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Demographic and lifestyle determinants of time spent in physical activity among Malaysian adolescents

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ABSTRACT

Background and objectives: The objective of the present study is to examine factors affecting time spent in physical activity among adolescents in Malaysia.

Patients and methods: A nationally representative data of adolescents that consists of 25399 respondents is used. The demographic (age, gender, education) and lifestyle (fruits and vegetables consumption, carbonated soft drink consumption, cigarette smoking, alcohol drinking, sex behaviour, participation in physical education class, obesity) determinants of physical activity are assessed using binomial regression. **Results:** The results show that age is negatively associated with time spent in physical activity. However, being male and education levels are positively related to time spent in physical activity. Having unhealthy lifestyle and being obese are associated with low levels of physical activity. Physical education seems to promote participation in physical activity.

Conclusion: In conclusion, demographic and lifestyle factors play an important role in determining levels of physical activity among adolescents. In order to reduce the prevalence of physically inactive adolescents, policy makers should focus primarily on late adolescents, females, adolescents who engage in unhealthy lifestyle and seldom attend physical education classes, as well as obese adolescents.

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1. Introduction

It is clearly evident that physical activity plays an important role in improving health. Being physically active is negatively associated with the risk of mortality, heart diseases, cancers, diabetes, high blood pressure, obesity, osteoporosis and mental health disorders [1,2]. Studies show that there are numerous factors affecting the decision of people to participate in physical activity (i.e. demographic, lifestyle and health factors) [3–5]. Interestingly, there are evidences suggesting that individuals who are physically active in adolescent years are more likely to engage in physically active behaviour in their adulthood than their peers who are physically inactive in adolescent years [6].

In Malaysia, a recent report of the Ministry of Health showed that the prevalence of being physically active among adolescents is very low (14.1%) [7]. As a consequence of this phenomenon, the

number of obese adolescents has increased tremendously [7], which may lead to various diseases in adulthood. Therefore, physical inactivity among adolescents has become a serious public health issue and has been given attention by researchers and policy makers. If policy makers have a better understanding of factors affecting level of physical activity among adolescents, a more effective intervention measure directed towards promoting physically active lifestyle among adolescents can be introduced.

Numerous studies related to participation in physical activity among adolescents in Malaysia were conducted [8–10]. However, only few used a nationwide data with a large sample size. Study by Baharudin et al. [11] is by far the most comprehensive study. The authors used a nationwide data and found that demographic factors, such as age and gender are associated with participation in physical activity. Other non-demographic factors such as school session, breakfast intake and body weight were also found to be significant in influencing physical activity. However, there are other potential determining factors of physical activity which are not examined by Baharudin et al. [11] but are worthy of consideration. These include dietary behaviour, cigarette smoking, alcohol drinking, sex behaviour and participation in physical education (PE)

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class. The present study anticipates that physical activity is associated with these factors because they reflect health awareness. Since physical activity is a health investment, health awareness may be closely related to it. It is also noteworthy that study by Baharudin et al. [11] only examined whether adolescents were physically inactive or not, and did not analyse time that adolescent spent in physical activity. As a result, factors affecting decisions related to time spent in physical activity remain unidentified.

Given the gaps in the literature related to physical activity among adolescents, a more comprehensive study is needed. The present study makes an effort to investigate factors associated with physical activity among adolescents in Malaysia, and attempts to contribute to existing literature in several ways. Firstly, various demographic and lifestyle factors are taken into account in the analysis, which include dietary behaviour, cigarette smoking, alcohol drinking, sex behaviour and PE class. Secondly, different from previous studies, the present study uses a count data regression to examine time spent in physical activity (i.e. amount of physical activity). Thirdly, the statistical analysis is performed based on a nationwide data that consists of a large sample. Taken together, findings of the present study can assist policy makers in identifying which group of adolescents tends to spend more or less time in physical activity. Hence, the prevalence of physical inactivity among adolescents can be reduced.

2. Methods

2.1. Sample

The present study was based on a secondary analysis of a cross-sectional dataset. Data was extracted from the Malaysia Global School-based Student Health Survey (GSHS) 2012 [7]. The survey used a two-stage cluster sampling in order to ensure that the sample could represent secondary school students in Malaysia. In the first-stage sampling, secondary schools were selected based on the probability proportional to the size of school. Of all the secondary schools in Malaysia, 234 were selected to take part in the survey. In the second-stage sampling, systematic random sampling was applied to select classrooms from each school. All the students in the selected classrooms were surveyed.

