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Physical Activity among Cambodian Americans: An Exploratory Study

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Abstract

Introduction—Available data indicate that Asian Americans as a group have lower levels of physical activity than non-Latino whites. However, few studies have focused on physical activity among Asian American sub-groups. Our objectives were to describe levels of physical activity, as well as individual and environmental correlates of physical activity among Cambodian Americans.

Methods—We conducted a telephone survey of Cambodians living in three geographic areas (Central California, Northern California, and the Pacific Northwest) during 2010. Physical activity levels were assessed using the International Physical Activity Questionnaire (IPAQ) short version. Survey items addressed demographic characteristics, knowledge about the health benefits of physical activity, social norms and supports with respect to physical activity, the availability of neighbourhood recreational facilities, and neighbourhood characteristics.

Results—Our study group included 222 individuals. Only 12% of the study group reported low levels of physical activity, 40% reported moderate levels, and 48% reported high levels. Physical activity was strongly associated with the availability of neighborhood recreational facilities such as parks, but not with neighborhood characteristics such as heavy traffic.

Discussion—Our results suggest that a majority of Cambodian Americans are adherent to current physical activity guidelines. Neighborhood recreational facilities that provide opportunities for leisure-time physical activity are associated with higher levels of physical activity in Cambodian communities. Future research should assess the reliability and validity of the IPAQ in a Cambodian American study group.

Keywords

Cambodian Americans; Physical activity

INTRODUCTION

Regular physical activity reduces the risk of premature morbidity and mortality from many chronic diseases such as coronary heart disease, hypertension, diabetes, colon cancer, and breast cancer [1]. The United States (US) Department of Health and Human Services released new physical activity guidelines for Americans during 2008. These guidelines specify that adults should do the following amount of physical activity each week: 150 minutes of moderate-intensity physical activity, or 75 minutes of vigorous-intensity physical activity, or an equivalent combination of moderate-intensity and vigorous-intensity physical activity [2]. However, national survey data indicate that only about two-thirds (65%) of US adults are active at levels consistent with these guidelines [3].

Relatively few US studies have addressed physical activity levels among Asians in general or among Asian sub-groups. However, available data suggest that Asian Americans as a group engage in less physical activity than non-Latino whites [4–6]. Further, Asian Americans are a diverse ethnic group originating from the Far East, Indian subcontinent, and Southeast Asia [7]. They have different economic characteristics, pre-migration and post-migration experiences, food selections and cooking methods, and forms of entertainment [7–9]. Therefore, physical activity data collection efforts should focus on each Asian sub-group so that intervention approaches can be tailored to specific Asian communities [10].

The US Census Bureau's 2009 American Community Survey counted 275,000 Cambodians [11]. Over 99% of Cambodian Americans are immigrants or the children of immigrants [12]. Cambodian communities in the US are economically and educationally disadvantaged, as well as linguistically isolated [13]. Further, Cambodians in the US have received very little attention from health disparity researchers, and we were unable to identify any studies that focused on physical activity barriers and facilitators among Cambodians [14].

Our objectives were to assess levels of physical activity among Cambodian Americans in a population-based sample, and to examine correlates of higher versus lower levels of physical activity. Previous studies of physical activity in other populations indicate that individual and environmental factors can both determine levels of physical activity [1,15–17]. Therefore, our study addressed individual factors (demographic characteristics, knowledge about the health benefits of physical activity, and social norms and supports with respect to physical activity), as well as environmental factors (the availability of neighbourhood recreational facilities and neighbourhood characteristics).

METHODS

Overview

We collaborate with an advisory group of Cambodian community leaders who work for health and social services organizations. The advisory group provided advice about our sampling approach, survey implementation procedures, and survey instrument. Our survey was conducted over a five-month period (October, 2010–February, 2011) in three geographic areas of the US with relatively large Cambodian communities: Central California (Sacramento and Stockton areas), Northern California (Oakland and San Jose areas), and the Pacific Northwest (Portland and Tacoma areas) [18]. Individuals were eligible for the study if they were of Cambodian descent and in the 20–69 age group. The Fred Hutchinson Cancer Research Center Institutional Review Board approved our survey instrument and study procedures.

