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Project Report to WADA

Project Title:

Cultivating clean sport environment with athlete support personnel (ASP): Study on anti-doping knowledge, attitude and practice of ASP and anti-doping educational programme

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Abstract

Background: Athlete support personnel (ASP) work closely with athletes to participate in or prepare for sports competitions. Their involvement in preventing and eliminating doping among athletes is crucial.

Objectives: This study investigated the knowledge, attitude, and practice on doping in sports among ASP from Southeast Asian countries before and after participating an online anti-doping educational programme.

Methods: An anonymized self-administered questionnaire assessing the knowledge, attitude, and practice on doping in sports issues was administered to ASP before and after delivering an online educational programme. Wilcoxon-Signed rank test was performed to test for the differences between pre and post responses.

Results: Overall, 596 respondents from eleven countries participated in the study. The majority were male (67.1%), non-healthcare professionals (89.4%), and retired elite athletes (57.7%). Their knowledge was found to be poor, reflected in a mean score of 16.1±5.4 out of 30. Attitudes towards doping, as measured by the Performance Enhancement Attitude Scale (PEAS) scores, was 18.1±9.4, indicating a negative attitude. While some respondents provided information on medication and supplements use in sports to athletes, only 11.8% reported regular updates on doping in sports topics. Meanwhile, the knowledge and PEAS scores were significantly different between the genders ($p=0.04$; $p=0.02$). The knowledge score was also negatively correlated with the PEAS ($p<0.01$). The intervention was found to enhance the support person' knowledge on doping in sports ($p<0.01$) and increased the deterrence against doping in sports ($p<0.01$).

Conclusion: This study highlights significant knowledge gaps among ASP in Southeast Asia regarding anti-doping practices. Enhancing their knowledge and fostering positive attitudes toward anti-doping efforts can promote a culture of doping-free sports, particularly among the emerging generation of young athletes they support.

Keywords: doping, athlete support personnel, drugs in sports, youth athletes, Southeast Asia

PLAIN SUMMARY

Doping in sports is intentional where athletes purposely ingest or use prohibited substances in sports or inadvertent where athletes accidentally consume food products or supplements adulterated with banned substances received from unreliable sources. This is mostly caused by the poor awareness of the athletes to refer to the proper source of information when taking any substances. Athlete support personnel is the supportive person working with, treating, or assisting an athlete participating in or preparing for sports competition. Just to name a few, supportive staff such as coaches, personal trainers, team physicians, physiotherapists, pharmacists, and nutritionists are important companions that athletes have in their athletic life. They are the ones who provide emotional support, training modules, and even health advice to the athletes. Athletes, especially the young ones, rely greatly on these supporting staff.

With the increasing doping cases among young athletes, the involvement of athlete support personnel to prevent and eliminate doping is crucial. However, past literature had reported that not all the support person had sufficient knowledge of doping-related issues, and they lacked the confidence to fulfil their responsibilities to support anti-doping. Thus, healthcare professionals could play important roles in sports collaborating with anti-doping agencies to ensure correct delivery of information and quality use of medication and supplements in sports. The current project is the first multi-country pre-post educational intervention study in Southeast Asia aiming to engage athlete support personnel working in national sports schools or elite youth programmes in cultivating a clean sports environment among elite youth athletes.

The athlete support personnel from Brunei, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, and Vietnam were invited to participate in the project. The knowledge, attitude, and practice related to doping in sports issues were assessed using a self-administered questionnaire.

A total of 596 support personnel from the countries mentioned had filled in the questionnaire and registered for the online course. Most of them were male (67.1%), with an average age of 38 years old, had a bachelor's degree (57.4%), were non-healthcare professionals (89.4%), and had participated in national or international sports events before as an athlete (57.7%). The majority of the respondents (59.1%) were coaches, followed by sports trainer (9.7%), sports administrator (9.2%), and referees (3.9%). Among the invited countries, Vietnam contributed to the highest number of respondents (28.9%), followed by Indonesia (24.0%) and Philippines (15.6%).

We found that the athlete support personnel were having a poor to moderate level of knowledge of doping in sports issues. Most of the respondents were aware of the definition of doping violations but were unclear of their exact roles as athlete support personnel. As most of the respondents were non-healthcare professionals, their ability to identify the prohibited substances in sports was relatively poor. Nevertheless, the respondents in general had a negative attitude towards doping behaviour. Most of them disagreed that doping is necessary and unavoidable in competitive sports. Besides, the respondents reported that they do encourage athletes to be good role models in anti-doping, but they rarely publicly support anti-doping. Most of the athlete support personnel have experience in advising athletes regarding medication and supplements use in sports, but only 11.8% of them updated regularly on the topics of doping in sports, and only 41.4% attended courses on anti-doping before.

The respondents were then invited to an online anti-doping educational course designed and developed by the researcher team using the healthcare model and the World Anti-Doping Agency International Standard for Education. The online course comprised of four main topics which are 1) overview of anti-doping initiatives; 2) medications and supplements use in sports; and Therapeutic Use Exemption; 3) misuse of prohibited substances in sports and its implications; and 4) detection of prohibited substances. The online course was published in Universiti Kebangsaan Malaysia massive open online course platform. Participants could access the platform via the link provided at anytime and anywhere to complete the course content. Participants need to complete all the published content including pre-recorded lectures, short quizzes, reflective writings, case studies, and forum discussion. After the participants completed all the published materials, they needed to complete a feedback form and post-interventional questionnaire to receive an e-certificate.

From the 596 respondents who participated in the pre-interventional survey, all were provided with the link to participate in the online course. We also received email inquiries to participate from the publicity by NADOs in their respective official pages, summing to 620 pre-registered participants. However, despite these efforts, only 20 ASP accessed the online platform, with merely 12 successfully completing the course. In addition, despite 288 community pharmacists expressing interest in the course and signing up, only 61 logged into the online platform, and a mere 22 completed the course.

Although the publicity of the course reaching 908 ASP and pharmacists, only 81 (8.9%) logged in, and 34 of them (42%) completed the course. Despite the extremely low completion rate, the median knowledge score of the respondents showed a significant increase from 19 to 25 after completing the online course showing that the respondents generally achieved a better score for the knowledge-based questions. Besides, following the intervention, the participants were found to have a lower median PEAS of 16 from the pre-intervention score of 20.

BACKGROUND

Athletes, as they progress in their professional sports career, have the constant desire to improve and win. In their pursue of a successful career in sports, athletes are never doing it alone. They are surrounded by athlete support personnel in their training routines, injury prevention and treatment, and many other daily activities. Athlete support personnel (ASP) is defined by the World Anti-Doping Agency (WADA) as "any coach, trainer, manager, agent, team staff, official, medical, paramedical personnel, parent or any other person working with, treating or assisting an athlete participating in or preparing for sports competition" (WADA 2021a). Apart from supporting the athletes for sports competition with their expertise, ASP are perceived as the most trustful and important person athletes have in their career. As athletes will spend most of their time with ASP, ASP can influence athletes' decision and perception on doping to a certain extent. Coaches were found to be the most important source of information for taking supplements among young athletes in Malaysia (Chiang et al. 2018b). Yukhymenko-Lescroart et al. (2015) discussed on the effect of coach behaviour on athletes' willingness to cheat. The athletes would tend to use prohibited substances if the coach were to verbally persuade them. A study by Kim and Kim (2017) also revealed that approximately 40% of the adolescent athletes in Korea received information on performance-enhancing substances from sources other than the national anti-doping agency.

Despite past literatures highlighting on the potential influence and impact of support person on the athletes' decision, a considerable number of literatures had shown that ASP are actually having insufficient knowledge in the anti-doping topics. Blank et al. (2013) pointed out most of the parents of Austrian junior athletes felt poorly to moderately informed on doping issues and knowledge. Similarly, coaches, physical trainers, and technical staff were reported not knowing the meaning of WADA and the substances listed in the WADA Prohibited List. Although the support person is the closest companion to the athletes in career, they reported a lack of engagement with, or opportunities to engage with formal anti-doping education (Morente-Sanchez & Zabala 2015; Seif et al. 2015). This may lead to lack of confidence for the ASP to discuss and disseminate anti-doping education to the athletes. A recently published systematic review also suggested that coaches had limited knowledge especially on the prohibited substances and the consequences of non-compliance to doping control, but many of them still provide anti-doping advice without referring to the proper references or undergoing formal anti-doping education (Barnes et al. 2022).

In spite of ASP was generally found to have inadequate knowledge on doping substances or sanction for anti-doping rules violation, there is no excuse for them when it comes to their roles against doping. The World Anti-Doping Code (WADC) clearly defines the responsibility of ASP under the Article 21.2 that all support person should be aware of and comply with anti-doping responsibilities, cooperate with athlete testing programme, and use their influence to foster anti-doping attitudes in athletes (WADA 2021a). Previous works in the field had indicated that both the healthcare professional and non-healthcare professional groups were having a negative attitude towards doping in sports (Chiang et al. 2018a; Mazanov et al. 2014; Morente-Sanchez & Zabala 2015). Most of the physicians regarded athletes using banned substances as unethical and they believed healthcare professionals should actively participate in counteracting the phenomenon of doping in sports (Domagała-Rodacka et al. 2018). Majority of the pharmacists also perceived that doping prevention initiatives are important, and they could play a vital role in doping prevention (Ama et al. 2002; Chiang et al. 2018a). Furthermore, most coaches believed they have a major role in promoting anti-doping but some

stated that the priority role they perceived would be maximizing athletes' performance rather than anti-doping (Barnes et al. 2022).

Regarding the doping-related experiences among ASP, previous study demonstrated that some of the ASP claimed knowing someone who had used banned substances, and some had seen people inciting others or being incited to use banned substances (Morente-Sanchez & Zabala 2015). In the context of the incidence of pharmacists meeting a real athlete coming for advice or requesting for medications or supplements, past study had shown that up to 40% of the community pharmacists claimed having experience in dispensing medications or supplements for performance enhancement or body image purposes (Chiang et al. 2018a). As a friendly neighbourhood healthcare provider easily accessible to the public, pharmacists can be a reliable source of information. Some studies reported that almost half of the respondents received doping enquiry from athletes (Ama et al. 2002) while some reported that only minority of them had such experience (Chiang et al. 2018; Laure & Lejeune 2000).

As ASP can be considered as one of the most important components of anti-doping in the athletes' athletic pathway, education and information shall be provided to them. This is particularly important for ASP that work closely with young athletes because attitudes towards doping are formed early (Backhouse et al. 2009). These young athletes may continue their careers as elite athletes or may change their career path to supporting staff such as coaches, trainers, and officials. Thus, investment in education for the ASP working with youth athletes can instil anti-doping values and promote healthy and ethical behaviours among the athletes (WADA 2021b).

