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FINAL REPORT

The 3D Project: Development and evaluation of a multidimensional universal program addressing three interrelated behavioural influences on doping behaviour

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Executive Summary

Half (40-50%) of mid-adolescent boys in Australia and the United States report the use of protein powders or shakes for muscle-building purposes (Bell et al., 2004; Eisenberg et al., 2012; Yager & McLean, 2020), with higher use (60-91%) reported among adolescent athletes (Diehl et al., 2012; Tsarouhas et al., 2018). Muscle building supplements are largely unregulated in Australia and around the world (Binns et al., 2018; Pawar & Grundel, 2016), and include products such as protein powder, creatine, and testosterone boosters.

Body image, and in particular, dissatisfaction with muscularity, is increasingly recognised as a key driver of muscle building supplement use in adolescent boys and young men, but has received little attention as an anti-doping target. Australian research found that boys with poor body image were more likely to consume Appearance and Performance Enhancing Supplements [APES] such as protein powders and creatine, and more likely to have lenient attitudes towards the use of doping in sport (Yager & O'Dea, 2014). A meta-analysis of personal and psychosocial predictors of doping provides further confirmation that body dissatisfaction, and muscularity dissatisfaction in particular, are linked with increased doping intentions and doping use (Ntoumanis et al., 2014). Those authors concluded that "body image should be targeted in prevention programs, particularly those that reach adolescent athletes" (Ntoumanis et al., 2014, pp 22).

Intervention programs to reduce doping and steroid use have predominantly focused on athletes. However there is evidence that doping behaviors are becoming more prevalent among the general population (Baron, Martin, & Abol Magd, 2007; Lippi, Franchini, & Guidi, 2008). Male non-athletes have been shown to report the highest usage levels of doping and muscle building supplement use, followed by recreational athletes, whilst elite athletes reported the lowest rates of use (Wanjek, Rosenthal, Strauss, & Gabriel, 2007). In light of this pattern of usage, adolescent boys in the general population were identified as an important target for anti-doping efforts as they may become future recreational or elite athletes, and their attitudes and beliefs in relation to doping contribute to the culture around doping use. If adolescent boys have a 'win at all costs' attitude, and positive attitudes towards doping, they are more likely to engage in the practice, this may also contribute to a social environment that supports doping behavior (Ntoumanis et al., 2014). Further, adolescent boys may become involved in sporting organizations in capacities other than as athletes; for example, they may become coaches, support personnel, or volunteers. It is vital that individuals in these supporting roles also receive adequate anti-doping education and support to ensure that attitudes and social norms within sporting organizations align with an anti-doping stance (Mazanov, Backhouse, Connor, Hemphill, & Quirk, 2014).

Despite this increasing recognition of the relationship between body image and the use of APES in sport in the literature, no doping prevention programs had incorporated a body image focus, and no body image programs had incorporated efforts to prevent APES use.

In this project, we set out to develop and test a comprehensive universal program that would reduce body dissatisfaction, Appearance and Performance Enhancing Substance [APES] use, and lenient attitudes towards doping in sport among adolescent boys, that could

be disseminated on a large scale in order to create attitude change at the individual, community, and societal levels.

In Phase 1, we identified the two programs that had the most evidence of efficacy in improving attitudes towards supplement use, and body image for boys: The *Athletes Training and Learning to Avoid Steroids* [ATLAS] Program (Goldberg et al., 1996), and *The Body Project: More than Muscles (*Brown et al., 2017; Brown & Keel, 2015). Design Thinking and a Participatory Action Research approach was used to incorporate the needs of boys, teachers, and parents into a school-based program for boys which aims to reduce body dissatisfaction and the use of muscle-building supplements in adolescent boys (14-16 years). A range of data collection strategies were used to inform program development and optimisation, including interviews with adolescent boys and parents, an open-ended questionnaire for body image experts, and trialling resources with teachers and adolescent boys. Five themes were identified in the guidance for developing body image programming for boys; the need for privacy and safe space, the need for interactive resources and multimedia, the need for evidence and authenticity, the need to understand social norms and attitudes, and the need to consider classroom practicalities.

In Phase 2, a randomized controlled trial [RCT] was conducted to determine the efficacy of the Goodform program in reducing intentions to use APES, improving attitudes towards doping, and enhancing body image in adolescent boys, aged 14-16years. A sample of 596 boys in grades 9 and 10 (M_{age} = 14.81, SD_{age} = 0.51) at nine secondary schools in Australia were randomly assigned to Goodform (*n* = 259) or control (*n* = 224) at the school level. Self-reported body image, supplement use, anabolic androgenic steroid (AAS) use, and attitudes around using AAS and muscle building supplements were measured at baseline, post-intervention, and eight-week follow-up. Analyses with multi-level, mixed-effect regression models revealed no changes over time attributable to the intervention.

This research was conducted throughout the Covid-19 pandemic, which presented many challenges for research in schools. Overall, our findings have implications for researchers in the body image and eating disorder prevention fields. Lessons learned in this study can inform future school-based efforts for reducing muscle building supplement use.

Phase 3, which is ongoing, involves dissemination of the findings on a large scale, including in journals, at conferences, and through resources distributed to teachers, coaches, and parents.

The online interactive tool is available at

www.goodform.org.au

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Phase 1- Development of the Goodform Program

Introduction

Over the past ten years, Western countries have seen a rapid proliferation of the nutritional supplements, and Appearance and Performance Enhancing Supplements [APES] industries- now worth over $100 Billion and growing (Almendarez, 2016; Daily, 2014). A wide range of substances are available to increase weight and build muscle. Almost 41% of mid-adolescent boys in the US reported the use of protein powders/shakes for muscle-building purposes "sometimes" or "often" (Eisenberg et al., 2012). Nutritional supplements are used by up to 42% of adolescents aged 13-19 years (Bell, Dorsch, Mccreary, & Hovey, 2004), 91% of adolescent athletes (Diehl et al., 2012) and 88% of College athletes (Burns, Schiller, Merrick, & Wolf, 2004). Evidence indicates that nutritional supplements can have consequences for poor physical and mental health (James, Kristjánsson, & Sigfúsdóttir, 2011) and also act as a gateway to use of more serious drugs and anabolic steroids (Backhouse et al., 2013; Ntoumanis et al., 2014). Meta-analyses of the factors predicting doping indicate that the use of legal supplements, perceived social norms, and lenient attitudes towards doping are the strongest predictors of doping behaviour (Ntoumanis et al., 2014). Further research indicates that supplement use seems to "influence reasoning patterns and the motivational impetus in favour of doping use, even among non-doper adolescents" (p. e586), suggesting that the underlying social cognitive processes of supplement use and doping are aligned (Barkoukis, Lazuras, Lucidi, & Tsorbatzoudis, 2015).

Body dissatisfaction is a key individual psychological factor in APES use. Concerns about weight and muscularity predict increased use of anabolic steroids and APES among adolescent boys and college age men (Litt & Dodge, 2008; van den Berg, Neumark-Sztainer, Capri, & Wall, 2007). In adolescent boys, research by the PI, OI's and others indicates that body dissatisfaction is related to anabolic steroid use and consumption of supplements (Field et al., 2005; Jampel, Murray, Griffiths, & Blashill, 2016; McCabe & Ricciardelli, 2003; Smolak, Murnen, & Thompson, 2005; Yager & O'Dea, 2014). Furthermore, our previous research indicates that adolescent boys who are more dissatisfied with their body have more lenient attitudes towards the use of doping (Yager & O'Dea, 2014). This finding is supported by meta-analysis that confirmed that body dissatisfaction and concern about muscularity were linked with doping intentions and doping use in men (Ntoumanis et al., 2014).

Body dissatisfaction and eating disorders are now recognised as issues for boys and men (Murray et al., 2017). Around 40% of adolescent boys report want to be thinner, and 33% report wanting to be bigger or to gain weight, meaning that around three-quarters of all boys' preferred body size is different from their own (Dion et al., 2015; Nagata et al., 2019). Body dissatisfaction is associated with poor self-esteem (Wojtwicz & Von Ranson, 2012) and disordered eating and exercise behaviours (Prnjak, 2021). Adolescents with body dissatisfaction are also more likely to engage in potentially harmful behaviours such as misuse of drugs and alcohol (Bornioli et al 2019), use of steroids to increase muscle bulk (Kanayama et al., 2006), self-harm (Muehlenkamp & Brausch, 2012) and have reduced Quality of Life (Griffiths et al., 2017), than their satisfied peers.

Strong connections exist between body dissatisfaction, consumption of supplements, attitudes towards doping in sport, and doping itself. Universal intervention programs must focus on these three interrelated attitudes and behaviours to be effective in preventing doping among adolescent boys.