Sampling

Commonly used telephone survey sampling methods, such as random digit dialling, are cost-prohibitive for surveys of smaller racial/ethnic populations. Therefore, name lists are often used to identify members of Asian immigrant communities [19]. We applied a list of Cambodian last names (that we have successfully used in a previous project) to an electronic database of telephone listings for our study areas [20]. Specifically, we identified 1,744 telephone numbers that were associated with one of the Cambodian last names. All these telephone numbers were included in our survey sample.

Survey Recruitment

Addresses associated with the telephone numbers in our survey sample received an introductory letter (Khmer and English versions) from the project. Surveys were conducted over the telephone by bilingual, bicultural Cambodian interviewers. Respondents were given the option of completing their survey in Khmer or English, and received a \$20 grocery store card as a token of appreciation for their time. Up to 11 attempts were made to contact each telephone number (including at least three daytime, three evening, and three weekend attempts). If a household included more than one age-eligible Cambodian, we attempted to interview the individual with the most recent birthday.

Survey Instrument

Prior research has shown that Asian groups have more difficulty completing Likert scales than other groups, and many Cambodian immigrants have little formal education [12,21]. Therefore, we made the response options for our survey items as simple as possible. Specifically, the response options for most of our individual and environmental survey items were yes, no, and not sure/don't know. The survey instrument was developed in English, translated into Khmer, back translated to ensure lexical equivalence, reconciled, and pre-tested [22].

Physical activity levels were assessed using the short telephone version of the International Physical Activity Questionnaire (IPAQ). This survey instrument asks respondents to consider occupational activities, transportation activities, leisure activities, and house and yard work when responding to physical activity questions. It records physical activity within a seven day period in three categories: vigorous activity, moderate activity, and walking. Specifically, six items ask about the number of days that an individual engaged in vigorous physical activity, moderate physical activity, and walking during the last seven days as well as the time spent doing vigorous physical activity, moderate physical activity, and walking on each of those days. Consistent with the IPAQ recommendations for cultural adaptation, we made several changes to the examples of vigorous and moderate physical activities that were provided to participants during the IPAQ item administration [23]. However, we retained the intent of the items by choosing examples of physical activities that represent the appropriate intensity [23,24].

Survey participants provided information about their gender, age, educational level, marital status, and employment status. They also provided information about their birthplace and English-language proficiency. Foreign-born participants specified how many years they had lived in the US.

Six survey items addressed knowledge about the health benefits of physical activity and five survey items assessed social norms and supports in relation to physical activity. Respondents were asked if they thought physical activity can prevent colon cancer, breast cancer, high blood pressure, high blood cholesterol, heart disease, and diabetes. They were also asked how many of their family members (who they lived with or saw regularly) were physically

active, how many of their friends were physically active, whether any of their family members had ever encouraged them to do more physical activity, whether any of their friends had ever encouraged them to do more physical activity, and whether a doctor had ever encouraged them to do more physical activity.

Nine survey items addressed the availability of sidewalks and recreational facilities in participants' neighbourhoods, and eight survey items addressed characteristics of participants' neighbourhoods. First, respondents were asked if all the streets in their neighbourhood had sidewalks and to specify whether the following recreational facilities were available in their neighbourhood: walking trails, bicycling trails, parks, sports fields or sports courts, community centers that offer exercise programs, gyms or fitness centers, swimming pools, and shopping malls. Second, they were asked if they thought the following were problems in their neighbourhood: heavy traffic, crime, vandalism, litter, noise, air pollution, poor lighting at night, and unattended dogs.

Data Analysis

We systematically followed the IPAQ guidelines for data processing and analysis. The IPAQ protocol for short form data was used to categorize physical activity levels as low, moderate, or high [23]. Proportion of life in the US (which is considered to be a good measure of acculturation) was calculated from responses to questions addressing age and years since immigration [25]. Categories for this variable were <50% and ≥50%. US-born respondents were included in the ≥50% category. Chi-square tests and Fisher's exact tests were used to examine the relationship between each study variable and levels of physical activity (low, moderate or high) in bivariable comparisons [26].