Education is one of the most crucial components in anti-doping and athlete's first experience with anti-doping should be through education (WADA 2021a). Theories and models are very useful to plan, implement and evaluate educational interventions. In doping in sports, doping behaviour can be perceived as a health harming behaviour as most of prohibited substances or methods were used at supratherapeutic doses or without proper medical indications. Thus, theories of health behaviour can guide the search for non-compliance to healthy behaviour and provide insight into shaping of an effective way to reach the target population. Among the health behaviour theory, there are several health models that are frequently used by researchers to explain and promote health behaviour. The Health Belief Model (HBM) is one of the most commonly used health models. HBM consists of several concepts that predict why people will take action to prevent, to screen for, or to control illness conditions. Thus, it is specifically useful in disease avoidance, health screening and disease protection (Champion & Skinner 2008). The Health Promotion Model (HPM) denotes that one's health behaviour could be affected by their lifestyles, psychological health, and social and cultural environment. HPM categorizes the factors affecting health behaviours similar to HBM, but it is different from HBM in which it focuses more on self-actualization after the basic needs were met. HPM assumes that one would perform health promoting behaviour based on prior related behaviour, self-efficacy, positive emotions towards the behaviour and other interpersonal influences from the environment (Pender et al. 2015)

Meanwhile, the Theory of Planned Behaviour (TPB) portrays health behaviour as directly reflected by the intention to perform the behaviour. The direct determinants of the behavioural intent are one's attitude towards performing the behaviour and the social norms associated with such behaviour (Montano & Kasprzyk 2008). This theory added on perceived behavioural control to cognitive factors (beliefs and values) that determine motivation (behavioural intention) to further explain behaviours over which people have less volitional

control (Montano & Kasprzyk 2008). Although one was informed on the recommended health behaviour to practise, one may choose not to take immediate action. This is explained by the Transtheoretical Model (TTM) in which the person will consider taking the health actions after they received information. This relies on their position at different stages of changes, namely the precontemplation, contemplation, preparation, action, and maintenance. Although TTM is usually studied among chronic conditions, but it is also used to change exercise behaviours, addiction treatments, and other healthcare behaviours (Prochaska et al. 2008).

Whilst some research has been carried out on anti-doping worldwide, studies carried out in In were limited. Thus, this study aims to employ the KAP survey methodology to advance the understanding of the knowledge, attitude, and practice of ASP among the elite youth athletes in the countries of Southeast Asia on doping. The results from the KAP study can establish a baseline data for future assessments and would be helpful to develop more effective educational activities (Rav-Marathe et al. 2016). With the administration and exposure of educational package to the ASP, it is expected to enhance the capabilities of the ASP in combating doping in sports.

OBJECTIVES

Phase 1: KAP study on athlete support personnel

1. To develop questionnaires for pre- and post-intervention knowledge, attitude and practice studies on awareness and knowledge of doping in sports among athlete support personnel

2. To determine the pre-interventional knowledge, attitude, and practice of doping in sports among athlete support personnel in SEA countries

Phase 2: Educational Intervention - Doping in Sports Massive Open Online Course

1. To conduct an online webinar in which participants will be exposed to anti-doping modules and educational programmes adapted from reference materials from WADA and RADOs

2. To determine the post-interventional knowledge, attitude, and practice of doping in sports among athlete support personnel in SEA countries

METHODS

This was a single arm quasi-experimental pre-post interventional study targeting the ASP from national sports schools or elite youth training programmes in Southeast Asian countries on doping in sports issues. Ethical approval for this study was sought from the Research Ethics Committee, Universiti Kebangsaan Malaysian (UKM PPI/111/8/JEP-2022-405), Education Policy Planning and Research Division of Ministry of Education Malaysia (KPM.600-3/2/3-eras(12752), and Sports, Co-curricular and Arts Division of Ministry of Education Malaysia (KPM.600-2/1/4 Jld. 6 (56).

Invitations to collaborate in the study were emailed to all the Member Country Representative (MCR) from the Southeast Asia Regional Anti-Doping Organisation (SEARADO) member countries including Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, and Vietnam. Upon discussion and online meetings with the MCR, all countries agreed to participate in the study.

From the listed countries, ASP from forty-six sports schools and youth training programme were invited to participate in the study. ASP in this study is defined based on the World Anti-Doping Code (WADC) as "any coach, trainer, manager, agent, team staff, official, medical, paramedical personnel, parent or any other person working with, treating or assisting an athlete participating in or preparing for sports competition" (WADA 2021a). The main targeted sample in this study is the ASP from national sports school that provides official training to the elite youth athletes, which is defined as a school, whether state-funded or private, that concentrates resources on developing sporting talent either within the curriculum and/or through extra-curricular activities (Thompson et al. 2022). However, due to the difference among educational system in each country, other facilities suggested by the MCR were included. These institutions were chosen due to their active participation in national and international sports events or suggested by the MCR of the respective National Anti-Doping Organizations (NADOs). Thus, the respondents recruited should reflect the actual elite sports society. The list of the participating facilities is available in **Appendix 1**.

Phase 1: KAP study on athlete support personnel

The pre-interventional ASP' knowledge, attitude, and practice on doping in sports were determined by using self-administered questionnaire. ASP working in the aforementioned institutions at the duration of study were invited to join the study. This included but not limited to chiropractors, coaches, dietitians, team manager, medical assistant, nursing profession, nutritionists, occupational therapist, pharmacists, physicians, physiotherapists, psychologists, sport administrator, and sports trainers. Academic teachers who are involved in teaching the academic subjects and not directly involved in preparing the athletes for sports competition are not included in the study. The participants were also excluded from the study if they were not able to read or understand English and their native language.

The questionnaire was adapted and adopted from previous literature. The survey comprised of four sections. Section A consists of questions which ask about respondent's basic demographic characteristics including age, gender, educational level, types of sport-related profession and years of practice in current supporting role etc. The specific types of sports that

the ASP provide support was not included in the study as the ASP may provide support across a number of sports and there is a possibility that identifying the sport may provide clue to identification of the individuals.

Section B of the questionnaire asks about the ASP knowledge on doping. The topic area covered in the questionnaire included prohibited substances and methods, roles of WADA and ASP, anti-doping rules violation, official national anti-doping agency, therapeutic-use exemption, and athlete biological passport. The knowledge questions were adapted from the previous literature and was revised based on the updates to the latest WADA Prohibited List 2023 and the WADC (Mazanov et al. 2014; Voravuth et al. 2022; WADA 2022). Section B was also tailored to the respective roles for the healthcare professionals (HCP) and the non-HCP as the depth of the information they need to deliver to the athletes differ. HCP is defined as any medical doctors (both generalist and specialist practitioners), nursing professionals, including public health nurses, midwifery professionals, including public health midwives, dentists, pharmacists, traditional and complementary medicine professionals, paramedical practitioners, dieticians and nutritionists, and physiotherapists (WHO 2013). Assessment of the knowledge was done based on the marks that the respondent obtained. Each correct answer was awarded one mark while wrong answer or answering "Don't know" was given zero mark. Thus, the full marks for this section would be 30 marks if the respondents were able to answer all the items correctly. The respondent's score was graded as good if score ≥84%, moderate if score 61-83% and poor if ≤60% (Auersperger et al. 2012; Voravuth et al. 2022). We have included an explanatory statement at the beginning of the questionnaire that advises the respondents not to refer to any resources when answering the knowledge-based questions.

Section C measures the attitude of ASP on doping by using the performance enhancing attitude scale (PEAS) (Petroczi & Aidman 2009; Folkerts et al. 2021). PEAS consists of a unidimensional and reliable 17-instruments scale measured on a six-point Likert-type scale ranging from strongly disagree (1) to strongly agree (6). The responses were categorized into positive responses (slightly agree to strongly agree) and negative responses (slightly disagree to strongly disagree). The Cronbach' alpha value was found to increase from 0.70 to 0.81 when omitting the statements 9, 13, 14 and 16; and a shorter version of 8-item scale had a good model fit which we employed in our study (Folkerts et al. 2021). In the last section, section D, respondents were asked on their practice and experience on anti-doping activities. This section allowed us to estimate how frequently they received enquiries from young athletes on medication and supplements use in sports, and their past experiences in doping in sports training.

The questionnaire was prepared in English and underwent forward translation to respective language by professional editors and translators from several academic institutions and private translation services, which include the Centre for the Advancement of Language Competence (CALC), Universiti Putra Malaysia; Faculty of Languages and Linguistics, Universiti Malaya; Fish Translation Enterprise; and Translife Group Pte Ltd. The questionnaire was translated into Malay (Malaysia); Indonesia (Indonesia); Lao (Laos); Khmer (Cambodia); Burmese (Myanmar); Tagalog (Philippines); Thai (Thailand), Tetum (Timor-Leste), and Vietnamese (Vietnam). Backward translation was then conducted by the respective NADOs' educational team to ensure the phrase and terms used in the questionnaire was appropriate and suitable in the context of doping in sports. All questionnaires were prepared in bilingual which

were English and the native language to ensure all the respondents were able to understand the questionnaires.

Psychometric evaluations and validation

Prior to the distribution of the questionnaire, it was pre-tested by several validation tests and psychometric evaluations. Content validity test was conducted to ensure the concepts of interest are comprehensively represented by the items in the questionnaire. A total of eight reviewers not involved in developing the questionnaire were invited to review the questionnaire. Academicians with drugs in sports background from the Universiti Kebangsaan Malaysia (UKM), Universiti Kuala Lumpur Royal College of Medicine Perak (UniKL RCMP) and Liverpool John Moores University and representatives from the Anti-Doping Agency of Malaysia, Anti-Doping Agency of Singapore, SEARADO and National Sports Institute of Malaysia were invited as the independent reviewers. A cover letter and the questionnaires were emailed to the invited experts, explaining briefly on the study, along with clear and concise instructions on how to rate each item. To evaluate whether items were relevant, clear, and essential, experts were given a critical appraisal sheet with the following four inquiries: 1) the relevance of each question in the tool; 2) the importance of each question; 3) the clarity of each question; and 4) additional comments or recommendations for improvement of each section. The list of the invited content reviewers is available in **Appendix 2** while the list of the reviewed items was available in **Appendix 3**.

Content validity was presented in Item-Content Validity Index (I-CVI) and Scale-level Content Validity Index (S-CVI). I-CVI is defined as the proportion of content experts giving the item a relevance rating of 3 or 4. It is calculated by dividing the number of reviewers who agreed on the statement over the total number of reviewers. The targeted I-CVI of the study was set as ≥ 0.83 as we have eight invited experts for content validation (Yusoff 2019). A four ordinal Likert scale for degree of relevance was provided with choice of “4” (highly relevant) and “3” (quite relevant) are considered agree with the statement while the choice of “2” (somewhat relevant) and “1” (not relevant) are considered disagree. Scale-level Content Validity Index based on the average method (S-CVI/Ave) is defined as the average of the I-CVI scores for all items on the scale or the average of proportion relevance judged by all experts. The proportion relevant is the average of relevance rating by individual expert. It is calculated by dividing the sum of I-CVI scores over the total number of items in the questionnaire (Yusoff 2019). The relevance ratings on the item scale by eight experts rated on a four-point relevance scale are available in **Appendix 4**. The I-CVI for the questionnaire ranged from 0.88 (7 agreed) to 1.00 (8 agreed) which represents a high content validity of individual items while the S-CVI/Ave for the questionnaire is reported as 0.97 which represents a high overall content validity of the entire survey form. These computed CVIs were considered satisfactory (Yusoff 2019).

