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Associations between utilitarian walking, meeting global physical activity guidelines, and psychological well-being among South Korean adolescents

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ABSTRACT

Introduction: This study examined the levels of utilitarian walking by age and gender and associations between utilitarian walking, meeting global physical activity guidelines, and psychological well-being in a nationally representative sample of South Korean adolescents.

Methods: The 2016 Korea Youth Risk Behavior Web-based Survey included complete self-reported data from 60,548 adolescents aged 12–17 years (M age = 14.8 ± .02). Utilitarian walking was the exposure variable and outcome variables included meeting the World Health Organization's moderate-to-vigorous physical activity (MVPA) recommendation (≥ 60 min/day), happiness, and stress. Covariates included age, gender, area of residence, economic status, and academic performance. The Complex Samples (CS) general linear and logistic regression analyses were conducted.

Results: A significant age x gender interaction was observed on weekly utilitarian walking. Boys showed higher utilitarian walking than girls (5.8 vs. 5.1 h/wk; $p < .001$). The age differences were more apparent among girls with younger age generally showing higher utilitarian walking than older age except 12 vs. 13 years ($p < .001$). Among boys, age differences were only observed for 12 vs. 13 years and 13 vs. 14 years ($p < .001$). Weekly utilitarian walking for 1–5 h (Odds ratio[OR]: 1.73, 95%Confidence interval[CI]: 1.41–2.13) and > 5 h (OR: 5.26, 95%CI: 4.32–6.41), compared to < 1 h, were associated with meeting the MVPA recommendation (*p-for-trend* < .001). Compared to adolescents who reported < 1 h/wk on utilitarian walking, those reporting 1–5 h/wk (OR: 1.18, 95%CI: 1.12–1.25) and > 5 h/wk (OR: 1.29, 95%CI: 1.22–1.37) were associated with higher odds of being happy in a linear fashion (*p-for-trend* < 0.001) after adjusting for MVPA in addition to covariates. No associations were observed between utilitarian walking and no/low stress.

Conclusion: Higher levels of utilitarian walking were associated with meeting the MVPA recommendation and being happy. Future studies should investigate the correlates of utilitarian walking to inform interventions and strategies to promote such walking among Korean adolescents.

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1. Introduction

Based on compelling evidence suggesting numerous health benefits of physical activity in young people (Poitras et al., 2017), global physical activity guidelines recommend that children and adolescents should accumulate at least 60 min of moderate-to vigorous-intensity physical activity (MVPA) per day for optimal health (World Health Organization [WHO], 2010). However, physical inactivity in young people is prevalent worldwide with some variations existing across countries (Aubert et al., 2018). In high-income countries, active modes of transport, such as walking or cycling, to and from school (Faulkner et al., 2009) has shown to assist young people in achieving the daily recommendation of MVPA with some unique health benefits (Kek et al., 2019; Pabayo et al., 2010).

In a systematic review examining the associations between active school transport and physical activity, moderate quality evidence suggested that active school transport is positively associated with overall physical activity levels with some evidence of causation (Larouche et al., 2014b; Lau et al., 2017). In addition, active school transport was favorably associated with body weight and cardio-metabolic health (Larouche et al., 2014b; Pabayo et al., 2010). Therefore, active travel, particularly active school transport, is incorporated into health promotion strategies for young people in many high-income countries (Green Committee Canada, 2007; Mandic et al., 2016; Mori et al., 2012; Muennig et al., 2014).

In South Korea (Korea thereafter), despite that more than three quarters of adolescents (77%) walked to and from places for approximately 25 min per day (Song et al., 2016), a low proportion of adolescents meet the global MVPA recommendation (60 min/day) (WHO, 2010). This finding has been consistent from 2014 to 2017 (5–6%) based on different national data (Lee et al., 2016; Oh et al., 2018; Song et al., 2016). Though corresponding evidence with cycling as a means to active transport is not available in the adolescent age group, the most common transportation mode among 1044 Korean elementary school students was walking (51%) followed by automobile transport (20.5%), public transit (15%), and biking (13.2%) (J.A. Lee et al., 2015). Combined, walking is likely to be a primary mode of active transport among Korean adolescents, it is uncertain whether utilitarian walking contributes to meeting the WHO's MVPA recommendation and/or is associated with varying health indicators in Korean adolescents, as observed in adolescents from other high-income countries (Larouche et al., 2014b).