Several doping educational programs exist. However, most focus on knowledge, which alone does not alter health behavior (Goldberg, Bents, Bosworth, Trevisan, & Elliot, 1991; Kelly & Barker, 2016). Very few programs have been scientifically evaluated using rigorous RCT methodologies to determine their impact on doping intentions and behaviors.

Although there is a general awareness about the importance of addressing boys' body dissatisfaction and disordered eating issues (Levine, 2019; Murray et al., 2017), few school-based prevention programs have been effective for adolescent boys (Yager, Diedrichs, Ricciardelli, & Halliwell, 2013). In schools, the majority of body-image programming has been co-educational, but most programs were originally developed for girls, and adapted to include boys. In a review of school-based programs, it was found that body image programs implemented in a co-educational setting were not effective for both boys and girls, only one or the other (Yager et al., 2013). Two programs have been developed specifically for boys aged 12-14 years, and one of these resulted in minor improvements in aspects of body image and negative affect (McCabe, Ricciardelli & Karantzas, 2010; Stanford, McCabe, 2005).

The program with the strongest evidence base for effectiveness in men is The Body Project: More than Muscles, which takes a cognitive-dissonance approach to discourage internalisation of the hyper-muscular ideal and reduce body dissatisfaction (e.g., Brown, Forney, Pinner, & Keel, 2017; Brown & Keel, 2015; Jankowski et al., 2017; Kilpela et al., 2016). At the time of development, the most efficacious program for reducing APES use was the Athletes Training and Learning to Avoid Steroids [ATLAS] program (Goldberg et al., 1996). This program was one of the first to demonstrate improvements in body image among adolescent boys. We conducted a replication in an Australian boys' school and found acceptable outcomes on body image measures (Yager, McLean, & Li, 2019). The Body Project: More Than Muscles (Brown et al., 2017) and ATLAS (Goldberg et al., 1996) thus formed the basis of our program.

This phase of the project aimed to utilise a "design thinking" approach, in which end-users' feedback and perspectives are incorporated in testing iterations of intervention materials (Brown & Wyatt, 2010). Our intention was to develop an intervention program specifically for boys that was based on previously efficacious programs, to improve body image, and reduce intended and actual use of appearance and performance enhancing substances (APES). In order to ensure the greatest possible impact, we set out to design a program that could be implemented in the classroom setting by health and physical education (HPE) teachers, in regular school Health and Physical Education classes.

"Design thinking" presents a structured approach to the integration of the needs, perceptions, and feedback of the end-users of a product or intervention (Brown & Wyatt, 2010; IDEO, 2015). Approaches to intervention design that involve community and end-user participation in their development have been highlighted as potentially helpful in previous

reviews and commentary on eating disorder prevention programs (Levine & Smolak, 2005; Neumark-Sztainer et al., 2006; Piran, 2001; Stice et al., 2013). Like Community-based Participatory Design, co-creation, and co-production, this approach involves: 1) a deep consideration of users' needs, and 2) insights from users in an iterative process of product development and feedback, to enhance the product usability and uptake. The Design Thinking Approach differs from Participatory Design in that it takes a somewhat more structured approach to the process of developing the end product (Behrendorff et al., 2011). Others have also developed frameworks of integration of design thinking and theory driven approaches to the development of interventions to enhance physical and psychological health and these were used to inform our processes (Mummah, Robinson, King, Gardner, & Sutton, 2016; Yeager et al., 2016). We adopted the same principles that creatives and designers apply when developing materials, websites, and products to enhance the relevance and dissemination of our program (Yager, 2018).

Method

Participants

Four participant groups took part in this research; experts (academics or community educators with experience designing and conducting body image and APES prevention programs), high school teachers (grades 7-12), boys aged 14-17, and parents of boys aged 14-17. Each of these groups were chosen based on their potential involvement in the program (i.e., teachers, as the program is teacher delivered; boys, as they are the target audience), their knowledge of the target audience's needs and prior knowledge (i.e., teachers and parents), or their expertise in prevention and intervention (i.e., expert group). total, N = 78 people provided data or feedback, including n = 55 boys, n = 8 teachers, n = 7 parents, and n = 6 experts.

Instrumentation

A range of instruments were used to gather advice and feedback from end-users in order to inform the optimisation of the Goodform Program.

Expert survey. To understand experiences of conducting interventions with boys and men, we designed a questionnaire with three open-ended questions concerning a) structure and format, b) general advice, and c) challenges of designing and running such interventions.

Semi-structured interview questions (boys and parents). Separate sets of questions on topics including body image, cheating in sport, supplements and doping, and health education, were developed for this study. Questions were open-ended and intended to serve as a guideline for topics to be discussed, with the interviewers able to exercise their discretion in asking additional questions.

Researcher reflection on HPE teacher workshop. The first author presented a number of resources at a workshop for HPE teachers for their informal evaluation. The author recorded her reflections on the workshop to assist in the refinement of the resources.

Intervention materials. Intervention materials were designed with input from all authors. A professional design agency was contracted to guide the researchers through steps 1 and 2 of the Design thinking process, in order to *empathise* with end users and *ideate* potential solutions, respectively.

Procedure

As this research included multiple data collection methods, detailed procedures are not included here. All participants provided informed consent, including parental consent for boys taking part in interviews. Ethics approval was granted by the Victoria University Human Ethics Committee. Participants were recruited via social media (e.g., announcements on Twitter, teacher groups on Facebook and LinkedIn) and pre-existing relationships between schools and the research team. Materials were not all trialled by all groups due to time and resource limitations; as such, they were selected based on a) the necessity of the group's feedback in improving the resource (e.g., it was important that the digital tool was trialled in classes due to the high level of technicality; it was less necessary to trial resources with parents) and b) our evaluation of the feedback and interviews received during early stages (e.g., resources that were consistent with feedback received needed less trialling).

Data Analysis

Thematic analysis was used to analyse interview data and expert survey responses, with an inductive approach taken to coding and theme development (Braun & Clarke, 2006). All interviews and feedback were read by the first author several times to familiarise herself with the data. Upon familiarisation, several initial codes were developed for emerging topics in the data. Interviews were then re-read and themes and sub-themes were identified.

Results

In developing Goodform, a number of recommendations were identified that would aid in the development of body image and APES programs for boys more generally. These recommendations were gained from experts, boys, parents, and teachers. Themes are described below.

Privacy/safe space. Four experts and all boys described the importance of privacy and safety for boys/men when discussing or completing activities concerning body image. One participant said this was especially a problem with boys, stating "Adolescent boys tend to find it harder to express concerns and understand body image related issues and are a few years behind girls in this respect (i.e., it's not until 14-15 that the majority can relate)." (Participant 1, expert). One of the boys interviewed echoed this difficulty in discussing body image around classmates, stating:

> *You know, [it would be good to know] what, what their friends think too, because um, ah, like the stuff just like at school at least I don't think it's [body image] discussed very often and we often don't know what other people think about it either*. (Participant 2, adolescent boy).

One participant suggested that boys could interact with close others if exercises were sensitive, stating "But so like encourage them to have friends with them or bring friends or something like that because you don't want to have that one loser in the corner just like making them feel left out." (Participant 3, adolescent boy).

Practical implications. Creation of a safe space with considerations for boys' and mens' privacy should be taken seriously when conducting prevention programs. Typically, programs for women and girls rely on a degree of trust and information sharing with peers (e.g., The Body Project); however, as boys are typically socialised not to discuss their

emotions this approach may be less effective (Oransky & Marecek, 2009). Researchers and teachers could consider strategies such as written activities, normalising body image concerns among boys and men, and allowing participants to work with friends or trusted others for sensitive topics.

Interactivity and multimedia. Throughout our development of Goodform, it became clear that programs for adolescent boys require a high degree of interactivity. This finding was apparent through trialling resources with classes of boys (see Table 3), and became evident through our interviews and feedback-seeking, too. One boy stated:

> *… I don't want to sit there for like two hours, not even two hours, maybe even 30 minutes listening to a boring person that doesn't even make anything interesting. My mind isn't going to get anywhere. And then literally like, you know, daydreaming about something else.* (Participant 3, adolescent boy)

This participants' thoughts were echoed by two experts, who expressed that if boys were not fully engaged in the content they would become disruptive. Some suggestions for increasing engagement among males were constructing their own materials (e.g., PowerPoint, word document; Participant 5, adolescent boy), using animations or podcasts (Participant 6, Teacher), keeping content brief and succinct (Participant 7, Expert), and using humour (Participant 3, adolescent boy).

Practical implications. Activities for boys should be clear, structured, succinct, and highly directive. We also suggest including multimedia within most activities for programs for boys, even in programs that include a face to face component.