Content Validity Ratio (CVR) was applied to quantify the necessity of the items. A four ordinal Likert scale for degree of importance was provided with choice of “4” (essential), “3” (useful but not essential), “2” (provide some information but not essential) and “1” (not essential). CVR varies between 1 and -1. The higher score indicates further agreement of members of panel on the necessity of an item in an instrument. The formula of content validity ratio is $CVR = (Ne - N/2)/(N/2)$, in which the Ne is the number of experts indicating "essential"

and N is the total number of experts. The numeric value of content validity ratio is determined by Lawshe Table (Zamanzadeh et al. 2015; Rodrigues et al. 2017). The importance ratings on the item scale rated on a four-point importance scale are presented in **Appendix 5**. The CVR of the questionnaire ranged from 0.75 (7 agreed) to 1.0 (8 agreed) which represents that most of the panels agreed on the necessity of the item in the questionnaire. Items with CVR lower than 0.75, would be eliminated based on the Lawshe's table for 8-expert panels (Ayre & Scally 2013). Minor grammatical changes were also made based on the reviewers' comments to improve the clarity of the questionnaire without changing the original meaning of the questions. Some questions with complicated or complex structures were simplified to ensure that the respondents can understand well during self-administration of the questionnaire.

After the content validation was completed, a pilot test to study the face validity was carried out on 30 ASP from five sport schools in Malaysia (Yusoff 2019). The mean age of the respondents in the pilot study was 33.4-year-old with standard deviation of 7.15 years. Almost half of them have at least bachelor's degree and were previously national or international athletes. The proportion of HCP and non-HCP in the pilot study was equal, and the respondents had served in their current roles for an average of 7.5 years. The face validity was conducted to evaluate the questionnaire in case it needs to be amended or to eliminate any possible ambiguous questions, to determine whether the questionnaire is balanced in its structure, and to discover whether instructions were properly followed. No major comment was received, thus all of the items were maintained in the questionnaire.

Besides, internal consistency of the questionnaire was measured using reliability analysis. Standard deviation (σ) to measure the dispersion was measured with the expected $\sigma \neq 0$. The α value of the questionnaire was found to be 0.87 which showed an acceptable threshold for reliability (Terwee et al. 2007). For the knowledge section of the questionnaire, item analysis was measured using the item difficulty index. Item difficulty index is defined as the proportion of correct answers on a given item with range of 0.0 to 1.0 (Boateng et al. 2018). The higher is the item difficulty index, the greater proportion of the respondents answer the item correctly, which means the item is easier. Most of the items had their difficulty index fell between 0.2 to 0.8 in which the difficulty level is not easy or too difficult (Sharma 2021). Only one question which asked about the status of insulin as prohibited substance has difficulty index of 0.13, signifying that most of the respondents were not aware of that insulin is actually not allowed to be used in sports.

After the completion of pre-testing, we proceeded with distributing the questionnaire among the ASP in the selected facilities. An estimation of 867 ASP was working at the institutions by respective MCR during the study duration. Hence, a sample size of 267 respondents was required with the assumption of confidence interval of 95% and margin error of 5% (Krejcie & Morgan 1970).

ASP were approached with the help from the representatives of respective NADOs. The ASP were provided with the link to the questionnaire in English and their native language. The link explained about the study and if they agreed to participate, they were asked to provide informed consent and fill in the survey. Participation in the study was voluntary and no incentives were given. Consent form was available on the first page of the survey link before the respondents proceed with the questionnaire and no sign-in was required to ensure anonymity. The link was distributed to the ASP via email or *WhatsApp* by the data collector.

After the end of data collection period, the link was disabled and no other personnel except the researchers would be able to access it. The data collected was recorded in another separate offline document in a password protected computer after being retrieved from *Google Form* and all data in the Google cloud storage was destroyed.

On the other hand, for the institutions which required physical questionnaire, envelopes containing the bilingual questionnaires and informed consent form were distributed to the ASP during outreach programme. The consent form which contains the respondent's information were removed and the data collected in the questionnaire were keyed in an excel file separately to the researcher for data extraction and analysis to ensure the confidentiality of the respondents secured. All the study related documents were stored in a ring file in locked cabinet in the institute and they would be sent for disposal after three years of storage.

Phase 2: Educational Intervention - Doping in Sports Massive Open Online Course

The ASP who answered the questionnaire was invited to a doping in sports online course via the collected email address in *Google Form* or physical questionnaire. The doping in sports online course is a massive open online course (MOOC) developed and designed by referring to the WADA 2021 International Standard for Education (ISE) and the pre-interventional study results.

The main objective of the course is to serve as an upstream intervention to achieve early deterrence on doping behaviours among young athletes by educating ASP from sport schools and youth training facilities. The online course consists of four topics which are: 1) overview of anti-doping initiatives; 2) medications and supplements use in sports; and Therapeutic Use Exemption; 3) misuse of prohibited substances in sports and its implications; and 4) detection of prohibited substances. All the four components as suggested by the WADA ISE were included in the course content which were information provision, anti-doping education, awareness raising, and values-based education (WADA 2021b).

The content includes information on overview of doping and anti-doping agencies, list of doping substances and methods, medical use of these agents, potential detrimental health effects of abusing these substances, providing real-life doping cases and scenario and focus on how the participants as athlete support personnel could help in preventing inadvertent doping. The specific learning objectives for each topic is available in **Appendix 6**. The course offered learning experience through cognitive and affective domain (WADA 2021b). The participants should be able to remember, understand, and apply the knowledge from the online course in their daily routines which fulfils the cognitive domain. Most of the learning outcomes were focusing on ensuring the participants to "understand" the topic as our pre-KAP study indicated that the general knowledge on such topic is poor but had good attitude. Besides, the value-based education embedded within the case studies, forum discussion and reflective writings should encourage participants to commit and express "integrity" and "respect" through their support of anti-doping behaviour (affective domain).

We integrated the Health Promotion Model (HPM) and Transtheoretical Model (TTM) in the course content as we target to promote anti-doping behaviour at individual level by promoting healthy behaviour and deterring doping (unhealthy) behaviour. HPM proposed that one would commit to engage in healthy behaviour that they anticipated to bring benefits or values to them. Positive affect and enhanced self-efficacy could increase the likelihood of commit to and maintain the health-promoting behaviour (Pender et al. 2015). Meanwhile, TTM

proposed that behaviour change occurs in stages from precontemplation to action and maintenance. The person may transit from not intending to act, planning to act with intention, establishing objectives, acting, and maintaining their behaviours. The transition in different stages could be affected by factors such as self-efficacy, decisional balance, and process of change (Hashemzadeh et al. 2019). Thus, the learning activities within each topic were presented and pivoted around these theories.

The lectures in the course were prepared and delivered by speakers from academic institutions, anti-doping agencies, and sports authorities. The invited speakers were from different backgrounds including pharmacists, international doping control officers, nutritionist, former international athlete, and representatives from sports authorities. The online course conducted on the MOOC platform contained various educational materials that the participants need to go through. These included video recordings and lecture notes of the mentioned topics, short quizzes to gauge their self-understanding, case studies published in the forum section to initiate discussions and reflections, and other reading materials such as articles, news reports, bulletins, and video clips. The participants were also required to complete reflective writings at the end of the online course.

Apart from ASP, we decided to expand the education pool to community pharmacists in Malaysia. This is to introduce and engage more healthcare professionals in Malaysia on anti-doping initiatives among athletes. The online course was promoted through the Malaysian Pharmaceutical Society I-bulletin (dated 19th May; 25th May and 2nd June 2023) and social media publicity. Once registered, participants were flexible to login to the MOOC platform to assess the content at their own time. An e-certificate was provided to all the participants that completed the all the activities within the online course. Upon the completion of the online course, participants were provided the similar questionnaire to assess the post-interventional knowledge and attitude, and feedback form to assess the quality of the learning materials, length and relevance of the online course, and their confidence on the education activities.

Data Analysis

Data were analysed using the SPSS software version 23. All categorical demographic data was presented in frequency and percentage. The level of statistical significance for all inferential tests was set at a p-value < 0.05. The distribution of the numerical data in the study was examined using the Kolmogorov-Smirnov test. The distribution of the numerical data in the study was examined using the Kolmogorov-Smirnov test, revealing that the age of the respondents, the year(s) of practice as supportive person, and overall knowledge score were normally distributed ($p>0.05$). For the analysis of relationship between respondents' knowledge score with demographic data, independent t-test tests were used to look for association of knowledge score with gender, health professional status, ex-athlete status while Pearson correlation test was used to associate knowledge score with years of practice as support personnel. Meanwhile, the association between respondents' PEAS score with demographic data and knowledge were examined. Demographic data including gender and status of being an elite athlete were associated with PEAS score using independent t-test. One-way Analysis of Variance (ANOVA) test was used for examining the relationship between knowledge grade and PEAS score. Lastly, to evaluate the relationship between respondents' experience and practice with demographic data, knowledge and attitude, Pearson chi-square test was used for categorical data while independent t-test was used for the relationship between experience with the knowledge score and PEAS score. Wilcoxon-Signed rank test was conducted to examine

the association between pre-interventional and post-interventional knowledge score and PEAS of the respondents.

RESULTS AND FINDINGS

Pre-Interventional KAP study on athlete support personnel

The translated questionnaires were distributed with the help of MCR from respective NADOs to the targeted population. A total of 596 respondents from all the eleven SEARADO member countries including Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, and Vietnam completed the questionnaire over a period of 12 months, between January and December 2023.

Demographic characteristics

The demographic characteristics of the respondents are shown in **Table 1**. Most of the respondents were male (n=400, 67.1%), with mean age of 38.4 years and standard deviation (SD) of 9.4. Most of them held bachelor's degrees (n=342, 57.4%), were non-healthcare professionals (n=533, 89.4%), and had previous experience as athletes participating in national or international sports events (n=344, 57.7%).

The majority of the respondents (n=352, 59.1%) were coaches, followed by sport trainer (n=58, 9.7%), sport administrator (n=55, 9.2%) and referee (n=23, 3.9%). Among the invited countries, Vietnam contributed to the highest number of respondents (n=172, 28.9%), followed by Indonesia (n=143, 24.0%) and Philippines (n=93, 15.6%). On average, respondents had worked in their current role for 9.7 years (SD=7.5).

Table 1: The respondents' demographic characteristics (n=596)

Demographic variables	Number (n)	Percentage (%)
Gender		
Male	400	67.1
Female	196	32.9
Highest education level		
Primary education	2	0.3
Secondary education	71	11.9
Diploma	36	6.0
Bachelor's degree	342	57.4
Master's degree	127	21.3
Doctorate' degree (PhD)	18	3.0
Country currently serving		
Brunei	13	2.2
Cambodia	16	2.7
Indonesia	143	24.0
Laos	12	2.0
Malaysia	26	4.4
Myanmar	34	5.7
Philippines	93	15.6
Singapore	17	2.9
Thailand	62	10.4
Timor-Leste	8	1.3
Vietnam	172	28.9
Professional status		
Chiropractors	0	0
Dietitian	5	0.8
General practitioner/ medical doctor	16	2.7

Medical assistant	1	0.2
Nursing profession	14	2.3
Nutritionist	3	0.5
Occupational therapist	1	0.2
Pharmacist	2	0.3
Physiotherapist	10	1.7
Psychologist	9	1.5
Coach	352	59.1
Manager	18	3.0
Sport administrator	55	9.2
Sport trainer	58	9.7
Others	52	8.7

Knowledge on Doping in Sports

The mean knowledge score for the respondents was reported to be 16.1 (SD=5.4), indicating a poor to moderate level of knowledge related to drugs in sports. The descriptive analysis of the six domains on the respondents' knowledge of doping in sports was summarized in **Table 2**. Most of the respondents knew that anabolic-androgenic steroids (n=302, 50.7%), stimulants (n=332, 55.7%), and morphine (n=325, 54.5%) are prohibited in sports. However, insulin (n=130, 21.8%) and beta-2 agonists (n=164, 27.5%) were lesser known among the respondents. Besides, most of the respondents were able to answer correctly for the descriptions about therapeutic use exemption (n=342, 57.4%) and but most were unsure about what athlete biological passport is (n=310, 52.0%).

