The direct and indirect effects of motor competence on adolescents' mental health through health-related physical fitness

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Abstract:

Mental health is an important public health issue and up to one in five youth experience mental health problems. The primary purpose of this study was to examine the relationship among motor competence, health-related physical fitness and mental health outcomes in adolescents. A secondary goal was to test the direct and indirect effects of motor competence on adolescents' mental health through health-related physical fitness. Participants were 279 adolescents (Mage = 12.49, SD = 0.89) recruited in the south-west region of the US Motor competence including volleyball, soccer, and ultimate Frisbee, were assessed using PE Metrics™. FITNESSGRAM® test battery was used to assess health-related physical fitness components. Students completed a survey measuring their depressive symptoms and health-related quality of life. Motor competence was significantly associated with components of health-related physical fitness (r ranged from −0.15 to 0.38). The robust fit of the model supports the significant indirect effect of motor competence on mental health outcomes through health-related physical fitness ($\chi 2/df = 39.92/25$; CFI = 0.97; RMSEA = 0.046; 90% CI [0.02, 0.07]). The hypothesized conceptual model tested in this study provides insights into the potential interaction of motor competence and health-related physical fitness with adolescents' mental health.

Keywords: motor competence | health-related physical fitness | mental health | adolescents

Article:

Introduction

Mental health is an important public health issue as up to one in five youths experience mental health problems (Bor, Dean, Najman, & Hayatbakhsh, Citation2014; U.S. Department of Health and Human Services, Citation2010). Mental health, as a state of well-being, refers to one's awareness of his or her ability in dealing/coping with the stresses/difficulties in life, working in a proficient and efficient pattern, and being able to serve his or her community (World Health Organization, Citation2014). Mental health outcomes include well-being and ill-being among

adolescence such as anxiety, depression, psychosocial well-being and quality of life, which are referred as the most common mental health outcomes in literature (Bor et al., Citation2014; Lubans et al., Citation2016; USDHHS, Citation2010). The US Public Health Service reported that approximately 20% of youth had a diagnosable mental health disorder and the number of youth who received outpatient mental health services increased considerably from 9.2% in 1996–1998 to 13.3% in 2010–2012 (Olfson, Druss, & Marcus, Citation2015). It is urgent to investigate the behavioural and psychosocial mechanisms toward mental health among adolescents.

It is well established that a healthy level of health-related physical fitness (PF) has numerous benefits for youth's physical health (i.e., cardiovascular and metabolic diseases, obesity, and musculoskeletal problems) as well as mental health (i.e., depression, anxiety, stress, quality of life; Blair, Cheng, & Holder, Citation2001; Esteban-Cornejo et al., Citation2014; Janssen & LeBlanc, Citation2010; Smith et al., Citation2014). As an important health marker during adolescents development, health-related PF can be thought of as an integrated measure of the body functions including cardiorespiratory endurance, muscular strength and endurance, flexibility, and body composition (Blair et al., Citation2001; Welk & Meredith, Citation2010). Adolescence is a time period that involves rapid physical, mental, social, and emotional growth and development; however, health-related PF during these years is on declining (Sawyer et al., Citation2012). Blair and colleagues (Citation2001) proposed a conceptual model which claims the components of health-related PF may be the direct determinants of health outcomes. Consistent with Lubans et al. (Citation2016)'s assumption that certain health-related PF components may explain the potential mechanisms to an individual's mental health such as cognition, depression, and quality of life. The documented potential indicators of mental health in previous studies are cardiorespiratory fitness, muscular fitness, and motor competence (Gu, Keller, Weiller-Abels, & Zhang, Citation2017; Xiang et al., Citation2017). Xiang et al. (Citation2017) provided preliminary evidence that only components of health-related PF (e.g., cardiorespiratory fitness, muscular fitness) but not motor competence have emerged as the direct and independent risk factors for adolescents' mental health such as depression. In 2015, the American Heart Association published a policy statement supporting health-related PF is more important than physical activity in relation to health outcomes (Kaminsky et al., Citation2013). Unfortunately, it is always a challenge in the effort of promoting and maintaining adequate health-related PF among adolescents. Therefore, research examining the determinant of health-related PF is needed among adolescents.

