Author(s): Rachele, Jerome N.; Jaakkola, Timo; Washington, Tracy L.; Cuddihy, Thomas F.; McPhail, Steven M.

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Research article

Adolescent Self-Reported Physical Activity and Autonomy: A Case for Constrained and Structured Environments?

Jerome N. Rachele ✉, Timo Jaakkola, Tracy L. Washington, Thomas F. Cuddihy and Steven M. McPhail
School of Public Health and Social Work and Institute of Health and Biomedical Innovation, Queensland University of Technology, Victoria Park Rd, Kelvin Grove, Brisbane, Australia

Abstract
The provision of autonomy supportive environments that promote physical activity engagement have become popular in contemporary youth settings. However, questions remain about whether adolescent perceptions of their autonomy have implications for physical activity. The purpose of this investigation was to examine the association between adolescents' self-reported physical activity and their perceived autonomy. Participants (n = 384 adolescents) aged between 12 and 15 years were recruited from six secondary schools in metropolitan Brisbane, Australia. Self-reported measures of physical activity and autonomy were obtained. Logistic regression with inverse probability weights were used to examine the association between autonomy and the odds of meeting youth physical activity guidelines. Autonomy (OR 0.61, 95% CI 0.49-0.76) and gender (OR 0.62, 95% CI 0.46-0.83) were negatively associated with meeting physical activity guidelines. However, the model explained only a small amount of the variation in whether youth in this sample met physical activity guidelines (R^2 = 0.023). For every 1 unit decrease in autonomy (on an index from 1 to 5), participants were 1.64 times more likely to meet physical activity guidelines. The findings, which are at odds with several previous studies, suggest that interventions designed to facilitate youth physical activity should limit opportunities for youth to make independent decisions about their engagement. However, the small amount of variation explained by the predictors in the model is a caveat, and should be considered prior to applying such suggestions in practical settings. Future research should continue to examine a larger age range, longitudinal observational or intervention studies to examine assertions of causality, as well as objective measurement of physical activity.

Key words: Adolescent, autonomy, physical activity, self-determination theory, self-report.

Introduction

Physical activity engagement has proven important in the primary and secondary prevention of several chronic conditions (Warburton et al., 2006). However, the process of ingraining long-term lifestyle physical activity patterns has proven to be a difficult enterprise (Muller-Riemenschneider et al., 2008). An individual's lifestyle is the sum of cumulative day to day choices. These choices are made in response to stimuli on a background palate of intrinsic and extrinsic factors that have led to ingrained habitual patterns (Telama et al., 2005). Evidence has shown that lifestyle patterns developed during childhood and adolescence have a tendency to carry over into adulthood (Hallal et al., 2006; Telama et al., 2013).

In addition to the long-term benefits of regular physical activity, increases in physical activity among youth have proven to be associated with a number of important factors; including nutritional intake (Storey et al., 2009), academic performance (Rasberry et al., 2011; Trudeau and Shephard, 2010), depressive symptoms (Aman et al., 2009; Rothon et al., 2010; Motl et al., 2004), stress (Twisk, 2001), risk-taking behaviours (Geckil and Dundar, 2011), self-esteem (Ekeland et al., 2005a; 2005b; Twisk, 2001) and wellness (Rachele et al., 2014). In order to better understand the context of youth physical activity engagement, it is important to establish its associated predictors. The knowledge of such predictors may influence the planning and structure of physical activity and health promotion interventions aimed at youth.

Autonomy is one of three basic 'psychological needs' that individuals need to satisfy, along with competence and relatedness, that comprise self-determination theory. Autonomy has been defined as the ability to do what one does independently, without being forced to do so by some outside power, and is in essence self-determination (Boden, 2008). It is fostered by a context that provides autonomy support in the form of acknowledging the behavior's perspective, opportunity for initiative, and the provision of choice (Deci et al., 1994; Ryan, 1982). A recent systematic review on exercise, physical activity, and self-determination theory showed consistent support for a positive relationship between more autonomous forms of motivation and exercise, with a trend towards identified regulation predicting initial/short-term adoption more strongly than intrinsic motivation, and being more predictive of long-term exercise adherence (Teixeira et al., 2012). Among children aged 8-12 years, the provision of autonomy supportive environments has proven to increase rates of play and physical activity (Roemmich et al., 2012); .

