

Assessment of the environmental support for physical activity scale among Thai elderly

Mayuree Leethong-in* Jintana Yunibhand*

Yupin Aunguroch* Joan K. Magilvy**

Leethong-in M, Yunibhand J, Aunguroch Y, Magilvy JK. Assessment of the environmental support for physical activity scale among Thai elderly. Chula Med J 2011 Sep - Oct; 55(5): 421 - 35

- Introduction** : *The Environmental Support for Physical Activity Questionnaire (ESPA) was developed for older people in western country. However, due to different geographical features and lifestyle between countries, modification to the ESPA has been made to create "the Thai Environmental Support for Physical Activity (TESPA)".*
- Objective** : *To verify the reliability and validity of TESPA.*
- Settings** : *Twelve communities in six provinces of Thailand*
- Research design** : *Cross-sectional design.*
- Patients** : *Three hundred and twenty older people were randomly selected using multistage random sampling.*
- Methods** : *The content validity was determined by three geriatric experts. The construct validity was approached by structural equation modeling and known-group method. The reliability was analyzed using alpha coefficient.*
- Results** : *The content validity index of TESPA was 0.92. The construct validity illustrated that the measurement model explained 61% of the variance of TESPA. The internal consistency and the test-retest reliability of the scale were 0.73 and 0.76.*

* Doctoral candidate student, Faculty of Nursing, Chulalongkorn University, Thailand.

** FAAN Professor, Associate Dean for Academic Programs, University of Colorado Denver College of Nursing, USA

Conclusion : *TESPA is reliable, and able to successfully assess the physical environment for elderly in Thai culture.*

Keywords : *Thai elderly, physical activity, physical environment, psychometric evaluation of instrument.*

Reprint request: Yunibhand J. Faculty of Nursing, Chulalongkorn University, Phyathai Rd,
Pathumwan, Bangkok 10330, Thailand. E-mail: jintana.y@chula.ac.th

Received for publication. January 31, 2011.

มยุรี สีทองอิน, จินตนา ยูนิพันธุ์, ยุพิน อังสุโรจน์, จอนห์ เค แมกกี้. การประเมินแบบสอบถาม environmental support for physical activity เพื่อใช้กับผู้สูงอายุไทย. จุฬาลงกรณ์เวชสาร 2554 ก.ย. - ต.ค.; 55(5): 421 - 35

- บทนำ** : แบบสอบถาม Environmental Support for Physical Activity Questionnaire (ESPA) เป็นแบบสอบถามที่ถูกพัฒนาเพื่อใช้กับผู้สูงอายุในประเทศทางตะวันตก ด้วยความแตกต่างของลักษณะทางกายภาพและวิถีการดำเนินชีวิต แบบสอบถาม ESPA จึงได้รับการปรับปรุงและเปลี่ยนเป็น “ the Thai Environmental Support for Physical Activity (TESPA)”
- วัตถุประสงค์** : ประเมินความเที่ยงและความตรงของแบบสอบถาม TESPA
- สถานที่ทำการศึกษา** : 12 ชุมชน ใน 6 จังหวัด ของประเทศไทย
- รูปแบบการวิจัย** : การวิจัยแบบตัดขวาง
- ผู้ป่วยที่ได้ทำการศึกษา** : ผู้สูงอายุไทยจำนวน 320 คน ที่ได้มาโดยการสุ่มตัวอย่างแบบหลายขั้นตอน
- วิธีการศึกษา** : ประเมินความตรงเชิงเนื้อหา โดยผู้เชี่ยวชาญทางสาขาผู้สูงอายุจำนวน 3 ท่าน ความตรงเชิงโครงสร้างวิเคราะห์ด้วยโมเดลสมการโครงสร้าง และใช้วิธีกลุ่มที่รู้จัก ประเมินความเที่ยงโดยใช้สถิติสัมประสิทธิ์แอลฟา
- ผลการศึกษา** : ความตรงเชิงเนื้อหา 0.92 ความตรงเชิงโครงสร้างพบว่าโมเดลแบบจำลองเครื่องมือมีความกลมกลืนกับข้อมูลเชิงประจักษ์สามารถร่วมกันอธิบายความผันแปรของเครื่องมือได้ร้อยละ 61 ส่วนค่าความเที่ยงภายในและค่าการทดสอบซ้ำเท่ากับ 0.73 และ 0.76
- สรุป** : แบบสอบถาม TESPA มีความเที่ยงและความตรงสำหรับการประเมินสิ่งแวดล้อมกายภาพสำหรับผู้สูงอายุในวัฒนธรรมไทย
- คำสำคัญ** : ผู้สูงอายุไทย, การเคลื่อนไหวออกแรง, สิ่งแวดล้อมทางกายภาพ, การประเมินคุณภาพของเครื่องมือ.

