Knowledge of performance enhancement and interpersonal communication among Caribbean adolescent athletes: implications for social norm formation and program intervention design

Jules Woolf[1] Ph.D. (Principal Investigator)
Coinvestigators: Sasha Sutherland[2,3] Ph.D., Alana Griffiths[3] Ph.D., Lixin Wu[1], Hahyeong Kim[1], & Maryalice Wu[1] Ph.D.

[1] University of Illinois Urbana-Champaign
[2] Caribbean Regional Anti-Doping Organization
[3] University of the West Indies Cave Hill

Final report for the World Anti-Doping Agency
June 2025

Table of Contents

Acknowledgements

This project would not have been possible without the support of numerous on-the-ground sport administrators and support personnel who facilitated access to athletes. We are grateful to the event coordinators, team managers, coaches, and parents who assisted during data collection that occurred across multiple countries and events. While there are too many to name individually, we sincerely thank each of them for their contribution.

We extend special thanks to Marsha Boyce of the Caribbean Regional Anti-Doping Organization for her valuable insights, guidance, and assistance in promoting the study. Our gratitude also goes to Dr. Adrian Lorde of the Barbados Olympic Association for his help in supporting and publicizing the project. Special thanks are due to Patrick Werleman, Chair of the Caribbean Regional Anti-Doping Organization, for his continued support and encouragement of research in this region.

Four graduate research assistants from the University of Illinois, Byron Juma, Jonathan Ruwuya, Jake Simms, and Alyssa Trad provided support at various points throughout the project. This included consultation on the initial development of survey questions, assistance with data collection at one of the key sites, and data entry. Their efforts, particularly in participant recruitment, were pivotal to the success of the project and are deeply appreciated.

Most importantly, we thank all the young athletes who generously took time out of their event preparations to complete the questionnaire.

We are especially grateful to the World Anti-Doping Agency, and in particular to Kelsey Martin and Tony Cunningham, for their ongoing support, advice, and patience throughout this project.

Principal Investigator contact details:

Jules Woolf, Ph.D.
Assistant Professor
University of Illinois Urbana-Champaign
Department of Recreation, Sport and Tourism
224 Huff Hall
1206 S. Fourth Street | M/C 586
Champaign, IL 61820
217.300.8358
jwoolf@illinois.edu

Executive summary

Despite the Caribbean's strong sporting identity and international success, there is a notable absence of social science research on doping in the region, especially among adolescent athletes. This is an important population, given their developmental stage and increased vulnerability to misinformation and social influences.

Anti-doping education is a key requirement of the World Anti-Doping Code, but existing knowledge assessment tools are often poorly aligned with education content and lack psychometric validation. To address this gap, the current study developed a new questionnaire grounded in WADA's International Standard for Education (ISE) and Athlete Curriculum. The instrument included multiple-choice and recall-based questions mapped to learning objectives for youth and talented athletes.

At the same time, doping behavior is rarely shaped by knowledge alone. Social norms, which represent what others are seen to do, and what they're believed to approve of, play a powerful role in shaping young athletes' decisions. Guided by the Theory of Normative Social Behavior, this project also examined how peers, coaches, and parents influence adolescents' intentions to use supplements and their doping susceptibility.

The study involved a two-part questionnaire administered to Caribbean adolescent and young adult athletes (n = 388) at four international sporting events between 2022 and 2023. The first part validated the newly developed knowledge assessment; the second investigated the influence of close others using constructs from the normative behavior framework. The full questionnaire was pilot-tested with early adolescent athletes using cognitive interviews to ensure clarity and age-appropriate comprehension.

There were two main outcomes from this study:

First, the Anti-Doping Knowledge Assessment (ADKA) was developed and validated. This 12-item questionnaire was constructed using existing inventory items, which were aligned with the learning objectives for young and talented athletes derived from WADA's Athlete Curriculum. The ADKA differentiates between high and low-knowledgeable athletes, making it a suitable diagnostic tool. An extended 15-item version is proposed for older or more advanced athletes.

Second, the study explored the influence of referent others on intentions to use supplements and athletes' doping susceptibility using the Theory of Normative Social Behavior. Importantly, the frequency with which parents discuss supplements with their child moderated the effect of perceived parental approval on intentions to use supplements. This finding suggests that parents should be equipped with relevant information to promote conversations on responsible supplement use and help mitigate inadvertent ADRV. Furthermore, parental closeness was observed to have a direct and negative effect on doping susceptibility, suggesting that parents serve a protective function in preventing doping. Taken together, parental influence emerged as a particularly important outcome, and future research and education initiatives should involve parents as key stakeholders in promoting clean sport. Teammates and coaches also had significant direct effects on athletes' intentions to use supplements and doping susceptibility, reinforcing the importance of social dynamics and interpersonal communication in anti-doping interventions.

Abbreviations

ADOs	Anti-Doping Organizations
ADRV	Anti-Doping Rule Violation
ADKA	Anti-Doping Knowledge Assessment
ASDI	Adolescent Sport Drug Inventory
ASKQ	Anabolic Steroid Knowledge Questionnaire
ATHENA	Athletes Targeting Healthy Exercise & Nutrition Alternatives
ATLAS	Adolescents Training and Learning to Avoid Steroids
CARICOM	Caribbean Community and Common Market
IRB	Institutional Review Board
ISE	International Standard for Education
RADO	Regional Anti-Doping Organization
TNSB	Theory of Normative Social Behavior
TUEs	Therapeutic Use Exemptions
UKAD	United Kingdom Anti-Doping
WADA	World Anti-Doping Agency

List of Tables

List of Figures

Background

WADA has repeatedly encouraged social science research projects to take a regional perspective. The Caribbean is one region where systematic research on doping has been absent, despite calls for action (Acevedo et al., 2011). The paucity of doping research on Caribbean countries is surprising given the region's strong sporting tradition and history. Sport is part of the Caribbean's regional identity (CARICOM Commission on Youth Development, 2010), as witnessed by their success internationally. For instance, at the 2016 Olympic Games, 5% of Gold medals were won by Caribbean countries (Jordens, 2016).

Research on doping in regions neglected by scholars reports that athletes' knowledge of doping and supplements is poor, even among professional and elite athletes (e.g., Barghi et al., 2015; Muwonge et al., 2015), a trend that extends globally (Woolf, 2021). Backhouse (2015) recommends that anti-doping education target youth as this is a time when their attitudes and values are forming (Döring et al., 2015), which has implications for doping behavior (Ntoumanis et al., 2014). In the Caribbean however, research on young athletes and doping is nascent. Even research on youth substance abuse in a Caribbean context is limited (Peacock et al., 2018). Yet there are concerns that substance use among adolescents is rising (Inter-American Drug Abuse Control Commission, 2016). This is exacerbated by the Caribbean's young population where approximately a quarter are around the adolescent age range (Pan American Health Organization, 2018).

Given these circumstances, research on doping in Caribbean adolescent athletes is sorely needed. A suitable starting point is to chronicle young athletes' knowledge of doping. Thus, this project focused on athletes' doping knowledge. To ensure that knowledge was accurately assessed, a metric was developed and validated.

In addition, adolescent athletes are often confused about doping (Duncan et al., 2018) and are influenced by those closest to them (Woolf et al., 2014). However, our understanding of how this influence occurs is limited. Hence this project included a second study that explored the influence of close others on adolescent athletes, with regards to supplement use and doping. Extending this line of inquiry to include supplements is beneficial, as the use of these substances is associated with the risk of doping (Hurst et al., 2019). A detailed examination of knowledge assessment in doping research is presented, followed by the theoretical framework used to explore the influence of close others.

Knowledge Assessment in Anti-Doping Research

Knowledge of anti-doping rules and procedures is a crucial element in promoting clean sport. Accurate knowledge may serve as a protective factor against intentional doping by informing athletes about the rules, risks, and consequences of doping (WADA, 2021a). Moreover, being knowledgeable protects against unintentional doping, as athletes who are better informed are less likely to unknowingly violate anti-doping regulations (Chan et al., 2019; Hurst et al., 2017).

Accurately assessing athletes' knowledge has important practical implications. Anti-doping organizations (ADOs) rely on knowledge assessments to identify gaps in understanding, tailor educational interventions, and evaluate the effectiveness of education programs over time (Orr et al., 2018). The significance of knowledge evaluation has grown in light of the International Standard for Education (ISE) introduced by WADA (2021b), which requires all Code signatories to systematically plan, implement, monitor, and evaluate anti-doping education.

From a theoretical standpoint, a well-designed knowledge assessment tool is essential for advancing both empirical inquiry and the development of effective anti-doping interventions.

Accurate measurement of knowledge serves not only as an indicator of what athletes know but also as a foundation for understanding how knowledge interacts with other psychological constructs such as attitudes, intentions, susceptibility, perceived legitimacy, and perceived norms, which are all factors commonly addressed in anti-doping research. If the measurement of knowledge is imprecise or insensitive, it undermines the validity of any theoretical model that incorporates knowledge as a variable to help explain or predict doping-related constructs and behavior. Without psychometrically sound instruments, claims about impact, learning, or compliance remain speculative at best. Thus, the development of valid, reliable, and relevant knowledge measures is a theoretical and practical necessity for building robust anti-doping education systems and advancing anti-doping research. Despite the recognized importance of knowledge assessment, there is a scarcity of validated, well-functioning tools in the field (Sagoe et al., 2016; Zhumabayeva et al., 2022). Thus, the development of sound knowledge assessments remains an important need within anti-doping research.

Several consistent challenges have been observed in the ways knowledge has been measured in anti-doping research. First, there are issues with how researchers define "knowledge." and the subsequent wording of measurement items. Frequently, participants are asked about their beliefs or confidence in a statement or are asked to rate their perceived knowledge rather than demonstrating factual recall or comprehension (e.g., Goldberg et al., 1990; 1996). This blurs the distinction between knowledge and perception and complicates interpretation.

Second, the construction of assessments is often unsystematic, with the design and validation processes for knowledge measures are often underreported or insufficient. In many cases, researchers rely solely on internal expertise or informal expert review to establish face or

content validity, without further psychometric testing. For instance, Awaisu et al. (2015) indicated that their instrument was validated through expert opinion but provided little detail about systematic validation steps.

Third, there is often a disconnect between the knowledge being assessed and the educational content delivered or between the knowledge assessed and the goals of the research study. Ideally, knowledge assessments should align closely with the learning objectives of anti-doping education programs or research goals (Woolf, 2021). However, many studies fail to demonstrate or even state this alignment. Notable exceptions exist. Alexandrescu et al. (2021) designed their questionnaire specifically to reflect the topics taught within a theoretical sports training course, while Awaisu et al. (2015) constructed their knowledge tool through collaboration with pharmacy education specialists familiar with program learning outcomes.

Fourth is the widespread reliance on recognition-based formats, such as true/false, yes/no, prohibited/not prohibited, or multiple-choice questions. While easy to administer, these formats introduce a significant probability of correct guessing, which can artificially inflate knowledge scores, even though, historically these have been consistently poor (Woolf, 2021). For example, a true/false format inherently gives respondents a 50% chance of guessing correctly, which undermines the precision of the measure. Even adding an option for “I do not know”, while it may reduce correct guessing, it does not eliminate the problem. More sensitive recall-based assessments could provide a stronger test of actual knowledge but are rarely employed (Orr et al., 2018), likely because of the increased workload these would impose on assessment. Given the limited resources of researchers and anti-doping organizational personnel (Morente-Sánchez & Zabala, 2013), recall-based assessments may be less practical although advancements in automation may assist this process in the future.

Overall, the field suffers from inconsistent item word, design, and alignment structure, limited transparency about measure development, and an over-reliance on simplistic question formats. These issues complicate comparisons within and across studies and limit confidence in conclusions drawn about athletes' actual knowledge levels. The development of more rigorous, transparent, and relevant knowledge assessments is essential for advancing both research and practice in anti-doping education. To illustrate these challenges further, the next section reviews early knowledge scales and highlights their specific limitations. This will be followed by an examination of more recent efforts to improve the measurement of doping-related knowledge.

Early Knowledge Assessment and the ATLAS and ATHENA studies

Efforts to measure athletes' knowledge of doping predate the establishment of WADA and the implementation of the World Anti-Doping Code (hereafter, "Code"). In the late 20th century, researchers recognized the need to evaluate athletes' understanding of substances such as anabolic steroids, recreational drugs, and ergogenic aids, often in the context of early prevention programs targeting substance abuse more broadly. However, many of the early knowledge scales reflected the conceptual and methodological limitations of their time.

One of the earliest instruments developed to assess athletes' knowledge and attitudes toward drugs in sport was the King Drug in Sport Questionnaire (Tricker & Connolly, 1996). This tool sought to measure knowledge and attitudes across eight different drug categories, spanning both performance-enhancing and recreational substances. Although the scale was validated through a Delphi process involving experts in drug education, health behavior, sport psychology, and coaching, the original questionnaire is not widely available, limiting independent evaluation of its quality.

Similarly, the Anabolic Steroid Knowledge Questionnaire (ASKQ) developed by Trenhaile et al. (1998) aimed to assess the knowledge of preadolescent athletes. The ASKQ included true/false and multiple-choice items but suffered from several design flaws, including double-barreled questions, questions that arguably have multiple correct answers and content that has since become outdated. While both instruments represented important early steps toward systematic knowledge measurement, they also exemplify many of the problems that would continue to characterize the field, namely, limited transparency in scale development, poorly defined constructs, and questions that were not always aligned with contemporary understandings of doping or anti-doping efforts.

Beyond these early efforts, a substantial body of work was produced by Goldberg, Elliot, MacKinnon, and colleagues during the 1990s and into the early 2000s. Their studies are particularly influential (and problematic) within the anti-doping research literature. Goldberg et al. (1990) initially assessed U.S. high school football players' "knowledge" of anabolic steroids using a 10-point scale on 15 items. However, the phrasing of the questions asked participants to rate their level of agreement with statements about the effects of steroids (e.g., "anabolic steroids cause heart disease"). This suggests that the instrument measured confidence in their beliefs rather than actual factual knowledge. The questionnaire appears to have included two strategically false items to reduce response bias and discourage patterned responding, though this is not explicitly explained. Specifically, causing kidney disease and improved aerobic capacity were identified as outcomes not associated with anabolic steroid use (though kidney damage has since been associated with anabolic steroid use – see Davani-Davari et al., 2019). Only a partial list of question items was provided, which made it difficult for future researchers to evaluate or replicate the scale.

As their research evolved, projects led by Goldberg and Elliot, led to the development of the intervention programs ATLAS (Adolescents Training and Learning to Avoid Steroids) and ATHENA (Athletes Targeting Healthy Exercise & Nutrition Alternatives). These programs incorporated knowledge assessments that, according to publications such as Goldberg et al. (1996a; 1996b; 2000), measured participants' beliefs about the effects of anabolic steroids, supplements, and exercise. However, critical examination reveals that these assessments remained vulnerable to the same issues. First, Goldberg et al. (1996a) only provided one question out of the 18 true or false questions used, making it difficult for replication. Second, the example provided was “I believe that anabolic steroids can cause liver disease.”, which as framed, is not falsifiable.

Their other study (Goldberg et al., 1996b) is also problematic as their scale included an assessment of “Knowledge of steroid alternatives” that had five questions using a 7-point Likert-type scale anchored with “know alternatives” and “do not know”. Their scale for “Knowledge of steroids effects” included 45 items anchored with “very correct” and “very incorrect”, again using a 7-point Likert-type scale. Finally, seven questions on knowledge of dietary supplements and protein powders/ergogenic drugs were also asked and these had a 7-point Likert-type scale where participants rated their perceived level of knowledge from “good knowledge” to “poor knowledge.” Similar to the criticism raised above, these question formats are problematic as these amount to assessments of confidence in their answer and self-assessment of their level of knowledge, rather than be an assessment of knowledge per se.

Moreover, later work by this research team introduced a pattern of citation practices that compounded measurement problems. Later studies (e.g., Elliot et al., 2004, 2008; Ranby et al., 2009) cited Goldberg et al. (2000) as the source of their knowledge assessment instruments,

while Elliot et al. (2006) cited Elliot et al. (2004) as their source for their knowledge assessment tool. However, Goldberg et al. (2000) do not provide a clear description of the knowledge questions used, and they draw upon even earlier versions of their assessments (Goldberg et al., 1996a; 1996b) without disclosing item adoptions or modifications. MacKinnon et al. (2001), a research team that included several researchers from the ATLAS and ATHENA studies provided the questions they used but not the scale, or the rationale for its creation. Finally, a later study by Ranby et al. (2009), with multiple ATLAS and ATHENA team members, listed their knowledge questions and reported that these were measured on a 7-point agreement scale, yet were coded as being either “correct” or “incorrect”, which is incompatible with their scale. In summary, research that studied the ATLAS and ATHENA interventions referenced scales that were poorly documented, inconsistently structured, and methodologically questionable, and this demonstrates a lack of transparency and methodological rigor within the field.

These early examples set the foundation for many of the challenges observed in later measurement efforts, as subsequent research continued to replicate and extend these initial shortcomings rather than systematically addressing them. The following section examines more recent efforts to develop knowledge assessments and evaluates whether these more contemporary studies have overcome or continue to reproduce the methodical problems rooted in these early works.

Contemporary Knowledge Assessment Efforts

Rather than emerging as a direct response to the shortcomings of early doping knowledge assessments, more recent efforts to measure athletes' knowledge have developed in a fragmented and inconsistent manner. In many cases, researchers have created their own assessment tools without clear reference to prior measurement issues or standards. Some studies have designed

bespoke instruments with little indication of systematic development or validation, while others have recognized the absence of a standardized approach and attempted, with varying degrees of rigor, to construct their own measures. Others have made use of conveniently available quizzes created by WADA, although these quizzes were either developed as an engagement tool rather than to evaluate knowledge or as a means to certify education module completion.

Consequently, while there have been isolated improvements, such as increased attention to curriculum alignment or expert consultation, the field as a whole has not demonstrated a coordinated or cumulative progression toward better knowledge measurement. Given the limited resources most scholars and anti-doping personnel face (Morente-Sánchez & Zabala, 2013), it is understandable that recognition-based formats such as true/false, yes/no, and multiple-choice questions remain prevalent, and few studies have incorporated recall-based assessments. However, there is still a lack of transparency regarding the construction and validation of their instruments.

Limited Sensitivity of Dichotomous and Trichotomous Recognition-Based Formats

One of the most persistent limitations in doping knowledge assessment is the widespread reliance on recognition-based item formats that use dichotomous (e.g., yes/no; true/false) and trichotomous (e.g., yes/no/I don't know) response structures. These items offer ease of administration and scoring, but they present serious psychometric limitations. Primarily, they lack sensitivity and do not adequately capture the gradations of athletes' understanding. In dichotomous formats, respondents have a 50% chance of guessing the correct answer. While trichotomous items may reduce guessing slightly by offering an "I don't know" option, they still offer limited insight into how much or what kind of knowledge an individual holds.

Numerous studies exemplify these shortcomings. For instance, Jalilian et al. (2011) employed 18 knowledge statements focused on the side effects of anabolic steroids, using true/false response options. In addition, Muwonge et al. (2015) used a ten-item knowledge test with yes/no response options to assess athletes' understanding of ADRVs. Although only 10% of participants self-reported lacking knowledge of doping, their answers to the substantive questions were incorrect approximately 90% of the time, suggesting either overconfidence, an issue with knowledge, or survey design. Notably, the question that assessed participants' knowledge of the definition of doping, based on the information provided, may have been negatively phrased (i.e., potentially, "Agree or disagree - I do not know the definition of doping"). This demonstrates that even with a dichotomous question format, the wording of question items needs to be carefully considered to ensure accurate or interpretable data is produced.

Similarly, Shibata et al. (2017) administered a twelve-item yes/no questionnaire to pharmacy students, but the wording of the questions was problematic. First, only five of the items assessed actual knowledge. The rest measured exposure to education, desire for more education, or opinions about educational responsibility. Even within the knowledge items, several questions were poorly phrased or leading. For example, the item "Do you think that athletes are permitted to use the prohibited substance to improve their performance?" is leading while it also lacks clarity about the context (e.g., in-competition vs out-of-competition, TUE), and others such as "Do you think athletes were never permitted to use the prohibited substance for medical treatment?" are confusingly worded.

Several studies used a trichotomous question format and provided participants with the option to select "I do not know". For example, Sas-Nowosielski and Świątkowska (2007)

developed a 45-item knowledge scale that covered athletes' rights and responsibilities, doping control, and knowledge of prohibited substances and methods. Providing a list of medications and supplements and asking whether these are prohibited is a common survey method used by many researchers (Antić, 2017; Ozkan et al., 2020; Turfus et al., 2019). While some rely on the prohibitive list provided by WADA, others, such as Antić (2017) go a step further. In his study with primary care physicians, a list of seven drugs they commonly come into contact with and were from a list of the most prescribed medicines in the country was used. This approach is relevant because it matches the daily experience of these support personnel and could serve to identify and reduce (through corrective education) common instances of unintentional doping.

Efforts to Align Knowledge Assessment with Education

One encouraging development has been a growing, though still limited, effort to align knowledge assessments with the specific content of educational programs or intended learning outcomes. For instance, Alexandrescu et al. (2021) designed their questionnaire for high school students enrolled in a sports training program to reflect the topics covered within their theoretical coursework. Their questions focused on the doping control process, the prohibitive lists, and the ethics of sport competition. Although they explicitly stated their intent to align assessment with instruction, they provided limited detail on how individual questions were developed or validated.

Awaisu et al. (2015) also demonstrated greater intentionality in constructing a knowledge measure. Their questionnaire, targeted at pharmacy students, was developed through collaboration with faculty experienced in curriculum design and program learning outcomes assessment. However, while some of their questions were on the prohibitive list and consequences of doping, others asked about supplement prevalence (which is difficult to

accurately quantify – see Garthe & Maughan, 2018), awareness of WADA, and other professional organization policy statements. Presumably, awareness of anti-doping, particularly governance and policy aspects, were or would become learning outcomes for this program, as these were reported as being low.

Turfus et al. (2019) designed their questionnaire to test Jamaican high school athletes' familiarity with the 2015 Code. They used information from the Code, previous research on supplement use, and a similar study conducted by a Master's student (although this was unavailable on the institution's thesis repository). Thus, the intentionality of the survey design was explained. Moreover, the questionnaire was pilot-tested with university physical therapy students to ensure clarity, format, and ease of completion, although this sample is dissimilar from the target population of the study. Of concern, however, was that they reported that the maximum score for their knowledge assessment was 31 points but only 27 questions were detailed in the study, leaving gaps in how the instrument was structured and scored.

Sepriani et al. (2022, 2023) also developed a knowledge test based explicitly on the 2021 Code, incorporating dimensions of factual, conceptual, and procedural knowledge. Factual questions focused on definitions, conceptual questions focused on types, effects, and consequences of doping, while procedural questions included results management and questions on testing and TUE. However, despite providing a strong rationale for the design of their knowledge assessment, they provided limited information on the number and content of items, and no information on the score range or psychometric properties was disclosed, limiting external evaluation. This made it difficult to evaluate their measurement design. Taken together, these examples illustrate promising, though still partial, steps toward ensuring that knowledge assessments meaningfully reflect what athletes are intended to know about anti-doping.