Most of the respondents were aware that doping violations include attempted use of a prohibited substance or method by athlete (n=471, 79.0%), attempted administration of a prohibited substance or method to an athlete by an athlete support person (n=397, 66.6%), and failure to submit to sample collection (n=332 55.7%).

Most of the respondents were found to correctly answer the name of their respective NADO in this study (n=349, 58.6%). They were also able to identify the roles of WADA which include coordinating anti-doping activities, maintaining the WADC and the Prohibited List. However, almost half of the respondents were unaware that accreditation and reaccreditation of laboratories for testing procedures were part of WADA roles. In regard to their roles as athlete support personnel, most of the respondents were aware that they need to know and comply with all anti-doping policies and rules, cooperate with the athlete-testing program. Only half of the respondents (n=302, 50.7%), agreed using their influence on athlete values and behaviour to foster anti-doping attitudes is part of their roles as athlete support person.

For the analysis of the relationship between the respondents' knowledge score with demographic data, knowledge score was found to be significant different between gender ($t(595)=-2.03$, $p=0.04$), with females scoring slightly higher (16.6±5.0) than males (15.6±5.4). However, knowledge scores did not significantly differ by professional status ($p=0.47$) or previous athletic experience ($p=0.42$). The knowledge score was also not correlated with their years of experience as athlete support personnel ($p=0.13$).

Table 2: The respondents' knowledge of doping in sports (n = 596)

Domains/ Variables	Correct answer	Number of correct answers, n (%)	Number of wrong answers, n (%)
Knowledge on prohibited substances in sports			
1. The substances classified by the World Anti-Doping Agency (WADA) as prohibited in sports under the WADA Prohibited List 2023 include/ You may want to alert your athletes if they are taking the following substance(s) as they could be prohibited in sports under the WADA Prohibited List 2023:			
(i) Anabolic androgenic steroids (AAS)	True	302 (50.7)	294 (49.3)
(ii) Peptide hormones	True	224 (37.6)	372 (62.4)
(iii) Growth factors	True	210 (35.2)	386 (64.8)
(iv) Beta-2 agonists/ Reliever inhaler for asthma attack	True	164 (27.5)	432 (72.5)
(v) Insulin	True	130 (21.8)	466 (78.2)
(vi) Stimulants	True	332 (55.7)	264 (44.3)
(vii) Diuretics/ Water pills	True	271 (45.5)	325 (54,5)
(viii) Nicotine/ Cigarettes	False	328 (55.0)	268 (45.0)
(ix) Morphine	True	325 (54.5)	271 (45.5)
(x) Beta-blockers/ Medication for high blood pressure	True	180 (30.2)	416 (69.6)
(xi) Caffeine	False	370 (62.1)	226 (37.9)
(xii) Alcohol	False	284 (47.7)	312 (52.3)
2. Some athletes use diuretics as masking agents to hide the presence of other banned substances in their urine/ Some athletes use water pills to increase urine volume to hide the presence of other banned substances in their urine	True	264 (44.3)	332 (55.7)
Knowledge on National Anti-Doping Agency			
1. What is the title of national anti-doping agency in your country?	Answer based on country	349 (58.6)	247 (41.4)
Knowledge on Therapeutic Use Exemption & Athlete Biological Passport			
1. Therapeutic Use Exemption (TUE) allows athletes to use prohibited substances for medical reasons in or out of competition	True	342 (57.4)	254 (42.6)
2. The Athlete Biological Passport (ABP) programme monitors specific parameters in the body to measure the effects of doping without detecting the doping substance or method.	True	286 (48.0)	310 (52.0)

Table 2: The respondents' knowledge of doping in sports (n = 596) *(cont.)*

Domains/ Variables	Correct answer	Number of correct answers, n (%)	Number of wrong answers, n (%)
Knowledge on roles of World Anti-Doping Agency (WADA)			
1. The roles of the World Anti-Doping Agency (WADA) include:			
Coordinating anti-doping activities worldwide	True	463 (77.7)	133 (22.3)
Maintaining the World Anti-Doping Code	True	393 (65.9)	203 (34.1)
Maintaining a list of prohibited substances and methods in sports	True	384 (64.4)	212 (35.6)
Accreditation and reaccreditation of laboratories for sample analysis	True	250 (41.9)	346 (58.1)
Prosecution of doping offenders in sports	False	353 (59.2)	243 (40.8)
Knowledge on definition of doping			
1. Doping violations include:			
Attempted use of a prohibited substance or method by an athlete	True	471 (79.0)	125 (21.0)
Attempted administration of a prohibited substance or method to an athlete by an athlete support person	True	397 (66.6)	199 (33.4)
Acts by an athlete support person to discourage or retaliate against reporting to authorities	True	310 (52.0)	286 (48.0)
Failure of the athlete to submit to sample collection without compelling justification after notification	True	332 (55.7)	264 (44.3)
Possession of a prohibited substance or method by an athlete support person	True	335 (56.2)	261 (43.8)
Knowledge on roles of athlete support personnel			
1. The roles of athlete support person include:			
Being knowledgeable about and to comply with all anti-doping policies and rules	True	521 (87.4)	75 (12.6)
Cooperation with the athlete-testing program	True	412 (69.1)	184 (30.9)
Being responsible for what the athlete eats and use, in the context of anti-doping	False	198 (33.2)	398 (66.8)
Using their influence on athlete values and behaviour to foster anti-doping attitudes	True	302 (50.7)	294 (49.3)

Attitude towards Doping in Sports

The mean score for the performance enhancing attitude scale (PEAS) was 18.1 with SD of 9.4, indicating a negative attitude toward drugs use in sports. **Table 3** summarizes the PEAS in detail. There was a significant difference between the attitude and the knowledge grade ($F(2,593)$, $p=0.01$). Post-hoc analysis revealed was a statistically significant difference for the mean PEAS for participants with moderate knowledge (mean PEAS of 16.94, $p=0.02$) compared to poor knowledge (mean PEAS of 19.29) but not with good knowledge (mean PEAS of 16.39). There was no statistically significant difference of the PEAS between participants with good and moderate knowledge ($p=0.95$). Gender differences were also observed, with males exhibiting significantly higher PEAS scores (19.17±9.85) than females (17.18±8.58, $t(595)=2.41$, $p=0.02$). Attitude did not significantly differ based on previous athletic participation ($p=0.16$) or attendance at anti-doping courses ($p=0.87$). A weak, negative correlation was observed between knowledge and PEAS scores ($r(594)=-0.2$, $p<0.01$).

Table 3: The respondents' attitude towards performance enhancing (n=596)

Variables	Number of respondents with negative attitude (disagree)	Number of respondents with positive attitude (agree)
Doping is necessary to be competitive	462 (81.6%)	134 (22.4%)
Doping is not cheating since everyone does it	512 (85.9%)	84 (14.1%)
Only the quality of performance should matter, not the way athletes achieve it	406 (68.1%)	190 (31.9%)
Athletes should not feel guilty about breaking the rules and taking performance-enhancing drugs	501 (84.1%)	95 (15.9%)
The risks related to doping are exaggerated	451 (75.7%)	145 (24.3%)
Doping is an unavoidable part of the competitive sport	413 (69.3%)	183 (30.7%)
Legalizing performance enhancements would be beneficial for sports	428 (71.8%)	168 (28.2%)
There is no difference between drugs, fiberglass poles and speedy swimsuits that are all used to enhance performance	463 (77.7%)	133 (22.3%)

Practice and Experience in Drugs use in Sports

The current study showed that more than 55% of the respondents had experience of providing information to the athletes about medications and dietary supplements use in sports. However, it is worrying that 45.6% of the respondents claimed that they had counselled athletes about

anti-doping without referring materials from WADA. This study also reported that only 41.4% of the respondents had attended courses on doping in sports and 55.5% of the respondents claimed that they update themselves on the topics of doping in sports but only 11.8% of them do it regularly for at least once a week. **Table 4** summarizes the practice and experience of the respondents on doping issues.

The study had reported no significant difference between the respondents' professional status with their experience in receiving enquiries from the athletes on medication use in sports (p=0.33) and supplements use in sports (p=0.27). Surprisingly, there was no significant association between updating practices on doping topics and knowledge scores (t(595)=0.79, p=0.43). However, attendance at anti-doping courses was associated with higher knowledge scores (16.53±5.50) compared to those who had never attended such courses (15.54±5.04, t(595)=2.28, p=0.02). Besides, the respondents' practice of publicly support anti-doping and practice of promoting the athletes to be good role models are not significantly associated with PEAS (p=0.84; p=0.82).

Table 4: The respondents' experience and practice regarding doping issues (n=596)

Domains/ Variables	Numbers (n)	Percentage (%)
Request for information from athletes		
1. Advised athletes about anti-doping without referring materials from the World Anti-Doping Agency?		
Yes	272	45.6
No	279	46.8
Not relevant	45	7.6
2. Approached by athlete for information about the proper use of medications in sports?		
Yes	326	54.7
No	230	38.6
Not relevant	40	6.7
3. Asked for information about dietary supplements (including sports food and nutritional ergogenic aids) for use in enhancing sports performance?		
Yes	340	57.0
No	256	43.0
Supply of medicines/ supplements/ substances for athletes		
1. Prescribed/dispensed or been asked to purchase any drugs/ supplements/ substances for body slimming/ muscle gain?		
Yes	87	14.6
No	458	76.8
Not relevant	51	8.6
2. Suspected that the medications prescribed/ dispensed/ purchased for an athlete for the treatment of a disease were actually used to improve their sports performance?		
Yes	143	24.0
No	361	60.6
Not relevant	92	15.4
3. Promoted dietary supplement (including sports food and nutritional ergogenic aids) to an athlete?		
Yes	236	39.6
No	360	60.4
Course / Training in doping in sports		

1. Attended any courses/seminars/talks on doping in sports?		
Yes	247	41.4
No	349	58.6
2. Keep updated on the topics of doping in sports?		
Yes	331	55.5
No	265	44.5
3. How often do you update yourself on the topics of doping in sports?		
More than once a week	18	5.5
Once a week	21	6.4
Once a month	118	35.7
Rarely	173	52.4
Stance against doping in sports		
1. Over the past 3 months, have you ever publicly claimed to support anti-doping?		
Yes	254	42.6
No	342	57.4
2. Encouraged athletes to be good role models in anti-doping?		
Yes	492	82.6
No	104	17.4

Phase 2: Post-Interventional study on athlete support personnel

From the 596 respondents who participated in the pre-interventional survey, all were provided with the link to participate in the online course. We also received email inquiries to participate from the publicity by NADOs in their respective official pages, summing to 620 pre-registered participants. However, despite these efforts, only 20 ASP accessed the online platform, with merely 12 successfully completing the course. In addition, despite 288 community pharmacists expressing interest in the course and signing up, only 61 logged into the online platform, and a mere 22 completed the course. Although the publicity of the course reaching 908 ASP and pharmacists, only 81 (8.9%) logged in, and 34 of them (42%) completed the course.

