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Original research

## Measurement and invariance characteristics of psychosocial correlates of youth physical activity

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### ABSTRACT

**Objectives:** Physical inactivity needs to be strategically addressed from and throughout childhood and adolescence. The *youth physical activity promotion* model provides a comprehensive framework for understanding and promoting physical activity in youth. This study examined psychometric characteristics of the *children's attraction to physical activity* scale and the *perceived physical competence* scale, two frequently utilized instruments to measure the underlying predisposing factors emphasized in the *youth physical activity promotion* model.

**Design:** A cross-sectional correlational research design was utilized to address the research purposes.  
**Methods:** Participants ( $N = 1563$ ) were involved with a large school-based initiative involving 19 schools in two U.S. states. The *children's attraction to physical activity* and *perceived physical competence* scales were administered in the schools by the physical education teachers using a customized online platform. Confirmatory factor analysis and invariance model testing (i.e., configural, metric, and scalar invariances) were conducted with the Linear Structural Relations 8.8 software.

**Results:** The results supported the multidimensionality of the *children's attraction to physical activity* scale and demonstrated that the 6-factor measurement model was invariant by gender and mostly invariant by school level (elementary, middle, high). The scalar non-invariance across school levels was attributed to weak psychometric properties in two of the *children's attraction to physical activity* subscales (i.e., peer acceptance and fun of physical exertion).

**Conclusions:** The findings support the utility of the *children's attraction to physical activity* and *perceived physical competence* for capturing predisposing factors within the *youth physical activity promotion* model but document the need for refinements in several key subscales.

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### 1. Introduction

An improved understanding of factors associated with youth PA is critical for advancing public health and reversing the obesity epidemic. Studies have consistently documented sharp declines in PA levels in early adolescence<sup>1,2</sup> with larger drops evident in females than males.<sup>3</sup> Numerous studies have sought to characterize the underlying psychosocial correlates that are associated with these patterns.<sup>4,5</sup> While many correlates have been identified, differences in research design, sample population and activity measures have made it difficult to draw consistent conclusions.<sup>6–8</sup> Another challenge in advancing research in this area is that

psychosocial correlates are often studied in isolation or without an underlying theoretical basis. Baranowski et al. advocated the mediating variable framework that is supported by ecological, social, and psychological theories as a critical method to develop effective behavioral interventions.<sup>8,9</sup> Several studies have used mediation analyses and/or structural equation modeling to test the predictive utility of psychosocial correlates<sup>10,11</sup> but these studies have examined individual psychosocial constructs rather than comprehensive models.

The *youth physical activity promotion* (YPAP) model was developed to specifically help advance research on correlates of PA and to facilitate more effective activity promotional programming.<sup>12</sup> The YPAP model is grounded in a social-ecological framework that acknowledges the influence of various factors on children's PA.<sup>12</sup> The model is defined by three broad factors that collectively influence youths' involvement and interest in PA: *predisposing, enabling,*

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and reinforcing factors. Predisposing factors include variables that reflect a child's interest or desire to be physically active; enabling factors include variables that allow the child to be physically active; and reinforcing factors include variables that may encourage or support the child's PA behavior.<sup>12</sup> The predisposing factors are viewed as the predominant influence since it captures two key constructs supported by the social cognitive theory<sup>13</sup> and the expectancy-value theory<sup>14</sup>; outcome expectations ("Is it worth it?") and efficacy expectations ("Am I able?").<sup>12</sup> Numerous studies<sup>4,5,15</sup> have used the *Children's Attraction to PA* (CAPA) scale<sup>16</sup> to capture the *Is it worth it?* construct and the *Perceived Physical Competence* (PPC) scale<sup>17</sup> to capture the *Am I able?* construct.

Studies to date have supported the utility of the YPAP model.<sup>5,18,19</sup> For example, a large-scaled study surveying 1033 12–19 years old youth demonstrated that predisposing factors (i.e., perceived competence and attraction to PA) and reinforcing factors (i.e., parental influence) accounted for 17–20% and 15% of the variances in youth PA, respectively.<sup>5</sup> Working with a younger sample (i.e., elementary school children;  $N=994$ ), Welk et al. found that parental influence, as a reinforcing factor, accounted for 20% of the variance in children's PA.<sup>19</sup> Similarly, in a more recent study, Seabra et al. supported the positive association between predisposing factors (i.e., perceived competence, attraction to PA) and younger children's PA level ( $N=683$ ).<sup>20</sup> Despite the overall support of the factors within the YPAP model, questions remain about the measurement characteristics for the two commonly studied predisposing factors – perceived competence and attraction to PA. Specifically, some studies used the CAPA to reflect a single unitary construct of *Attraction to PA*<sup>4,5,11</sup> but several recent studies<sup>18,21</sup> based on younger youth (i.e., elementary school children) supported the presence of 5 independent latent variables within *Attraction to PA* (i.e., liking of game, liking of exercise, fun of physical exertion, importance of exercise, peer acceptance). Studies testing the latent structure of the predisposing factors among older youth (e.g., middle school and high school students) are not yet available. Further, items on the peer acceptance subscale were shown in several studies not to fit within *Attraction to PA*.<sup>21,22</sup> The present study will directly evaluate the measurement characteristics of the CAPA scales and PPC to determine the optimal way to operationalize these constructs.

