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Adolescent boys' reactions to using avatars to represent their bodies

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Overweight and obesity continue to be a challenge among adolescents, specifically adolescent boys. From 2009–2010 the prevalence of obesity was higher among adolescents (18.4% ages 12–19, 18.0% ages 6–11) than preschool-aged children (12.1% ages 2–5) and higher among boys (18.6%) than girls (15%; Ogden et al., 2014). In addition, physical activity and healthy eating decline throughout childhood, increasing the risk of obesity during adolescence (Driskell, Dymont, Mauriello, Castle, & Sherman, 2008; Pate et al., 2002). One of the chief barriers to effective treatment of weight issues in adolescence is that many teens do not perceive that they are overweight (Barlow et al., 2007). Lu and colleagues (2015) analyzed the National Nutrition Examination Survey (NHANES) and found that the percentage of obese adolescent boys who accurately perceived their weight status significantly declined from 80% (NHANES III, 1988–1994) to 58% (Continuous 3 cycles of NHANES, 2007–2008–2009–2010–2011–2012). Misperception of weight status may diminish healthy lifestyle behaviors, while overweight or obese adolescents who recognize themselves as overweight are more likely to adopt healthy lifestyle behaviors, such as healthy eating and regular physical activity (Maximova et al., 2008) and engage more intensely in positive behavior change (Bittner Fagan, Diamond, Myers, & Gill, 2008). Although obesity in adolescence has become more widely recognized as an important concern for health care providers and researchers alike, little work has been done to develop state-of-the-art instruments to measure adolescent body perception.

Whitlock and colleagues (2010) recommended that health care providers not only measure weight status but also assess how adolescents perceive their own bodies to screen and refer them appropriately. Despite the availability of technology to automatically and systematically calculate body mass index (BMI), the most commonly reported method used by providers for screening excess weight is visual inspection (Perrin, Flower, & Ammerman, 2004; Dorsey, Wells, Krumholz, & Concato, 2005; Barlow et al., 2007). Clinicians used the electronic health record to accurately document BMI during 3% of the visits, BMI percentile during 4% of the visits, and weight category during 12% of the visits (Shaikh, Nelson,

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Tancredi, & Byrd, 2010). In addition, the clinicians counseled their clients on nutrition, physical activity, and sedentary activity in 20 to 25% of all the visits (Anis et al., 2004). Although weight and height are routinely measured vital signs, the calculation of body composition and assessment of body perception, health risk, and related behaviors are not routinely done (Dunn, Marcus, Garcia, Kohl, & Blair, 1999; Eden, Orleans, Mulrow, Pender, & Teutsch, 2002).

Beyond the clinical setting, in research studies, investigators commonly use figure drawings and questionnaires to examine body image and attitudes in adolescents (Cohane & Pope, 2001). Figure drawings include sets of nine male and/or female silhouettes, ranging from extremely thin to extremely fat, usually adapted from Stunkard, Sorenson, and Schlusinger (1983). These drawings are uni-dimensional with the whole body increasing in size, versus variation in individual body parts increasing. As a result of the whole body changing in size, adolescents may select images that do not reflect the perceptions of their bodies. There is a need to augment existing instruments with one that is multidimensional, computerized, and can be manipulated by adolescents to depict their perceptions of their bodies and body parts.

Given the lack of available measures and the gap that existed, researchers developed the ATTitudes and Avatars INstrument (ATTAIN), an online, multidimensional instrument guided by the integrated behavior model (IBM; Montano & Kasprzyk, 2008). The IBM proposes that an important determinant of behavior is intention to perform the behavior. A person is likely to carry out a behavior with motivation as determined by three constructs: attitude, perceived norm, and personal agency. The focus of this instrument is the construct of attitude, which is a person's overall favorableness or unfavorableness toward performing the behavior. An important innovation of this tool is the inclusion of satisfaction or dissatisfaction and accuracy of perceptions of the body and size of body parts when defining attitude.

The ATTAIN includes 20 survey items to measure boys' perceptions of their bodies, body parts, weight, and intentions to make changes to their bodies. The avatars were developed so the adolescent boys could create current and preferred representations of their bodies (Lyles, Riesch, & Brown, 2015). The purpose of this study was to provide a detailed description of adolescent boys ages 11 to 14 completing the ATTAIN in the classroom and explore feasibility and acceptability of the instrument.