Because we examined three levels of physical activity, polytomous logistic regression (using individuals with moderate levels of physical activity as the reference group) was used to assess independent associations between our study variables and physical activity levels [27]. All demographic variables and other variables with a p-value of ≤0.25 in bivariable comparisons were included in our multivariable analysis [28]. As a tool to build a summary model, our polytomous logistic regression analysis applied a backward elimination to non-demographic variables while forcing demographic variables to stay in the model. This backward elimination repeatedly removed the least statistically significant variable one at a time until every non-demographic variable in the model had a p-value of <0.05 (in the presence of the other variables in the model) [29]. All statistical analyses were conducted using SAS version 9.2 (SAS Institute, Cary, North Carolina).

RESULTS

Survey Response

Of the 1,744 numbers in our survey sample, 908 were verified to be ineligible (675 non-working telephone numbers, 162 not ethnically eligible, 24 not age eligible, and 47 business numbers). An additional 478 numbers could not be assessed for eligibility because there was no answer to 11 telephone contact attempts. Interviewers verified that 358 of the telephone numbers were for Cambodian residential addresses that included at least one individual in the 20–69 age group, and 249 of these households agreed to participate in the survey. Therefore, the cooperation rate (response rate among reachable and eligible households) was 70%.

Study Group

Twenty-seven of the survey respondents had incomplete data for one or more of the six IPAQ survey items. Because we were unable to categorize these respondents' physical

activity levels (according to the IPAQ guidelines for data processing and analysis), they were excluded from the data analysis. Therefore, our final study group included 222 individuals. One hundred and seventy nine (81%) of these respondents chose to complete their survey in Khmer and 43 (19%) chose to complete their survey in English.

Physical Activity Levels

Only 27 (12%) of the respondents reported low IPAQ levels of physical activity, 89 (40%) reported moderate IPAQ levels of physical activity, and 106 (48%) reported high IPAQ levels of physical activity.

Demographic Characteristics

Two hundred and five (92%) of the individuals in our study group were born in Asia and 17 (8%) were born in the US. As shown in Table 1, 45% of the study group were residents of Central California, 21% were residents of Northern California, and 35% were residents of the Pacific Northwest. Approximately one-third of the study group were male, less than 45 years old, and spoke English fluently or very well. Three-fifths had less than 12 years formal education, two-thirds were currently married, and about one-half were currently employed. Just under one-half had spent at least 50% of their life in the US. Current employment was associated with physical activity levels ($p=0.04$). There were no other significant associations between demographic characteristics and levels of physical activity.

Knowledge and Social Norms/Supports

Table 2 provides information about the respondents' knowledge and Table 3 provides information about social norms and supports. Over three-quarters knew that physical activity can prevent high blood pressure, high blood cholesterol, heart disease, and diabetes. However, only 57% knew that physical activity can prevent colon cancer, and only 47% knew that physical activity can prevent breast cancer. About two-fifths reported that all or more than half of their family members were physically active, and about one-quarter reported that all or more than half of their friends were physically active. The proportions reporting that a family member, friend, and doctor had encouraged them to do more physical activity were 73%, 70%, and 74%, respectively. The following variables were significantly associated with higher levels of physical activity: knowing physical activity can prevent heart disease ($p=0.03$) and reporting all or more than half of family members were physically active ($p=0.04$).

Neighbourhood Recreational Facilities and Characteristics

Forty-six percent of the respondents indicated that all the streets in their neighbourhood had sidewalks. The availability of neighbourhood recreational facilities ranged from 36% for community centers that offer exercise programs to 82% for parks (Table 4). The availability of parks (<0.001), community centers that offer exercise programs ($p=0.003$), gyms or fitness centers ($p=0.004$), and shopping malls ($p=0.003$) were all strongly associated with higher physical activity levels. Perceived neighbourhood problems ranged from 36% for unattended dogs to 51% for heavy traffic and crime (Table 5). There were no significant associations between perceived neighbourhood problems and levels of physical activity.