Validation Practices: Progress and Recurring Challenges

While some studies have incorporated more structured approaches to the overall design of their knowledge assessment, the details of measurement items, the validation processes, and comprehensive psychometric evaluation remain rare. Orr et al. (2018) took an important step by consulting anti-doping experts, athletes, coaches, and support personnel to inform item development. They pilot-tested their knowledge instrument for test-retest reliability and included both recognition and recall components, which was a notable advancement given the field's historical overreliance on recognition-based formats. Participants were asked to identify the banned status of substances and methods and between in-competition and out-of-competition restrictions were differentiated. Participants were also asked to recall desired and adverse effects of substances such as anabolic steroids and amphetamines. Hence their study represented a more sensitive approach to assessing true knowledge.

Sagoe et al. (2016) also made efforts to improve instrument quality by consulting an expert on anabolic steroid abuse in developing their 21-item multiple-choice knowledge test used in the Hercules program for high school students. An example item tested knowledge about the chemical nature of anabolic steroids. This indicates a deeper and more intricate question. However, given the nature of the program and target population, this question example may be demonstrative that the design was led by the expertise of the researcher rather than the needs of the participants, which raises questions about the constructive alignment of their knowledge assessment to program outcomes.

Hurst et al. (2020) further contributed to this trend of intentional design by evaluating a clean sport education program for junior elite athletes. Their eight-item multiple-choice knowledge test was developed in consultation with anti-doping education experts and pilot-tested

with a small group of elite athletes to ensure clarity and comprehension. However, similar to the criticism made above, the instrument was not pilot-tested with the actual target population of junior athletes, and some inconsistencies remained regarding question selection between different studies (e.g., Hurst et al., 2023), where the number of questions asked changed but no explanation for the deviation from their previous work provided.

Despite these advancements and efforts to construct well-designed items, there have been many cases where the mistakes of the past have been replicated. For example, Yalçın et al. (2019) used 11 questions to determine the level of doping knowledge among national-level athletes. However, these questions were framed using a 5-point level of agreement scale (i.e., Strongly disagree to Strongly Agree). Moreover, some questions focused on athletes' self-assess of their knowledge about doping and the commonality of substances used in sport. Scores that were more in agreement were determined to be representative of greater knowledge.

Moran et al., (2008) developed and validated a scale on doping attitudes and behavior. In doing so, they also included an assessment of athletes' knowledge of doping. This was assessed using questions on whether the athletes have received information on banned substances, and if so, from where, and their confidence in their knowledge. Hence, these were not measures of knowledge per se.

Morente-Sánchez and Zabala (2015) and Morente-Sánchez et al. (2019) describe their questionnaire as bespoke and informed by an earlier review of literature they conducted (Morente-Sánchez & Zabala, 2013). Hence, they demonstrated intentionality in designing their scale. They used four questions to assess Spanish football players', coaches', physical trainers', and other technical staff's knowledge of doping. Two questions were dichotomous (i.e., yes or no) and asked if the respondent knew the meaning of the acronym WADA and the prohibitive

list. They were instructed to write in their answers if they did, though it does not appear that this information was assessed. The final two questions were multiple choice items asking what type of substance clenbuterol is and the inclusion criteria for the prohibitive list. While they provided some details of their questions, it was unclear how these were derived based on the review of literature, although it should be noted that the knowledge portion of their questionnaire was just one aspect of their studies.

Reliance on ADO resources

One way scholars have overcome the absence of an established knowledge scale has been to use existing tools available from ADOs. For instance, Mazanov et al. (2008, 2014) used a survey created by UK Sport's Drug-Free Sport team (now called UKAD) with the assistance of an independent research company. This included 18 true/false questions and one 5-item response question that focused on four topics (Prohibitive substances and methods, Testing, Athletes rights and responsibilities, and Supplements). Others, such as Tsivitanidou et al. (2023), have relied on resources from WADA. They used an adaptive version of WADA's interactive Play True quiz game that is often used as an engagement tool. They operationalized the questions into the domains of General Knowledge and Doping Control. Questions were added based on local laws, and which of 14 presented substances were prohibited in sport. They pilot-tested their scale with high school students for reading comprehension, which matched the target population. However, they implemented a nontransparent weighting system, assigning different values to different questions without fully explaining the rationale, complicating the interpretation of results.

Another available WADA resource used in research is the quiz from the ALPHA e-learning system. This was used by Murofushi et al., (2018, 2022), and Zhumabayeva et al.

(2022). This is a 4-reponse option multiple-choice quiz that covers the philosophy of anti-doping, the purpose of the Code, definitions, effects of using anabolic steroids, and athletes' rights and responsibilities. While these resources are convenient, they have not been validated nor were they created specifically for empirical research. These examples highlight that while some researchers have moved toward more systematic instrument development, full transparency and psychometric rigor are still inconsistently applied.

In sum, the measurement of anti-doping knowledge has advanced only incrementally over the past several decades. While some contemporary efforts reflect greater intentionality and methodological care, the field continues to grapple with unresolved issues of validity, alignment, and sensitivity. Addressing these shortcomings is essential not only for evaluating education efforts but also for advancing theory-driven understandings of doping behavior. In the following section, we shift focus to a second strand of this project, which explores how Caribbean adolescent athletes are influenced by social norms, which, much like knowledge, plays a key role in doping prevention and policy and program design. A summary of the theory of normative behavior is presented along with a review of relevant research in this area.

Theory of Normative Social Behavior

The theory of normative social behavior (TNSB) states that the relationship between descriptive norms and behaviors is moderated by injunctive norms, outcome expectations, and perceived social distance (Rimal & Real, 2005; Chung & Rimal, 2016). Whereas descriptive norms are the perception of the prevalence of a behavior, injunctive norms involve people's beliefs about what they should do, such that social sanction may result from noncompliance (Bendor & Swistak, 2001). Outcome expectations capture the perceived benefits to oneself and/or the group for enacting the behavior. In a performance-enhancing context, loss aversion

(Kahneman & Tversky, 1984) may spur one to use substances because of the belief that not following suit risks falling behind competitors. Finally, perceived social distance is the relative closeness of referent groups. If there is greater social distance from a particular referent group then the strength of affiliation with the referent group is likely less influential (Chung & Rimal, 2016). However, this because complicated when the social distance of referent groups is harder to distinguish, for example, between one's peers, parents, and inspirational others, such as coaches. In sum, the TNSB states if one believes referent others approve of a behavior, the behavior is expected to provide benefits to oneself or the group, and if one closely identifies with the group, then this will magnify the effect of descriptive norms. This explains how the (un)popularity of behavior does not necessarily result in others conforming to the norm.

However, some behaviors are private, and direct observations of doping are likely rare. Even supplement use may occur in private and away from teammates (e.g., at home). Under these circumstances, perceptions of private behaviors are formed through communication, such as with one's peers and referent others (Lapinski & Rimal, 2005). Knowing how adolescents talk with others could provide insights into the development of social norms. Previous research has added communication frequency to the TNSB and shown that it contributes to the effects of descriptive norms (Real & Rimal, 2007). Beyond the frequency of communication, knowing the content of communication could further our understanding of norm formation and influence (Geber et al., 2019). Adolescents do exhibit distinct communication strategies when discussing substance use (Kam et al., 2016) and the content of their conversations may serve to signal not just the occurrence, but the acceptability of behavior (Geber et al., 2019). Taken together, anti-doping organizations may benefit from understanding how adolescent athletes talk to close others (in terms of frequency and content), about performance enhancement and how this affects

social norms (see Figure 1 for a summary). This is particularly relevant given that anti-doping interventions, such as ATLAS and ATHENA (Goldberg & Elliot, 2005), involve a peer-led component, and peer involvement in anti-doping interventions is encouraged (Backhouse et al., 2009. Moreover, meta-analysis reveals peer-led prevention interventions on substance use are more effective than adult-led programs (Cuijpers, 2002).

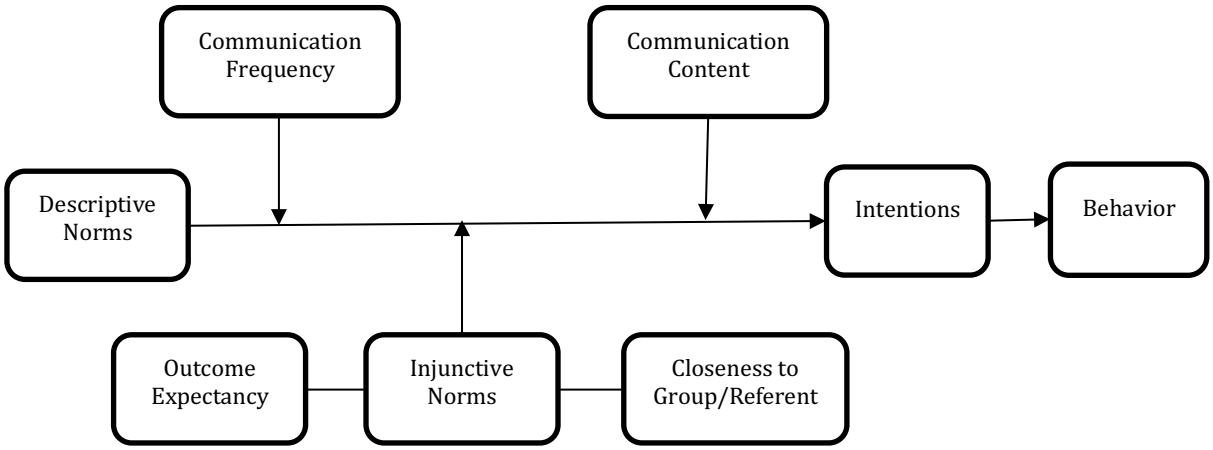

Figure 1. Theory of Normative Social Behavior

Research on Adolescent Athletes

A recent meta-analysis on doping that included research on adolescents revealed that using legal supplements, perceived social norms, and positive attitudes towards doping were strongly linked with doping intentions and doping behavior (Ntoumanis et al., 2014). Social norms and the influence of others (e.g., the athletes' entourage) are important factors when researching doping among adolescent athletes. Young athletes, whose knowledge of doping may be limited (Fürhapter et al., 2013; Nolte et al., 2014) or muddled (Duncan et al., 2018) may turn to parents and coaches for advice (Turfus et al., 2019). Yet these same individuals may similarly have poor knowledge and feel unprepared to provide the requested advice (Backhouse et al., 2015). Such circumstances are worrisome as they can result in bad advice, inadvertent doping, and even initiation of doping. Parents can be very influential in the lives of athletes, especially at

younger ages, which may unintentionally promote a positive attitude towards doping (Madigan et al., 2016). In contrast, positive relationships with coaches, teachers, family members, and teammates may serve to buffer temptations to dope (Erickson et al., 2015). While previous research has identified that parents and coaches have influence over athletes, what is less clear is how the mechanism of influence operates.

Another obvious source of influence on young athletes is their peers. One's peers are a source of information that can shape one's values and beliefs (Forehand & Wierson, 1993) and are a source of identity formation (Brown & Klute, 2003), which has implications for doping (Erickson et al., 2015; Ntoumanis et al., 2014). Adolescents may be more sensitive to peer influence, particularly about engaging in risky behaviors (Albert et al., 2013). Young athletes may be especially guided by what their friends do and think when it comes to intentions to dope (Woolf et al., 2014). This influence is especially acute during "middle adolescence" (14-17 years old) and adolescents may be less receptive to adults' perspectives (Onrust et al., 2016).

Social norms are often identified as a means to investigate social influence. As research in this area has grown, there has been concern over the lack of consistency with the conceptualization and operationalization of social norms (Chung & Rimal, 2016). This is problematic as it affects the interpretation of research findings. It is important to understand where norms originate. Norms are "socially negotiated and contextually dependent modes of conduct" (Rimal & Lapinski, 2015, p. 394). While in some cases, norms can be easily identified by the actions of the collective (e.g., standing for an ovation), in other cases it is harder to infer. This is especially true with private behaviors (such as doping). In such cases, it is people's perception of what the collective is doing that matters. These "descriptive norms" (Rimal & Lapinski, 2015) may influence behavior, even if the reality is that the occurrence of behavior is

low. Furthermore, people's beliefs in what others expect them to do may also influence behavior. These “injunctive norms” (Cialdini et al., 1990) are hypothesized to influence behavior because of one’s need to be affiliated with others (Cialdini & Goldstein 2004). This explanation is important because the "others" in this case are likely to have more or less influence based on the relationship between the two parties. For instance, Woolf et al. (2014) demonstrated that the proximity of relationships matters when it comes to the influence of injunctive norms. As mentioned previously, different referents have different influential effects on adolescents, and these effects may vary based on adolescents’ stage of development (Onrust et al., 2016). Research on social norms, therefore, needs to take into account specific referents (Shulman et al. 2017) when operationalizing constructs.

However, research on doping and social norms has often used general terms (“other people”) or composite measures that do not differentiate the source (Lazuras et al., 2015, 2017; Nicholls et al., 2019). This is problematic because it would be of benefit to know who is influential. It is likely that different referents (i.e., close friends versus casual acquaintances) have a different influence, even if the behavior of others (i.e., descriptive norms) is frequently observed. That injunctive norms may moderate the relationship between descriptive norms and behavior is not taken into account in doping research (see Woolf et al., 2014 for an exception). However, the TNSB (Rimal & Real, 2005) is designed to take this into account. While the TNSB may appear similar to other theories that are often used in a doping context (e.g., the theory of planned behavior, the theory of reasoned action), it specifically theorizes about normative influence rather than just use them in the theoretical model. Thus, the TNSB is an appropriate theoretical framework to explore how adolescent athletes are influenced. Furthermore,

increasingly more research is adopting the TNSB in the study of social norms (Shulman et al, 2017).

In summary, research on adolescent athletes has identified many factors that predict intentions to dope and doping behavior (Nicholls et al., 2017; Ntoumanis et al., 2014). One area of research interest is the role of social norms on adolescents. Athletes at this age are at a stage of their development when others close to them may influence how they think about, and act with regard to performance-enhancing substances. However, our knowledge of the relative influence of different sources on adolescent athletes is limited, in part because previous research has not explicitly identified or distinguished the source of influence (for an exception, see Woolf et al., 2014), or has combined different sources together to produce one composite measure of influence (Nicholls et al., 2019). Therefore, the research question posed for this portion of the project was whether different referent others have different influential effects on Caribbean adolescent athletes' intentions to use and reported behavior of use of performance-enhancing and doping substances.

Study Objectives

To summarize, for this research study, there were two specific objectives.

Objective 1: Development and Validation of a Knowledge Assessment Tool

The first objective of this project was to develop and validate an appropriate instrument to assess doping knowledge among adolescent athletes in the Caribbean. Existing tools in the field are limited in several respects, including lack of alignment with educational content, insufficient psychometric validation, and reliance on dichotomous or trichotomous item formats that reduce measurement sensitivity. This objective aimed to address these gaps by designing an instrument that aligns with learning outcomes from the ISE (WADA, 2021b) for this age group

and to ensure that questions provide an accurate assessment of athletes' knowledge. The goal was to create a tool that could support both educational needs assessments and the evaluation of anti-doping programs.

Objective 2: Examining the Influence of Close Others on Sport Supplement and Doping-Related Beliefs and Behaviors

The second objective was to investigate how close others (parents, coaches, and peers) influence adolescent athletes' beliefs, intentions, and behaviors regarding supplement use and doping. Drawing on the TNSB, this study explored the influence of descriptive norms (what others are perceived to do), injunctive norms (what others are perceived to approve of), and communication patterns on intentions to use supplements and doping susceptibility. Particular attention was paid to the varying influence of different referents. Together, these two objectives were designed to generate foundational knowledge about doping-related knowledge and normative influence among adolescent athletes in the Caribbean.

Questionnaire Development and Pilot Study

Design

A questionnaire was developed to achieve both study objectives. The anti-doping knowledge assessment component was constructed through a comprehensive review of the International Standard for Education (ISE), the Guidelines for the ISE (WADA, 2021b), and a draft of WADA's Athlete Curriculum. This Athlete Curriculum supplements the Guidelines and serves to provide an example of an Athlete Curriculum. It is recommended that the Athlete Curriculum be used to select learning objectives to be achieved for the target group of education activities, to assist with curriculum development, to assess existing curriculum for its suitability, and to inform assessments. We used it primarily for this latter purpose.

The Athlete Curriculum was built using evidence-informed pedagogical principles and learning design strategies and incorporated Bloom's taxonomy (Bloom 1956) to structure the learning objectives. Bloom's taxonomy classifies cognitive learning into hierarchical categories that range from lower-order skills, such as remembering and understanding, to higher-order processes like analyzing and evaluating. Though the taxonomy emphasizes the progression toward complex thinking, it should be noted, as Woolf (2021) has argued, that lower-level competencies such as "recognition," "recall," and "comprehension" remain important within the context of anti-doping education, particularly when aiming to prevent unintentional violations and establish a baseline of fundamental knowledge.

Target Group Identification and Topic Selection

Following the Guidelines for the ISE, we selected "youth athletes" and "talented athletes" as our primary target groups. The *youth athlete* stage is defined as, "Older children involved in sport at school or attending a sport center/club, attending on a regular basis and possibly competing at local or regional levels and play for enjoyment" (WADA 2021c, p. 29). *Talented athletes* are defined as, "Athletes training regularly and committed to sport, identified as talented through some formal mechanism, such as attending talent camps or part of a talented development program" (WADA, 2021c, p. 30). It is at this stage that athletes begin to get drug tested.

The Athlete Curriculum identifies topic areas to be covered and within each topic, learning objectives are listed for each target group. Although Article 18.2 of the Code identifies 11 mandatory topics to be covered in an ADO's Education program, the Athlete Curriculum lists 13 topic areas. These are:

1. Principles and values associated with clean sport

2. Introduction to clean sport and the global anti-doping system
3. Athletes', Athlete Support Personnel's (ASP's) and other groups' rights and responsibilities under the Code
4. The principle of strict liability
5. Anti-Doping Rule Violations (ADRVs)
6. Consequences of doping, for example, physical and mental health, social and economic effects, and sanctions
7. Substances and methods on the Prohibited List (List)
8. Use of medications and Therapeutic Use Exemptions (TUEs)
9. Risks of supplement use
10. Testing procedures, including urine, blood and the Athlete Biological Passport (ABP)
11. Requirements of the Registered Testing Pool (RTP), including whereabouts and the use of ADAMS
12. Results management
13. Speaking up to share concerns about doping

The two supplementary topic areas were number 2 (Introduction to Clean Sport and the Global Anti-Doping System) and 12 (Results Management). It was unclear why there was a difference between the Athlete Curriculum and the Guidelines for the ISE, however, it may be that these were subsumed within other areas (e.g., Principles and Testing procedures respectively). For planning purposes, we used the full 13 topic areas when planning the knowledge assessment.

Item Development and Alignment

After selecting the target groups and the corresponding topic areas and learning objectives, we conducted an extensive review of existing resources to identify candidate items. We focused on the WADA Youth Quiz[1] (15 multiple-choice items in the version we used) and the Play True Quiz Handouts[2] (39 items at the time of review; later expanded to 47). From these sources, 16 questions were selected based on their relevance to the target population and alignment with the 13 topic areas. Each question was coded by topic and mapped to a learning objective for both youth and talented athletes. In some cases, a single item addressed multiple topic areas.

To enhance the sensitivity of the assessment and address criticism of recognition-only formats, we created four additional recall-based items. Recall questions require respondents to retrieve information from memory, making them cognitively more demanding and potentially more accurate indicators of actual knowledge (Orr et al., 2018; Woolf, 2021). The first question asked, “How many anti-doping rule violations are there?”, followed by a request to name them. Using a similar format, the next question asked how many values are in the Spirit of Sport statement, followed by a request to list them.

Two doctoral students with backgrounds in pedagogy and anti-doping education independently reviewed item-topic alignment. One reviewer had experience as a doping control officer and educator. Disagreements were resolved through discussion. All 13 topic areas were addressed in the items aligned with the *talented athlete* target group but not for the *youth athlete* target group as not all topic areas have learning objectives for this group. For example, *youth athletes* are not expected to know Topic area 7: Substances and methods on the Prohibited List (List). Appendix B provides a summary of questions and the corresponding topic area.

[1] https://www.wada-ama.org/sites/default/files/resources/files/youth_quiz_english.pdf
[2] https://www.wada-ama.org/sites/default/files/2024-09/2024_quiz_-_english.pdf

Questionnaire Structure and Formatting

Additional sections were developed to assess key demographic characteristics (e.g., age, gender, sport, sport experience, nationality), and variables associated with the TNSB. These were supplemented by control variables, and a QR Code that provided further information on anti-doping. The questionnaire was divided into logical blocks based on content area, and instructions were embedded throughout to aid navigation and comprehension. Aesthetic features such as layout consistency and color coding were added to improve participant engagement and reduce survey fatigue.

Pilot Study

Ensuring that research instruments are appropriate for the target population is a critical, yet often overlooked, component of the data collection process. This is particularly important in research involving adolescents and technical topics such as doping, where assumptions about question comprehension may not hold. Concerns have been raised in the literature that instruments developed for adults are frequently applied to youth populations without adequate adaptation, resulting in questionable validity (Kanayama et al., 2007). For example, Nicholls et al. (2017) were unable to validate the Performance Enhancement and Attitude Scale (Petróczi & Aidman, 2009) with adolescent athletes, citing language comprehension as a likely cause.

To address these concerns and consistent with recommendations from Bandalos (2018), a pilot study was undertaken with a demographically appropriate, but younger, sample of Caribbean adolescent athletes. This strategy was deliberately chosen to safeguard against comprehension issues in the actual study population. If younger athletes could complete and understand the questionnaire, it was reasonable to infer that older adolescents (i.e., our target group) would also be able to do so.

This decision stands in contrast to other studies that conducted pilot testing with participants older than their intended samples. For example, Turfus et al. (2019) tested their knowledge survey with university physical therapy students, even though their target population was Jamaican high school athletes. Similarly, Hurst et al. (2020) piloted their instrument with elite athletes but did not test it with junior athletes, who were the focus of their main study. Such practices, while well-intentioned, risk overlooking age-related differences in vocabulary, cognitive development, and engagement with anti-doping terminology. Our approach was designed to mitigate these issues by prioritizing developmental alignment over convenience.

The pilot test was conducted in Barbados with six early adolescents between the ages of 11 and 15. Each participant completed the draft questionnaire independently while the time taken was recorded. Immediately afterward, participants engaged in either a one-on-one interview or a small group discussion designed to assess their understanding of the instrument. Participants were asked to identify any confusing words or phrases, paraphrase selected questions to demonstrate comprehension, and suggest alternative wording when appropriate. This cognitive interviewing (Willis, 2005) technique allowed us to assess not only surface-level comprehension but also deeper interpretive challenges.