Despite the extremely low completion rate, the median knowledge score of the respondents showed a significant increase from 19 to 25 after completing the online course ($p<0.01$) showing that the respondents generally achieved a better score for the knowledge-based questions. Besides, following the intervention, the participants were found to have a lower median PEAS of 16 from the pre-intervention score of 20 ($p=0.02$). A summary of participant feedback is provided in **Appendix 7** highlighting the perceived effectiveness and value of the intervention despite the challenges encountered in achieving higher completion rates.

DISCUSSION

This is the first multi-country study that extends our understanding of the athlete support personnel working with youth athletes from Southeast Asian countries on their current knowledge, attitude, and experiences related to doping in sports, and the effect of an online educational intervention.

The current study revealed that most of the respondents were able to identify anabolic-androgenic steroids (AAS) and stimulants as prohibited substances in sports. This is consistent with previous studies that reported that AAS and stimulants were easily recognized as prohibited in sports (Mazanov et al. 2014; Kaoche et al. 2020). These substances were largely abused by athletes and the anti-doping testing figures report published by WADA also showed that these substances made up almost half of the adverse analytical findings reported (WADA 2023). On the other hand, caffeine was identified correctly by most of the respondents as non-prohibited. This is because caffeine, which is present in coffee, tea, caffeinated soda, energy drinks, and isolated nutrition supplements, is widely used by athletes as an ergogenic aid to improve endurance, muscle velocity, and strength (Guest et al. 2021). After the prohibited status of caffeine was lifted by WADA in 2004, caffeine was found in more than 70% of the urine samples collected after competitions from 2004 to 2015, proving its prominent use and popularity among athletes (Aguilar-Navarro et al. 2019).

Nevertheless, insulin, beta-blockers (or medications for high blood pressure), and beta-2 agonists (or medications for asthma) were not identified by most of the respondents in our study as prohibited or potentially prohibited substances in sports. This could be due to the perception of the respondents that these medications for the treatment of chronic conditions are not banned in sports. For instance, insulin is normally used by diabetic patients to treat high sugar levels, but it could be misused by bodybuilders and weightlifters to suppress proteolysis and increase protein synthesis for faster muscle gain (Evans & Lynch 2003). Meanwhile, beta-blockers are prohibited in competition for certain sports only, such as archery, automobile, golf, shooting, etc (WADA 2022) and less than 1% of doping tests were positive for beta-blockers, suggesting infrequent misused by athletes (WADA 2023). Although beta-2 agonists are prohibited, there are a few exceptions to the commonly prescribed inhalers including salbutamol, formoterol, and salmeterol (WADA 2022). Therefore, the respondents in our study who were mainly non-healthcare professionals might have lesser awareness of the status of prohibition of these substances. Taken together, these results implied that most ASP in our region were able to point out most of the well-known prohibited substances but were not conversant with the potential anti-doping rule violations associated with routinely prescribed medications.

Besides, the study extends our knowledge of the familiarity of the ASP on the definition of anti-doping rule violations (ADRVs). Most of the respondents in this study were aware of what constitutes ADRVs, except for possession of prohibited substances or methods by an ASP and discouraging or retaliating against the reporting to authorities. Comparing the rates of correct answers for different domains of knowledge sections in our study, the respondents were able to score better for the ADRVs questions but performed poorly for the doping substances. This could be related to the occupations of the respondents in our study, which were mainly coaches, who are more familiar with the doping violation rules and regulations but are less familiar with the doping substances. Past systematic review on coaches also summarized that coaches were typically more familiar with general doping rules and regulations but were less

knowledgeable when it comes to banned substances and biological passports (Barnes et al. 2022).

Furthermore, this study highlighted that most of the respondents were aware of the roles of WADA and were familiar with the NADO in their own countries. This could be attributed to the respondents being recruited in this study were mainly from international academic institutions or sports schools and they were more likely to have experience with the NADO. Even though some of the NADOs such as the Lao-National Anti-Doping Organisation and Indonesia Anti-Doping Organisation were recently established within the past five years, the effort of the national organisations led by SEARADO to promote anti-doping was deemed a great success when most of the ASP were able to identify the respective NADO correctly. The familiarity of the ASP with their respective NADOs is essential as they can always refer to their NADOs if they have any doubts or uncertainties related to anti-doping.

On the other hand, our study also showed that the respondents were not well-informed on their roles as athlete support personnel, especially since they were not aware of their responsibilities to foster anti-doping attitudes among the athletes. They, instead, were having the thoughts that they were responsible for what the athletes eat and use, which is actually the athlete's responsibility. The lack of awareness of their potential roles in promoting anti-doping attitudes among athletes is common among the ASP, especially the coaches, as they do not prioritize anti-doping education in their routine with the athletes compared to training which was regarded as more relevant in preparation for competitions (Mazanov et al. 2014; Barnes et al. 2022).

Our study evaluated the relationship of the respondent's socio-demographic information with their knowledge score. Previous literature suggested that the level of knowledge among the ASP appeared to be related to several factors including gender, age, experience, and professional roles. Nonetheless, our study found no difference in the knowledge score for the HCP and the non-HCP. This is contrary to the previous finding by Mazanov et al. (2014) that HCP (sports physicians) had significantly better knowledge when compared to non-HCP (family members, sports trainers). This could be accounted for the difference between the types of HCP recruited in our study, which mainly consisted of general practitioners, nurses, physiotherapists, and psychologists. Thus, the specific knowledge related to doping in sports is not commensurable with the sports physicians who are specially trained in sports medicine. Apart from that, we discovered that the knowledge score of our respondents is associated with gender. This contradicts past findings where male parents were found to have significantly better knowledge about doping and its side effects than their female counterparts (Blank et al. 2013). However, there was no significant level of difference between the knowledge of drugs in sports with years of practice and their previous status as national or international athletes. This contradicts the past literature which reported that more experienced and older coaches have better knowledge than younger ones (Mandic et al. 2013).

In spite of the insufficient knowledge, it is reassuring that the attitudes of the ASP towards doping in our study were negative and refused. A past meta-analytical review examining on the predictors of doping intentions, susceptibility, and behaviour pointed out that doping attitudes were a significant predictor for doping susceptibility and behaviour (Blank et al. 2016). Hence, it is essential to look into each statement from the PEAS carefully. Among the eight statements about a positive, lenient, and permissible attitude toward doping, some of the respondents in our study seem to agree that the quality of performance matter more than the way athletes achieve, and doping is an unavoidable part of the competitive sport.

Interestingly, both of these statements associate doping in sports with the demands of competitive sports itself, indicating a more permissive attitude towards doping among top-tier athletes (Folkerts et al. 2021). We proposed it is plausible that the respondents felt doping could be more prevalent among elite athletes as most of the doping cases were reported among elite athletes.

As our respondents are ASP serving young athletes, their attitudes may influence the decisions of the young athletes. It is evident from previous behavioural studies that pressure and extremely high expectations from the coaches and parents would lead young athletes to favour health-harming behaviours, including doping (Blank et al. 2013; Nicholls et al. 2017). A possible explanation for this may be the parents and coaches, who are considered the superiors within the sports team hierarchy, were presumed by the younger athletes as the most trusted source of information and the most important decision-makers in their athletic journey (Kristensen et al. 2022). In addition, if the coaching climate and the team environment were generally pro-doping and more lenient towards the use of performance enhancement, young athletes may wind up justifying that use of performance-enhancing substances (including doping agents) is acceptable, and they would need to dope to compete in a "level playing" field (Kristensen et al. 2022).

Besides, we found that if the ASP were more knowledgeable about doping in sports, they would have a more negative attitude towards doping in sports. Contrary to expectations, this study did not find a significant difference between their attitude toward performance enhancement and their previous participation in sports as athletes. Blank et al. (2013) reported that parents who had pursued their sporting careers in the past had a significant difference in their attitudes towards doping compared to those who had not had a competitive sports career. As they had experienced the realities of doping during their competitive athletic journey, their acceptance of the doping phenomenon may have been different. Finally, the difference reported between the genders on doping attitude mirrored the past study conducted by Alaranta et al. (2006), indicating that male respondents may have a more permissive attitude toward the use of doping agents.

The practice of the ASP with regard to anti-doping activities accords with our earlier observations on the negative attitudes. Most of the respondents claimed they encouraged the athletes to be good role models in anti-doping, but rarely publicly claimed to support anti-doping. This may be a good opportunity for the NADOs to engage the ASP in social media campaigns to create anti-doping awareness. This can be explicitly effective for the ASP working with young athletes as younger generations are more likely to engage in social media websites and applications, and the anti-doping social norms and key messages can be reinforced (Fischer & Birren 2023).

On the other hand, approximately half of the respondents have had experience of being approached by athletes asking for information about medication and supplements use in sports. Some of the respondents even admitted advising the athletes without referring to the information from the official anti-doping agency. This is in line with the previous study by Mazanov et al. (2014) that some of the ASP were willing to overlook some practices even if they were aware they were not professionally trained and had limited knowledge to be the primary source of information on anti-doping and supplements use in sports. Our study also reported that only a small number of the respondents had attended courses on doping in sports. A systematic review by Barnes et al. (2022) on coaches had reported that most of the coaches never engaged in formal anti-doping education before, but more relied on self-education from

internet resources or past experiences. This is worrying as the information provided by the untrained ASP may be incorrect and even lead to inadvertent use of prohibited substances if not given careful attention.

Moreover, most of the ASP in our study rarely keep themselves updated on the topics of doping in sports. This was further substantiated by the low participation rate and completion rate of the online interventional education programme. As joining the education programme was voluntary, it is probable that, without institutional support and the lack of interest, ASP would prioritize other activities in the context of a busy schedule. This is congruent with past literature where doping issues were normally given the lowest priority by the athletes and support personnel (Patterson et al. 2023). Most of the ASP were also occupied with the preparation for multiple major games which were rescheduled to 2023 due to the outbreak of the Coronavirus disease pandemic and isolation and travel restrictions.

Notwithstanding the low participation rate, the inadequacy related to anti-doping awareness we found in the pre-intervention study pointed to the potential gaps of which anti-doping agencies could take note of. Although the ASP in our study were mainly non-HCP, who did not require extensive understanding of prohibited substances in sports, knowledge was suggested as a protective factor against doping in sports (Blank et al. 2016; Blank et al. 2021). The WADC obligates all ASP to be knowledgeable of and comply with anti-doping policies and rules, as ignorance and poor awareness could lead to unintentional doping rule violations (WADA 2021a). Therefore, we administered the educational materials with the learning objectives focusing on remembering, understanding, and applying the knowledge in their daily routines. This was achieved by quizzes (remembering and understanding), and case studies and reflective writing (applying knowledge), designed based on the revised Bloom's taxonomy of cognitive learning. As most of the ASP recruited had minimal experience in anti-doping education, we believe that early exposure to even the lower level of the taxonomy is helpful to build foundations for future trainings by the NADOs. It is also evident that the incremental learning process is useful to promote critical thinking and problem-solving skills, which could be beneficial for the ASP to deal with different groups of athletes (Nkhoma et al. 2017).

