Factors Affecting Adoption of Knee Osteoarthritis Preventive Behavior among the Elderly in Saraburi Province, Thailand

Ampaiwan Toomsan, Pornpan Saminpanya, and Supatcharee Makornkan
Asia-Pacific International University, Thailand

Abstract

A cross-sectional survey was initiated to study the factors affecting adoption of preventive behaviors regarding knee osteoarthritis among the elderly in Nong Yang Suea Subdistrict, Muak Lek District, Saraburi Province. The PRECEDE-PROCEDE Framework model was adopted as the basis for the investigation. The population chosen consisted of elderly people aged 60 years and over who had never been diagnosed with osteoarthritis. Data were collected, via a specially generated questionnaire, from 285 respondents selected using proportional quota sampling. The questionnaire possessed acceptable internal consistency (Cronbach's Alpha Coefficient of .82). Data were analyzed by utilizing descriptive statistics, *t*-test, Pearson's correlation coefficient, and stepwise multiple regression analysis. The results showed that the overall adoption of osteoarthritis preventive behaviors by the elderly was at a moderate level (78.6%). The predisposing, enabling, and reinforcing factors were associated with the adoption of preventive behaviors for osteoarthritis in the elderly. The predisposing factors, which include perceived self-efficacy and attitude to prevent osteoarthritis, the enabling factors, which involve the arrangement of the home environment, and reinforcing factors, which involve the social support, were able to predict (31.9%) the osteoarthritis preventive behaviors adopted by the elderly ($p < .05$).

Keywords: *Preventive behaviors, knee osteoarthritis, elderly, Precede-Proceed Framework*

Background and Importance of the Problem

At present, the aging population around the world has caused an increase in the rate of illnesses from chronic non-communicable diseases. Osteoarthritis fits into this category (Worathanarat et al., 2014). In Thailand, data from the Ministry of Public Health for the years 2007 to 2009 indicated that the number of patients in the country with knee osteoarthritis per 100,000 population was 33.87%, 38.90%, and 40.54%, respectively. If classified by region, it was found that the central region had the highest number of osteoarthritis cases (Bureau of Policy and Strategy, 2009). Among the elderly in Thailand, osteoarthritis is one of the top five health problems. The others are, in order of importance, hypertension, diabetes, having less than 20 active teeth, and depression (Kanyayant et al., 2020).

Osteoarthritis involves the deterioration of the knee joint, also known as degenerative joint disease, characterized by the chronic and permanent pathology of articular cartilage and the destruction of articular cartilage, which occurs slowly (Hochberg et al., 2012). According to statistics from Thailand in 2010, there were more than six million patients with orthopedic disease. The most degenerative of these occurs in the knee joint (Pereira et al., 2011), as the knee must support all parts of the body. Age is one of the many risk factors for osteoarthritis (Charoenchonwanich, 2016).

Knee degeneration has many causes. Degeneration may be caused by deterioration of the cartilage with age. Up to 40% of people over 60 years have osteoarthritis of the knee. It is two to three times more frequently found in women than in men. Overweight people are at greater risk of knee degeneration, as are those whose knees have been exposed to long term usage, incorrect posture, or activities that put a lot of pressure on the knee joint. Such assaults cause defects in components of the joints, such as loose knee joints and weak thigh muscles. Alternatively, damage may be caused by accidents resulting in injuries to ligaments and chronic injuries in knee joints (Royal College of Orthopedic Physicians of Thailand, 2011).

The factors relating to beneficial self-care behaviors adoption among the elderly with osteoarthritis were optimizing knee physiology and body mass index monitoring. Related factors such as the diligence shown by the primary caregiver, the living conditions of the house, and stress reduction all contributed to a positive outcome (Singha et al., 2015). Although osteoarthritis is not life-

threatening, it has significant and adverse consequences, which can cause chronic disabilities affecting both physical and mental health. In severe cases, it causes a lot of pain, joint deformities, and disabilities. This affects both physical and mental health, the career of patients, and family welfare—causing considerable economic, labor, and social loss and heightened resource utilization (Orthopedic Decade Foundation, 2011).

From the information mentioned above, it can be seen that the incidence of osteoarthritis is continuously increasing among the elderly in Thailand. The role of community health personnel and nurses is to emphasize preventive measures regarding health problems identified in the community. Therefore, the current researchers were interested in studying the preventive behaviors adopted for osteoarthritis among the elderly in Nong Yang Suea sub-district, Muak Lek District, Saraburi. This is a locality where preventive behaviors among the elderly with respect to osteoarthritis has never been studied. The Nong Yang Suea subdistrict is divided into 14 villages (March 29, 2016 civil registration figures). Health care is under the responsibility of the Subdistrict Health Promoting Hospital of Nong Yang Suea consisting of seven villages and Khlong Sai Sub-district Health Promoting Hospital, seven villages. The results of this study will be used to develop plans for enhancing and minimizing elderly health problems, which will contribute to sustainability and improve the quality of life among the elderly.

Research Objectives

1. To study the prevention behavior of osteoarthritis among the elderly in Nong Yang Suea sub-district, Muak Lek District, Saraburi.

2. To study the factors affecting adoption of preventive behaviors for osteoarthritis among the elderly in Nong Yang Suea Subdistrict, Muak Lek District, Saraburi. Predisposing factors considered were gender, age, body mass index, education level, occupation, income adequacy, chronic health problems, history of knee injury/accident and severity of osteoarthritis using the Oxford Knee Score, knowledge, attitude, and perceived self-efficacy. Enabling factors investigated included the arrangement of the home environment, and reinforcing factors included social support from family/caregivers, neighbors, and health workers.