Engaging in MVPA and muscular strengthening exercises was associated with psychological well-being among a nationally representative sample of Korean adolescents (Min et al., 2017); however, it is less understood whether engaging in utilitarian walking is associated with positive psychological health outcomes in the adolescent population. Addressing this inquiry is particularly important given that Korean adolescents have been consistently ranked at the bottom in happiness among > 30 countries registered with the Organization of Economic Cooperation and Development (OECD) (Yun, 2014). Furthermore, internationally, literature pertaining to active transport (walking, cycling, or both) has predominantly measured active transport to/from school exclusively and its association with physical health outcomes (Waygood et al., 2017).

Examining associations between utilitarian walking and psychological well-being is also important for Korean adolescents as they have highly structured daily schedules that correspond to societal academic expectations (Lee and Yi, 2016; Lee et al., 2010). Long study time (i.e., 13–15 h/day) among Korean adolescents, especially those in higher grades, has been noted previously (Carr and Wang, 2017). It is also typical that physical education classes get replaced with “free study time” where students self-direct the time to studying *more important* subjects in classroom (Lee and Cho, 2014). A recent study investigating the context of physical activity among Korean adolescents indicated that school is a primary setting for physical activity as they spent most of their waking hours in school (Curtin et al., 2018). Furthermore, based on a report from the Organization for Economic Development (OECD), 14% of Korean students did not participate in any physical activity outside of school (Organization for Economic Co-operation and Development, 2017). Because Korean adolescents dedicate almost two thirds of the day to studying in school and after school in private tutoring institutions (Lee and Yi, 2016), there is limited room to intervene at the population level to increase overall physical activity.

Unlike structured forms of physical activity such as organized sport or physical education, utilitarian walking can easily be incorporated into one's daily routines outside of school with the appropriate built environment (Giles-Corti et al., 2009). Previous research that included Korean adults also has shown that increased access to places could improve overall physical activity and health outcomes(S.H. Lee et al., 2015). If utilitarian walking is positively associated with both MVPA and psychological well-being among Korean adolescents, encouraging utilitarian walking can be considered as a health promotion strategy. To the authors' knowledge, however, no study has investigated these associations in the Korean adolescent population. Though the associations between age, gender, and active transport, including both utilitarian walking and cycling, have been largely mixed in the international literature (Larouche et al., 2015; Pabayo et al., 2011; Reimers et al., 2013; Silva et al., 2011; Sirard and Slater, 2008), age and gender were significant correlates of utilitarian walking in a previous study that used a representative sample of Korean adolescents (Song et al., 2016).

The objectives of this study were to first describe the levels of utilitarian walking by age and gender, and examine the associations between utilitarian walking, MVPA, happiness, and stress among a large, nationally representative sample of Korean adolescents aged 12–17 years. Conceptually, controlling for MVPA while examining the relationship between utilitarian walking and psychological well-being can potentially be problematic because MVPA and utilitarian walking could be dependent to one another (Larouche et al., 2014a; Lau et al., 2017). However, no research has examined the relationship of MVPA and utilitarian walking longitudinally in the context of Korea. Therefore, we added MVPA as a covariate in examining the relationship between utilitarian walking and psychological well-being for exploratory purposes.

2. Methods

2.1. Study participants

Data from the 12th Korea Youth Risk Behavior Web-based Survey (KYRBS) collected in June 2016 were used for this analysis (data available at http://yhs/cdc.go.kr). The KYRBS was developed by the KCDC, Ministry of Education, and Ministry of Health and Welfare (Kim et al., 2016) and is a repeated, cross-sectional, nation-wide, multi-stage cluster sampled survey that monitors health and health behaviors among Korean adolescents aged between 12 and 18 years. The questionnaire consists of 117 items in 15 sub-fields related to health (e.g., mental health, oral health, self-rated health), and health behaviors (e.g., physical activity, smoking, drinking, diet, weight control behavior). Psychometric properties for each measure have not been reported. However, acceptable ranges of validity and reliability values has been provided for all questions in the KYRBS (kappa scores ranging 0.41–0.98; % agreement ranging 77.6%–100%) (Kim et al., 2016). A total of 400 middle schools and 400 high schools were recruited from 17 metropolitan cities and provinces. To obtain a representative sample, schools were selected as primary sampling units (PSUs) that are geographically representative. Within each PSU, one classroom per school grade was sampled using the systematic sampling technique (Ministry of Education et al., 2016). Prior to data collection, participating school boards, individual schools, teachers, and parents provided informed consent. Students completed a self-administered web-based questionnaire using a computer in a private area in the computer room in each school, which took approximately 45–50 min to complete. Among those recruited (67,983 students from 800 schools), data were collected from 65,528 students from 798 schools (response rate: 96.4%) (Ministry of Education et al., 2016). Adolescents aged 18 years were excluded from the study because the WHO's physical activity recommendations for children and youth includes up to the age of 17 years. A total of 60,548 adolescents aged between 12 and 17 years were eligible for the present study. All participants provided informed consent (Ministry of Education et al., 2016). The KYRBS is conducted based on the Population Health Promotion Act 19 and Bioethics and Safety Acts 2.1 and 2.2.1; therefore, no institutional ethics approval was required (National Statistics Approval Number: 117058). Detailed information about the survey methodology is published elsewhere (Kim et al., 2016; Ministry of Education et al., 2016).

