CORRELATES OF ADULT PHYSICAL ACTIVITY PARTICIPATION IN THE TROPICS

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ABSTRACT

Background: Understanding socio-environmental correlates of physical activity is important for future planning of health promotion actions to address physical inactivity however there are limited studies that specifically focus on populations living in a tropical environment. Methods: A mailed questionnaire assessing self-report measures of physical activity, barriers, perception of the physical and social environment, self efficacy and social support was administered to 1,930 neighbourhood residents (response rate 22%) in a tropical regional centre in Australia in 2004. Results: Almost 67% (95% confidence interval = [62.3, 71.3]) of respondents were sufficiently active for health. Respondents who were sufficiently active for health were more likely to score high on the self-efficacy ($p<0.001$) and on the social support ($p=0.002$) scores. Respondents who were sufficiently active for health were more likely to be self-motivated ($p=0.010$), could be active even when they are tired ($p=0.001$), have family support to be active ($p=0.003$), and perceive their neighbourhood as safe for walking ($p=0.031$). Conclusions: Social variables were more strongly associated with physical activity behaviour than environmental factors.

KEY WORDS: Physical activity; Environment; Barriers; Tropics.

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INTRODUCTION

The health benefits of regular moderate intensity physical activity are well recognized (United States Department of Health and Human Services [USDHHS], 1996; Bauman, 2004). Nevertheless physical inactivity remains a significant public health issue in many developed countries (USDHHS, 1996). National surveys conducted in Australia in 1997, 1999 and 2000 showed a decline in regular participation from 62 per cent in 1997 to 57 per cent in 1999 and 2000 (Armstrong et al., 2000). Queensland data from 2005, revealed that only 46.1% of residents were sufficiently active for health benefits (Joyner and Mummery, 2006).

Development of relevant and effective health promotion actions to address physical inactivity requires a clear understanding of factors that influence both the adoption and maintenance of physical activity behaviours (Gebel et al., 2007). Many early interventions were based on theories and models that emphasised individual behavior change however there is now a clearer understanding and rationale for using socio-ecological models (Sallis and Owen, 1997). Socio- ecological models recognize that physical activity is influenced by multiple personal, social and physical environmental factors (Sallis and Owen, 1997; Humpel et al., 2002).

Much research has already been conducted exploring the multiple domains that contribute to the physical inactivity problem. However, to date the authors have found limited studies that have specifically focused on populations living in a tropical environment, where temperatures and levels of humidity are high. Duncan and Mummery (2004) examined psychosocial and environmental factors associated with physical activity in a cross sectional study conducted in Rockhampton, which is located directly on the Australian Tropic of Capricorn. Their findings showed that environmental aesthetics and safety appear to be important influences of physical activity however the influence of weather was not specifically examined (Duncan and Mummery, 2004). Barnett and Spinks (2007) studied exercise behaviours in postmenopausal women in Townsville, Queensland, Australia, and found that weather was a strong discriminator between exercising and non-exercising women. Non-exercising women did not feel confident that they could exercise in hot, humid weather (Barnett and Spinks, 2007). It is possible that tropical climates could have a significant impact on physical activity behaviour however more research in this area is needed. Consideration of climate may be an important factor in determining how environmental changes are made and health messages are framed (Gebel et al., 2007) as well as informing what other sorts of interventions are needed and are of most value in tropical communities.

This paper discusses the findings of a survey conducted in tropical North Queensland, Australia. The survey investigated the individual, social and environmental factors that correlated with whether or not people living in a tropical climate were sufficiently active for health. The significance of the findings will be discussed in relation to contemporary views on recommended health promotion action.

METHODS

Design and study participants

Cross-sectional self report data was collected by means of a postal survey in November and December 2004. The study participants were restricted to neighbourhood residents residing in five suburbs in Townsville, located in tropical North Queensland (19°13 S), Australia. Townsville has a dry tropical climate, with distinct wet and dry seasons. At the time of the survey administration, average annual mean minimum temperatures were 22.9^{0}C and average annual mean maximum temperatures were

30.8^{0}C, with average annual humidity levels of 63% at 9:00 am and 58% at 3:00 pm (Bureau of Meteorology, 2009). The sampling area was restricted because the data was also being used as a baseline for future evaluation of an environmental modification that was being undertaken by the local council. Participants were residents who lived within 1.5 kms of the proposed intervention as well as a broader comparison group outside this area.