METHODS

Design and Sample

The descriptive study included three written open-ended questions for data collection to which young adolescent boys (11 to 14 years) responded after completing the ATTAIN application. The boys were recruited if they met the following criteria: (a) male gender; (b) between ages of 11 and 14; (c) able to speak, read, and write English; (d) had parents/guardians who were able to read and write English to provide consent; and (e) free from cognitive disabilities that would limit understanding of the ATTAIN (assessed by school physical education teachers).

Upon approval from the University's Institutional Review Board, the recruitment plan consisted of meeting with the school personnel to discuss recruitment strategies. Based on recommendations from the school personnel, the research team introduced the study during the physical education (PE) classes at a middle school in a small city in the Midwest.

Procedure

The ATTAIn had two components. The first component consisted of 23 survey items based on the IBM (Montano & Kasprzyk, 2008). The second component consisted of an online application that enabled the boys to design avatars to portray their current body shapes and their preferred body shapes. The development of the instrument from inception to final product evolved over 16 months of collaboration between a creative director and the research team. The research team consisted of the principal investigator, the co-investigator, and four undergraduate nursing students. The research team, statistician, director of Information Technology (IT) at the University, and creative director met at least monthly and more frequently as needed to review and discuss the vision and necessary parts to be included in the ATTAIn. Using an iterative process, the principal investigator made several revisions to the ATTAIn after receiving feedback from the research group, six health experts, and six adolescent boys (Lyles et.al., 2015).

The research team also met for measurement training. Each research assistant was trained to measure body parts using the procedure recommended by the American College of Sports Medicine (Tucker, 2011). During training, the research team members measured the body parts of the same people to verify similar measurements, plus or minus two centimeters. Once the research team established interrater reliability in the research lab, the team members used the measurement procedure with the boys.

Prior to data collection, the research team first met with the school personnel including the principal, middle school IT staff, PE teachers, and the school nurse to discuss how and when the information would be presented to the boys during PE classes. The investigator demonstrated the ATTAIn application to the school personnel and addressed any concerns. The research team then introduced the study to the boys during the physical education classes. They sent a packet with information about the study home with the adolescent boys to discuss the study with their parents. The boys and parents returned the signed assent and consent forms to their physical education teachers.

On the day of data collection, the boys who assented to be in the study were excused from PE class to the school library to complete the ATTAIn application. Each boy sat at a laptop where the application was preloaded. The research team divided the boys with half getting their measurements taken and the other half monitored while completing the ATTAIn on the laptops. When finished, the groups switched tasks. This system allowed for completion of the ATTAIn and body measurements in the allotted time of 40 minutes.

To begin the ATTAIn, the boys entered their first names, avatar names, birthdates, self-reported heights, ethnicities, and races. Next, they provided responses to the 23 survey items. The survey items included the boys' attitudes and intentions/actions to change their bodies. After the boys completed the survey items, the boys were asked to design two avatars, a

Current Avatar and a Preferred Avatar. An avatar example is displayed in Figure 1. A 50th percentile avatar based on the previously entered height (in feet and inches) was generated for the boys to use. The first avatar for the boys to design was the Current Avatar, which represented how the boys believed that their bodies looked at that time. Once the Current Avatar was completed, it was populated on the next screen for the boys to design their Preferred Avatar, which represented how they wanted their bodies to look. The research team incorporated this feature of working from the Current Avatar so the boys did not have to start over, and it created a more accurate representation. The boys were able to make each body part bigger or smaller on each avatar by clicking on left (smaller) and right (bigger) arrows. The body parts included the head, neck, chest, upper arms, forearms, waist, hips, thighs, and calves. Each click on the arrow, whether left or right, represented one pixel or one centimeter of movement. The application allowed the boys to make as many changes to the body parts as they wanted until they logged out of the application. For the Actual Avatar, there was no avatar that was generated on the screen. The label Actual Avatar was created to identify the collective measurements of the body parts and for the research team to compare avatars.