2.2. Measures

2.2.1. Utilitarian walking

Two items on the frequency and duration of utilitarian walking were used to measure active travel to/from places. Participants were asked “During the past seven days, how many days did you walk for ≥10 min (this includes walking to commute to school or move from one place to another)?” with response options ranging from 1 (none) to 8 (seven days). Participants were also asked to indicate how many hours and minutes per day they walked. Hours utilitarian walking per week was calculated by multiplying the frequency and duration of utilitarian walking. Utilitarian walking was categorized into < 1 h per week, 1–5 h per week, and > 5 h per week based on a previous study (Larouche et al., 2014b).

2.2.2. MVPA

Leisure-time PA was assessed using questions translated from the Youth Risk Behavior Surveillance System (YRBSS) questionnaire (available at http://www.cdc.gov/HealthyYouth/yrbs/index.htm). Survey participants were asked “During the past seven days, how many days did you engage in heart-pumping activities for ≥60 min?” with response options ranging from 1 (none) to 8 (seven days). For analyses, MVPA was categorized into meeting (≥60 min of MVPA daily; those who responded “8”) and not meeting (those who responded “0–7”) the WHO (2010)'s recommended level of physical activity. For sensitivity analyses, MVPA was also categorized into accumulating ≥60 min of MVPA for 5 days and 6 days, respectively, per week.

2.2.3. Psychological well-being

Items on self-reported happiness and stress were used to measure psychological well-being. Participants were asked “On regular days, how happy are you?” with response options ranging from 1 (very happy) to 5 (very unhappy), and “On regular days, how much do you feel stressed?” with response options ranging from 1 (very much feeling stressed) to 5 (not at all feeling stressed). The happiness variable was recoded so that higher scores reflect being happy while lower scores reflect being unhappy. Happiness and stress were categorized into binary categories based on positive (very happy and happy; not at all feeling stressed and not so much feeling stressed) versus neutral and negative responses (neutral, unhappy, and very unhappy; neutral, feeling stressed, and very much feeling stressed).

2.2.4. Covariates

Self-reported age (12–17 years), gender (boy or girl), family economic status (very high, high, middle, low, or very low), area of residence (large cities, medium cities, or small cities that were predetermined by the KYRBS) and academic achievement (very high, high, middle, low, or very low) were considered as covariates based previous literature showing their associations with psychological well-being in the Korean adolescent population group (Kang et al., 2015; Lee et al., 2010). In addition to these covariates, MVPA was included as a potential covariate to examine the association between utilitarian walking and psychological well-being, independent of MVPA. Though MVPA and utilitarian walking could be dependent to one another (Larouche et al., 2014a; Lau et al., 2017), we added MVPA as a covariate because the correlation between MVPA and utilitarian walking was not statistically significant in our sample.

2.3. Statistical analysis

Because of the multi-stage cluster sampling design of the KYRBS, *Complex Samples Procedures* in IBM SPSS 25.0 were used. The Complex Samples (CS) Plan procedure was used for all analyses to take into account stratification by region and clustering within schools. Whether the data included outlying values was explored using descriptive statistics. Data points ± three standard deviations from the mean of utilitarian walking were considered outliers (Tabachnick and Fidell, 2019) and removed from the analyses (n = 915). Means and standard errors (M ± SE) or percentages (%) of key variables and covariates are described by gender. To describe average hours of utilitarian walking per week by age and gender, CS descriptive statistics were estimated. To meet the normality assumption for parametric tests, log transformation was performed on the average utilitarian walking per week. CS general linear models (CSGLM) were conducted to test the differences in average hours of utilitarian walking per week by age and gender with Bonferroni-corrected post-hoc tests for paired comparisons. Additional CSGLM stratified by gender were followed with Helmert contrasts if significant age x gender interaction existed.