Multivariable Findings

The following six variables were independently associated with being in the high physical activity category (versus being in the moderate physical activity category): currently unmarried ($p<0.001$), currently employed ($p=0.047$), knowing that physical activity can prevent diabetes ($p=0.01$), living in a neighbourhood without bicycling trails ($p=0.01$), living in a neighbourhood with parks ($p=0.03$), and living in a neighbourhood with

community centers that offer exercise programs ($p=0.03$). Only one variable was independently associated with being in the low physical activity category (versus being in the moderate physical activity category). Specifically, individuals in the low physical activity category were less likely to live in a neighbourhood with parks ($p=0.03$) than individuals in the moderate physical activity category.

DISCUSSION

Previous analyses have consistently found that Vietnamese in the US have low levels of physical activity, compared to other racial/ethnic groups [30,31]. For example, an analysis of 2005 California Health Interview Survey (CHIS) data showed that Vietnamese have lower levels of physical activity than whites, blacks, and Latinos [30]. In contrast, a recent study that administered the IPAQ to a convenience sample of immigrant Korean women in the US Midwest found that 78% of the respondents were adherent to physical activity guidelines [32]. Our findings similarly suggest that most (88%) Cambodians in the US are adherent to physical guidelines (as defined by moderate or high IPAQ physical activity levels), and nearly one-half (48%) have high levels of physical activity (according to the IPAQ definition).

Data comparing physical activity levels among foreign-born and native-born individuals are relatively limited [33]. However, an analysis of CHIS data found that foreign-born Asians were significantly less likely to engage in leisure-time physical activity than US-born Asians, and leisure-time physical activity increased with years in the US [5]. In contrast, a study of Chinese immigrants to Washington State found that individuals who had been in the US for less than 10 years were significantly more likely to exercise regularly than those who have been in the US for a longer period [34]. We found no relationship between proportion of life in the US or English language proficiency and physical activity levels among Cambodian Americans.

We found that levels of knowledge about the health benefits of physical activity were relatively high with respect to high blood pressure, high cholesterol, heart disease, and diabetes. However, only about one-half of our study group was aware of the relationship between physical activity and breast cancer, and the relationship between physical activity and colon cancer. A recent national survey found that 62% of all Americans (and 62% of Asian Americans) knew that physical activity can decrease the likelihood of getting certain types of cancer [35].

Chen and colleagues have recently reported that leisure-time physical activity is positively associated with greater knowledge about the health benefits of exercise, as well as social support among adults in Taiwan [36]. Only 67% of our respondents with low levels of physical activity were aware of the relationship between physical activity and heart disease, compared to 88% of respondents with moderate levels of physical activity and 85% of respondents with high levels of physical activity ($p=0.03$). Additionally, the proportions of our respondents with low, moderate, and high physical activity levels who reported most or all their family members were physically active were 19%, 37%, and 45%, respectively ($p=0.04$).

Our findings suggest that the availability of neighbourhood recreational facilities may have an important influence on physical activity among Cambodian Americans. Specifically, we documented significant associations between the availability of multiple types of recreational facilities and physical activity levels. For example, only 52% of individuals reporting low levels of physical activity had a park in their neighborhood, compared to 81% of individuals with moderate levels of physical activity and 90% of individuals with high

physical activity ($p < 0.001$). Our findings also suggest that neighborhood characteristics are not determinants of physical activity in Cambodian American communities. A recent study of Latina immigrant women in North Carolina had similar findings. Specifically, living in a community where places to exercise were available was associated with physical activity but factors such as heavy traffic and poor street lighting were not [37].

Our study has several strengths. Specifically, we used population-based sampling methods, conducted our survey in multiple geographic areas, and had a relatively high cooperation rate. However, there are also several limitations. First, only households that were included in a database of land-line telephone listings were eligible for the survey and households with wireless only telephone coverage were excluded. Second, respondents may have differed in important ways from those who were unreachable or refused participation, and participants with missing data for one or more of the IPAQ items may have had different physical activity patterns than those without missing data. Finally, this exploratory study of physical activity among Cambodian Americans used cross-sectional methodology and our sample size was relatively modest.