On the day of data collection, the physical education teachers measured the heights and weights of the boys wearing one layer of clothing (shorts and a shirt) using a stadiometer and digital scale respectively. The research assistants then measured each boy in a separate room of the library with the door closed to ensure privacy. They measured each of the boys' body parts twice and averaged the circumferences of the head, neck, chest, upper arm, forearm, waist, hips, thigh, and calf using an anthropometric tape measure. These body parts were the same body parts that the boys made smaller and bigger for their Current and Preferred Avatars.

Following the measurements, the boys had the option of entering their names in a drawing for an iPod Touch. In addition, the research team provided a notecard for each boy to respond to three open-ended questions about the study: What did you like about the study? What didn't you like about the study? What would you suggest we change about the study? No identifying information was included on the notecards rendering responses anonymous.

Data Analysis

Deductive content analysis, to test categories and concepts, was used to analyze the data (Elo & Kyngas, 2007). The principal investigator analyzed the responses to the questions according to the process, which included three phases: preparation, organizing, and reporting (Elo & Kyngas, 2007).

The preparation phase included selecting the units of analysis and making sense of the data as a whole. The units of analysis were the boys' responses.

The organizing phase included developing a categorization matrix and coding the data according to the categories. The research team evaluated the responses to each question. Five categories were created to organize the responses: (1) survey items; (2) avatars; (3) body; (4) layout of the ATTAIN; and (5) setting.

The reporting phase included the results of the analyzing process. The principal investigator used the comments from the boys in addition to other criteria to determine the acceptability and usability of a potential universal screening instrument such as the ATTAIn. The other criteria used to assess usability of a universal screening instrument included the following: (a) instrument should be feasible; (b) should not place unreasonable burden on human or fiscal resources; (c) acceptable for multiple stakeholders; (d) allow for collecting, managing, and interpreting screening assessment data; (e) consider appropriate accommodations for the targeted population; and (f) provide useful information from a screening assessment that results in improved treatment (Glover & Albers, 2007).

RESULTS

A total of 335 study packets were sent home, and 59 boys 11 to 14 years of age assented with parental consent to complete the ATTAIn. Almost half (44.1%) of the boys were age 13 ($M = 12.6$, $SD = 0.83$). Over three-quarters (78.0%) self-reported their race as Caucasian/white and a few (10.2%) reported that they were of Hispanic ethnicity. The boys' measured heights were minimum 54 inches and maximum 72 inches ($M = 63.1$, $SD = 4.23$) while the measured weights were minimum 69 pounds and maximum 291 pounds ($M = 122.7$, $SD = 36.65$). The investigator used the CDC BMI Percentile Calculator for Child and Teen (<http://apps.nccd.cdc.gov/dnpabmi/>), to calculate the BMI and assign a weight category for each boy: underweight (<5th percentile), healthy weight (5th percentile up to 85th percentile), overweight (85th percentile to less than 95th percentile), obese (95th percentile to less than 97th percentile), and High BMI (97th percentile; Ogden et al., 2010). The boys were categorized as healthy weight (64.4%), overweight (18.6%), obese (10.2%), high BMI (6.8%), and no boys as underweight. The mean CDC BMI-for-age percentile was 63.0 ($SD = 29.43$).

Feasibility was defined as the boys completing the ATTAIn in the allotted time, and instructions and sections being reported as clear by the boys and school personnel. The school personnel found the instrument to be clear and innovative in capturing young adolescent boys' perceptions of their bodies and body parts. On the day of data collection, the boys were able to complete the ATTAIn online and have their measurements taken in a 40-minute time period (class period). One boy's computer froze, so he had to start the online application over. There were no other technical issues with the online instrument. The boys' questions about the ATTAIn related to how to answer the race and ethnicity items and how to navigate from one screen to the next. The research assistants instructed the boys to answer the items to the best of their ability and showed them where to click "next" to proceed.

The research team reviewed the notecard responses and separated the responses into categories (Table 1). About the survey items, individual boys indicated that they liked that they did not have to answer some items (option of *do not want to answer*) and the item about eating more or less (*I am trying to change my body now by...*). Two boys indicated that use of multiple-choice items provided options for the boys to review instead of generating an answer. Individual boys indicated they thought some items and choices were *strange*, *uncomfortable*, or *didn't make sense*. Seven boys wrote there were *too many items* or *repeating of items*. These boys did not elaborate on what made the items strange,

uncomfortable, or confusing. They also did not state which particular items seemed redundant. About the body, a boy thought there were *too many items on the topic of the body*. Five boys wrote they *didn't like the items about their butt*, because *most boys don't talk about that*. They recommended adding a response, *I don't care*; and *reduce the amount of questions*.

