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PHYSICAL ACTIVITY AND ITS PREDICTORS AMONG OLDER THAI ADULTS

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ABSTRACT

The purpose of this study was to determine how well the behavior-specific cognitions (perceived benefits, perceived barriers, self-efficacy, family support, neighborhood environment, and convenient facilities) and personal factors (gender, income, and education) predicted physical activity in older Thai adults. The Physical Activity Promotion Model (PAPM) guiding this study was adapted from Pender's (1996) revised Health Promotion Model and the findings of a literature review. A multi-stage sampling technique was used to select eight villages from two sub-districts located in Chonburi Province, Thailand. The data were collected from 112 non-institutionalized Thai women and men aged 60 years and older using face-to face interviews. Hierarchical regression analysis indicated that the six behavior-specific cognitions accounted for about 40% (adjusted $R^2 = .40$, $p < .05$) of the variability in physical activity, while the nine variables together explained 50% (adjusted $R^2 = .50$, $p < .05$) of the variance in physical activity. Only four variables (income, perceived barriers, neighborhood environment, and convenient facilities) were significant predictors of physical activity. Although perceived benefits, self-efficacy, family support, gender, and education were not significant predictors, a conclusion that these variables do not play important roles in physical activity would be premature because so few studies of these factors were conducted with older Thai adults. Further research in this field remains to be done to determine if the findings of this study are consistent in this population.

Keywords : Physical activity, older adults, Thai adults, health promotion.

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INTRODUCTION

Health care for older adults in Thailand will become a crucial problem in the future. Like most countries, the number of Thai people aged 60 and older will dramatically change in the next decade. The number of older Thai adults increased from 2.4 million (5.5%) in 1980 to 3.9 million (7.3%) in 1990, and is expected to represent 14.1 % of the population accounting for 9.9 million elderly people by the year 2020 (United Nations, 1993). In addition, the average life expectancy increased from 63 years in 1992 to 67 years in 1996 for Thai men, and 69 to 71 years for Thai women.

As average life expectancy increases, the chance of these people experiencing chronic diseases and inability to perform activities of daily living increases. Siripanich (1989) and colleagues found that 61% of older Thai adults had health problems and 70% of them suffered from at least one chronic illness. The most common health problems of older Thai adults were arthritis, hypertension, diabetes mellitus and heart disease (Jitapunkul, Bunnag, and Ebrahim, 1993). Moreover, several researchers have shown an association between chronic diseases and functional dependence of older adults (Guralnik and Simonsick, 1993; Krach, Vaney, DeTurk, and Zink, 1996). Given these numbers, many older adults will suffer from a decreased ability to perform activities of daily living over the next several decades.

Empirical evidence has shown that exercise training improved muscular strength and reduced the risk of many chronic diseases even in old age (e.g., Phillips and Hazeldene, 1996; Schuster, Petosa, and Petosa, 1995; Scully, Kremer, Meade, Graham, and Dudgeon, 1998; Spirduso, 1995; Welsh and Rutherford, 1996). Improvements in cognitive performance, anxiety, and depression were also found in elderly people who engaged in regular physical activity (Perrig-Chiello et al., 1998; van Boxtel et al., 1997; Williams and Lord, 1997). Most importantly, recent investigations have revealed that regular physical activity improved and maintained functional abilities in older adults (e.g., Clark, 1996; Davis, Ross, Preston, Nevitt, and Wasnich, 1998; DiPietro, 1996; Huang et al., 1998; Morey, Pieper, and Cornoni-Huntley, 1997; Wolinsky, Stump, and Clark, 1995).

Although accumulated evidence demonstrates substantial beneficial effects of increased physical activity, sedentary lifestyle continues to be prevalent among older persons. In Thailand, researchers have reported low levels of physical activity among older adults. Siripanich et al. (1989) found that 40% of their survey respondents reported no physical activity at all in their leisure time. Of those who performed leisure-time physical activity, 33% reported a low level of activity. Junswang (1990) investigated men and women aged 60 and older in Songkla Province and their findings showed that 34% engaged in no physical activity. Thongwichien and Silpasuwan (1989) reported that 47% of the older adults living in Bangkok communities did not engage in any leisure-time physical activity.

Recently, the studies of factors that influenced older persons to engage in physical activity have received increasing interest. In western countries, a number of researchers have investigated predictors of physical activity among older adults. However, these findings remained unclear for the aged population in Thailand. Studying predictors of physical activity among older Thai adults can fill this gap in the literature. Moreover, the current national health policy specifies health and quality of life as objectives for the elderly population. Physical activity is identified as a strategy to achieve these objectives. Thus the study's emphasis on predictors of physical activity among older Thai adults can make a significant contribution to achieving the aforementioned objectives.