The IPAQ has been used extensively in countries around the world, and the validity and reliability of the short and long IPAQ versions have been proven to be comparable to other questionnaires [23,38–40]. However, we are unaware of any validity and reliability studies addressing the performance of the IPAQ in Cambodian populations and one recent study found that the IPAQ performed poorly among adolescents in Vietnam [41]. It is possible that the short version of IPAQ meaningfully over-estimated levels of physical activity in our Cambodian American study group. Future research should assess the reliability and validity of the short IPAQ version, the long IPAQ version, and instruments such as the Global Physical Activity Questionnaire in Cambodian and other Asian immigrant communities [23,42].

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REFERENCES

1. US Department of Health and Human Services. Physical activity. www.healthypeople.gov. Retrieved June 15, 2011
2. US Department of Health and Human Services. 2008 physical activity guidelines for Americans. Hyattsville: US Department of Health and Human Services; 2008.
3. Centers for Disease Control and Prevention. Prevalence of self-reported physically active adults—United States. *Morbidity and Mortality Weekly Reports*. 2008; 57:1297–1300.
4. Centers for Disease Control and Prevention. Physical activity among Asians and Native Hawaiian or other Pacific Islanders—50 states and the District of Columbia, 2001–3. *Morbidity and Mortality Weekly Reports*. 2004; 53:756–760.
5. Kandula NR, Lauderdale DS. Leisure time, non-leisure time, and occupational physical activity in Asian Americans. *Annals of Epidemiology*. 2005; 15(4):257–265. [PubMed: 15780772]
6. Mampilly CM, Yore MM, Maddock JE, Nigg CR, Buchner D, Heath GW. Prevalence of physical activity levels by ethnicity among adults in Hawaii, BRFSS 2001. *Hawaii Medical Journal*. 2005; 63(10):270–273. [PubMed: 16294701]
7. Asian American Health Initiative. Who are Asian Americans?. Annapolis: Asian American Health Initiative; 2005.
8. Ro M. Moving forward: addressing the health of Asian American and Pacific Islander women. *American Journal of Public Health*. 2002; 92(4):516–519. [PubMed: 11919042]

9. Wong EC, Marshall GN, Schell TL, Elliott MN, Babey SH, Hambarsoomians K. The unusually poor health status of Cambodian refugees two decades after resettlement. *Journal of Immigrant and Minority Health*. 2011; 13(5):876–882. [PubMed: 20878473]
10. President's Advisory Commission on Asian Americans and Pacific Islanders. Asian Americans and Pacific Islanders—Addressing health disparities: opportunities for building a healthier America. Washington DC: US Department of Health and Human Services; 2003.
11. US Census Bureau. Selected population profile in the United States: Cambodian alone or in any combination. www.factfinder.census.gov/Cambodian. Retrieved April 11, 2011
12. Ouch, C.; Park, Y. The Cambodian community in the United States. Seattle: Cross Cultural Health Care Program; 1999.
13. US Department of Commerce. We the people: Asians in the United States—Census 2000 special reports. Washington DC: US Department of Commerce; 2004.
14. Ghosh C. Healthy People 2010 and Asian American/Pacific Islanders: defining a baseline of information. *American Journal of Public Health*. 2003; 93(12):1093–1098.
15. Giles-Cortu B, Donovan RJ. The relative influence of individual, social, and physical environmental determinants of physical activity: a review. *Social Science and Medicine*. 2002; 54(12):1793–1812. [PubMed: 12113436]
16. Hempel N, Owen N, Leslie E. Environmental factors associated with adults' participation in physical activity: a review. *American Journal of Preventive Medicine*. 2002; 22(3):188–199. [PubMed: 11897464]
17. Trost SG, Owen N, Bauman AE, Sallis JF, Brown W. Correlates of adults' participation in physical activity: review and update. *Medicine and Science in Sports and Exercise*. 2002; 34(12):1996–2001. [PubMed: 12471307]
18. Pfeifer, ME. US Census 2000: Cambodian residential distribution. www.hmongstudies.org. Retrieved August 5, 2009
19. Mateos P. A review of name-based ethnicity classification methods and their potential in population studies. *Population Space and Place*. 2007; 13(4):243–263.
20. Taylor VM, Talbot J, Do HH, et al. Hepatitis B knowledge and practices among Cambodian Americans. *Asian Pacific Journal of Cancer Prevention*. 2011; 12(4):957–961. [PubMed: 21790233]
21. Lee JW, Jones PS, Mineyama Y, Zhang XE. Cultural differences in response to a Likert scale. *Research in Nursing and Health*. 2002; 25(4):295–306. [PubMed: 12124723]
22. Eremenco SL, Cella D, Arnold BJ. A comprehensive method for the translation and cross-cultural validation of health status questionnaires. *Evaluation and the Health Professions*. 2005; 28(2):212–232.
23. International Physical Activity Questionnaire group. The International Physical Activity Questionnaire. www.ipaq.ki.se/ipaq.htm. Retrieved June 11, 2010
24. Ainsworth BE, Haskell WL, Whitt MC, et al. Compendium of physical activities: an update of activity codes and MET intensities. *Medicine and Science in Sports and Exercise*. 2000; 32(9):S498–S504. [PubMed: 10993420]
25. Anderson J, Moeschberger M, Chen MS, Kunn P, Wewers ME, Guthrie R. An acculturation scale for Southeast Asians. *Social Psychiatry and Psychiatric Epidemiology*. 1993; 28(3):134–141. [PubMed: 8378809]
26. Rosner, B. Fundamentals of biostatistics. Boston: Duxbury; 2006.
27. Hosmer, DW.; Lemeshow, S. Applied logistic regression. New York: Wiley; 2000.
28. Bancroft TA. Analysis and inference for incompletely specified models involving the use of preliminary tests of significance. *Biometrics*. 1964; 20(6):427–444.
29. Harrell, FE. Regression model strategies with applications to linear models, logistic regression, and survival analysis. New York: Springer; 2001.
30. Holtby, S.; Zahnd, E.; Chin, YJ.; Lordi, N.; Grant, D.; Rao, M. Health of California's adults, adolescents, and children. Sacramento: California Department of Public Health; 2008.