While there appears to be a positive relationship between autonomy and physical activity, comparable relationships are yet to be established among adolescent populations. Understanding this relationship may aid in the design of interventions facilitating physical activity engagement among young people. Specifically, the opportunities given to participants to independently make decisions about their physical activity. The purpose of this investigation was to examine the association between adolescents' self-reported physical activity (whether or

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not they met minimum recommended physical activity guidelines (Department of Health and Ageing, 2004)) and their autonomy. It was anticipated, based on existing literature (Hagger et al., 2003; 2005; Lim and Wang, 2009), that a positive association would be found between meeting minimum physical activity guidelines and autonomy.

Methods

Participants

This investigation included a total of 384 adolescents (95 males and 177 females) aged between 12 and 15 years. Participants were recruited from six secondary schools in metropolitan Brisbane, Australia. Schools were categorized as either from low, medium, or high socioeconomic status (SES) backgrounds. School SES background was determined by the Australian Curriculum, Assessment and Reporting Authority's Index of Community Socio-Education Advantage (ICSEA). Details on the ICSEA scale used in this study have been published elsewhere (Rachele et al., 2013, Australian Curriculum Assessment and Reporting Authority, 2012). Participants were recruited from two non-denominational same-sex private schools classified as high SES; one same-sex and one co-ed private school classified as mid SES, both with religious affiliations, and one non-denominational public school; and one non-denominational public school classified as low SES.

Instruments

International Physical Activity Questionnaire for Adolescents: The International Physical Activity Questionnaire for Adolescents (IPAQ-A), adapted from the International Physical Activity Questionnaire Long Version, was developed for use in adolescents (Hagstromer et al., 2008; Rachele et al., 2012). This adapted version also measures physical activity over the previous seven days, and covers four domains of physical activity being school-related physical activity, including activity during physical education classes and breaks, transportation, housework, and leisure time. In each of the four domains, the numbers of days per week and time periods per day spent walking, in moderate activity and in vigorous activity are recorded. Variations from the adult version include questions about physical activity at work being replaced by physical activity at school, and including only one question about physical activity in the garden or at home (versus 3 in the standard IPAQ) (Hagstromer et al., 2008). Since its establishment, the IPAQ-A has been used in used in several empirical studies (De Bourdeaudhuij et al., 2010; Hagstromer et al., 2008; Rachele et al., 2014), and significant associations have been found for moderate-to-vigorous physical activity among adolescents aged 12 to15 years when compared to accelerometers ($r = 0.20$, $p < 0.01$) and VO_2 max ($r = 0.20$, $p < 0.01$) (Ottevaere et al., 2011): which although low, appear promising for future iterations of the instrument. It has been reported that the minimum dose of physical activity per week in youth to gain health benefits is 420 minutes per week (one hour per day) at a moderate-to-vigorous intensity (Trost, 2005). Total time spent per week engaging in moderate-to-vigorous physical activity can be summed across each of the four domains, and computed to establish if participants are meeting physical activity recommendations (World Health Organization, 2010, Department of Health and Ageing, 2004). The IPAQ-A was used in this way for this investigation to identify those participants who were (and were not) meeting the minimum physical activity levels recommended for obtaining health benefits.

Self-Determination Scale: Autonomy was assessed using Sheldon and Deci's (Sheldon and Deci, 1996) 10-item Self-Determination Scale. This 10-item scale has two factors; awareness of self and perceived choice. For each item, participants were asked to indicate which of two statements is more true for them (e.g., "A. I sometimes feel that it's not really me choosing the things I do" and "B. I always feel like I choose the things I do"). Participants responded on a 1 (only A feels true) to 5 (only B feels true) scale. After re-coding reversed items, the mean responses from participants formed an autonomy index. The scale has good internal consistency (alphas ranging from 0.85 to 0.93) and adequate test-retest reliability ($r = 0.77$); and has shown to be a strong predictor of several psychological health outcomes including self-actualization, empathy, life satisfaction and creativity(Sheldon and Deci, 1996, Sheldon, 1995).