The purpose of this study was to determine how well the behavior-specific cognitions (perceived benefits, perceived barriers, self-efficacy, family support, neighborhood environment, and convenient facilities) and personal factors (gender, income, and education) predicted physical activity. The knowledge gained from this study can assist people to make physical activity a sustainable part of their lives.

THEORETICAL FRAMEWORK

The Physical Activity Promotion Model (PAPM) guiding this study was adapted from Pender's (1996) revised Health Promotion Model. Pender's model postulated that behavior-specific cognitions (cognitive-perceptual factors) and individual characteristics (modifying factors) lead to health-promoting behaviors. In the PAPM, behavior-specific cognitions were organized into six constructs: (1) perceived benefits, (2) perceived barriers, (3) self-efficacy, (4) family support, (5) neighborhood environment, and (6) convenient facilities. Personal factors were categorized into three constructs: (1) gender, (2) income, and (3) education. Based on the findings of a literature review, these nine constructs were identified by a number of investigators as important variables and were significantly associated with physical activity among older adults (e.g., Caserta and Gillett, 1998; Clark, 1999; Conn, 1998; Hays and Clark, 1999; Hellman, 1997; Jones and Nies, 1996; Kutner, Barnhart, Wolf, McNeely, and Xu, 1997; Melillo, Williamson, Futrell, and Chamberlain, 1997; Pinto, Marcus, and Clark, 1996; Sallis, Hovell, and Hofstetter, 1992). The relationships between the variables are depicted in Figure 1.

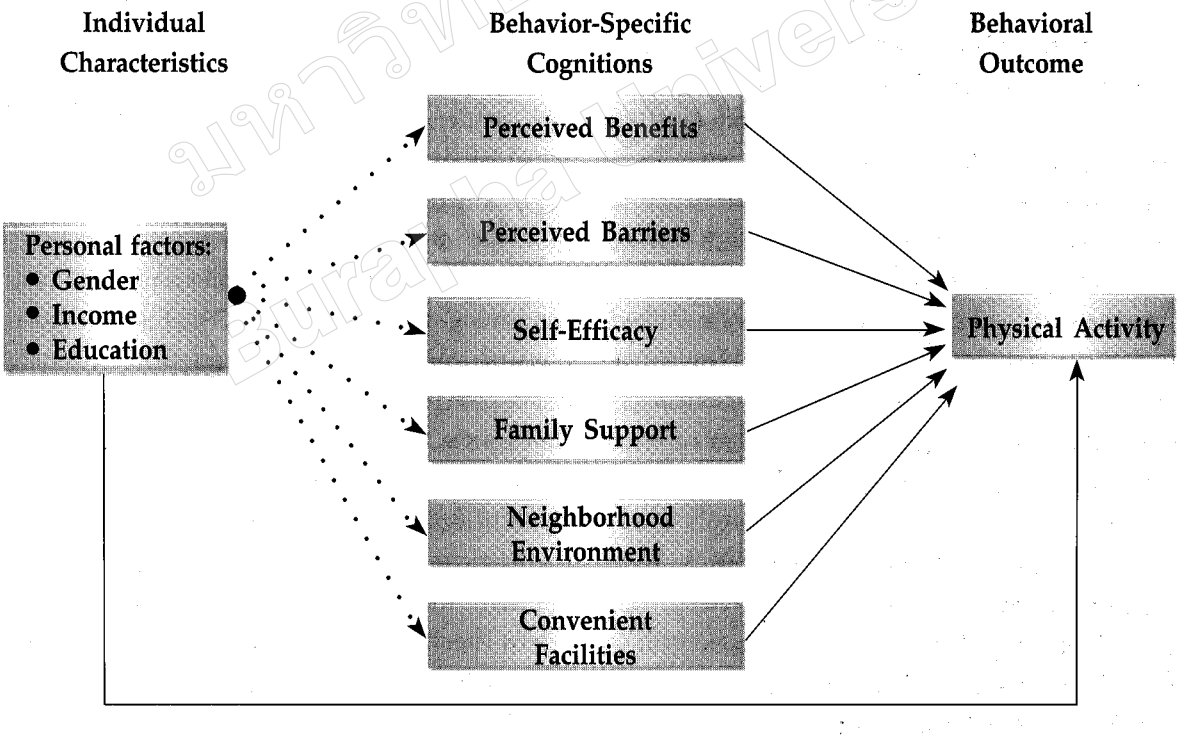

Figure 1. The Physical Activity Promotion Model (PAPM)