31. Nguyen TT, Liao Y, Gildengorin G, Tsoh J, Bui-Tong N, McPhee SJ. Cardiovascular risk factors and knowledge of symptoms among Vietnamese Americans. *Journal of General Internal Medicine*. 2009; 24(2):238–243. [PubMed: 19089498]
32. Choi J, Wilbur J, Miller A, Szalacha L, McAuley E. Correlates of leisure-time physical activity in Korean immigrant women. *Western Journal of Nursing Research*. 2008; 30(5):620–638. [PubMed: 18443207]
33. Kandula NR, Keresy M, Lurie N. Assuring the health of immigrants: what the leading health indicators tell us. *Annual Review of Public Health*. 2004; 25:357–376.
34. Taylor VM, Yasui Y, Tu SP. Heart disease prevention among Chinese immigrants. *Journal of Community Health*. 2007; 32(5):299–310. [PubMed: 17922202]
35. Oh A, Shaikh A, Waters E, Atienza A, Moser RP, Perna F. Health disparities in awareness of physical activity and cancer prevention: findings from the National Cancer Institute's 2007 Health information National Trends Survey (HINTS). *Journal of Health Communication*. 2010; 15(3):S60–S77.
36. Chen YJ, Huang YH, Lu FH, et al. The correlates of leisure time physical activity among an adult population from Southern Taiwan. *BMC Public Health*. 2011 Epub June 3.
37. Evenson KR, Sarmiento OL, Tawney KW, Macon L, Ammerman AS. Personal, social, and environmental correlates of physical activity in North Carolina Latina immigrants. *American Journal of Preventive Medicine*. 2003; 25(30):S77–S85.
38. Craig CL, Marshall AL, Sjöström M, et al. International physical activity questionnaire: 12-country reliability and validity. *Medicine and Science in Sports and Exercise*. 2003; 35(8):1381–1395. [PubMed: 12900694]
39. Deng HB, McFarlane DJ, Thomas GN, et al. Reliability and validity of the IPAQ-Chinese: the Guangzhou Biobank Cohort study. *Medicine and Science in Sports and Exercise*. 2008; 40(2): 303–307. [PubMed: 18202571]
40. Hallal PC, Gomez LF, Parra DC, et al. Lessons learned after 10 years of IPAQ use in Brazil and Columbia. *Journal of Physical Activity and Health*. 2010; 7(2):S259–S264. [PubMed: 20702914]
41. Lachat CK, Verstraeten R, Khanh LNB. Validity of two physical activity questionnaires (IPAQ and PAQA) for Vietnamese adolescents in rural and urban areas. *International Journal of Behavioral Nutrition and Physical Activity*. 2008; 10(7):5–37.
42. World Health Organization. Global physical activity surveillance. www.who.int/chp/steps/GPAQ. Retrieved June 14, 2011