A growing body of evidence suggests that motor competence may play a key role in understanding health-related PF in adolescents (Stodden, Gao, Goodway, & Langendorfer, Citation2014; Stodden et al., Citation2008). Motor competence, in general, is defined as the degree of skill performance in goal-directed tasks/games involving movement coordination and manipulation of the movement patterns (i.e., soccer; SHAPE America, Citation2014; Stodden et al., Citation2008). Motor competence has been purported as contributing to youth's health-related PF and is thought to provide the foundation for an active lifestyle (Gu, Thomas, & Chen, Citation2017; Stodden et al., Citation2008). In a sport/game setting, one's motor competence could be observed from his/her proficiency in specific motor skills, such as passing, receiving, and shooting in soccer (Gu, Thomas, et al., Citation2017). It is suggested that adolescents should spend many hours each day engaging in large muscles involved motor skills in various activities/games, which may provide the foundation for their physical and psychosocial growth (Bardid et al., Citation2016; Barnett et al., Citation2016; Cattuzzo et al., Citation2016; Hands, Larkin, Parker, Straker, & Perry, Citation2009). For example, Bardid and colleagues (Citation2016) found that 3rd/4th graders with high motor competence had greater psychosocial health (i.e., motivation and

global self-work) than those with low motor competence. It is important to understand the underlying mechanism and differentiate which variables (health-related PF components vs. motor competence) proposed in Blair et al. (Citation2001)'s model are important in relation to mental health (Lubans et al., Citation2016; Xiang et al., Citation2017). To the best of our knowledge, no previous studies have investigated the independent and combined effects of health-related PF and motor competence on mental health outcomes proposed in Blair et al. (Citation2001)'s conceptual model among adolescents. This information can guide the development of targeted interventions for adolescents who are at risk for low health-related PF in these components, and ultimately prevent mental health impairment among adolescents.

Theoretically, it is reasonable to assume the indirect association between motor competence and mental health since the growing evidence support motor competence serves as a determinant of health-related PF during adolescence (McMorris, Citation2014; Robinson et al., Citation2015; Stodden et al., Citation2008). The purpose of this study, therefore, was to examine the relationship among motor competence, four components of health-related PF (cardiorespiratory fitness, muscular fitness flexibility, and body composition [BMI]), and mental health outcomes (depression and health-related quality of life [HRQOL]) among adolescents. A secondary purpose was to test the direct and indirect effects of motor competence on adolescents' mental health through health-related PF.

Methods

Participants

Two hundred and seventy-nine adolescents (148 female, 131 male; Mage = 12.49, SD = 0.89) participated in this study and were recruited from three public middle schools in the south-west region of the US Participants were predominately Caucasian (66.2%) and remaining included 15.6% Hispanic, 6.5% Black, 5.5% Asian, and 6.2% others. There were 54.5% in the sixth grade (n = 152), 27.6% in the seventh grade (n = 77), and 17.9% in the eighth grade (n = 50). The study was approved by the University Institutional Review Board, and supported by the school district and the school principals prior to the beginning of the study. Parental informed consent and child assent forms were received before the data collection.

Study design and procedure

A prospective research design was used in this study across the 2014–2015 academic year. In the fall semester of 2014, participants' motor competence was assessed using the PE Metrics™ (SHAPE America, Citation2010). After five months later, FITNESSGRAM tests were conducted in the spring semester of 2015. At the end of the spring semester, participants spent around 15–20 min completing a series of survey scales to report their depressive symptoms and HRQOL.