METHODS

Sample

A multi-stage sampling technique was used to yield a probability sample of elderly men and women. Two sub-districts (Nongkankok and Bangsai) were randomly chosen from entire sub-districts located in Muang district, Chonburi province. Using simple random sampling, four villages were selected from each sub-district. The sites included rural and urban communities. Based on a power analysis, a sample size of 112 non-institutionalized Thai women and men aged 60 years and older was required. According to Cohen (1992), for a multiple regression with nine independent variables, a medium effect size (d = .30), a power of .80, and an alpha of .05, the sufficient sample size equals 110. Fifty additional persons (Thorndike, 1978) were included in the recruitment lists of elderly men and women as an estimate of individuals who would not meet the inclusion criteria or who would be unwilling to participate in the study. A table of random numbers was used to draw ten men and ten women from each village for a total of 160 persons. Then, a recruitment list of 20 subjects for each village was randomly sorted. Finally, the first 7 men and 7 women on the list for each village were invited to participate in this study (a total of 112 subjects).

Criteria for sample selection included: (1) Thai women and men, (2) 60 years of age or older, (3) non-institutionalized, (4) no hearing impairment or disability, (5) able to walk unassisted, (6) able to understand and speak Thai, and (7) willing to participate in the study.

Procedure

The subjects were given a complete verbal explanation of the study by the researcher. Those who agreed to participate in the study were asked to sign a written consent form. If the subjects did not wish to participate, did not meet the criteria for inclusion, or were unable to complete the interview, the next number on the recruitment list for that village was selected. To avoid confounding of measures, only one member was included in the study if more than one person in a family was randomly selected.

A face-to-face structured interview was used in this study. Data collection was completed during a home visit made at a time that was convenient for the subjects and the researcher. The interview took approximately 30 minutes.

Measures

The measures for this study include (1) Personal data sheet, (2) Exercise Benefits/Barriers Scale (EBBS), (3) Exercise Self-Efficacy Scale (S-E Scale), (4) Family Support Questionnaire, (5) Neighborhood Environment Scale, (6) Convenient Facilities Scale, and (7) Physical Activity Questionnaire (PAQ).

A Personal data sheet was used to collect demographic and socioeconomic data including age, gender, income, marital status, and educational level.

The Exercise Benefits/Barriers Scale (EBBS), developed by Sechrist, Walker, and Pender (1987), was used to measure the perceptions of individuals concerning the barriers and benefits of regular physical activity. The EBBS consists of 29 benefit items and 14 barrier items, on a 4-point forced-choice scale. Calculation of Cronbach's alpha from the Thai study population (N=112) yielded an alpha of 0.95 for the Benefits Scale and 0.73 for the Barriers Scale. The content validity index for the EBBS was reported as 0.91.

The Exercise Self-Efficacy Scale (S-E Scale), developed by Laffrey and Asawachaisuwikrom (in review), was used to measure individuals' confidence in their ability to perform physical activity under various situations. The original S-E Scale consisted of 11 items, on a 5-point scale from 1 (not at all confident) to 5 (very confident) and 0 for not applicable. The 11-item scale was

tested with 77 older Mexican- American women, with an internal consistency of 0.86. Prior to its use with the Thai study population, the items were refined to be more relevant to Thai culture. The refined 12-item S-E Scale was tested for reliability with a Cronbach's alpha coefficient of .86. The content validity index was 0.82. The Family Support Questionnaire, developed by Chayakul (1995), consisted of 15 items with responses of 0 (No) or 1 (Yes). Calculation of Cronbach's alpha from the study population (n = 112) yielded an alpha coefficient of 0.92. The content validity was examined by five Thai experts in the field of health promotion (Chayakul, 1995).

The Neighborhood Environment Scale was used to assess perceived exercise environment. The original Neighborhood Environment Scale, developed by Sallis et al. (1997), consisted of three separate items: (1) neighborhood features, (2) perceived safety, and (3) neighborhood characteristics. The total score was obtained by summing all of the items. This scale was tested for reliability with 30 older Thai men and women, with a 2-week test-retest reliability coefficient of 0.70.

