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The Patterns and Associations between Attitudes towards Active Travel and Physical Activity among Residents in Three Selected Provinces of Thailand

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Abstract

Active travel offers opportunities for regular physical activity, influenced by socio-demographic, socio-economic, and socio-psychological determinants. This study investigated the associations between positive attitudes towards active travel environments and literacy with sufficient physical activity in Thailand. A cross-sectional study was conducted with 343 residents recruited from three communities in 2019. A self-administered questionnaire collected data on demographics, physical activity levels (using the Global Physical Activity Questionnaire), and attitudes towards 11 supportive conditions for active travel. Factor analysis identified three factors: (1) attitudes towards public transport environments, capturing perceptions of convenience, attractiveness, and affordability; (2) attitudes towards walking and cycling environments, reflecting supportive conditions like safety and conduciveness; and (3) active travel literacy, relating to awareness and understanding of active travel concepts. Multivariable logistic regression analysis revealed that participants with positive attitudes towards public transport environments (adjusted odds ratio (AOR) 2.06, 95% confidence interval (CI) 1.01–4.17) and active travel literacy (AOR 2.93, 95% CI 1.10–7.79) had a significantly higher likelihood of achieving sufficient physical activity. Policymakers should prioritize enhancing the convenience, attractiveness, and affordability of public transport and promote educational campaigns to boost active travel literacy and encourage active travel behaviors.

Keywords: physical activity, active travel, prevalence, associated factor, Thailand

Introduction

The health benefits of sufficient physical activity in reducing risks of non-communicable diseases have been well documented.[1] Insufficient physical activity is responsible for 7.2% of all-cause deaths worldwide.[2] Middle-income countries have the highest total number of such deaths due to their larger populations.[2] Thailand, an upper-middle-income country in Southeast Asia, has been experiencing a gradual decline in sufficient physical activity rates.[3–7] Adults with sufficient physical activity declined from 81.5% in 2009 to 80.8% in 2015.[3,4] In response, the Thai government launched the National Physical Activity Strategy 2018–2030, alongside various initiatives to promote physical activity across cities.[8,9]

One effective way to combat insufficient physical activity is through active travel, which includes walking or cycling solely for transport or in combination with public transport. Recent studies have extensively reported the linkage between the health benefits of physical activity and active travel.[10–12] Active travel provides opportunities for regular physical activity as it consumes less time, and is convenient to integrate as a form of exercise.[13] In Thailand, previous surveys have shown that active travel contributed to 15% and 17% of daily energy expenditure from physical activity.[14,15]

Understanding the factors that influence active travel is crucial for developing effective interventions. According to the conceptual frameworks of active travel, socio-demographic, socio-economic, and socio-psychological determinants influence active travel.[13,16–18] The social context of active travel is conceptualized through a multi-layered approach composed of community, peers, household, and the individual. Objective individual characteristics, the accessibility of destinations, and the availability of mobility tools are interpreted through

subjective perceptions of mobility options. These, together with socio-psychological variables, shape people's intention to choose specific travel activities and, ultimately, the behavior itself.[13,16–18] However, in Thailand, the specific role of positive attitudes towards active travel environments and literacy in influencing sufficient physical activity levels has not been thoroughly explored.

The Thai Walking and Cycling Institute plays a strong role in promoting active travel nationwide.[19] One of the Institute's most remarkable initiatives is the promotion of walking and the use of bicycles in ten communities across five regions of the country.[19] A study in Thailand suggested that the initiative helped promote physical activity in the communities and contributed to the decline in energy expenditure and carbon dioxide emissions among the locals.[20] However, while the initiative has shown promise, there is a significant gap in understanding the relationship between sufficient physical activity levels and individual attitudes towards supportive conditions for active travel.

This study used a case study approach in three selected communities to identify the prevalence and associations between sufficient physical activity levels and individual attitudes towards conditions that support active travel.

Materials and Methods

Study Design, Population, and Sample Size

A cross-sectional study was employed, recruiting residents from three of ten communities in the Thai Walking and Cycling Institute's project in 2019, aiming for geographical diversity and a broad range of socio-demographic, socio-economic, and environmental contexts.[19]

The selected communities included King Taksin in Bangkhla District, Chachoengsao Province, Central Region (Community A); Suk Sabaijai in Mueang Kalasin District, Kalasin Province, Northeastern Region (Community B); and Ban Thatsobvan in Chiang Kham District, Payao Province, Northern Region (Community C). Key features of the three communities are exhibited in Table 1.