Measures

Socio-demographic variables

Socio-demographic information including age, sex, and ethnicity was obtained from the school district. The socio-economic status (SES) was also identified based on each participant's lunch

meal status according to the Income Eligibility Guidelines (IEGs; Start & Assistance, Citation2012).

Motor competence

Students' motor competence was assessed with the PE Metrics™ battery (SHAPE America, Citation2010) including skills in soccer, volleyball, and Ultimate Frisbee. PE Metrics™ is a valid and reliable assessment battery for measuring students' motor competence, and all the assessment procedures/criteria are consistent with children's developmental level (considering age/grade) identified by NAPSE's Assessment Task Force (Zhu et al., Citation2011). It is a process-oriented performance evaluation based on specific performance criteria for each sport skill (i.e., techniques/components of each skill), which is consistent with how we define motor competence in this study. Students' performance of each skill was scored based on a four-level competence scoring rubric (4 = always; 3 = consistently; 2 = usually; 1 = sometimes/seldom). The level 3 or above is denoted as the nationally-recommended proficiency level (SHAPE America, Citation2010). Students were provided with instructions for each skill assessment and observed the demonstration of each skill before being asked to perform. Specifically, for the volleyball assessment, students were asked to perform the overhead and forearm passing of a tossed ball to a target player (five opportunities for each type of pass) measuring their consistency and accuracy of overhead and forearm passing (total score ranges 0–16). Students were asked to play a 3-on-3 modified game of Ultimate Frisbee for 5 min, and their performance was evaluated based on the four-level scoring rubric within three categories: basic skills, offence and defence skills during the performance (total score ranges 0–16). We assessed basic skills, offensive, defensive, and transition skills for soccer in a modified game of 3-on-2 soccer and each category was assessed based on the four-level rubric (total score ranges 0–16). The total scores from these three sports were represented as an overall index of motor competence in this study (ranges 0–44).

Health-related physical fitness

Health-related PF was represented by cardiorespiratory fitness, muscular fitness (including strength and endurance), flexibility, and body composition measured by FITNESSGRAM test battery (Welk & Meredith, Citation2010). Specifically, cardiorespiratory fitness was assessed by the Progressive Aerobic Cardiovascular Endurance Run (PACER). Muscular fitness was measured by two tests, curl-ups and 90-degree push-ups. Flexibility was assessed by back-saver sit-and-reach test and shoulder stretch test. Body composition was represented by body mass index (BMI) according to height and weight using the standard formula: BMI = weight (kg)/[height (m)]2. Based on the FITNESSGRAM standards chart, participants' raw scores for each test were transformed and categorized into two categories: 1 = Health Fitness Zone (HFZ) and 0 = Need Improvement (NI). The standardized scores were used in the descriptive analysis in order to calculate the fitness status of each component (% of students in HFZ) in our sample and the raw scores were used for all fitness components in SEM model as latent variables.

Depression

The 20-item Center for Epidemiologic Studies Depression Scale (CES-DC; Faulstich, Carey, Ruggiero, Enyart, & Gresham, Citation1986) was used to assess participants' depressive

symptoms. Participants responded to each item on a 4-point scale ranging from not at all (0) to a lot (3). A Total score was calculated by the sum of the items, ranging from 0 (no symptoms) to 60 (high level of symptoms). Scores at or above 15 are suggestive of depression based on previous research, while depression was treated as a continuous variable in this study. CES-DC was a reliable and valid measure of depression for adolescents aged 12–18 years in previous research (Fendrich, Weissman, & Warner, Citation1990; Ruggero, Petrie, Sheinbein, Greenleaf, & Martin, Citation2015), and in the current sample: Cronbach's alpha coefficient was .85.