Eligible participant addresses were identified using local council geographical information system maps and participants were then randomly selected. Initially 2100 surveys were posted of which 1930 were addressed to actually occupied properties. It was requested that respondents must be an adult aged of 18 years or over. As an incentive to return the survey respondents were offered the opportunity to go into a random draw to win gift vouchers at a sports store. Two mail outs were used two weeks apart.

Participation in the study was voluntary and informed consent was implied on the completion of the survey. Ethics approval was gained from the James Cook University Human Ethics committee.

Questionnaire

The questionnaire contained 84 items covering the areas of physical activity participation, barriers to physical activity, self-efficacy, physical environment and safety, social environment and general demographics including health issues. A copy of the survey instrument is available upon request to the first author.

Self reported participation in the previous week was assessed using The Active Australia Physical Activity Questionnaire and scoring method (Australian Institute of Health and Welfare, 2003). The instrument asks respondents to recall the amount of time spent in activity for purposes of recreational walking, walking for transport reasons, and moderate to vigorous activity for periods of at least 10 minutes during the last seven days. Respondents were asked to report the duration in hours and minutes and the frequency of recreational and transport related walking, gardening, vigorous activity and moderate intensity activity. Participation in "sufficient activity" was defined as a total of 150 minutes of activity per week in all of the above activities excluding gardening and is derived from the Australian National Physical Activity Guidelines (Commonwealth Department of Health and Aged Care, 1999).

Respondents were asked general demographic questions, such as age, gender, ethnicity and level of education, and whether or not they had any chronic or long-term health problems and if so what they were. They were also asked questions about current and past smoking behaviour, weight and height and body mass index was calculated from these. The questions relating to perceived self-efficacy (six questions), social support (four questions) and physical environment and safety (15 questions) have been previously described and validated by Duncan and Mummery (2004). The items in social support and physical environment and safety were a mixture of both positively and negatively worded statements. During analysis items were transformed so that scores showed one direction. Respondents were asked to assess the degree to which 20 different barriers impacted on their participation in physical activity. Examples of potential barriers included: lack of interest in exercise, lack of time, lack of company, lack of child care, etc. For each statement there were five categories ranging from never to very often. These five categories were then grouped into two – one for those who say that the item is never or rarely an issue and one for those who say that the item is sometimes, often or very often an issue.

Statistical analysis

Categorical variables were described as percentages. Depending on the distribution numerical data were summarized using mean and standard deviation (SD) or median and inter-quartile range (IQR). Standard bivariate statistical tests such as t-tests for approximately normally distributed data, Chi-square tests for categorical data, and non-parametric Wilcoxon tests for numerical data not normally distributed, were utilized to compare respondents who were sufficiently active for health with respondents who were not. Responses to the 20 barrier questions, to the six perceived self-efficacy questions, to the 15 physical environment and safety questions, and to the four social support questions were added up to create four new numerical scores.

Multivariate logistic regression analyses were used to identify independent correlates for being "sufficiently active for health": (1) one model used the added up scores of barriers, perceived self-efficacy, physical environment and safety, and social support treating these issues conceptually; (2) the second model treated all items of barriers, perceived self-efficacy, physical environment and safety, and social support as independent factors. Backward and forward stepwise procedures were used to identify the two multivariate models. All remaining demographic and health related characteristics were considered as potential confounders. The models were adjusted for potential confounding if the estimate had changed by more than 5%. All possible two-way interactions were considered. Results of multivariate logistic regression analyses were presented as prevalence odds-ratios and 95%-confidence intervals (95%-CI).

Statistical analysis was conducted using SPSS, release 12 for Windows and STATA, release 8. A significance level of 0.05 was assumed throughout the analysis.

RESULTS

A total of 420 residents of Townsville (response rate 22%) replied to the survey. The majority (73.0%) of respondents were female and their mean age was 44 years (SD $\pm$13.6; range 18 to 83). About 3.4% of respondents were of Indigenous descent. The majority of respondents (87%) were born in Australia and had lived a median time of 23.5 years (IQR = [10.0, 38.0]) in the tropics.