Research Hypotheses

1. The predisposing, enabling, and reinforcing factors are associated with preventive behaviors for osteoarthritis among the elderly, with a statistically significant at the .05 level

2. The predisposing, enabling, and reinforcing factors affect the behaviors adopted for preventing osteoarthritis among the elderly, with a statistical significance at the .05 level

Research Conceptual Framework

A cross-sectional survey was adopted to study factors affecting preventive behaviors and prevention of osteoarthritis among the elderly. This was accomplished by applying the conceptual PRECEDE-PROCEED Framework model (see Figure 1), including concepts and research findings related to three E-behaviors (eating, exercise, emotion), including the theory of prevention of osteoarthritis.

Research Methodology

This was a cross-sectional research study which aimed to study factors affecting adoption of behaviors to prevent knee osteoarthritis in respondents at Nong Yang Suea Subdistrict, Muak Lek District, Saraburi.
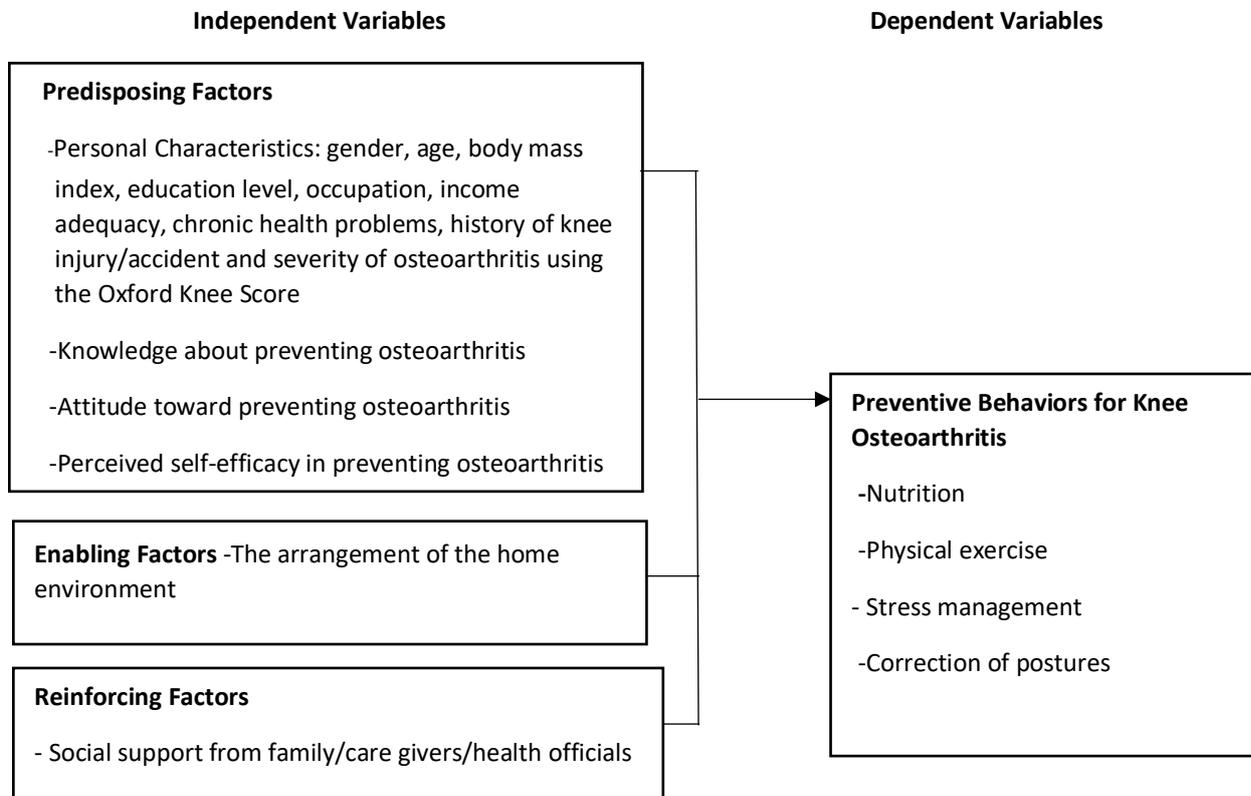
Population and Sample
Population

The population refers to people aged 60 years or more who live in Nong Yang Suea Sub-district, Muak Lek District, Saraburi Province, or 1,048 people (information from Muak Lek District Public Health Office, Saraburi Province, June 16, 2019) who had never been diagnosed with knee osteoarthritis by a physician.

Sample Group

The sample consisted of respondents aged 60 years and above living in Nong Yang Suea Subdistrict, Muak Lek District, Saraburi Province, which came to 285 people. The calculation of the sample size was done by using Proportional Quota Sampling.

Figure 1 *Research Conceptual Framework*

Independent Variables   **Dependent Variables**

Predisposing Factors

-Personal Characteristics: gender, age, body mass index, education level, occupation, income adequacy, chronic health problems, history of knee injury/accident and severity of osteoarthritis using the Oxford Knee Score

-Knowledge about preventing osteoarthritis

-Attitude toward preventing osteoarthritis

-Perceived self-efficacy in preventing osteoarthritis

Enabling Factors -The arrangement of the home environment

Reinforcing Factors

- Social support from family/care givers/health officials

Preventive Behaviors for Knee Osteoarthritis

-Nutrition

-Physical exercise

- Stress management

-Correction of postures

Data Collection Tool

The tool used in this research was a questionnaire created by the researchers in question form per the theoretical concepts used in the study, together with a review of the relevant literature to cover the scope of the study's content and objectives. The data collection questionnaires consisted of 4 parts:

Part 1: Predisposing Factors consisting of 4 sections
Section 1: Personal characteristics of the population group, consisting of gender, age, body mass index, education level, occupation, income adequacy, chronic health problems, history of knee injury/accident, and severity of knee osteoarthritis using the Oxford Knee Score.
Section 2: Knowledge about preventing knee osteoarthritis, consisting of meaning, cause, symptoms, risk factors, and treatment on a five-point rating scale questionnaire (strongly agree, agree, somewhat agree, disagree, strongly disagree).
Section 3: Attitude toward preventing knee osteoarthritis, consisting of belief and opinion in self-care preventive behavior on a five-point questionnaire (strongly agree, agree, somewhat agree, disagree, strongly disagree).
Section 4: Perceived self-efficacy in preventing knee osteoarthritis, consisting of nutrition, physical exercise, stress management, proper manner in walking, sitting and avoiding knee injury on a five-point questionnaire (strongly agree, agree, somewhat agree, disagree, strongly disagree).