Health-related quality of life

HRQOL was measured by the 23-item paediatric QOL inventory generic core scales (PedsQL 4.0; Varni, Seid, & Kurtin, Citation2001), including physical functioning (eight items), emotional functioning (five items), social functioning (five items), and school functioning (five items). Participants responded to a 5-point Likert scale (0 = never a problem; 1 = almost never a problem; 2 = sometimes a problem; 3 = often a problem; 4 = almost always a problem). The items were reverse-scored and linearly transformed to a 0 (lowest) to 100 (highest) scale. The PedsQL 4.0 demonstrated acceptable reliability and validity in the previous studies (Gu, Solmon, & Zhang, Citation2014), and its Cronbach's alpha coefficient was .82 in the current study.

Statistical analysis

Statistical analyses were conducted using SPSS Version 24.0 (IBM Corp., Armonk, NY, USA) and AMOS Version 24. After screening the raw data to assure accuracy and normality, three steps were taken to analyse the data in this study. First, Pearson product-moment correlation was used to examine the bivariate correlations among motor competence, health-related PF (cardiorespiratory fitness, muscular fitness, flexibility, and BMI), and mental health outcomes (depression and HRQOL). Second, two separate hierarchical regression analyses were conducted to investigate the role of four health-related PF components in predicting depression and HRQOL, after accounting for all socio-demographic variables, respectively.

Lastly, structural equation modelling (SEM) analysis was used to address the second purpose of this study. Specifically, the first SEM model was structured to test the direct and indirect effects simultaneously of motor competence on students' mental health outcomes. Then, according to the assumption that motor competence serves as the direct indicator of health-related PF (Stodden et al., Citation2008), the second SEM model was structured to test the potential indirect effects of motor competence on students' mental health outcomes through health-related PF without the direct path from MC to mental health outcomes. The model fit was determined using Goodness-of-fit statistics (Hu & Bentler, Citation1999; Markus, Citation2012), including $\chi 2$ goodness-of-fit test ($\chi 2$GoF), normed fit index (NFI), incremental fit index (IFI), comparative fit index (CFI), and root mean squared error of approximation (RMSEA). The Akaike Information Criterion (AIC) and the Bayesian Information Criterion (BIC) of the two models were also examined, with lower values representing better fit (Burnham & Anderson, Citation2003). To test the statistical significance of the indirect effect, the bootstrapping technique was utilized for the models by calculating the 95% confidence intervals after controlling for all covariates including sex, age, ethnicity, and SES (Preacher & Hayes, Citation2008).

Results

The results for descriptive statistics are presented in Table 1. Approximately 41% girls and 35.3% boys showed at least mild depressive symptoms in the sample (CES-DC ≥15). Less than half of the adolescents demonstrated recommended competent level-3 or above in overall motor competency in this study according to PE Metrics™ criteria (SHAPE America, Citation2010), with 35.2% in volleyball, 48.6% in soccer, and 52.8% in ultimate frisbee. Around 42.3% of our participants met the health fitness zone for all FITNESSGRAM tests in the study. There were 32.8% for BMI, 15.2% for cardiorespiratory fitness, 20.2% for muscular fitness, and 21.2% for flexibility in the need improvement category.

Table 1. Descriptive characteristics for the study sample (N = 279)

Variables	N (% students)	Mean	*SD*
Demographic			
Age (year)		12.49	.89
Sex (Female)	148 (53.0%)	-	-
SES (Paid)	215 (77.4%)	-	-
Ethnicity (White)	182 (66.2%)	-	-
Mental Health Outcomes			
HRQOL	-	81.11	14.91
Depression (≥ 15)	107 (38.6%)	14.40	10.83
Health-related PF (meet HFZ)	118 (42.3%)	5.97	1.19
BMI	170 (67.2%)	.67	.47
Cardiorespiratory	218 (84.8%)	.85	.36
Muscular Fitness	194 (79.8%)	1.77	.48
Flexibility	186 (78.8%)	2.69	.64
Motor Components (≥ *level 3*)	63 (22.6%)	26.94	7.33
Volleyball	98 (35.2%)	10.13	3.29
Soccer	135 (48.6%)	10.77	3.99
Ultimate Frisbee	147 (52.8%)	8.30	2.48

SES: socio-economic status (paid lunch); Health-related PF: health-related physical fitness; HRQOL: health-related quality of life; BMI: body mass index; HFZ: health fitness zone; PACER: progressive aerobic cardiovascular endurance run; SD: Standard Deviation.