We used the sample size formula for estimating prevalence of sufficient physical activity levels.[21] The formula used was as follows:

$$n = \frac{Z^2 \, x \, P(1-P)}{d^2}$$

where Z = 1.96 (the Z value for 95% confidence level)

P = 0.62 (expected proportion based on national prevalence of sufficient physical activity level from the 2016 National Physical Activity Survey)[22]

d = 0.06 (accepted margin of error)

Based on this formula, the calculated sample size was 252. Adjusting for a 10% non-response rate, the target sample size was increased to 280. Ultimately, 343 samples were collected, exceeding the required minimum. Data from the three communities were combined, as they shared key characteristics outlined in Table 1, making them comparable for analysis.

Table 1. Key features of the three selected communities

Feature	Community A (King Taksin)	Community B (Suk Sabaijai)	Community C (Ban Thatsobvan)
Region	Central	Northeastern	Northern
Village size (square kilometers)	0.5	1.5	0.5
Population density (persons/square kilometers)	900	384	1,808
Topography	Plain	Plain	Plain
Land use	Accommodation zone	Accommodation zone	Accommodation zone
Roads and intersections	1–2 lanes, intersections every 50–100 meters	1–2 lanes, intersections every 50–100 meters, bypass	1–2 lanes, intersections every 50–100 meters
Vehicle speed (kilometers/hour)	20–40	40–70	20–40
Active mobility infrastructure	Functional sidewalks, bike lanes	Functional sidewalks, bike lanes	Narrow sidewalks, no bike lanes, optimal lighting

Questionnaire Design and Data Collection

A self-administered questionnaire was utilized to assess physical activity levels. Adapted from the World Health Organization Global Physical Activity Questionnaire, the questionnaire comprised three main parts: demographic profiles, physical activity levels, and self-assessment of attitudes towards supportive conditions for active travel in communities.[23]

The first part collected demographic information including gender, age, body mass index (BMI), education level, occupation, and monthly income. The second part focused on physical activity across five sections: vigorous intensity at work, moderate intensity at work, moderate intensity in transport, vigorous intensity in recreational activities, and moderate intensity in recreational activities. Each section included three questions: whether any physical activity was done last week, the number of days physical activity was done, and the number of minutes per day.

The third part assessed respondents' attitudes towards supportive conditions for active travel in their communities. Eleven conditions related to active travel, such as an understanding of active travel, exposure to campaigns, perceived safety, behavior in the community, conducive environments for walking and cycling, convenience and attractiveness of public transport, reasonable pricing, traffic conditions, and sufficiency of recreation areas and communal amenities, were self-rated on a Likert scale (1=strongly disagree to 5=strongly agree).[13,16–18]

Participants were selected by community leaders in consultation with researchers. Questionnaires were distributed by geographical areas, targeting residents aged six years and above in the selected households, but those with reading difficulties were excluded. The questionnaire took approximately 15 minutes to complete. No incentives were provided. Personal data were encrypted for confidentiality, and data were collected from December 2019 to March 2020.

Variable Management and Data Analysis

The dependent variable was sufficient physical activity levels, defined as at least 150 minutes of moderate- or 75 minutes of vigorous-intensity physical activity per week (WHO recommendations).[24] Physical activity levels were determined using responses to the three sections: 1) participants who answered 'yes' or 'no' to the first question about doing physical activity were classified as '1' or '0', respectively, 2) the number of days reported in the second question was divided by seven to convert to a weekly unit. For example, an answer of five days was calculated as 5/7, and 3) activity intensity was classified by metabolic equivalent task (MET) values, with '4' for moderate and '8' for vigorous intensity, with one MET equal to the resting state.[23]

Independent variables included gender, age, BMI, education level, occupation, income range, and factors from factor analysis (explained later). Age was categorized into 8–52 years and 53–85 years (median age of 53 years). BMI was grouped into underweight/normal (BMI <23 kg/m^2) and overweight/obese (BMI ≥23 kg/m^2).[25] Education level was categorized as up to primary education or secondary education and above. Occupation included agricultural workers, office-based employees/business owners, and retired/unemployed. Monthly income was divided into 0–12,000 Thai baht (THB) (US$ 0–348) and 12,001–85,000 THB (US$ >348–2,465) (median income of 12,000 THB (US$ 348), with 1 THB=US$ 0.029 as of 16 Dec 2024).

