

Physical activity patterns and associated factors among youths in Singapore: A cross-sectional islandwide community study

Lok Pui Ng¹ FCFP(S), Qi He Mabel Leow^{1,3} PhD, Aminath Shiwaza Moosa^{1,3} FCFP(S), Keng Fang Tan², Yi Xuan Valerie Chan², Shin Yu Sim², Ngiap Chuan Tan^{1,3} FCFP(S), Ding Xuan Ng¹ BEng

Dear Editor,

Physical activity (PA) plays a critical role in preventing non-communicable diseases and improving mental well-being.¹ PA should commence as a lifelong lifestyle at a young age, but global physical inactivity rates remain high across various age groups.² In Singapore, structured PA is embedded in early schooling through physical education and co-curricular activities (CCAs) but becomes voluntary as youths transit to higher education. With increasing autonomy and academic pressures, PA engagement among older youths may decline. Prior Singapore studies have reported that many adolescents in Singapore fail to meet the World Health Organization's (WHO) recommended 60 minutes of moderate-to-vigorous PA daily.³

While existing research primarily focuses on adults, less is known about the determinants of PA behaviour in youths.^{4,5} This study aimed to assess PA levels among youths in Singapore and identify key behavioural, demographic and contextual factors influencing their PA engagement. The integrated behavioural model (IBM) was used to frame the investigation, focusing on knowledge, attitudes, perceived norms and personal agency.

This study employed a cross-sectional design between August 2023 and November 2024, involving multi-ethnic youths in Singapore. Inclusion criteria were youths aged 15 to 24 years. Youths were excluded if they were serving National Service or have any disabilities preventing engagement in PA. Ethics approval was obtained from the Institutional Review Board in Hwa Chong Institution, Singapore prior to the commencement of the study. Participants were informed about the purpose of the study, and informed of their anonymity and confidentiality prior to starting the survey. Submission of the electronic survey (e-survey) indicated implied consent.

Participants were recruited through social media and street outreach, and they completed an online

e-survey hosted on the Singapore digital forms platform, FormSG. The survey included 53 items across domains such as demographics, mental health, PA-related knowledge and attitudes, social influences, self-efficacy, environmental factors, and the International Physical Activity Questionnaire-Short Form (IPAQ-SF). Mental health and exercise self-efficacy were assessed using the Patient Health Questionnaire-2 (PHQ-2) and Exercise Self-Efficacy Scale, respectively.^{6,7} Metabolic equivalent of task (MET)-minutes per week were derived from IPAQ-SF, and IBM domains were quantified via composite scores.

Descriptive statistics, correlation analysis and multiple linear regression were employed to explore associations. Statistical significance was set at $P \leq 0.05$. All analyses were performed using R version 4.4.2 (R Foundation for Statistical Computing, Vienna, Austria) and SPSS Statistics version 27 (IBM Corp, Armonk, US).

A total of 1188 youths were invited to participate in the study, and 622 responded (52.4%). Consequently, 56 participants were excluded for not meeting eligibility criteria, leaving 566 youths for analysis. More youths were male (51.1%), Chinese (83.6%) and had a normal BMI (54.1%). A large proportion of participants were enrolled in pre-university institutions (39.9%). About 16.4% of youths screened positive for likely depressive disorder using PHQ-2.

The median weekly PA level among participants was 2343 MET-minutes (interquartile range 985–4266 MET-minutes). Based on IPAQ-SF classification, 18.4% of participants were categorised as inactive (<600 MET-minutes), 42.9% as minimally active (600–3000 MET-minutes) and only 38.7% achieved health-enhancing physical activity (HEPA) levels (>3000 MET-minutes). The median daily sitting time was 420 minutes.

Mean IBM construct scores revealed modest to high attitudes and awareness, with a knowledge score of 2.96 out of 6 (standard deviation [SD] 1.33), attitude

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¹ SingHealth Polyclinics, Singapore

² Hwa Chong Institution, Singapore

³ Duke-NUS Medical School, Singapore

Correspondence: Dr Ngiap Chuan Tan, SingHealth Polyclinics HQ, 167 Jalan Bukit Merah, Tower 5, #15-10, Singapore 150167.

Email: tan.ngiap.chuan@singhealth.com.sg

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score of 4.14 out of 5 (SD 0.64), perceived norms score of 3.52 out of 5 (SD 0.73) and self-efficacy score of 30.54 out of 40 (SD 5.94).

Linear regression analysis revealed several key determinants of higher PA levels. Participation in sports-related CCAs was positively associated with higher MET-minutes per week ($\beta=1012$, $P=0.027$). Youths with more positive attitudes toward PA ($\beta=649$, $P=0.013$) and those with stronger perceived social

norms ($\beta=467$, $P=0.015$) also exhibited higher PA levels. Conversely, youths who were enrolled in post-secondary institutions had significantly lower PA levels by approximately 1000 MET-minutes per week (all $P<0.05$).

This study also explored the influence of school holidays on youth's PA. Youths who reported engaging in less PA during school breaks recorded significantly lower MET-minutes per week (mean=2371) than those

Table 1. Linear regression for IPAQ-SF MET minutes per week (n=566).