Based on the correlation analyses (Table 2), motor competence was significantly associated with components of physical fitness including cardiorespiratory fitness, muscular fitness, and body composition (r ranged from −.15 to .38), but not with flexibility. Both depression and HRQOL were significantly related to overall motor competence and three components of health-related PF (cardiorespiratory fitness muscular fitness, and body composition). There was a strong negative correlation between and depression HRQOL ($r = -.72$) in this study. The assumption of non-multicollinearity was met with the diagnostics of variance inflation factors (VIF) less than 10 and tolerance statistics larger than .10 (Field, Citation2009). The hierarchical regression analyses indicated that cardiorespiratory fitness ($\beta = -.24$, $p < .01$) emerged as a significant predictor of depression after controlling all socio-demographic variables, accounted for 18.2% of the variance in the model. It was found that muscular fitness ($\beta = .25$, $p < .01$) was a significant predictor of

HRQOL, accounting for 12.5% of the variance in the model after adjusting for the covariates (i.e., sex, age, ethnicity, and SES).

Table 2. Correlations among the study variables (N = 279)

	1	2	3	4	5	6	7
1. BMI	(-)						
2. Cardiorespiratory Fitness	−.43**	(-)					
3. Muscular Fitness	−.26**	.51**	(-)				
4. Flexibility	.15*	−.10	.02	(-)			
5. Motor Competence	−.15**	.38**	.36**	−.07	(.78)		
6. HRQOL	−.16**	.21**	.29**	.02	.20**	(.82)	
7. Depression	.25**	−.25**	−.23**	−.03	−.23**	−.72**	(.85)
M	20.78	38.60	1.77	2.69	26.94	81.11	14.40
SD	4.30	16.09	0.48	0.64	7.33	14.91	10.82

Cronbach alpha coefficients are provided along the diagonal for self-report measures. Intra-class reliabilities are reported for motor competence measures. HRQOL: Health-related Quality of Life; BMI: Body Mass Index. M: mean; SD: standard deviation;
* $p < .05$. ** $p < .01$.

According to the SEM model (see Figure 1), the goodness-of-fit indices suggested a well-fitting model ($\chi 2/df = 38.78/24 < 3$; NFI = .92; IFI = .97; CFI = .97; RMSEA = .047; 90% CI [.02, .07]). MC was a strong predictor of health-related PF ($\beta = .77$, $p < .001$; Path a). Path coefficients from health-related PF to mental health outcomes ($\beta = .17$, $p = .37$; Path b) and MC to mental health outcomes ($\beta = .22$, $p = .29$; Path c) were not significant in this model. That is, the result did not support the direct effect from MC to mental health outcomes in our sample. The second SEM model (see Figure 2) examined the potential indirect effect of MC on students' mental health outcomes through health-related PF according to the assumption that MC serves as the direct indicator of health-related PF (Stodden et al., Citation2008). The goodness-of-fit indices suggested a well-fitting model ($\chi 2/df = 39.92/25 < 3$; NFI = .92; IFI = .97; CFI = .97; RMSEA = .046; 90% CI [.02, .07]). The robust fit of the model supports the hypothesized indirect effect and the standardized parameter estimates of the model are presented in Figure 2. This model also showed better fitting, based on lower AIC and BIC values (97.93 and 100.09), than the first model (98.78 and 101.02). Within this model, motor competence significantly and positively predicted overall health-related PF ($\beta = .78$, $p < .001$; Path a). The health-related PF became a significant predictor of mental health outcomes ($\beta = .36$, $p < .001$; Path b). The indirect effects from motor competence to depression ($\beta = -.26$) and HRQOL ($\beta = .22$) were small but significant. According to the bootstrapping test after controlling for all covariates (Preacher & Hayes, Citation2008), the magnitude of indirect effects was statistically significant by calculating the bootstrap 95% CI [−.19, −.02] for depression and [.02, .25] for HRQOL. The significant indirect effect of motor competence on mental health outcomes through health-related PF was supported regardless of the socio-demographic covariates in this study. The variance explained in the dependent variables by the model was 61.1% for health-related PF and 13% for mental health outcomes.