Part 2: Enabling Factors consisting of 1 section

Section 5: Arrangement of home environment, consisting of placement of home appliances, organizing the environment around the house on a five-point questionnaire (*strongly agree*, *agree*, *somewhat agree*, *disagree*, *strongly disagree*).

Part 3: Reinforcing Factors consisting of 1 section

Section 6: Social support from family/care givers/health officials, consisting of advice on nutrition, physical exercise, stress management, proper manner in walking, sitting and avoiding knee injury on five-point questionnaire (every day, 5–6 times per week, 3–4 times per week, 1–2 times per week, never).

Part 4: Preventive Behaviors for Knee Osteoarthritis consisting of 1 section

Section 7: Preventive behaviors for knee osteoarthritis of the respondents, consisting of nutrition, physical exercise, stress management, proper manner in walking, sitting and avoiding knee injury on five-point questionnaire (every day, 5–6 times per week, 3–4 times per week, 1–2 times per week, never).

Criteria and Interpretation

The criteria and interpretation of the questionnaire is calculated by using range (Ritjaroon, 2014), and divided into three levels as followings:

- severity of knee osteoarthritis using the Oxford Knee Score: a) satisfactory joint function = 40–48; b) mild to moderate knee osteoarthritis = 30–39; c) moderate to severe knee osteoarthritis = 20–29; and d) severe knee osteoarthritis = 0–19.

- Knowledge in preventing knee osteoarthritis: a) the highest level, with scores from 48–64; b) moderate level, with scores from 31–47; and c) low level, with scores from 13–30.

- Attitude toward preventing knee osteoarthritis: a) the highest level, with scores from 52–70, b) moderate level, with scores from 33–51; and c) low level, with scores from 14–32.

- Perceived self-efficacy in preventing knee osteoarthritis: a) the highest level, with scores from 55–75; b) moderate level, from 35–54; and c) low level, from 15–34.

- Arrangement of the home environment divided into three levels: a) the highest level, with scores from 45–60; b) moderate level, from 29–44; and c) low level from 12–28.

- Social support from family/care givers/health officials: a) the highest level, with scores from 45–60; b) moderate level, from 29–44; and c) low level from 12–28.

- Preventive behaviors for knee osteoarthritis of respondents: a) the highest level, with scores from 89–120; b) moderate level, from 57–88; and c) low level from 24–56.

Psychometric Evaluation of the Questionnaire

The questionnaire's reliability was tested on respondents in the Muak Lek District, Saraburi Province. The respondents were a group of 30 who possessed similar criteria to our study. Results were calculated as a reliability coefficient using Cronbach's Alpha Coefficient Method, with a reliability value equal to .82.

Planning Research Ethics to Protect the Rights and Confidentiality of Research Participants

In this study, the rights of participants were protected. This research project was approved by the Human Research Ethics Committee of Asia-Pacific International University. Sample group members could terminate their participation without giving a reason to the researchers. The information in the questionnaire was kept confidential and not disclosed; hence, the results were summarized as a whole.

Data Analysis

The data were analyzed using a statistical software program; the following statistics were used:

1. Descriptive Statistics were used to describe the information on predisposing factors, enabling factors, reinforcing factors, and preventive behaviors for osteoarthritis of the elderly. This was presented in the form of a table showing frequency, percentage, mean, and standard deviation (*SD*).

2. Analytical Statistics

2.1 Analysis of relationships between the predisposing factors, with a nominal scale and an ordinal scale (gender, body mass index, chronic health problems, history of knee injury/accident) and preventive behaviors for musculoskeletal syndrome, was accomplished by using a *t*-test and one-way ANOVA.

2.2 Analysis of relationships between the predisposing, enabling, and reinforcing factors with an interval scale, and adoption of preventive behaviors for osteoarthritis among the elderly, was accomplished using Pearson's correlation coefficient.

2.3 Analysis of the success of preventive behaviors moderating the occurrence of osteoarthritis in the elderly was accomplished using stepwise multiple regression analysis.

Research Results

Predisposing Factors

Most respondents were female (67.7%) with an average age of 68.4 years. A total of 63.5% had a body mass index lower than 25, most (74.7%) had finished primary education, worked as hired employees (29.5%), and earned an adequate income with some savings (38.2%). Of this number, 80.7% had chronic health problems, and 69.5% had never had a knee injury/accident. The severity of any undiagnosed knee osteoarthritis was estimated using the Oxford Knee Score; more than half of the population (52.2%) had satisfactory joint function, 25.7% had mild to moderate knee osteoarthritis, 15.1% had moderate to severe knee osteoarthritis, and 7.4% had severe knee osteoarthritis.

As for knowledge and perceived self-efficacy in preventing knee osteoarthritis, they were at high levels overall (78.6% and 74.7%, respectively), followed by moderate levels of 18.2% and 25.3%. As for perceived self-efficacy in preventing knee osteoarthritis, it was at a moderate level of 72.3%, followed by a high level of 27.7 %, as shown in Table 1.