	Overall, no. (%)	Unstandardised β	95% confidence interval	P value
Age, years				
Below 18	372 (65.7)	-	-	-
18 and above	194 (34.3)	-	-	-
Sex				
Female	277 (48.9)	Ref	-	-
Male	289 (51.1)	-148	-666 to 371	0.576
Ethnicity				
Chinese	473 (83.6)	-939	-1973 to 94	0.075
Malay	32 (5.7)	Ref	-	-
Indian	36 (6.4)	-984	-2315 to 348	0.147
Others	25 (4.4)	646	-838 to 2130	0.393
BMI ^a				
Underweight	138 (24.4)	-27	-730 to 676	0.939
Normal	306 (54.1)	457	-136 to 1050	0.131
Overweight/obese	122 (21.6)	Ref	-	-
Housing				
HDB 2 to 3 room flat	31 (5.5)	1338	298 to 2378	0.012
HDB 4 to 5 room flat	236 (41.7)	Ref	-	-
Condominium/executive	222 (39.2)	179	-339 to 698	0.498
Landed property	67 (11.8)	256	-513 to 1024	0.514
Others	10 (1.8)	-558	-2343 to 1226	0.539
Educational institution				
Upper secondary	144 (25.4)	Ref	-	-
ITE/polytechnic	69 (12.2)	-1005	-1907 to 103	0.029
Pre-university	226 (39.9)	-1023	-1685 to -360	0.003
University	107 (18.9)	-1021	-1835 to -208	0.014
Others	20 (3.5)	-69	-1561 to 1424	0.928

Table 1. Linear regression for IPAQ-SF MET minutes per week (n=566). (Cont'd)

	Overall, no. (%)	Unstandardised β	95% confidence interval	P value
Co-curriculum activity				
None	68 (12.0)	Ref	-	-
Clubs and societies	153 (27.0)	-373	-1252 to 506	0.405
Performing arts	121 (21.4)	-306	-1250 to 638	0.525
Sports and games	180 (31.8)	1012	116 to 1908	0.027
Uniformed groups	44 (7.8)	-393	-1593 to 808	0.521
PHQ-2				
Unlikely depressive disorder	473 (83.6)	Ref	-	-
Likely depressive disorder	93 (16.4)	-114	-749 to 520	0.723
Integrated behavioural model construct				
Knowledge score	2.96 (1.33)	67	-112 to 245	0.464
Attitude score	4.14 (0.64)	649	137 to 1161	0.013
Perceived norms score	3.52 (0.73)	467	92 to 843	0.015
Personal agency score	30.54 (5.94)	30	-20 to 80	0.236

BMI: body mass index; HDB: Housing Development Board (public housing in Singapore); IPAQ-SF: International Physical Activity Questionnaire-Short Form; ITE: Institute of Technical Education; MET: metabolic equivalent of task; PHQ-2: Patient Health Questionnaire-2

^a BMI: underweight refers to participants with BMI <18.5 kg/m², normal 18.5–22.9 kg/m² and overweight/obese >23 kg/m².

who maintained (mean=3332) or increased their activity levels (mean=3468) during vacation. Youths with reduced PA outside of school curriculum scored significantly lower across all IBM constructs: knowledge, attitudes, perceived norms and self-efficacy (all $P<0.001$).

Participants reported several barriers that hindered their engagement in PA. The most cited barrier was lack of time (76.5%), followed by lack of self-motivation (56.9%).

The findings underscore the need for multi-level interventions to promote PA among youths in Singapore.⁹ Given that intrinsic attitude and social support were key drivers of PA, public health efforts should focus on strengthening these behavioural drivers.

Peer and family-based strategies may be particularly beneficial in maintaining healthy PA levels.⁸ The results suggest that lack of social support and periods of reduced structure, such as school holidays, leads to significant drops in PA. Fostering supportive peer and family environment, and educating parents about their role in modelling and supporting PA could mitigate this seasonal decline, and reinforce positive

attitudes and habitual engagement in PA. This will support lifelong health, enabling youths to have better quality of life in their later years.

Beyond formal school curriculum, schools should consider implementing flexible, interest-driven sports programmes that accommodate youths' diverse schedules. For effective curriculum and infrastructure planning and implementation, system-based approach and periodical school-based surveys may be necessary to identify periods of highest demand for activities by youths. Schools may consider the deployment of artificial intelligence, automation and innovation to overcome resource and manpower limitations when operationalising these activities to ensure their sustainability and accessibility.

The significant decrease in PA among post-secondary youths highlights the need for system-level support. As youths transit to more autonomous academic settings, academic demands and lack of structured schedules become major barriers to sustained PA engagement. Addressing these barriers through community engagement, peer support and targeted messaging on the cognitive and long-term health benefits of exercise may mitigate the decline.¹⁰

A major strength of this study is the use of validated behavioural tools in a large, multi-ethnic youth study population. However, recruitment may not be representative of the broader youths given its outreach based on ease of access and convenience. Additionally, IPAQ's HEPA threshold exceeds current WHO recommendations and differs across age groups, potentially affecting interpretation. Future studies using objective PA tracking and longitudinal follow-up are warranted.

Given Singapore's national preventive health agenda with the launch of Healthier SG and Grow Well SG, it is imperative to intervene early from young and sustain PA engagement through individuals' life journey. Strategies that reinforce positive attitudes, foster social support and offer enjoyable PA opportunities are crucial to reversing the current trends in youth inactivity.

Ethics statement

Ethics approval was obtained from Institutional Review Board (IRB) in Hwa Chong Institution, Singapore (reference number not available).

Declaration

The authors declare there are no affiliations with or involvement in any organisation or entity with any financial interest in the subject matter or materials discussed in this manuscript.

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