychological need-supportive social environment for anti-doping: • Provide athletes with convincing rationales in the avoidance of unintentional doping in daily life. • Inform athletes that the action of avoiding unintentional doping is their own decision and they should take initiatives and responsibility for their actions. • Support athletes by making them realise that they are not alone in avoiding unintentional doping. • Provide athletes with opportunities to develop confidence and engage in the behaviours to avoid unintentional doping.
The Trans-Contextual Model (Deci & Ryan, 1985)	Autonomous motivation in sport	Create an autonomy-supportive sporting environment for athletes: • Promote enjoyment, excitement, and a sense of goal accomplishment in sport. • Introduce and highlight important values in sport, such as honesty, discipline, sportspersonship, winning through hard work and exploration of own potentials. • Provide meaningful reasons for doing sport, and let athletes have a say over what they complete in training and competitions. • Having athletes feel that they are accepted as important members of the team. • Show athletes that they are doing well, and they can excel in sport without using banned performance-enhancing substances.

Theory of Planned Behaviour (Hagger et al., 2003; Hagger, Chatzisarantis, et al., 2009)	Attitude and behavioural beliefs toward the avoidance of unintentional doping	Promote and strengthen adaptive beliefs, and downplay maladaptive beliefs, among athletes toward avoiding unintentional doping: • Highlight the importance of competing fairly against others. • Inform athletes of the potential negative health side effects of banned performance-enhancing substances, including addiction. • Inform athletes that unintentional doping will likely worsen sport performance, effectiveness of training or recovery, or competition outcomes. • Inform athletes that doping actually puts athletes into a disadvantaged position when competing against other players.
	Subjective norm and normative beliefs toward the avoidance of unintentional doping	• Highlight the importance of significant others (e.g., coach, teammates, close friends, family, supporters, or media etc) and the social environment in avoiding unintentional doping. • Ensure athletes would be influenced by significant others to avoid unintentional doping.
	Perceived behavioural control and control beliefs toward the avoidance of unintentional doping	• Strengthen athletes' courage and perceived power to "say no" to banned performance-enhancing substances or the offers of suspicious food/ supplement products. • Enhance athletes' confidence in identifying if the food, drinks, supplements, or drugs contained banned performance-enhancing substances by providing them with examples. • Discuss with athletes about the challenges they have in preventing unintentional doping, and the practical solutions of how they can avoid these situations. • Show athletes that there is a wealth of resources (e.g., WADA's website, coaches, team doctors, doping control officers) for them to seek help in the avoidance of unintentional doping.
Strength Energy Model of Self-Regulation (Chan & Hagger, 2012c; Hagger & Chatzisarantis, 2009)	Self-Control	• Carefully monitor the physical and mental stress of athletes, and ensure athletes do not become over stressed, pressured or tired in sport and their daily life. • Assist athletes in recognising the situations and signs where they might be vulnerable to lapses in self-control (e.g., fatigue, hunger, hypoglycaemia) and take appropriate action to maintain high standards of anti-doping behaviours in those situations (e.g., always have a 'known ingredients' snack or energy drink handy when hungry or thirsty, get into the habit of checking all foods when in unusual situations such as when on tour). • Remind athletes of the importance of recovery for physical and psychological functioning • Incorporate relaxation training that help relieves stress and the prevention of burnout. • Training the self-regulation capacity of athletes using ego-depletion tasks that require self-control (response inhibition, impulse control). • Glucose supplementation during times when they are likely to be mentally fatigued.

