

## Research Article

# Assessing Quality of Life Using Zhan's Concept Among Thai Osteoarthritis Patients: A Structural Equation Modelling Approach

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## ABSTRACT

Quality of life (QoL) in Thai patients with knee osteoarthritis and its predicting factors according to Zhan's concept have been well described by various studies; but not all predicting factors have been simultaneously tested in a single study. This study aimed to examine quality of life of Thai patients with knee osteoarthritis, as well as direct effects of personal factors, health-related factors, and social/culture/environmental factors on quality of life of patients with knee osteoarthritis. 300 patients aged 60 years or older receiving care at five hospitals in Nakhonnayok, Thailand, were purposively selected from May 2019 to June 2020. Participants completed the knee osteoarthritis severity scale, social support scale, quality of life scale, and demographic and health status questions. Structural equation modeling was used to analyze the data. Overall quality of life was at a moderate level. Knee osteoarthritis severity; which was a health-related factor, and social support; which was social/culture/environmental factors, had significantly, negative and positive direct effects on quality of life, respectively. These two causal factors could explain 33% of the variance of quality of life. Healthcare providers and settings should provide more programs with activities to promote social support and alleviate knee osteoarthritis severity for the Thai elderly patients with knee osteoarthritis.

### Keywords:

Quality of life, Knee osteoarthritis, Thai patients, Structural equation modeling

## 1. INTRODUCTION

Osteoarthritis of the knee is one of the prevalent illnesses worldwide. In Thailand, knee osteoarthritis is the seventh most prevalent disorders in individuals aged 60 years or older following hypertension, diabetes, hyperlipidemia, obesity, abdominal obesity, and metabolic syndromes. The prevalence of knee osteoarthritis in the elderly was 12.0% in men and 22.2% in women<sup>1</sup>. Knee osteoarthritis is one of the leading causes of disability in the elderly which leads to a poor quality of life and a low performance in job and/or activity of daily living<sup>2</sup>.

Disabilities associated with knee osteoarthritis limit the patient's performance on daily living activity immensely. If left untreated or managed, more disabilities and suffering could be expected. Patients will experience more chronic pain, deformity of joints and legs, limited joint movement, abnormal walking, limited activities of daily living, dependence on others, and permanent disabilities. These debilitating effects of knee osteoarthritis impair the patient physical, psychological, emotional, and psychosocial well-being, resulting in a decrease in patients' quality of life<sup>3,4</sup>. Osteoarthritis severity affects the patient's quality of life. In a medical center in the central Thailand, patients with osteoarthritis

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with a more severe disease (i.e., a Kellgren-Lawrence (KL) class 4) had a significantly lower quality of life associated with the joint function than those with mild disease (i.e., KL class 2)<sup>5</sup>. Another study in Thai osteoarthritis patients also showed that patients with a late, severe stage (i.e., KL class 3 – 4) had quality of life regarding pain and joint function worse than those with early, mild stage (i.e., KL class 1 – 2)<sup>6</sup>. Pain was negatively associated with quality of life in the elderly with knee osteoarthritis ( $r = -0.62$ ,  $P < 0.01$ ) while physical activities was positively associated with quality of life ( $r = 0.33$ ,  $P < 0.01$ )<sup>7</sup>. Exercise to improve mobility and strength of joint muscles in the elderly with knee osteoarthritis also helped maintain physical, psychological, environmental, and relationship aspects of quality of life with statistical significance<sup>8</sup>.