older adults, physical activity is necessary to provide and maintain health.⁽¹⁾ Physical environment, a concept of environment which includes both natural features and human constructs,^(2,3) is significantly associated with physical activity participation within older people.⁽⁴⁻⁸⁾ While the significance of physical environment is well recognized, an accurate measure to identify the specific characteristics of the physical environment in relationship to one's physical activity, with respect to older Thai people (aged 60 years and older), currently not well established.

Most questionnaires on the physical environment currently used have been developed in Western countries. Most of these scales are used covering all age groups.⁽⁹⁻¹²⁾ Furthermore, different reliability among urban and rural respondents have been noticed.⁽¹⁴⁾ Some questionnaires are designed using either neighborhood-focused scales or community-focused scale to assess the physical environment,^(5,12,14) whereas others use both.^(8,15) Prior research has found that aspects of physical environment, i.e., safety, traffic volume, street lighting, unattended dogs, sidewalks and accessible public recreation facilities, influence on one's physical activity,⁽⁵⁻⁸⁾ while other evidences suggest equivocal results.^(12,14,16) These inconsistencies may be related, particularly in older adults, to the type of measurement used to assess the physical environment.

The Environmental Supports for Physical Activity Questionnaire (ESPA) is a measurement designed to capture and assess the supporting social and physical environment for physical activity typically performed by all ages.^(4,17) Since not all ESPA attributes apply to the elderly Thais who live in either urban or rural area, most attributes are closely

congruent with this population. In addition, the coefficient differences between urban and rural respondents of ESPA were small when compared to other questionnaires.⁽¹³⁾ As a result, ESPA was chosen for assessment of physical environment of senior Thai people.

The differences in geographic features, culture and patterns of living of elderly Thais, may be influenced not only by their neighborhood and community but also home environment. Just over three-fourths of elder Thais resided in their own homes.⁽¹⁸⁾ Most spend the majority of their days in household chores, family care activities, gardening, as well as participating in community group activities.⁽⁵⁻⁶⁾ With advancing age, the home environment and close surroundings become the major living space where senior citizens perform their everyday activities and spend most of their time.⁽¹⁹⁾ According to the findings of a preliminary study in 10 older Thais, home was most frequently mentioned as the favorite place for engaging in physical activity because of safety concerns and convenience. Even though ESPA focuses primarily on neighborhood and community environmental attributes, the relationship of home environment and physical activity of older people is still unknown.

After obtaining written consent from the author, ESPA was translated into Thai by the method of back-translation process.⁽²⁰⁾ The instruments were translated from English into Thai by the researcher and an independent translator. The Thai versions of the instruments were evaluated by three Thai/English bilingual people. The questionnaire was translated back into English by two Thai-English independent translators who each had taught English to graduate

students for more than 20 years. The investigators then compared both versions in the original language, conducted checks with the translators, discussed the differences, and produced a final consensus version. Some items of ESPA questionnaire were deleted, and the questionnaire's format was reviewed. Deleted items reflected physical activities and/or places that are unfound in the Thai context. Five pages of the scale and various types of choices that were thought by the researcher to be difficult to answer for a Thai were also removed from the questionnaire. Furthermore, a need exists to assess home-focused scale as an aspect of the physical environment of elderly Thais. The modified ESPA was conceptualized to include three subscales with six items serving as supportive neighborhood and community environments, and four new items as supportive of home environment. The new one-page questionnaire was then named "Thai Environment Support for Physical Activity (TESPA)" in older Thai people. However, if there is low error in the assessment, the explanation of the relationship between physical environment and physical activity will be raised. For these reasons, TESPAs needs to be validated for older Thai population.

Objective

The purpose of this study was to assess TESPAs among elderly Thais for reliability and validity.

Instruments

Four instruments were used to collect data. They included, namely: demographic data questionnaire, the Chula Mental Test (CMT), the International Physical Activity Questionnaire - Long

form (IPAQ-L), and TESPAs

Demographics: The researcher designed a demographic data questionnaire which was used to obtain demographic and socioeconomic data of each subject.