Procedure

Questionnaires were distributed to students via teaching staff at their respective schools. Students were invited to complete the survey at home. Questionnaires included a participant information sheet for both parents and students detailing their involvement in the study. Questionnaires were then returned to teaching staff, and collected by the principal researcher. This study was approved by the Human Research Ethics Committee of the Queensland University of Technology (#1100000885).

Data analysis

Analyses were performed using StataSE version 13 (StataCorp, 2013). Demographic information (age, gender and school SES) was described using conventional descriptive statistics. Participants were categorized as either sufficiently or insufficiently physically active as determined by meeting physical activity guidelines of at least 420 minutes per week of moderate-to-vigorous physical activity, as recommended by the World Health Organization (World Health Organization, 2010) and Australian Federal Government Department of Health and Ageing (Department of Health and Ageing, 2004). Physical activity was categorized to ensure greater clinical meaningfulness of results (if participants were sufficiently physically active for health benefits), as well as to enable comparisons with internationally published categorical data for youth physical activity (Currie et al., 2012).The mean responses from participants (after reverse coding) were used to form an autonomy index, with scores ranging from 1 (lowest possible autonomy) to 5 (highest possible autonomy).

Previous investigations have indicated missing data from physical activity surveys among adolescents may

not be missing at random; with adolescents from low SES backgrounds more likely to have incomplete data (Corder et al., 2011). This meant that simple listwise deletion of participants on the basis of missing data (missing in a systematic way) could negatively influence the robustness of the study's findings. Inverse probability weighting was used in this analysis to prevent any bias created from missing data. Briefly, a logistic regression with the presence of missing data as the dependent variable and participant characteristics (SES, gender, age, ethnicity, school status) as independent variables was used to determine which participant characteristics were associated with missing data. Those characteristics associated with missing data were then used to create inverse probability weights (propensity for missing physical activity data). This was to ensure that participants with complete data and possessing traits in common with participant's who had missing data, were given a greater weighting during analysis.

A logistic regression was undertaken to examine the association between participants who were sufficiently physically active (dependent variable) and autonomy (independent variable). Potential confounding variables gender and school SES were also included in the model, as well as clustering at the school level (using the *vce cluster* option). Cronbach's alpha was also undertaken to determine the internal consistency reliability of the self-determination scale. Simulation studies of logistic regressions indicate that a minimum of 10 outcome events per predictor variable are required to avoid poor modeling including coefficient bias, poor confidence interval coverage, and type 1 error (Peduzzi et al., 1996). The regression model in this analysis contained 4 predictor values, requiring a minimum sample size of 40 participants.

Results

A total of 272 (70.8%) participants (95 males and 177 females) had complete data and were included in the analysis. The mean age (standard deviation) of participants was 13.7 (0.7) years. The number (%) of participants included were 37 (13.6%) from low SES schools, 131 (48.2%) from mid SES schools, and 104 (38.2%) from high SES schools. The analyses of missing data revealed that school SES ($p < 0.001$) indicated propensity for missing data and this variable was used to generate inverse probability weightings.

A total of 159 (58.5%) participants reported physical activity levels that exceeded guidelines. Within each SES group, the number (%) of participants who reported being sufficiently physically active were 19 (51.4%) from low SES schools, 78 (59.5%) from mid SES schools, and 59 (56.7%) from high SES schools. The mean (standard deviation) autonomy score was 3.07 (0.53). The results for the logistic regression are displayed in Table 1. The model indicated that autonomy ($p < 0.001$) and gender ($p = 0.004$) were negatively associated with meeting the physical activity guidelines, meaning that for every 1 unit decrease in autonomy, participants were 1.64 times more likely to meet physical activity guidelines. Acceptable internal consistency reliability was found for the self-determination scale ($\alpha = 0.76$).