About the avatars, sixteen boys wrote they liked them; however, one boy did not like how the avatars were set up, and another wanted *more options*. The boys recommended that the changes to the avatars included defining whether *it's muscle or just size changing* and to be more like video game avatars. Three boys liked the avatar body because they *could see and indicate what they thought of themselves*; and, the avatars could *help to lose weight*. One boy recommended that the arms and bodies of the avatars be able to be made bigger than what was allowed.

About the layout of the ATTAIn, four boys indicated they liked *all of it*. Two wrote that it was an *easy and simple survey*. Individual boys wrote that they liked that the items and avatars were *on the computer*, the ATTAIn was *quick and creative*, and there was a chance to *win an iPod*. The boy whose computer froze did not like that the survey kept *glitching*. One boy recommended that the ATTAIn should *all be in one*. Some boys' responses referred to the setting of the study. One boy wrote that he liked that he *missed PE class*; four other boys wrote they did not like *missing PE class* and having it administered *in the library*. One boy wished we had administered the study *during science class*.

DISCUSSION

This study provided a detailed description of boys ages 11 to 14 completing an online application, ATTAIn, in the classroom. Overall, the boys had a positive reaction to the ATTAIn and were able to complete it in the allotted classroom time. Few prevention programs exist that address body image with adolescents and a few include boys (Franko, Cousineau, Rodgers, & Roehrig, 2013). Boys do experience body image concerns (Ricciardelli & McCabe, 2004), and adolescence seems to be the time that these concerns emerge (McCabe, Ricciardelli & Finemore, 2002). The adolescent boys in this study had mixed reactions to the items about their bodies and body parts. In one study, adolescents who were part of a weight management program had positive reactions to the use of weight-related text messages that were relevant to them with personal information (Woolford & Clark, 2009). Franko et al. (2013) conducted a study that included an internet-based program for adolescents to promote health behavior change through technology and social engagement. They found that the adolescent girls responded positively to more of the questions than the boys who were more interested in games and earning points for prizes.

Similar to the study conducted by Franko and colleagues (2013), the adolescent boys in this study responded that they liked the chance to win a prize. Many also enjoyed the avatar sections of the ATTAIn and suggested the avatars resemble those in video games. Casazza and Ciccazzo (2007) found that adolescents preferred media-based education to print material and lectures, potentially inciting greater behavior change among adolescents when the intervention program is computer-based with interactive, animated presentations versus a

traditional intervention program. A computer-based, interactive, animated program such as the ATTAIN can allow for discussion and individual feedback to further improve health and nutrition education among adolescents, while delivering private and confidential information.

Regarding additional criteria for usability of the instrument, unreasonable burden on human and fiscal resources was negligible. The ATTAIN did cost a considerable amount of money to develop; however, cost to use and deliver the instrument was nominal and relied on existing technology (computer) that is common in most settings. Furthermore, changes to the instrument itself could be readily made with minimal costs since the ATTAIN has been developed.

The instrument was acceptable to multiple stakeholders. The school personnel, school nurse, and PE teachers did not have any concerns with the instrument when it was presented to them. They found it acceptable and acknowledged the innovation of the ATTAIN to capture adolescent boys' perceptions of their bodies, body parts, and weight. The boys indicated the ATTAIN was creative, liked the avatars, and appreciated being able to see what they thought of themselves. Others, including providers, parents, and additional researchers may also appreciate the benefits of the ATTAIN in the future. The ATTAIN offers the potential for adolescents to discuss their perceptions of their bodies and goals confidentially with their healthcare providers, families, teachers, and coaches who can offer individual feedback to the adolescent and further improve healthy lifestyle behaviors.

When developing the ATTAIN, consideration was taken to ensure investigators would be able to collect, manage, and interpret the data. The ATTAIN was intended for use by a broad audience, including researchers, providers, school nurses, public health nurses, health instructors, and dietitians, to aid in screening boys and assessing their perceptions. The instrument was designed for teachers and administrators for easier data collecting and management across a variety of sites, settings, and time points. The ATTAIN is web-based, which enables the investigator to access the instrument at any time.