Attitudes towards support for active travel were assessed using a self-rated Likert scale, grouped into low scores (1–2) and high scores (3–5). Exploratory Factor Analysis reduced 11 questions into composite factors for easier interpretation. Bartlett's sphericity test confirmed data suitability. The 11 questions were grouped using the principal component factor technique, retaining latent factors with an eigenvalue equal to or greater than one.[26] Varimax rotation grouped similar conditions based on the factor-loading matrix, and factor scores were generated using Bartlett's formula. The mean score of the new composite factors was approximately zero, with scores classified into two sub-categories (≥0 and <0). Scores above zero indicated a greater degree of positive attitudes towards active travel support, while scores below zero indicated relatively negative attitudes.

The analysis involved five steps: 1) descriptive statistics for demographic data and self-rated attitudes, 2) chi-square and rank sum tests to explore differences in sufficient and insufficient physical activity across demographics, 3) chi-square test to examine the relationship between attitudes towards a supportive environment for promoting physical activities and physical activity levels, 4) factor analysis to create a composite index reflecting attitudes towards a supportive environment, and 5) multivariable logistic regression to analyze the impact of demographics and composite scores on sufficient physical activity, adjusting for confounders. Robust standard errors accounted for within-province correlations, with statistical significance set at <0.05. All analyses were conducted using STATA software version 14 (StataCorp, College Station, TX, USA, serial number 10699393).

Ethics

The study followed the Declaration of Helsinki guideline and was approved by the Institutional Review Board of the Institute for Development of Human Research Protection in Thailand (protocol code IHRP2019115, No.110-2562, 23 Dec 2019). All participants were fully informed about the study and provided written informed consent.

Results

Baseline Characteristics

A total of 340 samples were recruited; 63% of participants were female (Table 2). Most had a BMI classified as underweight or normal weight (59%) and achieved secondary education or higher (78%). The largest occupation category was office-based employees or business owners (58%). Overall, 74% of participants met sufficient physical activity levels. Older participants (84% versus 61%, p <0.05), those who were overweight or obese (82% versus 66%, p <0.05), and participants with primary education or less (83% versus 69%, p <0.05) showed higher rates of sufficient physical activity than their counterparts.

Table 2. Comparison of sufficient physical activity levels by personal attributes

Characteristics	Overall (%)	Sufficient physical activity (%)	*P*-value*
Gender (n=339)			>0.05
Male	125 (37)	95 (76)	
Female	214 (63)	151 (71)	
Age (n=340)			<0.05
Median (p25, p75)	53 (42, 63)	57 (47, 64)	
8-52 years	163 (48)	99 (61)	
53-85 years	177 (52)	148 (84)	
Body mass index (n=338)			<0.05
Underweight or normal	199 (59)	132 (66)	
Overweight or obese	139 (41)	114 (82)	
Education level (n=319)			<0.05
Up to primary education	70 (22)	58 (83)	
Secondary education or above	249 (78)	171 (69)	
Occupation (n=315)			>0.05
Agricultural workers	36 (12)	25 (69)	
Office-based employees or business owners	184 (58)	133 (72)	
Retired or unemployed	95 (30)	79 (83)	
Monthly income (THB†, n=310)			>0.05
Median (p25, p75)	12,000 (5,000, 20,000)	12,000 (4,000, 24,000)	
0–12,000 THB (US$ 0–348)	170 (55)	118 (69)	
12,001–85,00 THB (US$ >348–2,465)	140 (45)	106 (76)	
Total	340 (100)	250 (74)	

**P-value from chi-square test. †1 Thai baht (THB) equals 0.029 US$ (as of 16 Dec 2024).*

Attitudes Towards Active Travel

Figure 1 showed the average scores of respondents' attitudes towards 11 active travel-supportive conditions in their communities. The highest mean scores were for traffic-free transport (3.8), conducive environments for walking (3.5), and conducive environments for cycling (3.4). In contrast, the lowest scores were observed for the attractiveness of public transport (1.8), the reasonable price of public transport (1.8), and the safety of public transport (1.8).