Table 1

Demographic Characteristics

Variable	All N=222 n (%)	Low N=27 n (%)	Moderate N=89 n (%)	High N=106 n (%)	p-value
Geographic area					
Central California	99 (45)	12 (44)	46 (52)	41 (39)	0.34
Northern California	46 (21)	4 (15)	15 (17)	27 (25)	
Pacific Northwest	77 (35)	11 (41)	28 (31)	38 (36)	
Gender					
Male	69 (31)	11 (41)	26 (29)	32 (30)	0.51
Female	153 (69)	16 (59)	63 (71)	74 (70)	
Age (years)					
<45	81 (37)	8 (30)	30 (34)	43 (41)	0.44
45	139 (63)	19 (70)	58 (66)	62 (59)	
Education (years)					
<12	129 (60)	17 (63)	53 (62)	59 (58)	0.78
12	85 (40)	10 (37)	32 (38)	43 (42)	
Marital status					
Currently married	149 (67)	18 (67)	65 (74)	66 (62)	0.23
Not currently married	72 (33)	9 (33)	23 (26)	40 (38)	
Employment status					
Currently employed	109 (49)	13 (48)	35 (39)	61 (58)	0.04
Not currently employed	113 (51)	14 (52)	54 (61)	45 (42)	
Proportion of life in US (%)					
<50	95 (43)	12 (44)	39 (44)	44 (42)	0.94
50	125 (57)	15 (56)	49 (56)	61 (58)	
English proficiency					
Speaks fluently or well	62 (28)	7 (27)	20 (23)	35 (33)	0.28
Speaks quite well, poorly or not at all	158 (72)	19 (73)	68 (77)	71 (67)	

Table 2**Knowledge**

Variable	All N=222 n (%)	Low N=27 n (%)	Moderate N=89 n (%)	High N=106 n (%)	p-value
Knew physical activity can prevent colon cancer					
Yes	127 (57)	13 (48)	47 (53)	67 (63)	0.21
No	95 (43)	14 (52)	42 (47)	39 (37)	
Knew physical activity can prevent breast cancer					
Yes	105 (47)	11 (41)	41 (46)	53 (50)	0.66
No	117 (53)	16 (59)	48 (54)	53 (50)	
Knew physical activity can prevent high blood pressure					
Yes	197 (89)	23 (85)	81 (91)	93 (88)	0.57
No	25 (11)	4 (15)	8 (9)	13 (12)	
Knew physical activity can prevent high cholesterol					
Yes	203 (91)	22 (81)	84 (94)	97 (92)	0.11
No	19 (9)	5 (19)	5 (6)	9 (8)	
Knew physical activity can prevent heart disease					
Yes	186 (84)	18 (67)	78 (88)	90 (85)	0.03
No	36 (16)	9 (33)	11 (12)	16 (15)	
Knew physical activity can prevent diabetes					
Yes	171 (77)	19 (70)	64 (72)	88 (83)	0.13
No	51 (23)	8 (30)	25 (28)	18 (17)	