In the pre-development phase of the ATTAIN, individual interviews were conducted to further understand what boys thought of their weight (Lyles, 2014). When asked, boys indicated that they liked and disliked specific parts of their body and also thought it was important to be able to change specific body parts. Using their feedback, the principal investigator created the ATTAIN survey items and avatars. Next, several boys 11 to 14 years of age were asked to provide initial feedback on the clarity and comprehensiveness of the ATTAIN (Lyles, et al., 2015). Finally, after having 59 boys complete the ATTAIN, some boys indicated they did not like certain items such as those about the butt or thought some items or options did not make sense. It is necessary to further test the ATTAIN to obtain additional feedback about items that did not make sense and also include boys of diverse races and ethnicities.

Lastly, the information from completing a screening assessment can be useful to the stakeholders, including the adolescent boys, school personnel, school nurses, and PE teachers and result in improved treatment. The investigator initially tested the ATTAIN for

content validity, internal consistency, and test-retest reliability (Lyles et al., 2015). There is a need to further test the psychometric properties and determine how it can guide referral recommendations. In addition, the instrument was tested with a small convenience sample and should be tested with a larger sample size. This study aimed at developing an acceptable and feasible method to measure real and perceived body shapes in young adolescent boys.

CONCLUSION

The ATTAIN incurs minimal costs to use; is acceptable to multiple stakeholders; and allows investigators to collect, manage, and interpret data. The boys specifically had an overall positive reaction to the ATTAIN, and could clearly complete it with 98% able to complete the application without technical assistance. The investigator could administer the ATTAIN online easily and access it at any time. Body image and weight are sensitive issues that will need to be treated as such. The ATTAIN as a potential screening instrument, could bring awareness to an adolescent who may not have been aware of his actual measurements prior to the screening and also identify how he wants to change his body. As the ATTAIN continues to develop as a screening instrument, it is imperative to document the benefits of the treatments being administered and the decisions made regarding intervention planning as a result of utilizing the ATTAIN.

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Highlights

1. An online, multidimensional, theoretically derived instrument for adolescents that incorporates survey items and design of avatars was developed for adolescents to depict their perceptions of their bodies and body parts.
2. The adolescent boys had an overall positive reaction to the Attitudes and Avatars Instrument.
3. The Attitudes and Avatars Instrument can allow for discussion and individual feedback to further improve health and nutrition education among adolescents while delivering private and confidential information.
4. The Attitudes and Avatars Instrument is an acceptable and feasible method to measure real and perceived body shapes in young adolescent boys.

Figure 1.
Avatar example

Table 1

Boys' responses to the notecard questions

Categories	Boys LIKE about ATTAIN	Boys DID NOT LIKE about ATTAIN	CHANGES the boys would make to ATTAIN
Survey Items	Questions	Too many questions/repeat questions (7 boys)	Add <i>I don't care</i>
	That you can put "don't want to answer" for the questions	Questions about our butt because most boys don't really talk about their butt (5 boys)	Reduce amount of questions/shorter (7 boys)
	Multiple choice brings out your thoughts, very helpful (2 boys)	Some questions/choices don't make sense (3 boys)	Some of the questions
	I like the survey. It asked a lot of questions that could help people	Some questions and answers were strange	More comfortable questions
	Good questions	Uncomfortable questions	Should be in between answers besides "don't want to answer"
	Where it says that you eat more and eat less	Too much questions around one topic	
Avatars		Some of the questions	
	Avatars (16 boys)	How avatar was set up	In avatar portion, define whether it's muscle or just size changing
		Avatar (want more options)	Change the avatar to be more like Xbox 360
Body			Better avatar with more options
	They give you help to lose weight	----	Bigger arms and body
	That I could see how I think of myself		
Layout of ATTAIN	That I can say what I think about my body		
	All of it (4 boys)	Kept glitching	All in one
	It was easy/simple survey (2 boys)		Fix glitching
	On computer		
	Quickness		
Setting	Was creative		
	Win an iPod (2 boys)		
	Got out of PE class	Missing PE (4 boys)	Do it during science
		In library	