Table 1 *Number and Percentage of Predisposing Factors* (*N* = 285)

Predisposing Factor	Level			Mean	*SD*
	Low (%)	Moderate (%)	High (%)		
The knowledge score on the prevention of osteoarthritis	9 (3.2)	52 (18.2)	224 (78.6)	2.7	0.5
Attitudes towards preventing osteoarthritis	0 (0.0)	206 (72.3)	79 (27.7)	2.3	0.4
Perceived self-efficacy in preventing osteoarthritis	0 (0.0)	72 (25.3)	213 (74.7)	2.7	0.4

Enabling Factors

Regarding enabling factors, which occurs in the setting of the home environment of the elderly, these were found to be at either a moderate or high level (Table 2). When considering each item, it was found that adequate lighting returned the highest score (70.9%), followed by living on the ground floor (69.1%), and then provision of support or walking aids (14.4%), such as handrails and the installation of handrails in the bathrooms for the elderly.

Table 2 *Number and Percentage of Enabling Factors* (*N* = 285)

Enabling Factor	Level			Mean	*SD*
	Low (%)	Moderate (%)	High (%)		
The setting of home environment	2 (0.7)	144 (50.5)	139 (48.8)	2.5	0.5

Reinforcing Factors

Most of the elderly received a low level of overall social support (75.8%). Considering each aspect, it was found that social support mostly came from health workers, followed by family/caregivers, and the least was from friends/neighbors, as shown in Table 3.

Table 3 *Number and Percentage of Receiving Social Support* (*N* = 285)

Reinforcing Factor (Level)	Low (%)	Moderate (%)	High (%)	Mean	SD
Overall social support	216 (75.8)	59 (20.7)	10 (3.5)	1.3	0.5
Social support from family/caregivers	186 (65.3)	64 (22.5)	35 (12.3)	1.5	0.7
Social support from friends/neighbors	246 (86.3)	29 (10.2)	10 (3.5)	1.2	0.4
Social support from health workers	106 (37.2)	123 (43.2)	56 (19.6)	1.8	0.7

Preventive Behaviors of Osteoarthritis among the Elderly

Most of the elderly (78.6%) had adopted a moderate level of preventive behaviors regarding knee osteoarthritis. When considering each aspect, it was found that a majority had adopted preventive behaviors for stress management, followed by doing exercises, and lastly, the correction of posture was given moderate attention, as shown in Table 4.

Table 4 *Number and Percentage of Osteoarthritis Preventive Behaviors* (*N* = 285)

Reinforcing Factor (Level)	Low (%)	Moderate (%)	High (%)	Mean	SD
Preventive behaviors for osteoarthritis (overall)	22 (7.7)	224 (78.6)	39 (13.7)	2.1	0.5
Diet	35 (12.3)	170 (59.6)	80 (28.1)	2.2	0.6
Stress management	16 (5.6)	74 (26.0)	195 (68.4)	2.6	0.6
Physical exercise	68 (23.8)	70 (24.6)	147 (51.6)	2.3	0.8
Adjustment and correction of the posture	121 (42.5)	145 (50.8)	19 (6.7)	1.6	0.6

Relationships between Predisposing, Enabling, and Reinforcing Factors and Preventive Behaviors for Osteoarthritis

An analysis of differences, using t-test statistics, was completed between two groups of independent variables (i.e., the predisposing factors which are gender, body mass index, chronic health problems, and history of knee injuries/accidents) and the dependent variable (i.e. preventive behaviors for knee osteoarthritis of the elderly). It was found that males and females adopted different behaviors in preventing osteoarthritis. For body mass index, chronic health problems, and history of knee injuries/ accidents, no differences in preventive behaviors for osteoarthritis were found as shown in Table 5.

Table 5 *Influence of Predisposing Factors on Preventive Behavior for Osteoarthritis in the Elderly (N = 285)*

Variables	N	Mean	SD	df	F	p-value
Gender				283	4.314	.039*
Male	92	2.13	0.47			
Female	193	2.03	0.45			
Body Mass Index				283	0.824	.365
More than 25	104	2.08	0.48			
Less than 25	181	2.05	0.45			
Chronic Health Problems				283	3.087	.080
Absent	55	2.16	0.46			
Present	230	2.03	0.45			
History of Injuries/Accidents around the Knee Joint				283	0.087	.769
Absent	198	2.04	0.48			
Present	87	2.10	0.40			

Note. *p* value < .05

Analysis of the impact of predisposing, enabling, and reinforcing factors on preventive behaviors for osteoarthritis in the elderly indicated that a majority of predisposing factors significantly (p < .05) impacted preventive behaviors for osteoarthritis (Table 6). These included adequacy of income, knowledge of osteoarthritis prevention, attitudes to prevent osteoarthritis, and perceived self-efficacy to prevent osteoarthritis.

The enabling factors represent arrangements adopted in the home environment. A positive correlation was found between osteoarthritis preventive behaviors in the elderly and most enabling factors studied ($p < .05$). A similar level of significance was noted for reinforcing factors, except that there was no reinforcement from support offered by health care officials (Table 6).

Table 6 *Influence of Predisposing, Enabling, and Reinforcing Factors on Osteoarthritis Preventive Behaviors* (N = 285)

Variables	Preventive Behavior	
	r	p value
Predisposing Factors		
Age	-.110	.065
Educational level	-.053	.373
Career	-.021	.727
Income Adequacy	-.155	.009*
Knowledge of osteoarthritis prevention	.125	.034*
Attitudes to prevent osteoarthritis	.159	.007*
Perceived self-efficacy to prevent osteoarthritis	.392	.000*
Enabling and Reinforcing Factors		
The arrangement of home environment	.206	.000*
Receiving social support	.181	.002*
Receiving social support from family/caregivers	.185	.002*
Receiving social support from friends/neighbor	.167	.005*
Receiving social support from health care officials	.052	.382

Note. *p value < .05

Predicting Predisposing, Enabling, and Reinforcing Factors Most Effective in Preventing Osteoarthritis

A number of factors operated to influence the prevention of osteoarthritis in the elderly. These might have a predictive ability. Their ability to predict the preventive behavior of osteoarthritis of the elderly was 31.9%, as shown in Table 7.