A total of 25507 questionnaires were distributed. The response rate was 88.7%. The survey was carried out from 23 February to 26 April 2012. The data was made available to the public in 2014 after the 2-year window. While the survey was not the latest dataset, it had a large sample size and was representative. Ethical approval was obtained from the Ministry of Health Research and Ethics Committee and Ministry of Education Ethics Committee (Project code: NMRR-11-974-10401). Parental consent forms were obtained before the survey. Adolescents who were not given consent by their parents were not canvassed.

2.2. Questionnaire

Self-administered bilingual questionnaires (English and Malay) were used. They were designed according to the standard questionnaire used by the GSHS. All the information was self-reported. The demographic data used in the present study consisted of age, gender and education level. Age was formatted as a discrete variable (11–18 years) to allow for a linear relationship. Education level was assessed based on the grades of adolescents. It was divided into six categories: Remove, Form 1, Form 2, Form 3, Form 4 and Form 5. Remove until Form 3 were lower secondary, while Form 4 and Form 5 were upper secondary.

The lifestyle factors comprised information on physical activity, fruits and vegetables (FV) consumption, carbonated soft drink

consumption, cigarette smoking, alcohol drinking, sex behaviour, participation in PE class and obesity. The definition of physical activity was explained prior to asking questions about physical activity. Adolescents were asked: 'During the past 7 days, on how many days were you physically active for a total of at least 60 min?' They answered with: '0 day', '1 day', '2 days', '3 days', '4 days', '5 days', '6 days' or '7 days'.

In terms of dietary behaviours, the survey asked adolescents about their FV consumption behaviour: 'During the past 30 days, how many time per day did you usually eat vegetables and fruits?' The possible answers were: 'not at all', '1 time', '2 times', '3 times', '4 times' and '5 or more times'. Carbonated soft drinks consumption behaviour was also assessed. Adolescents were asked: 'During the past 30 days, how many times per day did you usually drink carbonated soft drinks?' They responded with: 'not at all', '1 time', '2 times', '3 times', '4 times' or '5 or more times'.

The smoking behaviour was measured based on the following question: 'During the past 30 days, on how many days did you smoke cigarettes?' with plausible responses: 'did not smoke', '1–2 days', '3–5 days', '6–9 days', '10–19 days', '20–29 days' and '30 days'. Adolescents were categorised as non-smokers if they chose 'did not smoke'. Otherwise, they were coded as smokers. Alcohol drinking behaviour was assessed on the basis of the following question: 'During the past 30 days, on the days you drank alcohol, how many drinks did you usually drink per day?' The choices were: 'did not drink', '1 drink', '2 drinks', '3 drinks', '4 drinks' and '5 or more drinks'. Non-alcohol drinkers referred to those who chose 'did not drink'.

Adolescents were also asked to self-report their sexual behaviour. The question was designed as: 'Have you ever had sexual intercourse?'. Adolescents were considered to have sexual intercourse if they answered 'yes' and were considered to have no sexual intercourse if they answered 'no'. In addition, adolescents were requested to self-report their height and weight. These heights and weights were used to calculate body mass index (BMI) and determine whether adolescents were obese. Although self-reported information on height and weight may have reporting error, it was appropriate for research [12].

2.3. Statistical analysis

The dependent variable used in the present study was time spent in physical activity (i.e. the days of being physically active for at least 60 min). The maximum value of the dependent variable was 7 days and the minimum value was 0 day. The independent variables consisted of demographic (age, gender, education) and lifestyle variables (FV consumption, carbonated soft drink consumption, cigarette smoking, alcohol drinking, sex behaviour, participation in PE class, obesity). All the independent variables were categorical variables, except age. Since the dependent variable was discrete with count data, the present study used a binomial regression (i.e. a count data regression) to examine the factors associated with time spent in physical activity, assuming that overdispersion exists. A simple statistical test for overdispersion was conducted in order to confirm that there was overdispersion. Binomial regression and the test for overdispersion were described in great detail elsewhere [13]. Significant level was based on $P < .05$. Adolescents with missing information were removed from the sample. As a result, only 25399 respondents were used for analyses.

3. Results

Demographic and lifestyle characteristics of total sample and adolescents participating in physical activity are presented in Table 1. The mean age of all respondents and physical activity

Table 1
Demographic and lifestyle characteristics of total sample and adolescents participating in physical activity.