Authenticity and authority. One theme identified in the data was the source and authenticity of information, which mainly occurred in discussions about APES, was also evident in discussions of body image. Two sub themes were identified, the first being the trustworthiness of the source of information. Most boys and parents emphasised their trust in information that came from scientific evidence or health professionals. To illustrate, one participant described the credibility that professionals would lend to a program:

> *If you could have programs for my child, if I could, [it's] different coming from a parent but coming from a professional* [e.g., a first responder or doctor] *that they respect that's got firsthand experience that can tell the story.* (Participant 8, parent).

Boys generally regarded scientific information highly, with one participant stating that if he wanted advice on body image or APES, he would discuss it with a relative who has a background in the area. The influence and popularity of information online, however, was another topic that was raised by both boys and parents. One participant stated that he often sought information about health and fitness from online sources:

> *Well, there is bodybuilding.com that's just ah […] full of articles on like ah, like people's knowledge on that kind of stuff. So that's probably the main one, but there are, there are a lot of YouTube channels out there that do videos and that kind of stuff as well.* (Participant 2, adolescent boy).

While it should be acknowledged that online sources may be credible, less screening and quality control of information is applied to online sources. This recognition was echoed

by parents when discussing finding APES information online "Drug information is easily accessible online and doesn't provide great information or detail" (Participant 10, parent).

Another sub-theme of evidence credibility/authenticity was raised by three experts, in regard to the use of peer facilitators in some body image programs to enhance authenticity. One expert participant described a well-received program that included peer facilitators: "Feedback from the boys involved in piloting/road testing was consistent - they enjoyed hearing from young people about their experiences rather than being talked to from adults." (Participant 7, expert). Another expert stated, "I have also found that having at least some same-gendered facilitators has been essential to making the materials feel relevant for male populations and to promote modelling of healthy behaviours." (Participant 11, expert). However, one participant disagreed, stating:

> *The idea that women are less able to facilitate an intervention with men I think is bogus and sexist. We know body image is one part of wellbeing and not necessarily the most pressing issue men have, I think this needs to be borne in mind.* (Participant 4, expert).

Despite this disagreement on program facilitators, all experts agreed that content needed to appear authentic to males, with three specifically discussing this in the context of co-educational interventions; "The content and activities need to look as though they were designed specifically with boys in mind, not just converted from a female version." (Participant 12, Expert). Three experts highlighted the importance of designing content that was not simply adapted from girls' activities, although language (e.g. around muscularity, appearance) and specific examples (e.g., including male role models) were said to be important when conducting co-educational interventions. Most experts suggested that content should be piloted and co-designed with males, with one expert citing focus groups of males to design materials and gauge attitudes had been helpful, as well as collaboration with experienced others who worked with similar aged males.

Practical implications**.** Interventions for boys should balance information from respected professionals and authorities as well as peers. Media literacy components addressing the poor credibility of online information may be helpful for boys to better identify more accurate information. Additionally, researchers can ensure program authenticity by pilot-testing and co-designing their materials with boys and men.

Existing social norms and beliefs around body image and APES for men. A theme of understanding and working with existing beliefs around body image and APES in men emerged, which incorporated two sub themes. The first sub-theme was the differing gender norms for males around body image. One expert discussed some male participants' reactions to taking part in a body image program that are important in a universal intervention context:

> *The peer leader should emphasize use of intervention even if participants have positive body images. This is particularly important as the only two people to say they did not find the intervention useful was because they felt it assumed they had body image concerns.* (Participant 4, expert).

To our knowledge, this is not a common issue in interventions with females, perhaps because body image is assumed to be an issue of which girls and women should be aware. One parent commented on the changing norms around body image in boys;

> *Boys are much more aware of their physical appearance, and even I've noticed to the certain extent that in the last five years that with my sons year that a lot of boys, some are overweight were very reluctant to take off their shirts like at swimming carnivals, that they're reluctant, they're much more self-conscious than they have ever been before, whereas in my generation it wouldn't have really been a second thought they probably wouldn't have been so worried.* (Participant 9, parent).

This contrast between perceived increases in boys' body image issues and boys' (un)willingness to discuss body image issues with each other as highlighted when discussing privacy and safety may illustrate the social norms that exist for males.

The second sub-theme was the distinction between attitudes toward supplement use and attitudes toward illegal APES use. All boys stated that they thought using steroids in most sports was wrong, however two boys and five parents generally thought the use of supplements (e.g., protein powders, fat burners) was considered helpful or fairly harmless, despite some evidence of risk within existing literature (Petroczi, Taylor, & Naughton, 2011). To illustrate this, one parent stated

> *[if my son wanted to use protein powders] I really wouldn't mind - I mean I would probably like to work with them to find exactly what they are looking to achieve by using protein powder, and from there research various brands and various outlets to be able to use protein powder. I think so long as my child wasn't using it for any sort of nefarious reason such as ridiculous weight loss or ridiculous weight gain in the form of muscle it wouldn't concern me.* (Participant 13, parent).

One expert stated that a good intervention should address the capitalist aspects of body image (e.g., profiting from male appearance insecurities), which may be an alternative to focusing on health risks. It may be helpful to challenge beliefs and attitudes using a variety of methods, as previously held beliefs (e.g., the safety of legal APES) may be difficult to challenge given their perceived acceptability.

Practical implications**.** Before conducting an intervention, it may be helpful to understand the existing beliefs and attitudes of intended participant groups. Working with existing attitudes may be useful; for instance, while boys, and parents generally believed that using legal APES was acceptable, they believed that using anabolic steroids was morally wrong; as such, their values of fairness could be harnessed to produce attitude change.

Classroom practicalities. A theme identified in work with teachers, experts, and boys was around practical aspects of intervention delivery and evaluation, e.g., recruitment, measurement, and resources for teachers administering programs in a classroom setting. For instance, in the researcher reflection it was identified that it may not be practical to use some prevention activities as classroom assessment as originally planned within Goodform.

The researcher reflection from the HPE conference also identified questions of accessibility for materials, such as including closed captioning on videos.

Recruitment and participation were highlighted as challenges for research by four experts, with one stating that a challenge was stigma preventing participation (Participant 11, expert), and banter and teasing during the intervention (Participant 14, expert). Teasing was acknowledged as an issue by all boys, who could recall instances of banter or teasing within HPE lessons.

Practical implications. Those implementing body image material should consider having specific strategies in place to avoid teasing during the intervention, as this may decrease engagement and thus the efficacy of the program. Considerations around creating privacy and a safe space mentioned in the previous theme may be useful, as well as ensuring that teachers or facilitators are aware of the sensitive nature of the topic and are able to respond to any teasing from participants.

The Goodform Program

The Goodform program is based on the two successful existing programs at the time of development (2018); the Athletes Training and Learning to Avoid Steroids [ATLAS] program (Goldberg et al., 1996) and The Body Project: More Than Muscles (Brown et al., 2017) that use both a dissonance-based approach and a social norms approach to promote change in outcomes. Full details of the development of the intervention, which incorporated design thinking and included preliminary and pilot studies, are described in the development (Doley et al., 2020a) and protocol papers (Doley et al., 2020b).

This program includes four, 60-minute lessons which complement the Health and Physical Education curriculum for Year 9 and 10 boys (aged 14-16). These lessons critique appearance ideas, use of muscle building supplements, and anabolic steroids, taking a cognitive dissonance and social norms approach and incorporate Social Learning Theory. The aims of the program are to convince boys that they don't need to be hugely muscular and use supplements to become muscular, and to make them aware that supplements can be harmful to their physical, mental and social health.

Table 1: Overview of the GoodForm Program.

Session	Activities	Adapted from:
Session 1: Cultural Ideals	1) Introduction 2) Video: Pressure to conform to the cultural ideal 3) Digital Tool and worksheet: Define and critique the cultural ideal for men 4) Worksheet: How do we challenge this ideal? Homework: Write your advice to a younger boy	Adapted from The Body Project: More than Muscles
Session 2: Supplements and Steroids	1) Discussion: Read through Homework Task 2) Demonstration: Balloons and steroids 3) Jigsaw Inquiry: What are the side effects of supplement use? 4) Jigsaw Activity: Critique Supplement Ads 5) Video: What will people think?	Adapted from the ATLAS program and extended to include other muscle building supplements.
Session 3: Critiquing Supplement use	1) Quiz: Recap previous content 2) Jigsaw Activity: Role Plays to counter the use of supplements and steroids 3) Jigsaw Assignment: Develop a media campaign against steroid use	Adapted from the ATLAS program and extended to include other muscle building supplements.
Session 4: Advocacy and Activism	1) Presentation of media campaigns 2) Advocacy and Activism: Top 10 Worksheet 3) What next? Challenge Yourself	Adapted from the ATLAS program and combined with the concept of advocacy from The Body Project.