The Convenient Facilities Scale, developed by Sallis et al. (1997), was comprised of a list of facilities that can be utilized for physical activity. The summation of the reported presence of fa cilities was the total score of the Convenient Facilities Scale. Intraclass test-retest reliability of 0.80 was reported by Sallis and colleagues (1997). For this study, six items of facilities were deleted due to cultural relevance. The adapted Convenient Facilities Scales including 12 items were tested with 30 older Thai men and women, with a 2-week test-retest reliability coefficient of 0.71.

The Physical Activity Questionnaire (PAQ), developed by Voorrips, Ravelli, Dongelmans, Deurenberg, and Van Staveren (1991), consisted of scores for household activities, sports activities, and leisure time activities. The household activities category was comprised of ten questions with five possible ratings ranging from inactive (0) to very active (4). Sports and leisure time activities questions included type of activity, frequency, and duration of activity. Each activity was classified according to work posture and movements by using an intensity code based on net energy costs of each activity (Voorrips et al., 1991). The summation of all activities' scores resulted in a total score, with higher scores indicating greater total physical activity. Prior to its use in this study, the researcher tested the PAQ for reliability with 30 older Thai men and women and found a 2-week test-retest reliability coefficient of 0.98.

RESULTS

Demographic descriptions of subjects

The subjects for this study were 112 non-institutionalized older Thai men and women, who resided in Muang District, Chonburi Province. Subjects ranged in age from 60 years to 94 years, with an average age of 71 (SD = 7.47). One half (n = 56) of the subjects were men. Over fifty percent of the subjects (n = 63) reported having completed elementary school (Prathomsuksa 4). Twenty-five percent (n = 28) had limited literacy (could read only simple words and write their names) and 12% (n = 13) were illiterate. Of the 112 subjects, only 7% (n = 8) had completed high school. Almost 62% (n = 69) of the participants reported a monthly income less than 2,000 Baht.

Description of the major study variables

Table 1 is a summary of mean scores for the major study variables. In addition, forty-three percent (n = 48) of the subjects reported participating in low- to moderate-intensity regular physical activity. Of those who were regularly active, 54.2% (n = 26) were men and 45.8% (n = 22) were women. The subjects most often reported doing light calisthenics (e.g., sitting while moving hands/arms, standing with body movement)

Table 1. Ranges of scores, means, and standard deviations for the major study variables by gender.

Variable	Possible range	Men (n=56)			Women (n=56)		
		Actual range	Mean	SD	Actual range	Mean	SD
Perceived benefits	29-116	44-113	93.62	16.56	58-112	97.64	16.15
Perceived barriers	14-56	14-35	19.42	5.58	14-29	17.89	3.76
Self-efficacy	0-60	10-55	33.42	10.91	11-55	34.91	10.65
Family support	0-15	0-15	3.00	4.50	0-15	4.76	5.46
Neighborhood Environment	0-16	5-15	10.21	1.95	7-15	10.71	1.84
Convenient facilities	0-12	0-5	1.28	1.14	0-5	1.44	1.06
Physical activity	0-*	0.10-11.21	2.11	2.36	0.12-10.22	2.51	1.84

Note: * no ceiling for physical activity score.

(31%), followed by walking while moving hands/arms (22%), and swimming (1%). Common leisure time activities were gardening, raking leaves, mowing the lawn, and taking care of grandchildren.

Of the 64 persons (57%) who reported "no regular physical activity", 44 (69%) were "somewhat active" but did not meet the recommended level of regular physical activity (accumulated 30 minutes most days of the week), and 20 (31%) reported no leisure-time physical activity during the past year.

Hierarchical regression analysis

Prior to conducting hierarchical regression analysis, an assessment of multicollinearity, normal distribution, homoscedasticity, and linear relationships was performed. The results revealed correlation coefficients among the independent variables ranging from .001 to .54, tolerance values close to 1.00, and variance inflation factors of less than 10.0. As a result, multicollinearity was not a problem for the interpretation of the results (Lewis-Beck,1980; Pedhazur and Schmelkin, 1991; Polit, 1996). Also, scatter plots of the residuals demonstrated that the assumptions of normality, homoscedasticity, and linearity were met.

Hierarchical regression analysis was performed to determine how well the behavior-specific cognitions and personal factors predicted physical activity. Six behavior-specific cognitions (perceived benefits, perceived barriers, self-efficacy, family support, neighborhood environment, and convenient facilities) were entered first into the equation, followed by three personal factors (gender, income, and education). The results (Table 2) indicated that the six behavior-specific cognitions accounted for about 40% (adjusted R^2 = .40) of the variability in physical activity, while the nine variables together explained 50% (adjusted R^2 = .50) of the variance in physical activity. Only four variables (income, perceived barriers, neighborhood environment, and convenient facilities) were significant predictors of physical activity. The remaining variables (gender, education, perceived benefits, self-efficacy, and family support) did not make statistically significant contributions to the regression equation.