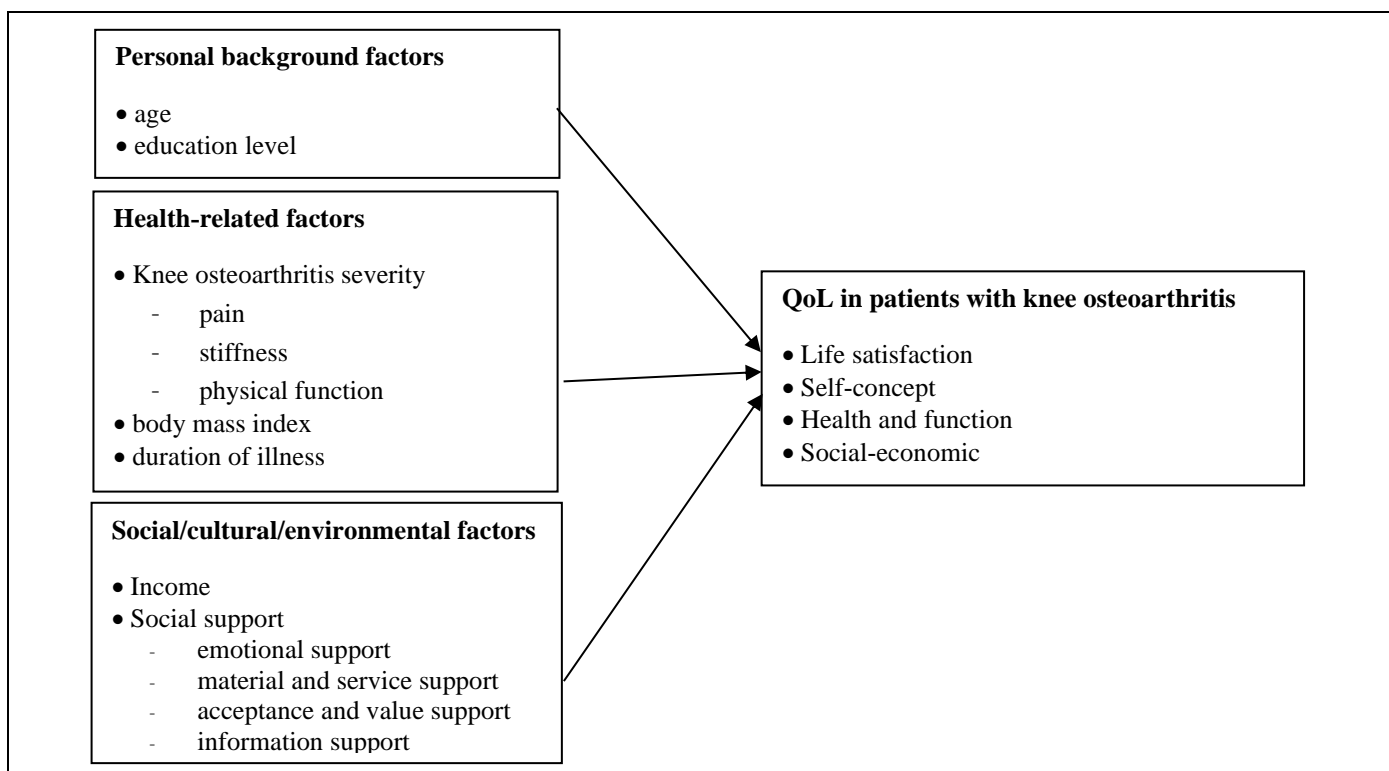
Quality of life is essential in human living both in good and bad health. In population development, individuals with adequate quality of life could be well developed. Among its wide range of definitions, Zhan's concept of quality of life has been figured and operationalized<sup>9</sup>. According to Zhan's concept of quality of life, there are four dimensions: life satisfaction, self-concept, health and function, and the social-economic. Life satisfaction, the first dimension, is defined as the individuals' perception on things they possess, their living environment, and how they live their life. Self-concept, the second dimension, refers to the individual's belief and perception on their image and self-worth. Health and function, the third dimension, is defined as how the individuals perceive their illness and ability to perform various activities to the point that they are contented with their living. Lastly, social-economic dimension is defined as how individuals perceive their interactions with their family, society, occupation, education, and income.

The previous literature demonstrated potential predictors of quality of life in patients with knee osteoarthritis or the elderly. Firstly, for personal background factors, age was found to have a positive direct effect on the quality of life of patients with knee osteoarthritis<sup>10,11</sup>. Furthermore, education level had a significant positive correlation with elderly quality of life<sup>10,12</sup>. Secondly, for health-related factors, knee osteoarthritis severity,<sup>5,7</sup> body mass index,<sup>11,13</sup> and duration of knee osteoarthritis since diagnosis<sup>4,14</sup> negatively affected the quality of life. Lastly, for social/cultural/environmental factors, social support is positively associated with quality of life in patients with knee osteoarthritis<sup>15-17</sup>. Another predictor of quality of life was income. It was found that income had a significantly positive correlation with the quality of life in the elderly with knee osteoarthritis<sup>10,18</sup>.

Previous studies, as described above, showed that quality of life was affected by three factors including

personal background, health-related factors, and social/culture/environmental factors. However, these studies examined quality of life with various influencing factors, but not all predicting factors according to Zhan's quality of life concept simultaneously tested in a single study. Therefore, there is a need to examine all relevant predicting factors based on Zhan's concept of quality of life in a single study. In addition, to examine a large set of factors with complicated associations simultaneously for a more valid and reliable causal model, a more comprehensive and powerful statistical analysis is needed. Structural equation modeling (SEM) offers validity of the measurement by allowing observable variables per construct simultaneously. A more valid conclusion on measurements could be made on the construct level. For reliability, SEM takes measurement errors of the observable variables into account. The relationships between constructs could be concluded with no bias by measurement errors; hence, relationships between constructs are highly reliable. To the best of our knowledge, study demonstrating this like present study was scanty and studies that included these variables were rare. Moreover, considering the elderly as a vulnerable group, especially the elderly with knee osteoarthritis, it is important to improve their quality of life. Quality of life in the elderly is influenced by various factors and depends on the cultural background and structure of a society. Since in the Naknonnayok province, study investigating quality of life and its influencing factors was scanty. Therefore, this present study aimed to (1) determine level of quality of life of Thai patients with knee osteoarthritis according to Zhan's concept, (2) examine the causal factors of quality of life. Study findings could be useful in developing interventions for promoting quality of life of patients with knee osteoarthritis.