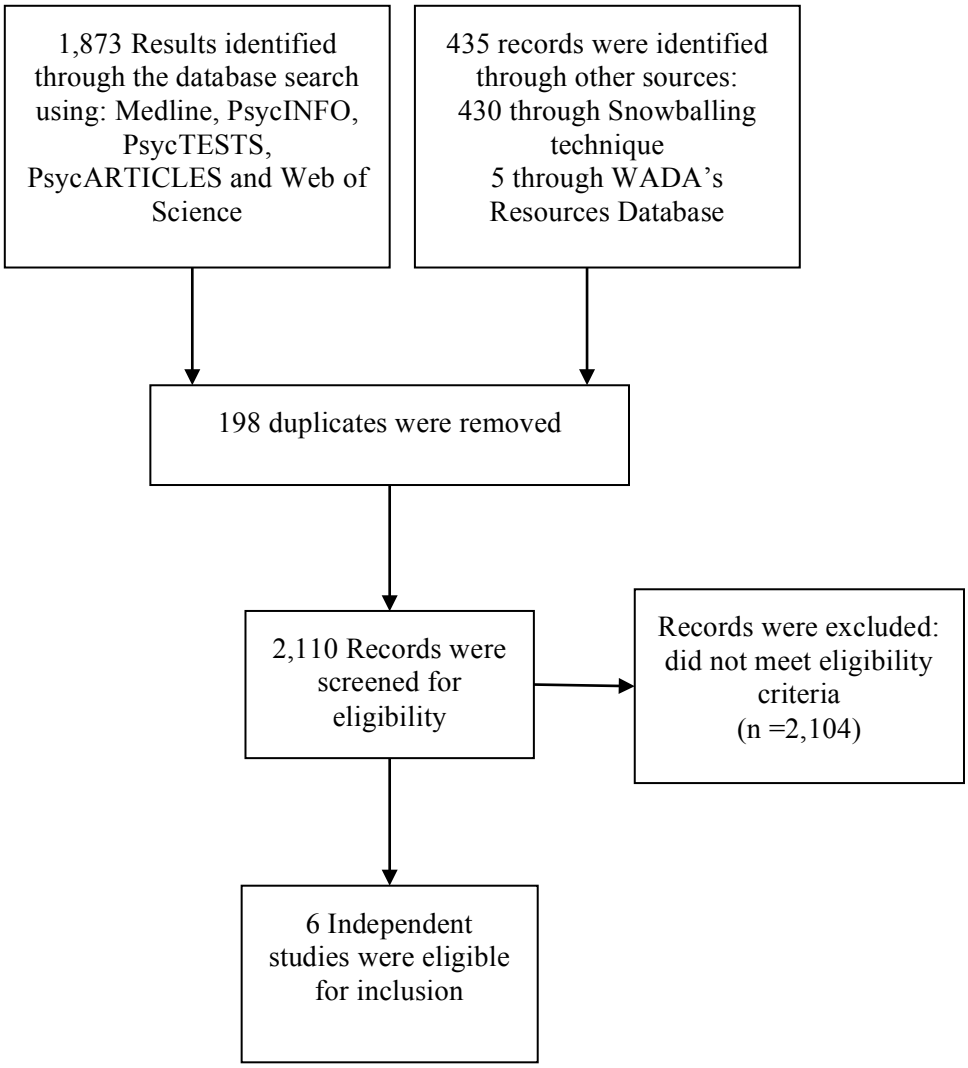

Figure 1. Flow diagram of literature search procedure.

Appendix 1

Risk of Bias Assessment for Eligible Quantative Studies

Criteria	1	2	3	4	5	6	7
1. Chan, Hardcastle et al. (2014)	+	+	+	+	+	+	+
2. Chan, Dimmock et al. (2015)	+	+	+	+	+	+	+
3. Chan, Lentillon-Kaestner et al. (2015)	+	+	+	+	+	+	+
4. Chan, Donovan et al. (2014)	+	+	+	+	+	+	+

Notes. The adopted seven criteria of Ntoumanis, Ng, and Backhouse (2014) related to sampling and measure because other criteria related to prospective/ longitudinal/ experimental studies were not applicable. Criteria 1 = random selection of participants; Criteria 2 = adequate sample sizes; Criteria 3 = sample representative; Criteria 4 = exclusion of participants was justified if applicable; Criteria 5 = group comparison accounts for differences in demographics; Criteria 6 = validated measures were used; Criteria 7 = measures used were clearly defined and were appropriate. In each criterion, + indicates no or low risk of bias, - indicates potential risk of bias.

Critical Appraisal Skills Programme (CASP) Checklist Results for Eligible Quantative Studies

Criteria	1	2	3	4	5	6	7	8	9	10
1. Chan and Hardcastle et al. (2014)	✓	✓	✓	✓	✓	?	✓	✓	✓	✓
2. Johnson et al. (2013)	✓	✓	✓	✓	✓	?	✓	✓	✓	✓

Notes. Criteria 1 = research aim; Criteria 2 = research method; Criteria 3 = study design; Criteria 4 = recruitment of sample; Criteria 5 = sample; Criteria 6 = relationship between researcher and participants; Criteria 7 = ethics; Criteria 8 = data analysis; Criteria 9 = findings; Criteria 10 = research value. For each criterion, ✓ indicates 'yes', X indicates 'no', ? indicates 'can't tell'.