Table 2. Summary of hierarchical regression analysis for variables predicting physical activity.

Variable	B	SE B	Beta	t	p
Step 1 (Constant)	-.24	1.61		0.15	.88
Perceived benefits	.14	.37	.03	0.36	.72
Perceived barriers	-.89	.52	-.14	-1.70	.09
Self-efficacy	.07	.21	.03	0.33	.74
Family support	.06	.04	.14	1.60	.11
Neighborhood environment	.21	.10	.19	2.12	.04
Convenient facilities	.80	.17	.41	4.80	.00
Step 2 (Constant)	-.81	1.49		-0.54	.59
Perceived benefits	.06	.34	.02	0.18	.86
Perceived barriers	-.10	.49	-.16	-2.01	.05
Self-efficacy	.09	.20	.04	0.47	.64
Family support	.01	.04	.03	0.40	.69
Neighborhood environment	.20	.09	.18	2.20	.03
Convenient facilities	.48	.16	.25	2.93	.00
Gender	.17	.30	.04	0.58	.56
Income	.00	.00	.35	4.21	.00
Education	.29	.20	.11	1.47	.15

Note: Adjusted R^2 = .40 for step 1; adjusted R^2 = .50 for step 2 ($p < .05$).

DISCUSSION

The Physical Activity Promotion Model, which was developed and tested with older Thai men and women, accounted for a high proportion (50%) of the variance in physical activity. The results showed that the six behavior-specific cognitions (perceived benefits, perceived barriers, self-efficacy, family support, neighborhood environment, and convenient facilities) explained a large percentage (40%) of the variability in physical activity, while adding personal factors (gender, education, and income) increased the prediction of physical activity by about 10%. The findings indicated that taken together, the behavior-specific cognitions in the model play an important role in predicting physical activity. Changing these mediating variables could produce changes in physical activity.

Among the significant predictors found in this study, income was the strongest predictor of physical activity among older Thai adults. Similar findings were reported by a number of the investigators. For example, Conn (1998) conducted a qualitative study with 30 older women. Almost half of the women in her study revealed that financial status played a crucial role in their ability to participate in physical activity. In another quantitative study with 225 community-dwelling older women, Conn (1997) also found a significant correlation between income and physical activity. Clark (1995) concluded that older adults

with low income were at high risk for inactivity.

Of the six behavior-specific cognitions proposed in the PAPM, convenient facilities, neighborhood environment, and perceived barriers were found to be significant predictors of physical activity. The findings indicated that individuals who perceived a greater number of convenient facilities (e.g., beach, golf course, health club/gym, public park) were more likely to participate in regular physical activity. The results of this study support the notion that community resources or facilities make a unique contribution to participation in physical activity (Caserta and Gillett, 1998; Clark et al., 1995; Nies, Vollman, and Cook, 1998, 1999).

Nighborhood environment was significantly predictive of physical activity. The results indicated that individuals who lived in safe neighborhoods with sidewalks, street lights, enjoyable scenery, or who frequently saw people exercising were more likely to participate in regular physical activity. In contrast, those who perceived that their neighborhood environment was filled with heavy traffic, hills, unattended dogs, high crime rates or lack of sidewalks, street lights, or enjoyable scenery were less likely to participate in physical activity. These findings support previous research by Sallis and colleagues (1992). Sallis (1997) pointed out that people who lived in high crime neighborhoods were often afraid for their safety if they walked near their homes. Similar findings were also found in the work of Corti, Donovan, and Holman (1997) that environmental characteristics influenced whether individuals participated in physical activity.

The findings of this study suggest that neighborhood environment present important motivators or obstacles to participation in physical activity among older Thai adults. It may be difficult to encourage people to participate in regular physical activity if neighborhood environments that facilitate such activity are not created.

As hypothesized, perceived barriers affected physical activity among older Thai adults. However, the contribution of perceived barriers to physical activity was not as large as that of income, neighborhood environment, and convenient facilities. The findings of this study support previously reviewed literature (e.g., Clark, 1999; Conn, 1998; Schuster, Petosa, and Petosa, 1995) that perceived barriers were influential in predicting physical activity among older adults. Individuals who perceived fewer barriers were more likely to participate in regular physical activity than those who perceived greater barriers.