The Chula Mental Test (CMT): The CMT is a 13-item, interview style, used to measure cognitive function of older Thais who have difficulty in reading and/or writing.⁽²¹⁾ Total scores indicate cognitive function and range from 0 - 19. The validity and reliability of the CMT was acceptable.⁽²¹⁾

The IPAQ-L: The IPAQ-L assesses the frequency, intensity and duration of all daily physical activity undertaken by five domains including: work-related activities, transport-related activities, domestic chores, leisure time related activities and time-spent sitting during the previous 7 days.⁽²²⁾ The total physical activity equals the MET (metabolic equivalents) score, which is the sum of minutes spent in each domain multiplied by the MET value.⁽²³⁾ Threshold values for the IPAQ-L in this study included the following categories: insufficient active (<600 MET-min/week), and sufficient active (> 600 Met-min-week).⁽²⁴⁾ After obtaining written consent from the author, the IPAQ-L was translated into Thai by the researcher and an independent translator in accord with the translation-back translation method.⁽²⁰⁾ The Thai version was evaluated by three Thai/English bilingual individuals, and then translated back into English by two Thai-English language professors. The two translators then compared the original English language version and the back translated English language version and produced a final Thai version of the instrument. The content was validated by three experts in geriatrics and a content validity index (CVI) of 0.96 obtained.

The stability by test-retest over two weeks using Spearman correlation coefficient of IPAQ-L was reported to be 0.77 in the pilot study.

The TESPAs: the TESPAs was conceptualized to include 3 subscales: home, neighborhood, and community environment supporting. The TESPAs is composed of 10 items: three neighborhood items, three community items, and four home items (Table 1). Neighborhood environment is referred to older people’s perceptions of support including: characteristics, access, and barriers to physical activity in an area within a 10-minute walk from their home.⁽¹⁷⁾ Community environment support refers to

older people’s perceptions of convenience and the safe conduct of physical activity in their community within a 20–minute drive from their home.⁽¹⁷⁾ Home environment support is defined as participants’ perceptions of convenience and safety, both in and around their home, in relation to their physical activity engagement. Likert scale was used to assess physical environment for physical activity. Possible responses were: 1 (strongly disagree), 2 (disagree), 3 (neither agree nor disagree), 4 (agree), and 5 (strongly agree). The possible scores ranged from 10 to 50. Higher scores indicated a higher level of perceived physical environment support towards physical activity.

Table 1. Example of the TESPAs questionnaire Please tell me how much you agree or disagree with the statements.

Statements	Strongly agree	Agree	Unsure	Disagree	Disagree Strongly
Home environment supporting					
1. You feel more convenient walking inside your home	5	4	3	2	1
2 You feel safer inside your home.	5	4	3	2	1
3.....	5	4	3	2	1
4.....	5	4	3	2	1
5.....	5	4	3	2	1
6.....	5	4	3	2	1
Neighborhood environment supporting					
7. The unattended dogs in your neighborhood are big problem for walking.	5	4	3	2	1
8.....	5	4	3	2	1
9.....	5	4	3	2	1
Community environment supporting					
10. The public recreation facilities in your community make you more safety for physical activity	5	4	3	2	1

Method

The cross-sectional design was conducted in two phases. Phase I involved quantifying TESPAs that had been implemented during the pilot study. Phase II included applying TESPAs to the current study; construct validity was accomplished through the use of confirmatory factor analysis and the known-group method.

Phase 1: Quantification of TESPAs

Validation and determination of the reliability of TESPAs's psychometric properties was accomplished. Three geriatric experts determined the content validity of the TESPAs scale. When the CVI reached an acceptable value, the pilot study was conducted.

Prior to data gathering, two research assistants, nursing graduates with Master Degree and research experience, were trained to interview participants who met the criteria. The research assistants were instructed and tested to confirm their understanding of sample criteria, definitions, and base concepts of each questionnaire until a satisfactory level was reached at the discretion of the investigator. Each research assistant and the investigator interviewed 5 samples and inter-rater reliability was assessed. Agreement between the research assistants and the investigator ranged from 78 - 92%, with an average agreement of 87%.