Apart from the need to improve the knowledge of ASP, specifically on the prohibited substances in sports, the direction of education should focus on inculcating values and emphasizing their indispensable roles in anti-doping. We attained the affective domain via value-based education and health behaviour model embedded within the case studies, forum discussion and reflective writings. The HPM and TTM were chosen as we target to promote anti-doping behaviour at individual level by promoting healthy behaviour and deterring doping (unhealthy) behaviour. We utilized the elements of change process in both the models, incorporating a commitment to a plan of action and preparation for the anti-doping behaviour (Pender et al. 2015; Hashemzadeh et al. 2019). The case scenarios were designed for the ASP to envision the emotions felt by the athletes in difficult situations, to be more empathy with the athletes, and reinforced on their roles as ASP. Positive affect and enhanced self-efficacy would potentially cultivate and maintain the health-promoting behaviour (Pender et al. 2015). From our report, we also could observe improvement of the attitudes towards doping, which was considered a good start for anti-doping behaviour.

Based on the classification of the TTM, we presumed that most of the ASP that were willing to answer the questionnaire and participated in the online educational programme were at least at the contemplation or preparation of change phase. They were at a point where they intend to take action to learn more about the behaviour, but still in the process of balancing the

pros and cons associated with the behaviour. Information provision which could help to increase anti-doping awareness, along with self-re-evaluation with reflection, could be the most appropriate approach for our respondents. Anti-doping agency should subsequently engage their ASP with action-oriented anti-doping programme to promote their anti-doping behaviour more significantly, encouraging the uptake and consistency of the behaviour.

Due to the nature of the current study involving multiple countries across the region, the educational intervention was designed to be online in the form of massive open online course. E-learning or digital learning via online platform has the benefit of reaching more participants regardless of the geographical constraints, allowing the participants to conveniently access to the course at any time or anywhere, and the administrators could monitor the progress of the respondents and evaluate the educational programme. Besides, the current course could also be stopped and resumed at any time, avoiding information overwhelming. Unfortunately, as the online learning course is voluntary, independent learning is very important. If the participants were lacking interest and motivation to finish the course, then the interventional effect of the course might be impeded. We are also aware that accessibility issues with limited access to information technology or poor internet connections might be a limiting factor in some of the developing countries in our study to complete the course.

Limitations

A number of important limitations need to be considered in the current study. First are the various and poor response rates from the participating countries, with estimation by each NADO to be approximately 10 to 50% from the respective population. Besides, although the sample collected was nationally representative of the ASP working with the youth athletes, but it would tend to miss people who were ignorant about their roles in anti-doping and refused to participate even in the questionnaire. It is unfortunate that the study did not include parents of the youth athletes. They can be one of the most influential ASP that can influence the youth athletes, but due to time and resources constraints, language barriers, and digital constraints, we decided not to include them in our study.

Another limitation that we would like to acknowledge is that the self-administered questionnaire depends on the accuracy of self-reporting. Even the anonymity was assured, respondents may try to answer in a way they believe society wants them to, especially with respect to attitudes. Despite the socially desirable bias could be reduced by not directly observing our respondents while filling in the questionnaire, the ASP might look up references when answering the knowledge section, even the explanatory statement clearly indicates that the respondents should answer the knowledge-based questions honestly without referring to any resources. Thus, the knowledge scores and attitudes might be overestimated. Finally, as the educational intervention was designed using the HPM and TTM, which are both individual-level health theories, the intervention may not be able to deter doping phenomenon at a higher level (interpersonal and ecological level).

Recommendations & Implications of Future Study

The study gives an empirical basis to understand the potential knowledge gaps of the ASP from the Southeast Asian region on anti-doping, and their attitudes and experiences related to anti-doping. The study implied that the improvement of poor to moderate knowledge level and attitude of the ASP on anti-doping could promote and bolster the values of doping-free sports among the young athletes under their care. The cognitive and affective approach to anti-doping

learning should be considered by the NADOs as the core concept when administering anti-doping education as critical thinking and problem-based learning is effective in shaping and cultivating anti-doping behaviour.

As parents were not included in the current study, future study could aim to fill the research gap to determine the KAP of the parents. Besides, anti-doping agencies may organize outreach programme during sports competition or school sports as an opportunity for parents to attend and learn about anti-doping. With the increasing emphasis on anti-doping as part of the induction packages for ASP, it is easier and more acceptable for the ASP to talk about anti-doping with the younger athletes. As we observed a lack of self-initiative among the ASP on anti-doping education, relevant authorities could develop policy to ensure that all the ASP from the school level to have mandatory anti-doping course to build an understanding of anti-doping ideology and administration among ASP. The low self-completion rates also highlight the challenges encountered in engaging participants in online educational initiatives and underscore the need for further exploration of strategies to enhance participation and completion rates in similar interventions.

ACKNOWLEDGEMENT

This project has been funded and supported by of the World Anti-Doping Agency as part of its Social Science Research Grant Program. We are grateful to the Research Ethics Committee, Universiti Kebangsaan Malaysia (UKM PPI/111/8/JEP-2022-405), Education Policy Planning and Research Division of Ministry of Education Malaysia (KPM.600-3/2/3-eras(12752), and Sports, Co-curricular and Arts Division of Ministry of Education Malaysia (KPM.600-2/1/4 Jld. 6 (56) for approving and supporting our study.

We would like to extend our sincere appreciation to representatives from Southeast Asia Regional Anti-Doping Organization (SEARADO), Brunei Darussalam Anti-Doping Committee (BDADC), Cambodia Anti-Doping Agency (CADA), Indonesia Anti-Doping Organisation (IADO), Lao National Anti-Doping Organisation (Lao-NADO), Anti-Doping Agency of Malaysia (ADAMAS), Myanmar Anti-Doping Organisation (MADO), Philippine National Anti-Doping Organisation (Phi-NADO), Anti-Doping Singapore (ADS), Doping Control Agency of Thailand (DCAT), Timor-Leste National Anti-Doping Organisation (Timor-leste NADO), Vietnam Anti-Doping Centre (VADC), and all the respondent who participated in our study.

Finally, we would like to express our gratitude to all the reviewers involved in reviewing the data collection form and the statistician from the Biostatistics Research Consultation Clinic, National Institute of Health Malaysia, for their invaluable help, guidance, and support throughout the project.

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Appendix 1: List of participating schools or institutions or associations

Brunei 1. Brunei Darussalam Sports School 2. Majlis Sukan Sekolah-Sekolah Brunei Darussalam 3. Unit Kejurulatihan dan Pembangunan Sukan Brunei 4. Sports Medicine and Research Centre, Bandar Seri Begawan	**Philippines** 1. National Academy of Sports Philippines 2. University Athletic Association of the Philippines 3. Philippines National Collegiate Athletic Association 4. Junior teams of the Philippine Sports Commission (PSC)
Cambodia 1. Cambodia National Sports Federation	**Singapore** 1. Sports Academy at the Singapore Sports School 2. Singapore Sport Institute 3. National Youth Sports Institute
Indonesia 1. Central Java Province	**Thailand** 1. Thailand Kurash Association

2. East Java Province 3. West Java Province 4. Special Capital Region of Jakarta Province 5. South Sumatra Province *ASP representing each province were invited to join during outreach programmes	2. Thai Rugby Union 3. Taekwondo Association of Thailand 4. Region I, II from Zone I, East Thailand 5. Region I from Zone II, Central and West Thailand 6. Region III from Zone III, Northeast Thailand
Laos 1. Institute of Sports Department Laos 2. Sports Science Department Laos 3. Sports Talent School Laos 4. National Sport Federation	**Timor-Leste** 1. Saint Peter High School, Dili 2. National Volleyball Federation 3. National Taekwondo Federation
Malaysia 1. Sekolah Sukan Bukit Jalil 2. Sekolah Sukan Tunku Mahkota Ismail 3. Sekolah Sukan Malaysia Terengganu 4. Sekolah Sukan Malaysia Pahang 5. Sekolah Sukan Malaysia Sabah	**Vietnam** 1. Vietnam Tennis Federation 2. Vietnam Athletics Federation 3. Vietnam Football Federation
Myanmar 1. Institute of Sports and Physical Education (ISPE) Yangon 2. ISPE Mandalay 3. ISPE Malamyine 4. ISPE Taunggyi 5. ISPE Loikaw 6. ISPE Monywa 7. Sports and Physical Education Department 8. Competition and Training Department	

Appendix 2: List of Invited Content Reviewers

1. Dr. Enrico Magosso (Universiti Kuala Lumpur Royal College of Medicine Perak)

2. Dr. Mohd Kaisan bin Mahadi (Universiti Kebangsaan Malaysia)

3. Dr. Shamin Mohd Saffian (Universiti Kebangsaan Malaysia)

4. Mr. Nishel Kumar Silvaraja (National Sports Institute of Malaysia)

5. Prof. Dr. David Mottram (Liverpool John Moores University/ International Olympic Committee)

6. Mr. Nor Safwan Hadi bin Nor Afendi (Universiti Kuala Lumpur Royal College of Medicine Perak)

7. Ms. Merey Tan (Anti-Doping Agency of Singapore)

8. Assoc. Prof. Dr. Farrah-Hani Imran (Education Committee, Anti-Doping Agency of Malaysia)

Appendix 3: List of Items for Content Validation of Survey Form

SECTION B: KNOWLEDGE OF DOPING IN SPORTS (HEALTHCARE PROFESSIONALS)

PART 1: Knowledge on WADA Prohibited List

Q1. The substances classified by the World Anti-Doping Agency (WADA) as prohibited in sports under the WADA Prohibited List 2023 include:

Item 1: Anabolic androgenic steroids (AAS)
Item 2: Peptide hormones
Item 3: Growth factors
Item 4: Beta-2 agonists
Item 5: Insulin
Item 6: Stimulants
Item 7: Diuretics/ water pills
Item 8: Nicotine
Item 9: Morphine
Item 10: Beta-blockers
Item 11: Caffeine
Item 12: Alcohol

Q4/ Item 13: Some athletes use diuretics as masking agents to hide the presence of other banned substances in their urine.