Table 7 *Stepwise Regression Analysis of Elderly Osteoarthritis Preventive Behaviors*

Variables	B	Std. Error	Beta	t	p-value
Perceived self-efficacy to prevent osteoarthritis	0.375	0.058	0.355	6.421	.000
Arrangement of house environment	0.115	0.049	0.129	2.338	.020
Attitude towards to prevention of osteoarthritis	0.115	0.056	0.113	2.076	.039

Code. Constant = 3.671; R^2 = .319; F = 21.065; p value < .001

Discussion
Osteoarthritis Preventative Behaviors Seen in the Elderly

The results showed that the elderly surveyed in this study had adopted strategies favorable to the prevention of osteoarthritis. A majority gave emphasis to stress management and exercise, but considerable improvement in diet and posture would be beneficial. This is consistent with the study of Taweechai (2000), who found that the elderly with osteoarthritis had moderate self-care behaviors.

There is a clear physical change with age and a deterioration of various systems in the body, especially when they are associated with osteoarthritis. Unsurprisingly, osteoarthritis impairs the elderly's physical fitness (Ham & Sloane, 1992). Thus, self-care behaviors must be adjusted to suit the

physical condition in order to reduce the severity of the disease. When considered in detail, it can be seen that the majority of the elderly took care of themselves by preventing accidents while walking down the stairs by holding the handrail every time, followed by getting enough rest and sleep (least 6–8 hours a day), and avoiding squat toilets. Applying warm or cold water to the knee joints to provide comfort in the knee area was less commonly seen; this may be because the elderly had an incomplete understanding of osteoarthritis.

Predisposing Factors

The results showed that gender was associated with the occurrence of osteoarthritis among the elderly. Females were at a greater risk than males (p value = .039). Following menopause, estrogen deficiency occurs, which is associated with osteoarthritis of the knee (Sun et al., 2007). Thus, the preventive behaviors adopted for osteoarthritis among the elderly are necessarily different. This is consistent with the study results reported by Muraki et al. (2009). Their Japanese population, aged 60 years and above, showed a 32% prevalence of osteoarthritis in females, while only 14% of males were affected. The latest results of the Thai Elderly Health Survey 2013 (Duangthipsirikul et al., 2013), which collected data from 14,000 elderly people randomly assigned to be representatives from 28 provinces in 12 nationwide health service networks, found that most of the samples had never been tested for osteoarthritis (72.9 %). The elderly who were diagnosed by a doctor as suffering from osteoarthritis accounted for 10.60% of the population. Of these, 2.20% were males and 8.40 % were females.

Palank (1991) indicated that learning opportunities increase with age; older people have a greater chance of accumulating experiences with appropriate stimuli, perceptions, and behaviors than do younger ones. The current study included only the elderly, so there was no meaningful difference in age range. Hence, age was not correlated with osteoarthritis preventive behaviors.

In this study, body mass index was not correlated with the adoption of preventive behaviors of osteoarthritis among the elderly. This may have been because the majority of individuals had a body mass index lower than 25, which did not exceed the standard value. Hence, they did not ascribe importance to the adoption of preventative behaviors. When there is an excess body mass index or obesity (BMI greater than 25), the body has to bear more weight, and this results in a loss of space between the knee joints. This means the knee joints are subjected to repeated friction or shock when activities occur, and this can easily result in joint injury (Teichtahl et al., 2008). This is a reinforcing factor for osteoarthritis.

The level of education was not correlated with the elderly's osteoarthritis preventive behaviors. This may have been due to the little difference in the educational level of the sample selected for this study. For example, most of the participants had finished primary school (74.7%) and with a further 17.2% never having been to school. This finding was inconsistent with the results obtained by Callahan et al. (2010) who examined the association between education level with X-ray results and the symptoms of osteoarthritis in African-Americans and Caucasians. They found that those who have had less than 12 years of studies have a greater than 50% risk of detecting osteoarthritis of the knee. There was a higher risk of developing the disease in females than males.

Occupation was not correlated with osteoarthritis preventive behaviors. This was because the majority of the sample group were hired employees, followed by agriculture (29.5% and 23.5%, respectively). These represent the kinds of occupations that require them to work outside the home but do not involve occupations that require unusual force to be applied through joints. According to a study conducted by Nilkanuwong and Prechanon (2005), standing, lifting, squatting, and repetitive activities, where unusual high loads are exerted on the joints (such as roadworkers who use jack hammers), cause much friction to occur in the joints leading to greater risks of osteoarthritis. This is consistent with a study conducted by Dahaghin et al. (2009), who indicated that women who worked from home were at greater risk of developing osteoarthritis than those who work outside the home.

Income adequacy was related to osteoarthritis preventive behaviors adopted by the elderly (p value = .009), which was in accordance the commencing hypothesis adopted. This may have been because the majority of the study group had sufficient income but no savings, followed by those with

an inadequate income with accompanying debt (38.2% and 26.3%, respectively). This is consistent with the outcomes obtained in the study of Boukeaw and Teungfang (2016). They studied the health care and health status of Thai elderly individuals using secondary data from the 2011 Elderly Population Survey. It was found that income was the most important variable in predicting the health status of the elderly in Thailand with a standard regression coefficient (β) reported of .174.

The history of injuries or accidents involving the knee area had no relationship on the level of osteoarthritis preventive behaviors adopted by the study group reported here. This was probably because the majority of the elderly had never had a history of knee injury or accident. The Oxford Knee Score showed that more than half (52.2%) of the elderly did not have any abnormality in the knee joint followed by 25.3 % who had only mild symptoms of osteoarthritis. Hence, it is not difficult to understand why there was no effect reported for this variable.