Variables	Definitions	Total sample (n = 25399) frequency (%)	Participating (n = 20697) frequency (%)
Demography			
Age	Age (years) [mean (standard deviation)]	14.91 (1.43)	14.92 (0.01)
Gender			
Male	Gender is male	12690 (49.96)	10391 (50.21)
Female	Gender is female	12709 (50.04)	10306 (49.79)
Education			
Remove	Remove class student	153 (0.60)	106 (0.51)
Form 1	Form 1 class student	5262 (20.72)	4145 (20.03)
Form 2	Form 2 class student	5319 (20.94)	4318 (20.86)
Form 3	Form 3 class student	5591 (22.01)	4634 (22.39)
Form 4	Form 4 class student	4509 (17.75)	3699 (17.87)
Form 5	Form 5 class student	4565 (17.97)	3795 (18.34)
Lifestyle			
FV			
0	Do not consume	2670 (10.51)	1953 (9.44)
1	1 time per day	2963 (11.67)	2306 (11.14)
2	2 times per day	4298 (16.92)	3399 (16.42)
3	3 times per day	4533 (17.84)	3784 (18.28)
4	4 times per day	3714 (14.62)	3168 (15.31)
5	≥5 times per day	7221 (28.43)	6087 (29.41)
Soft drink			
0	Do not consume	18242 (71.82)	15050 (72.72)
1	1 time per day	3751 (14.77)	3006 (14.52)
2	2 times per day	1833 (7.22)	1458 (7.04)
3	3 times per day	788 (3.10)	617 (2.98)
4	4 times per day	288 (1.13)	214 (1.03)
5	≥5 times per day	497 (1.96)	352 (1.70)
Cigarette			
0	Do not smoke	22710 (89.41)	18551 (89.63)
1-2	1 to 2 days	962 (3.79)	764 (3.69)
3-5	3 to 5 days	426 (1.68)	333 (1.61)
6-9	6 to 9 days	262 (1.03)	203 (0.98)
10-19	10 to 19 days	237 (0.93)	196 (0.95)
20-29	20 to 29 days	176 (0.69)	138 (0.67)
30	30 days	626 (2.46)	512 (2.47)
Alcohol			
0	Do not drink	24124 (94.98)	19772 (95.53)
1	1 serving	674 (2.65)	488 (2.36)
2	2 servings	277 (1.09)	203 (0.98)
3	3 servings	122 (0.48)	89 (0.43)
4	4 servings	47 (0.19)	38 (0.18)
5	≥5 servings	155 (0.61)	107 (0.52)
Sex			
Yes	Yes	1872 (7.37)	1338 (6.46)
No	No	23527 (92.63)	19359 (93.54)
PE			
0	0 day	2884 (11.35)	1793 (8.66)
1	1 day	10788 (42.47)	8941 (43.20)
2	2 days	5031 (19.81)	4207 (20.33)
3	3 days	851 (3.35)	709 (3.43)
4	4 days	567 (2.23)	487 (2.35)
5	≥5 days	5278 (20.78)	4560 (22.03)
Obese			
Yes	Obese	2448 (9.64)	2029 (9.80)
No	Not obese	22951 (90.36)	18668 (90.20)

Note: Age is a discrete variable. Hence, mean and standard deviation are reported. FV refers to fruits and vegetables. PE refers to physical education.
Source: GSHS 2012

participants is approximately 15 years. However, the standard deviation age of total sample is slightly greater than that of participants. The gender distributions of total sample and participants are almost equal. Of all respondents, the majority are Form 3 class students (22.01%), followed by Form 2 (20.94%), Form 1, (20.72%) Form 5 (17.97%), Form 4 (17.75%) and Remove (0.60%). Physical activity participants have somewhat similar education characteristics.

More than a quarter of all respondents (28.43%) and participants (29.41%) consume 5 times or more of FV per day. Only a small amount of all respondents (10.51%) and participants (9.44%) do not

consume FV. A large proportion of total respondents (71.82%) and participants (72.72%) do not consume soft drink. Only less than 2% of each group consume 4 times or more of soft drink per day. In terms of cigarette smoking, almost 90% of total respondents and participants do not smoke, and only less than 4% smoke 1–2 days in the past 30 days. Likewise, a very large proportion of all respondents (94.98%) and participants (95.53%) do not drink alcohol, and only less than 3% drink 1 serving on the days they drank alcohol in the past 30 days.

Considering the sexual behaviour, only 7.37% of total sample and 6.46% of participants engage in sexual intercourse. Of all

respondents, the majority (42.47%) attend 1 day of PE class per week, followed by 5 days (20.78%), 2 days (19.81%), 0 day (11.35%), 3 days (3.35%) and 4 days (2.23%). Somewhat similar characteristics are observed among physical activity participants. In terms of bodyweight, only the minority of total respondents (9.64%) and participants (9.80%) are obese.