Discussion

This study examined the association between self-reported physical activity and autonomy in adolescents. The findings suggest that self-reported physical activity was negatively associated with autonomy among adolescents in this sample. However, it was noteworthy that these variables explained only a small proportion of variance in adolescent self-reported physical activity levels. This is perhaps unsurprising, given that it is likely that youth have a variety of (and potentially not easily measurable) influences on their physical activity. Nonetheless, these findings indicate that the greater independence of decision-making that adolescents are provided, the less likely they are to engage in physical activity of sufficient levels required to meet national and international guidelines.

These results are somewhat surprising, and at odds with several previous studies. A recent systematic review conducted by Teixeira et al. (2012) identified 66 published empirical studies, including experimental, cross-sectional, and prospective studies that have measured exercise causality orientations, autonomy/need support and need satisfaction, exercise motives (or goal contents), and exercise self-regulations and motivation; including self-determination theory interventions aimed at increasing exercise behavior. The results showed consistent support for a positive relationship between more autonomous forms of motivation and exercise, with a trend towards identified regulation predicting initial/short-term adoption more strongly than intrinsic motivation, and intrinsic motivation being more predictive of long-term exercise adherence. It was also found that competence satisfaction and more intrinsic motives positively predict exercise participation across a range of samples and settings. Furthermore, in a recent investigation among children aged 8-12 years, the provision of autonomy supportive environments increased rates of play and physical activity (Roemmich et al., 2012). The findings from this study are also at odds with several similar studies in the physical education literature; which have demonstrated that providing an autonomy supportive environment within physical education settings is associated with both

Table 1. Logistic regression results between self-reported physical activity and autonomy

Independent variable	Odds-ratio	Robust SE	p-Value	95% Confidence Interval	
Autonomy	.61	.07	.000	.49	.76
Age	1.00	.35	.992	.51	1.98
Gender	.62	.09	.002	.46	.83
	Pseudo $R^2 = .023$				

SE = Standard Error: The dependent variable in this analysis is meeting physical activity guidelines coded so that 0 = did not meet physical activity guidelines and 1 = did meet physical activity guidelines

intention to be physically active, and actual leisure-time physical activity (Hagger et al., 2003; 2005; Lim and Wang, 2009).

The implications of the study findings from a practical standpoint suggest that interventions designed to facilitate youth physical activity should limit opportunities for youth to make independent decisions about their engagement. For example, in a hypothetical scenario, a school wished to make time available for free activities, and encourage its student to engage in physical activity endeavours during this time. The current findings suggest that if the school provided students with a range of choices about the types of activities available (both active and inactive), students would be less likely to engage in physical activities. Consequently, a limited range of options should be considered. However, caution should be exercised given the small amount of variation explained in physical activity by the predictor variables in the model.

Another notable finding from this investigation was the relationship found between gender and physical activity. Females in this study were 1.62 times less likely to meet physical activity recommendations. This finding aligns with global trends, which have found that males are more likely to meet physical activity recommendations (60 minutes of moderate-to-vigorous physical activity daily) for all countries that participated in the Health Behaviour in School-Aged Children study, with this trend being significant in most countries (Currie et al., 2012).