Table 3**Social Norms/Supports**

Variable	All N=222 n (%)	Low N=27 n (%)	Moderate N=89 n (%)	High N=106 n (%)	p-value
Proportion of family members that were physically active					
All or more than half	86 (39)	5 (19)	33 (37)	48 (45)	0.04
About half, less than half or none	136 (61)	22 (81)	56 (63)	58 (55)	
Proportion of family friends that were physically active					
All or more than half	53 (24)	3 (11)	21 (24)	29 (27)	0.21
About half, less than half or none	169 (76)	24 (89)	68 (76)	77 (73)	
Family member had encouraged more physical activity					
Yes	162 (73)	18 (67)	64 (72)	80 (75)	0.63
No	60 (27)	9 (33)	25 (28)	26 (25)	
Friend had encouraged more physical activity					
Yes	155 (70)	14 (52)	67 (75)	74 (70)	0.07
No	67 (30)	13 (48)	22 (25)	32 (30)	
Doctor had encouraged more physical activity					
Yes	165 (74)	18 (67)	68 (76)	79 (75)	0.60
No	57 (26)	9 (33)	21 (24)	27 (25)	

Table 4

Neighbourhood Recreational Facilities

Variable	All N=222 n (%)	Low N=27 n (%)	Moderate N=89 n (%)	High N=106 n (%)	p-value
Neighbourhood streets all have sidewalks					
Yes	103 (46)	8 (30)	43 (48)	52 (49)	0.18
No	119 (54)	19 (70)	46 (52)	54 (51)	
Walking trail in neighbourhood					
Yes	170 (77)	20 (74)	71 (80)	79 (75)	0.65
No	52 (23)	7 (26)	18 (20)	27 (25)	
Bicycling trail in neighbourhood					
Yes	170 (77)	18 (67)	75 (84)	77 (73)	0.07
No	52 (23)	9 (33)	14 (16)	29 (27)	
Park in neighbourhood					
Yes	181 (82)	14 (52)	72 (81)	95 (90)	<0.001
No	40 (18)	13 (48)	17 (19)	10 (10)	
Sports field and/or sports court in neighbourhood					
Yes	158 (71)	15 (56)	67 (75)	76 (72)	0.14
No	64 (29)	12 (44)	22 (25)	30 (28)	
Community center that offers exercise programs in neighbourhood					
Yes	80 (36)	4 (15)	27 (30)	49 (46)	0.003
No	142 (64)	23 (85)	62 (70)	57 (54)	
Gym and/or fitness center in neighbourhood					
Yes	137 (62)	10 (37)	52 (58)	75 (71)	0.004
No	85 (38)	17 (63)	37 (42)	31 (29)	
Swimming pool in neighbourhood					
Yes	111 (50)	11 (41)	39 (44)	61 (58)	0.10
No	111 (50)	16 (59)	50 (56)	45 (42)	
Shopping mall in neighbourhood					
Yes	166 (75)	13 (48)	68 (76)	85 (80)	0.003
No	56 (25)	14 (52)	21 (24)	21 (20)	

Table 5

Neighbourhood Characteristics

Variable	All N=222 n (%)	Low N=27 n (%)	Moderate N=89 n (%)	High N=106 n (%)	p- value
Heavy traffic					
Yes	114 (51)	11 (41)	46 (52)	57 (54)	0.48
No	108 (49)	16 (59)	43 (48)	49 (46)	
Crime					
Yes	114 (51)	10 (37)	48 (54)	56 (53)	0.28
No	108 (49)	17 (63)	41 (46)	50 (47)	
Vandalism					
Yes	104 (47)	11 (41)	41 (46)	52 (49)	0.73
No	118 (53)	16 (59)	48 (54)	54 (51)	
Litter					
Yes	90 (41)	8 (30)	38 (43)	44 (42)	0.46
No	132 (59)	19 (70)	51 (57)	62 (58)	
Noise					
Yes	82 (37)	12 (44)	30 (34)	40 (38)	0.58
No	140 (63)	15 (56)	59 (66)	66 (62)	
Air pollution					
Yes	84 (38)	9 (33)	34 (38)	41 (39)	0.87
No	138 (62)	18 (67)	55 (62)	65 (61)	
Poor lighting at night					
Yes	86 (39)	11 (41)	30 (34)	45 (42)	0.45
No	136 (61)	16 (59)	59 (66)	61 (58)	
Unattended dogs					
Yes	80 (36)	6 (22)	38 (43)	36 (34)	0.13
No	142 (64)	21 (78)	51 (57)	70 (66)	