Another unanswered question is whether the commonly used measurement model for the predisposing factors within the YPAP model holds equally well across different ages and genders. The original depiction of the YPAP model posits that the effect of the predisposing factors on PA promotion is moderated by demographic variables such as age, gender, ethnicity/culture, and socioeconomic status.<sup>12</sup> For example, Schaben et al.<sup>5</sup> found that middle school youth demonstrated higher mean values in PA and the PA correlates than high school youth. Seabra et al.<sup>21</sup> reported that weight status and socioeconomic status explained considerable variance in the constructs measured by the CAPA and PPC scales. These studies support the hypothesized moderating effect of demographic variables within the theoretical framework of the YPAP model. However, it is unknown whether the differences in the YPAP correlates were due to inherent age-related variances in the measuring scales or to true differences in these moderators. To date, no study has systematically evaluated the utility of these scales using the established invariance testing method.<sup>23</sup> Therefore, the primary goal of the study is to systematically test the invariance nature of these scales by both gender and age. If the invariance testing proves that the constructs in the YPAP model hold equally for boys and girls and across ages, then the YPAP model provides a suitable mediating variable framework to advance research on factors that may explain or influence developmental changes and gender-based disparities in PA participation.<sup>24</sup>

## 2. Methods

Participants ( $N=1563$ ) included 803 (51.4%) boys and 760 (48.6%) girls from 19 schools in two U.S. states funded through PE4Life™ school physical education (PE) grants during the 2012–2013 academic year. The participants' grade ranged from 3rd to 12th. Of all, 541 (34.6%) were from elementary school, 326 (20.9%) from middle school, and 696 (44.5%) were from high school. This study was conducted through a participatory research network constituted by university researchers, the PE4Life™ organization, and the participating schools. De-identified data were collected by PE4Life™ and then analyzed by the research team. The institutional review board approval was waived due to the nature that de-identified data were utilized and reported in this study. The researchers are all certified personnel who followed all the ethical guidelines to safeguard the participants' rights.

The reduced version of the CAPA scale<sup>16</sup> was used in this study to measure overall *Attraction to PA*. The CAPA instrument specifies 5 subscales that collectively capture attraction to PA: liking of game (LikeGame), fun of physical exertion (FunExert), liking of exercise (LikeExer), importance of exercise (ImpExer), and peer acceptance (PeerAcc). The reduced version of CAPA with 15 items (3 items in each subscale) has been frequently used in school-based research,<sup>5,21</sup> and is phrased in the structured alternative format to reduce social desirability. The internal consistency was acceptable in the present study ( $\alpha=.75$ ), similar to findings from a previous study.<sup>5</sup> The following is one item from the LikeGame subscale: *Decide which statement is more like you: For some kids, games and sports are their favorite thing [4.Really true for me] [3.Sort of true for me]; Other kids like other things more than games and sports [1.Really true for me] [2.Sort of true for me].*

Five items scored on a 4-point scale were used to measure perceived physical competence (PerComp). These items were selected from Harter's original PPC scale<sup>17</sup> for children. This instrument also used the structured alternative approach to constrain the tendencies for socially acceptable responses. Previous studies have showed the original instrument had relatively good internal consistency ( $\alpha=.71$ ),<sup>16</sup> which is similar to the present study ( $\alpha=.75$ ). The following is one item from the PerComp scale: *Decide which statement is more like you: Some kids are good at most games and sports [4.Really true for me] [3.Sort of true for me]; Other kids aren't much good at games and sports [1.Really true for me] [2.Sort of true for me].*

The data were obtained as part of a regional, participatory research network established by PE4Life™ to help schools enhance PE programming. The schools' PE teachers administered the instruments using a customized, web-based data collection platform called the Youth Activity Profile (YAP). The YAP contains a self-report measure of PA as well as a battery of psychosocial correlates including the CAPA and PPC scales. Students logged in using a unique school ID and then provided information about gender, school level (elementary, middle or high school), and grade. The online application guided them to complete the PA items along with the CAPA and PPC scales. Data were collected between December 2012 and May 2013 but only data from the CAPA and the PPC scales were used in the present analyses.

Descriptive statistics including sample size, means, standard deviations, and normality of the variables were calculated across gender and school level. Further, bivariate Pearson product-moment correlations were conducted among the outcome variables.

The measurement models were tested using confirmatory factor analysis (CFA). The measurement model investigated the loadings of factors on observed variables, interrelations of the factors, and the errors of the observed variables. As shown in Fig. 1, the original a priori measurement model was specified with items from the

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