Demographic and lifestyle factors associated with physical

Table 2
Demographic and lifestyle factors associated with physical activity.

Variables	Estimates	SE	IRR	95% CI	P
Constant	2.040	0.273	7.687	4.498, 13.137	<.001
Demography					
Age	-0.086	0.016	0.917	0.889, 0.946	<.001
Gender					
Male	0.315	0.012	1.370	1.339, 1.402	<.001
Female	–	–	1.000	–	–
Education					
Remove	-0.263	0.092	0.769	0.642, 0.920	.004
Form 1	-0.432	0.065	0.649	0.571, 0.738	<.001
Form 2	-0.325	0.051	0.723	0.655, 0.798	<.001
Form 3	-0.218	0.036	0.804	0.749, 0.864	<.001
Form 4	-0.105	0.024	0.900	0.858, 0.944	<.001
Form 5	–	–	1.000	–	–
Lifestyle					
FV					
0	–	–	1.000	–	–
1	0.035	0.025	1.036	0.987, 1.087	.124
2	0.085	0.023	1.088	1.041, 1.138	<.001
3	0.176	0.022	1.192	1.141, 1.245	<.001
4	0.244	0.023	1.277	1.220, 1.336	<.001
5	0.301	0.021	1.351	1.297, 1.407	<.001
Soft drink					
0	–	–	1.000	–	–
1	-0.104	0.016	0.902	0.873, 0.931	<.001
2	-0.105	0.022	0.901	0.862, 0.941	<.001
3	-0.128	0.033	0.880	0.825, 0.939	<.001
4	-0.179	0.055	0.836	0.752, 0.931	<.001
5	-0.215	0.042	0.806	0.743, 0.876	<.001
Cigarette					
0	-0.106	0.036	0.900	0.839, 0.965	.003
1–2	-0.180	0.045	0.835	0.765, 0.912	<.001
3–5	-0.174	0.055	0.840	0.754, 0.935	.002
6–9	-0.187	0.065	0.829	0.731, 0.941	.004
10–19	-0.011	0.065	0.989	0.871, 1.123	.865
20–29	-0.088	0.074	0.916	0.793, 1.058	.234
30	–	–	1.000	–	–
Alcohol					
0	–	–	1.000	–	–
1	-0.202	0.037	0.817	0.760, 0.878	<.001
2	-0.176	0.056	0.839	0.751, 0.936	.003
3	-0.134	0.084	0.874	0.742, 1.030	.145
4	0.089	0.128	1.093	0.851, 1.404	.502
5	-0.046	0.073	0.955	0.828, 1.103	.467
Sex					
Yes	-0.112	0.022	0.894	0.856, 0.934	<.001
No	–	–	1.000	–	–
PE					
0	–	–	1.000	–	–
1	0.247	0.020	1.281	1.232, 1.331	<.001
2	0.297	0.022	1.346	1.289, 1.404	<.001
3	0.299	0.035	1.349	1.259, 1.445	<.001
4	0.354	0.041	1.424	1.314, 1.543	<.001
5	0.434	0.021	1.543	1.480, 1.609	<.001
Obese					
Yes	-0.092	0.019	0.912	0.879, 0.947	<.001
No	–	–	1.000	–	–
α	0.412	–	–	–	<.001
LR	1727.100	–	–	–	<.001
Observations	25399				

Note: IRR refers to incidence rate ratio. CI refers to confidence interval. LR refers to likelihood ratio. α is used to determine whether the data is over dispersed. FV refers to fruits and vegetables. PE refers to physical education.

Source: GSHS 2012

activity are described in Table 2. It appears that the data has over-dispersion given that the estimate of α is highly significant. Therefore, a negative binomial regression is appropriate for the current analysis. In terms of the overall significance of the regression, the likelihood ratio (LR) statistics is significant, thereby concluding that all the independent variables are jointly significant in explaining physical activity.

Because the coefficients estimated from the negative binomial regression do not have direct interpretations, incidence rate ratio (IRR) is calculated for each independent variable. Age is negatively associated with time spent in physical activity (IRR = 0.917). In other words, older adolescents are less likely to spend more time exercising than their younger counterparts. Males are more likely to spend more time in physical activity than females (IRR = 1.370). Setting Form 5 students as the reference group, Remove until Form 4 students are less likely to spend more time in physical activity (IRR = 0.796–0.900).