Level of physical activity

The median minutes of physical activity achieved by the participants during the previous week was 270 minutes (IQR = (90, 600), range = 0 – 4800). A total of 10.7% (95%-CI = [7.7, 13.7]) of respondents were completely sedentary (physical activity of zero) during the previous week, while 66.8% (95%-CI = [62.3, 71.3]) of the respondents were sufficiently active for health. The median physical activity time of respondents not sufficiently active for health was 50 minutes (IQR = [0, 90]) and the median physical activity time of respondents sufficiently active was 400 minutes (IQR = [263, 780])(Table 1). There were no statistically significant differences between respondents who were sufficiently active for health and those who were not with respect to demographic

characteristics (Table 1). Of respondents who were not sufficiently active for health 57.6% said their health limits physical activity compared to 45.0% of people who were sufficiently active (p=0.003).

Barriers to physical activity

Compared to the participants who were sufficiently active for health, respondents who were not sufficiently active were significantly more likely to respond that they were sometimes, often or very often lacking an interest in exercise or physical activity (p<0.001), lacking self discipline (p=0.007), lacking energy or were too tired (p=0.002), receiving no enjoyment from exercise or physical activity (p=0.002), felt an overall lack of motivation (p<0.001), and found the weather to be too hot or humid (p=0.032)(Table 2). The mean of the added up score of all barriers was 49.0 for the people who were not sufficiently active for health and 44.6 for the people who were sufficiently active (p=0.001)

Table 1: Demographic and health related factors in the strata of sufficiently active for health. Results were based on data collected from 419 residents[#] of Townsville, north Queensland, Australia in 2004/2005.

	Not sufficiently active (n=139)	Sufficiently active (n=280)	p value
Demographic factors			
Mean age (SD)* [years]	43.9 (13.8)	43.7 (13.5)	p=0.873
% Female	76.8%	71.0%	p=0.206
% Born in Australia	90.6%	84.9%	p=0.110
Median time lived in the tropics (IQR)** [years]	24 (9, 40.25)	23 (13, 36)	p=0.644
% Indigenous Australian	2.2%	3.2%	p=0.758[##]
% Finished year 12 at school	47.8%	54.7%	p=0.178[###]
% With trade qualification	54.7%	58.8%	p=0.427
% Currently employed	68.1%	69.2%	p=0.826
Median number of dependent children (IQR)	1 (0, 2)	1 (0, 2)	p=0.087
% Living with child	63.5%	56.4%	p=0.168
% Dog owner	64.5%	64.3%	p=0.967
Health related factors			
% People with chronic health problems	37.0%	30.3%	p=0.174
% People whose health limits physical activity (from "a little" to "all the time")	57.6%	45.0%	p=0.003
Smoking status			
% Current smokers	21.2%	16.8%	p=0.276
% Ex-smokers	27.9%	29.9%	p=0.677
Median number of cigarettes smoked per day (IQR), range	0 [0, 0], 0 - 40	0 [0, 0], 0 - 50	p=0.238
Mean body mass index (SD) kg/m^2 (n = 382)	27.5 (± 5.3)	27.0 (± 5.8)	p=0.423
Physical activity during previous week			
Median minutes spent walking (IQR)	20 (0, 70)	210 (113, 300)	/
Median minutes spent with moderate activity (IQR)	0 (0, 0)	30 (0, 120)	/
Median minutes spent with vigorous activity (IQR)	60 (0, 150)	180 (90, 360)	/

*SD = Standard deviation; **IQR = Inter-quartile range; #One person did not answer the questions relating to physical activity;
##Fisher's exact test; ###Chi-square test for trend.

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Table 2: Perceived barriers to regular physical activity in the strata of being sufficiently active for health or not of a sample of 419[#] Australian residents living in the tropics.