A series of CS logistic regression models were conducted with sequential Bonferroni correction to examine (1) the association between utilitarian walking and meeting the MVPA recommendation before and after adjusting for covariates (age, gender, area of residence, economic status) and (2) associations between utilitarian walking and positive responses for psychological well-being before and after adjusting for covariates and MVPA. In examining the association between utilitarian walking and meeting the MVPA recommendation, sensitivity analyses were followed with different frequencies of MVPA (i.e., accumulating ≥ 60 min of MVPA for 5 days and 6 days per week). Odd ratios (OR) and 95% confidence intervals (95% CI) were generated, and significance level was set at $p < .001$ *a priori*. The OR of 1.5 and 5.0 reflected small (Cohen's $d = 0.2$) and large (Cohen's $d = 0.8$) effects, respectively (Chen et al., 2010). Exposure-outcome gradients were also calculated using the analysis of linear trend (*p*-for-trend) to examine if associations between the ordered categories of utilitarian walking and meeting the MVPA recommendation or psychological well-being are in a linear fashion. Specifically, the association between the exposure (i.e., utilitarian walking) and outcome (happiness and no/low stress) should be incremental. In a case where odds ratio is not statistically significant, the analysis of linear trend (*p*-for-trend) was not interpreted.

3. Results

A total of 59,633 out of 60,548 samples were used in analyses. No significant differences were found in sociodemographic variables before and after the exclusion of outliers. The sample characteristics are presented in Table 1. On average, Korean adolescent boys and girls engaged in 5.8 and 5.1 h of utilitarian walking per week (50 and 44 min daily), respectively. The proportion of adolescents accumulating ≥60 min of MVPA for 5, 6, and 7 days per week was 13.1% (18.8% in boys, 7.0% in girls), 7.1% (10.6% in boys, 3.4% in girls), and 5.1% (7.7% in boys, 2.3% in girls), respectively. Adolescents who reported that they are very happy/happy and not at all feeling stressed/not so much feeling stressed were 66.6% (69.8% in boys, 63.1% in girls) and 19.7% (25.0% in boys, 13.9% in girls), respectively.

Fig. 1 illustrates the average hours adolescents engaged in utilitarian walking per week by age and gender. A significant age x gender interaction was found ($F[5, 674] = 7.815$) in utilitarian walking. Adolescent boys reported more hours walking to get to places than adolescent girls ($t[1, 678] = 10.473$). Decomposing the interaction by gender, a main effect for age emerged for both boys (Wald $F[5, 674] = 9.78$) and girls (Wald $F[5, 674] = 33.77$). Specifically, age differences in boys were significant between 13 vs. 14 years (Wald $F[1, 678] = 25.03$) and between 14 vs. 15 years (Wald $F[1, 678] = 27.49$). Among girls, significant age differences were observed in all pairs of age groups: between 12 vs. 13 years (Wald $F[1, 678] = 49.70$) 13 vs. 14 years (Wald $F[1, 678] = 100.05$), 14 vs. 15 years (Wald $F[1, 678] = 87.17$), 15 vs. 16 years (Wald $F[1, 678] = 36.88$), and 16 vs. 17 years (Wald $F[1, 678] = 22.46$).

Table 2 shows the association between weekly utilitarian walking categories and meeting the MVPA recommendation. Adjusted analyses showed that, compared to weekly utilitarian walking < 1 h, utilitarian walking 1–5 h (OR = 1.73, 95% CI = 1.41, 2.13) and > 5 h (OR = 5.26, 95% CI = 4.32, 6.41) were associated with higher odds of achieving the recommended level of MVPA (60 min daily). With the latter association representing a large effect. This pattern was similar when different MVPA frequency cutoffs (i.e., meeting the MVPA recommendation for 5 and 6 days) were used.

Table 3 shows the association between weekly utilitarian walking and psychological well-being. Compared to weekly utilitarian walking < 1 h, utilitarian walking 1–5 h (OR = 1.18, 95% CI = 1.12, 1.25) and > 5 h (OR = 1.29, 95% CI = 1.22, 1.37) were associated with higher odds of reporting happiness in a linear fashion (*p-for-trend* < .001), after adjusting for covariates. The strength of the observed associations were small. No associations existed between utilitarian walking and no/low stress after adjusting for covariates.

4. Discussion

Based on a large, representative sample of Korean adolescents aged from 12 to 17 years, this study examined the levels of weekly utilitarian walking by age and gender and associations between weekly utilitarian walking, MVPA, and psychological well-being. Overall, findings indicated that utilitarian walking was favorably associated with MVPA and happiness after adjusting for covariates. The results of this study add to the previous literature suggesting that active transport in varying forms and types (e.g., cycling, walking, active school transport) is favorably associated with MVPA and different health indicators among children and youth (Carver et al., 2011; Larouche et al., 2014b; Lau et al., 2017; Pabayo et al., 2011).