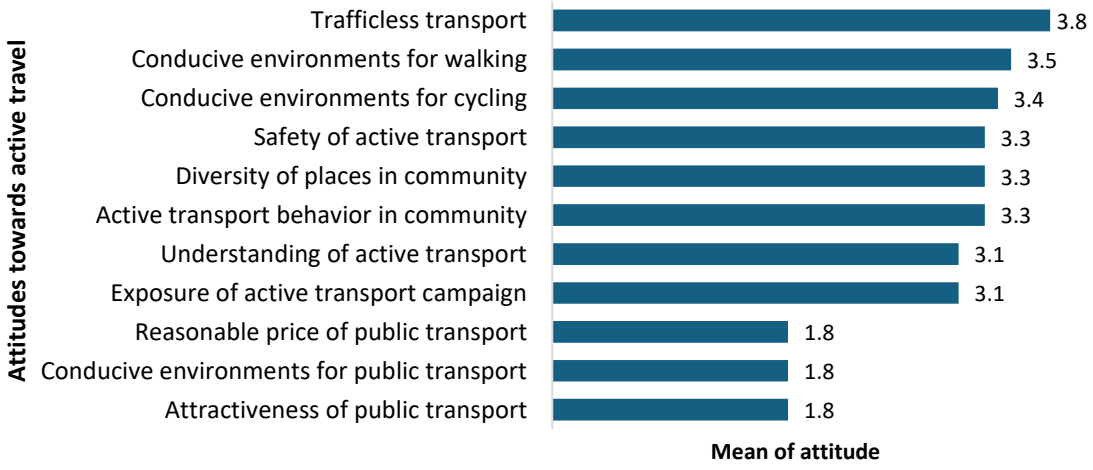
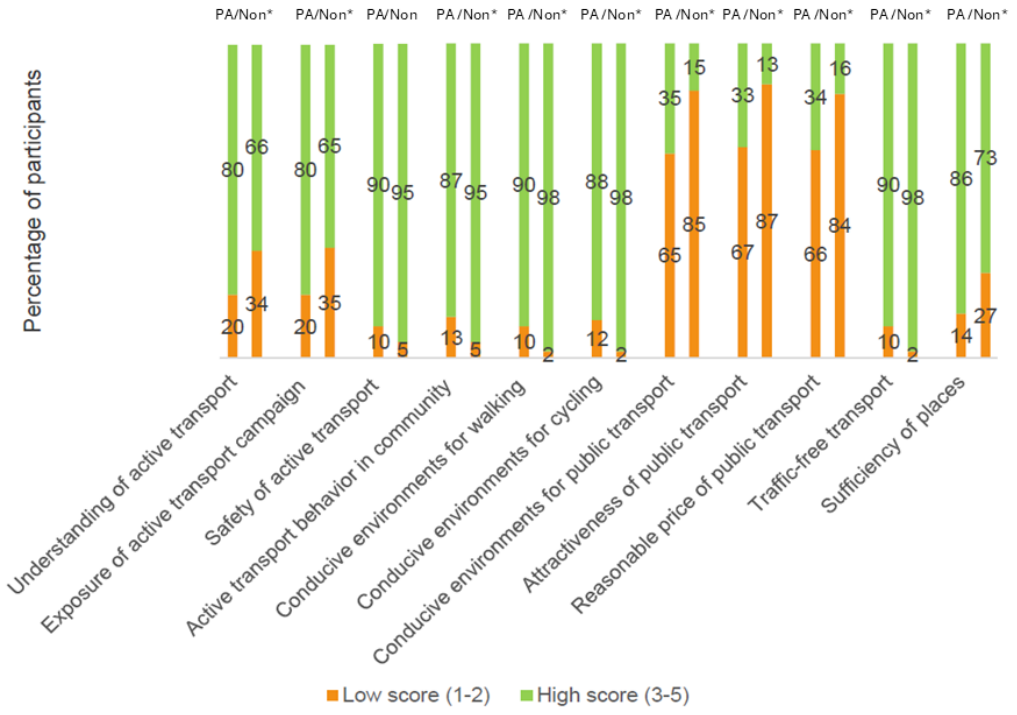


Figure 1. Average scores of attitudes towards active travel conditions

Figure 2 displayed the percentages of participants with sufficient and insufficient physical activity according to different supportive conditions by levels of scores of attitudes towards 11 active travel-supportive conditions in their communities. Participants with sufficient physical activity significantly outnumbered those with insufficient physical activity for high scores in several conditions: understanding of active travel, exposure to the active travel campaign, conducive environments for public transport, attractiveness of public transport, reasonable price of public transport, and sufficiency of places.