Results from the pilot confirmed that the questionnaire was broadly appropriate for older adolescents. Several minor revisions were made based on participant feedback, including improved word choice and clarification of question phrasing. For example, the term “junior athlete” caused confusion and was changed to “young athlete”. Also, the terms “sanctioned” and “sanction”, were not comprehended, and through discussions with the young athletes, the inclusion of the word “penalties” to demonstrate that sanctions are otherwise known as penalties was made. Similarly, the noun “physician” was clarified to include “doctor”, which was more

comprehendible to the athletes. The revisions enhanced readability without altering the substantive meaning of any items.

The average time to complete the questionnaire was 31 minutes. While this exceeded the intended 20–30-minute window, the extended time was primarily due to two of the younger participants taking longer to complete the survey. Given their age and expected reading level, this was not deemed problematic.

By conducting this pilot study with a demographically appropriate, and younger sample, we strengthened the content validity of our instrument, enhanced confidence in its clarity and usability, and met ethical standards by ensuring that participants in the main study would be able to meaningfully engage with the research materials. This methodologically attentive approach contrasts with prior studies that relied on pilot samples misaligned with their study population and contributes to the growing call for rigor in instrument development within anti-doping research.

Method

Participants

Participants were 388 athletes representing their country at an international sport event. There were 173 females, and 215 males aged between 15 - 22 years of age (Mean – 18.3, SD = 2). Thirty-four countries were represented including others uncategorized, and the top five countries represented were Trinidad & Tobago (n = 76), Bahamas (n = 36), Jamaica (n = 28), Barbados (n = 26), and Grenada (n = 26). Twelve primary sports were identified with the top five included, Track & Field/Athletics (n = 189), Netball (n = 48), Swimming (n = 45), Basketball (n = 27), and Cycling (n = 24). Participants had competed in their primary sport for 7.79 years on average.

Although the study originally targeted adolescent athletes, defined as those aged 15–19, data collection opportunities were constrained by the COVID-19 pandemic. Several targeted events were canceled, and an opportunity to collect data at the inaugural Caribbean Games arose. While the event primarily targeted youth athletes, it also served as a developmental competition for emerging talent and included athletes up to 22 years of age. This age range was selected to capture the adolescent phase of development, which has been recognized as extending into the early twenties (Steinberg, 2008). Approval from WADA and the University IRB was obtained for this amendment to the original project description.

To be eligible for participation, individuals had to be current citizens or residents of a Caribbean nation, aged between 15 and 22 at the time of data collection, and actively competing in a junior-level or young adult international sporting event. Participants were required to meet the criteria of either Junior Elite (defined as athletes aged 15 to 22 who have qualified for international junior competitions) or Junior Competitor (defined as athletes aged 15 to 22 who have qualified for national-level junior competitions). The questionnaire was translated into French and a certification of translation was obtained. Hence, participants had to be fluent in English or French, as these were the primary languages spoken at the target events (e.g., CARIFTA Games, Caribbean Games), and the study materials were only available in those two languages.

Participants were excluded from the study if they fell outside the specified age range, were not actively competing at the time of data collection, or were not fluent in English or French. The initial sample consisted of 443 individuals between the ages of 11 and 29 years. To align with the study's focus on Caribbean adolescent athletes, the sample was restricted to participants aged 15 to 22 years, resulting in the exclusion of 30 individuals. An additional 24

responses were removed due to incompleteness, and one response was excluded because the participant declined to disclose their gender. This yielded a final analytic sample of 388 participants. Given the data collection context at sporting events and the minimal risk posed to participants, a waiver of documentation of informed consent was obtained to ethically facilitate participant enrollment.

Measures

The first portion of the questionnaire consisted of the knowledge assessment that contained 16 multiple-choice test questions followed by 4 open recall questions described earlier. The full questionnaire and items measured are provided in Appendix A, and the primary measures are described below.

Attitudes Toward Performance-Enhancing Drugs

We used the 4-item measure for attitudes from the Adolescent Sport Drug Inventory (ASDI) (Nicholls et al. 2019). This subscale measures attitudes on a 7-point Likert scale anchored (1 = strongly disagree, 7 = strongly agree) with higher scores indicating a more positive attitude toward performance-enhancing drugs. Example questions include, “You have to take PEDs to play at the highest level in sport”, and “Making PEDs legal would improve sport.”

Descriptive Norms (Teammates/Athletes; Sport Supplements / Performance-Enhancing Drugs)

Descriptive norms are the perception of the prevalence of behavior, and we separated this into two referent groups. The first was specific to the athlete (“The first 3 questions are about your teammates/training partners.”) and the second was general to athletes similar to themselves (“The next 3 questions are about athletes in your sport and age group.”), and as shown, instructions were provided to participants before specific questions were posed. The framing of

the second item set was designed to still maintain a level of specificity rather than use a general term, such as “athletes similar to you”. This was important as previous research has demonstrated that athletes perceive that the prevalence of PED increases when athletes are more distal, older, and more senior (i.e., play at a higher level) (Woolf et al., 2014). In addition, separate blocks of questions were created for “Sport Supplements” and “Performance-Enhancing Drugs (PEDs)”. Example questions for each referent group and substance include, “Many of my teammates/training partners use sport supplements”, “Sport supplements use often occurs among athletes in my sport and age group”, “I know many of my teammates/training partners use PEDs”, and “Many athletes in my sport and age group use PEDs”. Similar items have been used in previous research (Woolf et al., 2014). A 7-point Likert scale from 1 (strongly disagree), 4 (neither agree nor disagree), and 7 (strongly agree) was employed.

Injunctive Norms (Teammates/Training Partners /Coach(es)/ Parent(s); Sport Supplements/ Performance-Enhancing Drugs)

Injunctive norms reflect individuals’ beliefs about what they ought to do, and because noncompliance may lead to social sanction, it is important to clearly identify the source from whom such sanction is expected. We followed Rimal and Real’s (2005) conceptualization and operationalization where wording focuses on the “appropriateness”, “support”, “favorableness” and “approval” from specific referent others. Hence, separate blocks were created for 3-items that made explicit reference to teammates/training partners, coach(es), and parent(s). Headings were used to inform the respondent of the referent, which was repeated in each question. Questions on sport supplements were asked first, and questions on performance-enhancing drugs were asked in a later section of the questionnaire. Example questions include, “My teammates/training partners would approve if I used sport supplements,” “My coach(es) would

support it if I used PEDs", and "My parent(s) would like it if I used PEDs." These questions are similar to those used previously (Woolf et al., 2014). All questions were measured on a 7-point Likert scale from 1 (strongly disagree), 4 (neither agree or disagree), and 7 (strongly agree).

Perceived Social Distance: (Teammates/Training Partners/ Coach(es)/ Parent(s))

Perceived Social Distance reflects the closeness of social and personal relations, and to measure this, we used the Unidimensional Relationship Closeness Scale (URCS) from Dibble, Levine, & Park (2011). The scale is reported to be unidimensional and to have convergent and divergent validity. Although this is a 12-item scale, we followed Dibble et al.'s (2011) recommendation to use 11 items. This scale employs a 7-point Likert scale ranging from 1 (strongly disagree) to 7 (strongly agree). The scale is designed for specific referent members to be identified, which we did for our three referent groups (Teammates/training partners/ Coach(es)/ Parent(s)). Hence, items used included "My relationship with my teammates/training partners is close", "My coach(es) and I have a strong connection", and "My relationship with my parent(s)is important in my life.".

Outcome Expectations: (Sport supplements/ performance-enhancing drugs)

Outcome expectations capture the perceived benefits to oneself for engaging in the behavior identified. In our context, that includes the use of sport supplements and performance-enhancing drugs. To measure outcome expectations for sport supplements, we used the Sport Supplement Belief Scale (Hurst et al., 2017) as this provides a unidimensional instrument designed to assess athletes' beliefs about the effectiveness of sports supplements. Hurst et al., (2017) conducted a series of studies to validate the scale and demonstrated that that higher scores were significantly associated with the use of a greater number of supplements and that the scale differentiated between users and non-users of supplements. Outcome expectations for

supplement use were measured on a 6-point scale from 1 (strongly disagree) to 6 (strongly agree), with no neutral or middle option available. For consistency, we adapted the Sport Supplement Belief Scale for performance-enhancing drug use using the same question format but substituting the two substance terms. Some examples of questions are, “Supplements improve the quality of my training”, “Supplements are necessary for me to be competitive,”, “Using PEDs would help me realize my potential”, and “My chances of winning improve if I used PEDs”.

Communication Frequency: (Sport Supplements / Performance-Enhancing Drugs)

To assess communication frequency, we used a generalized frequency format that has been used in previous research (e.g., Geber et al., 2017; Real & Rimal, 2007) and separate sections focused on sport supplements and performance-enhancing drugs. Five response options were presented in order of relative magnitude ranging from Never, Rarely, Sometimes, Often, and Very Often. Questions were framed to include the directionality of the conversation and two questions were asked for each of the three reference groups. For example, “How often do you talk to your teammates/training partners about sport supplements?”, “How often does your coach(es) talk to you about sport supplements?”, and “How often do your parent(s) talk to you about PEDs?”

Communication Content: (Sport Supplements / Performance-Enhancing Drugs)

Previously Geber et al. (2017) had classified communication content as being pro-behavior, anti-behavior, or neutral. We used a similar format and response options ranged from 1 (very negative way), 3 (neither a negative nor positive way), and 5 (very positive way). Similar to communication frequency, communication content included two questions for each reference group, that accounted for directionality, and separate blocks used for sport supplements and

performance-enhancing drugs. For example, “When I talk to my teammates/training partners about sport supplements it is in a:”, “When my coach(es) talk to me about PEDs it is in a:”, and “When I talk to my parent(s) about PEDs it is in a:” To account that some athletes may not engage in conversations on the topic, a sixth option of “It isn’t talked about” was provided.

Intentions to Use Sport Supplements

To measure intentions to use sport supplements a 3-item Likert scale previously used by (Woolf et al., 2014) was adopted. This included questions such as “I intend to use sport supplements in the near future” and “I will use sport supplements in the near future.” Response options ranged from 1 (strongly disagree), 4 (neither agree nor disagree), and 7 (strongly agree).

Doping Susceptibility

As doping is a taboo topic, athletes are reluctant to reveal that they use or intend to use performance-enhancing drugs. A commonly used substitute for doping behavior is doping susceptibility, which provides a measure of the risk that athletes may use performance-enhancing drugs. We used the Doping Susceptibility subscale from the validated Adolescent Sport Drug Inventory (ASDI) (Nicholls et al. 2019). The subscale includes five questions that present circumstances (e.g., “I would be tempted to take PEDs, if I knew they would increase my performance”, and “I would be tempted to take PEDs if I had a bad injury”), and influential others (e.g., “I would be tempted to take PEDs if my coach tells me too”). A 7-point Likert scale was used with scores ranging from 1 (strongly disagree), 4 (neither agree or disagree), and 7 (strongly agree).

Santa Clara Strength of Religious Faith Questionnaire

Evidence exists that religious faith may be a protective factor against doping (Rodek et al., 2009; Zenic, et al., 2013), given the moral component promoted in traditional religious

practices and doping categorized as an immoral act. To control the extent to which participants identify as religious we used the Santa Clara Strength of Religious Faith Questionnaire (Plante & Boccaccini, 1997). This 10-item Likert-type scale has been validated using confirmatory factor analysis (Lewis et al., 2001), where a one-factor model was tested and accepted based on fit statistics. All factor loadings were high, and the internal consistency was reported at 0.93. In the development of the scale, Plante and Boccaccini (1997) also reported high internal reliability (0 .95) and split-half reliability (r = .92). Example questions include “My religious faith is extremely important to me”, and “I look to my faith as a source of inspiration” and are rated on a 4-point scale, anchored with “strongly agree/disagree” with no neutral option.

Procedure

Research ethics approval was obtained from both the University of Illinois Urbana-Champaign and the University of the West Indies Cave Hill before the commencement of data collection. Data were collected at four international youth and young adult sporting events. This included the 2022 Caribbean Games, the 2022 CARIFTA Triathlon Championships, the 2023 CARIFTA Track and Field Championships, and the 2023 Commonwealth Youth Games. Sports represented at the Caribbean Games included athletics, basketball (3x3), cycling, futsal, judo, netball, and swimming. At the Commonwealth Youth Games, athletes competed in athletics, beach volleyball, cycling, netball, rugby sevens, swimming, and triathlon. Although the Commonwealth Youth Games were open to all Commonwealth countries, only athletes from the Caribbean were recruited. The remaining two events focused specifically on triathlon and athletics respectively.

Before each event, the research team liaised with event organizers through the Caribbean RADO. Notifications were sent in advance to inform officials, team managers, coaches, athletes,

and parents that the research team would be at the event. This included an overview of the study and links to consent materials, which could be viewed and completed electronically before the event.

At each event, a recruitment booth was set up in a high-traffic area in the Athletes Village or a similar location based on the size of the event. The booth featured informational materials, promotional items (e.g., university-branded pins, pens, stickers), and printed and electronic (QR code) access to study documents. Trained research staff were available at the booth to explain the study, answer questions, and provide informed consent, parental permission, and child assent forms as applicable.

The recruitment booth was strategically situated near an area with tables and seating to facilitate questionnaire completion under the observation of the research team. Between one and three team members staffed the booth at each event to manage recruitment and monitor data collection.

Participants completed a quantitative paper-based survey. A physical questionnaire was used to reduce the likelihood of participants searching online for correct responses during the knowledge assessment component. Additionally, given unreliable internet access across some sites, a digital format was not feasible. The questionnaire included detailed instructions, clarification of the term performance-enhancing drugs, and examples of commonly known substances and their shorthand names.

To encourage participation, athletes were offered a modest incentive of $10 (US). In accordance with the University of Illinois's IRB guidance for International Research, the appropriateness of compensation was assessed relative to the average daily income in each host country. This calculation confirmed that the incentive represented less than 5% of the average

daily wage, thereby minimizing the risk of undue inducement and ensuring that participation remained voluntary. Upon completion, each questionnaire was reviewed briefly for completeness (e.g., one response per question, no missing sections), after which participants received the incentive.

Data Analysis

Validation of Anti-Doping Knowledge Assessment Questionnaire

Participants' anti-doping knowledge was assessed using a 16-item questionnaire, with responses recoded into binary format (1 = correct, 0 = incorrect). This coding facilitated the analyses of item difficulty and the overall scale reliability, structured through a three-phase analytical approach.

To validate the Anti-Doping Knowledge Assessment Questionnaire (ADKA), the initial analytical phase employed Classical Test Theory (CTT) to conduct a preliminary assessment of the questionnaire items. This step examined item difficulty and discrimination to determine each item's contribution to the reliability and validity of the scale.

The second phase assessed the construct validity using a two-pronged analytical strategy. The sample was randomly divided into two subsets. The first subset was subjected to exploratory factor analysis (EFA) using R software (version 4.3.1), aiming at the exploration of the latent structure of the scale and identifying potential item clusters that aligned with distinct theoretical constructs. Building upon the insights gleaned from EFA, the subsequent confirmatory factor analysis (CFA) was then conducted on the second subset. The CFA, also implemented in R, tested the factor structure suggested by the EFA(s), establishing the robustness of the scale's underlying structure and ensuring that the identified item clusters reliably represented the intended constructs.

Given the dichotomous nature of collected data, factor analyses were conducted using the Weighted Least Squares Mean and Variance Adjusted (WLSMV) estimator, which provides more accurate parameter estimates and standard errors under such conditions of categorical data. Model fit was evaluated using conventional criteria: the Chi-Square test of model fit, the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), and the Root Mean Square Error of Approximation (RMSEA). Acceptable model fit was indicated by non-significant Chi-Square statistics (acknowledging its sensitivity to sample size), CFI and TLI values greater than or equal to .95, and RMSEA values less than or equal to .06 (Hu & Bentler, 1999; Kline, 2015). These indices collectively offered a comprehensive assessment of model adequacy, enabling a robust evaluation of construct validity with a high degree of confidence.

The third phase incorporated Item Repones Theory (IRT) to further examine item-level performance and scale reliability across varying levels of participant anti-doping knowledge. This multifaced approach ensured that the ADKA not only measured the intended construct but did so with precision and theoretical alignment.

Theory of Normative Social Behavior

To address the second research objective, which was grounded in the Theory of Normative Social Behavior, path analyses were conducted. Specifically, this study investigated relationships between key psychosocial predictors and two primary outcome variables: intention to use sport supplements (IUS) and doping susceptibility (DS). IUS was measured using a composite score of three items, with higher scores indicating stronger intentions. DS was measured using five items, with higher composite scores reflecting greater susceptibility to doping.

Psychosocial predictors of interest included descriptive norms (DN), injunctive norms (IN), outcome expectations (OE), communication frequency, and closeness with key referents (teammates, coaches, and parents). Descriptive norms captured perceived peer behavior, while injunctive norms reflected perceived social approval. Communication frequency and closeness were assessed with multiple items and averaged for each referent group. The first path analysis focused on the influence of predictors related to teammates, especially the descriptive norms shared with teammates as shown in Figure 2.

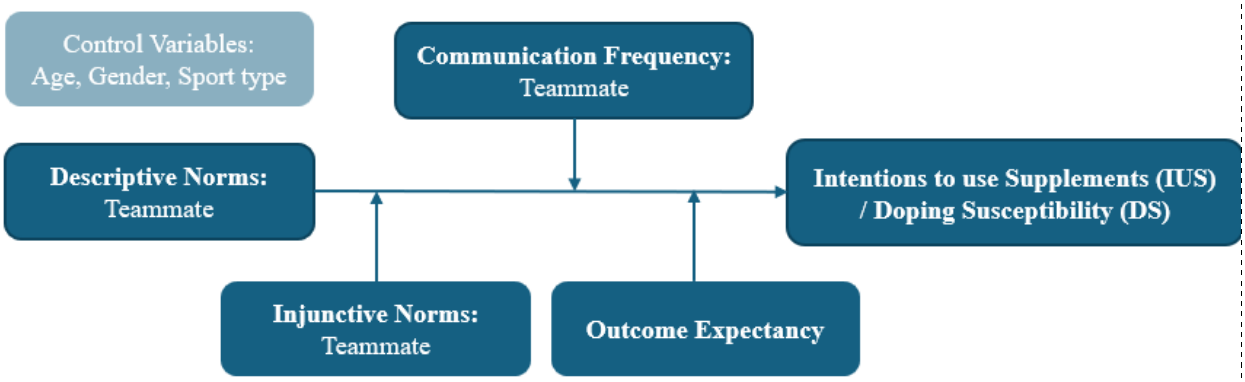

Figure 2. Path Diagram of the Effect of Descriptive Norms-Teammates on IUS and DS

Additionally, closeness with teammates, coaches, and parents was assessed through multiple items per group. Control variables included age, gender (coded 1 = female), type of sport (1 = team sport; 0 = individual sport), and level of religious faith, measured using the mean of ten items from the Santa Clara Strength of Religious Faith Questionnaire which is only added in predicting Doping Susceptibility. Figure 3 presents the second path analysis model illustrating the effects of injunctive norms—shared by all agents (teammates, coach, and parents)—on the outcomes of IUS and DS, analyzed separately. These effects are further moderated by outcome expectancy, communication frequency, and closeness.

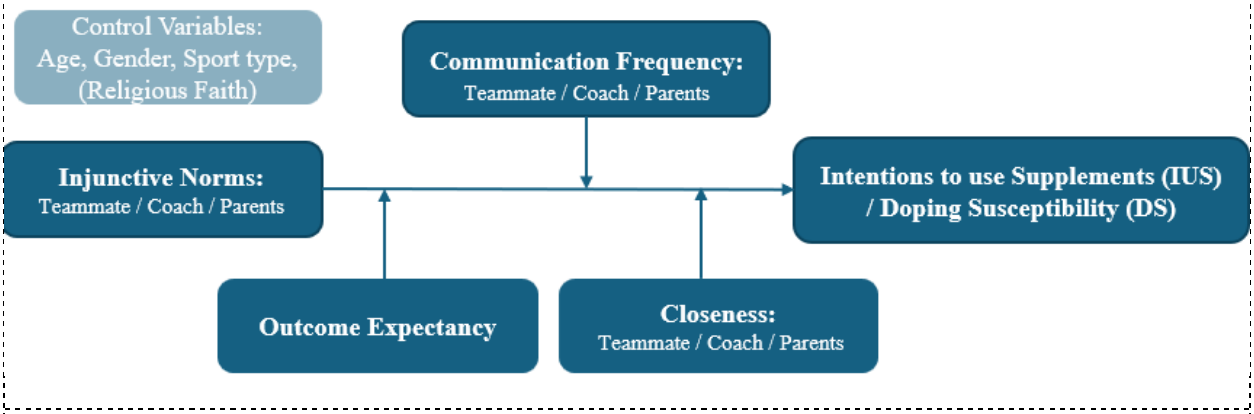

Figure 3. Path Diagram of the Effect of Injunctive Norms on IUS and DS

Prior to the main analyses, composite scores were computed for each psychosocial predictor. To ensure accurate estimation and reduce multicollinearity—particularly in the context of moderation analysis—all predictor variables were standardized by centering. Separate path analyses were then conducted for IUS and DS using multiple regression models in R to examine how descriptive norms, injunctive norms, outcome expectations, closeness, and communication influence IUS and DS. These analyses also explore potential moderation effects, particularly whether injunctive norms moderate the influence of descriptive norms and other predictors or not. All models were adjusted for the control variables, allowing for a clearer interpretation of the relationships between social norms and athletes' behavioral intentions and susceptibilities.

Results

Preliminary Analysis

Item-level analyses were conducted using CTT to evaluate the psychometric performance of the ADKA. As shown in Table 1, item difficulty, discrimination, and item-rest score correlations were computed (DeVellis, 2017; Nunnally & Bernstein, 1994). Item difficulty, defined as the percentage of participants who answered each item correctly, reflected how challenging each item was for the sample population. Item discrimination reflected each item's capacity to differentiate between high- and low-performing participants. Item-rest correlations

assessed the alignment between each item and the overall test score, excluding the item itself (Crocker & Algina, 2006; Tavakol & Dennick, 2011).

As shown in Table 1, Items 1, 5, 12, and 13 were characterized by high difficulty indices. This indicates that the majority of participants answered these items correctly, which suggests they were relatively easy for the sample. Although such items may be appropriate for measuring foundational knowledge, their limited variance constrains their utility in differentiating between respondents at different levels of the construct being measured. This interpretation is supported by their moderate to low discrimination values, which further suggest a diminished capacity to distinguish between individuals with high versus low anti-doping knowledge. For determining foundational knowledge, these items may be appropriate. However, if determined to be too simplistic, these items may benefit from being revised to increase their cognitive demand or alignment with more nuanced aspects of the desired learning objectives (Kim & Yoon, 2011).