The Conceptual framework of this study was guided by the concept and measurement of quality of life of Zhan<sup>9</sup> and previous research. According to Zhan, quality of life consists of life satisfaction, self-concept, health and function, and the social-economic. The quality of life was directly influenced by factors including personal background factors (i.e., age and education), health-related factors (i.e., knee osteoarthritis severity, body mass index, and duration of illness), and social/cultural/environmental factors (i.e., income and social support). It was hypothesized that: (1) personal background factors, age and education, had a positive direct effect on quality of life; (2) health-related factors, knee osteoarthritis severity, body mass index, and duration of knee osteoarthritis, had a negative direct effect on quality of life; and (3) social/cultural/environmental factors, income and social support, had a positive direct effect on quality of life. This hypothesized model was shown in Figure 1.



**Figure 1.** Conceptual framework of quality of life of patients with knee osteoarthritis with its influencing factors based on Zhan's concept<sup>9</sup>

## 2. MATERIALS AND METHODS

### 2.1. Research design

A cross-sectional correlational study was employed. The study is reported following the STROBE cross-sectional guidelines.

### 2.2. Participants and setting

The study population was individuals aged 60 years or older diagnosed with knee osteoarthritis receiving regular care at out-patient department of all five hospitals in Nakhonnayok province, Thailand, including Nakhonnayok Hospital, HRH Princess Maha Chakri Sirindhorn Medical Center, and three community hospitals (i.e., Ongkharak Hospital, Banna Hospital, and Pakpli Hospital).

The sample size estimation was based on the correlational causal model which suggested the size of at least 200 participants or of a ratio of 10 - 20 participants to a given parameter.<sup>19</sup> In this study, with a ratio of 15 participants to one parameter, and 16 parameters estimated (as presented in Table 3), a sample size of 240 participants was required. With a 20% compensation rate to offer more practical quota proportional the number of patients with knee osteoarthritis in each hospital, 300 participants were needed.

Participants were selected using the purposive sampling method. To be eligible, participants had to be

diagnosed with knee osteoarthritis, able read and write in Thai language, and were willing to participate the study. Patients with stroke, inability to walk, the need for walk-assisting device, or knee replacement surgery were excluded. The numbers of participants proportional the number of patients with knee osteoarthritis in each hospital were 122, 89, 11, 39, and 39 participants from Nakhonnayok Hospital, HRH Princess Maha Chakri Sirindhorn Medical Center, Ongkharak Hospital, Banna Hospital, and Pakpli Hospital, respectively.

### 2.3. Instruments

This study used a questionnaire developing by the researcher as guided by relevant theories, literature, and previous research. Questions both originally created and modified by the researcher were examined for content validity by three experts in behavioral science and outcomes research using the Index of Item-objective Congruence (IOC) as the quality criterion. These questions were also tested for internal consistency reliability in 50 individuals with characteristics comparable to the prospective participants. Cronbach's alpha coefficient was used as the quality criterion for internal consistency reliability. The questionnaire consisted of four sections as follows:

The first section, *general background characteristics*, included gender, age, marital status, education level, occupation, having income, weight, height, co-morbid illnesses, duration of knee

osteoarthritis since diagnosis, and medication. Twelve questions were multiple-choice and open-ended.

The second section, *knee osteoarthritis severity*, used the Modified Thai version of the Western Ontario and McMaster (WOMAC) index in knee osteoarthritis patients<sup>20,21</sup>. The modified Thai WOMAC was the scale for measuring knee pain guided by The Royal College of Orthopedic Surgeons of Thailand. With a total of 22 questions, this modified scale evaluated three domains of knee osteoarthritis severity including pain (5 questions), stiffness, (2 questions), and physical function (15 questions). A response was a visual analog scale of 0 to 10 points, where 0 indicated no pain, stiffness, or physical function limitation, and 10 indicated the most unbearable pain, stiffest, or most limited physical function, respectively. Higher scores indicated more severe knee osteoarthritis, i.e., more pain, stiffness, and physical function limitation in various activities of daily living. This Modified WOMAC Thai version has a higher internal consistency with Cronbach's alpha coefficients ranging from 0.85 – 0.97<sup>22</sup>. In this study, the Modified WOMAC Thai version had an acceptable content validity (IOC indices of 0.67 – 1.00) and a high internal consistency reliability (Cronbach's alpha coefficient of 0.87).

The third section, *social support*, were modified from the Thai social support scale of Chuen-im<sup>23</sup>. With a total of 18 questions, the scale evaluated four dimensions of social support including emotional support, material and service support, acceptance and value support, and information support. The response was a 4-point rating scale ranging from 1 “not at all true” to 4 “always true.” With the total score of 18 to 72 points, higher total scores indicated higher levels of social support. In this present study, this set of questions had an acceptable content validity (IOC indices of 0.67 – 1.00) and a high internal consistency reliability (Cronbach's alpha coefficient of 0.93).