The pilot study was carried out in October 2008. The aims were to assess the feasibility, and to assess psychometric properties using TESPAs. After obtaining approval from the IRB, Chulalongkorn University, Thailand, consent was obtained from the directors of two Primary Care Units (PCU), in two

villages (one located in an urban environment and the other in a rural area), in Khon Kaen Province, Thailand. Purposive sampling was employed to recruit a sample of 15 older people by selecting from a name list of family folder of each primary care unit by the investigator and nurses. Participants were older Thai people who met the following inclusion criteria: 60 years of age and over, mobile and cognitively capable of answering questions accurately. No health problems or ongoing treatments that would interrupt participation in physical activity such as having suffered a recent cardiovascular event (prior 6 months), renal failure, liver cirrhosis, human immunodeficiency virus, major surgery in the last 6 weeks, or a history of medication use for the heart or blood vessels during the last three months. Fifteen older people from each setting were recruited using purposive sampling. Each potential participant was given an informed consent form that explained the purposes of the study, tasks to be completed and the length of time needed to complete the interview as well as its benefits, risks, types of questionnaires they would be asked to answer, and that they could withdraw at anytime without negative repercussions. The participants were interviewed at their homes or at a local temple, wherever suited them. A code number was assigned to each participant to keep confidentiality. Moreover, stability of reliability of TESPAs was obtained in two weeks, whereas internal consistency was assessed at baseline.

The participants were predominantly older (mean age = 70 ± 4.19 years), lived with spouse (53.3%), employed (62.6%), females (76.7%), who had an elementary education (80%) and a household income of less than 5,000 baht (USD 147) per month

(76.7%). A substantial proportion (63.3%) of them lived in a municipal area for an average of 44.6 years in their own residence. Although 50% (n = 15) of the participants felt they had a sufficient level of physical activity, 20% (n = 6) said their physical activity level was low. Only 23.3% (n = 7) reported having no current health problems, and 16.7% of them were hypertensive. Their most frequent type of physical activity was household-related activities, followed by leisure time, transportation-related and occupational activities.

Phase 2: Assessing the Instrument

Phase II involved determination of the construct validity of TESP. A sample of 320 elderly people was obtained via multi-stage random sampling from 12 villages in six provinces of Thailand. Six provinces were randomly selected from each of the regions, including Phitsanulok, Saraburi, Surat Thani, Udon Thani, Prachuap Khiri Khan, and Chon Buri provinces. Then one district was randomly selected from each selected province. After that, two sub-districts were randomly chosen from each district particularly within a sub-district, a village or community in a municipal area and a village in a non-municipal area were randomly chosen. One person from each family was selected using a systematic random sampling technique from a list of family names provided by the PCU unit of each village. None of the selected names were involved in any of prior pilot studies.

Data were collected between November 2008 and April 2009. Prior to the interview, the investigator introduced herself, established rapport, explained the purpose of the study. The contributions

of the participants would then take place, the selection criteria and emphasized the confidentiality or anonymity of the information were then collected. Potential participants were eligible if they scored ≥ 15 on the CMT, were able to ambulate without assistive devices and were willing to participate. The interview process took about approximately 15 - 20 minutes. A 5-minute rest was given after completion of each questionnaire. The participants were initially asked to complete the questionnaire on personal data, and TESP, followed by the IPAQ-L questionnaires. Each participant was given a handkerchief for their time participating in the interview.

Data analysis

Descriptive data are presented as mean \pm SD. The internal reliability of the scale was based on an alpha coefficient greater than or equal to 0.70;⁽²⁵⁾ stability of the scale was analyzed by product correlation coefficient. Reliability of each item, overall reliability, and construct validity of the scale were determined using structural equation modeling (SEM).⁽²⁶⁾

The known-group technique was conducted using multivariate analysis of variance, to compare the physical environment of those who reported sufficient physical activity and those who did not. Statistical significance for analyses except SEM was defined as $p < 0.05$. SPSS version 17.0 was used.

Results

Table 2 depicts participants' age, which ranged from 60 to 94 years old. Half of the participants (50.0%) age ranged in between 60-69 years old. The participants were predominantly female (55%, n=176),

and married (64.4%, n=206); majority of them had elementary education(75.6%, n=242). In addition, household activities had the highest level of

participation, followed by transportation related activities, leisure, and occupation, respectively.

Table 2. Demographic characteristics of the study samples (n = 320).