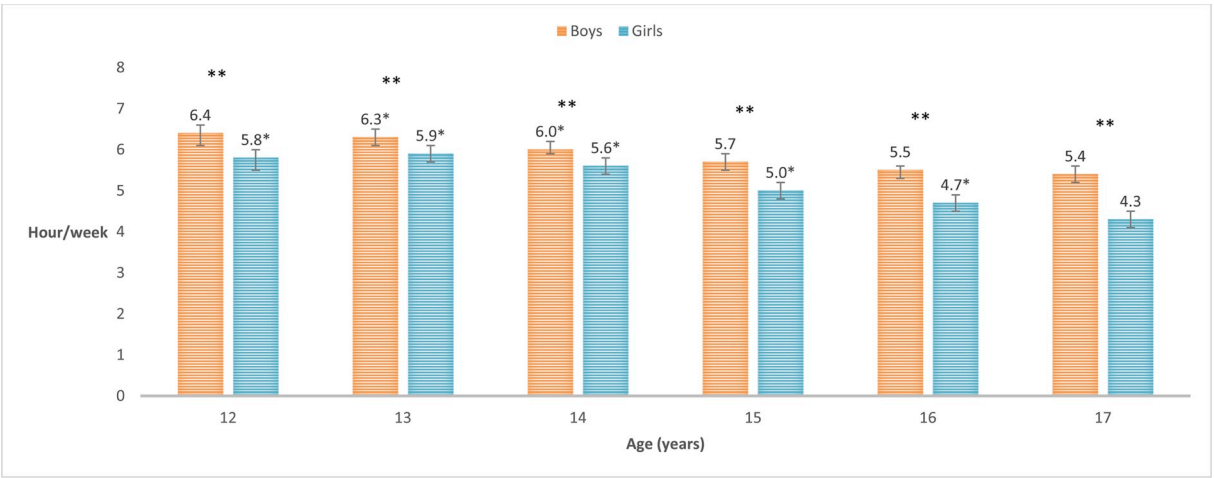
Table 1
Sample characteristics—2016 Korea Youth Risk Behavior Web-based Survey (n = 59,633).

	Overall	Boys	Girls
n (%)	59,633 (100)	30,648 (51.4)	28,985 (48.6)
Age (year; M ± SE)	14.9 ± 0.02	14.9 ± 0.04	14.9 ± 0.04
Hours utilitarian walking per week (hour; M ± SE)	5.5 ± 0.03	5.8 ± 0.04	5.1 ± 0.05
Economic status (%, 95% CI)			
High	37.7 (37.0, 38.4)	39.9 (39.0, 40.8)	35.3 (34.3, 36.3)
Middle	47.4 (46.8, 48.0)	45.0 (44.3, 45.6)	50.0 (49.3, 50.8)
Low	14.9 (14.5, 15.3)	15.1 (14.6, 15.7)	14.6 (14.0, 15.3)
Area of Region (%, 95% CI)[a]			
Large sized cities (n = 79)	43.4 (42.1, 44.8)	34.5 (40.8, 53.6)	43.3 (40.4, 46.3)
Medium sized cities (n = 84)	51.0 (49.6, 52.5)	50.9 (48.1, 53.6)	51.2 (48.2, 54.2)
Small sized cities (n = 66)	5.5 (4.8, 6.4)	5.6 (4.4, 7.2)	5.5 (4.2, 7.1)
Academic achievement (%, 95% CI)			
Very high	12.9 (12.6, 13.3)	14.5 (14.1, 15.0)	11.2 (10.8, 11.6)
High	25.3 (24.9, 25.7)	24.3 (23.8, 24.8)	26.3 (25.8, 26.9)
Middle	28.6 (28.2, 29.0)	27.9 (27.3, 28.4)	29.4 (28.9, 30.0)
Low	23.2 (22.8, 23.6)	22.5 (22.0, 23.0)	23.9 (23.3, 24.4)
Very low	10.0 (9.7, 10.3)	10.8 (10.4, 11.2)	9.1 (8.8, 9.5)
Hours utilitarian walking per week (%, 95% CI)			
< 1 h	11.1 (10.8, 11.5)	9.5 (9.1, 9.9)	12.9 (12.3, 13.5)
1–5 h	53.1 (52.6, 53.6)	51.5 (50.8, 52.2)	54.8 (54.1, 55.5)
> 5 h	35.8 (35.2, 36.4)	39.0 (38.3, 39.8)	32.3 (31.4, 33.2)
Days of MVPA ≥ 60 min per week (%, 95% CI)			
None	36.5 (35.8, 37.3)	28.0 (27.3, 28.6)	45.7 (44.9, 46.5)
1 day	16.7 (16.3, 17.1)	14.3 (13.8, 14.8)	19.3 (18.7, 19.8)
2 days	15.1 (14.7, 15.4)	15.8 (15.3, 16.3)	14.3 (13.8, 14.8)
3 days	12.3 (12.0, 12.7)	14.9 (14.4, 15.3)	9.6 (9.1, 10.0)
4 days	6.3 (6.0, 6.5)	8.2 (7.9, 8.6)	4.2 (3.9, 4.4)
5 days	6.0 (5.8, 6.3)	8.2 (7.9, 8.6)	3.7 (3.4, 3.9)
6 days	2.1 (1.9, 2.2)	2.9 (2.7, 3.2)	1.1 (1.0, 1.2)
7 days	5.1 (4.8, 5.3)	7.7 (7.3, 8.1)	2.3 (2.1, 2.5)
Psychological well-being			
Happiness (happy and very happy) (%, 95% CI)	67.2 (66.7, 67.7)	70.5 (69.9, 71.2)	63.6 (62.9, 64.3)
Stress (no/low stress) (%, 95% CI)	20.0 (19.5, 20.4)	25.3 (24.8, 25.9)	14.2 (13.7, 14.7)