The last section, *quality of life*, were modified from the work of Chuen-im<sup>23</sup> which were based on the concept of quality of life of Zhan<sup>9</sup>. The total of 30 questions evaluated four dimensions of quality of life including life satisfaction, self-concept, health and function, and social-economic. The response was a 5-point rating scale ranging from 1 “totally disagree” to 5 “totally agree.” With the total score of 30 – 150 points, levels of quality of life were categorized as low, moderate, and high with respect to 30 – 70, 71 – 110, and 111 – 150 points, respectively. In this present study, this set of questions had an acceptable content validity (IOC indices of 0.67 – 1.00) and a high internal consistency reliability (Cronbach's alpha coefficient of 0.91).

#### 2.4. Data collection

The researcher contacted all hospital directors for data collection permission. Six research assistants

were nurses and nurse assistants who were trained by the researcher. At each hospital, the researcher and assistants approached prospective participants to introduce themselves and provide information regarding objectives, process, and voluntary and anonymity nature of the study. The signed written informed consent was obtained before the participation. The researcher read the questions and wrote the answers for the participants. The interview took about 30 minutes for each participant. The filled questionnaire was checked for completeness. The data collection was conducted from May 2019 to June 2020.

#### 2.5. Data analysis

Firstly, descriptive statistics including frequency with percentage, mean with standard deviation (SD), and minimum and maximum values were used to summarize general background characteristics and study variables. Correlations between two variables were tested using Pearson's product moment correlation coefficient or Spearman Rank Correlation coefficient, as appropriate. Normal distribution assumption was tested using Kolmogorov-Smirnov test, skewness, and kurtosis.

Certain observed or measured variables were not normally distributed based on Kolmogorov-Smirnov test. However, since no variables had skewness of more than 2 and kurtosis of more than 7, the assumption of multivariate normal distribution of these variables was not unacceptably violated<sup>24</sup> and the maximum likelihood parameter estimation for structural equation modeling (SEM) was adequately robust.

Secondly, bivariate correlations among all variables hypothesized in the original causal model depicted in the conceptual framework were determined using the SEM. A correlation coefficient of 0.85 or higher indicates multicollinearity<sup>19</sup>. In this study, bivariate correlation coefficients among all variables were in the range of 0.003 to 0.874. The correlation coefficient of 0.874 of pain and joint function was the only one coefficient that was higher than the 0.85 criterion. In general, it is recommended to remove a variable of a given bivariate pair with the multicollinearity problem. However, since a measurement model was subject to testing, both variables (i.e., pain and joint function) were left in the model. Variance inflation factor (VIF) was also conducted to detect multicollinearity among variables, which VIF > 10 was considered as having multicollinearity. In this study, the VIF was 1.000.

Thirdly, for the measurement model, confirmatory factor analysis was performed to assess the goodness of the measurement model. Once the measurement model was satisfied, SEM was conducted to test the hypothesized relationships depicted in the conceptual

framework. In the confirmatory factor analysis, 11 measured variables were tested whether they were correlated with their respective latent variables including knee osteoarthritis severity with three

measured variables (i.e., pain, stiffness, and physical function), social support with four measured variables (i.e., emotional support, materials and service support, acceptance and value support, information support), and

**Table 1.** General background characteristics of the participants (N = 300).

Characteristics	N	%
<b>Hospital</b>		
HRH Princess Maha Chakri Sirindhorn Medical Center	122	40.7
Nakhonnayok Hospital	89	29.7
Pakpli Community Hospital	39	13.0
Banna Community Hospital	39	13.0
Ongkharak Community Hospital	11	3.7
<b>Gender</b>		
Men	59	19.7
Women	241	80.3
<b>Age (years), mean = 70.28 ± 7.39; min. = 60, max. = 98</b>		
≤ 70	174	58.0
71 - 80	95	31.7
≥ 81	31	10.3
<b>Education level</b>		
No formal education	9	3.0
Primary school	193	64.3
Junior high school	11	3.7
Senior high school	38	12.7
Associate degree	7	2.3
Bachelor's degree or higher	33	11.0
Not specified	9	3.0
<b>Occupation</b>		
Housewife/homemaker	119	39.7
Agricultural worker	55	18.3
Retired government employee	37	12.3
General labor	18	6.0
Small business	17	5.7
Government employee	12	4.0
Not working	33	11.0
Others	4	1.3
Not specified	5	1.7
<b>Having income</b>		
No	64	21.3
Yes	226	75.3
Not specified	10	3.3
<b>Marital status</b>		
Married	179	59.7
Widowed/divorced	88	29.3
Single	26	8.7
Not specified	7	2.3
<b>Having co-morbid illness</b>		
Yes	240	80.0
No	58	19.3
Not specified	2	0.7
<b>Duration of knee osteoarthritis diagnosis (years), mean = 5.33 ± 4.30 years; min.= 1 month, max. = 20 years.</b>		
≤ 5	192	64.0
5.01 - 10.00	75	25.0
10.01 - 15.00	5	1.7
15.01 - 20.00	11	3.7
Not specified	17	5.7
<b>Body mass index (kg/m<sup>2</sup>)</b>		
< 18.5 (underweight)	7	2.3
18.5 - 22.9 (normal)	60	20.0
23.0 - 24.9 (overweight)	71	23.7
25.0 - 29.9 (level 1 obesity)	109	36.3
30.0 or higher (level 2 obesity)	45	15.0