PART 2: Knowledge on roles of WADA

Q2: The roles of the World Anti-Doping Agency (WADA) include:

Item 14: Coordinating anti-doping activities worldwide
Item 15: Maintaining the World Anti-Doping Code
Item 16: Maintaining a list of prohibited substances and methods in sports
Item 17: Accreditation and reaccreditation of laboratories for sample analysis
Item 18: Prosecution of doping offenders in sports

PART 3: Knowledge on definition of doping

Q3: Doping violations include:

Item 19: Attempted use of a prohibited substance or method by an athlete
Item 20: Attempted administration of a prohibited substance or method to an athlete by an athlete support person
Item 21: Acts by an athlete support person to discourage or retaliate against reporting to authorities
Item 22: Failure of the athlete to submit to sample collection without compelling justification after notification
Item 23: Possession of a prohibited substance or method by an athlete support person

PART 4: Knowledge on roles of athlete support personnel

Q7: The roles of athlete support person include:

Item 24: Being knowledgeable about and to comply with all anti-doping policies and rules
Item 25: Cooperation with the athlete-testing program
Item 26: Being responsible for what the athlete eats and use, in the context of anti-doping
Item 27: Using their influence on athlete values and behaviour to foster anti-doping attitudes

PART 5: Knowledge on Therapeutic Use Exemption and athlete biological passport

Q5/ Item 28: Therapeutic Use Exemption (TUE) allows athletes to use prohibited substances for medical reasons in or out of competition

Q6/ Item 29: The Athlete Biological Passport (ABP) programme monitors specific parameters in the body to measure the effects of doping without detecting the doping substance or method

PART 6: Knowledge on National Anti-Doping Agency

Q8/ Item 30: What is the title of national anti-doping agency in your country?

SECTION B: KNOWLEDGE OF DOPING IN SPORTS (NON-HEALTHCARE PROFESSIONALS)

PART 1: Knowledge on WADA Prohibited List

Q1. You may want to alert your athletes if they are taking the following substance(s) as they could be prohibited in sports under the World Anti-Doping Agency (WADA) Prohibited List 2023:

Item 1: Anabolic androgenic steroids (AAS)
Item 2: Peptide hormones
Item 3: Growth factors
Item 4: Reliever inhaler for asthma attack
Item 5: Insulin
Item 6: Stimulants
Item 7: Diuretics/ Water Pills
Item 8: Cigarettes
Item 9: Morphine
Item 10: Medication for high blood pressure
Item 11: Caffeine
Item 12: Alcohol

Q4/ Item 13: Some athletes use water pills to increase urine volume to hide the presence of other banned substances in their urine.

PART 2: Knowledge on roles of WADA

Q2: The roles of the World Anti-Doping Agency (WADA) include:

Item 14: Coordinating anti-doping activities worldwide
Item 15: Maintaining the World Anti-Doping Code
Item 16: Maintaining a list of prohibited substances and methods in sports
Item 17: Accreditation and reaccreditation of laboratories for sample analysis
Item 18: Prosecution of doping offenders in sports

PART 3: Knowledge on definition of doping

Q3: Doping violations include:

Item 19: Attempted use of a prohibited substance or method by an athlete
Item 20: Attempted administration of a prohibited substance or method to an athlete by an athlete support person
Item 21: Acts by an athlete support person to discourage or retaliate against reporting to authorities
Item 22: Failure of the athlete to submit to sample collection without compelling justification after notification
Item 23: Possession of a prohibited substance or method by an athlete support person

PART 4: Knowledge on roles of athlete support personnel

Q7: The roles of athlete support person include:

Item 24: Being knowledgeable about and to comply with all anti-doping policies and rules
Item 25: Cooperation with the athlete-testing program
Item 26: Being responsible for what the athlete eats and use, in the context of anti-doping
Item 27: Using their influence on athlete values and behaviour to foster anti-doping attitudes

PART 5: Knowledge on Therapeutic Use Exemption and athlete biological passport

Q5/ Item 28: Therapeutic Use Exemption (TUE) allows athletes to use prohibited substances for medical reasons in or out of competition

Q6/ Item 29: The Athlete Biological Passport (ABP) programme monitors specific parameters in the body to measure the effects of doping without detecting the doping substance or method.

PART 6: Knowledge on National Anti-Doping Agency

Q8/ Item 30: What is the title of national anti-doping agency in your country?

SECTION D: PRACTICE AND EXPERIENCE ON DEALING WITH DOPING IN SPORTS ISSUES

PART 1: Request for information from athletes

Q1/ Item 1: Have you ever advised athletes about anti-doping without referring materials from the World Anti-Doping Agency?

Q3/ Item 2: In your practice, have you been approached by athlete for information about the proper use of medications in sports?

Q5/ Item 3: In your practice, have you been asked for information about dietary supplements (including sports food and nutritional ergogenic aids) for use in enhancing sports performance?

PART 2: Supply of medicines/ supplements/ substances for athletes

Q2/ Item 4: Have you ever prescribed/dispensed or been asked to purchase any drugs/supplements/substances for body slimming/ muscle gain?

Q4/ Item 5: Have you ever suspected that the medications you prescribed/ dispensed/ purchased for an athlete for the treatment of a disease were actually used by them to improve their sports performance?

Q6/ Item 6: Have you ever promoted dietary supplement (including sports food and nutritional ergogenic aids) to an athlete?

PART 3: Course / Training in doping in sports

Q9/ Item 7: Have you attended any courses/seminars/talks on doping in sports?

Q11/ Item 8: Do you keep yourself updated on the topics of doping in sports?

PART 4: Stance against doping in sports

Q7/ Item 9: Over the past 3 months, have you ever publicly claimed to support anti-doping?

Q8/ Item 10: Have you ever encouraged athletes to be good role models in anti-doping?

Appendix 4: The relevance ratings on the item scale by eight experts: Items rated on 4-Point Relevance Scale

Section B: Knowledge on doping in sports for healthcare professionals (HCP)										
Item	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Expert 5**	**Expert 6**	**Expert 7**	**Expert 8**	**Experts in Agreement**	**Item-CVI**
1	√	√	√	√	√	√	√	√	**8**	**1**
2	√	√	√	√	√	√	√	√	**8**	**1**
3	√	√	√	√	√	√	√	√	**8**	**1**
4	√	√	√	√	√	√	√	√	**8**	**1**
5	√	√	√	√	√	√	√	√	**8**	**1**
6	√	√	√	√	√	√	√	√	**8**	**1**
7	√	√	√	√	√	√	√	√	**8**	**1**
8	√	√	√	√	√	√	√	√	**8**	**1**
9	√	√	√	√	√	√	√	√	**8**	**1**
10	√	√	√	√	√	√	√	√	**8**	**1**
11	√	√	√	√	√	√	√	√	**8**	**1**
12	√	√	√	√	√	√	√	√	**8**	**1**
13	√	√	√	√	√	√	√	√	**8**	**1**
14	√	√	√	√	√	√	√	√	**8**	**1**
15	√	√	√	√	√	√	√	√	**8**	**1**
16	√	√	√	√	√	√	√	√	**8**	**1**
17	√	√	√	√	√	√	√	√	**8**	**1**
18	√	√	√	√	√	√	√	√	**8**	**1**
19	√	√	√	√	√	√	√	√	**8**	**1**
20	√	√	√	√	√	√	√	√	**8**	**1**
21	√	√	√	√	√	√	√	√	**8**	**1**
22	√	√	√	√	√	√	√	√	**8**	**1**
23	√	√	√	√	√	√	√	√	**8**	**1**
24	√	√	√	√	√	√	√	√	**8**	**1**
25	√	√	√	√	√	√	√	√	**8**	**1**
26	√	√	√	√	√	**X**	√	√	**7**	**0.88**
27	√	√	√	√	√	**X**	√	√	**7**	**0.88**
28	√	√	√	√	√	√	√	√	**8**	**1**
29	√	√	√	√	√	√	√	√	**8**	**1**
30	√	√	√	√	√	√	√	√	**8**	**1**

1: quite relevant/highly relevant; 0: not relevant/somewhat relevant

The relevance ratings on the item scale by eight experts: Items rated on 4-Point Relevance Scale

Section B: Knowledge on doping in sports for healthcare professionals (non-HCP)										
Item	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Expert 5**	**Expert 6**	**Expert 7**	**Expert 8**	**Experts in Agreement**	**Item-CVI**
1	√	√	√	√	**X**	√	√	√	**7**	**0.88**
2	√	√	√	√	**X**	√	√	√	**7**	**0.88**
3	√	√	√	√	**X**	√	√	√	**7**	**0.88**
4	√	√	√	√	**X**	√	√	√	**7**	**0.88**
5	√	√	√	√	**X**	√	√	√	**7**	**0.88**
6	√	√	√	√	**X**	√	√	√	**7**	**0.88**
7	√	√	√	√	**X**	√	√	√	**7**	**0.88**
8	√	√	√	√	**X**	√	√	√	**7**	**0.88**
9	√	√	√	√	**X**	√	√	√	**7**	**0.88**
10	√	√	√	√	**X**	√	√	√	**7**	**0.88**
11	√	√	√	√	**X**	√	√	√	**7**	**0.88**
12	√	√	√	√	**X**	√	√	√	**7**	**0.88**
13	√	√	√	√	**X**	√	√	√	**7**	**0.88**
14	√	√	√	√	√	√	√	√	**8**	**1**
15	√	√	√	√	√	√	√	√	**8**	**1**
16	√	√	√	√	√	√	√	√	**8**	**1**
17	√	√	√	√	√	√	√	√	**8**	**1**
18	√	√	√	√	√	√	√	√	**8**	**1**
19	√	√	√	√	√	√	√	√	**8**	**1**
20	√	√	√	√	√	√	√	√	**8**	**1**
21	√	√	√	√	√	√	√	√	**8**	**1**
22	√	√	√	√	√	√	√	√	**8**	**1**
23	√	√	√	√	√	√	√	√	**8**	**1**
24	√	√	√	√	√	√	√	√	**8**	**1**
25	√	√	√	√	√	√	√	√	**8**	**1**
26	√	√	√	√	√	**X**	√	√	**7**	**0.88**
27	√	√	√	√	√	**X**	√	√	**7**	**0.88**
28	√	√	√	√	**X**	√	√	√	**7**	**0.88**
29	√	√	√	√	**X**	√	√	√	**7**	**0.88**
30	√	√	√	√	√	√	√	√	**8**	**1**

1: quite relevant/highly relevant; 0: not relevant/somewhat relevant

The relevance ratings on the item scale by eight experts: Items rated on 4-Point Relevance Scale

Section D: Practice and experience on dealing with doping in sports issues

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Experts in Agreement	Item-CVI
1	√	√	√	√	√	√	√	√	**8**	**1**
2	√	√	√	√	√	√	√	√	**8**	**1**
3	√	√	√	√	√	√	√	√	**8**	**1**
4	√	√	√	√	√	√	√	√	**8**	**1**
5	√	√	√	√	√	√	√	√	**8**	**1**
6	√	√	√	√	√	√	√	√	**8**	**1**
7	√	√	√	√	√	√	√	√	**8**	**1**
8	√	√	√	√	√	√	√	√	**8**	**1**
9	√	√	√	√	√	√	√	√	**8**	**1**
10	√	√	√	√	√	√	√	√	**8**	**1**

1: quite relevant/highly relevant; 0: not relevant/somewhat relevant

Appendix 5: The importance ratings on the item scale by eight experts: Items rated on 4-Point Importance Scale