New Resource Development

The first lesson of the Goodform program was based on the initial discussion from the first lesson of The Body Project. We worked with the design agency to develop this as an interactive online tool and to align this activity with the guiding principles of 1) Privacy and a safe space, and 2) interactive tools and multimedia. Illustrations were commissioned to guide the narrative and facilitate boys' progress with the tool on their own or in pairs, reporting their responses in their worksheet. We tested the tool with three successive classes of year 7 and 9 boys, and made several changes to the wording and format of the content and worksheets to enhance comprehension of the messages intended in the program. This interactive tool is available at www.goodform.org.au.

In collaboration with a professional media agency, we also developed a short video for Goodform to clearly convey the idea that muscle building supplement use is not normal, acceptable, or advisable. This messaging was intended to contribute to the social norms component of the program (i.e., that using muscle building substances is perceived as unacceptable by important others). The film conveys how friends, girlfriends, parents, and sports coaches might react to discovering that the adolescent boy has been using an unnamed muscle building substance. We left the exact substance open to interpretation so that boys would interpret the film based on their current knowledge and experiences. Public health communication and social marketing campaigns often employ emotional tactics to create behaviour change. We used the literature from these research areas to inform the development and scripting of the film.

Materials for students included a workbook in either electronic or paper format. Use of either format was according to school preferences. This workbook included activities delivered in each of the four sessions. Teachers delivering the intervention were given a teacher workbook, which included prompts and instructions for delivering the content. Teachers were also provided with six instructional videos, around 5 minutes in length, (two general videos, and one each corresponding to each lesson of Goodform) on the program and how to deliver it. Each session was approximately 45-60 minutes long, depending on school timetabling. Activities for each session are described in more depth in Doley et al., (2020b). There was some flexibility around delivery, which was negotiated with the researchers, with some schools delivering the four sessions of Goodform over five weeks rather than four weeks to accommodate as prior curriculum commitments that did not allow schools to deliver the four sessions in consecutive weeks.

Phase 2: Randomised Controlled Trial of the Goodform Program

In light of the lack of empirical investigation of body image programs specifically developed for adolescent boys and mixed findings from the few studies that have examined both supplement use and body image, this research focuses on progressing the knowledge base in relation to boy's body image and APES prevention programs. It is evident that a single approach may not be effective in improving both body image and muscle building supplement use, and as such, we developed a universal program using previously effective approaches of cognitive dissonance and social learning theory, with an additional social norms approach.

The decision to design a universal program was based on a) the lack of pre-existing literature around effectiveness of selective prevention for boys, b) the high prevalence of supplement use observed in Yager & McLean (2020), and c) the low likelihood that adolescent boys would self-select for a body image intervention, given the stigmatising attitudes towards the issue held among males (Griffiths et al., 2014). We focused solely on developing materials for boys as there is still relatively less understanding of how body image develops, and how we can prevent body image problems in boys (Murray et al., 2019; Murray et al., 2017). Specifically, our aim was to examine the efficacy of Goodform relative to a waitlist control condition for improving body image, reducing supplement use, and reducing favourable attitudes towards AAS.

We hypothesised that the Goodform program would result in improvements to our primary outcomes (muscularity dissatisfaction, body fat dissatisfaction, height dissatisfaction, attitudes towards AAS use including both intentions to use and expectations of use, and use of muscle building supplements and AAS) and secondary outcomes (negative body talk, internalisation of the muscular ideal, pressures to be lean/muscular, and social norms of supplement and AAS use) compared to the control group.

Method

Participants

Secondary schools in Australia were approached via their Principal or physical education teachers to invite participation of Year 9 and/or 10 in the evaluation of Goodform (*n* = 36 schools responded to our initial enquiry from a total of *n* = 118 who were contacted). The invitation to participate described the nature of the program, including an overview of the background literature. Interested schools were invited to ask further questions of the research team. Schools that indicated their interest (*n*=18) were sent further information and discussed a timeline with the research team. Eligibility criteria were that a) the school was located in Australia, and b) the intervention could be delivered in a single sex setting to boys in grade 9 and/or 10 at the school. The program was targeted at Year 9 and 10 boys aged 14-16 as boys this age may have started to experience body image concerns or pressure to use muscle building supplements, there are no evidence-based resources that have been effective with this age group. Schools in Australia are unlikely to allow Year 11 and 12 students to participate in research involving program evaluation due

to Senior Secondary exams. In total, 10 schools agreed to take part, and one withdrew before completing baseline measures. Data were collected across two school years, 2019 (six schools) and 2021 (three schools). Schools were not available to researchers during 2020 as they transitioned to remote learning due to COVID-19 lockdown restrictions. It is worth noting that the proportion of students in the control and intervention conditions was similar in 2019 and 2021 according to a chi-square test, $\chi^2 = .53$, $p = .47$, indicating that any differences due to the pandemic would impact groups equally.

Participants were grade 9 (aged 13 to 15 years) and 10 (aged 14 to 16 years) boys from independent all-boys' (*n*=2), independent co-educational (*n*=3), public all-boys' (*n*=1), and public co-educational (*n*=3) schools. Schools were located in New South Wales (*n* = 3) South Australia (*n* = 1), Victoria (*n* = 4), and Queensland (*n* = 1). See Table 1 for detailed demographic information about participants.

Table 1

Participant Demographics by Condition

Demographic	Control *n*=224	Intervention *n* =259	Total *N*=483
Age	M_{age}=14.71, SD_{age}=0.45	M_{age}=14.88, SD_{age}=0.54	M_{age}=14.81, SD_{age}=0.51
School type			
Public co-educational	1	2	3
Public all boys	1	0	1
Independent co-educational	1	2	3
Independent all boys	1	1	2
Location of school [a, b]			
Major cities	1	3	4
Inner Regional	3	1	4
Outer Regional	0	1	1
Index of Socio-Community Economic Advantage (ICSEA)[c]	1074.00	1070.75	
Nationality/cultural background[a, b]			
Australian	147 (71.3%)	83 (76.15%)	230 (73.02%)
Chinese	25 (12.13%)	12 (11.01%)	37 (11.75%)
Indian	12 (5.82%)	5 (4.58%)	17 (5.39%)
English	9 (4.37%)	5 (4.58%)	14 (4.44%)
Korean	9 (4.37%)	0	9 (2.86%)
Other specified	72 (34.95%)	55 (50.49%)	127 (40.32%)

[a]Note – Cultural information and location data were only obtained for participants from five schools, as these measures were added later to the questionnaire. [b] participants described their nationality and cultural background in free text response , and as such, percentages may add to greater than 100%. [c]ICSEA Index is taken from myschool.edu.au website; the average of schools is 1000.

Intervention

Intervention schools were provided with materials to implement Goodform, a four-lesson classroom-based educational program for mid-late adolescent boys aged aimed at improving body image, reducing positive outcome expectations for AAS use, and reducing intentions to use muscle enhancing supplements. Health and physical education (HPE) teachers delivered the face-to-face intervention to their students as a whole class during regular HPE lesson time. Short videos were provided to educate teachers about the aims of each lesson, potential challenges that could arise in each lesson, and to run through the activities involved.

Materials for students included a workbook in either electronic or paper format. Use of either format was according to school preferences. This workbook included activities delivered in each of the four sessions. Teachers delivering the intervention were given a teacher workbook, which included prompts and instructions for delivering the content. Teachers were also provided with six instructional videos, around 5 minutes in length, (two general videos, and one each corresponding to each lesson of Goodform) on the program and how to deliver it. Each session was approximately 45-60 minutes long, depending on school timetabling. Activities for each session are described in more depth in Doley et al., (2020b). There was some flexibility around delivery, which was negotiated with the researchers, with some schools delivering the four sessions of Goodform over five weeks rather than four weeks to accommodate as prior curriculum commitments that did not allow schools to deliver the four sessions in consecutive weeks.

Classroom environments are dynamic, and while 100% fidelity to programming is desirable, it is also an unrealistic goal for most teachers, classrooms, and schools. Four teachers from four intervention schools completed self-report measures of fidelity to the intervention. Of those, none indicated that they delivered all lessons exactly as planned, with deviations to components of the sessions, for example, skipping one of the three or four topics covered in a lesson. Out of 16 possible topics within the program, on average, 70.31% of topics were fully completed, 26.56% of topics were partially completed, and 3.13% of topics were not covered at all.

Control Group. This study used an inactive, wait list control group. Participants in the control group completed their regular HPE classes during the course of the intervention, considered to be 'treatment as usual'. The control group was provided with all resources to deliver Goodform following their completion of the intervention.