**Table 2.** Quality of life of the participants (N = 300).

Dimensions of quality of life	Possible range	Actual range	Mean	SD	Level
Life satisfaction	6 - 30	8-30	23.02	3.57	High
Self-concept	8 - 40	15-40	26.85	3.60	Moderate
Health and function	9 - 45	13-45	31.97	5.98	Moderate
Social-economic	7 - 35	12-35	25.30	4.70	High
<b>Overall quality of life</b>	<b>30-150</b>	<b>70-143</b>	<b>108.81</b>	<b>15.23</b>	<b>Moderate</b>

quality of life with four measured variables (i.e., life satisfaction, self-concept, health and function, and social-economic). The extent of correlations of latent variables and their measured variables was reported as standardized factor loadings (or factor loading coefficients).

Lastly, goodness of fit of the hypothesized model with the empirical data was verified using relevant indices, i.e., chi-square test ( $\chi^2$ ), p-value, degree of freedom (df),  $\chi^2/df$ , Incremental Fit Index (IFI), Comparative Fit Index (CFI), and Root Mean Square Error of Approximation (RMSEA). If the fit of the original causal model was inadequate, the model was modified until the fit was achieved. With the modified model, direct effects of each of all hypothesized variables on quality of life were reported as path coefficients. Lisrel software program was used for SEM. Statistical significance was set at a type I error of 5%.

### 3. RESULTS AND DISCUSSION

#### 3.1. General background characteristics

Of the 300 participants, the majority were from HRH Princess Maha Chakri Sirindhorn Medical Center (40.7%), followed by Nakhonnayok Hospital (29.7%), and the rest three community hospitals. Most of them were women (80.3%). They had an average age of  $70.28 \pm 7.39$  years (min. = 60, max. = 98). Almost two-thirds had primary education (64.3%). The majority were

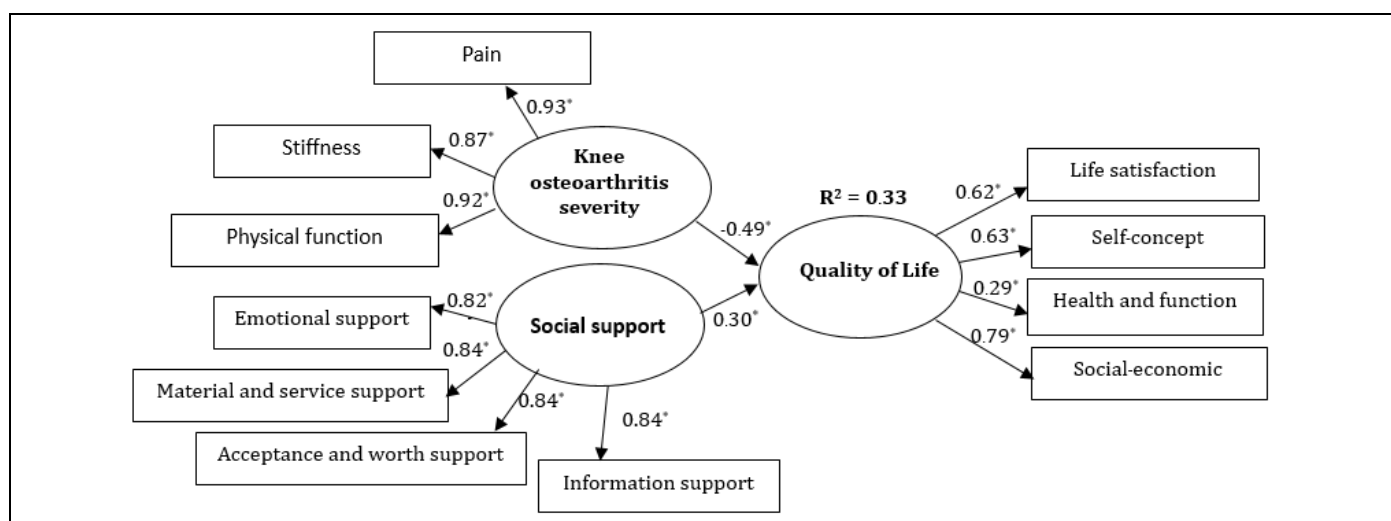
homemaker or housewife (39.7%) and married (59.7%). They had an average monthly income of 9,700 (SD = 13,113.46; min. = 600, and max. = 70,000 Baht). Almost two-thirds had been diagnosed with knee osteoarthritis less than 5 years (mean =  $5.33 \pm 4.30$  years), with the shortest duration of one month and the longest duration of 20 years. In addition to knee osteoarthritis, most participants had at least one co-morbid illness (80.0%), mostly hypertension, hyperlipidemia, and diabetes (62.7%, 47.0%, and 29.0%, respectively). More than half had a BMI of more than  $25.0 \text{ kg/m}^2$  indicating obesity (51.3%) (Table 1).