Demographic characteristics	n	%
Age (years)		
60-69	160	50.0
70-79	126	39.4
> 79	34	10.6
Gender		
Male	114	35.6
Female	206	64.4
Marital status		
Married	176	55.0
Single	13	4.0
Widowed	126	39.4
Separated	5	1.6
Employment		
Retried	134	41.9
Working	186	58.1
Income (Baht per month)		
Less than 5000	208	65.0
5,001-10,000	76	23.7
10,001-20,000	22	6.9
20,001-30,000	8	2.5
More than 30,000	6	1.9
Health problems		
None	107	33.4
Past/Current health problems	213	66.6
Living arrangement		
Living alone	23	7.2
Shared living	297	92.8
Member of a Senior club		
Not a member/Do not participate	178	55.6
Participate	142	44.4
Area of living		
Urban area	198	61.9
Rural area	122	38.1
Characteristics of home		
One level	121	37.8
Double storey or high raised	199	62.2

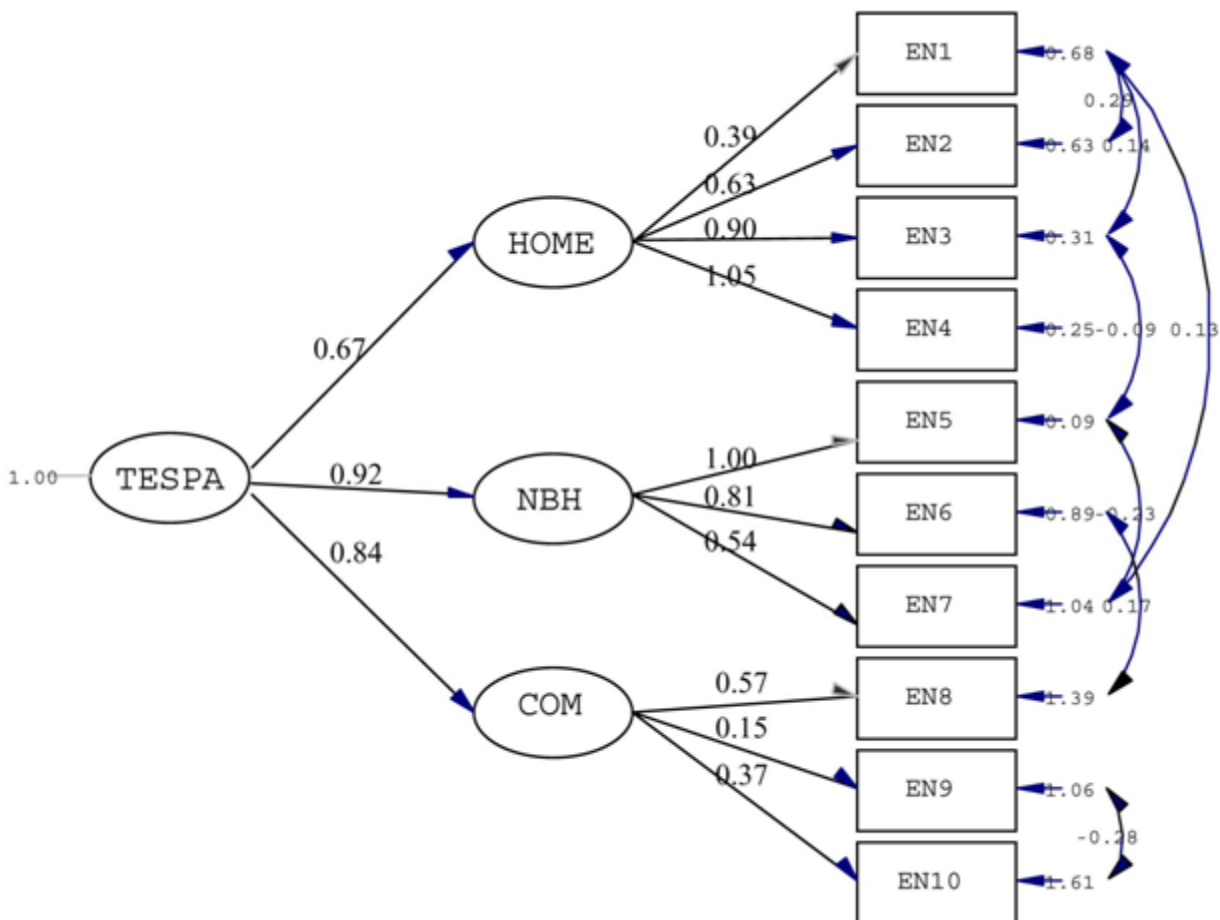
Phase 1: Quantification of TESPА

The CVI of the TESPА questionnaire was 0.92. The reliability coefficients and the test-retest reliability of the scale were 0.73 and 0.76, respectively. Also, the alpha coefficient of home had the highest value, followed by neighborhood and community, respectively ($\alpha= 0.83, 0.66, \text{ and } 0.06$). TESPА was culturally appropriate for elderly Thais and the procedures were followed without any difficulty.