Measures

Measures were administered to all participants at three time points; baseline (T1), approximately five weeks after baseline (post-intervention; T2) and approximately eight weeks after baseline (follow-up; T3). A full description of the measures used in this study is available in the protocol paper (Doley et al., 2020b), and briefer descriptions are provided below.

All measures are self-report and were completed online using the survey software Qualtrics. The questionnaire was examined for suitability for adolescent reading level using the Simple Measure of Gobbledygook (SMOG; McLaughlin, 1969), and was found to be

suitable for a reading age of approximately 11 years of age. The boys took approximately 15 minutes to complete the questionnaire at each time point.

Body Fat Dissatisfaction, Muscularity Dissatisfaction, and Height Dissatisfaction. The revised version of the Male Body Attitudes Scale [MBAS] (Ryan et al., 2011; Tylka et al., 2005) was used to measure muscularity dissatisfaction, body fat dissatisfaction, and height dissatisfaction. The Muscularity dissatisfaction subscale has seven items, an example item is 'I think I have too little muscle on my body'. The body fat dissatisfaction subscale has five items, an example item is 'I think my body should be leaner'. The height dissatisfaction subscale has three items, an example item is 'I wish I were taller'. Scores for all subscales occur on 5-point Likert-type scale from 1 (never) to 5 (always), with higher scores indicating greater dissatisfaction. The mean total of each subscale was used. The subscales demonstrate high internal consistency and construct reliability in men (Ryan et al., 2011). Internal consistency at time 1 for each subscale ranged from questionable (α=.68 – height dissatisfaction) to good (α=.86 – muscularity dissatisfaction, α=.87 – body fat dissatisfaction) in the current study.

Thin and Muscular Ideal Internalisation. The Sociocultural Attitudes Towards Appearance Questionnaire – 4 – Revised [SATAQ-4R] was used to measure thin and muscular ideal internalisation (Schaefer et al., 2017). The SATAQ-4-R has three subscales relating to internalisation. The internalisation thin/low body fat subscale has two items, an example item is 'I think a lot about looking thin'. The internalisation muscular subscale has three items, an example item is 'It is important for me to look muscular'. The general attractiveness internalisation subscale has 2 items, an example item is 'I don't really think much about how I look' (reverse scored). All subscale responses occur on a 5-point Likert-type scale from 1 (definitely disagree) to 5 (definitely agree), with higher scores indicating greater internalisation. The mean total of each subscale was used. Internal consistency at time 1 for each subscale ranged from acceptable (α=.77 thin/low body fat) to good/excellent (α=.87 muscularity internalisation, α=.90 general attractiveness internalisation). All subscales of the SATAQ-4-R have demonstrated good internal consistency (Schaefer et al., 2017) and convergent validity with other measures of body dissatisfaction and ED symptoms in men.

Pressures to be Thin or Muscular. The Sociocultural Attitudes Towards Appearance Questionnaire – 4 – Revised [SATAQ-4R] was used to measure sociocultural appearance pressures (Schaefer et al., 2017). The SATAQ-4-R has four subscales relating to appearance pressures. The family pressures subscale has 5 items, an example item is : 'I feel pressure from family members to be more muscular'. The peer pressures subscale has four items, an example item is: 'I feel pressure from my peers to look in better shape'. The media pressures subscale has six items, an example item is 'I feel pressure from the media to look thinner'. The significant other pressures has five items, an example item is 'I feel pressure from significant others to decrease my level of body fat'. All subscale responses occur on a five point Likert-type scale from 1 (definitely disagree) to 5 (definitely agree), with higher scores indicating greater sociocultural appearance pressures. The mean total of each subscale was used. Internal consistency at time 1 for each subscale ranged from good (α=.81, pressures from family) to excellent (α=.91 peers subscale, α=.94 significant others subscale, and α=.96 media subscale).

Negative Body Talk. The Male Body Talk Scale (Sladek et al., 2014) was used to measure negative body talk. The scale includes two subscales, the muscle talk subscale which has ten items (example item: 'I wish I had bigger biceps') and the fat talk subscale which has six items (example item: 'I need to lose this belly fat'). Responses occur on a 7-point Likert-type scale from 1 (never) to 7 (always) with higher scores indicating greater frequency of negative body talk. The mean total of each subscale was used. Internal consistency at time 1 for each subscale was excellent (α=.95 fat talk, α=.96 muscle talk). Both subscales demonstrate excellent internal consistency in men and good convergent validity with measures of body dissatisfaction and muscle dysmorphia (Sladek et al., 2014).

Attitudes towards AAS. The Outcome expectations for Using Steroids (O-AAS; Parent & Moradi, 2011) scale was used to measure attitudes towards AAS. Responses occurred on a 7-point Likert scale from 1 (strongly agree) to 7 (strongly disagree) with higher scores indicating more negative expectations around using AAS. The mean total of the scale was used. An example item is: 'If I used anabolic steroids, I would feel better about how I look'. Internal consistency at time 1 was excellent, α=.96. The O-AAS has excellent internal consistency in men and correlates moderately with measures of drive for muscularity (Parent & Moradi, 2011).

Intentions to use AAS. The Intentions to use Steroids (I-AAS; Parent & Moradi, 2011) scale was used to measure intentions to use AAS. Responses occurred on a 7-point Likert scale from 1 (strongly agree) to 7 (strongly disagree) with higher scores indicating less intentions to use AAS. The mean total of the scale was used. An example item is: 'I intend to try anabolic steroids'. Internal consistency at time 1 was excellent, α=.96. The I-AAS has excellent internal consistency in men and correlates moderately with measures of drive for muscularity (Parent & Moradi, 2011).

Use of Supplements and AAS. Supplement and AAS use was measured through direct questioning. Two questions were used to ask about the use of muscle building supplements and AAS use. Specifically, participants were asked in the past 3 months, have you used muscle building supplements/anabolic steroids? Responses to the items are indicated on a binary scale from 0 (*no*) to 1 (*yes*).

Social Norms for AAS and Supplement use. Social norms around using AAS and supplement use were measured using items adapted from Ling et al.'s Peer Norms Scale of Physical Activity (Ling et al., 2014). Specifically, two items were used to measure social norms for using AAS, an example item is: 'My friends would disapprove if they saw my using steroids' (reverse scored). Three items were used to measure social norms for using muscle building supplements; an example item is 'How many of your close friends do you think use muscle building supplements?'. Two items used a 4 point Likert-type scale, and three used a 3 point scale. Internal consistency for these scales was poor (α=.19 for supplement use) to questionable (α=.66 for AAS use).

Demographics. Cultural background, date of birth, and postcode were collected at each time point for individual participants. These were collected to describe the sample, and to facilitate data matching across timepoints.

Teacher feedback. Teacher feedback from the HPE teachers who delivered the program was also collected using self-report questionnaires. Teacher feedback was to be completed by teachers delivering the program following each lesson, and was sent via email to the research team either immediately following the lesson, or upon conclusion of the program. Feedback included both open-ended questions and items where teachers were asked to allocate scores for each topic within the program on student engagement, activity success, and activity completion, adapted from a previous study (McLean et al., 2019). Overall, the *n* = 4 teachers who completed the feedback had positive feedback around delivering Goodform and reported that most activities were well received by students.

Procedure

A cluster randomised-controlled trial design was utilised to evaluate Goodform with school as the cluster level. A cluster design was used to ensure that the program could be delivered during normal health and physical education lessons. The research was approved by the Victoria University Human Research Ethics Committee [HREC; HRE: 18:175], the Victorian Department of Education and Training [2018_003920], and NSW Department of Education and Training [SERAP 2020406]. This trial was retrospectively registered with the Australian and New Zealand Clinical Trials Registry on May 14th 2019, registration number ACTRN12619000725167.

School principals provided consent for the school to participate, and HPE head teachers arranged for teachers of year 9 or 10 classes to read the information sheet and consent to participate in the program. Schools were randomised to condition by the team using simple randomisation on an excel spreadsheet with a 1:1 ratio (intervention:control), and the team enrolled schools in the program. Neither the participants nor the researchers were blind to the intervention condition for practical purposes.

Approval for opt-out parental consent was obtained on the basis that it reduced administrative requirements for the schools. Three weeks prior to data collection, information sheets and explanatory videos about the project were distributed to parents by the schools. To opt their child out of the research, parents completed an electronic form via the survey software Qualtrics. Study outcomes were measured at baseline, post-test, and follow-up (two months post-test). Teachers supervised data collection procedures in class in accordance with the guidelines sent out by the researchers. Researchers were not present. This was initially implemented to enable school participation from broad geographical locations but was then a required condition of school participation due to COVID-19 related education department requirements that non-school personnel not attend school premises. Boys were given an information sheet and presented with a video describing the study in plain language. Boys from independent schools indicated their informed assent by completing the questionnaire. Boys from public schools indicated their informed consent by signing an electronic consent form via Qualtrics, as this was required by Human Ethics Committees of state-based Departments of Education. A total of 7 participants opted out of survey completion. Lists of unique ID codes were sent to the school and provided to teachers for boys to input into the online questionnaire to facilitate data matching. As attendance records were not kept by all teachers, we do not have data regarding how many students did not complete the study due to specific reasons (i.e., due to absence from

school, or if they simply did not want to take part in the questionnaire). See Figure 1 for a description of participant flow and allocation throughout the study. Complete details of the study procedure are provided in the protocol paper (Doley et al., 2020b).