#### 3.2. Quality of life

The participants had a moderate overall quality of life (Mean = 108.81, SD = 15.23). The dimensions of life satisfaction and social-economic were at a high level while the rest two dimensions were at a moderate level (Table 2).

#### Causal factors of quality of life

Based on the confirmatory factor analysis, the results indicated that all 11 observed variables were significantly correlated with their respective latent variables with standardized factor loadings or factor loading coefficients of 0.29 – 0.93 (p-value < 0.01 for all) (Figure 2).

**Figure 2.** Modified causal model of quality of life in patients with knee osteoarthritis with standardized pathway coefficients (N = 300)

\* p-value &lt; 0.01

**Table 3.** Bivariate correlations of all study variables (N = 300).

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.Age	-														
2.Income	-0.199 <sup>†</sup>	-													
3.Education	-0.156*	0.813 <sup>†</sup>	-												
4.Duration of KO	0.131*	-0.064	-0.011	-											
5.BMI	-0.305 <sup>†</sup>	0.285 <sup>†</sup>	0.188	-0.018											
<b>KO severity</b>															
6.Pain	-0.016	-0.041	-0.094	0.064	-0.034	-									
7.Stiffness	-0.009	-0.084	-0.170*	0.037	-0.049	0.828 <sup>†</sup>	-								
8.Physical function	0.038	-0.077	-0.092	0.037	0.003	0.874 <sup>†</sup>	0.804 <sup>†</sup>	-							
<b>Social support</b>															
9.Emotional support	0.111	-0.147*	-0.110	0.063	-0.049	-0.035	0.015	-0.040	-						
10.Acceptance and value support	-0.031	-0.108	-0.093	0.033	-0.077	-0.043	-0.003	-0.107	0.528 <sup>†</sup>	-					
11.Information support	-0.013	-0.274 <sup>†</sup>	-0.217 <sup>†</sup>	0.048	-0.113	-0.005	0.073	-0.067	0.625 <sup>†</sup>	0.573 <sup>†</sup>	-				
12.Material and service support	0.157*	-0.264 <sup>†</sup>	-0.192 <sup>†</sup>	0.051	-0.130*	0.049	0.036	-0.005	0.575 <sup>†</sup>	0.440 <sup>†</sup>	0.615 <sup>†</sup>	-			
<b>QoL</b>															
13.Life satisfaction	0.105	0.083	0.098	-0.156*	-0.097	-0.270 <sup>†</sup>	-0.172 <sup>†</sup>	-0.323 <sup>†</sup>	0.246 <sup>†</sup>	0.152*	0.193 <sup>†</sup>	0.168 <sup>†</sup>	-		
14.Self-concept	0.027	0.050	0.046	-0.089	-0.034	-0.246 <sup>†</sup>	-0.222 <sup>†</sup>	-0.352 <sup>†</sup>	0.220 <sup>†</sup>	0.258 <sup>†</sup>	0.183 <sup>†</sup>	0.219 <sup>†</sup>	0.605 <sup>†</sup>	-	
15.Health and function	-0.074	0.207 <sup>†</sup>	0.223 <sup>†</sup>	-0.066	0.016	-0.539 <sup>†</sup>	-0.452 <sup>†</sup>	-0.601 <sup>†</sup>	0.191 <sup>†</sup>	0.170 <sup>†</sup>	0.164*	0.037	0.589 <sup>†</sup>	0.552 <sup>†</sup>	-
16.Social-economic	0.027	0.148*	0.173 <sup>†</sup>	-0.073	-0.030	-0.432 <sup>†</sup>	-0.373 <sup>†</sup>	-0.466 <sup>†</sup>	0.222 <sup>†</sup>	0.124*	0.140*	0.222 <sup>†</sup>	0.486 <sup>†</sup>	0.474 <sup>†</sup>	0.680 <sup>†</sup>

<sup>†</sup> Pearson's product moment correlation coefficients or Spearman's rank correlation coefficients, as appropriate.

\* p-value < 0.05.

<sup>†</sup> p-value < 0.01.

(QoL, Quality of life, KO = Knee osteoarthritis)

The bivariate correlations between each of all variables hypothesized in the causal model suggested that certain variables including age, income, education, duration of knee osteoarthritis diagnosis, and BMI were correlated well with each dimension of quality of life (Table 3). Once all of these variables were tested in the causal model by the SEM, results indicated that the initial hypothesized model inadequately fit the empirical data as indicated by most indices ( $\chi^2 = 846.54$ ,  $df = 268$ ,  $p\text{-value} < 0.001$ ,  $\chi^2/df = 3.16$ ,  $RMSEA = 0.09$ ,  $IFI = 0.86$  and  $CFI = 0.86$ ). After certain variables (i.e., age, education, body mass index, duration of illness, and income) were omitted as depicted in Figure 2, all indices for the goodness-of-fit improved and indicated an adequate fit except the significant chi-square test ( $\chi^2 = 638.76$ ,  $df = 258$ ,  $p\text{-value} < 0.001$ ,  $\chi^2/df = 2.48$ ,  $RMSEA = 0.07$ ,  $IFI = 0.91$ , and  $CFI = 0.91$ ). The Fit indices resulted from SEM prior to and after model modification were presented in Table 4. This finding indicated that the modified causal model of quality of life with knee osteoarthritis severity and social support among patients with knee osteoarthritis fit the empirical data adequately as hypothesized<sup>25</sup>.