Phase 2: Assessing the Instrument

The total sum scores of TESPА ranged from 19.00 to 50.00, with a mean of 34.87 (SD = 6.47).

Based on confirmatory factor analysis, the findings demonstrated that the construct of TESPА consisted of home, neighborhood, and community environment subscales. The correlation among the items ranged from 0.02 to 0.77 and the total scale could explain 61.01% of the variance of the physical environment. Home, neighborhood, and community subscale could account for 29.4%, 19.7%, and 12.0% of the variance, respectively. The measurement model testing was designed to estimate which of then ten items were used as indicators for the model. Although the original model was statistically significant, the model was not consistent with the data $\chi^2/df = 4.59$ and a RMSEA



$\chi^2 = 33.27, df = 25, p = .13, \chi^2/df = 1.33, GFI = 0.98, RMSEA = 0.03, NFI = 0.98, CFI = 0.99$

Figure 1. The measurement model of the TESPА: revised model

Note: NBH= neighborhood environment; COM= community environment

value greater than 0.05 ($= 151.54, df = 33; p < 0.0001$ GFI = 0.91; RMSEA = 0.06; NFI = 0.88; CFI = 0.91). Based on modification indices, error covariances were allowed to correlate. The revised measurement model (see Figure 1) was re-assessed and findings indicated that overall fit indices had improved. The revised model was fit with the following data/df = 1.33 ($= 33.27, df = 25, p = 0.13, GFI = 0.98, RMSEA=0.03, NFI= 0.98, CFI= 0.99$). Moreover, the correlations between subscales presented significantly low to moderate values (Home-Neighborhood, $r = 0.51, p < 0.01$; Home-Community, $r = 0.29, p < 0.01$;

Neighborhood-Community, $r = 0.38, p < 0.01$).

Table 3 illustrates the loadings with t-values and squared multiple correlation coefficients among each observed variables for the TESP scale. The squared multiple correlations for observed variables of the latent variables ranged from 0.02 to 0.92. The R^2 of items 2, 3, 4, 5, and 6 were acceptable indicators, but items 1, 7, 8, 9, and 10 which were less than 0.40.

Table 4 shows differences in the TESP scale subscale between the two physical activity levels ($P < 0.05$).

Table 3. Path coefficients for confirmatory factor analysis and reliability estimates for the TESP scale (revised model).

Question item	path coefficients	Reliability estimates (R^2)
Home environment supporting		
1. You feel more convenient walking inside your home	0.39*	0.18
2. You feel safer inside your home.	0.63*	0.39
3. You feel more convenient	0.90*	0.72
4. You feel safer	1.05*	0.82
Neighborhood environment supporting		
5. Place to walk	1.00*	0.92
6. The motorized traffic	0.81*	0.44
7. The unattended dogs in your neighborhood are big problem for walking.	0.54*	0.23
Community environment supporting		
8. The area of Primary Care Unit	0.57*	0.19
9. Parks/playgrounds/sports fields	0.15*	0.02
10. The public recreation facilities in your community make you more safety for physical activity.	0.37*	0.08

Note: * $p < 0.05$

Table 4. Known-group validity of TESPA.

TESPA subscale	Level of Physical activity		Total mean (SD.)	t-test statistic
	Sufficient mean (SD.)	Insufficient mean (SD.)		
• Home	15.44 (3.35)	13.93 (3.29)	14.95 (3.40)	3.777***
• Neighborhood	10.85 (2.67)	9.33 (2.53)	10.36 (2.72)	4.829***
• Community	9.82 (2.20)	9.01 (2.04)	9.56 (2.18)	3.154**
Total TESPA score	36.11 (6.31)	32.27 (6.05)	-	5.148***

Note: ***p<0.001, **p<0.01

Discussion

Testing of the TESPA measurement provided additional evidence for the validity and reliability. The findings are discussed in the following section.