	Not sufficiently active (n=139)	Sufficiently active (n=280)	p value
% Respondents who sometimes, often or very often …..			
… were self conscious about their looks	32.6%	29.0%	p=0.468
… lack interest in exercise or physical activity	69.5%	50.4%	p<0.001
… lack self discipline	83.6%	71.3%	p=0.007
… lack time	84.3%	77.5%	p=0.107
… lack energy or are too tired	91.0%	78.3%	p=0.002
… lack company to be active with	48.5%	46.3%	p=0.676
… receive no enjoyment from exercise or physical activity	54.5%	37.9%	p=0.002
… are discouraged to be physically active due to failed past attempts	25.4%	25.7%	p=0.954
… lack the necessary equipment to be physically active	33.6%	31.0%	p=0.598
… find the weather to be too hot or humid to be physically active	85.7%	76.6%	p=0.032
… find the weather to be too cold to be physically active	14.5%	14.3%	p=0.954
… feel they lack the skills to be physically active	25.2%	21.5%	p=0.411
… feel there is a lack facilities to be physically active	36.4%	37.2%	p=0.874
… feel they lack the knowledge on how to exercise	27.5%	23.7%	p=0.411
… feel they have a lack of good health	47.3%	35.1%	p=0.018
… fear injury	25.8%	16.3%	p=0.024
… feel that there is a lack of a pleasant environment in which to be active	43.9%	36.8%	p=0.169
… feel that there is a lack of a safe place to be physically active	44.3%	36.1%	p=0.113
… feel an overall lack of motivation	81.8%	60.1%	p<0.001
… have no child care	31.1%	21.7%	p=0.042
Total mean score of barriers (range 20 to 82) (SD)	49.0 (12.4)	44.6 (12.1)	p=0.001

[#]One person did not answer the questions relating to physical activity and between 14 and 25 respondents did not answer the barrier questions.

Table 3: Confidence to participate in physical activity and social support in the strata of being sufficiently active for health or not of a sample of 419[#] Australian residents living in the tropics.

	Not sufficiently active (n=139)	Sufficiently active (n=280)	p value
% Respondents feeling "confident or very confident" to be active even …			
… when it is hot outside	29.5%	40.6%	p<0.001
… when I don't have someone to exercise with	47.8%	60.4%	p=0.030
… when I don't have any money	45.5%	59.6%	p=0.021
… when I am tired	5.1%	19.1%	p<0.001
… when I am too busy with work and/or family commitments	5.9%	17.8%	p<0.001
… when the activity takes a lot of effort	15.6%	31.4%	p<0.001
Total mean score of self-efficacy questions (range 6 to 30) (SD)	14.7 (4.8)	18.0 (5.3)	p<0.001
% Respondents who had been "often or very often" …			
… encouraged by family, friends or colleagues to be physically active in the last three months	18.0%	31.9%	p=0.003
… had family, friends or colleagues do something to help them to be physically active in the last three months	11.5%	24.7%	p=0.001
… had family, friends or colleagues who made it difficult for them to be physically active in the last three months	20.2%	12.6%	p=0.089
… had family, friends or colleagues offer to do physical activity with them in the last three months	12.2%	22.9%	p=0.007
Total mean score of social support questions (range 4 to 20) (SD)	10.3 (3.2)	11.8 (3.3)	p<0.001

[#]One person did not answer the questions relating to physical activity, between two and 11 respondents did not answer the confidence questions, and between one and two respondents did not answer the social support questions.

Table 4: Perceived physical environment and safety in the strata of being sufficiently active for health or not of a sample of 419[#] Australian residents living in the tropics.

% Respondents "agreeing or strongly agreeing" that	Not sufficiently active (n=139)	Sufficiently active (n=280)	p value
... it is safe to walk in their neighbourhood	52.9%	67.1%	p=0.003
... dogs frighten people who walk in their neighbourhood	53.6%	43.6%	p=0.117
... their neighbourhood is friendly	60.9%	70.3%	p=0.107
... crime is high in their neighbourhood	18.2%	19.3%	p=0.295
... there are pleasant walks to do in their neighbourhood	56.5%	62.0%	p=0.405
... shops and services are within walking distance in their neighbourhood	73.9%	73.9%	p=0.345
... they often see people out on walks in their neighbourhood	87.6%	89.6%	p=0.700
... their neighbourhood is kept clean and tidy	73.2%	68.8%	p=0.579
... there are busy streets to cross when out on walks in their neighbourhood	63.0%	61.4%	p=0.641
... the footpaths are in good condition in their neighbourhood	44.9%	55.8%	p=0.098
... there is heavy traffic in their neighbourhood	60.1%	54.6%	p=0.556
... it is safe to cycle in their neighbourhood	57.6%	69.5%	p=0.016
... the streets are well lit in their neighbourhood	37.4%	41.1%	p=0.453
... there are open spaces such as parks and ovals for people to walk in or around in their neighbourhood	66.9%	72.1%	p=0.251
... there are bicycle or walking paths/trails within walking distance of their homes in their neighbourhood	73.9%	81.4%	p=0.128
Total mean score of environmental questions (range 29 to 70) (SD)	48.6 (7.0)	50.8 (6.8)	p=0.003

[#]One person did not answer the questions relating to physical activity and between one and seven respondents did not answer the environment and safety questions.