In terms of direct effects of the causal factors on quality of life, both knee osteoarthritis severity as a health-related factor and social support which as a

social/culture/environmental factor were significantly associated with quality of life. Direct pathway from knee osteoarthritis severity to quality of life was negatively significant (standardized pathway coefficient = -0.49,  $p\text{-value} < 0.01$ ); while direct pathway from social support to quality of life was positively significant (standardized pathway coefficient = 0.30,  $p\text{-value} < 0.01$ ). These two causal factors could explain 33% of the variance of quality of life ( $R^2 = 0.33$ ) (Figure 2).

### 3.3. Discussion

In this correlational study, quality of life of Thai patients with knee osteoarthritis according to Zhan's concept was determined, and direct effects of the causal factors according to Zhan's concept on quality of life, including personal background factors, health-related factors, and social/cultural/environmental factors were examined using the SEM. The findings according to study objectives were worth discussing as follows.

#### *Quality of life of elderly patients with knee osteoarthritis*

The findings showed the quality of life at a moderate level. It was similar to those found in the previous literature<sup>10,23</sup>. With a high level of quality of life

**Table 4.** The Fit indices resulted from SEM prior to and after model modification

Fit indices	Criterion	Results prior to modification	Results after modification	interpretation
$\chi^2$ , p-value	p > 0.05	846.54, p<.001	638.76, p<.001	Reject
$\chi^2/df$	< 5.00	3.16	2.48	Accept
IFI	> 0.90	0.86	0.91	Accept
CFI	> 0.90	0.86	0.91	Accept
RMSEA	< 0.08	0.09	0.07	Accept

in life satisfaction and social-economic dimensions, these patients were content with their housing, facilities for daily living, and treatments given. They also felt that they lived an accomplished life. They perceived adequate intention and care of their family members in daily living and accompanying them to the scheduled clinic appointment. They did not perceive that osteoarthritis limited their participation in family and social activities or their job performance. The majority did not have medical expense problems. The majority of these patients were housewives or homemakers (40.0%), married (60.0%), and with an average monthly income of 9,700 baht. These factors could allow them to have a satisfactory living. In addition, universal coverage offering healthcare service free of charge could also alleviate the financial burden on medical care.

### Causal factors of quality of life

The originally hypothesized causal model did not fit the empirical data well. As a result, age, education, body mass index, duration of illness, and income were omitted. Even with modification, the model did not completely fit the empirical data since chi-square test was still statistically significant. Errors of exogenous observed variables, i.e., emotional support, material and service support, acceptance and worth support and information support were allowed to correlate. As a result of the final modified model, chi-square was still statistically significant. This significant difference between the model and empirical data based on chi-square test could be due to a relatively large sample size. A sample size of 300 participants which was 20% larger than an estimated size of 240 could contribute to a smaller observed type I error. In addition, chi-square test is more likely to violating multivariate normality<sup>26</sup>. Other fit indices including  $\chi^2/df = 2.48$ , RMSEA = 0.07, IFI = 0.91 and CFI = 0.91 indicated the better fit to the empirical data of the modified model. Specifically, both  $\chi^2/df$  of 2.48 and RMSEA of 0.07 indicated a fair fit according to the criteria of 2.00 – 5.00<sup>27,28</sup> and < 0.08<sup>24</sup>, respectively.

Among the three main influencing factors of quality of life, only health-related factors and social/cultural/environmental factors were found significantly correlated with quality of life in Thai patients with knee osteoarthritis. For health-related factors, only knee osteoarthritis severity, not body mass index or duration of illness, was negatively correlated

with quality of life; while for social/cultural/environmental factors, only social support, not income, was positively correlated with quality of life (standardized pathway coefficient = -0.49 and 0.30, respectively, p-value < 0.01 for both). These two significant predictors could explain a moderate portion of the variance of quality of life (33%). This finding was consistent with the study hypothesis. Based on Zhan's concept of quality of life, certain components of health-related factors, and social/cultural/ environmental factors, but not personal background factors were found to have influence on quality of life based on our findings.

*Knee osteoarthritis severity* was negatively associated with quality of life. When aging, pain, stiffness, and physical function limitation on activities of daily living of knee joints get worse; hence a decrease in quality of life. The finding is consistent with previous studies revealing that knee osteoarthritis severity is negatively associated with quality of life in the elderly patients with knee osteoarthritis<sup>5-7,29-30</sup>. With more pain, stiffness, and physical function limitation on activities of daily living, the patients feel the loss of ability in their movement and mobility. They feel the loss of social role and participate less in social activities. They are frustrated with dependence on others. In addition, with the chronic nature of osteoarthritis and its treatment, they are frustrated with the accumulating medical expense. As a result, a more severe osteoarthritis damages all dimensions of quality of life, namely life satisfaction, self-concept, health and function, and social-economic.