For this sample, the researcher noted that lack of time, exercise clothes and feeling embarrassed were not found to be major barriers to physical activity. These findings were different from those found in previous research (e.g., Auweele et al., 1997). A possible explanation may be that many older Thai women and men prefer to doing light calisthenics on their own at home, walking near their homes, or exercising with their neighbors at the health club. Thus, they may not place themselves in environments in which they would feel embarrassed. Also, it is possible that some individuals who participated in physical activity programs available in the community might have felt that their exercise clothes were appropriate for them. For example, in facilities in which older adults typically exercised gym shorts were not required and were not worn.

In contrast to the previous research, perceived benefits, self-efficacy, and family support were not predictive of physical activity. The findings are not consistent with previous reviewed literature in which perceived benefits (Howze et al., 1989; Melillo et al., 1997) and self-efficacy (Conn, 1998; McAuley, 1993; McAuley, Lox, and Duncan, 1993) significantly predicted physical activity among older adults. Similarly, the findings were not congruent with previous work by Sallis et al. (1992) who showed that family support strongly

predicted adoption of vigorous activity for women. However, the results of the present study are congruent with studies by Conn (1997, 1998) who found perceived benefits to be a weak predictor of physical activity. Conn (1998) also used the EBBS to measure perceived benefits, thus validating the findings in this study.

For the sample in the present study, gender and education were not related significantly to physical activity. These results were inconsistent with previous studies in which men were more likely to participate in physical activity than women (Howze et al., 1989) and that more educated persons tended to participate in more physical activity (Sallis et al., 1992). Since so few studies of these concepts were conducted with older Thai adults, a conclusion that perceived benefits, self-efficacy, family support, gender, and education do not play important roles in physical activity would be premature. Future research in this area remains to be done to determine if the findings are consistent with this population.

IMPLICATIONS FOR PRACTICE AND RESEARCH

Health promoting behaviors are of primary concern to nurses and other health professionals. Physical activity has been shown to be essential to older adults in order to increase their likelihood of staying healthy and functioning independently. This study contributes scientific evidence of predictors of physical activity that can provide the basis for generating effective interventions to increase physical activity among older adults in Thailand.

The finding that income was the most powerful predictor is consistent with earlier research (for example, Clark, 1995; Conn, 1997, 1998), suggesting implications for nursing interventions aimed at increasing the proportion of lower income older adults who are physically active on a regular basis. Physical activity programs that do not require special or costly equipment tend to be successful and appropriate for older Thai men and women. As described earlier, many older adults preferred to do low-to moderate intensity physical activity such as calisthenics, walking, daily housework, and gardening on their own at home. Therefore, emphasizing the integration of physical activity into daily life could be of primary importance to older adults. This kind of intervention involves fewer perceived barriers relevant to social and environmental influences so that it is not too difficult to introduce older adults to regular physical activity through such a program.

Analysis of the data distinctly showed that convenient facilities and neighborhood environment present important motivators or barriers to participation in physical activity. Public health policies that provide opportunities and reduce barriers to physical activity are needed. Changing the environmental context should include increased availability and accessibility to community facilities such as sidewalks, parks, bike-lanes, and recreation centers.

In addition, the findings of this study suggest that nurses or other professionals can be leaders in promoting physical activity by educating people in the community. Education programs aimed at the promotion of physical activity should emphasize low-to moderate-intensity physical activity including type, frequency, and duration required to achieve beneficial effects. The accumulating scientific evidence of the positive benefits of physical activity in old age need to be disseminated to people in the community, especially to older adults. Understanding appropriate physical activity and its benefits may help older adults increase confidence in their capability to achieve regular activity and reduce perceived barriers to physical activity. Through an effective education program, perceived benefits and self-efficacy may be strengthened for motivating them to be more active.

The Physical Activity Promotion Model (PAPM) can form the basis for further research to help nurses and health professionals investigate the kinds of questions that will lead to health promotion in older adults. This model is in its early testing with the Thai population, yet significant associations among the major components of the model indicate that further testing is warranted.

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REFERENCES

Auweele, Y. V., Rzewnicki, R., and Mele, V. V. 1997. Reasons for not exercising and exercise intentions: A study of middle-aged sedentary adults. *Journal of Sports Sciences* 15:151-165.

Caserta, M. S. and Gillett, P. A. 1998. Older women's feelings about exercise and their adherence to an aerobic regimen over time. *The Gerontologist* 38:602-609.