Knowledge about preventive behavior regarding osteoarthritis was associated with the actual adoption of preventive behaviors for osteoarthritis (p value = .034), which was in accordance with the commencing hypothesis adopted. A total of 78.6 % individuals had a high level of knowledge about preventing osteoarthritis. This is probably because most of the people involved had chronic health problems (80.7 %). They had to visit health workers regularly. Therefore, there were opportunities for them to talk about health care and health practices including behaviors beneficial to preventing osteoarthritis of the knee. Knowledge and the information gained about the disease are essential to enable patients to practice healthy behaviors to prevent and manage the disease properly and appropriately (Royal College of Orthopedic Medicine of Thailand, 2010)

Attitudes towards the prevention of osteoarthritis were associated with preventive behaviors for osteoarthritis in the elderly (p value = .007). The results obtained supported the commencing hypothesis. This is in line with Green and Kreuter's (2005) concept. Attitudes are beliefs and the feelings a person has towards people, things, actions, situations, etc., have both positive and negative effects on behavioral change. This also is consistent with the study conducted by Kuptnirattisaikul et al. (2000). They studied the attitudes and health behaviors in the elderly with osteoarthritis after letting them watch videos and suggesting exercises for knee osteoarthritis. It was found that the resulting attitudes towards exercise were mostly rated as positive. The authors concluded that exercise-guided videos can change attitudes and health behaviors regarding self-care among the elderly with osteoarthritis.

Perceived self-efficacy represents the practice of preventing osteoarthritis. This was associated with the adoption of preventive behaviors for osteoarthritis among the elderly (p value = .000). The result obtained supported our commencing hypothesis. This is in line with the concept promoted by Bandura (1977). He stated that perceived self-efficacy was a person's belief that they were capable of effectively performing any desired behavior. If persons believed that they were capable of performing an act, then they were likely to be able to perform that act. Therefore, if the elderly possess beliefs about the possibility of preventing osteoarthritis, they are more likely to adopt correct preventive behaviors. This is consistent with the study of Chanwan et al. (2015), who found that perceived self-efficacy was statistically related to participation in health promotion among the elderly.

Enabling Factors

The results showed that the home environment was positively correlated with the adoption of preventive behavior for knee osteoarthritis (p value = 0.000). From the study, it was found that the majority of the sample population had a home environment favouring osteoarthritis prevention (moderate and high levels totaled 64.4%). This is consistent with recent literature, which indicates that a suitable environment for everyday life prevents further deterioration of joints and prolongs the functional life of joints (Royal College of Orthopedic Medicine, 2011). Developing a favourable house environment includes living on the ground floor, going up and down the stairs as little as possible, holding the railing when going up and down, using a bathroom with a Western (Sit) toilet or, if a squat toilet is the option, using a chair with a hole in the middle or placing a three-legged device over the toilet, and finally placing handrails beside the toilet to enable the elderly to stand up conveniently. For

those with weak knees, and knee-buckling issues, there should be railings in the bathroom and indoors to prevent falls. Therefore, in order for a person to adopt proper health behaviors, the environment must also be taken into account. From the study of Kulwai (2009), it was found that the condition of the residence or the place of the family residence was a factor that promoted the person's environmental safety. In the study conducted by Ratnai (2012), he indicated that safe home conditions might mean that home modifications were needed to ensure the corridors were not slippery, the floors smooth, there were no raised floors or steep steps (ideally the elderly inhabit a ground floor), that no furniture obstructed walkways, appropriate railing was attached on the wall of the bathroom and in general areas, and brightness was increased in some places. These measures help support and prevent injuries in the elderly that occur in the home by providing an environment suitable for them, thus enabling the elderly to adopt self-care behaviors that are convenient and easy to follow.

Reinforcing Factors

The results showed that getting social support was associated with preventive behaviors for osteoarthritis among the elderly (p value = < .001), which supported the initial hypothesis adopted. This outcome was in line with the concept promoted by Green and Kreuter (2005), namely, reinforcing factors represent supporting information and encouragement an individual receives from another person, such as a colleague, supervisor, and health officers. The feedback received could include a reward that is tangible, a compliment, acceptance, or even punishment. All these affect the practice of health behaviors. The results also were consistent with the study conducted by Dana and Chinsuwan (2011). They found that caregivers had a significant effect on self-care behaviors of the elderly with knee osteoarthritis. The family or caregivers play a very important role in caring for the elderly because they are potentially able to keep the elderly safe without too many complications. The study conducted by Senchum et al. (2011) indicated that supportive family relationships were positively correlated with the role of caring for and promoting the health of the elderly. In another study, it was found that being supported by peers or health workers improved the learning of patients with osteoarthritis and their health practices improved (Piyakhachornrot et al., 2011).

In this research, it was found that predisposing and enabling factors were useful in predicting osteoarthritis preventive behavior uptake by the elderly. Variables, such as perceived self-efficacy for preventing osteoarthritis, attitudes towards prevention of osteoarthritis, and arrangement of home environments acted synergistically, enabling practitioners to predict osteoarthritis prevention behavior adoption by the elderly (p value < .001).