Results are described as means and standard errors (M ± SE) or percentages (%) and 95% confidence intervals (95% CI).
MVPA = Moderate-to vigorous-intensity physical activity.
[a] Large, medium, small-sized cities categorization was predetermined by the KYRBS before they published the data.

Among Korean adolescents, promoting utilitarian walking may contribute to meeting the MVPA recommendation for optimal health. This information is important because low levels of overall physical activity among Korean adolescents has been observed over the years. Based on South Korea's 2016 and 2018 Report Cards on Physical Activity for Children and Youth (Oh et al., 2018; Song et al., 2016), where physical activity-related indicators are evaluated using the best available evidence, a letter grade of "F" was given to the overall physical activity (less than 20% of children and youth met the WHO's physical recommendation: 60 min/day of MVPA) in both years. In fact, the percentage of Korean children and youth meeting the WHO's physical activity recommendation is very low (~5%) (Aubert et al., 2018). Korean data supports the findings from predominantly North American countries suggesting that utilitarian walking could be an important potential source of MVPA (Larouche et al., 2014b; Lau et al., 2017) and daily habitual physical activity (Tudor-Locke et al., 2001). However, caution is needed when interpreting the results of our study. Specifically, higher utilitarian walking was associated with meeting the MVPA recommendation; but, we do not know whether utilitarian walking serves as a source for MVPA (i.e., two behaviours are dependent) or if Korean adolescents who engage in more utilitarian walking is also more likely to engage in MVPA (i.e., two variables are independent) in the Korean adolescent population. The non-significant correlation between weekly utilitarian walking and MVPA (one-tailed Pearson $r = .146$, $p > .001$) shown in our sample warrants future longitudinal investigation.

Our findings provide further support for the potential psychological health benefits of active travel, utilitarian walking in this case, regardless of destinations—whether or not it is to/from school or other places (Leung and Loo, 2017; Ramanathan et al., 2014; Sun et al., 2015; Ward et al., 2015; Waygood et al., 2017). This study was the first to confirm this association among a representative sample of Korean adolescents. However, the association was only significant between utilitarian walking and happiness, but not stress. In the literature, the association between active travel, including utilitarian walking, and stress has been indeed mixed (Waygood et al., 2017). Specifically, active travel itself was described as an opportunity for adolescents to emotionally prepare for themselves for the day at school and de-stress from the school during their return walk to home (Murray and Mand, 2013). On the other hand, engaging in solitary walk to school, compared to commuting with friends, made adolescents feel stressed (Westman et al., 2017). Traffic noise, travel anxiety, and parent-child conflict on independent mobility were also noted as stress-inducing factors related to active travel among young people (Bryant et al., 2004; Murray and Mand, 2013). Furthermore, it was highlighted that



Note.

*$p < .001$ for significant difference with a subsequent age group.

**$p < .001$ for significant gender differences

Fig. 1. Hours utilitarian walking per week by sex and age among South Korean adolescents aged 12-17 years—2016 Korea Youth Risk Behavior Web-based Survey (n = 59,633)

Note.