Table 5: Results of multivariate logistic regression analysis of socio-environmental correlates of being sufficiently active for health of a sample of Australian residents living in the tropics.

	Not sufficiently active	Sufficiently active	POR [95%-CI][#]	p-value
*Model 1**				
Total self-efficacy score	Continuous		1.1 [1.1, 1.2]	p<0.001
Total social support score	Continuous		1.1 [1.0, 1.2]	p=0.002
*Model 2***				
"I lack the general motivation for being physically active"				
Sometimes, often, or very often	103	155	1	
Never or rarely	20	100	2.2 [1.2, 4.1]	p=0.010
"Even when I am tired I feel that I could be physically active"				
Not at all confident	58	53	1	
Slightly confident to very confident	65	202	2.5 [1.5, 4.2]	p=0.001
"In the last 3 months family, friends and colleagues have encouraged me to perform physical activity"				
Never or rarely	69	89	1	
Sometimes, often, or very often	54	166	2.1 [1.3, 3.4]	p=0.003
"I believe it is safe to walk in my neighbourhood"				
Strongly disagree, disagree, or unsure	54	87	1	
Agree	59	115	0.8 [0.5, 1.4]	p=0.397
Strongly agree	10	53	2.5 [1.1, 5.7]	p=0.031

* Model 1 was adjusted for the confounding effects of perceived severity of limitation of physical activity due to health issues. There were no significant two-way interactions in the model. The model was able to predict 69.2% of the activity levels correctly. There were 30 data records with incomplete information.

**Model 2 was adjusted for the confounding effects of perceived severity of limitation of physical activity due to health issues and the total time the respondent had lived in Australia. There were no significant two-way interactions in the model. The model was able to predict 72.0% of the activity levels correctly. There were 42 data records with incomplete information.

[#]POR [95%-CI] = Prevalence odds-ratio with 95%-confidence interval.

Self-efficacy and social support

Compared to the participants who were not sufficiently active for health, respondents who were sufficiently active were more likely to feel confident or very confident to be active even when it was hot outside, even when they were tired, even when they were too busy with other commitments, and even when the activity took a lot of effort ($p<0.001$; respectively) (Table 3). Compared to respondents who were not sufficiently active for health, participants who were sufficiently active were significantly more likely to be supported by family, friends or colleagues to be active ($p<0.003$)(Table 3).

Physical environment and safety

Respondents who were sufficiently active for health were more likely to agree or strongly agree that it was safe in their neighbourhood to walk ($p=0.003$) or to cycle ($p=0.016$) compared to people who were not sufficiently active (Table 4).

The mean of the added up score of all environmental questions was 48.6 for the people who were not sufficiently active for health and 50.8 for the people who were sufficiently active ($p=0.003$).

Multivariate results

The first logistic regression analysis showed that the total added up self-efficacy score ($p<0.001$) and the total social support score ($p=0.002$) were correlated to being sufficiently active for health.The second multivariate analysis showed that independent significant correlates of activity levels were the barrier "I lack the general motivation for being physically active" ($p=0.010$), the self-efficacy statement "Even when I am tired I feel that I could be .physically active" ($p=0.001$), the social environment statement "In the last 3 months family, friends and colleagues have encouraged me to perform physical activity" ($p=0.003$), and the physical environment issue "I believe it is safe to walk in my neighbourhood" ($p=0.031$)(Table 5)

DISCUSSION

This study is one of the first to investigate individual, social and environmental correlates that impact on whether or not people are sufficiently active for health in a tropical environment. Our results showed that social variables including high levels of self-efficacy and social support were more strongly associated with physical activity behaviour than physical environmental variables. These findings are consistent with previous studies (Sallis and Owen, 1997; Giles-Corti and Donovan, 2002; Burton et al., 2007; Sallis and Owen, 1999; Salmon et al., 2003). The only remaining environmental factor significant during multivariate analysis separating sufficiently active people from others was the perception that it was safe to walk and cycle in the neighbourhood. It is possible that people who are active in their neighbourhood see it as being safer due to the fact that they are out and about unharmed whereas people who are not active may only have a limited experience of their neighbourhood.