Conversely, Items 4, 8, 14, and particularly Item 15 were identified as highly difficult, with a small proportion of participants answering them correctly. Such low correct response rates may be attributable to content not well aligned with the sample's knowledge, excessively technical language, or ambiguous wording (DeMars, 2010). These items also exhibited weak discrimination indices, indicating poor ability to differentiate among respondents with differing overall test scores. Item 15 was especially problematic, demonstrating both minimal discrimination and a negative item-rest correlation, suggesting that it detracted from the internal coherence of the scale. Similarly, Items 4, 8, and 14 had low item-rest correlations, reinforcing concerns about their psychometric contribution.

Furthermore, internal consistency reliability for the 15-item scale, as assessed by Cronbach’s alpha, was acceptable at .73, a threshold generally suitable for early-stage research

instruments (Nunnally & Bernstein, 1994). However, when Item 15 was removed, the alpha increased to .76, indicating a modest improvement in reliability and further supporting its reconsideration for revision or exclusion. The learning objectives for Items 4, 8, and 15 were covered by other Items. However, the learning objective for Item 14 – "Requirements of the Registered Testing Pool (RTP), including whereabouts and the use of ADAMS" – was not met by other Items. The reason this Item has a high difficulty rating may be due to the participants' age and competitive level. That is, they may not be part of an RTP or familiar with the intricacies of the whereabouts policy, hence their difficulty in answering this question. Collectively, these results underscore the need for iterative refinement based on item-level performance to enhance the validity, reliability, and interpretability of the instrument.

Table 1

Item Difficulty and Item-Rest Score Correlations

Items	Item difficulty	Item Discrimination	Item-Rest Score Correlation
Item 1	.89	.27	.34
Item 2	.50	.47	.28
Item 3	.72	.60	.50
Item 4	.24	.36	.16
Item 5	.89	.30	.52
Item 6	.62	.40	.28
Item 7	.62	.54	.36
Item 8	.33	.27	.06
Item 9	.73	.45	.34
Item 10	.79	.54	.60
Item 11	.64	.47	.34
Item 12	.82	.41	.45
Item 13	.84	.42	.59
Item 14	.19	.25	.14
Item 15	.09	.05	-.02
Item 16	.53	.56	.32

Note. Item difficulty is represented by the percentage of participants who provided the correct response to each item, serving as an indicator of how challenging an item is for the sample population. Item discrimination refers to an item's ability to differentiate between participants who have high overall scores and those who have low overall scores on the test, with higher values indicating better discrimination. The item-rest score correlation is the correlation of each item with the total score excluding that item, used to assess the item's consistency with the overall scale.

Validation of the Anti-Doping Knowledge Assessment

Factor Analysis Results

To investigate the latent structure of the anti-doping knowledge scale, a series of exploratory factor analyses (EFAs) were conducted using a tetrachoric correlation matrix and the Weighted Least Squares Mean and Variance Adjusted (WLSMV) estimator, which is appropriate for binary item formats. The primary objective was to assess the suitability of a unidimensional factor solution and evaluate the potential benefits of item exclusion or the adoption of a multifactor structure.

Parallel Analysis and Eigenvalues. Initial factor retention decisions were informed by both the Kaiser criterion (eigenvalues > 1) and parallel analysis. The observed eigenvalue pattern showed a marked drop after the first factor, with eigenvalues of 5.84, 1.44, 1.28, and 1.06. While the Kaiser rule suggested a four-factor solution, parallel analysis—considered a more robust criterion—indicated that only the first observed eigenvalue exceeded the simulated random data threshold (see Figure 4), supporting a unidimensional factor structure (Horn, 1965).

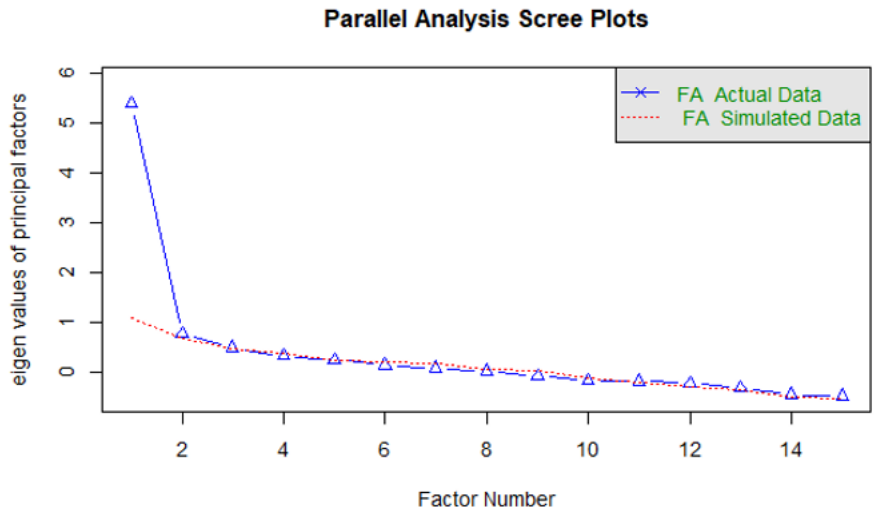

Figure 4, Scree plot of the Parallel Analysis

EFA Results. As presented in Table 2, the initial one-factor EFA including all 16 items demonstrated adequate approximate fit: $\chi^2(90) = 126.72$, $p = .0065$, RMSEA = .046 [90% CI = .025, .064], CFI = .942, TLI = .932. However, the SRMR value of .121 exceeded the commonly accepted threshold of .08 (Hu & Bentler, 1999), raising concerns about model residuals.

Table 2

Model Fit Indices for Exploratory Factor Analyses

Model	χ^2(df)	RMSEA [90% CI]	CFI	TLI	SRMR
EFA (All 16 Items)	126.72 (90)	.046 [.025, .064]	.942	.932	.121
EFA (Excl. Item 15)	119.92 (77)	.054 [.034, .072]	.934	.921	.126
EFA (Excl. Items 8 & 15)	111.85 (65)	.061 [.041, .080]	.928	.913	.126
EFA (Excl. Items 8, 14 & 15)	73.62 (45)	.057 [.032, .080]	.967	.960	.110
EFA (2-Factor Model)	93.03 (76)	.034 [.000, .056]	.973	.963	.100

Note. WLSMV estimator used for all models; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Square Residual

Subsequent models were estimated following stepwise exclusion of problematic items. Item 15 was first removed due to poor psychometric performance identified in both classical test theory (CTT) and item response theory (IRT) diagnostics—namely, low discrimination and a negative item-total correlation. The revised model improved slightly: $\chi^2(77) = 119.92$, $p = .0013$, RMSEA = .054 [.034, .072], CFI = .934, TLI = .921, SRMR = .126. Further removal of Item 8 did not substantially improve fit; although RMSEA increased slightly to .061, CFI and TLI remained acceptable (CFI = .928, TLI = .913), while SRMR remained at .126.

The most improved unidimensional model excluded Items 8, 14, and 15, yielding stronger fit: $\chi^2(45) = 73.62$, $p = .0045$, RMSEA = .057 [.032, .080], CFI = .967, TLI = .960, and SRMR = .110. While the SRMR remained marginally above the threshold, the overall fit

indicated substantially improved model parsimony and construct coherence, aligning with theoretical expectations for a unidimensional measure of anti-doping knowledge.

As a comparative alternative, a two-factor EFA was also estimated. This model demonstrated superior fit statistics: $\chi^2(76) = 93.03$, $p = .0897$, RMSEA = .034 [.000, .056], CFI = .973, TLI = .963, SRMR = .100. According to Hu and Bentler (1999), this model meets all conventional criteria for good fit. However, from a construct validity perspective, the added complexity of the two-factor model is not theoretically justified, as the ADKA was intentionally developed as a unidimensional tool aligned with the learning objectives of WADA's Athlete Curriculum. Moreover, the parallel analysis (see Figure 1) strongly favors a dominant first factor, reinforcing the selection of a refined one-factor solution.

Confirmatory Factor Analysis (CFA) Evaluation. To confirm the refined unidimensional structure suggested by EFA, a CFA was conducted using the 12-item version of the scale (excluding Items 4, 8, 14, and 15). All items were specified to load on a single latent factor representing general anti-doping knowledge. Model fit indices indicated acceptable global fit: $\chi^2(45) = 73.62$, $p = .0045$, RMSEA = .057 [90% CI = .032, .080], probability RMSEA ≤ .05 = .289, CFI = .967, TLI = .960, and SRMR = .110. While the SRMR slightly exceeded the conventional threshold of .08 (Hu & Bentler, 1999), the RMSEA and incremental indices confirmed the model's adequacy.

Standardized factor loadings are shown in Table 3. Items 10 (.917) and 13 (.925) demonstrated particularly strong loadings. However, Items 2 (.557), 7 (.541), 11 (.550), and 16 (.502) had factor loadings below the preferred threshold of .60 (Kline, 2015), suggesting a limited contribution to the latent trait. Despite these lower values, all item loadings were statistically significant ($p < .001$).

Together, the EFA and CFA results support a refined unidimensional model of anti-doping knowledge. The final 12-item scale demonstrates acceptable model fit and internal consistency. While several items (e.g., Items 2, 7, 11, 16) may benefit from future refinement or revision, the overall factor structure aligns well with theoretical expectations and empirical indicators of construct validity. Future efforts may explore the impact of item revisions on model fit and evaluate potential multidimensional alternatives should substantive theory evolve.

Table 3

Standardized Factor Loadings and Significance Tests for CFA (Unidimensional Model)

Item	Estimate	SE	Est./SE	*p*-value
Item 1	.707	.000	999.000	.999 (fixed)
Item 2	.557	.076	7.290	.000
Item 3	.718	.069	10.430	.000
Item 5	.832	.071	11.645	.000
Item 7	.541	.085	6.366	.000
Item 9	.676	.071	9.555	.000
Item 10	.917	.034	26.925	.000
Item 11	.550	.084	6.547	.000
Item 12	.731	.070	10.373	.000
Item 13	.925	.039	23.690	.000
Item 16	.502	.088	5.732	.000

Note. All loadings are standardized and statistically significant at $p < .001$

Item Response Theory Analysis

The original ADKA questionnaire includes 16 items across 13 topic areas. While IRT typically requires unidimensionality, modeling 13 separate dimensions with so few items poses challenges in estimation and convergence. Thus, we applied a unidimensional IRT model as a preliminary step to evaluate individual item characteristics.

To determine the best-fitting model, we compared the Rasch model, 2PL-IRT, and 3PL-IRT. Unlike classical test theory, IRT models the probability of a correct response based on item

parameters. The 3PL-IRT includes item difficulty, discrimination, and guessing. The 2PL-IRT excludes guessing, while the Rasch model assumes equal discrimination across items. Model comparisons using information criteria and chi-square tests indicated the 2PL-IRT was optimal (AIC = 6123.193, BIC = 6249.946, CFI = .964, TLI = .958, RMSEA = .039, SRMR = .052).

More formally, item difficulty refers to the ability level where the probability of getting an item right is .5 (50%). Thus, a larger item difficulty estimate implies a more difficult level of the item. Item discrimination is to measure how an item can successfully differentiate participants with different levels of abilities. Currently, there is no strict cut-off for an acceptable range of discrimination estimates and Baker (2001) recommended a moderate discrimination as greater than .64. Also, extending from the tradition of factor analysis requiring larger than .3 factor loading (Costello & Osborne, 2005), IRT discrimination parameter (a slope parameter) can be re-written as a factor analytic tradition, and it requires larger than .5 estimates in discrimination parameter. Negative values suggest the item may be functioning in the opposite direction. According to Baker (2001), “It is either poorly written or there is some misinformation prevalent among the high-ability students” (p. 32).

The result of 2PL-IRT is shown below in Table 4. Items 4, 8, 14, and 15 are flagged as problematic because of their small to negative item discrimination estimates. This result consistently aligns with previous CTT-based investigations and EFA. Also, these four items showed extremely high item difficulty above 2 standard deviations implying these items were too difficult, which is not a desirable property of the test. Notably, Item 15 showed a negative item discrimination estimate. A possible explanation is that the wording of this Item involves a specific policy detail (the 10-year sample storage rule) that may be unfamiliar to younger athletes, such as those in this study.

Table 4

Results of 2PL-IRT

Item	Item discrimination (*a*)	Item difficulty (*b*)
1	1.277	-2.043
2	.695	.019
3	1.745	-.798
4	**.462**	2.680
5	2.656	-1.463
6	.744	-.760
7	1.066	-.580
8	**.144**	5.118
9	1.161	-1.059
10	3.130	-.909
11	1.084	-.662
12	1.979	-1.231
13	3.389	-1.104
14	**.414**	3.573
15	**-.142**	-16.131
16	.876	-.134

Note. Item parameters here are driven from the IRT which is a model-based analysis different from CTT as Table 1.

More information about item properties can be summarized and examined using visual presentation of item characteristic curve (ICC) and item information plots (see Figure 5). The

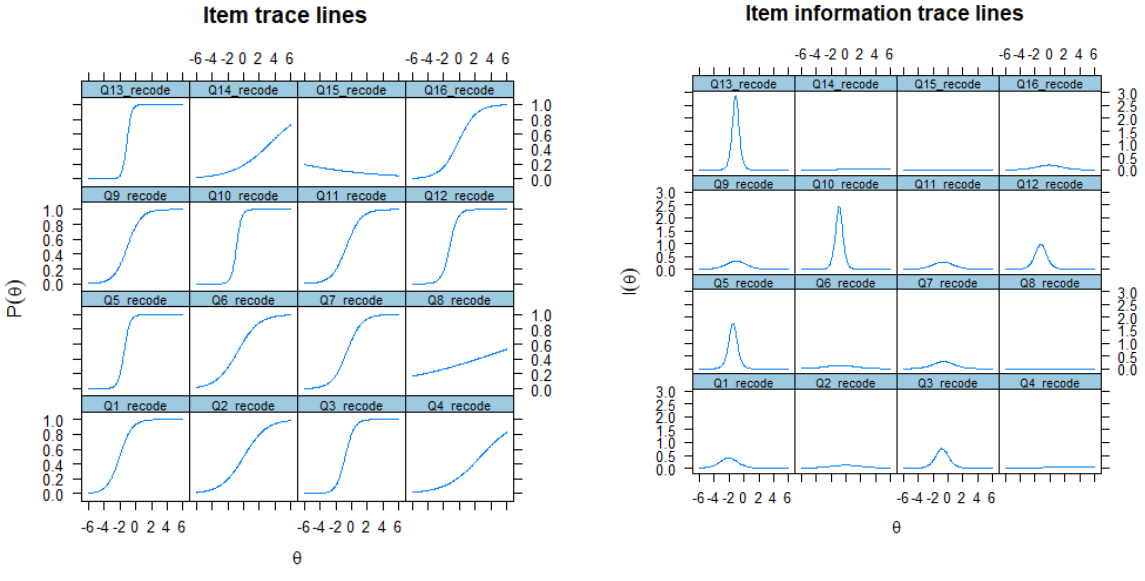

Figure 5. ICC and Information

left-hand side of Figure 5 shows ICCs for each item. The slope of ICC is proportional to the item discrimination and is called the slope parameter. The Y axis refers to the probability of getting the question correct and X axis refers to the different levels of ability (θ). ICC should be monotonically increasing because higher ability level people should show a higher probability of getting the answer correct (Nguyen et al., 2014). In that sense, Item 15 is questionable because it shows a negative slope. Another important property to investigate is item information. Item information can be computed to measure how much information $I(\theta)$ each item can provide across different ability levels. Items 4, 8, 14, and 15 provided the least information, nearly flat across all ability levels.

In summary, the ADKA demonstrated promising psychometric properties as a unidimensional measure of anti-doping knowledge among adolescent and young adult athletes. Analyses across classical test theory, factor analysis, and item response theory consistently identified Items 4, 8, 14, and especially 15 as problematic, warranting their revision or removal. The learning objectives addressed by Items 4, 8, and 15 are covered by other Items, and their removal does not compromise the overall comprehensiveness of the ADKA. However, Item 14 corresponds to a unique learning objective, specifically, “Requirements for the Registered Testing Pool (RTP), including whereabouts and the use of ADAMS”. While its exclusion may be justified given the limited relevance of the RTP, whereabouts, and ADAMs for younger or lower-tier athletes, its poor performance may also signal a need for enhanced educational emphasis if WADA deems this content essential for early-stage and younger athletes. These nuances will be further explored in the Discussion section. As is, the refined 12-item scale exhibits acceptable internal consistency and structural validity, supporting its utility as an

evaluation tool aligned with WADA's Athlete Curriculum. Future revisions should consider further refinement of lower-loading items and ongoing validation in diverse athlete populations.

Assessment of Recall-Based Anti-Doing Knowledge

In addition to the multiple-choice items, the ADKA included a set of open-ended, recall-based questions designed to provide a more sensitive assessment of athletes' anti-doping knowledge. These items targeted retention of key anti-doping concepts, specifically, the list of ADRVs and the values identified in the Spirit of Sport statement. These questions therefore moved beyond recognition-based knowledge to assess deeper learning.

Participants were first asked to indicate the number of ADRVs in the WADA Code, followed by an invitation to list as many as they could recall. Using the complete number of questionnaires collected, there were 443 participants and of these, 270 either did not respond or explicitly stated they did not know the answer. Non-numerical responses (e.g., "many", and "a lot") were not accepted as valid responses. Of the 173 numerical responses, only 41 participants (23.7% of those who answered; 9.3% of the total sample) correctly identified that there are 11 ADRVs. The remainder provided a wide range of answers, from 2 to 53. Common incorrect responses included 10 (21 participants; 12.1% of those answering, 4.7% of total), 3 (17 participants; 9.8% of those answering, 3.8% of total), and 4 (13 participants; 7.5% of those answering, 2.9% of total).

When asked to name the ADRVs, 146 participants attempted the task. Responses were coded as correct or incorrect using a generous interpretation to credit partial or approximate answers. For example, the phrase "knowing someone who dopes" was accepted as a correct proxy for Article 2.10 Prohibitive Association. One participant successfully named all 11 ADRVs. On average, athletes listed 1.57 correct ADRVs (SD = 1.50). Most participants named

only one correct ADRV (90 responses; 61.6% of those answering, 20.3% of the total sample). Most respondents only provided 1 answer (84; 57.1% responses), followed by 2 (31; 21.1% responses), and 3 (15; 10.2% responses), indicating that few knew or attempted to provide distinct answers.

Participants were also asked to identify the number of values in the Spirt of Sport statement, followed by a request to list these individually. A total of 109 participants attempted the question, providing numerical estimates ranging from 1 – 53. Only five respondents (4.6% of those answering; 1.1% of the total sample) correctly identified the number as 12. The most common responses were 3 (17.4%), 4 (16.5%), 5 (13.8%), and 10 (9.2%), which reflect commonly used round or symbolic numbers. This pattern suggests that many participants may have relied on heuristic reasoning or estimation rather than direct recall of the Spirit of Sport statement. When naming the specific values, respondents typically listed between one and four statements. The maximum number of correct values named by any participant was three, achieved by eight individuals (15.7% of those answering, 1.8% of the total sample).

These findings highlight that using more sensitive assessment measures can identify notable gaps in athletes' knowledge of anti-doping rules and policy justifications. While a small proportion demonstrated accurate knowledge, the majority struggled to identify the number or name of ADRVs, which should be considered foundational elements of anti-doping knowledge. Performance on the Spirit of Sport items was also notably weak. These results should be considered problematic, given that these values form the ethical basis of anti-doping policy, and the Spirit of Sport is used to justify placing a substance or method on the prohibited list. This also underscores the importance of reinforcing deeper conceptual learning within anti-doping

education programs. The results also suggest the potential utility of using recall-based items as diagnostic tools to identify specific content areas requiring further instructional emphasis.

Theory of Normative Social Behavior Model Testing

Descriptive statistics and correlation coefficients for each model of IUS and DS are provided separately in Table 5 and Table 6. The means and standard deviations of the same 'closeness' measures (e.g., Closeness_Team) are included for both models to report their correlation coefficients with other variables in each model.

In terms of missing data, the proportion of missingness for each variable in both the IUS and DS models did not exceed 5%. Additionally, Little's (1988) test for missing completely at random (MCAR) was conducted and we found that the data was not MCAR in the DS model. Despite the relatively small amount of missing data, we chose a more statistically conservative approach to handle it, rather than simply deleting the missing cases. Thus, for the current analysis, missing data was handled by full information maximum likelihood (FIML).

Table 5

Descriptive Statistics and Correlation between Variables of IUS Model (N = 388)

	M	*SD*	1[2]	2	3	4	5	6	7	8	9	10	11	12	13
1. IUS	3.482	2.005	-												
2. Communication_Team_SUP[1]	2.322	1.083	.354	-											
3. Communication_Coach_SUP	2.46	1.17	.395	.711	-										
4. Communication_Parent_SUP	2.382	1.235	.366	.72	.729	-									
5. DN_Team_SUP	3.686	2.017	.637	.338	.393	.395	-								
6. DN_Athelete_SUP	3.996	1.886	.594	.272	.32	.33	.807	-							
7. IN_Team_SUP	3.618	1.882	.669	.253	.268	.254	.651	.649	-						
8. IN_Coach_SUP	3.533	2.036	.683	.261	.321	.254	.67	.648	.869	-					
9. IN_Parent_SUP	3.448	2.041	.703	.281	.346	.307	.652	.631	.833	.891	-				
10. Outcome_Exp_SUP	2.843	1.307	.592	.305	.346	.332	.633	.576	.632	.667	.682	-			
11. Closeness_Team	4.741	1.311	.092	.201	.13	.147	.057	.021	.1	.078	.073	.109	-		
12. Closeness_Coach	4.389	1.455	.137	.268	.284	.205	.08	.034	.103	.105	.136	.125	.606	-	
13. Closeness_Parent	5.983	1.124	.104	.149	.132	.14	.092	.161	.165	.144	.149	.033	.408	.294	-

Note. [1] SUP refers to the use of supplements. [2]Correlation coefficients were analyzed after scaling the variables.

Table 6

Descriptive Statistics and Correlation between Variables of DS Model (N = 388)

	M	*SD*	1[2]	2	3	4	5	6	7	8	9	10	11	12	13
1. DS	1.768	1.252	-												
2. Communication_Team_PED[1]	1.712	0.923	.288	-											
3. Communication_Coach_PED	1.704	0.973	.291	.8	-										
4. Communication_Parent_PED	1.669	1.043	.406	.697	.758	-									
5. DN_Team_PED	1.697	1.098	.393	.182	.216	.223	-								
6. DN_Athelete_PED	2.316	1.415	.321	.108	.139	.124	.58	-							
7. IN_Team_PED	1.707	1.215	.466	.254	.265	.32	.573	.428	-						
8. IN_Coach_PED	1.583	1.1	.489	.233	.251	.299	.634	.44	.816	-					
9. IN_Parent_PED	1.544	1.107	.436	.219	.217	.228	.57	.415	.786	.861	-				
10. Outcome_Exp_PED	2.25	1.177	.307	.175	.106	.075	.289	.374	.373	.376	.366	-			
11. Closeness_Team	4.741	1.311	.019	.163	.114	.164	-.028	.013	.035	.031	.026	.042	-		
12. Closeness_Coach	4.389	1.455	.066	.18	.153	.189	.016	.064	.077	.114	.133	.082	.606	-	
13. Closeness_Parent	5.983	1.124	-.148	-.01	-.05	-.002	-.159	-.069	-.178	-.182	-.15	-.09	.408	.294	-

Note. [1] PED refers to the use of performance enhancing drugs. [2]Correlation coefficients were analyzed after scaling the variables.