**P-value from chi-square test <0.05. PA: sufficient physical activity level. Non: insufficient physical activity level.*

Figure 2. Physical activity levels by attitude scores towards active travel conditions

Exploratory Factor Analysis

Exploratory Factor Analysis of the 11 questions on active transport-supportive conditions identified three primary factors with eigenvalues greater than one: (1) attitudes towards public transport environments (conducive environments for public transport, attractiveness of public transport, and reasonable price of public transport), (2) attitudes toward walking and cycling environments (safety of active travel, active travel behavior in the community, conducive environments for walking, conducive environments for cycling, and sufficiency of recreation areas and communal amenities in the community), and (3) active travel literacy (understanding of active travel, and exposure to active travel campaign) (Table 3). The factor loadings of each question indicate its alignment with one of these themes.

Table 3. Factor loading matrix of the list of attitudes towards the supportive environment for active travel

Variable	Factor 1	Factor 2	Factor 3	Uniqueness
Understanding of active travel	0.15	0.09	**0.73**	0.43
Exposure to active travel campaign	-0.03	0.18	**0.67**	0.51
Safety of active travel	0.03	**0.56**	0.35	0.53
Active travel behavior in the community	0.05	**0.65**	0.08	0.51
Conducive environments for walking	-0.06	**0.77**	0.07	0.39
Conducive environments for cycling	-0.08	**0.84**	0.09	0.27
Conducive environments for public transport	**0.90**	-0.03	0.05	0.17
The attractiveness of public transport	**0.94**	-0.04	0.04	0.12
Reasonable price of public transport	**0.92**	0.00	0.01	0.15
Traffic-free transport	-0.33	0.10	-0.02	0.74
Sufficiency of recreation areas and communal amenities in the community	0.11	**0.33**	0.31	0.71

**Factor loadings in bold indicate variables most strongly associated with each factor. Factor 1 captures attitudes toward public transport environments, Factor 2 reflects supportive conditions for walking and cycling, and Factor 3 relates to active travel literacy.*

Factor Score and Physical Activity Level: Multivariable Logistic Regression Analysis

Multivariable logistic regression analysis revealed that older participants and those with higher BMI had significantly greater odds of having sufficient physical activity levels (adjusted odds ratio (AOR) 1.73, 95% confidence interval (CI) 1.45–2.06, and odds ratio 2.28, 95% CI 1.18–4.41, respectively), as shown in Table 4. Additionally, participants with positive factor scores for attitude towards public transport environments (AOR 2.06, 95% CI 1.01–4.17) and active travel literacy (AOR 2.93, 95% CI 1.10–7.79) were more likely to have sufficient physical activity (Table 4).

Table 4. Multivariable logistic analysis of factors associated with sufficient physical activity levels

Variables	Sufficient physical activity	
	Adjusted odds ratio	95% confidence interval
Age group		
53–85 years (reference=8–52 years)	1.73	1.45–2.06
BMI group		
Overweight and obese (reference=underweight and normal)	2.28	1.18–4.41
Factor of attitude towards public transport environments		
≥0 (reference <0)	2.06	1.01–4.17
Factor of attitude towards walking and cycling environments		
≥0 (reference <0)	1.16	0.47–2.88
Factor of attitude towards active travel literacy		
≥0 (reference <0)	2.93	1.10–7.79

The model adjusted for gender, education, occupation, and income. Only statistically significant variables (p-value <0.05) are shown in the table.

Discussion

This study examined the association between positive attitudes towards active travel environments and literacy with the likelihood of engaging in sufficient physical activity. Notably, positive attitudes towards public transport environments and active travel literacy were significantly associated with a higher likelihood of engaging in sufficient physical activity.