*$p < .001$ for significant difference with a subsequent age group.

**$p < .001$ for significant gender differences.

Table 2

Associations between utilitarian walking and meeting the MVPA guidelines[1] among South Korean adolescents aged 12-17 years—2016 Korea Youth Risk Behavior Web-based Survey (n = 59,633).

	Unadjusted	Adjusted[a]
	OR (95% CI)	OR (95% CI)
Meeting ≥ 60 min of MVPA daily		
Hours utilitarian walking per week		
< 1 h	1.00 (Reference group)	1.00 (Reference group)
1–5 h	1.82 (1.48, 2.24)*	1.73 (1.41, 2.13)*
> 5 h	5.94 (4.87, 7.25)*	5.26 (4.32, 6.41)*
One unit increase in walking	*p*-for-trend < .001	*p*-for-trend < .001
Meeting ≥ 60 min of MVPA 6 days per week		
Hours utilitarian walking per week		
< 1 h	1.00 (Reference group)	1.00 (Reference group)
1–5 h	1.85 (1.57, 2.20)*	1.76 (1.49.2.08)*
> 5 h	5.57 (4.72, 6.57)*	4.94 (4.20, 5.81)*
One unit increase in walking	*p*-for-trend < .001	*p*-for-trend < .001
Meeting ≥ 60 min of MVPA 5 days per week		
Hours utilitarian walking per week		
< 1 h	1.00 (Reference group)	1.00 (Reference group)
1–5 h	1.83 (1.64, 2.04)*	1.75 (1.56, 1.95)*
> 5 h	4.47 (4.00, 5.00)*	4.02 (3.60, 4.50)*
One unit increase in walking	*p*-for-trend < .001	*p*-for-trend < .001

OR = Odds Ratio, 95% CI = 95% Confidence Interval, MVPA = Moderate-to-vigorous physical activity.

*$p < .001$.

[a] Adjusted for age, gender, area of residence, and economic status.

young people may experience a variety of feelings such as enjoyment, stress, excitement, or challenge depending on how they travel and where they go (Johansson et al., 2013; Murray and Mand, 2013).

When utilitarian walking was compared by age and gender, it was lower among girls compared to boys. Also, progressively lower levels of utilitarian walking were observed in girls across all age group pairs except for 12 and 13-year-olds and in boys aged between 12 and 14 years only. In a recent study examining demographic correlates of active transportation among Korean adolescents indicated that while gender was not associated with active transportation, older age was positively associated with active

Table 3
Associations between utilitarian walking and psychological well-being among South Korean adolescents aged 12-17 years—2016 Korea Youth Risk Behavior Web-based Survey (n = 59,633).

	Unadjusted	Adjusted[a]
	OR (95% CI)	OR (95% CI)
Happiness		
Hours utilitarian walking per week		
< 1 h	1.00 (Reference group)	1.00 (Reference group)
1–5 h	1.30 (1.23, 1.37)*	1.18 (1.12, 1.25)*
> 5 h	1.50 (1.42, 1.59)*	1.29 (1.22, 1.37)*
One unit increase in walking	*p*-for-trend < .001	*p*-for-trend < .001
No/low stress		
Hours utilitarian walking per week		
< 1 h	1.00 (Reference group)	1.00 (Reference group)
1–5 h	1.12 (1.05, 1.20)*	1.02 (0.95, 1.10)
> 5 h	1.23 (1.15, 1.32)*	1.03 (0.96, 1.11)
One unit increase in walking	*p*-for-trend < .001	*p*-for-trend < .001

OR = Odds Ratio, 95% CI = 95% Confidence Interval.
*$p < .001$.
[a] Adjusted for age, gender, area of residence, economic status, and moderate-to-vigorous physical activity.

transportation (Lee et al., 2018). Similarly, though age and gender are commonly reported correlates of physical activity, the results have been largely mixed with active travel in international literature, which includes both cycling and walking (Sirard and Slater, 2008). In a 12-country study, gender was a significant correlate of active school transport in Canada only but not in other 11 countries. Rather, country was an important moderator of the relationship between individual and environmental correlates, including gender, and active school transport. This suggests macro-level variables—the built environment, sociocultural perceptions, and values attached to independent walking without accompanying adults—may be more important and modify the gender-active school transport relationship heterogeneously (Larouche et al., 2015). Evidence relating to the relationship between age and active transport has also been inconsistent (Cooper et al., 2006; Giles-Corti et al., 2009; McDonald, 2007; Timperio et al., 2006). Future studies should examine the potential influence of age and gender specifically on utilitarian walking in the adolescent age group to confirm our findings. In addition, better understanding of the mechanisms of individual-level and macro-level correlates on utilitarian walking is required.