Data Preparation and Analysis

Power Analysis. RMASS was used to conduct an a priori power analysis to determine adequate sample size for this study (Roy, Bhaumik, Aryal, & Gibbons, 2007). With alpha set at .05, the analysis indicated that 504 participants (252 in each of the intervention and control) would be needed to achieve a power of .80 to detect small to medium effect size. These calculations were based on the following criteria: three measurement occasions (pre, post, follow-up), 5% attrition from pre- to post-test, and 15% attrition from post to eight week follow up.

Data Cleaning. Data were matched by a unique code used across the three time points. On occasion (in less than 15 instances) boys appeared to make typographical errors as they entered the code assigned to them. Where unique codes at T1, T2, or T3 appeared similar, but differed by one digit (e.g., ABC123 and ABC122) similarity between codes across timepoints was reviewed alongside the demographic data by two of either JD, SM, or ZY to decide whether there were enough similarities to indicate that this was the same student. In situations where one of these codes was not assigned to another student to that school, and demographic data were considered to be sufficiently similar, data were considered a match. For students who mistakenly used their student identification number rather than the unique code, this was replaced with their assigned unique code for data matching, and their student identification number was deleted to retain privacy. Cases with less than 5% of data who were not able to be matched with another time point were deleted (n=12). Data from n=8 students at T2 were deleted, as the class completed the survey approximately three weeks too soon. Twenty students at T2 and 26 students at T3 completed the questionnaire in less than 3 minutes at T2 and were excluded from analyses.

Finally, extensive data quality checks were conducted by using longstring analysis and manual inspection for 'donkey voting' and inappropriate comments. Specifically, longstring analysis was conducted to indicate where participants had responded to a measure with the same response for ten questions on a measure, in a row. Manual checks were conducted by either EQ or JD, and potentially inappropriate responses were reviewed by two other authors (from either ZY, SM, or JD). Those that were agreed to be inappropriate responses that could reflect poor data accuracy by at least two authors were flagged for exclusion from analyses.

Data Analyses

Confirmatory analyses. Per our published study protocol, we conducted a total of 14 generalized linear mixed-effects regression models predicting our continuous outcome variables, and two mixed-effects logistic regression models predicting our primary categorical outcome variables. We accounted for potential clustering effects within individuals and within schools by modelling random effects at each of these two levels. In all models, we specified an auto-regressive covariance structure to account for repeated

measures within individuals. Missing data were estimated using full-information maximum likelihood modelling. Whilst it was theoretically possible to also model random effects at the classroom level (i.e., a three-level model), attempting to do so resulted in model convergence errors. Complex three-level models were subsequently abandoned in favour of simpler two-level models.

Exploratory analyses. We ran two major sensitivity analyses. First, we ran a mixed-effects regression model including only those boys who reported at least some muscularity dissatisfaction, operationalised as a mean score of 1.5 or higher on the muscularity dissatisfaction subscale of the MBAS-R, which falls mid-way between "never" and "rarely". We did this because there are known issues of floor effects in universal body image programs, and in this study, there were a substantial minority of boys with a mean score < 1.5 on the muscularity dissatisfaction subscale (17.3%), for whom it could be reasonably considered there was no body dissatisfaction in need of improvement. Second, we ran a mixed-effects regression model including only those boys who reported at least a moderate level of muscularity dissatisfaction, operationalised as a mean score on the muscularity dissatisfaction subscale of 3 or higher, which equates to "sometimes" or more. In total, 30.1% of boys reported at least moderate body dissatisfaction. Taken together, both models can be construed as sensitivity analyses examining whether, and to what extent, our results were sensitive to floor effects. To avoid a proliferation of analyses, we used muscularity dissatisfaction as the test variable for these sensitivity analyses; we did not conduct additional sensitivity analyses with other outcome variables.

Results

Descriptive Statistics

Participants reported relatively low levels of dissatisfaction with muscularity and body fat at baseline, with the median falling closest to "rarely". They reported relatively higher levels of dissatisfaction with height, with the median falling mid-way between "rarely" and "sometimes". For muscularity and general attractiveness internalisation outcomes, the median fell closest to the mid-point of the scale – "neither agree nor disagree". The median for low body fat internalisation fell closer to "disagree". Median values for the variables representing pressure from peers, significant others, the media, and family, were closest to "disagree". The median value for muscularity-related body talk was closest to "sometimes", and for body-fat-related body talk, "rarely". Median values for the variables representing expectancies and outcomes of using AAS, and intentions to use AAS, fell closest to "somewhat disagree".

Table 2 provides descriptive data for our two categorical outcome variables. A minority of boys reported using supplements to build muscle or burn fat within the past 3 months, with figures across our experimental condition and timepoints ranging from 10.7% to 15.2%. Considerably fewer boys reported using AAS within the past 3 months, with figures ranging from 0.6% to 5.8%.

Table 2
Descriptive Statistics for our Categorical Outcome Variables

		Time 1		Time 2		Time 3	
		N (%)					
Outcome variable	Condition	No	Yes	No	Yes	No	Yes
Supplement use	Intervention	181 (86.6)	28 (13.4)	169 (86.2)	27 (13.8)	117 (84.8)	21 (15.2)
	Control	183 (87.6)	26 (12.4)	158 (89.3)	19 (10.7)	173 (84.8)	31 (15.2)
Anabolic steroid use	Intervention	205 (97.2)	6 (2.8)	185 (95.9)	5 (4.1)	130 (94.2)	8 (5.8)
	Control	206 (98.6)	3 (1.4)	176 (99.4)	1 (0.6)	199 (97.5)	5 (2.5)

Outcomes of the Program

Table 3 provides summary statistics from the 14 mixed-effects models examining continuous outcome variables. Notably, we observed no significant interactions of condition with time. We observed main effects of condition (i.e., the intervention versus control) in 3 models examining muscularity internalisation, outcomes, and expectancies of using AAS, and social norms around using AAS. Collapsed across time, boys enrolled in the intervention reported lower muscularity internalisation and less permissive social norms around using AAS than those in the control group. Conversely, boys in the intervention group reported more positive outcomes and expectancies of AAS use than those in the control group.
We observed main effects of time in 8 models. Over time, collapsed across condition, we observed significant increases in muscularity dissatisfaction, pressure from significant others, pressure from peers, pressure from the media, pressure from family, outcomes and expectancies about using AAS, and intentions to use AAS. Conversely, over time, we observed significant decreases in muscularity internalisation.

Table 3.

Summary Statistics from the Mixed-Effects Regression Models Examining the Effectiveness of the Intervention Relative to Control

	Main effect of condition		Main effect of time		Interaction effect (condition by time)	
Variable	$F(df_1, df_2)$	*p*	$F(df_1, df_2)$	*p*	$F(df_1, df_2)$	*p*
Muscularity dissatisfaction	$F(1, 500.49) = 0.10$	.747	$F(2, 500.49) = 7.13$	**< .001**	$F(2, 571.71) = 0.12$	.888
Body fat dissatisfaction	$F(1, 495.36) = 1.58$	.209	$F(2, 537.88) = 1.59$	.205	$F(2, 537.88) = 1.69$	.185
Height dissatisfaction	$F(1, 497.16) = 3.50$	.062	$F(2, 574.48) = 2.48$	.085	$F(2, 574.48) = 1.63$	.197
Muscularity internalisation	$F(1, 492.88) = 7.39$	**.007**	$F(2, 549.86) = 18.65$	**< .001**	$F(2, 549.86) = 1.12$	.304
Low body fat internalisation	$F(1, 490.26) = 3.36$	.067	$F(2, 571.37) = 1.52$	.219	$F(2, 571.37) = 1.15$	.317
General attractiveness internalisation	$F(1, 484.45) = 0.43$	.512	$F(2, 603.29) = 2.23$	.108	$F(2, 603.29) = 0.81$	.445
Pressure from family	$F(1, 494.58) = 0.12$	.734	$F(2, 585.19) = 9.60$	**< .001**	$F(2, 585.19) = 0.63$	.532
Pressure from peers	$F(1, 493.65) = 0.01$	.926	$F(2, 589.84) = 3.27$	**.039**	$F(2, 589.84) = 1.26$	.283
Pressure from significant others	$F(1, 493.64) = 1.63$	.202	$F(2, 607.25) = 6.41$	**.002**	$F(2, 607.25) = 2.06$	.129