*Social support* was found to have a positive effect on quality of life in patients with knee osteoarthritis. The patients could gain more social support emotionally when they perceive that someone encourages them in continuing the treatment. They could gain more acceptance and value support by others when they are accepted, respected and valued by others despite their osteoarthritis. More information support could be gained by perceiving that there is always someone willing and readily available to provide advice on self-care for osteoarthritis. The patients could gain more material and service support when they perceive that family members are available to help perform household chores so they can have more rest. With all dimensions of social support, the elderly with knee osteoarthritis could have higher quality of life. The results are in line with other research that found social



support offers positive effect on quality of life in the elderly with knee osteoarthritis<sup>15-17</sup>.

This study found that quality of life in patients with knee osteoarthritis was not significantly associated with personal background factors (i.e., age and education level), some health-related factors (i.e., body mass index and duration of illness), and one of social/cultural/environmental factors (i.e., income). This is inconsistent with Zhan's concept and previous studies showing that age, body mass index, and duration of illness are negatively associated with quality of life while education level and income are positively associated with quality of life in patients with knee osteoarthritis.<sup>10-14,18,30</sup> The direction of the associations of these variables with quality of life in our study was consistent with those found in previous studies, but the strength of the associations was too low to reach a statistically significant level. This could be due to a homogenous nature of the participants in the present study. Specifically, almost 60% of the participants were in their 60 – 70 years of age, almost two-thirds (64%) had primary education, about three-quarters (75.3%) had income, as high as 64% had knee osteoarthritis not more than 5 years, and more than half had an BMI of 25.0 kg/m<sup>2</sup> (51.3%). These relatively homogenous characteristics of the participants could contribute to nonsignificant effects of these factors on quality of life.

### 3.4. Limitations

This study had certain limitations. *First*, in rating severity of knee osteoarthritis, the use of visual analog scale for these Thai elderly patients could be problematic. To verify the level of their severity using the modified WOMAC scale, either on pain, stiffness, or physical function limitation, uncertainty or indecisiveness was shown in many participants despite the advice from the trained research assistants. Thus, the results on the associations of knee osteoarthritis severity with quality of life should be interpreted with caution. The *second* limitation could arise from social desirability bias. Since all six research assistants were nurses and nurse assistants that the patients were acquainted with, answers for certain questions from these patients could be deviated from the truth. For example, are you bored with complying with the treatment for knee osteoarthritis prescribed by the doctor. The *third* limitation could be from the purposive sampling method on patients within Nakhonnayok province, a specific geographical area of Thailand. The sample may not be representative of Thai patient population, which limits generalizability of the findings to Thai elderly patients with knee osteoarthritis. *Lastly*, the cross-sectional design used in this study limits assessing changes in quality of life and causal relationship over time.

Future research needs to consider the use of a longitudinal study, which will enable us to address, over time, the causal relationship among knee osteoarthritis severity, social support, and the quality of life of Thai patients with knee osteoarthritis. In addition, future experimental studies should investigate the effectiveness of interventions that improve social support and relieve knee osteoarthritis severity. Moreover, for the causal model, with 33% of the variance of quality of life explained by social support and knee osteoarthritis severity, other factors with potential influence on quality of life should be studied to broaden options for improving quality of life in patients with knee osteoarthritis. Qualitative research on factors influencing quality of life should also be conducted. As the limitation of using the visual analog scale, to obtain more reliable conclusions, other scales or methods should be used to assess the severity of knee osteoarthritis. Additionally, in order to minimize social desirability bias, research assistants who are not health professionals should be considered. Finally, expanding and strengthening the model's generalizability may require testing it on a larger sample of individuals with knee osteoarthritis.

### 4. CONCLUSION

It can be concluded that quality of life of Thai patients with knee osteoarthritis based on Zhan's concept was at a moderate level. The modified causal model tested with the SEM revealed a good fit with the empirical data. Based on our findings, certain components of health-related factors, and social/cultural/environmental factors, but not personal background factors were found to have influence on quality of life. Social support, which was a social/cultural/environmental factor, significantly directly influenced on quality of life, with positive effect. While knee osteoarthritis severity, which was a health-related factor, significantly, directly influenced on quality of life, with negative effects. These two influencing factors explained 33% of the quality of life variance. Health care professionals should provide more programs with activities to promote social support and alleviate knee osteoarthritis severity for the Thai elderly patients with knee osteoarthritis.

Regarding clinical practice and policy making, since knee osteoarthritis severity had a direct influence on quality of life, more programs with activities to prevent and alleviate the symptoms should be implemented with the co-operations of the community, family members and healthcare professionals. With a direct influence of social support on quality of life, more programs with activities to strengthen social support by supporting emotion, acceptance and value, material and service, and information should be implemented.

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### Conflict of interest

The authors declare that they have no conflict of interest.

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### Ethics approval

The study was approved by the Ethics Committee for Human Study of Srinakharinwirot University (approval number: SWUEC/X-201/2561).

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