Predicting Intention to Use Sport Supplements (IUS)

Table 7 summarizes the results for predicting IUS. First, Model 1 was analyzed as illustrated in Figure 2. Results showed that several predictors were significantly associated with intention to use sport supplements (IUS). Specifically, regarding response on the teammates, descriptive norms (DN) were a significant positive predictor of IUS (B = .226, SE = .053, p < .001), as were injunctive norms (IN; B = .367, SE = .051, p < .001), outcome expectancy (B = .151, SE = .051, p < .01), and communication frequency (B = .145, SE = .040, p < .001). The interaction between DN and IN was also statistically significant (B = –.038, SE = .048, p < .05).

The negative coefficient suggests that the positive association between injunctive norms and intention to use sport supplements (IUS) becomes weaker as descriptive norms increase. In other words, when athletes perceive that many of their teammates actually use sport supplements (high DN), the influence of perceived social approval or pressure (IN) on their own intention to use supplements is reduced. This suggests that there is normative saturation and that if

supplement use is perceived to be widespread, social approval adds relatively little explanatory power. Conversely, when it is perceived that few teammates use sport supplements, perceived approval plays a stronger role in shaping intentions. Other interactions and control variables (age, gender, and sports participation) were not statistically significant.

Table 7

Results for the Moderation Analyses of IUS

DV = IUS	Model 1 DN – Team & IN - Team		Model 2-1 IN – Team & Closeness - Team		Model 2-2 IN – Coach & Closeness - Coach		Model 2-3 IN – Parent & Closeness - Parent	
	B	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Control								
Age	.001	.02	.002	.021	-.01	.02	.018	.02
Gender	.03	.075	.037	.078	.012	.076	.013	.074
Sports	-.147	.104	-.218*	.105	-.218*	.102	-.213*	.097
Predictor								
(1) DN	.226***	.053	-	-	-	-	-	-
(2) IN	.367***	.051	.456***	.049	.473***	.049	.5***	.05
(3) Outcome_Exp_SUP	.151**	.051	.231***	.05	.2***	.051	.172**	.051
(4) Closeness	.018	.038	.012	.039	.017	.038	.053	.039
(5) Communication _SUP	.145***	.04	.169***	.041	.18***	.041	.147***	.038
(1) x (2)	-.038*	.048	-	-	-	-	-	-
(1) x (3)	-.003	.049	-	-	-	-	-	-
(1) x (4)	.001	.037	-	-	-	-	-	-
(1) x (5)	.067	.039	-	-	-	-	-	-
(2) x (3)	-	-	.006	.041	-.025	.043	-.023	.041
(2) x (4)	-	-	.02	.039	-.031	.04	.145***	.045
(2) x (5)	-	-	-.012	.04	.027	.041	.006	.039

Note. * p < .05, ** p < .01, **** p < .001.

Next, Model 2s were analyzed as illustrated in Figure 3. In all three models, injunctive norms (IN) with teammates (B = .456, SE = .049, p < .001), coaches (B = .473, SE = .049, p < .001), and parents (B = .500, SE = .050, p < .001) were positive predictors of intention to use sport supplements (IUS). Outcome expectancy was also consistently significant across models—team (B = .231, SE = .050, p < .001), coach (B = .200, SE = .051, p < .001), and parent (B = .172, SE = .051, p < .01). Communication frequency with each agent was positively associated with

IUS in all models: team (B = .169, SE = .041, p < .001), coach (B = .180, SE = .041, p < .001), and parent (B = .147, SE = .038, p < .001).

Interestingly, participation in team sports (coded as 1) was significantly associated with lower IUS compared to individual sports—team (B = –.218, SE = .105, p < .05), coach (B = –.218, SE = .102, p < .05), and parent (B = –.213, SE = .097, p < .05). Notably, only Model 2-3 revealed a significant interaction: the effect of parental injunctive norms on IUS was moderated by how often athletes discussed supplements with their parents (B = .145, SE = .045, p < .001). This suggests that when conversations about supplement use with parents are more frequent, the influence of perceived parental approval (IN) is amplified. In other words, active communication reinforces the strength of injunction norms, emphasizing the role of interpersonal dialogue in shaping intentions to use sport supplements.

In summary, descriptive norms, injunctive norms from teammates, coaches, and parents, outcome expectations, and participation in individual sports (vs. team sports) were all significant positive predictors of intentions to use sport supplements. Notably, a significant interaction between DN and IN among teammates suggested a normative saturation effect, which means that when athletes perceive high levels of supplement use among teammates, the influence of injunctive norms on intentions was diminished. Conversely, when perceived use was low, injunctive norms played a stronger role. In addition, the influence of parental injunctive norms on IUS was amplified by more frequent communication, highlighting how active dialogue with parents reinforces the effects of perceived parental approval.

Predicting Doping Susceptibility (DS)

Table 8 summarizes the results for predicting doping susceptibility (DS). In Model 1, both descriptive norms (DN; B = .146, SE = .060, p < .05) and injunctive norms (IN; B = .227,

SE = .059, $p < .001$) with teammates were significantly and positively associated with doping susceptibility. Outcome expectancy regarding performance-enhancing drugs also showed a strong positive effect (*B* = .170, *SE* = .055, $p < .001$), as did communication frequency with teammates about doping (*B* = .135, *SE* = .046, $p < .01$). Among the control variables, participation in team sports was associated with greater doping susceptibility compared to individual sports (*B* = .287, *SE* = .124, $p < .05$). Other predictors, including closeness and all interaction terms, were not statistically significant.

Table 8

Results for the Moderation Analyses of DS

DV = DS	Model 1 DN – Team & IN - Team		Model 2-1 IN – Team & Closeness - Team		Model 2-2 IN – Coach & Closeness - Coach		Model 2-3 IN – Parent & Closeness - Parent	
	B	*SE*	*B*	*SE*	*B*	*SE*	*B*	*SE*
Control								
Age	.027	.025	.024	.025	.035	.024	.028	.024
Gender	.123	.093	.111	.094	.111	.094	.09	.09
Sports	.287*	.124	.283*	.125	.295*	.122	.258*	.120
Faith	.005	.045	.014	.045	-.009	.045	.019	.045
Predictor								
(1) DN	.146*	.06	-	-	-	-	-	-
(2) IN	.227***	.059	.245***	.065	.393***	.064	.237***	.064
(3) Outcome_Exp_PED	.170***	.05	.199***	.051	.172***	.049	.196***	.047
(4) Closeness	-.038	.044	-.054	.045	-.021	.045	-.102*	.045
(5) Communication _PED	.135**	.046	.139**	.047	.124**	.047	.291***	.044
(1) x (2)	.019	.044	-	-	-	-	-	-
(1) x (3)	-.005	.05	-	-	-	-	-	-
(1) x (4)	-.002	.043	-	-	-	-	-	-
(1) x (5)	.068	.045	-	-	-	-	-	-
(2) x (3)	-	-	.084	.053	-.030	.053	.017	.047
(2) x (4)	-	-	-.033	.047	.065	.047	.066	.041
(2) x (5)	-	-	.051	.044	.026	.040	.044	.039

Note. * p < .05, ** p < .01, **** p < .001.

Regarding Model 2s as Figure 3, in all three models, injunctive norms (IN) were significant positive predictors of doping susceptibility—team (*B* = .245, *SE* = .065, $p < .001$), coach (*B* = .393, *SE* = .064, $p < .001$), and parent (*B* = .237, *SE* = .064, $p < .001$). Outcome

expectancy for performance-enhancing drugs (PED) was also positively associated with DS in each model—team (B = .199, SE = .051, p < .001), coach (B = .172, SE = .049, p < .001), and parent (B = .196, SE = .047, p < .001). Similarly, communication frequency about doping with each agent predicted higher DS—team (B = .139, SE = .047, p < .01), coach (B = .124, SE = .047, p < .01), and parent (B = .291, SE = .044, p < .001). Notably, closeness with parents was negatively associated with DS (B = –.102, SE = .045, p < .05), indicating that stronger parent-child bonds may buffer against susceptibility. Participation in team sports (coded as 1) was positively associated with greater DS across all models—team (B = .283, SE = .125, p < .05), coach (B = .295, SE = .122, p < .05), and parent (B = .258, SE = .120, p < .05). No significant interaction effects were observed in predicting doping susceptibility outcome.

In summary, the analysis revealed that across all models, injunctive norms from teammates, coaches, and parents were significantly and positively associated with DS, as were outcome expectancies and communication frequency with each referent. These findings suggest that the more athletes perceive approval and benefits associated with PED use, and the more frequently they discuss doping, the more susceptible they are to engaging in such behavior. Notably, closeness with parents emerged as a protective factor, with stronger parent-child bonds associated with lower doping susceptibility. In contrast to the IUS models, no significant moderation effects were observed. Finally, athletes participating in team sports showed significantly higher susceptibility to doping across all models, suggesting that the team environment may foster shared norms or pressures that increase risk.

Communication Content Around Sport Supplements and PEDs

Although not included in the Theory of Normative Social Behavior (TNSB) model testing, the questionnaire also gathered data on the content and tone of athletes' communication

about sport supplements and PEDs) These data offer valuable insight into the social environments that shape substance-related attitudes and intentions, particularly through interactions with teammates, coaches, and parents. Table 9 summarizes the valence of these conversations, which refers to whether the tone was positive (e.g., supportive or encouraging use), neutral, or negative (e.g., disapproving or warning against use). Higher scores indicate more positive communication from the source. By examining both the direction (to/from) and valence of these interactions, this section provides additional context for understanding the normative messages athletes encounter and highlights patterns that may inform future research and education efforts.

Table 9

Communication Content About Sport Supplements and PEDs

Source	Communication To (M, SD)	Communication From (M, SD)	Communication To (M, SD)	Communication From (M, SD)
	Supplements		**PEDs**	
Teammates	3.26 (1.16)	3.31 (1.14)	2.03 (1.10)	2.10 (1.10)
Coaches	3.37 (1.20)	3.42 (1.20)	2.10 (1.14)	2.15 (1.21)
Parents	3.34 (1.16)	3.32 (1.20)	2.09 (1.15)	2.12 (1.21)

Note. Higher scores indicate more positive communication content. "To" = communication initiated by the athlete; "From" = communication received by the athlete

In summary, these results suggest that communication about sport supplements tends to be more positive in tone compared to communication about PEDs. This pattern is consistent across all three referent groups (teammates, coaches, and parents) and is evident regardless of whether the athlete was the source or recipient of the message. Although no inferential statistical analyses were conducted, the consistency of this pattern points to a clear normative distinction:

supplements are more socially acceptable and more likely to be discussed approvingly, while PEDs remain stigmatized and are more often discussed negatively.

Discussion

This study set out to address two enduring shortcomings in anti-doping research. First, there has been a lack of consistency in how anti-doping knowledge has been assessed. Existing tools have often been developed without systematic procedures, and lacked validity, alignment with educational objectives, and the sensitivity required to measure actual understanding. To address this, we developed and validated a knowledge assessment tool (the ADKA) tailored to adolescent and young athletes and grounded in WADA's Athlete Curriculum. Second, although social influence is widely recognized as a factor in doping behavior, prior research has seldom examined how different social referents, such as teammates, coaches, and parents, shape athletes' beliefs and behaviors. Drawing on the TNSB, this study explored the differential influence of these referents on intentions to use supplements and susceptibility to dope. The following discussion unpacks the study's main findings, reflects on their theoretical significance, and highlights implications for anti-doping education and policy.

Accurately measuring what athletes know about anti-doping is essential for both educational practice and theoretical modeling (Woolf, 2021). A valid assessment instrument provides educators and policymakers with evidence of program efficacy, while also allowing researchers to meaningfully include knowledge as a predictor, mediator, or control variable in anti-doping research. Yet, as this study reinforces, much of the existing work in this area relies on instruments that are poorly constructed, psychometrically weak, or only loosely connected to educational curricula. The ADKA addresses this gap by aligning with the learning outcomes for talent and young athletes, as described in WADA's Guidelines for the ISE and the Athletes

Curriculum (WADA, 2021c). Unlike previous instruments, which were pilot-tested with older, more educated, and more athletic accomplished populations (e.g., Hurst et al. 2020; Turfus et al., 2019), the ADKA was pilot-tested with younger athletes than the intended sample, This methodological choice adheres to the recommendation from Bandolas (2018) for measurement design and ensured the clarity and appropriateness of item wording, increasing the likelihood that comprehension issues would be detected early. Through rigorous psychometric testing, including classical test theory, factor analysis, and item response theory, the ADKA was refined into a 12-item instrument using a multi-response recognition format (see Appendix C). The final tool offers flexibility for expansion for both older or more experienced athletes and through the incorporation of recall-based components that better assess deeper learning.

Anti-Doping Knowledge Assessment (ADKA)

Four items (1, 5, 12, 13) exhibited low discrimination or unusually high correct response rates, raising concerns about their ability to distinguish between athletes with different knowledge levels. These items assess foundational knowledge and therefore, despite their simplicity, may be suitable for younger athletes. Still, these questions are not without weaknesses. Item 1 assesses athletes' comprehension of the term doping. This aligns with learning objective 2 ("Introduction to clean sport and the global anti-doping system") and the outcome that athletes will be able to define doping. It is therefore an appropriate item to include. However, the longer response option for the correct answer may be vulnerable to test-wise strategies, such as selecting the longest response, which test-takers often perceive as more likely to be correct (Haladyna & Rodriguez, 2013). Indeed, it is recommended that response options be of similar length (Haladyna et al., 2002). A recommended shorter version (e.g., "Doping is using

a prohibitive substance or method") may be a potential improvement, however, this is unlikely to significantly increase the difficulty of the question.

Item 5 ("Can I be tested for doping?") may be problematic as the response options include three negative and one positive statement, which may make the question subject to guessing (Haladyna & Rodriguez, 2013). The item aligns with learning objective 3 ("…right and responsibilities under the Code") and 10 ("Testing procedures…"), and these objectives are also covered by Items 6, 8, and 9. Greater coverage by other items reduced concerns over this question, especially given its foundational nature. Moreover, the incorrect and negatively phrased responses (based on age, athletic status, and sport risk) are all plausible alternatives. However, the question may not be suitable for older audiences as one of the response options refers to the age of the respondent. An alternative would be to edit this response option to "Not if you are a young athlete", so the referent is removed. The revised version of the ADKA includes this suggested amendment (see Appendix C).

Item 12 addresses the sanctions for doping and aligns with learning objective 6 ("Consequences…") for talented athletes. However, it also aligns with the young athlete learning objectives of 3 (…rights and responsibilities under the Code"), and 5 ("Anti-Doping Rule Violations"). The ease of this question may be explained by its greater alignment with the criteria for Youth Athletes rather than Talented Athletes. These learning objectives are covered by other items, and therefore, this reduces concern over its low difficulty rating.

Finally, Item 13 ("Who is allowed to perform a doping control ?") has two weaknesses. First, the correct response option is substantially longer than others, and second, it includes a clang association where the phrase "doping control" appears in the stem and answer (Haladyna & Rodriguez, 2013). It is therefore recommended that the stem be changed to "Who is allowed to

perform a doping test?") and the correct response option be shortened to "A doping control officer." This response option would closely match the length of other options. However, the clang association of "doping" remains. The alternative of "drug test" is not recommended given the potential ambiguity of the phrase "drug" and the list of potential answers. While this amendment may improve the wording of the question, it is unlikely to alter the difficulty of the question. As part of an athlete's foundational knowledge, this is not considered problematic as it is still relevant for them to know the existence of doping control officers.

In contrast to the foundational items, four others (Items 4, 8, 14, and 15) were found to be overly difficult, with low correct response rates and weak discrimination. These likely reflect either misalignment with participant knowledge or item design issues. Item 4 concerns nutritional supplement safety and the potential for an inadvertent ADRV. It is therefore aligned with learning objective 4 ("The principle of strict liability") and 9 ("Risks of supplement use"). Notably, the response options were all plausible for an uninformed respondent and did not meet the criteria for poor item construction. None included misleading determiners that could distract from the correct answer. There were no clang associations or implausible distractors. Although the stem and multiple responses refer to "safe", this does not constitute a flaw as "safety" is an important context for the question. The most likely explanation for this item's difficulty, therefore, is insufficient participant knowledge. Learning objectives 4 and 9 are addressed by other item questions (3, 6, 7, and 11), negating the necessity of this question. Still, it is concerning, given the risk of inadvertent doping and supplement use (Hurst et al., 2019) that this question was answered poorly. As such, we recommend retaining this item in the extended ADKA for older or more advanced athletes (see Appendix C), rather than removing it entirely.

Item 8 assesses knowledge of the doping control process and aligns with learning objective 3 ("…rights and responsibilities under the Code.") and 10 ("Testing procedures…"). These objectives are also addressed by Items 5, 6, 9, 12, and 13, which reduce concerns over its exclusion from the standard ADKA. The question presents several scenarios that are plausible to uninformed respondents and does not violate established principles of good item construction (Haladyna & Rodriguez, 2013). Therefore, the low performance on this item likely reflects a genuine knowledge gap among participants rather than a flaw in item design. It is possible that many athletes in the sample have not experienced the doping control process and may be unaware of their procedural rights, such as the right to be accompanied during testing. As this is a foundational element of athlete rights under the Code, we recommend retaining this item in the extended ADKA for athletes at a more advanced stage of their career (see Appendix C).

Item 14 focuses on the use of "whereabouts" information and serves to assess learning objective 11 ("Requirements of the Registered Testing Pool…"). It is a challenging question, likely due to the technical specificity of the content. A plausible explanation for the poor performance on this question is that most athletes in the sample are not currently part of a Registered Testing Pool and are therefore unfamiliar with the policy or its practical implications. Importantly, Item 14 is the only question that targets learning objective 11. While this supports its inclusion on conceptual grounds, its psychometric weakness suggests that it may not be suitable for younger or less experienced athletes. We therefore recommend that Item 14 only be retained as part of the extended ADKA, which is intended for more advanced athlete populations (see Appendix C).

Finally, Item 15 assessed learning objective 12 ("Results Management") and focuses on the storage duration of a collected doping control sample. This question includes time

information along with two specific determiners (“an indefinite period” and “it cannot be stored”) that may serve as distractors. According to Haladyna and Rodriguez (2013), such phrasing risks introducing confusion or misdirection, particularly if the distractors are phrased in ways that encourage guessing or over-interpretation. As a result, this item may be classified as a “trick question,” which violates recommended principles of good item design. The poor psychometric performance of this item likely reflects both the wording issues and a general lack of athlete familiarity with long-term sample storage policies. Given that Item 16 also targets learning objective 12 and is better constructed, we recommend removing Item 15 from the ADKA.

To complement the recognition-format items of the ADKA, four open response questions were included to assess athletes’ ability to recall anti-doping information. These items covered the number and content of the list of ADRVs and the values in the Spirit of Sport statement. This format was intended to more accurately capture what athletes could retrieve from memory (assuming prior exposure to this information), without being prompted by pre-selected options. While recall-based formats are often considered more cognitively demanding and thus potentially better indicators of true knowledge, our findings suggest significant limitations to their use in this context.

Low response quality and high rates of non-response were observed for both open-ended items, indicating that participants either lacked confidence in their knowledge or were unfamiliar with the question content. This is consistent with the experience of Orr et al. (2018), who found that athletes struggled to recall information about both the desired and adverse effects of four PEDs (amphetamines, anabolic androgenic steroids, growth hormone, and erythropoietin). In their study, a third of participants on average failed to answer questions on desired effects, and

over half did not respond for certain substances. For adverse effects, 59% of participants did not respond. This was despite most athletes self-reporting that they were moderately or well-informed about PEDs. In our study, approximately 60% of participants did not answer the initial question on the number of ADRVs, and only a third attempted to list them. Performance was even poorer on the Spirit of Sport items, with nearly 75% of athletes not providing a response.

Morente-Sánchez and Zabala (2015) and Morente-Sánchez et al. (2019) also used open-response items in their knowledge assessment, asking participants to define the acronym "WADA" and to name the categories of the Prohibitive List. However, the authors did not report the from these items, although they noted that recall-based questions are difficult to implement.

While the recall format may offer theoretical advantages in measuring deeper learning, its practical utility is constrained by issues related to scoring subjectivity, low participant engagement, and varying levels of participants' ability. This suggests that open-response items may not be suitable for general deployment in large-scale assessments of anti-doping knowledge, particularly with younger populations.

However, the questions asked were very specific and somewhat arcane. More suitable recall questions should be considered for future research or education programming. For example, recall-based questions could ask participants to identify the criteria for a method or substance to be placed on the Prohibitive List or to name a resource to check the prohibited status of medications (i.e. Global DRO). Furthermore, recall-based items still offer diagnostic value in smaller, formative education settings where follow-up discussion is possible. Future efforts might consider hybrid formats, such as cued recall or short-answer prompts with structured rubrics, to better balance the depth and sensitivity of assessment with the feasibility of implementation.

Theory of Normative Social Behavior

The TNSB posits that while descriptive norms are key predictors of intentions and behavior, they are moderated by injunctive norms, outcomes expectations, perceived social distance, and communication (Rimal & Real, 2005; Chung & Rimal, 2016). Previous research has identified the proximity of the referent source of injunctive norms to be an important component of the theory (Woolf et al., 2014). However, previous research has not considered the different roles of sources that may all be considered proximal. In this study, we explore how three proximal referents (teammates, parents, and coaches) may influence intentions to use sport supplements and their susceptibility to dope.

Intentions to Use Supplements

Two moderating effects were observed. First, the findings revealed the parental injunctive norms were moderated by frequency of communication with parents. This is an important outcome as it underscores the influential role of parents in young athlete lives. Given the communications surrounding sport supplements between parent-child are generally positive, this should be a concern, and anti-doping administrators should consider ways to co-opt parents in having informed conversations about the risks of supplements with their child.

Second, descriptive norms were moderated by injunctive norms. While this is predicted by the theory, a negative coefficient was reported. This was a counterintuitive finding and may be explained by normative saturation, wherein the effects of injunctive norms diminish as the perceived behavior of teammates increases. This suggests that when supplement use is assumed to be highly prevalent among teammates, what teammates think about supplement use has little impact on intentions to use supplements. From a practical perspective, attempts to persuade

athletes to avoid sport supplements would not benefit by calling into question the opinion of other teammates.