The results of this study were not totally consistent with the PRECEDE-PROCEED Framework model (Green & Kreuter, 2005). They found that the variables influencing change in behavior were predisposing and enabling factors. As for reinforcing factors, this study found no influence on behavioral change, contrary to expectations proposed by the Model. Therefore, when planning any behavioral change, the overall influence of these factors must be taken into account; one factor should not be taken into account exclusively. Green and Kreuter (2005) showed that behavioral change can be expected only when a motivating or inducing cause is present (the predisposing factor), but the behavior may be poor if the individual has not received the support, resources, or skills necessary to improve it. Thus, the proper allocation or use of resources (reinforcing factors) also encourages such behavior. In addition, receiving reinforcement in the form of supporting resources or motivation will increase individual behavior (enabling factor). When a person is encouraged by an enabling factor, this creates motivation and effects the predisposing factor. Likewise, when a person is rewarded and satisfied with the outcome of an action, (s)he is recognized and incentivized to continue that particular behavior. In addition, an appropriate health promotion environment and the availability of social reinforcement enables a behavior to persist because of help and support for each other in society.

Suggestions for Future Research

Preventive behaviors for osteoarthritis risk in the elderly should be studied using a combination of study methods such as observation, in-depth interviews, conducting group discussions, and surveys

to get to know the problems and obstacles in daily life that are consistent with reality. There also might be a study on the causes or factors that may affect the occurrence of falls or accidents in the elderly. The results could be used as a guideline for organizing activities to prevent knee osteoarthritis.

References

Bandura, A. (1997). Self-efficacy: the exercise of control. W. H. Freeman/Times Books/Henry Holt & Co.

Boukeaw, P., & Teungfung, R. (2016). Health care and health status of Thai aging. *Journal of the Association of Researchers, 21*(2), 94–109.

Bureau of Policy and Strategy, Ministry of Public Health. (2009). *Thailand Public Health Statistics 2009*. https://ghdx.healthdata.org/record/thailand-public-health-statistics-2009

Callahan, L. F., Shreffler, J., Siaton, B. C., Helmick, C. G., Schoster, B., Schwartz, T. A., Chen, J., Renner, J. B., & Jordan, J. M. (2010). Limited educational attainment and radiographic and symptomatic knee osteoarthritis: A cross-sectional analysis using data from the Johnston County (North Carolina) Osteoarthritis Project. *Arthritis Research Therapy*, *12*(2), R46. https://doi.org/10.1186/ar2956

Chanwan, B., Sirichotiratana, N., Prutipinyo, C., Tadadej, C., & Khajornchaikul, P. (2015). Kānraprū khwāmsāmāt khǭng tonʻēng tǭ kānmī sūanrūam kān songsœ̄m sukkhaphāp phūsūngʻāyu tām suk banyat khǭng ʻāsāsamak sāthāranasuk nai khēt thētsabān mư̄ang čhangwat Pathum Thānī [Village health volunteers' self-efficacy on the participation in elderly health promotion programs according to Health Regulation in Municipality of Pathumphani Province]. *Vajira Nursing Journal, 17*, 86–99. https://phad.ph.mahidol.ac.th/research/2558/169-Benjamas%20Chanwan.pdf

Charoenchonwanich, K. (2016). *Sanlayasāt būrana saphāp khǭ khao sư̄am* [Reconstructive surgery of the osteoarthritic knee]. Siriraj.

Dahaghin. S., Tehrani-Banihashemi, S., Faezi, S., Jamshidi, A, & Davatchi. F., (2009). Squatting, sitting on the floor, or cycling: Are life-long daily activities risk factors for clinical knee osteoarthritis? Stage III results of a community-based study. *Arthritis & Rheumatology, 61*(10), 1337–1342. https://pubmed.ncbi.nlm.nih.gov/19790110/research

Dana K., & Chinsuwan, A. (2011). Kānphatthanā botbāt khrǭpkhrūa nai kāndūlǣ phūpūai sūngʻāyu rōk khwām dan lōhit sūng: Na sūn sukkhaphāp chumchon nai narang dambon bānphū ʻamphœ̄ yāng sīsurāt čhangwat Mahā Sārakhām [A development of family roles in caring for elderly person with hypertension: At Noonrung primary care unit Banku Subdistrict, Yangsisurat District, Mahasarakham Province]. *Journal of Nursing Division, 38*(3), 22–37. http://61.19.69.198/ULIB//dublin.linkout.php?url=http%3A%2F%2F61.19.69.198%2FULIB%2F%2F_ fulltext%2Fserialcontent%2F13399108671%2F20120105103829_974.pdf

Duangthipsirikul, S., Sirisamud, T., & Teerawatananon, Y. (2013). *Preliminary study report 2013.* Technology assessment project and health policy. www.hitap.net/research

Green, L. W., & Kreuter, M. W. (2005). *Health program planning: An educational and ecological approach* (4th ed.). McGraw-Hill Higher Education.

Ham, R. J., & Sloane, P. D. (1992). *Primary care geriatrics: A case-based approach* (2nd ed.). Mosby–Year Book.

Hochberg, M. C., Altman, R. D., April, K. T., Benkhalti, M., Guyatt, G., McGowan, J., Towheed, T., Welch, V., Wells, G., & Tugwell, P. (2012). American College of Rheumatology (ACR) 2012: Recommendations for the use of non-pharmacologic and pharmacologic therapies in osteoarthritis of the hand, hip, and knee. *Arthritis Care & Research, 64*(4), 465–474.