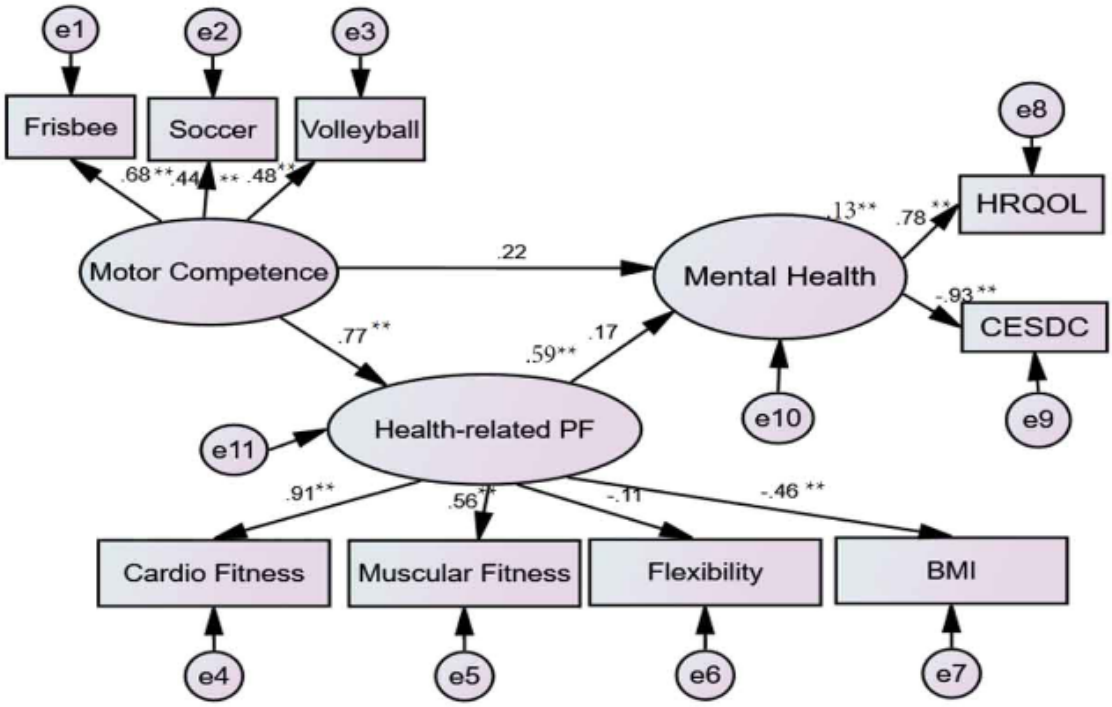

Figure 1. The direct effect structural model

Note. Health-related PF: Health-related Physical Fitness; HRQOL: Health-related Quality of Life; BMI: Body Mass Index; CESDC: Depression. * p < .05. ** p < .001.