Pressure from the media	$F(1, 495.71) = 2.32$	.128	$F(2, 621.04) = 10.33$	**< .001**	$F(2, 621.04) = 2.28$	.103
Body talk – muscularity	$F(1, 492.31) = 3.16$	.076	$F(2, 560.59) = 0.36$	.696	$F(2, 560.59) = 0.36$	.696
Body talk – body fat	$F(1, 494.35) = 0.10$	.758	$F(2, 517.21) = 2.22$	.109	$F(2, 517.21) = 2.22$	.109
Outcomes and expectancies of using anabolic steroids	$F(1, 472.10) = 6.22$	**.013**	$F(2, 668.75) = 1.19$	**.024**	$F(2, 668.75) = 1.19$	.305
Intentions to use anabolic steroids	$F(1, 464.18) = 3.86$	.050	$F(2, 684.44) = 7.06$	**< .001**	$F(2, 684.44) = 1.02$	.360
Social norms, supplements	$F(1, 472.41) = 0.08$	.781	$F(2, 615.25) = 0.44$	.642	$F(2, 615.25) = 0.44$	.642
Social norms, anabolic steroids	$F(1, 466.44) = 5.25$	**.022**	$F(2, 592.71) = 0.42$	.655	$F(2, 592.71) = 0.41$	.662

Note: **bold** = significant at $p < .05$

Table 4 provides summary statistics from the two mixed-effects logistic regression models examining categorical outcome variables. No significant main or interaction effects were observed for supplement use. A significant main effect of condition was found for AAS use: Controlling for time, more boys reported using AAS in the intervention than the control. No main effect of time, or interaction effect of time by condition, was observed.

Table 4: Summary Statistics from the Mixed-Effects Logistic Regression Models Examining the Effectiveness of the Intervention Relative to Control

	Main effect of condition		Main effect of time		Interaction effect (condition by time)	
Variable	Wald χ^2(df)	*p*	Wald χ^2(df)	*p*	Wald χ^2(df)	*p*
Supplement use	$\chi^2(1) = 0.39$	.532	$\chi^2(2) = 2.29$	.318	$\chi^2(2) = 0.62$	.733
Anabolic steroid use	$\chi^2(1) = 5.86$	**.015**	$\chi^2(2) = 3.70$	.157	$\chi^2(2) = 1.20$	.550

For the above models, significant random effects at the school level were sometimes, but not always, observed. Importantly, the results of our regressions were substantively identical regardless of whether these random effects were modelled or omitted, suggesting that our results were not sensitive to school-based effects.

Sensitivity analyses

The results from these sensitivity analyses were not substantively different from the main analyses, although we did observe that, when including only individuals with moderate or more muscularity dissatisfaction, the main effect of time reversed direction, such that over time our participants reported less dissatisfaction. Importantly, however, no significant interactions of time by condition were observed. Finally, we note that our measure of internal consistency (Cronbach's alpha) for the variable representing social norms around muscle-building supplements was very low. We have analysed and reported summary statistics for the regression model based on this variable but advise against its interpretation.

Teacher Feedback from Goodform

Teachers of intervention classes were asked to provide quantitative as well as written feedback on aspects of Goodform and fidelity to the program. For each lesson, they were asked to rate on a scale with 1 indicating not at all/low, 2 indicating partially/medium, and 3 indicating fully/high, the degree to which the learning objectives were achieved. For each topic within the four lessons, they were asked to rate on the same 1-3 scale a) whether the activity was covered, b) how engaged students were in the content, c) the perceived success of the activity, and d) student understanding of the activity. The mean of each scale (i.e., whether the activity was covered, student engagement, perceived success, and student understanding) was calculated for the lesson, by adding the topic scores together and dividing by the number of topics. Teachers were also invited to provide open-ended responses regarding any highlights or changes they would make to the activities, as well as any further comments. Teachers from n=4 four intervention clusters (total n=4 participants, one from each cluster) provided feedback.

Table 5: Teacher Feedback on Goodform

	Learning Objectives Achieved	Activity Covered	Student Engagement	Perceived Success	Student Understanding
Lesson 1	2.50 (0.58)	2.93 (0.13)	2.75 (0.20)	2.88 (0.14)	2.56 (0.43)
Lesson 2	3.00 (0.00)	2.75 (0.30)	2.73 (0.31)	2.73 (0.31)	2.73 (0.31)
Lesson 3	2.50 (0.58)	2.67 (0.38)	2.33 (0.54)	2.25 (0.17)	2.33 (0.27)
Lesson 4	2.50 (0.58)	2.31 (0.55)	2.25 (0.25)	2.25 (0.25)	2.67 (0.58)

General written feedback

Lessons 1 and 2 were commended by teachers who reported a high level of student engagement, and that the content was interesting and relevant. Highlights of Lesson 1

included the digital tool, and worksheet. Highlights of Lesson 2 included researching supplements and critiquing advertisements.

Three schools reported that the role plays in lesson three didn't engage students, whereas one school reported a high level of engagement with role playing. One school reported low student engagement with the media campaign, whereas another school reported that it was well received by students.

Overall schools found engagement was low in lesson 4, and the message was repetitive. One school suggested that the media campaign may not be necessary, but another school reported that it was the highlight of the lesson but could be shortened. One school recommended that future iterations of the program include more content about improving body confidence. In summary, there was no consistency to the recommendations that leads us to believe that the program content itself should be changed, however the feedback has reinforced the fact that teachers and schools should be allowed to utilise and adapt programs to suit the behavioural and academic needs of their students outside of formal evaluation context.

General Discussion

The aim of this study was to develop and evaluate the effect of the Goodform program on muscularity-oriented body image and attitudes towards muscle building supplement use in adolescent boys. A multi-disciplinary team utilised the Design Thinking process to adapt, optimise, and create new resources that would meet the needs of boys, teachers, and parents, as recommended by experts in the field. It was hypothesised that Goodform would improve muscularity-oriented body image and attitudes towards using AAS, as well as a range of risk factors for body dissatisfaction and supplement use. Contrary to our hypotheses, the program did not result in any improvement or change over time in our variables of interest for the intervention group relative to the control group. Muscularity dissatisfaction, appearance pressures, and attitudes towards using AAS all increased over time, regardless of condition.

The lack of improvement on outcome measures attributable to the Goodform intervention on body image variables was surprising. Previous literature examining effectiveness of dissonance-based body image interventions for men found medium to large effect size improvements in most body image variables (Almeida et al., 2021; Brown et al., 2017; Brown & Keel, 2015; Jankowski et al., 2017). The literature around improvements in body image from interventions to reduce AAS use or improve attitudes around AAS use is less consistent; but there is some evidence that suggests that such programs can improve body image (Goldberg et al., 2000; Sagoe et al., 2016).

We offer the following potential explanations for these findings that were different to what was expected:

1) Universal programs- Goodform used a universal approach, targeting all boys rather than an at-risk group. While universal approaches are beneficial for girls, they are now known to be are less effective for boys (Chua et al., 2020). Previous programs finding improvements in body image variables involved self-selection into the program (Almeida et al., 2021; Brown et al., 2017; Brown & Keel, 2015; Jankowski et al., 2017). Universal prevention research is challenging as there may be floor effects in that boys are not experiencing or not reporting negative body image, leaving little room for improvement after an intervention. The effects of universal prevention interventions might also not be seen for many years, when the content of the program becomes more relevant.
2) Low initial supplement use- Boys in this study had, or reported, very low use of muscle building supplements, compared to previous research (Bell et al., 2004; Eisenberg et al., 2012; Yager & McLean, 2020). Similar to the previous point, if the boys did not have high supplement use to begin with, then this means there was less room for improvement after the intervention. It may be the case that problematic supplement use and attitudes towards doping are impacted at the school level by school culture.
3) Age of boys engaged in this project- It is possible that the specific approach taken in ATLAS and The Body Project is less effective among school-aged boys, who may not

have internalised norms around muscularity to the same extent as college-aged men. Dissonance based body image programs have previously been trialled with older adolescent or adult males (Almeida et al., 2021; Brown et al., 2017; Brown & Keel, 2015; Jankowski et al., 2017), and typically males from higher risk groups (i.e., sexual minority men (Brown & Keel, 2015; Jankowski et al., 2017) or men who self-report body image concerns (Almeida et al., 2021) and who self-select to participate. Considering the first and third explanations, offering Goodform as a selective program for boys at risk of body dissatisfaction and problematic use of supplements and AAS may be a useful direction for future research.