This study included a number of important limitations. First, evidence indicates that youth from lower SES backgrounds may have poorer reading proficiency than their higher SES counterparts (Willms, 2003). It is therefore likely that lower levels of reading proficiency among students from lower SES schools may have meant these students had a greater propensity to not return completed self-report questionnaires (and were initially underrepresented in the model). However, this potential shortcoming was overcome by employing inverse probability weights (for missing data) in the analyses to ensure that students with similar attributes to those who had missing data were assigned a higher weighting within the model. This analysis technique meant that individuals attending lower SES schools have been weighted more heavily in the model reported in this study. Second, this study only included participants aged 12 to 15 years, and consequently, the findings cannot be extrapolated beyond this age group. Further investigations in the 9 to 12 year and 15 to 17 year age groups would enhance the understanding of physical activity's relationship with autonomy during continuing decline in physically activity levels among youth (Nader et al., 2008). Third, while this study included different SES groups, and representation of participants from all SES groups via inverse probability weighting methods could be considered a strength, this investigation only included participants from a high income nation where participation in school education is compulsory for adolescents in this age group. Therefore these findings may not be applicable to youth from dissimilar societies. Finally, although the study design was suitable to address the research aim, longitudinal observations, potentially including measurements of the autonomy supportive environments of the school or home, or intervention trial (such as the direction manipulation of the environment) would have strengthened this study, and be required before any assertions of causality could be made.

There are a several related priorities for future research. Informing the understanding of the relationship between physical activity and self-determination among youth populations is of considerable importance, particularly for why the findings of this study are at odds with the findings with from other age groups (Teixeira et al., 2012). Furthermore, physical activity levels generally begin to decline at 9 years of age, and continue until 15 years (Nader et al., 2008). Indeed, this decline is sharper among youth from disadvantaged or low income communities and remains a priority for subsequent investigations (Borraccino et al., 2009). A longitudinal observational study incorporating measurements of physical activity and self-determination over at least the ages of 9 to 15 years could provide considerable insight into this relationship; complementing similar studies in this area (Cox et al., 2008; McDavid et al., 2014; Wallhead et al., 2014). Furthermore, self-reported physical activity measures provide important information about the type and context of physical activity performed; however, these assessments could be supplemented with objective measurement instruments such as accelerometers to improve measurement accuracy (Rachele et al., 2012).

Conclusion

Autonomy was found to have a significant, although small negative association with self-reported physical activity in this sample. Future research should continue to examine a larger age range, longitudinal observational or intervention studies to examine assertions of causality, as well as objective measurement of physical activity.

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Key points

- Autonomy was negatively associated with meeting physical activity recommendations
- The findings suggest that more structured environments would facilitate physical activity
- The small amount of variation explained by the predictors in the model is a caveat

✉ **Dr Jerome N. Rachele**
School of Public Health and Social Work, Queensland University of Technology, Victoria Park Rd, Kelvin Grove, Brisbane, Australia

AUTHOR BIOGRAPHY

Jerome N RACHELE
Employment
School of Public Health and Social Work and Institute of Health and Biomedical Innovation, Faculty of Health, Queensland University of Technology
Degree
PhD, BAppSc (HMS), BEd (Sec)
Research interests
Physical activity, school-based interventions, active transport
E-mail: j.rachele@qut.edu.au

Timo JAAKKOLA
Employment
Department of Sports Sciences, Motor Behaviour and Research unit, University of Jyvaskyla
Degree
PhD
Research interests
Physical activity, physical education, sport psychology, motivation
E-mail: timo.jaakkola@jyvaskyla.fi

Tracy L WASHINGTON
Employment
Civil Engineering and Built Environment School, Science and Engineering Faculty, Queensland University of Technology
Degree
PhD, MA, BaMF
Research interests
Physical activity, public open spaces, active transport, workplace interventions
E-mail: tracy.washington@qut.edu.au

Thomas F CUDDIHY
Employment
School of Exercise and Nutrition Sciences and Institute of Health and Biomedical Innovation, Faculty of Health, Queensland University of Technology
Degree
PhD, MHMS, BEd
Research interests
Physical activity, physical education, wellness, health promotion
E-mail: t.cuddihy@qut.edu.au

Steven M McPHAIL
Employment
School of Public Health and Social Work and Institute of Health and Biomedical Innovation, Faculty of Health, Queensland University of Technology and Centre for functioning and Health Research, Queensland Department of Health, Brisbane, Australia
Degree
PhD, BPhty
Research interests
Physical activity, health services, rehabilitation, randomized controlled trials, behaviour change
E-mail:steven.mcphail@health.qld.gov.au