Chayakul, C. 1995. The effectiveness on exercise education and social support from family members on promotion of exercise in the elderly in Wat Makok Community, Phayathai District, and in Thung Songhong Housing Community, Don Maung District; Bangkok Metropolis. Unpublished master's thesis, Mahidol University, Bangkok, Thailand.

Clark, D. O., Patrick, D. L., Grembowski, D., and Durham, M. L. 1995. Socioeconomic status and exercise self-efficacy in late life. *Journal of Behavioral Medicine* 18:355-375.

Clark, D. O. 1996. The effect of walking on lower body disability among older blacks and whites. *American Journal of Public Health* 86:57-61.

Clark, D.O. 1999. Physical activity and its correlates among urban primary care patients aged 55 years or older. *Journals of Gerontology Series B-Psychological Sciences and Social Sciences* 54B:S41-S48.

Conn, V. S. 1997. Older women: social cognitive heory correlates of health behavior. *Women Health* 26:71-85.

Conn, V. S. 1998. Older adults and exercise: Path analysis of self-efficacy related constructs. *Nursing Research* 47:180-189.

Corti, B., Donovan, R. J., and Holman, C. D. 1997. Factors influencing the use of physical activity facilities: Results from qualitative research. *Health Promotion Journal of Australia* 7:16-21.

Davis, I. W., Ross, P. D., Preston, S. D., Nevitt, M. C., and Wasnich, R. D. 1998. Strength, physical ctivity, and body mass index: Relationship to performance-based measures and activities of daily living among older Japanese women in Hawaii. *Journal of the American Geriatrics Society* 46:274-279.

DiPietro, L. 1996. The epidemiology of physical activity and physical function in older people. *Medicine and Science in Sports and Exercise* 28:596-600.

Guralnik, J. and Simonsick, E. 1993. Physical disability in older Americans. *Journal of Gerontology* 48:3-10.

Hays, L. M. and Clark, D. O. 1999. Correlates of physical activity in a sample of older adults with type 2 diabetes. *Diabetes Care* 22: 706-712.

Hellman, E. A. 1997. Use of the stages of change in exercise adherence model among older dults with a cardiac diagnosis. *Journal of Cardiopulmonary Rehabilitation* 17:145-155.

Howze, E. H., Smith, M., and DiGilio, D. A. 1989. Factors affecting the adoption of exercise behavior among sedentary older adults. *Health Education Research* 4:173-180.

Huang, Y., Macera, C.A, Blair, S.N., Brill , P.A., Kohl, H.W., and Kronenfeld, J.J. 1998. Physical fitness, physical activity, and functional limitation in adults aged 40 and older. *Medicine and Science in Sports and*

Exercise 30(9), 1430-5.

Jitapunkul, S., Bunnag, and., and Ebrahim, S. 1993. Health care for elderly people in developing countries: A case study of Thailand. *Age and Ageing* 22, 377-81.

Jones, M., and Nies, M. A. 1996. The relationship of perceived benefits of and barriers to reported exercise in older African American women. *Public Health Nursing* 13(2), 151-158.

Junswang, W. 1990. *Healthy lifestyle of older adults*. Unpublished research report, Payup University, Thailand.

Krach, P., Vaney, S. D., DeTurk, C., and Zink, M. H. 1996. Functional status of the oldest-old in a home setting. *Journal of Advanced Nursing* 24, 456-464.

Kutner, N. G., Barnhart, H., Wolf, S. L., McNeely, E., and Xu, T. 1997. Self-report ben-efits of Tai Chi practice by older adults. *Journal of Gerontology: Psychological Sciences* 52B(5), P242-P246.

Laffrey, S. C., and Asawachaisuwikrom, W. (in review). Development of an exercise self-fficacy questionnaire for older Mexican-American women. *Nursing Measurement.*

Lewis-Beck, M. S. 1980. *Applied Regression: An Introduction.* SAGE Publications, Newbury Park, CA.

McAuley, E. 1993. Self-efficacy and the maintenance of exercise participation in older adults. *Journal of Behavioral Medicine* 16(1):103-113.

McAuley, E., Lox, C., and Duncan, T. E. 1993. Long-term maintenance of exercise, self-efficacy, and physiological change in older adults. *Journal of Gerontology: Psychological Sciences* 48:218-224.

Melillo, K. D., Williamson, E., Futrell, M., and Chamberlain, C. 1997. A self-assessment tool to measure older adults' perceptions regarding physical fitness and exercise activity. *Journal of Advanced Nursing* 25: 1220-1226.