4) Data quality- As data were collected during covid lockdowns, and in geographically diverse areas to promote a more diverse sample, the research team could not supervise data collection procedures. We provided detailed instructions and protocols to schools, and prepared teachers as best we could, but there were still a range of silly comments entered into the online survey software that indicated that boys were joking around in class. We implemented strict data screening procedures to ensure that only the data from boys with what looked like regular responses were included (hence the fact that over 600 boys were engaged in the project and complete data from 488 was used), but this may have affected boys' capacity t feel comfortable reporting attitudes and behaviours freely.
5) Covid context- Considerable increases in depression, anxiety, and disordered eating symptoms have been noted in Australia during and after the COVID-19 lockdowns (Phillipou et al., 2020). Given that our data were collected in this time, the results may be reflective of the broader experience and context of adolescents during the pandemic.

Changes in body image and AAS attitude variables over time was noted across the whole
sample. Specifically, there were increases in muscularity dissatisfaction, pressure from significant others, pressure from peers, pressure from the media, pressure from family, outcomes and expectancies about using AAS, and intentions to use AAS. Little data exists on change in body image over time among boys, but existing studies typically find either little change or slight improvement over time (Amaral & Ferreira, 2017; de Guzman & Nishina, 2014; Dion et al., 2015), although there are exceptions which find small deteriorations (Bucchianeri et al., 2013). Notably, we did observe a decrease in muscularity internalisation, which mirrors previous findings (Amaral & Ferreira, 2017; de Guzman & Nishina, 2014; Dion et al., 2015). These data should not be substituted for longitudinal data, as half of the participants received an intervention, but it is noteworthy that these deteriorations were found within this cohort of adolescents. In light of these observed increases in body dissatisfaction over time, consistent with other recent research showing higher levels of body dissatisfaction in older adolescent boys (McLean et al., 2021), it is clear that further effective intervention is needed in this age group to prevent growing levels of body dissatisfaction and attendant negative consequences.

There are limitations which should be considered when interpreting the outcomes of this trial. We had considerable attrition from baseline to follow-up; some of this attrition was due to the burden on schools during 2020/2021 COVID-19 lockdowns. Furthermore, increases in disordered eating symptoms noted in Australia during the COVID-19 lockdowns

(Phillipou et al., 2020) may be a limitation, as some of our data were collected prior to lockdowns, and some following lockdowns. The inability to observe and facilitate data collection was a limitation. Additionally, we had difficulty matching data for a number of participants, who entered their unique code incorrectly at one or more time points, decreasing our usable sample size. It is possible that errors may have occurred either by students in entering codes or teachers in distributing them. Utilising teacher-delivery instead of researcher-delivery of the intervention could be a limitation, as we could not control the variability in the knowledge and attitudes around body image, muscle building supplements, and AAS use, and individual variations in interpretation of the program. Additionally, although fidelity ratings indicated that the majority of activities were adhered to, it is of note that some activities were only partly covered. As such, the Goodform intervention program may not have had the full impact that was desired.

It is worth noting that although Goodform was ineffective in improving either primary or secondary outcomes, engagement in the program was good, and the teacher feedback was generally positive. The Goodform program was designed after extensive consultation with end-users (Doley et al., 2020a), and as such this may have resulted in a program that is enjoyable for participants and easy for teachers to deliver at the expense of content that provides greater complexity and challenges for both participants and teacher delivery. Given that the program did not seem to cause any harm, it could be adopted by schools to fill the gap in body image and supplement education programs for boys although future research should continue to strive to identify content that does improve outcomes for this population. There may also be elements and structure of the program that could be adopted for similar interventions tested among other populations.

It is imperative that effective interventions are developed that target body image, muscle building supplements, and AAS use in boys, but conducting school-based research during the COVID-19 pandemic was challenging. Although Goodform was ineffective in improving body image and supplement use, our trial provides insights as to how such interventions can be conducted in the future. We strongly recommend the observation of data collection and thorough data cleaning practices when working with an adolescent population. Aiming to engage an older male audience (16-18) may be more effective as they may be more likely to be experiencing body dissatisfaction and using muscle building supplements, thus increasing the relevance of the program content. Researchers should continue to develop approaches to improve body image and reduce muscle building supplement use for adolescent boys – however challenging this may be.

Dissemination

Phase 3 of the project focussed on dissemination of the Goodform Program outcomes at scientific conferences and publication of results in academic journals. We have also developed a range of materials for teachers and parents that will be distributed by our dissemination partner, The Embrace Collective. The CI for this project, Dr Zali Yager, is now the Executive Director at The Embrace Collective and will manage dissemination.

We have had to revise and update all aspects of our website and web hosting that is taking some time, and availability of these materials is currently still under development. The final funding from this project is being utilised to upgrade the web hosting behind the interactive digital tool, as this was now developed 5 years ago and is in need of technical updates. The Embrace Collective has received further funding to disseminate these materials in 2024.

The Embrace Collective Website and The Embrace Hub will distribute the following:

- Goodform Program materials including: teacher workbook, student workbook, and access to all digital resources.
- 'Body Confident School Guidelines' PDF that includes recommendations drawn from this research
- The Embrace Sport Playbook, which includes recommendations drawn from this research
- Goodform Guide for parents, including an e-book, and a PDF that they can print off, and a parent masterclass about boys' body image and supplement use.

Resources will be marketed through social media posts on groups for teachers, coaches, and parents. Resources will be available worldwide, and we will seek to meet and partner with representatives from WADA and ASADA to link to Goodform resources from their website. We will reconnect with our network at Anti-Doping Norway, and Drug Free Sport New Zealand to offer the program in those countries.

Conclusion

In conclusion, this research has provided significant new knowledge to the doping, and body image fields. Through the development and evaluation of this new program that targets the behavioural drivers of doping, we have learned that this program was not effective in improving key outcome variables in terms of body image, and intentions to use AAS. However, the work completed provides an updated program, that incorporates engaging technology, and is easy to implement, that might be more effective if trialled in targeted settings, in sport settings, or if provided to boys as an intervention that they can engage with, on their own, online.

Given that the Goodform program did not seem to cause any harm, it could be adopted by schools to fill the gap in body image and supplement education programs, as schools often need to teach about this topic to meet curriculum requirements. In particular, we recommend the use of Goodform as a targeted prevention program, in situations where there is a cluster or group of boys who are observed to have particularly problematic attitudes and behaviours. We also recommend trialling the first session of this program as a stand-alone digital intervention for boys seeking information about body image and muscle building supplement use.

This project, although significantly impacted by Covid, has therefore led to the development of program materials, and supporting information and resources for parents and teachers, that can help them to support adolescent boys in their decision making around muscle building supplement use. These materials will be made available online on our new and improved website, that has the capacity to reach a much larger number of people in Australia and around the world.

Outputs: Scientific Communications

Publications from this project include:

1. Doley, J.R., McLean, S.A., Griffiths.,S & Yager, Z. Doley, J. R., McLean, S. A., Griffiths, S., & Yager, Z. (2021). Designing body image and eating disorder prevention programs for boys and men: Theoretical, practical, and logistical considerations from boys, parents, teachers, and experts. *Psychology of Men & Masculinities*, *22*(1), 124.

2. Doley, J.R., McLean, S., Griffiths, S., & Yager, Z. (2020). Study protocol for Goodform-a classroom-based intervention to enhance body image and prevent doping and supplement use in adolescent boys. *BMC Public Health 20* (1), 1-11.

3. Yager, Z., Doley, J. R., McLean, S. A., & Griffiths, S. (2023). Goodform: A cluster randomised controlled trial of a school-based program to prevent body dissatisfaction and muscle building supplement use among adolescent boys. *Body Image*, *44*, 24-35.

4. Piplios, O., Yager, Z., McLean, S. A., Griffiths, S., & Doley, J. R. (2023). Appearance and performance factors associated with muscle building supplement use and favourable attitudes towards anabolic steroids in adolescent boys. *Frontiers in Psychology*, *14*.

We delivered the following conference presentations:

- Appearance Matters 9, July 2021 Online
  - Oral Presentation: "Goodform: Initial outcomes of a pilot trial of a boys' body image and supplement prevention program with 14-16 year-old boys in Australia
- Presentation to Anti-Doping Norway: Body Image: How do we talk about it?
- Australian and New Zealand Academy for Eating Disorders [ANZAED] conference in Sydney in 2022.

Media Attention

- 'Half of Australian Adolescents are using Protein Powder'. ABC 4th March 2020.
- 'Bigorexia' hits teens using roids and supplements. The Daily Telegraph 22nd August 2020
- Featured on SBS show 'The Feed' on muscle dysmorphia.

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