The most similar study in terms of tropical location previously reported was undertaken in Rockhampton, Queensland and this study also found self-reported perceptions of social support and self-efficacy to be important influences of physical activity (Duncan and Mummery, 2004). Similar to the findings in our study, Duncan and Mummery reported that safety was an important environmental issue although they additionally found that perceptions of environmental aesthetics to be relevant (Duncan and Mummery, 2004).

The relationship between weather and physical activity is not clearly understood and past studies in non tropical environments, have only shown weak relationships (Humpel et al., 2002). We were interested in whether the tropical location of our study impacted on correlates for physical activity however while the hot and humid conditions were cited as a common barrier for both sufficiently active and insufficiently active respondents it would appear that socio-environmental correlates remain the same. Alternatively, respondents may have been more adaptive to tropical conditions and continued engaging in physical activity.

What does appear to be important is the degree of self-efficacy individuals have in overcoming this barrier with our active respondents stating that they felt they could be active even when it was hot and humid. This is consistent with Barnett and Spinks study of post menopausal women in Townsville who found that weather was one of the main contributors to different perceptions towards exercise (Barnett and Spinks, 2007). In their study women who did not regularly exercise did not feel confident that they could exercise if the weather was very hot or humid. Future studies comparing people living in tropical environments with people from temperate climates might be insightful in defining the effect of climate on physical activity further.

What do these findings imply in relation to the health promotion actions that are needed to address the problem of physical inactivity? Although the landscape of health promotion is moving in an upstream direction with a greater emphasis on socio-ecological actions (Keleher et al., 2007), it is clear that there are significant factors downstream around barriers and self efficacy and social support that continue to need addressing. Our research was not able to establish strong links between physical activity and environmental features other than the safety aspects however broader physical environmental correlates have been shown in previous research (Humpel et al., 2002; Pikora et al., 2002; Pikora et al., 2003) and there continues to be support for broader midstream and upstream approaches to make environments safe, accessible and conducive for active living. Policies to support this are needed. However this study supports that upstream actions in isolation seem unlikely to be sufficient to change individual behaviour (Giles-Corti and Donovan, 2002). In our study inactive participants seemed to have difficulties in overcoming barriers and had a lower level of self efficacy and social support. With such individuals there remains a need to focus on their lifestyle and behaviours and continue educational and motivational approaches towards healthier choices and lifestyles (Sallis and Owen, 1997; Giles-Corti and Donovan, 2002; Burton et al., 2007) while still ensuring that they have safe and accessible areas to be active in. In particular in tropical environments it would appear that people need to be encouraged not to see hot and humid conditions as a final barrier but rather something that requires respective behaviour adjustment: (1) people need to adjust the times that they are active in and make the most of the cooler early morning and evening conditions and (2) people can choose activities such as swimming or indoor sports in air-conditioned environments.

This study had several limitations that need to be considered when interpreting results. The overall response rate of 22% was

low and may not reflect the true characteristics of the study population. Also due to this study being a baseline for an intervention the participants were not randomly selected from the overall population of Townsville, instead resided in just five suburbs and may therefore not be representative. A comparison of our sample with the census data of the overall Townsville population (Australian Bureau of Statistics, 2006) suggested that there was an over-representation of females, an older mean age by approximately 10 years and an over-representation of slightly lower income individuals. The bias towards female and older respondents has been observed in other mail survey research (Armstrong et al., 1994), while the lower income level was due to the sampling strategy. In addition, self-reported data on physical activity participation may not be an accurate reflection of activity. Respondents in this survey appear to achieve a higher number of median minutes of physical activity than the general population however it is unlikely that true population participation in physical activity is any different in this tropical location compared to Australia and Queensland overall. It is more likely to reflect that the people who chose to complete the survey were those who already had an interest in physical activity possibly because they are already active and value it as a personal priority. This is a likely issue in regards to both this study and other studies in the area in that selection biases towards respondents generally being interested and motivated in the topic may in fact lead to an over estimation of true physical activity levels in the overall population.

CONCLUSION

The findings from this study show that socio-environmental correlates of adult physical activity participation in this tropical environment are no different to those experienced in other locations. Social variables were more strongly associated with physical activity behaviour than physical environmental variables. Findings support the need for multi-strategy health promotion actions across the downstream, midstream and upstream continuum that include individual and social components through to broader infrastructure, systems and policy changes.

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