Morey, M. C., Pieper, C. F., and Cornoni-Huntley, J. 1997. Physical fitness and functional limitations in community-dwelling older adults. *Medicine and Science in Sports and Exercise* 30(5):715-723.

Nies, M. A., Vollman, M., and Cook, T. 1998. Facilitators, barriers, and strategies for exercise in European American women in the community. *Public Health Nursing* 15(4):263-272.

Nies, M. A., Vollman, M., and Cook, T. 1999. African American women's experiences with physical activity in their daily lives. *Public Health Nursing* 16(1):23-31.

Pedhazur, E. J. and Schmelkin, L. P. 1991. *Measurement, Design, and Analysis: An Integrated Approach.* Erlbaum, Hillsdale, NJ.

Pender, N. J. 1996. *Health Promotion in Nursing Practice.* 3rd ed. Appleton and Lange, Stamford, CT.

Perrig-Chiello, P., Perrig, W. J., Ehrsam, R., Staehelin, H. B., and Krings, F. 1998. The effects of resistance training on well-being and memory in elderly volunteers. *Age and Aging* 27: 469-475.

Phillips, W. and Hazeldene, R. 1996. Strength and muscle mass changes in elderly men following maximal isokinetic training. *Gerontology* 42:114-120.

Pinto, B. M., Marcus, B. H., and Clark, M. M. 1996. Promoting physical activity in women: The new challenges. *American Journal of Preventive Medicine* 12(5):395-400.

Polit, D. F. 1996. *Data Analysis and Statistics for Nursing Research.* Appleton and Lange, Stamford, CT:

Sallis. J. F., Hovell, M. F., and Hofstetter, C. R. 1992. Predictors of adoption and maintenance of vigorous physical activity in men and women. *Preventive Medicine* 21(2):237-251.

Sallis, J. F., Johnson, M. F., Calfas, K. J., Caparosa, S., and Nichols, J. F. 1997. Assessing perceived physical environmental variables that may influence physical activity. *Research Quarterly for Exercise and Sport* 68(4): 345-351.

Siripanich, B., Twichachat, T., Pokkul, W., Twichachat, N., Rerkgnam, S., and Tomana, P. 1989. *Behavior and Lifestyles of Healthy Thai Older Adults*. Samdee, Bangkok.

Schuster, C., Petosa, R., and Petosa, S. 1995. Using social cognitive theory to predict intentional exercise in post-retirement adults. *Journal of Health Education* 26(1):14-21.

Scully, D., Kremer, J., Meade, M. M., Graham, R., and Dudgeon, K. 1998. Physical exercise and psychological well being: A critical review. *British Journal of Sports Medicine* 32:111-120.

Sechrist, K. R., Walker, S. N., and Pender, N. J. 1987. Development and psychometric evaluation of the Exercise Benefits/Barriers Scale. *Research in Nursing and Health* 10: 357-365.

Spirduso, W. W. 1995. *Physical Dimensions of Aging*: *Human Kinetics*. Champaign, IL.

Thongwichien, S. and Silpasuwan, P. 1989. *Self-care of the Elderly in Bangkok Community* Unpublished research report, Mahidol University, Bangkok, Thailand.

Thorndike, R. 1978. *Correlational Procedures for Research*. Gardner Press, Inc., New York.

United Nations. 1993. *World Population Prospects: The 1992 Revision*. United Nations, New York:

Van Boxtel, M. P. J., Paas, F. G. W. C., Houx, P. J., Adam, J. J., Teeken, J. C., and Jolles, J. 1997. Aerobic capacity and cognitive performance in a cross-sectional aging study. *Medicine and Science in Sports and Exercise* 29(10): 1357-1365.

Voorrips, L. E., Ravelli, A. C. J., Dongelmans, P. C. A., Deurenberg, P., and van Staveren, W. A. 1991. A physical activity questionnaire for the elderly. *Medicine and Science in Sports and Exercise* 23(8):974-979.

Welsh, L. and Rutherford, O.M. 1996. Effects of isometric strength training on quadriceps muscle properties in over 55 year olds. *European Journal of Applied Physiology and Occupational Physiology* 72(3):219-223.

Williams, P. and Lord, S. R. 1997. Effects of group xercise on cognitive functioning and mood in older women. *Australian and New Zealand Journal of Public Health* 21(1): 45-52.

Wolinsky, F. D., Stump, T. E., and Clark, D. O. 1995. Antecedents and consequences of physical activity and exercise among older adults. *The Gerontologist* 35(4):451-462.