Whether differences between team and individual sports and intentions to use supplements were explored. Team sports reported lower intentions to use supplements. A possible explanation for this observation is the individual sports that were mainly featured in this study are sports that rely more on strength and speed. These included track and field, swimming, and cycling. In contrast, the athletes in team sports competed in basketball, netball, and soccer. While these sports also involve speed and strength, they feature greater motor skill requirements, tactical interaction, and shared accountability, which may reduce reliance on performance-enhancing aids.

Beyond these findings, there were no other moderating or comparison effects. However, several main effects were observed. Descriptive norms, outcome expectations, communication (parents, coaches, and teammates), and injunctive norms of parents and coaches were positively associated with intentions to use supplements. These results demonstrate that social influence, communication, and expectations are all associated with intentions, and future research is needed to explore and unpack these various factors. Importantly, this study adds to the limited application of TNSB in the anti-doping domain by disaggregating the influence of specific referents. The findings provide partial support for the theory's assertion that descriptive and injunctive norms are moderated by contextual factors (Rimal & Real, 2005; Chung & Rimal, 2016).). Moreover, our findings also explore multiple proximal sources and provide support that these do not exert influence uniformly and future research should explore the differential effect of proximal referents. In practical terms, the results highlight the need for intervention strategies to consider the role of parents and how they may influence their child to use supplements based

on how frequently they discuss this topic. Efforts should be made to educate parents so that they understand the influence they have and how they can help ensure their child uses sport supplements appropriately and minimize the risks of acquiring an unintentional ADRV.

Doping Susceptibility

Contrary to the predictions of the TNSB, no moderating effects were observed for doping susceptibility. This finding was unexpected and future research is warranted to explore this further. However, several main effects were observed that are of interest. Most prominently is the negative association between parental closeness and doping susceptibility. This suggests that strong parental bonds may serve a protective function against doping. Given the role of parental communication and supplement use recorded above, future research on parent-child dynamics is a potentially fertile area for new research.

Team sport athletes were also more susceptible to doping compared to individual team athletes. A possible explanation for this is that individual athletes tend to have more exposure to anti-doping education, thereby warranting the need for greater outreach to team sport athletes. Beyond these observations, main effects were observed for descriptive norms, injunctive norms of all referents, communication frequency with all referents, and outcome expectations.

Taken together, these results highlight the ongoing importance of applying socially grounded frameworks, such as the TNSB, to understand and intervene in doping susceptibility. Although the theory's moderating pathways were not supported in this context, the strong main effects suggest that social and normative variables remain highly relevant. Future studies should continue to refine the model and explore the role of social relations and social dynamics in preventing doping and safeguarding clean sport.

Limitations

Several limitations should be considered when interpreting the findings of this study. First, although the ADKA was developed in alignment with WADA's Athlete Curriculum and validated through psychometric procedures, the instrument may not capture the full breadth of anti-doping knowledge, particularly among more experienced or elite-level athletes. However, the intent of the study was to produce a relatively short assessment tool that could realistically be implemented by anti-doping educators and scholars. A comprehensive assessment of anti-doping knowledge would be better served by a full inventory of questions, such that the performance on learning objectives could be differentiated. This was outside the scope of the current study, however, future research may consider this approach. In addition, some items exhibited limited discrimination or were overly difficult, which may reflect mismatches with participant experience rather than deficits in item design. Further item refinement and testing across diverse athlete populations is needed.

Second, while the study included adolescent and young athletes from multiple sports, the sample was not fully representative of all sport types or geographic regions. For example, athletes from individual sports associated with international competition were overrepresented compared to those from grassroots or non-Olympic sports. This may limit the generalizability of findings related to both anti-doping knowledge and social influences on supplement use and doping susceptibility.

Third, the recall-based items, while offering insight into memory-based learning, showed low response rates and limited utility for broad-scale implementation. Their poor performance may reflect limited exposure to the assessed content, challenges in expressive recall among younger athletes, or both. Although recall items are theoretically valuable, practical constraints on scoring and interpretation warrant caution in future applications.

Fourth, while the TNSB provided a useful framework, its moderating effects were only partially supported. The absence of moderation in some models may suggest measurement limitations in operationalizing constructs such as injunctive norms or communication, or it may indicate that other unmeasured variables influence susceptibility to doping. Additionally, given that some questions dealt with sensitive topics (e.g., doping susceptibility, interpersonal closeness), it is possible that social desirability bias influenced responses.

Finally, the cross-sectional design precludes causal inference. Although the path models identify associations among variables, longitudinal or experimental studies are needed to assess how social influences and knowledge interact over time and whether these relationships hold across different developmental stages or education interventions.

Knowledge Translation and Dissemination

An invited presentation, entitled, "Exploring the Role of Social Norms and Adolescent Athletes' Susceptibility to use Sport Supplements and Performance-Enhancing Substances" was presented at the University of Birmingham, England. The presentation was promoted across the university and was open to the public. The presentation attracted faculty members and doctoral students from the Sport, Exercise & Rehabilitation Sciences. A separate discussion was held with doctoral students as part of a doctoral seminar and group lab meeting.

Two manuscripts are in preparation. The first manuscript will focus on the development and results obtained from the ADKA and will be submitted to the journal Performance Enhancement & Health. The second manuscript will focus on the theory of normative social behavior. Sport and communication journals (e.g., International Journal of Sport Communication, Communication & Sport), health communication journals (e.g., Health

Communication, Communication Monographs), and drug-related journals (e.g., Substance Use and Misuse, Drugs: Education, Prevention and Policy) will be targeted.

Research Project Reflections, Challenges, and Lessons Learned

This research project encountered several methodological, logistical, and contextual challenges, many of which were shaped by the global COVID-19 pandemic and its ripple effects on international travel, institutional policy, and sport event scheduling. Reflecting on these issues reveals not only obstacles but also valuable lessons for future research on adolescent athletes in under-researched regions.

Disruptions Due to the COVID-19 Pandemic

The COVID-19 pandemic significantly disrupted the project's data collection timeline and strategy. Initially, three international youth sport events in the Caribbean were identified as primary data collection sites. However, all were eventually canceled. Specifically:

- The 2021 CARIFTA Track and Field Championships were first postponed from April to July and then canceled.
- The 2021 CARIFTA Aquatics Championships (Barbados) were rescheduled from March/April 2021 to February 2022 before also being canceled.
- The 2021 CARIFTA Triathlon and Aquathlon Championships (Bahamas) were similarly canceled.

Subsequent attempts were made to gain access to the 2022 CARIFTA Track and Field Championships (Jamaica) and the 2022 CARIFTA Aquatics Championships (Barbados). However, both events had limited planning windows due to ongoing uncertainty and retained mitigation protocols (e.g., social distancing, mask mandates), and we were unable to secure the

necessary permissions from the local organizing committees. Given these constraints, we made the decision not to travel to either event.

Even after formal travel restrictions were lifted and events took place, attendance at these events was below expectations. Many countries, athletes, coaches, and team managers continued to exhibit caution in resuming international travel. As a result, it became necessary to target additional events to reach the desired sample size. Given that most of these competitions are held annually, the need to identify and gain approval for alternative events contributed to further delays in data collection.

Ethical Review Complications, Travel Authorization, and Institutional Restrictions

In addition to pandemic-related disruptions, the project encountered unexpected delays related to ethics approvals. The University of Illinois institutional review boards required ethics approval not only from the researchers' home institution but also from every country where data collection was to occur. However, not all countries in the Caribbean had clearly identifiable IRBs, and at the outset of the project, the specific locations of future sport events were still unconfirmed. This made it difficult to determine which national IRBs to approach in advance and created uncertainty in planning timelines.

To address this issue, we requested that the University's IRB consider the revised Common Rule, which encourages the use of a single IRB for multi-institutional research. Nonetheless, we were directed to seek regional ethical oversight through the Caribbean Public Health Agency (CARPHA). After completing CARPHA's submission process and engaging in extended correspondence with their office, we were informed that CARPHA approval was not required for this type of study. We notified the University of Illinois IRB, and they agreed the

study could proceed. As we had research team members from the University of the West Indies Cave Hill, we also completed their IRB process.

The University of Illinois IRB also argued that the original design of recruiting English-speaking participants was discriminatory rather than a research limitation. It was requested that we produce all research materials (the questionnaire, consent forms, recruitment materials, etc.) in all languages spoken in the Caribbean. Although English, Spanish, and French are the most prominent languages spoken in the region, Dutch, Haitian Creole, and Papiamento are also official languages. Translating all materials into an additional five languages was outside the scope and budget of the project. Unfortunately, the IRB rejected our argument that this was a study limitation and not an ethical issue and was insistent that we comply with their instructions. We had to request the Department Chair intervene on our behalf, and while the IRB eventually capitulated, this further demonstrates the challenge of conducting international research. In sum, these delays in obtaining IRB approval contributed to challenges in coordinating data collection with event timelines.

Simultaneously, the University of Illinois placed restrictions on international travel during the pandemic, requiring detailed justification aligned with six criteria (including public health risk, possibility of quarantine, and potential academic impact). This created an additional administrative burden, as every trip required a comprehensive proposal and approval from the Office of the Provost.

Finally, at the time of data collection, the University of Illinois only allowed cash payments for participant incentives, and gift cards were not approved. This policy necessitated a lengthy procurement process and required members of the research team to travel with

significant amounts of cash. This arrangement introduced logistical challenges and heightened personal risk, adding stress to an already complex fieldwork process.

On-the-Ground and Staffing Challenges

The project also encountered unforeseen staffing and logistical obstacles. For the first data collection trip under this project, a research assistant was scheduled to accompany the principal investigator to assist with multiple concurrent projects. Unfortunately, the assistant tested positive for COVID-19 shortly before departure and was unable to travel. This placed additional demands on the principal investigator during the fieldwork phase and limited the scope of on-site research activities. Another event was postponed due to a hurricane, and while the rescheduled event was attended, this added to the logistical challenges of the project.

Communication with event organizers and national team managers proved to be another significant challenge. At the 2022 Caribbean Games in Guadeloupe (a French-speaking territory), the lingering effects of the COVID-19 pandemic affected participation patterns. Many athletes were from French or Spanish-speaking nations, while attendance from English-speaking Caribbean nations was lower than anticipated. This linguistic shift was not communicated in advance, and as our materials, at the time, were prepared solely in English, it limited our capacity to engage with athletes and collect data effectively.

Despite having secured prior permission to attend the event, the level of on-site support varied considerably. For example, upon arrival at one event, extended negotiations were required with the local organizing committee, who initially restricted our data collection to the warmup track, which we explained was unsuitable and inappropriate. After extended discussions, we were granted access to the Athletes' Village, albeit in a small, peripheral space monitored by security. Interactions with athletes were initially prohibited, and we were instructed by security

personnel to remain within a designated zone and not to approach athletes. These restrictions were later eased following discussions with hotel management, but it took several days before we were allowed to solicit athletes directly. The delay significantly curtailed the volume of data we could collect during the event.

At each event, we requested to attend official team meetings or address team officials during announcements, but these requests were denied. Ironically, some coaches and team managers later suggested that centralized completion of the questionnaire during such meetings would have been more efficient. This was the intended strategy we had attempted to pursue but were not permitted to implement.

Finally, resistance to participation in social science research was encountered by certain delegations. In one case, a team manager refused to allow athletes from their country to participate. Although we offered to walk them through the questionnaire and explain its structure and purpose, the manager insisted on reviewing and administering it independently, which was incompatible with our data integrity requirements. Upon rejection of this offer, we respected the manager's decision and did not recruit athletes from that delegation. Similar skepticism was encountered at other events, suggesting broader concerns among some delegations, team managers, and coaches about the role and value of social science research and anti-doping education.

Adjustments and Lessons Learned

Despite numerous logistical and contextual challenges, the research team adapted and successfully collected data at four international sport events across the Caribbean. Due to the annual nature of these competitions and pandemic-related delays, it took two years to complete the data collection process. Nonetheless, each event offered valuable opportunities not only for

gathering data but also for building relationships with stakeholders and enhancing future research feasibility.

One key lesson was the importance of flexibility in fieldwork planning. Working across multiple jurisdictions, languages, and institutional frameworks required adaptable timelines and contingency strategies. Securing ethics approvals, travel authorization, and local event permissions took longer than anticipated, underscoring the need for extended planning horizons in international, multi-country research.

The project also highlighted the need to strengthen recognition of the value of social science research and anti-doping education among event organizers and sport administrators. Resistance from some delegations and their team managers and coaches, event organizers, and logistical barriers to engaging athletes point to a need for better communication about the purpose and benefits of this work. Increased promotion of the ISE may help address this challenge by emphasizing the important role of education-based and social science research and reinforcing its legitimacy.

Finally, this study reaffirmed the critical importance of pilot testing, particularly when working with adolescent athletes and in cross-cultural contexts. Ensuring that research materials are developmentally appropriate and comprehensible contributes to both ethical rigor and data quality. While the project faced setbacks, the adjustments made enabled the research to proceed in a manner that was methodologically sound, contextually aware, and ethically responsible.

Conclusion

This project set out to advance the field of anti-doping education by developing and validating a psychometrically sound knowledge assessment instrument aligned with WADA's International Standard for Education (ISE) and the Athlete Curriculum, and by examining how

social referents influence young athletes' supplement use intentions and doping susceptibility. Both aims were successfully achieved. The Anti-Doping Knowledge Assessment (ADKA) provides a practical tool for evaluating learning outcomes among adolescent and talented athletes and fills a longstanding gap in education measurement. In parallel, the application of the Theory of Normative Social Behavior offered new insights into the differentiated influence of proximal sources, particularly parents, underscoring the need for more tailored interventions. These findings directly support WADA's strategic goals for evidence-informed education and will help inform future research and education programming.

References

Acevedo, P., Jorge, J. C., Cruz-Sánchez, A., Amy, E., & Barreto-Estrada, J. L. (2011). A ten-year assessment of anabolic steroid misuse among competitive athletes in Puerto Rico. *West Indian Medical Journal*, *60*(5), 531-535.

Albert, D., Chein, J., & Steinberg, L. (2013). The teenage brain: Peer influences on adolescent decision making. *Current directions in psychological science*, *22*(2), 114-120.

Alexandrescu, V. M., & Mihailescu, L. (2021). Methodological arguments support in maintaining the development of an anti-doping competence in the formal education of high school sports program students. *Journal of Physical Education and Sport, 21*(6), 3586–3592. https://doi.org/10.752/jpes.2021.06484

Antić, D. (2017). Evaluation of knowledge on doping in sports among Serbian general practitioners. *Medicinski pregled*, *70*(1-2), 25-31.

Awaisu, et al. (2015). Knowledge and perceptions of pharmacy students in Qatar on anti-doping in sports and on sports pharmacy in undergraduate curricula. *American Journal of Pharmaceutical Education*, *79* (8), 1-7.

Backhouse, S., McKenna, J., & Patterson, L. (2009). *Prevention through education: a review of current international social science literature. A focus on the prevention of bullying, tobacco, alcohol and social drug use in children, adolescents and young adults.* Montreal: World Anti-Doping Agency.

Backhouse, S.H. (2015). Anti-doping education for athletes. (229 – 238) In V. Møller, I. Waddington, & J. M. Hoberman (Eds.). *Routledge handbook of drugs and sport*. London: Routledge.

Backhouse, S. H., Whitaker, L., Patterson, L., Erickson, K., & McKenna, J. (2015). *Social psychology of doping in sport: A mixed studies narrative synthesis.* Montreal: World Anti-Doping Agency. https://www.wada-ama.org/sites/default/files/resources/files/literature_review_update_-_final_2016.pdf

Baker, F.B. (2001). The Basics of Item Response Theory, 2nd ed.. College Park, MD: ERIC Clearinghouse on Assessment and Evaluation.

Bandolas, D. L. (2018). *Measurement theory and applications for social sciences.* New York: The Guilford Press.

Barghi T. S., Halabchi F., Dvorak J., & Hosseinnejad, H. (2015). How the Iranian football coaches and players know about doping? *Asian Journal of Sport Medicine; 6*(2), e24392.

Bendor, J., & Swistak, P. (2001). The Evolution of Norms. *American Journal of Sociology*, *106*, 1493-1545.

Bloom, B. S. (1956). *Taxonomy of educational objectives, Handbook I: The cognitive domain.* David McKay Co Inc.

Brown, B. B., & Klute, C. (2003). Friendships, cliques, and crowds. In G. R. Adams & M .D. Berzonsky (eds). *Blackwell handbook of adolescent development*, 330-348.

CARICOM Commission on Youth Development (2010). *Eye on the future- investing in youth now for tomorrow's community. CARICOM Secretariat Publications*. Retrieved from: https://caricom.org/store/eye-on-the-future-investing-in-youth-now-for-tomorrows-community.

Chan, D. K. C., Tang, T. C. W., Yung, P. S. H., Gucciardi, D. F., & Hagger, M. S. (2019). Is unintentional doping real, or just an excuse?. *British Journal of Sports Medicine*, *53*(15), 978-979.

Chung, A., & Rimal, R. N. (2016). Social norms: a review. *Review of Communication Research, 4*, 1-28.

Cialdini, R. B., & Goldstein, N. J. (2004). Social influence: Compliance and conformity. *Annual Review of Psychology, 55*, 591-621.

Cialdini, R. B., Reno, R. R., & Kallgren, C. A. (1990). A focus theory of normative conduct: recycling the concept of norms to reduce littering in public places. *Journal of Personality and Social Psychology, 58*, 1015-1026.

Costello, A. B., & Osborne, J. (2005). Best practices in exploratory factor analysis: Four recommendations for getting the most from your analysis. *Practical assessment, research, and evaluation*, *10*(1).

Cuijpers, P. (2002). Effective ingredients of school-based drug prevention programs: A systematic review. *Addictive Behaviors, 27*, 1009–1023.

Davani-Davari, D., Karimzadeh, I., & Khalili, H. (2019). The potential effects of anabolic-androgenic steroids and growth hormone as commonly used sport supplements on the kidney: a systematic review. *BMC nephrology, 20*, 1-12.

Döring, A. K., Schwartz, S. H., Cieciuch, J., Groenen, P. J., Glatzel, V., Harasimczuk, J., ... & Milfont, T. L. (2015). Cross-cultural evidence of value structures and priorities in childhood. *British Journal of Psychology*, *106*(4), 675-699.

Duncan, L. R., Hallward, L., & Alexander, D. (2018). Portraits of adolescent athletes facing personal and situational risk factors for doping initiation. *Psychology of Sport and Exercise*, *39*, 163-170.

Elliot, D. L., Goldberg, L., Moe, E. L., DeFrancesco, C. A., Durham, M. B., & Hix-Small, H. (2004). Preventing substance use and disordered eating: Initial outcomes of the ATHENA

(Athletes Targeting Healthy Exercise and Nutrition Alternatives) program. *Archives of Pediatrics & Adolescent Medicine, 158*(11), 1043. doi:10.1001/archpedi.158.11.1043

Elliot, D. L., Goldberg, L., Moe, E. L., DeFrancesco, C. A., Durham, M. B., McGinnis, W., & Lockwood, C. (2008). Long-term outcomes of the ATHENA (Athletes Targeting Healthy Exercise & Nutrition Alternatives) program for female high school athletes. *Journal of Alcohol and Drug Education, 52*(2), 73–92.

Elliot, D. L., Moe, E. L., Goldberg, L., DeFrancesco, C. A., Durham, M. B., & Hix-Small, H. (2006). Definition and outcome of a curriculum to prevent disordered eating and body-shaping drug use. *Journal of School Health, 76*(2), 67–73.

Erickson, K., McKenna, J., & Backhouse, S. H. (2015). A qualitative analysis of the factors that protect athletes against doping in sport. *Psychology of Sport and Exercise*, *16*, 149-155.

Garthe I., & Maughan R. J. (2018). Athletes and Supplements: Prevalence and Perspectives. *International Journal of Sport Nutrition and Exercise Metabolism, 28*(2), 126–138.

Forehand, R., & Wierson, M. (1993). The role of developmental factors in planning behavioral interventions for children: Disruptive behavior as an example. *Behavior Therapy*, *24*(1), 117-141.

Fürhapter, C., Blank, C., Leichtfried, V., Mair-Raggautz, M., Müller, D., & Schobersberger, W. (2013). Evaluation of West-Austrian junior athletes' knowledge regarding doping in sports. *The Central European Journal of Medicine, 125*(1-2), 41-49. doi:10.1007/s00508-012-0318-7.

Geber, S., Baumann, E., & Klimmt, C. (2019). Where do norms come from? Peer communication as a factor in normative social influences on risk behavior. *Communication Research*, *46*(5), 708-730.

Goldberg, L., Bosworth, E. E., Bents, R. T., & Trevisan, L. (1990). Effect of an anabolic steroid education program on knowledge and attitudes of high school football players. *Journal of Adolescent Health Care, 11*(3), 210–214. https://doi.org/10.1016/0197-0070(90)90350-B

Goldberg, L, & Elliot, D.L. (2005). Preventing substance use among high school athletes: The ATLAS and ATHENA programs. *Journal of Applied School Psychology, 21*(1), 63 - 97.

Goldberg, L., Elliot, D., Clarke, G. N., MacKinnon, D. P., Moe, E., Zoref, L., Green, C., Wolf, S. L., Greffrath, E., Miller, D. J., & Lapin, A. (1996a). Effects of a multidimensional anabolic steroid prevention intervention: The Adolescents Training and Learning to Avoid Steroids (ATLAS) Program. *Journal of the American Medical Association, 276* (19), 1555–1562. https://doi.org/10.1001/jama.1996.03540190027025

Goldberg, L., Elliot, D. L., Clarke, G. N., MacKinnon, D. P., Zoref, L., Moe, E., Green, C., & Wolf, S. L. (1996b). The Adolescents Training and Learning to Avoid Steroids (ATLAS) prevention program: Background and results of a model intervention. *Archives of Pediatrics & Adolescent Medicine, 150*(7), 713–721. https://doi.org/10.1001/archpedi.1996.02170320059010

Goldberg, L., MacKinnon, D. P., Elliot, D. L., Moe, E. L., Clarke, G., & Cheong, J. (2000). The Adolescents Training and Learning to Avoid Steroids program: Preventing drug use and promoting health behaviors. *Archives of Pediatrics & Adolescent Medicine, 154*(4), 332-338. https://doi.org/10.1001/archpedi.154.4.332

Haladyna, T. M., Downing, S. M., & Rodriguez, M. C. (2002). A review of multiple-choice item-writing guidelines for classroom assessment. *Applied Measurement in Education, 15*(3), 309-333.

Haladyna, T. M., & Rodriguez, M. C. (2013). *Developing and validating test items*. Routledge.