The percentage of participants who achieved a sufficient physical activity level (73%) in these three communities was notably high compared to the estimated national level of 71% for 2019.[22] These high levels of sufficient physical activity could imply positive outcomes from active travel and physical activity promotion initiatives in the communities. However, the involvement of community leaders in the selection process might have introduced elements of convenience sampling, potentially leading to selection and information bias and an overestimation of physical activity levels.

Older age and higher BMI were strongly associated with adequate physical activity, contrary to previous national physical activity surveys. Although, these sub-populations might have difficulties from co-morbidities of obesity and non-communicable diseases to stay active, it was possible that they might have good health literacy about exercise and its benefits in reducing consequences of chronic diseases.[14,15,27,28] In addition, living in communities promoting active transport might create positive attitude towards walking and cycling.[28,29] Observations from the field also supported this assumption since various interventions have been introduced in the communities to promote the physical activity level of elderly and obese people. For example, the installation of community and public parks in Communities A and B attracted elderly and obese people to have morning and evening exercise, while speed reducing interventions and provision of good street lighting along the street in Community C encouraged retired people to go out walking, jogging, and cycling in the early morning.[28,30,31]

The significant associations between positive attitudes towards public transport environments and sufficient physical activity have highlighted the critical role of supportive infrastructure. Conducive environments for public transport, attractiveness, and reasonable pricing are essential components making public transport options accessible and appealing. These findings align with international evidence, which underscores the necessity of well-designed public transport systems to support active travel behaviors.[10,32–35]

Active travel literacy, which includes understanding and exposure to active travel campaigns, also showed a strong relationship with sufficient physical activity. Educating the public about the health benefits of active travel through information dissemination, campaigns, personalized travel planning, training, and social marketing is crucial. These educational efforts can significantly enhance the adoption of active travel

behaviors.[16] For instance, public campaigns that highlight the health benefits of walking and cycling can motivate individuals to make healthier lifestyle choices. Furthermore, the proactive involvement of local leaders, environmental and urban planners, and community members is essential to foster a culture of active travel and physical activity.[36,37]

It is worth noting that the non-significant association between attitudes towards walking and cycling environments and sufficient physical activity may stem from consistently high mean attitudes observed for these conditions. Participants already held favorable views on the conduciveness of the environment and community behavior related to walking and cycling, resulting in limited variability. This ceiling effect might have reduced the likelihood of detecting a significant association, as positive attitudes alone might have been insufficient to drive behavior change without complementary infrastructure improvements.[38]

The interplay between physical activity and active travel is complex and multifaceted. Active travel behaviors or active lifestyles result from a series of decisions and interactions between individual factors, social and built environments, and supportive policies and strategies.[13,16–18] Individual preferences, such as health consciousness and environmental awareness, interact with the availability of safe and accessible transport infrastructure. Social influences, including family and community norms, also shape transport behaviors.[16,17] This study's findings underscore the need for comprehensive approaches that address these multiple facets.

This study's strengths include the use of exploratory factor analysis combined with multivariable analysis, which provided a nuanced understanding of the associations between attitudes and sufficient physical activity while controlling for confounders. However, the study's generalizability is limited, as the sites were part of a specific project promoting walking and cycling. Future studies should include a broader range of areas nationwide. The reliance on community leaders for sample recruitment and questionnaire distribution might have introduced selection and information bias, highlighting the need for random sampling in future research to ensure representativeness. Additionally, the cross-sectional design limited causal inference, and the sample size calculation, while effective for estimating prevalence, was not optimized for detecting associations between attitudes and physical activity. Translating broad attitudinal themes into policy may require focusing on specific elements, such as enhancing public transport accessibility and affordability and promoting active travel literacy.

Conclusion

Positive attitudes towards public transport environments and active travel literacy were significantly associated with higher levels of sufficient physical activity. These findings suggest that while public transport infrastructure and active travel literacy are crucial, targeted improvements are needed in areas with lower support. Policymakers should focus on enhancing the convenience, attractiveness, and affordability of public transport. Educational campaigns that emphasize the benefits and safe practices of active travel could further strengthen active travel literacy.

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Conflicts of Interests

The authors declare no conflict of interest.

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