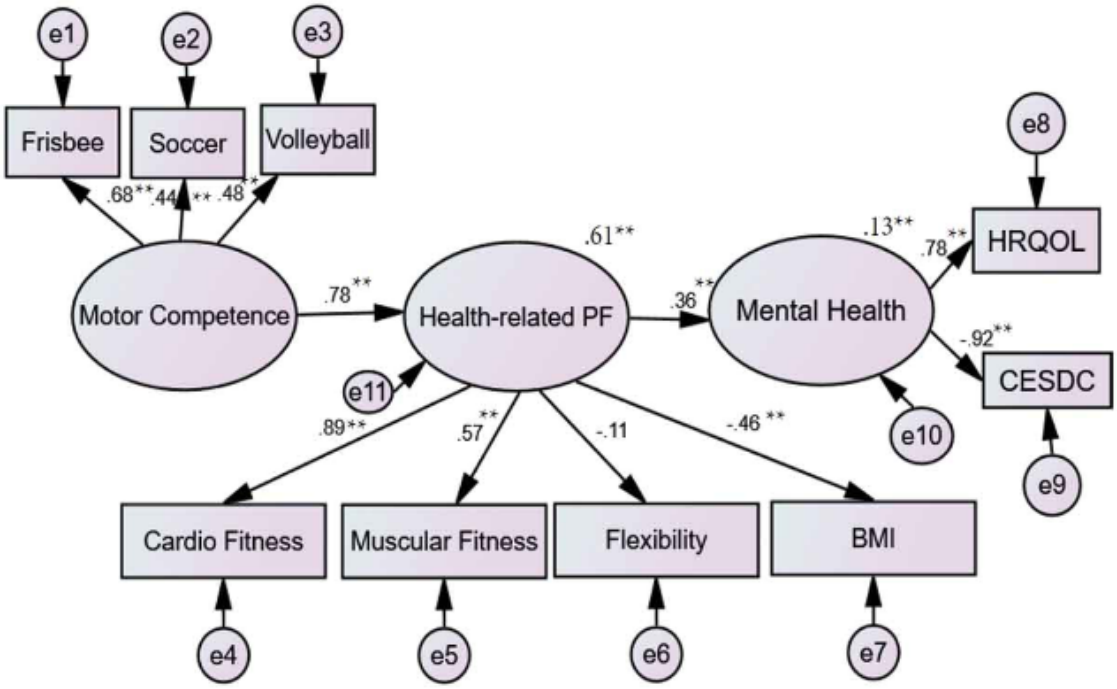

Figure 2. The Indirect effect structural model

Note. Health-related PF: Health-related Physical Fitness; HRQOL: Health-related Quality of Life; BMI: Body Mass Index; CESDC: Depression. Circles represent latent variables, and square represent observed variables (or indicator of the latent variables). * p < .05. ** p < .001.

Discussion

Mastering adequate motor competence and achieving a health-enhancing level of health-related PF are critical components to develop physically literate adolescents, who have sufficient skill and competence to live active and healthy lifestyles (SHAPE America, Citation2010, Citation2014). The findings of this study highlight the importance of the components of health-related PF for mental health outcomes including depression and HRQOL, and its relationships with motor competence. The hypothesized relations between behavioural factors (i.e., motor competence and health-related PF components) and mental health outcomes in this study were based on the conceptual model proposed by Blair et al. (Citation2001, p. S380). The mechanism proposed and tested in this study provides meaningful insight of the potential interactions of those variables toward adolescents' mental health, which is an important contribution to current physical education literature and research.

The findings of this study suggest that developing adolescents' motor competence, such as skills related to soccer, volleyball, and Ultimate Frisbee, may provide more opportunities or potential to promote their health-related PF during this developmental stage. Specifically, students who are skilful in individual sport skills during middle school years (i.e., 6th grade) are more likely to enrol in athletic program in the later grades, which may help them maintain or enhance their overall physical fitness level through intensive practice/training and seasonal games during adolescence. The US 2018 National Physical Activity Guideline also suggests that adopting grade- and developmental-appropriate activities (e.g., soccer, volleyball, Ultimate Frisbee, and basketball) is an effective strategy to promote health-related PF (Piercy et al., Citation2018). It is noticed that only 22.6% adolescents in our sample met the national recommended motor competence level, a slightly higher proportion compared to a previous study (11%) using TGMD-2 amongst 12- to 13-year-olds. Similar to previous research findings, students with developed motor skills have the greater competence to engage in various activities or tasks, and are more likely to be physically fit as a result of more practice opportunities (Cattuzzo et al., Citation2016; Stodden et al., Citation2008). Specifically, Cattuzzo and colleagues (Citation2016) noted in their systematic review the significant relationship between motor competence and, cardiorespiratory fitness (12 out of 12 studies), muscular fitness (7 out of 11 studies), and body weight status (27 out of 33 studies), but not flexibility. The results also provide primary evidence to support Stodden et al.'s (Citation2008) conceptual model, which may help with understanding the important role of motor competence in promoting and maintaining health-related PF in middle school years.