Hurst, P., Foad, A. J., Coleman, D. A., & Beedie, C. (2017). Development and validation of the sports supplements beliefs scale. *Performance Enhancement &Health, 5*(3), 89–97. https://doi.org/10.1016/j.peh.2016.10.001

Hurst, P., Kavussanu, M., Boardley, I., & Ring, C. (2019). Sport supplement use predicts doping attitudes and likelihood via sport supplement beliefs. *Journal of Sports Sciences, 37*(15), 1734-1740.

Hurst, P., King, A., Massey, K., Kavussanu, M., & Ring, C. (2023). A national anti-doping education programme reduces doping susceptibility in British athletes. *Psychology of Sport and Exercise*, *69*, 102512.

Hurst, P., Ring, C., & Kavussanu, M. (2020). An evaluation of UK athletics' clean sport programme in preventing doping in junior elite athletes. *Performance Enhancement & Health*, *7*(3-4), 100155.

Inter-American Drug Abuse Control Commission (2016). *A report on students' drug use in 13 Caribbean Countries: Antigua and Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago. OAS.* Official records; OEA/Ser.L/XIV.6.46. Organization of American States.

Jalilian, F., Allahverdipour, H., Moeini, B., & Moghimbeigi, A. (2011). Effectiveness of anabolic steroid preventative intervention among gym users: Applying theory of planned behavior. *Health Promotion Perspectives, 1*(1), 32. https://doi.org/10.5681/hpp.2011.002

Jordens, P. B. (2016). *Overview of the Caribbean region's medal performance at the 2016 Summer Olympic Games in Rio de Janeiro, Brazil*. Retrieved from

https://repeatingislands.files.wordpress.com/2016/09/caribbean-medal-performance-rio-2016.pdf

Kam, J. A., Krieger, J. L., Basinger, E. D., & Figueroa-Caballero, A. (2016). What do high school students say when they talk to their friends about substance use? Exploring the content of substance-use-specific communication with friends. *Health Communication*, *31*(5), 522-535.

Lapinski, M. K., & Rimal, R. N. (2005). An explication of social norms. *Communication Theory*, *15*(2), 127-147. doi: 10.1080/10410230701454049

Lazuras, L., Barkoukis, V., Mallia, L., Lucidi, F., & Brand, R. (2017). More than a feeling: The role of anticipated regret in predicting doping intentions in adolescent athletes. *Psychology of Sport and Exercise*, *30*, 196-204.

Lazuras, L., Barkoukis, V., & Tsorbatzoudis, H. (2015). Toward an integrative model of doping use: an empirical study with adolescent athletes. *Journal of Sport and Exercise Psychology*, *37*(1), 37-50.

Little, R. J. (1988). A test of missing completely at random for multivariate data with missing values. *Journal of the American Statistical Association, 83*(404), 1198-1202.

MacKinnon, D. P., Goldberg, L., Clarke, G. N., Elliot, D. L., Cheong, J., Lapin, A., Moe, E. L., & Krull, J. L. (2001). Mediating mechanisms in a program to reduce intentions to use anabolic steroids and improve exercise self-efficacy and dietary behavior. *Prevention Science, 2*(1), 15–28. https://doi.org/10.1023/A:1010082828000

Madigan, D. J., Stoeber, J., & Passfield, L. (2016). Perfectionism and attitudes towards doping in junior athletes. *Journal of Sports Sciences*, *34*(8), 700-706.

Mazanov, J., Backhouse, S., Connor, J., Hemphill, D., & Quirk, F. (2014). Athlete support personnel and anti-doping: Knowledge, attitudes, and ethical stance. *Scandinavian journal of Medicine & Science in Sports*, *24*(5), 846-856.

Moran A, Guerin S, Kirby K, MacIntyre T. *The development and validation of a doping attitudes and behavior scale*. Research report to World Anti-Doping Agency and The Irish Sports Council. 2008. https://www.wada-ama. org/en/resources/social-science/the-development-and-validation-of-adoping-attitudes-and-behaviour-scale

Morente-Sánchez, J., & Zabala, M. (2013). Doping in sport: a review of elite athletes' attitudes, beliefs, and knowledge. *Sports Medicine*, *43*(6), 395-411.

Morente-Sánchez, J., & Zabala, M. (2015). Knowledge, attitudes and beliefs of technical staff towards doping in Spanish football. *Journal of Sports Sciences*, *33*(12), 1267-1275.

Morente-Sánchez, J., Zandonai, T., & Díaz, M. Z. (2019). Attitudes, beliefs and knowledge related to doping in different categories of football players. *Journal of Science and Medicine in Sport, 22*(9), 981-986.

Murofushi, Y., Kawata, Y., Kamimura, A., Hirosawa, M., & Shibata, N. (2018). Impact of anti-doping education and doping control experience on anti-doping knowledge in Japanese university athletes: A cross-sectional study. *Substance Abuse Treatment, Prevention, and Policy, 13*(1), 44.

Murofushi, Y., Kawata, Y., Yamaguchi, S., Nakamura, M., Takazawa, Y., & Naito, H. (2022). Relationship between the level of willingness to learn about anti-doping and objective knowledge among Japanese university athletes: A cross-sectional study. *Frontiers in Sports and Active Living*, *4*, 955636.

Muwonge, H., Zavuga, R., & Kabenge, P. A. (2015). Doping knowledge, attitudes, and practices of Ugandan athletes': a cross-sectional study. *Substance Abuse Treatment, Prevention, and Policy*, *10*(1), 37.

Nguyen, T. H., Han, H. R., Kim, M. T., & Chan, K. S. (2014). An introduction to item response theory for patient-reported outcome measurement. *The Patient-Patient-Centered Outcomes Research*, *7*, 23-35.

Nicholls, A. R., Cope, E., Bailey, R., Koenen, K., Dumon, D., Theodorou, N. C., ... & Kristensen, A. H. (2017). Children's first experience of taking anabolic-androgenic steroids can occur before their 10th birthday: a systematic review identifying 9 factors that predicted doping among young people. *Frontiers in Psychology*, *8*, 1-21.

Nicholls, A. R., Madigan, D. J., & Levy, A. R. (2017). A confirmatory factor analysis of the performance enhancement attitude scale for adult and adolescent athletes. *Psychology of Sport and Exercise*, *28*, 100-104.

Nicholls, A. R., Morley, D., Thompson, M. A., Huang, C., Abt, G., Rothwell, M., ... & Ntoumanis, N. (2020). The effects of the iPlayClean education programme on doping attitudes and susceptibility to use banned substances among high-level adolescent athletes from the UK: A cluster-randomised controlled trial. *International Journal of Drug Policy*, *82*, 102820.

Nolte, K., Steyn, B. J. M., Krüger, P. E, & Fletcher, L. (2014). Doping in sport: Attitudes, beliefs and knowledge of competitive high-school athletes in Gauteng Province. *South African Journal of Sports Medicine, 26*(3), 81-86.

Ntoumanis, N., Ng, J. Y., Barkoukis, V., & Backhouse, S. (2014). Personal and psychosocial predictors of doping use in physical activity settings: a meta-analysis. *Sports Medicine*, *44*(11), 1603-1624.

Onrust, S. A., Otten, R., Lammers, J., & Smit, F. (2016). School-based programmes to reduce and prevent substance use in different age groups: What works for whom? Systematic review and meta-regression analysis. *Clinical Psychology Review*, *44*, 45-59.

Orr, R., Grassmayr, M., Macniven, R., Grunseit, A., Halaki, M., & Bauman, A. (2018). Australian athletes' knowledge of the WADA Prohibited Substances List and performance enhancing substances. *International Journal of Drug Policy*, *56*, 40-45.

Ozkan, O., Torgutalp, S. S., Kara, O. S., Donmez, G., Demire, H., Karanfil, Y., ... & Korkusuz, F. (2020). Doping knowledge and attitudes of Turkish athletes: a cross-sectional study. *Montenegrin Journal of Sports Science and Medicine, 9*(1), 49-55.

Pan American Health Organization. (2018). *Part 1: A profile of adolescents and youth in the Americas.* https://www.paho.org/adolescent-health-report-2018/part-one-a-profile-of-adolescents-and-youth-in-the-americas.html

Peacock, A., Leung, J., Larney, S., Colledge, S., Hickman, M., Rehm, J., ... & Ali, R. (2018). Global statistics on alcohol, tobacco and illicit drug use: 2017 status report. *Addiction*, *113*(10), 1905-1926.

Ranby, K. W., Aiken, L. S., MacKinnon, D. P., Elliot, D. L., Moe, E. L., McGinnis, W., & Goldberg, L. (2009). A mediation analysis of the ATHENA intervention for female athletes: Prevention of athletic enhancing substance use and unhealthy weight loss behaviors. *Journal of Pediatric Psychology, 34*(10), 1069–1083. https://doi.org/10.1093/jpepsy/jsp025

Real, K., & Rimal, R. N. (2007). Friends talk to friends about drinking: Exploring the role of peer communication in the theory of normative social behavior. *Health Communication, 22,* 169-180.

Rimal, R. N., & Lapinski, M. K. (2015). A re-explication of social norms, ten years later. *Communication Theory*, *25*(4), 393-409.

Rimal, R. N. & Real, K. (2005). How behaviors are influenced by perceived norms: A test of the Theory of Normative Behavior. *Communication Research, 32,* 389-414. doi: 10.1177/0093650205275385

Sagoe, D., Holden, G., Rise, E. N. K., Torgersen, T., Paulsen, G., Krosshaug, T., ... & Pallesen, S. (2016). Doping prevention through anti-doping education and practical strength training: The Hercules program. *Performance Enhancement & Health*, *5*(1), 24-30.

Sas-Nowosielski, K., & Świątkowska, L. (2007). The knowledge of the world anti-doping code among Polish athletes and their attitudes toward doping and anti-doping policy. *Human Movement, 8*(1), 57-64.

Sepriani, R. (2023). Web-based anti-doping education: A needs analysis for achievement sport athletes. *Journal Sport Area*, *8*(1), 34-42.

Sepriani, R., Bafirman, M., Gusril, S., & Bachtiar, S. (2022). Athlete Doping Knowledge Analysis: A Case Study of the 20th National Sports Week (PON) Papua 2021 in Indonesia. *International Journal of Human Movement and Sports Sciences*, *10*(4), 723-731.

Shibata, K., Ichikawa, K., & Kurata, N. (2017). Knowledge of pharmacy students about doping, and the need for doping education: a questionnaire survey. *BMC Research Notes*, *10*(1), 396.

Shulman, H. C., Rhodes, N., Davidson, E., Ralston, R., Borghetti, L., & Morr, L. (2017). The state of the field of social norms research. *International Journal of Communication*, *11*, 22.

Steinberg, L. (2008). A social neuroscience perspective on adolescent risk-taking. *Developmental Review, 28*(1), 78-106.

Tourangeau, R., Rips, L. J., & Rasinski, K. (2000). *The psychology of survey response*. Cambridge University Press.

Trenhaile, J., Choi, H. S., Proctor, T. B., & Work, P. (1998). The effect of anabolic steroid education on knowledge and attitudes of at-risk preadolescents. *Journal of Alcohol and Drug Education, 43*(2), 20–35.

Tricker, R., & Connolly, D. (1996). Drug education and the college athlete: Evaluation of a decision-making model. *Journal of Drug Education, 26*(2), 159–181. https://doi.org/10.2190/11Q1-R721-QTWJ-R6A5

Tsivitanidou, O., Christodoulides, E., & Petrou, M. (2023). High-School Athletes' Knowledge, Attitudes, and Perceptions on Doping: The Cyprus Sport-School Study. *Youth, 3*(2), 596–622.

Turfus, S. C., Smith, J. O. L., Mansingh, A., Alexander-Lindo, R. L., & Roopchand-Martin, S. (2019). Supplementation practices, perceptions and knowledge about anti-doping among Jamaican high school athletes. *Performance Enhancement & Health*, *7*(1-2), 100145.

Wanjek, B., Rosendahl, J., Strauss, B., & Gabriel, H. H. (2007). Doping, drugs and drug abuse among adolescents in the State of Thuringia (Germany): prevalence, knowledge and attitudes. *International Journal of Sports Medicine, 28*(04), 346-353.

Willis, G. (2005). *Cognitive interviewing: a tool for improving questionnaire design*. SAGE.

Woolf, J., Rimal, R., & Sripad, P. (2014). High school athletes' use of androgenic anabolic steroids: the role of proximal networks. *Journal of Sport Management. 28*(1), 8-20. DOI: 10.1123/jsm.2013-0046

WADA (2021a). *World Anti-Doping Code 2021*. https://www.wada-ama.org/sites/default/files/resources/files/2021_wada_code.pdf

WADA (2021b). *World Anti-Doping Code International Standard for Education January 2021*. https://www.wada-ama.org/sites/default/files/resources/files/international_standard_ise_2021.pdf

WADA (2021c). *2021 Code Implementation Support Program Guidelines for the International Standard for Education (ISE*). https://www.wada-ama.org/sites/default/files/resources/files/guidelinesforeducation_final.pdf

Yalçın, İ., Çalik, F., Ece, C., Geri, S., Seker, R., & Yalçın, S. (2019). Knowledge levels and preference reasons regarding the doping of U23 Turkish National Team athletes. *Progress in Nutrition, 21*(2), 391-397.

Zhumabayeva, G., Kapanova, G., Vinnikov, D., Bakasheva, M., Abdulla, V., & Grjibovski, A. (2022). Knowledge and experience of Kazakhstan athletes in anti-doping and the impact of past educational intervention. *Substance Abuse Treatment, Prevention, and Policy*, *17*(1), 32.

Appendix A: Questionnaire

ILLINOIS

Research Questionnaire

A study on Caribbean adolescent athletes' knowledge of anti-doping rules, and sources of influence in their lives.

Instructions [Important – Please read]:

Thank you for completing this questionnaire. In this questionnaire, you will complete an anti-doping quiz and answer questions on Sport Supplements (e.g., protein powder, vitamins, creatine) and Performance Enhancing Drugs (PEDs), which includes anabolic androgenic steroids (commonly just called "steroids"), human growth hormone (or "HGH"), erythropoietin (or "EPO"), and other substances you may have heard of.

Please answer each question **Openly** and **Honestly**. Your answers will be **Completely Confidential** and A**nonymous**. That means no-one will know what answers you chose. Most questions ask you to indicate your answer with a checkmark, while a few require you to write your answer. If you have any questions, please ask a member of the research team. This survey will take about 30 minutes to complete.

Part 1: Background information

In this section, we just want to learn a little more about who you are.

1. How old are you? _____
2. What is your primary sport you compete in? _____
3. How many years have you been competing in your primary sport? _____
4. What is the highest level you have competed at (check one box)?
   ☐ City/local competition ☐ Regional competition
   ☐ National level Competition/ National championship ☐ International Competition
5. What is your nationality (what country are you representing):

☐ Anguilla	☐ Columbia	☐ Guadeloupe	☐ St. Lucia
☐ Antigua and Barbuda	☐ Costa Rica	☐ Haiti	☐ St. Vincent & Grenadines
☐ Aruba	☐ Cuba	☐ Jamaica	☐ Suriname
☐ Bahamas	☐ Curacao	☐ Martinique	☐ Trinidad & Tobago
☐ Barbados	☐ Dominica	☐ Montserrat	☐ Turks & Caicos Islands
☐ Belize	☐ Dominican Republic	☐ Puerto Rico	☐ The British Virgin Islands
☐ Bermuda	☐ French Guiana	☐ St. Maarten	☐ The US Virgin Islands
☐ Cayman Islands	☐ Grenada	☐ St. Martin	☐ Other _____
	☐ Guyana	☐ St. Kitts and Nevis	

6. Do you identify with a specific race or ethnicity?
   ☐ Yes ☐ No ☐ Prefer not to answer
   If so, please describe what specific race or ethnicity you identify with:
   _____
7. What gender do you identify as:
   ☐ Male ☐ Female ☐ Prefer to self-describe ☐ Prefer not to say

Now turn over – There are Questions on both sides of the paper for you to Answer.

ILLINOIS

Part 2: Anti-Doping Knowledge

In this section, we want to see what you know about Anti-Doping. Please answer each question to the best of your ability. If you don't know the answer that's OK and you can state that in your answer. Choose **only one** option/answer for each question.

1. What is doping?
- ○ a. Doping is using any substance or method on the List of Prohibited Substances and Methods
- ○ b. Doping is using equipment which has not been approved
- ○ c. Doping is fighting during a competition
- ○ d. Doping is refusing to obey the official
- ○ e. Don't know

2. Why is doping banned?
- ○ a. Because it is dangerous for the athlete's health.
- ○ b. Because it goes against the spirit of sport.
- ○ c. Because it is against the rules as it unfairly enhances athlete performance.
- ○ d. All of the above
- ○ e. Don't know

3. How do I know if a substance is permitted or safe to use?
- ○ a. A substance is safe to use if you bought it in a pharmacy.
- ○ b. A substance is safe to use if it says "doping-free" on the box.
- ○ c. A substance is safe to use if it is made of plants.
- ○ d. A substance is safe to use if it does not contain any substances on the List of Prohibited Substances
- ○ e. Don't know

4. How can you tell if nutritional supplements are safe to use?
- ○ a. All nutritional supplements are safe to use
- ○ b. You cannot tell if nutritional supplements are safe to use
- ○ c. If the label says that they are safe
- ○ d. If the doctor gave it to you
- ○ e. Don't know

5. Can I be tested for doping?
- ○ a. No, because I am a young athlete
- ○ b. No, because I do not compete at the Olympics Games
- ○ c. Yes, any athlete can potentially be tested
- ○ d. No, because my sport is not a high-risk sport
- ○ e. Don't know

6. Can my coach or doctor be banned for breaking doping rules?
- ○ a. No, only athletes can be banned for breaking doping rules
- ○ b. A coach can be banned but not a doctor
- ○ c. No, there are no penalties for doping
- ○ d. Yes, a coach or doctor can be banned for breaking doping rules
- ○ e. Don't know

7. Who is responsible when a substance is found in an athlete's body?
- ○ a. The athlete's physician/doctor
- ○ b. The athlete's coach
- ○ c. The athlete
- ○ d. Depends on who gave the athlete the substance
- ○ e. Don't know

ILLINOIS

8. Can my coach or someone I choose, come with me to the doping control station?
- ○ a. Yes, your coach or someone you choose can come with you
- ○ b. Yes, but only if you are a young athlete (under 18 years)
- ○ c. Only if the Doping Control Officer has asked for a representative to be there
- ○ d. An athlete can never be accompanied to the doping control station
- ○ e. Don't know

9. Can I refuse to be tested?
- ○ a. No
- ○ b. Yes, if I have family commitments
- ○ c. Yes, if I am too busy
- ○ d. Yes, if I have school/work obligations
- ○ e. Don't know

10. Where can I find reliable information about anti-doping?
- ○ a. National Anti-Doping Organizations, The World Anti-Doping Agency
- ○ b. The Internet
- ○ c. Muscle or sport magazines
- ○ d. My friends
- ○ e. Don't know

11. What if my physician or doctor has to treat me with some medicine?
- ○ a. The physician/doctor should check if the medicine contains a prohibited substance
- ○ b. Whatever my physician/doctor gives me, it is safe
- ○ c. If I test positive from the substance my physician gave me, it is his/her fault
- ○ d. If it is for medical reasons, I can take whatever is necessary
- ○ e. Don't know

12. What are the sanctions (penalties) if I get caught doping?
- ○ a. There are no sanctions for doping
- ○ b. There are no sanctions if you are a young athlete
- ○ c. Penalties can range from a warning to a lifetime ban
- ○ d. Depends on who gave you the substance
- ○ e. Don't know

13. Who is allowed to perform a doping control?
- ○ a. A Doping Control Officer who can show identification and proof of authorization from an Anti-Doping Organization
- ○ b. A coach
- ○ c. Any doctor
- ○ d. Police officers
- ○ e. Don't know

14. Whereabouts information is used to:
- ○ a. notify athletes that they need to report to a Doping Control Officer as soon as they can
- ○ b. conduct out of competition testing of top elite level athletes
- ○ c. report the results of doping test
- ○ d. identify the location of sport events where doping tests will be done
- ○ e. Don't know

15. After an athlete gives a sample (blood and/or urine), for how long can it be stored and re-analyzed?
- ○ a. An indefinite period
- ○ b. 10 years
- ○ c. 2 years
- ○ d. It cannot be stored
- ○ e. Don't know

ILLINOIS

16. If an athlete tests positive for a banned substance they have the right to:
- ○ a. request the B sample be analyzed
- ○ b. attend or be represented for the opening and analysis of the B sample
- ○ c. request copies of the laboratory documentation package
- ○ d. all of the above
- ○ e. don't know

17. How many anti-doping rule violations are there? _____

18. Name as many of the anti-doping rule violations that you can:

19. The "Spirit of Sport" includes the values that anti-doping programs are founded on. How many value statements are there in WADA's Spirit of Sport? _____

20. Name as many values or value statements that are part of the Spirit of Sport:

Part 3: Thoughts on Sport Supplements and Performance Enhancing Drugs

Well Done! That's the hard part over with!
In this section, the questions are about your thoughts on Sport Supplements and Performance Enhancing Drugs. Don't Worry – There are no right or wrong answers.

Remember to answer Openly and Honestly.

- The first 4 questions are about **Performance Enhancing Drugs (PEDs)**. To what extent do you agree or disagree with each of the following statements? [place a check mark in the box]

		Strongly disagree	Disagree	Moderately disagree	Neither agree or disagree	Moderately agree	Agree	Strongly agree
1	In order to be successful in my sport, I need to take PEDs							
2	Legalizing PEDs would benefit my sport							
3	You have to take PEDs to play at the highest level in sport							
4	Making PEDs legal would improve sport							

ILLINOIS

- The next 6 questions are about **Sport Supplements**. To what extent do you agree or disagree with the following statements? [place a check mark in the box]

	The first 3 questions are about your **teammates/training partners**	Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
1	Many of my teammates/training partners use sport supplements							
2	Sport supplements use often occurs among my teammates/training partners							
3	I know many of my teammates/training partners use sport supplements							

	The next 3 questions are about **athletes in your sport and age group**	Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
4	Many athletes in my sport and age group use sport supplements							
5	Sport supplements use often occurs among athletes in my sport and age group							
6	I know many athletes in my sport and age group use sport supplements							

- The next 6 questions are about **Performance Enhancing Drugs (PEDs)**.
  To what extent do you agree or disagree with the following statements? [place a check mark in the box].
  Your answers will be **Confidential** and **Anonymous**, so please answer **Openly** and **Honestly**.

	The first 3 questions are about your **teammates/training partners**	Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
1	Many of my teammates/training partners use PEDs							
2	PED use often occurs among my teammates/training partners							
3	I know many of my teammates/training partners use PEDs							

	The next 3 questions are about **athletes in your sport and age group**	Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
4	Many athletes in my sport and age group use PEDs							
5	PED use often occurs among athletes in my sport and age group							
6	I know many athletes in my sport and age group use PEDs							

- The following statements are intended to provide an insight into your beliefs regarding other athletes' use of supplement and PEDs. Please write in answer between 0 (no-one) and 100 (everyone).