Kanyayant, C., Charoennukul, A., & Wayo, W. (2020). Kān chalǭ kān kœ̄t khǭ khao sư̄am kǭn khao sū wai sūngʻāyu [Delaying knee osteoarthritis prior to advancing age]. *Ramathibodi Nursing Journal, 26*(1), 5–17. https://he02.tci-thaijo.org/index.php/RNJ/article/view/140457

Kulwai, I. (2009). *The relationship between hardiness and social support and the ability to take care of the elderly's self* [Master's Thesis, Thammasat University]. https://www.google.com/search?q=Kulwai%2C+I.+%282009%29.+The+relationship+between+hardinessstamina+and+social+support+and+the+ability+to+take+care+of+the+elderly%27s+self.+%5BMaster%E2%80%99s+Thesis%2C+Graduate+School+Thammasat+University%5D.&sxsrf=ALiCzsaKMeixnKJ2xPW80DFoJf2XDkL_Ag%3A1659318996140&source=hp&ei=1DLnYs2WBoaYseMP4Jitg AM&iflsig=AJiK0e8AAAAAYudA5JUwR6O6OMT338ZPxmB35dQ6K4LL&ved=0ahUKEwjN0NP6xKT5AhUGTGwG HWBMCzAQ4dUDCAg&uact=5&oq=Kulwai%2C+I.+%282009%29.+The+relationship+between+hardinessstamina+and+social+support+and+the+ability+to+take+care+of+the+elderly%27s+self.+%5BMaster%E2%80%99s+Thesis%2C+Graduate+School+Thammasat+University%5D.&gs_lcp=Cgdnd3Mtd2l6EANQAFgAYNkFaABwAHgA gAEAiAEAkgEAmAEAoAECoAEB&sclient=gws-wiz

Kuptnirattisaikul, V., Leurcharusmee, A., & Nakasuwan, V. (2000). Kānsưksā thatsanakhati læ phrưttikam sukkhaphāp nai phūsūng'āyu rōk khǭ sưam [The study of attitude and health behavior in osteoarthritic elderly]. *Journal of Rehabilitation Medicine, 9*(3), 90–96. http://rehabmed.or.th/main/wp-content/uploads/2015/01/L-128.pdf

Muraki, S., Oka, H., Akune, T., Mabuchi, A., En-yo, Y., Yoshida, M., Saika, A., Suzuki, T., Yoshida, H., Ishibashi, H., Yamamoto, S., Nakamura, K., Kawaguchi, H., & Yoshimura, N. (2009). Prevalence of radiographic knee osteoarthritis and its association with knee pain in the elderly of Japanese population-based cohorts: The ROAD study. *Osteoarthritis Cartilages, 17*(9), 1137–1143.

Nilkanuwong, S., & Prechanon, S. (Eds.). (2005). *Tamrā rōk khǭ* [Rheumatology textbook]. Thai Rheumatism Association.

Orthopedic Decade Foundation. (2006). *Osteoarthritis.* http://www.boneandjointdecade.or.th/brochure.shtml

Palank, C. L. (1991). Determinants of health-promotive behavior: A review of current research. *The Nursing Clinics of North America, 26*(4), 815–832.

Pereira, D., Peleteiro, B., Araujo, J., Santos, R.A., & Ramos, E. (2011). The effect of osteoarthritis definition on prevalence and incidence estimates: A systematic review. *Osteoarthritis Cartilage*, *19*(11), 1270–1285.

Piyakhachornrot, N., Aree-Ue, S., Putwatana, P., & Kawinwonggowit, V. (2011). Impact of an integrated health education and exercise program in middle-aged Thai adults with osteoarthritis of the knee. *Orthopedic Nursing, 30*(2), 134–142. https://doi.org/10.1097/NOR.0b013e31821130bf

Ratnai, S. (2012). *Khūmư̄ kāndūlæ phūsūng'āyu* [Elder care manual]. Seang Dao.

Ritjaroon, P. (2014). *Lakkān wat læ pramǣnphon kānsưksā* [Educational measurement and evaluation] (7th edition.). House of Kermyst.

Royal College of Orthopedic Surgeons of Thailand. (2011). *Nǣo patibat bǭrikān sāthāranasuk rōk khǭ khao sưam Phǭ.Sǭ. sǭngphanhārǭihāsipsī* [Guidelines for the treatment of osteoarthritis of the knee]. https://www.chiangmaihealth.go.th/cmpho_web/document/160610146554495425.pdf

Senchum, W., Surit, P., Noosorn, N., & Kanokthet, T. (2011). Factor predicting role of family's member in providing care and health promotion for the elderly in Thumbon Phawor Maesot District, Tak Province. *Journal of Nursing and Health Sciences, 5*(2), 23–33. http://www.nurse.nu.ac.th/Journal/data/Vol.5%20No.2/004.pdf

Singha, S., Durongritichai, D., & Kasipul, T. (2015). Factors relating to self-care behavior of the elderly with knee osteoarthritis in Praksa Municipality Area, Muang District, Samutprakarn Province. *HCU Journal of Health Science, 18*(1), 115–130. http://journal.hcu.ac.th/pdffile/jn1836/%E0%B8%A5%E0%B8%87%E0%B9%80%E0% B8%A7%E0%B8%9B/%E0%B8%9A%E0%B8%97%E0%B8%97%E0%B8%B5%E0%B9%88%208.pdf

Sun, B. H., Wu, C., & Kalunian, K. C. (2007). New development of osteoarthritis. *Rheumatic Disease Clinics of North America, 33*(1), 135–148. https://doi.org/10.1016/j.rdc.2006.12.003

Taweechai, V. (2000).). *Phrưttikam kāndūlæ ton'ēng læ khwāmrunrǣng khǭng rōk khǭ khao sưam nai phūsūng'āyu* [Self-case behaviors and severity of knee osteoarthritis among the elderly]. [Master of Nursing Thesis, Chiangmai University]. http://cmuir.cmu.ac.th/handle/6653943832/29918

Teichtahl, A. J., Wang, Y., Wluka A. E., & Cicuttini, F. M. (2008). Obesity and knee osteoarthritis: New insights provided by body composition studies. *Obesity, 16*(2), 232–240. https://doi.org/10.1037/oby.2007.30

Worathanarat, P., Worathanarat, T., Angsanansuk, C., Kitkunasathien, C., Kanchanathepsak, T., & Leelapattana, P. (2014). *Withī chīwit kap rōk kradūk læ khǭ* [Lifestyles and musculoskeletal disorders]. Charansanitwong Printing.