Controlling for other variables, FV consumption is positively associated with time spent in physical activity (IRR = 1.036–1.351). In particular, the likelihood of allocating more time for physical activity increases with frequency of FV consumption. However, frequency of soft drink consumption reduces with the probability of spending more time in physical activity, holding other factors fixed (IRR = 0.806–0.902). Compared to adolescents who smoke 30 days, those who do not smoke (IRR = 0.900), smoke 1–2 days (IRR = 0.835), smoke 3–5 days (IRR = 0.840) and smoke 6–9 days (IRR = 0.829) have a lower likelihood of spending more time in physical activity. Adolescents who consume one to two servings of alcohol on the days they drank alcohol are more likely to spend less time in physical activity than their non-drinking counterparts (IRR = 0.817–0.839). Having sexual intercourse seems to reduce the likelihood of spending more time in physical activity (IRR = 0.894). Frequency of attending physical education class is positively associated with the probability of allocating more time for physical activity (IRR = 1.281–1.543). If other factors are held constant, adolescents who are obese are more likely to spend less time exercising (IRR = 0.912).

4. Discussion

The present study uses a nationwide data and a binomial regression to examine the effects of demographic and lifestyle factors on physical activity with a focus on adolescents. Findings of the present study offer a new insight into factors associated with time spent in physical activity. The factors include age, gender, education, FV consumption, carbonated soft drink consumption, cigarette smoking, alcohol drinking, sexual behaviour, PE class and obesity. It is noteworthy that adoption of healthy lifestyle, such as consuming more FV and less carbonated soft drink, and avoidance of smoking and drinking can increase time allocated for physical activity. Incorporating more PE classes in school may also improve the likelihood of being physical active among adolescents because results of the present study provide a strong evidence that attending PE class promotes physical activity.

The findings related to age in the present study are consistent with those evidenced in previous studies [11,14–16]. Zimmermann-Sloutskis et al. [14] conducted a nationwide survey in Switzerland and found that physical inactivity is more prevalent among older adolescents than younger adolescents. Similar finding was evidenced by Rezende et al. [15], who used the National Adolescent School-based Health Survey in Brazil. In Malaysia, Baharudin et al. [11] also found that age is positively associated with the likelihood of adopting a physically inactive lifestyle. Although the negative relationship between age and physical activity was clearly evidenced, its contributing factor was not explained in previous

studies. The present study postulates that lack of time is a likely reason explaining physical inactivity among older adolescents. Older adolescents often take more household responsibilities than their younger counterparts, and consequently have less time for physical activity. Since analysis of the present study is not based on a primary data, this suggested reason needs to be validated by a future study. Nevertheless, an important implication of the present study's findings is that an intervention measure directed towards promoting physically active lifestyle among late adolescents may yield promising outcomes. A policy that possesses direct impacts on late adolescents should be implemented.

As pointed out in previous studies, gender is significantly associated with physical activity [11,17–22]. Using a sample of two school districts, Sallis et al. [17] found that vigorous physical activity is more frequent among male students than female students. Vilhjalmsón and Thorlindsson [22] used a nationwide data of Iceland and observed that male adolescents are more likely to participate in physical activity than their female counterparts. In more recent studies, Al-Hazzaa et al. [19] and Baharudin et al. [11] also evidenced that male students are more physically active than female students. Findings of the present study suggest likewise. Several reasons may explain these outcomes. The first reason is attributed to cultural factor. Female adolescents are usually encouraged to spend more time in study and household activities instead of physical activities [11]. Moreover, the sport opportunities for females are also limited [19]. Another reason is that physical activity promotes masculinity [22]. Therefore, female adolescents may tend to avoid it in order to maintain their girly characteristics. An important implication of these findings is that policy makers need to pay special attention to female students if the objective of reducing the prevalence of physical inactivity among adolescents is to be met. A policy that can alter female adolescents' perspective about physical activity is worthy of consideration.

Education is independently associated with physical activity. Higher grade adolescents tend to spend more time in physical activity than their lower grade peers. This is consistent with the findings of previous studies [15,23]. Cheah et al. [23] made use of data from the Malaysian Adolescent Health Risk Behaviour study and found that in general, adolescents with self-perceived excellent or good academic performance allocate more time for physical activity than their counterparts with self-perceived poor or very poor academic performance. Also, they found that having well-educated parents is associated with a high frequency of physical activity. Similarly, Rezende et al. [15] identified that level of education is positively associated with the likelihood of being physically active. These findings may be attributed to the fact that higher educated adolescents are more aware of the benefits of physical activity than lower educated adolescents because they have better interpreting skills and health knowledge [23]. In addition, higher educated adolescents have higher self-efficacy than lower adolescents [24]. It is believed that people who are confident in their capabilities to participate in physical activity have a higher tendency to adopt a physically active lifestyle than people who lack confidence [25]. Based on these findings, one can suggest that adolescents who are in low grades should be the main focus of policy makers. A strategy directed towards improving the health knowledge of low grade adolescents can be considered.