Section B: Knowledge on doping in sports for healthcare professionals (HCP)										
Item	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Expert 5**	**Expert 6**	**Expert 7**	**Expert 8**	**Experts in Agreement**	**CVR**
1	√	√	√	√	√	√	√	√	**8**	**1**
2	√	√	√	√	√	√	√	√	**8**	**1**
3	√	√	√	√	√	√	√	√	**8**	**1**
4	√	√	√	√	√	√	√	√	**8**	**1**
5	√	√	√	√	√	√	√	√	**8**	**1**
6	√	√	√	√	√	√	√	√	**8**	**1**
7	√	√	√	√	√	√	√	√	**8**	**1**
8	√	√	√	√	√	√	√	√	**8**	**1**
9	√	√	√	√	√	√	√	√	**8**	**1**
10	√	√	√	√	√	√	√	√	**8**	**1**
11	√	√	√	√	√	√	√	√	**8**	**1**
12	√	√	√	√	√	√	√	√	**8**	**1**
13	√	√	√	√	√	√	√	√	**8**	**1**
14	√	√	√	√	√	√	√	√	**8**	**1**
15	√	√	√	√	√	√	√	√	**8**	**1**
16	√	√	√	√	√	√	√	√	**8**	**1**
17	√	√	√	√	√	√	√	√	**8**	**1**
18	√	√	√	√	√	√	√	√	**8**	**1**
19	√	√	√	√	√	√	√	√	**8**	**1**
20	√	√	√	√	√	√	√	√	**8**	**1**
21	√	√	√	√	√	√	√	√	**8**	**1**
22	√	√	√	√	√	√	√	√	**8**	**1**
23	√	√	√	√	√	√	√	√	**8**	**1**
24	√	√	√	√	√	√	√	√	**8**	**1**
25	√	√	√	√	√	√	√	√	**8**	**1**
26	√	√	√	√	√	**X**	√	√	**7**	**0.75**
27	√	√	√	√	√	**X**	√	√	**7**	**0.75**
28	√	√	√	√	√	√	√	√	**8**	**1**
29	√	√	√	√	√	√	√	√	**8**	**1**
30	√	√	√	√	√	√	√	√	**8**	**1**

1: essential/ useful but not essential; 0: provide some info but not essential/not necessary

The importance ratings on the item scale by eight experts: Items rated on 4-Point Importance Scale

Section B: Knowledge on doping in sports for healthcare professionals (non-HCP)										
Item	**Expert 1**	**Expert 2**	**Expert 3**	**Expert 4**	**Expert 5**	**Expert 6**	**Expert 7**	**Expert 8**	**Experts in Agreement**	**CVR**
1	√	√	√	√	**X**	√	√	√	**7**	**0.75**
2	√	√	√	√	**X**	√	√	√	**7**	**0.75**
3	√	√	√	√	**X**	√	√	√	**7**	**0.75**
4	√	√	√	√	**X**	√	√	√	**7**	**0.75**
5	√	√	√	√	**X**	√	√	√	**7**	**0.75**
6	√	√	√	√	**X**	√	√	√	**7**	**0.75**
7	√	√	√	√	**X**	√	√	√	**7**	**0.75**
8	√	√	√	√	**X**	√	√	√	**7**	**0.75**
9	√	√	√	√	**X**	√	√	√	**7**	**0.75**
10	√	√	√	√	**X**	√	√	√	**7**	**0.75**
11	√	√	√	√	**X**	√	√	√	**7**	**0.75**
12	√	√	√	√	**X**	√	√	√	**7**	**0.75**
13	√	√	√	√	**X**	√	√	√	**7**	**0.75**
14	√	√	√	√	√	√	√	√	**8**	**1**
15	√	√	√	√	√	√	√	√	**8**	**1**
16	√	√	√	√	√	√	√	√	**8**	**1**
17	√	√	√	√	√	√	√	√	**8**	**1**
18	√	√	√	√	√	√	√	√	**8**	**1**
19	√	√	√	√	√	√	√	√	**8**	**1**
20	√	√	√	√	√	√	√	√	**8**	**1**
21	√	√	√	√	√	√	√	√	**8**	**1**
22	√	√	√	√	√	√	√	√	**8**	**1**
23	√	√	√	√	√	√	√	√	**8**	**1**
24	√	√	√	√	√	√	√	√	**8**	**1**
25	√	√	√	√	√	√	√	√	**8**	**1**
26	√	√	√	√	√	**X**	√	√	**7**	**0.75**
27	√	√	√	√	√	**X**	√	√	**7**	**0.75**
28	√	√	√	√	**X**	√	√	√	**7**	**0.75**
29	√	√	√	√	**X**	√	√	√	**7**	**0.75**
30	√	√	√	√	√	√	√	√	**8**	**1**

1: essential/ useful but not essential; 0: provide some info but not essential/not necessary

The importance ratings on the item scale by eight experts: Items rated on 4-Point Importance Scale

Section D: Practice and experience on dealing with doping in sports issues

Item	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Experts in Agreement	CVR
1	√	√	√	√	√	√	√	√	**8**	**1**
2	√	√	√	√	√	√	√	√	**8**	**1**
3	√	√	√	√	√	√	√	√	**8**	**1**
4	√	√	√	√	√	√	√	√	**8**	**1**
5	√	√	√	√	√	√	√	√	**8**	**1**
6	√	√	√	√	√	√	√	√	**8**	**1**
7	√	√	√	√	√	√	√	√	**8**	**1**
8	√	√	√	√	√	√	√	√	**8**	**1**
9	√	√	√	√	√	√	√	√	**8**	**1**
10	√	√	√	√	√	√	√	√	**8**	**1**

1: essential/ useful but not essential; 0: provide some info but not essential/not necessary

Appendix 6: Learning Outcomes of Massive Open Online Course Doping in Sports

On successful completion of this online course, students should be able to demonstrate an ability to:

Topic 1: Overview of anti-doping initiatives

1. Define key terminology and the regulatory structure of anti-doping in sport
2. Understand key historical events that have shaped the current state of doping and anti-doping in sport
3. Understand the principle of Strict Liability
4. Understand their roles as athlete support personnel as stated in World Anti-Doping Code
5. Define anti-doping rule violations as stated in World Anti-Doping Code
6. Understand the importance and values associated with clean sport
7. Accepts or commits to value of "respect to teammates, competitors, and sports"

Topic 2: Medications & supplements use in sports and Therapeutic Use Exemption (TUE)

1. Develop an understanding of the most commonly used supplements in sports in relation to their safety and efficacy
2. Advise on the prevention of inadvertent doping in relation to supplement use
3. Develop an understanding of the most commonly used medications in sports
4. Understand the potential difference in formulary of medications in different countries
5. Understand the process for the application, review, and appeal process of Therapeutic Use Exemptions (TUE), and the responsibility of the healthcare provider throughout this process
6. Advise on the prevention of inadvertent doping in relation to medication use
7. Understand the potential roles of healthcare professionals at major sporting event and anti-doping

Topic 3: Misuse of prohibited substances in sports and its implications

1. Understand the inclusion criteria and the categories and classification of substances and methods that appear on the WADA Prohibited List and Monitoring Program
2. Understand the potential adverse health effects of the prohibited substances and methods
3. Understand the disciplinary, legal, and social consequences for athletes who dope
4. Accepts or commits to value of "integrity in sports"

Topic 4: Detection of prohibited substances

1. Understand the procedures for the doping control process (urine & blood test)
2. Understand the athletes' rights & responsibility during sample collection process
3. Understand the unique needs of disabled and minor athletes in relation to anti-doping
4. Understand why the Athlete Biological Passport (ABP) is used
5. Describe the results management process for an athlete after an Adverse Analytical Finding
6. Understand the Registered Testing Pool and athletes' whereabouts
7. Understand roles and implementation of the Anti-Doping Administration and Management System
8. Understand the roles of NADOs and governmental bodies in anti-doping activities

Appendix 7: MOOC Doping in Sports Respondents Feedback Form (n=34)

	Strongly Disagree	Disagree	Neutral	Agree	Strongly agree
TOPIC 1 Overview of anti-doping initiatives					
The information given in this topic is relevant and useful to me	-	-	-	25	9
The case studies in this topic are relevant and useful to me	-	-	-	21	13
The length of the session was just right	-	-	3	21	10
TOPIC 2 Medications & supplements use in sports and Therapeutic Use Exemption (TUE)					
The information given in this topic is relevant and useful to me	-	1	4	16	13
The case studies in this topic are relevant and useful to me	-	1	3	13	17
The length of the session was just right	-	1	8	15	10
TOPIC 3 Misuse of prohibited substances in sports and its implications					
The information given in this topic is relevant and useful to me	-	1	5	7	21
The case studies in this topic are relevant and useful to me	-	1	5	9	19
The length of the session was just right	-	-	7	12	15
TOPIC 4 Detection of prohibited substances					
The information given in this topic is relevant and useful to me	-	1	4	16	13
The case studies in this topic are relevant and useful to me	-	-	5	18	11
The length of the session was just right	-	-	5	13	16

Respondents Feedback Form Regarding their confidence level of Each Topic (n=34)

Topic 1: Overview of anti-doping initiatives	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Very confident
Define key terminology and the regulatory structure of anti-doping in sport	-	-	9	19	6
Describe key historical events that have shaped the current state of doping and anti-doping in sport	-	1	10	20	3
Explain the principle of Strict Liability	-	-	7	16	12
Describe your role as athlete support person as stated in the World Anti-Doping Code	-	-	9	14	11
Define anti-doping rule violations as stated in the World Anti-Doping Code	-	-	6	7	11
Describe the importance and values associated with clean sport	-	3	8	13	10
Accepts or commits to value of “respect to teammates, competitors, and sports”	-	-	11	7	16

Topic 2: Medications & supplements use in sports and Therapeutic Use Exemption (TUE)	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Very confident
Identify some of the most commonly used supplements in sports	1	3	8	10	12
Advise the athletes on the prevention of inadvertent doping in relation to supplement use	1	3	6	14	10
Identify some of the most commonly used medications in sports	1	2	5	11	15
Describe the potential difference in formulary of medications in different countries	1	3	10	13	7
Describe the process for the application, review, and appeal process of Therapeutic Use Exemptions (TUE)	1	5	9	9	10
Advise the athletes on the prevention of inadvertent doping in relation to medication use	1	3	8	9	13
Describe the potential roles of healthcare professionals at major sporting event and anti-doping	1	2	8	6	17

Topic 3: Misuse of prohibited substances in sports and its implications	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Very confident
Describe the inclusion criteria and the categories and classification of substances and methods that appear on the WADA Prohibited List and Monitoring Program	1	1	9	10	13
Identify some of the potential adverse health effects of the prohibited substances and methods	1	2	6	13	12
Describe the disciplinary, legal, and social consequences for athletes who dope	1	3	8	9	13
Accepts or commits to value of "integrity in sports"	-	-	4	10	20

Topic 4: Detection of prohibited substances	Not at all confident	Slightly confident	Somewhat confident	Quite confident	Very confident
Describe the procedures for the doping control process (urine & blood test)	1	1	10	14	8
Describe the athletes' rights & responsibility during sample collection process	1	-	7	13	13
Identify the unique needs of disabled and minor athletes in relation to anti-doping	1	1	6	10	6
Describe why the Athlete Biological Passport (ABP) is used	-	3	9	11	10
Describe the results management process for an athlete after an Adverse Analytical Finding	-	3	7	14	9
Describe the Registered Testing Pool and athletes' whereabouts	1	2	20	14	7
Describe the roles and implementation of the Anti-Doping Administration and Management System	1	1	11	12	9
Describe the roles of NADOs and governmental bodies in anti-doping activities	1	1	12	13	7