The content validity and construct validity of the TESPA scale were acceptable. Continued support for the construct validity of the scale was also provided through confirmatory factor analysis (LISREL 8.80 student edition) and the known-group method. The TESPA measurement model demonstrated that all measured sub-scales had significantly low to high parameter estimates, which were related to their specific constructs and validity of the relationships among observed variables and their constructs. The known-group technique is an examination of relationships based on theoretical predictions.⁽²⁷⁾ Within the known-group method, the findings demonstrated that all three physical environments, all three subscales and total scores were significantly correlated with physical activity. This finding indicated that older people who had sufficient level of physical activity scored significantly higher in each of three factors – supportive home, neighborhood, and community environment - than those who did not.

The majority of the elders sampled have lived in their home for a median 30 years; consequently. They were familiar with the physical characteristics of their environment in and outside the home. In addition, participations in household activities had the highest level of participation, followed by transportation related activities, leisure, and occupation, respectively. As a reason, senior citizens determined the aspects of their physical environment to which they are exposed, and in turn, that physical environment modifies their behavior. It is possible that the friendly environment contributed to physical activity engagement, while unfriendly environments discouraged activity. Therefore, although home environment is restricted by area and instruments, the finding demonstrates that it can be included as an additional aspect for providing physical activity engagement.

Regarding reliability, TESPA exceeded the desired criterion of 0.70 for new scales in particular; the home subscale had the highest value. However, the reliability for neighborhood and community subscale were depicted less than that in the previous study.⁽¹³⁾ Although the R² for items 1, 7, 8, 9 and 10 indicated that they were irrelevant for the TESPA scale,

the measurement model had a good fit with the empirical data. It is the first time this scale has been validated in elderly Thais, furthermore this study produced normative data for comparison in the elderly, which were not found in other studies. Approximately, 61% of the variance in the TESPAscale was explained by 10 items, whereas 39% of the variance in this scale remains unexplained. Corresponding with the SCT approach; Bandura argues that nearly all aspects of the physical environment can influence one's decision about physical activity engagement.⁽³⁾ Owing to the fact that the TESPAscale measurement includes only safety, convenience, and accessibility; it is possible that other aspects such as policy⁽²⁸⁾ may further contribute to physical activity. Additional work is needed to identify these yet unidentified aspects.

Conclusions

TESPA was developed from modified ESPA and the findings of a qualitative study of older Thai people. Psychometric evaluation of the TESPAscale, including validity and reliability, were mainly satisfactory. Although the testing of the TESPAscale represents an initial attempt, the results of the current study suggest that the definition of the physical environment should include home environment as well as that of the neighborhood and community as they also contain both motivators and obstacles for older Thai people undertaking physical activity.

Limitations and recommendations:

This study was limited by homogeneity of the sample. The majority of the participants were female, married, with low socioeconomic status, and lived in

their home. Continued evaluation of the psychometric properties both in other samples and additional new items are recommended. Additionally, the use of objective measurement should be considered. This can further add to the validity of the findings and confirm the subjective report.

Nevertheless, based on three subscales of the TESPAscale, manipulation of these factors with cognitive behavioral and policy strategies may encourage the elderly to increase their physical activity engagement. This result can extend the knowledge of the physical environment for physical activity measurement.

Acknowledgements

This article is a part of a doctoral dissertation that was supported by a grant from the Office of the Higher Education Commission, Ministry of Education, the Graduate School Chulalongkorn University and the Thailand Nursing Council.

References

1. World Health Organization. Ageing and Life Course. 2006 [cited 2006 Jun 6]. Available from: <http://www.who.int/ageing/en/>
2. Bandura A. Social Foundations of Thought and Action: A Social Cognitive Theory. Englewood Cliffs: Prentice-Hall, 1986
3. Bandura A. Self-efficacy: The Exercise of Control. New York: W. H. Freeman, 1997
4. Booth ML, Owen N, Bauman A, Clavisi O, Leslie E. Social-cognitive and perceived environment influences associated with physical activity in older Australians. *Prev Med* 2000 Jul;31(1): 15-22