In Korea, several attempts to increase physical activity levels among Korean young people as a means to promote health and well-being has largely been a failure due to conflicts with other priorities (e.g., academic achievement) (Oh et al., 2018). Rather than focusing on increasing MVPA or structured physical activity, such as physical education, promoting utilitarian walking may support Korean adolescents to also participate in more MVPA daily. This, in turn, may positively contribute to their happiness. Future studies should examine the mechanisms by which utilitarian walking and MVPA independently or co-dependently contribute to happiness and other psychological well-being measures among Korean adolescents to build on our findings. In addition, investigating correlates of utilitarian walking is warranted. In a recent population-based study examining demographic correlates (i.e., age, sex, household income, area of residence) of active travel that considered both walking and cycling simultaneously, younger age was the only significant correlate among adolescents (Lee et al., 2018). This indicates that engaging in active travel does not vary greatly across sex, income, and urban/rural areas in the Korean adolescent population.

Promoting utilitarian walking among young people faces two unique challenges in Korea. Concerns related to traffic safety may play a role in utilitarian walking among young people in Korea. In a study comparing traffic accidents among young people living in Seoul, Korea and Santiago, Chile, it is argued that though children in Seoul have higher independent mobility at a younger age, public spaces have higher traffic risk compared to their peers in Santiago (Blazquez et al., 2016). Though a variety of traffic calming measures are being implemented in designated zones around schools in Korea (Kang, 2015), these changes may have little impact on utilitarian walking outside of school zones among young people. Another challenge is increasingly alarming levels of air pollution and a lower quality of life in auto-oriented cities in Korea. Based on nationally representative data from China, Taiwan, and Korea, the perceived severity of air pollution that is associated with suitability for outdoor waking was similar between Korea and China (38% vs 37%) but was significantly lower in Taiwan (29%) compared to Korea and China ($p > .001$) (Chen and Lin, 2016). Given this contextual information specific to Korea, future work on the correlates of utilitarian walking among Korean adolescents should consider incorporating perceived and objective traffic safety and air quality/pollution measures. Perceived data can also be collected from adolescents and their parents to determine whether any discrepancy exists that may influence adolescent's independent mobility and utilitarian walking.

The strength of this study is the large sample size and national representativeness. The findings also add to the current literature supporting utilitarian walking as a means to increase overall MVPA (Larouche et al., 2014b; Lau et al., 2017) and psychological well-being (Ramanathan et al., 2014; Waygood et al., 2017) in the Korean context. However, there are several limitations that are inherent to using epidemiological surveillance surveys, which should be acknowledged. One major limitation is the cross-sectional nature of the survey, which makes it impossible to confirm temporality or directionality; thus, findings should be replicated using a longitudinal or experimental study design. In addition, the self-reported data limits the precision of specific activity doses. For example,

the frequency of MVPA was the only available data that reflects different doses of MVPA. Furthermore, in the representative sample of Korean adolescents included in our study, weekly utilitarian walking and the MVPA frequency were not correlated. This indicates that utilitarian walking may not be the source of MVPA in the Korean adolescent population. That being said, only the frequency of MVPA data was available in the KYRBS questionnaire. The potential independence or co-dependence between utilitarian walking and MVPA should be further investigated by incorporating different doses of MVPA (i.e., intensity, duration) and using more rigorous study design. In addition to walking, cycling is a common mode of active travel among adolescents in different countries (Larouche et al., 2014a; Reimers et al., 2013; Yang et al., 2014), however, we were not able to include cycling because it was not measured in the KYRBS questionnaire. Single-item measures were used to measure happiness and stress, respectively. These measures were used in previous studies (Ha and Hwang, 2014; Kye et al., 2016; Min et al., 2017); nonetheless, given the potential misclassification bias and low diagnostic capacity of self-reported measures (Abdel-Khalek, 2006; Zwolinsky et al., 2015), caution is needed in interpreting the findings.

5. Conclusions

Korean adolescents who spend more time walking to get to places reported higher MVPA and better happiness scores. Future studies should further investigate the correlates and determinants of utilitarian walking in order to inform interventions and strategies designed to increase utilitarian walking among adolescents. In addition, macro-level factors that potentially pose unique challenges to promoting utilitarian walking in the context of Korea, such as traffic safety and air pollution, should also be incorporated to better understand utilitarian walking behaviors in future investigations.

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