		Percentage (%)
1	Out of 100%, how many athletes in your sport and in your age group do you believe use supplements?	
2	Out of 100%, how many athletes in your sport and in your age group do you believe use PEDs to enhance their performance?	

ILLINOIS

Great Work! Keep it up! Take a break if you need to.

Make sure to read each question carefully

➢ The next 15 questions are about **Sport Supplements**.
To what extent do you agree or disagree with the following statements?

	The next 3 questions are about your: **Teammates/Training partners**	Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
1	My teammates/training partners would approve if I used sport supplements							
2	My teammates/training partners would support it if I used sport supplements							
3	My teammates/training partners would like it if I used sport supplements							

	The next 3 questions are about your: **Coach(es)**	Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
4	My coach(es) would approve if I used sport supplements							
5	My coach(es) would support it if I used sport supplements							
6	My coach(es) would like it if I used sport supplements							

	The next 3 questions are about your: **Parent(s)**	Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
7	My parent(s) would approve if I used sport supplements							
8	My parent(s) would support it if I used sport supplements							
9	My parent(s) would like it if I used sport supplements							

➢ The last questions are about your thoughts on **Sport Supplements**.

		Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
10	Supplements improve my performance						
11	Supplements are necessary for me to be competitive						
12	Supplements improve my confidence						
13	My chances of winning improve when I use supplements						
14	Supplements help me realize my potential						
15	Supplements improve the quality of my training						

ILLINOIS

- The next 15 questions are about **Performance Enhancing Drugs (PEDs)**.
  To what extent do you agree or disagree with the following statements? [place a check mark in the box].

  Your answers will be **Confidential** and **Anonymous**, so please answer **Openly** and **Honestly**.

	The next 3 questions are about your: **Teammates/Training partners**	Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
1	My teammates/training partners would approve if I used PEDs							
2	My teammates/training partners would support it if I used PEDs							
3	My teammates/training partners would like it if I used PEDs							

	The next 3 questions are about your: **Coach(es)**	Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
4	My coach(es) would approve if I used PEDs							
5	My coach(es) would support it if I used PEDs							
6	My coach(es) would like it if I used PEDs							

	The next 3 questions are about your: **Parent(s)**	Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
7	My parent(s) would approve if I used PEDs							
8	My parent(s) would support it if I used PEDs							
9	My parent(s) would like it if I used PEDs							

- The last questions are about your thoughts on **Performance Enhancing Drugs (PEDs)**.

		Strongly disagree	Disagree	Slightly disagree	Slightly agree	Agree	Strongly agree
10	Using PEDs would improve performance						
11	PEDs are necessary to be competitive						
12	Using PEDs would improve my confidence						
13	My chances of winning would improve if I used PEDs						
14	Using PEDs would help me realize my potential						
15	Using PEDs would improve the quality of my training						

ILLINOIS

Part 4: Relationships with other people
The following questions refer to your relationship with your teammates/training partners, coach(es) and parents.

Think about your relationship with your **teammates/training partners** when responding to the following questions.

		Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
1	My relationship with my **teammates** is close							
2	When we are apart, I miss my **teammates** a great deal							
3	My **teammates** and I disclose important personal things to each other							
4	My **teammates** and I have a strong connection							
5	My **teammates** and I want to spend time together							
6	My **teammates** are a priority in my life							
7	My **teammates** and I do a lot of things together							
8	When I have free time I choose to spend it alone with my **teammates**							
9	I think about my **teammates** a lot							
10	My relationship with my **teammates** is important in my life							
11	I consider my **teammates** when making important decisions							

Think about your relationship with your **coach(es)** when responding to the following questions.

		Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
1	My relationship with my **coach(es)** is close							
2	When we are apart, I miss my **coach(es)** a great deal							
3	My **coach(es)** and I disclose important personal things to each other							
4	My **coach(es)** and I have a strong connection							
5	My **coach(es)** and I want to spend time together							
6	My **coach(es)** is a priority in my life							
7	My **coach(es)** and I do a lot of things together							
8	When I have free time I choose to spend it alone with my **coach(es)**							
9	I think about my **coach(es)** a lot							
10	My relationship with my **coach(es)** is important in my life							
11	I consider my **coach(es)** when making important decisions							

ILLINOIS

Think about your relationship with your **parent(s)** when responding to the following questions.

		Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
1	My relationship with my **parent(s)**is close							
2	When we are apart, I miss my **parent(s)**a great deal							
3	My **parent(s)**and I disclose important personal things to each other							
4	My **parent(s)**and I have a strong connection							
5	My **parent(s)**and I want to spend time together							
6	My **parent(s)**is a priority in my life							
7	My **parent(s)**and I do a lot of things together							
8	When I have free time I choose to spend it alone with my **parent(s)**							
9	I think about my **parent(s)** a lot							
10	My relationship with my **parent(s)**is important in my life							
11	I consider my **parent(s)** when making important decisions							

Part 5: Talking with other people

- The next 12 questions are about **Sport Supplements.**

		Never	Rarely	Sometimes	Often	Very often
1	How often do you talk to your **teammates/training partners** about sport supplements?					
2	How often do your **teammates/ training partners** talk to you about sport supplements?					
3	How often do you talk to your **coach(es)** about sport supplements?					
4	How often does your **coach(es)** talk to you about sport supplements?					
5	How often do you talk to your **parent(s)** about sport supplements?					
6	How often do your **parent(s)** talk to you about sport supplements?					

		Very negative way	Mostly negative way	Neither a negative or positive way	Mostly positive way	Very positive way	We never talk about this
7	When I talk to my **teammates/training partners** about sport supplements it is in a:						
8	When **my teammates/training partners** talk to me about sport supplements it is in a:						
9	When I talk to my **coach(es)** about sport supplements it is in a:						
10	When my **coach(es)** talk to me about sport supplements it is in a:						
11	When I talk to my **parent(s)** about sport supplements it is in a:						
12	When my **parent(s)** talk to me about sport supplements it is in a:						

ILLINOIS

- The next 12 questions are about **Performance Enhancing Drugs (PEDs)**.

		Never	Rarely	Sometimes	Often	Very often
1	How often do you talk to your **teammates/ training partners** about PEDs?					
2	How often do your **teammates/ training partners** talk to you about PEDs?					
3	How often do you talk to your **coach(es)** about PEDs?					
4	How often does your **coach(es)** talk to you about PEDs?					
5	How often do you talk to your **parent(s)** about PEDs?					
6	How often do your **parent(s)** talk to you about PEDs?					

		Very negative way	Mostly negative way	Neither a negative or positive way	Mostly positive way	Very positive way	It isn't talked about:
7	When I talk to my **teammates/training partners** about PEDs it is in a:						
8	When my **teammates/training partners** talk to me about PEDs it is in a:						
9	When I talk to my **coach(es)** about PEDs it is in a:						
10	When my **coach(es)** talk to me about PEDs it is in a:						
11	When I talk to my **parent(s)** about PEDs it is in a:						
12	When my **parent(s)** talk to me about PEDs it is in a:						

You're doing Great! Almost done. Keep going!

Part 6: Final Section

- The next 10 questions are about **Sport Supplements.**

	To what extent do you agree or disagree with the following statements?	Strongly disagree	Disagree	Moderately disagree	Neither agree nor disagree	Moderately agree	Agree	Strongly agree
1	I intend to use sport supplements in the near future							
2	I will use sport supplements in the near future							
3	I plan to use sport supplements in the near future							

Which of the following sport supplements do you currently use or have used in the past?

		Currently use	Use frequently, but not right now	Have used in the past but infrequently	Have used in the past but no longer use	Have never used
4	Vitamin/mineral supplements					
5	Protein-carbohydrate shakes					
6	Creatine					
7	Sports drinks (e.g., Lucozade, Gatorade)					
8	Energy drinks (e.g., Red Bull, Monster)					
9	Caffeine					
10	Herbal products (e.g., Ginseng)					

ILLINOIS

- Are there any other sport supplements that use on a regular basis? If so, which ones?

- The next 7 questions are about **Performance Enhancing Drugs (PEDs)**.

		Strongly disagree	Disagree	Moderately disagree	Neither agree or disagree	Moderately agree	Agree	Strongly agree
1	I would be tempted to take PEDs if my coach tells me too							
2	I would be more likely to take PEDs if my parents or guardians encouraged me to							
3	I would be tempted to take PEDs, if I knew they would increase my performance							
4	I would be tempted to take PEDs if I had a bad injury							
5	I would be tempted to take PEDs if my coach put pressure on me to do so							

Below are two scenarios where your teammate is making you an offer.

Indicate how likely is it that you would accept your teammates offer using a slide scale from 1 (not at all likely) to 7 (very likely)

Scenario 1: It's the week before the most important competitive game/event of your season. Your opponents are of similar ability to you. Lately, your performance has been below your best. You don't feel you have the necessary fitness for this competition, and you're concerned about how you'll perform. You mention this to a teammate, who tells you that he/she uses a substance to enhance fitness. The substance is prohibited for use in sport according to the rules, but there's only a very small chance you'll be caught.	1 ☐ (not at all likely) 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ (very likely)

Scenario 2: It's two weeks before the most important competitive game/event of your season. Your opponents are of similar ability to you. You really want to take part. However, two months ago, you sustained a knee injury, and you know you need at least one more month of rehabilitation to fully recover. One of your teammates tells you that he/ she has recently used a new substance, which has helped him/her recover faster than usual from a knee injury. The substance is banned for use in sport, but the chance that you will be caught is extremely small.	1 ☐ (not at all likely) 2 ☐ 3 ☐ 4 ☐ 5 ☐ 6 ☐ 7 ☐ (very likely)

ILLINOIS

- These final questions are about your **Religious Faith.**
  Using the scale below indicate the level of agreement (or disagreement) for each statement.

		Strongly disagree	Disagree	Agree	Strongly agree
1	My religious faith is extremely important to me.				
2	I pray daily.				
3	I look to my faith as a source of inspiration.				
4	I look to my faith as providing meaning and purpose in my life.				
5	I consider myself active in my faith or church.				
6	My faith is an important part of who I am as a person.				
7	My relationship with God is extremely important to me.				
8	I enjoy being around others who share my faith.				
9	I look to my faith as a source of comfort.				
10	My faith impacts many of my decisions.				

Thank You so much for doing this questionnaire!

You can now return it and collect your incentive.

If you would like to learn more about anti-doping, the rules that govern your sport, and your rights and responsibilities under the WADA Code, scan this QR Code for a list of websites that may be of interest.

Appendix B: Learning Objectives Alignment

Question	Topic and Learning Objectives for Talent Athletes (TA) and Young Athletes (YA)
1. What is doping? a. Doping is using any substance or method on the list of prohibited substances and methods b. Doping is using equipment which has not been approved c. Doping is fighting during a competition d. Doping is refusing to obey the official	2: Introduction to clean sport and the global anti-doping system • Define doping and anti-doping (TA)
2. Why is doping banned? a. Because it is dangerous for the athlete's health. b. Because it goes against the spirit of sport. c. Because it is against the rules as it unfairly enhances athlete performance. d. All of the above	5: Anti-Doping Rule Violations (ADRVs) • Infer how rules about doping in sport protect athletes and clean sport (TA) 6: Consequences of doping, for example, physical and mental health, social and economic effects, and sanctions • Identify how doping is dangerous to health and goes against the values associated with clean sport (TA) 1: Principles and values associated with clean sport • Define clean sport and what it means to complete in clean sport (TA) 7: Substances and methods on the Prohibited List (List) • Explain why some substances and methods are prohibited in sport (TA) 13: Speaking up to share concerns about doping • Identify behaviors that are unsafe in sport, including doping (TA)
3. How do I know if a substance is permitted or safe to use? a. A substance is safe to use if you bought it in a pharmacy. b. A substance is safe to use if it says "doping-free" on the box. c. A substance is safe to use if it is made of plants. d. A substance is safe to use if it does not contain any substances on the List of Prohibited Substances	7: Substances and methods on the Prohibited List (List) • Identify that some substances and methods are prohibited in sport (TA) 9: Risks of supplement use • List some risks associated with supplement use (TA)

4. How can you tell if nutritional supplements are safe to use? a. All nutritional supplements are safe to use b. You cannot tell if nutritional supplements are safe to use c. If the label says that they are safe d. If the doctor gave it to you	4: The principle of strict liability • Identify situations when athletes take responsibility for their actions (TA) 9: Risks of supplement use • Identify what supplements are and why they may be used (TA) • List some risks associated with supplement use (TA)
5. Can I be tested for doping? a. No, because I am a young athlete b. No, because I do not compete at the Olympic Games c. Yes, any athlete can potentially be tested d. No, because my sport is not a high-risk sport	3: Athletes', Athlete Support Personnel's (ASP's) and other groups' rights and responsibilities under the Code • List some rights and responsibilities associated with clean sport (TA) 10: Testing procedures, including urine, blood and the Athlete Biological Passport (ABP) • Identify who can be tested, when and where (TA)
6. Can my coach or doctor be banned for breaking doping rules? a. No, only athletes can be banned for breaking doping rules b. A coach can be banned but not a doctor c. No, there are no sanctions for doping d. Yes, a coach or doctor can be banned for breaking doping rules	3: Athletes', Athlete Support Personnel's (ASP's) and other groups' rights and responsibilities under the Code • List some rights and responsibilities associated with clean sport (TA) 5: Anti-Doping Rule Violations (ADRVs) • Name one or more rules associated with doping in sport (TA)
7. Who is responsible when a substance is found in an athlete's body? a. The athlete's physician/doctor b. The athlete's coach c. The athlete d. Depends on who gave the athlete the substance	4: The principle of strict liability • Take responsibility for their actions in sport and as it relates to clean sport (TA)
8. Can my coach or someone I choose come with me to the doping control station? a. Yes, your coach or someone you choose can come with you b. Yes, but only if you are a young athlete (under 18 years) c. Only if the Doping Control Officer has asked for a representative to be there	3: Athletes', Athlete Support Personnel's (ASP's) and other groups' rights and responsibilities under the Code • Identify their rights and responsibilities in multiple contexts including sport (YA) • List some rights and responsibilities associated with clean sport (TA)

d. An athlete can never be accompanied to the doping control station	10: Testing procedures, including urine, blood and the Athlete Biological Passport (ABP) • List their rights and responsibilities during the doping control process (TA)
9. Can I refuse to be tested? a. No b. Yes, if I have family commitments c. Yes, if I am too busy d. Yes, if I have school/work obligations	3: Athletes', Athlete Support Personnel's (ASP's) and other groups' rights and responsibilities under the Code • Identify their rights and responsibilities in multiple contexts including sport (YA) • List some rights and responsibilities associated with clean sport (TA) 10: Testing procedures, including urine, blood and the Athlete Biological Passport (ABP) • List their rights and responsibilities during the doping control process (TA) • Identify who can be tested, when and where (TA)
10. Where can I find reliable information about anti-doping? a. International Federations, National Anti-Doping Organizations, The World Anti-Doping Agency b. The Internet c. Muscle or sport magazines d. My friends	2: Introduction to clean sport and the global anti-doping system • Identify where to find anti-doping information including the anti-doping rules (TA) • Identify which organization's anti-doping rules they are subject to (TA) 7: Substances and methods on the Prohibited List (List) • Identify where to find more information about prohibited substances and methods (TA)
11. What if my physician or doctor has to treat me with some medicine? a. The physician/doctor should check if the medicine contains a prohibited substance b. Whatever my physician/doctor gives me, it is safe c. If I test positive from the substance my physician gave me, it is his/her fault d. If it is for medical reasons, I can take whatever is necessary	8: Use of medications and Therapeutic Use Exemptions (TUEs) • Explain when and why medications might be used (YA) • Identify that some medications contain ingredients that are banned in sport (TA) • Describe what to do if they feel unwell and may need medication (TA) 4. Principle of strict liability • Identify the situations when athletes take responsibility for their actions.

12. What are the sanctions (penalties) if I get caught doping? a. There are no sanctions for doping b. There are no sanctions if I am a young athlete c. Penalties can range from a warning to lifetime ban d. Depends on who gave you the substance	6: Consequences of doping, for example, physical and mental health, social and economic effects, and sanctions • Examine consequences of substance use and abuse (TA) 3: Athletes', Athlete Support Personnel's (ASP's) and other groups' rights and responsibilities under the Code • Explain the consequences of forgetting or not complying with responsibilities in multiple contexts, including sports (YA) 5: Anti-Doping Rule Violations (ADRVs) • Analyze the consequences associated with breaking the rules (YA)
13. Who is allowed to perform a doping control? a. A Doping Control Officer who can show identification and proof of authorization from an Anti-Doping Organization b. A coach c. Any doctor d. Police officers	10: Testing procedures, including urine, blood and the Athlete Biological Passport (ABP) • Explain who Chaperones, DCOs and BCOs are and what they do (TA) • List their rights and responsibilities during the doping control process (TA)
14. Whereabouts information is used to: a. notify athletes that they need to report to a Doping Control Officer as soon as they can b. conduct out of competition testing of top elite level athletes c. report the results of doping test d. identify the location of sport events where doping tests will be done	11: Requirements of the Registered Testing Pool (RTP), including whereabouts and the use of ADAMS • Explain how whereabouts protect clean sport (TA)
15. After an athlete gives a sample (blood and/or urine), for how long can it be stored and re-analyzed? a. An indefinite period b. 10 years c. 2 years d. It cannot be stored	12: Results management • Define the results management process (TA)
16. If an athlete tests positive for a banned substance they have the right to: a. request the B sample be analyzed	12: Results management • Define the results management process (TA)

b. attend or to be represented for the opening and analysis of the B sample c. request copies of the laboratory documentation package d. All of the above	
17. How many anti-doping rule violations are there?	5. Anti-Doping Rule Violations (ADRV's) • Name one or more rules associated with doping in sport (TA) 1: Introduction to clean sport and the global anti-doping system • Define doping and anti-doping (TA) .
18. Name as many of the anti-doping rule violations that you can.	5: Anti-Doping Rule Violations (ADRVs) • Name one or more rules associated with doping in sport (TA)
19. The "Spirit of Sport" includes the values that anti-doping programs are founded on. How many value statements are there in WADA's Spirit of Sport?	1: Principles and values associated with clean sport • Name some values, including some associated with sport (YA) • Name and define values associated with clean sport (TA) 5: Anti-Doping Rule Violations (ADRVs) • Name values that are supported by the rules in sport
20. Name as many values or value statements that are part of the Spirit of Sport.	1: Principles and values associated with clean sport • Name and define values associated with clean sport (TA) • Identify values-based behaviors in sport (YA) 5: Anti-Doping Rule Violations (ADRVs) • Name values that are supported by the rules in sport (TA)

Appendix C: Anti-Doping Knowledge Assessment (ADKA)

12-Item ADKA (recommended for youth and talented athletes)

1. What is doping?
- ● a. Doping is using a prohibited substance or method
- ○ b. Doping is using equipment which has not been approved
- ○ c. Doping is fighting during a competition
- ○ d. Doping is refusing to obey the official
- ○ e. Don't know

2. Why is doping banned?
- ○ a. Because it is dangerous for the athlete's health.
- ○ b. Because it goes against the spirit of sport.
- ○ c. Because it is against the rules as it unfairly enhances athlete performance.
- ● d. All of the above
- ○ e. Don't know

3. How do I know if a substance is permitted or safe to use?
- ○ a. A substance is safe to use if you bought it in a pharmacy.
- ○ b. A substance is safe to use if it says "doping-free" on the box.
- ○ c. A substance is safe to use if it is made of plants.
- ● d. A substance is safe to use if it does not contain any substances on the List of Prohibited Substances
- ○ e. Don't know

4. Can I be tested for doping?
- ○ a. Not if you are a young athlete
- ○ b. No, because I do not compete at the Olympics Games
- ● c. Yes, any athlete can potentially be tested
- ○ d. No, because my sport is not a high-risk sport
- ○ e. Don't know

5. Can my coach or doctor be banned for breaking doping rules?
- ○ a. No, only athletes can be banned for breaking doping rules
- ○ b. A coach can be banned but not a doctor
- ○ c. No, there are no penalties for doping
- ● d. Yes, a coach or doctor can be banned for breaking doping rules
- ○ e. Don't know

6. Who is responsible when a substance is found in an athlete's body?
- ○ a. The athlete's physician/doctor
- ○ b. The athlete's coach
- ● c. The athlete
- ○ d. Depends on who gave the athlete the substance
- ○ e. Don't know

7. Can I refuse to be tested?
- ● a. No
- ○ b. Yes, if I have family commitments
- ○ c. Yes, if I am too busy
- ○ d. Yes, if I have school/work obligations
- ○ e. Don't know

8. Where can I find reliable information about anti-doping?
- ◉ a. National Anti-Doping Organizations, The World Anti-Doping Agency
- ○ b. The Internet
- ○ c. Muscle or sport magazines
- ○ d. My friends
- ○ e. Don't know

9. What if my physician or doctor has to treat me with some medicine?
- ◉ a. The physician/doctor should check if the medicine contains a prohibited substance
- ○ b. Whatever my physician/doctor gives me, it is safe
- ○ c. If I test positive from the substance my physician gave me, it is his/her fault
- ○ d. If it is for medical reasons, I can take whatever is necessary
- ○ e. Don't know

10. What are the sanctions (penalties) if I get caught doping?
- ○ a. There are no sanctions for doping
- ○ b. There are no sanctions if you are a young athlete
- ◉ c. Penalties can range from a warning to a lifetime ban
- ○ d. Depends on who gave you the substance
- ○ e. Don't know

11. Who is allowed to perform a doping test?
- ◉ a. A doping control officer
- ○ b. A coach
- ○ c. Any doctor
- ○ d. Police officers
- ○ e. Don't know

12. If an athlete tests positive for a banned substance they have the right to:
- ○ a. request the B sample be analyzed
- ○ b. attend or be represented for the opening and analysis of the B sample
- ○ c. request copies of the laboratory documentation package
- ◉ d. all of the above
- ○ e. don't know

Extended 15-item ADKA (recommended for talented athletes and above)

13. Can my coach or someone I choose, come with me to the doping control station?
- ◉ a. Yes, your coach or someone you choose can come with you
- ○ b. Yes, but only if you are a young athlete (under 18 years)
- ○ c. Only if the doping control officer has asked for a representative to be there
- ○ d. An athlete can never be accompanied to the doping control station
- ○ e. Don't know

14. How can you tell if nutritional supplements are safe to use?
- ○ a. All nutritional supplements are safe to use
- ◉ b. You cannot tell if nutritional supplements are safe to use
- ○ c. If the label says that they are safe
- ○ d. If the doctor gave it to you
- ○ e. Don't know

15. Whereabouts information is used to:

- ○ a. notify athletes that they need to report to a Doping Control Officer as soon as they can
- ◉ b. conduct out of competition testing of top elite level athletes
- ○ c. report the results of doping test
- ○ d. identify the location of sport events where doping tests will be done
- ○ e. Don’t know