5. Asawachaisuwikrom W. Predictors of Physical Activity Among Older Thai Adults [dissertation]. Austin: The University of Texas at Austin, 2001
6. Asawachaisuwikrom W. Factors Influencing Physical Activity Among Older Adults in Saensuk Sub-District, Chonburi Province. Chonburi: Faculty of Nursing Burapha University, 2004
7. Wilcox S, Bopp M, Oberrecht L, Kammermann SK, McElmurray CT. Psychosocial and perceived environmental correlates of physical activity in rural and older africanamerican and white women. *J Gerontol B PsycholSciSocSci* 2003 Nov;58(6):329-37
8. McNeill LH, Wyrwich KW, Brownson RC, Clark EM, Kreuter MW. Individual, social environmental, and physical environmental influences on physical activity among black and white adults: a structural equation analysis. *Ann Behav Med* 2006 Feb;31(1):36-44
9. Sallis JF, Johnson MF, Calfas KJ, Caparosa S, Nichols JF. Assessing perceived physical environmental variables that may influence physical activity. *Res Q Exerc Sport* 1997 Dec;68(4):345-51
10. Burton NW, Oldenburg B, Sallis JF, Turrell G. Measuring psychological, social, and environmental influences on leisure-time physical activity among adults. *Aust N Z J Public Health* 2007 Feb;31(1):36-43
11. Pereira MA, FitzerGerald SJ, Gregg EW, Joswiak ML, Ryan WJ, Suminski RR, Utter AC, Zmuda JM. A collection of Physical Activity Questionnaires for health-related research. *Med Sci Sports Exerc* 1997 Jun;29(6 Suppl): S1-205
12. Morris KS, McAuley E, Motl RW. Neighborhood satisfaction, functional limitations, and self-efficacy influences on physical activity in older women. *Int J BehavNutrPhys Act* 2008; 5:13
13. Brownson RC, Chang JJ, Eyer AA, Ainsworth BE, Kirtland KA, Saelens BE, Sallis JF. Measuring the environment for friendliness toward physical activity: a comparison of the reliability of 3 questionnaires. *Am J Public Health* 2004 Mar;94(3):473-83
14. Hooker SP, Wilson DK, Griffin SF, Ainsworth BE. Perceptions of environmental supports for physical activity in African American and white adults in a rural country in South Carolina. *Prev Chronic Dis* 2005 Oct;2(4):A11
15. Addy CL, Wilson DK, Kirtland KA, Ainsworth BE, Sharpe P, Kimsey D. Associations of perceived social and physical environmental supports with physical activity and walking behavior. *Am J Public Health* 2004 Mar; 94(3):440-3
16. Lim K, Taylor L. Factors associated with physical activity among older people-a population-based study. *Prev Med* 2005 Jan;40(1): 33-40
17. SIP 4-99 Research Group. Environmental supports for physical activity questionnaire [online]. 2002 [cited 2007 May 22]. Available from: <http://prevention.sph.sc.edu/tools/environmental.htm>
18. The National Statistical Office, Ministry of Information and Communication Technology.

- Summary of the Preliminary Survey of Elderly in Thailand in 2007. Bangkok: National Statistical Office, 2007
19. Dahlin-Ivanoff S, Haak M, Fange A, Iwarsson S. The multiple meaning of home as experienced by very old Swedish people. *Scand J Occup Ther* 2007;14(1):25-32
20. Marin G, Marin BV. *Research with Hispanic Populations: Applied Social Research Method Series 23*. Newbury Park: Sage, 1991
21. Jittapunkul S, Lailert C, Worakul P, Srikiatkachorn A, Ebrahim S. Chula Mental Test: A screening test for elderly people in less developed countries. *Int J Geriatr Psychiatry* 1996 Aug; 11(8):715-20
22. Booth M. Assessment of physical activity: an international perspective. *Res Q Exerc Sport* 2000 Jun;71(2 Suppl):S114-20
23. Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, Pratt M, Ekelund U, Yngve A, Sallis JF, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc* 2003 Aug;35(8):1381-95
24. Centers for Disease Control and Prevention. Are there special recommendations for older adults? [online]. 2006 [cited 2006 Aug 26]. Available from: http://www.cdc.gov/nccdphp/dnpa/physical/recommendations/older_adults.htm
25. Nunnally JC, Bernstein IH. *Psychometric Theory*. New York: McGraw-Hill, 1994
26. Bollen KA. *Structural Equations with Latent Variables*. New York: Wiley, 1989
27. Polit DF, Hungler BP. Collecting unstructured data. In: Polit DF, Hungler BP, eds. *Nursing Research Principles and Methods*. 6th ed. Philadelphia: Lippincott, 1999: 405-36
28. Bauman A, Sallis JF, Owen N. Environmental and policy measurement in physical activity research. In: Welk GL, ed. *Physical Activity Assessment for Health-Related Research*. Champaign: Human Kinetics, 2002: 241-51