In the present study, FV consumption, soft drink consumption, cigarette smoking, alcohol drinking and sexual behaviour are used to identify how lifestyle factors affect adolescents' physical activity levels. The findings are consistent with the hypothesis that unhealthy lifestyle is associated with low levels of physical activity. In particular, adolescents who do not consume FV, consume soft drink, drink alcohol and engage in sexual behaviour are unlikely to spend time in physical activity. Somewhat similar findings were

shared by previous studies [6,19]. Al-Hazzaa et al. [19] found that level of physical activity is positively associated with breakfast and fruit intake. Findings evidenced by Romaguera et al. [6] suggested that physically active female students tend to consume more fruits and vegetables than their physically inactive counterparts. The explanation for these findings is simple. Adolescents who are aware of their health often adopt a healthy lifestyle. Since physical activity can improve health, adolescents who have healthy lifestyle behaviours are likely to spend more time in it [6,19]. Surprisingly, however, the present study finds that frequency of smoking is positively associated with time spent in physical activity, which contradicts findings of Romaguera et al [6]. The authors found that smokers have a lower likelihood of being physically active than non-smokers. A plausible explanation for this unexpected finding is that adolescents may engage in smoking and physical activity in order to reduce stress. Hence, to some extent, smoking is a complement to physical activity. This explanation, however, has to be verified by an in-depth qualitative study that focuses particularly on the relationship between smoking and physical activity. In terms of policy implication, government may want to shift its focus to adolescents who adopt an unhealthy lifestyle. A programme that can directly improve health awareness among unhealthy adolescents may generate a worthwhile contribution to the reduction in physical inactivity.

The present study finds a positive relationship between the frequency of attending PE classes and time spent in physical activity. Using a nationwide data of the United States, Gordon-Larsen et al. [26] also found that attending PE classes is positively associated with participation in physical activity. They argued that PE classes provide adolescents with opportunities to participate in physical activity. These findings were also shared by Cheah et al. [23], who claimed that health awareness is the contributing factor. Adolescents who attend PE classes are more aware of the benefits of physical activity than their counterparts who do not attend PE classes, and consequently are more likely to participate in physical activity. Taken together, it can be concluded that PE class plays an important role in promoting physically active lifestyle among adolescents. Therefore, a policy aimed at increasing physical activity levels among adolescents should focus on introducing more PE classes to primary and secondary schools.

Another interesting finding evidenced in the present study is the negative effect of obesity on physical activity levels. The reason is that obese individuals are usually present oriented and less aware of their health. In other words, they are willing to sacrifice their future health for the current pleasures of engaging in unhealthy eating behaviour [27]. Since physical activity is unpleasant and only generates health benefits in the future, obese individuals are unlikely to allocate time for it. The relationship between BMI and physical activity was also examined in previous studies [6,11]. However, their findings are in contrast to that of the present study. Romaguera et al. [6] found that physically active individuals tend to have a higher BMI than physically inactive individuals. Although Baharudin et al.'s [11] scope was also Malaysia, they observed that individuals who are overweight or obese are more likely to be physically active than their peers with normal weight. Policy makers may want to take note of this.

One of the advantages of the present study is the representative data which consists of a large sample size. Additionally, a rigorous statistical method is applied to analyse time spent in physical activity. Nonetheless, the present study has several limitations. Firstly, the present study cannot examine the causality between physical activity and demographic, and lifestyle factors because the data is obtained from a cross-sectional study. Secondly, the information is self-reported by the respondents. Hence, the data may be biased. Thirdly, work related physical activity and travel related

physical activity are not taken into account. As a result, time spent in physical activity among adolescents may be biased downward. Despite these limitations, the present study has substantial contributions to literature and policy development.

Ethical statement

Ethical approval was obtained from the Ministry of Health Research and Ethics Committee and Ministry of Education Ethics Committee (Project code: NMRR-11-974-10401). Parental consent forms were obtained before the survey. Adolescents who were not given consent by their parents were not canvassed.

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