Numerous reviews have shown the positive impact of health-related PF components especially cardiorespiratory fitness, muscular fitness, and BMI on mental health outcomes in adolescents (Esteban-Cornejo et al., Citation2014; Haapala, Citation2013; Xiang et al., Citation2017). Consistent with previous research evidence, the positive trajectories of health-related PF to adolescents' mental health outcomes were supported. Further, including all four components of health-related PF in this hypothesized model is unique to the study. This highlights both growth- and maturation-related changes of motor competence and health-related PF are contributors of mental health. The SEM results suggest that the development of motor competence in adolescence may directly augment health-related PF and may serve to prevent mental health problems indirectly during adolescence. A recent study (Bardid et al., Citation2016) support the notion that actual and perceived motor competence might be crucial to improve psychosocial well-being, such as global self-worth among children. However, the direct effect of motor competence on mental health was not statistically significant in our adolescent youth sample. Since few studies

have simultaneously examined the combined effects of motor competence and health-related PF on mental health among adolescents, more research is warranted in this line of research.

Although the hypothesized model was based on the theoretical recommendation in the literature (Blair et al., Citation2001; Stodden et al., Citation2008), using a prospective research design instead of a longitudinal design to test the causal pathway is the main limitation of this study. Future longitudinal studies are recommended to test the feasibility of practical implementation. Given a lack of performance-based motor skill assessments in the literature, using the PE Metrics™ assessment rubrics focused on process-oriented criteria are the strength of this study, which provides a valid and objective measurement of how adolescents apply their motor skills in dynamic situations. Although using PE Metrics™ has been recommended by researcher (Hastie, Citation2017), other outcome-oriented motor skill assessment (i.e., TGMD-3) may be used in future research and may provide comprehensive pictures of development status of each individual adolescent. In this study, all the mental health outcomes were self-report scales. The inclusion of both self-report and objective assessments of individuals' mental health in future research can more accurately detect health-related problems in adolescents.

In conclusion, grounded in Blair et al. (Citation2001)'s conceptual model, the indirect effect of motor competence on mental health outcomes through health-related PF tested in the SEM model was supported and provided the insights to the current literature. Our research findings established that many adolescents (less than 50%) do not attain adequate motor competence according to national criteria (SHAPE America, Citation2010), which may be one of the reasons of why many adolescents in this study showed at least mild depressive symptoms. The development of competence in a variety of motor skills may provide promising avenues not only to the development of appropriate levels of health-related PF but also to promoting mental health among adolescents. The finding of this study also suggests the importance of opportunities for practice and encouragement of motor skill learning and development during adolescence (Barnett et al., Citation2016; Hardy, Barnett, Espinel, & Okely, Citation2013; Valentini & Rudisill, Citation2004). Moreover, aligned with the SHAPE America National PE Standards (i.e., Standard 1, 2, and 3), objectively assessing adolescents' motor competence and health-related PF and their potential relationships with mental health outcomes among adolescents have meaningful implications to meet the goal of Healthy People 2020. In particular, school-based interventions may emphasize skill acquisition and enhance health-related PF, which may contribute to the reduction of depressive symptoms and improve adolescents' quality of life (U.S. Department of Health and Human, Citation2010).

Disclosure statement

No potential conflict of interest was reported by the authors.

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