

Research Article

The Predictive Models of Quality of Life for Individuals with Systemic Lupus Erythematosus – The Application of the Path Analysis

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ABSTRACT

Purpose: Systemic lupus erythematosus is an autoimmune disease with an unknown etiology. The uncertainty of this disease causes physical discomfort and mental health distress. The purpose of this study is to apply a path analysis to verify proposed predictive quality of life models for persons with Systemic lupus erythematosus.

Methods: 94 participants were recruited from an outpatient clinic from a medical center in northern Taiwan. Participants were invited to join the study if they were able to meet inclusion criteria. Participants were evaluated by the attending physician via routine clinic visits and interviews. The participants then provided self-reports pertaining to their current levels of fatigue, pain, depression, anxiety, sense of competence, environmental impact, sense of mastery, and overall quality of life. SPSS (19th version) and LISREL (8.5th version) were used to analyze the dataset.

Results: The findings of the study confirmed that the severity of the disease was related to the patients' perceived quality of life. Furthermore, their sense of competence, fatigue, pain, depression, and anxiety had both direct and indirect effects on their quality of life. Fatigue, depression, sense of competence, and environmental impact derived the biggest total effect on physical health, psychological health, social relationships, and environmental domains of quality of life respectively.

Conclusions: The results of the study provide implications for clinicians who serve persons with Systemic lupus erythematosus. Suggested directions would include maintaining disease stability; managing physical and psychological health and secure of environmental resources.

Mesh Headings/Keywords: Systemic lupus erythematosus; Quality of life; Models; Statistical; Occupational therapy.

Introduction

Systemic lupus erythematosus (SLE) is a chronic autoimmune disease that has diverse complications. With the continual progress of medication and a better understanding of SLE, although the incident rates have increased three-fold within the past 40 years, the survival rate of the disease increased as well [1]. With the increasing prevalence rate, the healthcare cost of this population has also steadily become higher. A systematic review encompassing the years from 1990 to 2011 concluded that the mean annual direct and indirect cost per patient was anywhere between US\$2,214 ~ 16,875 and US\$ 2,239 ~ 35,540 respectively [2]. Some literature alluded to the idea that poor mental and physical healths were predictors of increased costs of healthcare since deterioration in mental and physical health interferes with the quality of life (QOL) for persons with SLE [3]. Among these, 67-90% of individuals reported that they had fatigue and pain problems [4]. Furthermore, the co-existing psychiatric diagnoses or psychological distress exacerbated

the already existing problems [5]. Additionally, glucocorticoid dosage and the total number of hospitalizations were said to be indicators of a flare up of the disease, and fluctuations in the disease process was an indicator of patients' self-perceived wellness [6].

Quality of life reflects ones' feeling toward their sense of well-being. Occupational therapy is a profession assisting clients in restoring their personal well-being by helping them to reengage in meaningful daily occupations [7]. Literature has shown that patients with SLE experience lower health-related QOL's (30~40%) in comparison to their healthy peers [8]. Gallop and Sutanto et al. developed a conceptual model illustrating the impact of SLE on patients' QOL. The model looked at symptoms, functions, and illness severity as predictors for QOL. The results showed that disease status and working status were significant predictors for QOL [9].

Based on previous research findings, we proposed a predictive model for the QOL of persons living with SLE. The

model takes into consideration various variables of symptoms, including pain, fatigue, depression, and anxiety, illness severity, such as disease activity, patient demographics, including age, education, marital status, working status, work satisfaction etc., factors related to participation, such as a sense of competence and mastery, and environmental support. The outcome variable of the model was adapted from the World Health Organization quality of life scale-brief version. It includes physical, psychological, social and environmental domains. Figures 1a-1d shows the initial model for each domain. We applied a path analysis in order to analyze the dataset. Path analysis has the merit to provide standardized coefficients demonstrating direct and indirect, as well as total effect of predicting factors on outcome variables (4 domains of QOL). The total effect of each predictor then provides an index of the magnitude of the impact of that variable on the outcome variable [10]. The index can then be utilized in clinical application to target an essential variable for improvement. Thus, our study hypotheses are as follows:

Hypothesis 1: A higher level of illness severity (e.g. disease activity and medication use) for the participant would result in a lower level of QOL for all domains.

Hypothesis 2: Increased levels of fatigue and pain, lower education levels, lower levels of competence and mastery will result in a lower physical QOL.

Hypothesis 3: Higher levels of depression and anxiety coupled with lower levels of competence and mastery will result in a lower psychological QOL.

Hypothesis 4: Individuals who live alone, have higher levels of depression and anxiety, and lower levels of competence and mastery will result in a lower social relationship QOL.

Hypothesis 5: The higher the number of depressive symptom, the lower the education level and level of work satisfaction, combined with an unfavorable work status, and lower levels of environmental impact and mastery will result in a lower environmental QOL.

Hypothesis 6: A lower sense of competence, environmental impact, and sense of mastery will result in a lower QOL in all 4 domains of QOL.

Materials and Methods

Participants

The subjects were recruited from the outpatient clinic of a university affiliated hospital in northern Taiwan. Inclusion criteria included: (1) fulfilling at least 4 of the 11 revised diagnostic criteria of having SLE as defined by the American College of Rheumatology (classification criteria for SLE SLICC 2012) [11]; (2) be above the age of 20; (3) have a minimum educational level of fifth grade at the elementary school level; and (4) achieve a score equal to or above 24 on the MMSE (Mini-Mental State Examination) [12].

Procedures

The study was approved by the ethical committee of the National Taiwan University Hospital (IRB approval number: 201405046RIN). The data was collected between July and December of 2014 with the procedure presented in Figure 2. Recruitment criteria was provided to the attending physician of the outpatient clinic in order to facilitate referral of suitable participants for the study. Once the patient was referred, the first author contacted the patient and explained the purpose of the study. If the patient chose to sign an informed consent for participation in the study, they were evaluated using the MMSE to ensure their qualification for the study. Afterwards, the physician assisted in evaluating the disease activity of the patient, and the patient was asked to fill out several computer-based questionnaires using a PC tablet. The entire procedure took approximately 30~40 minutes to complete.

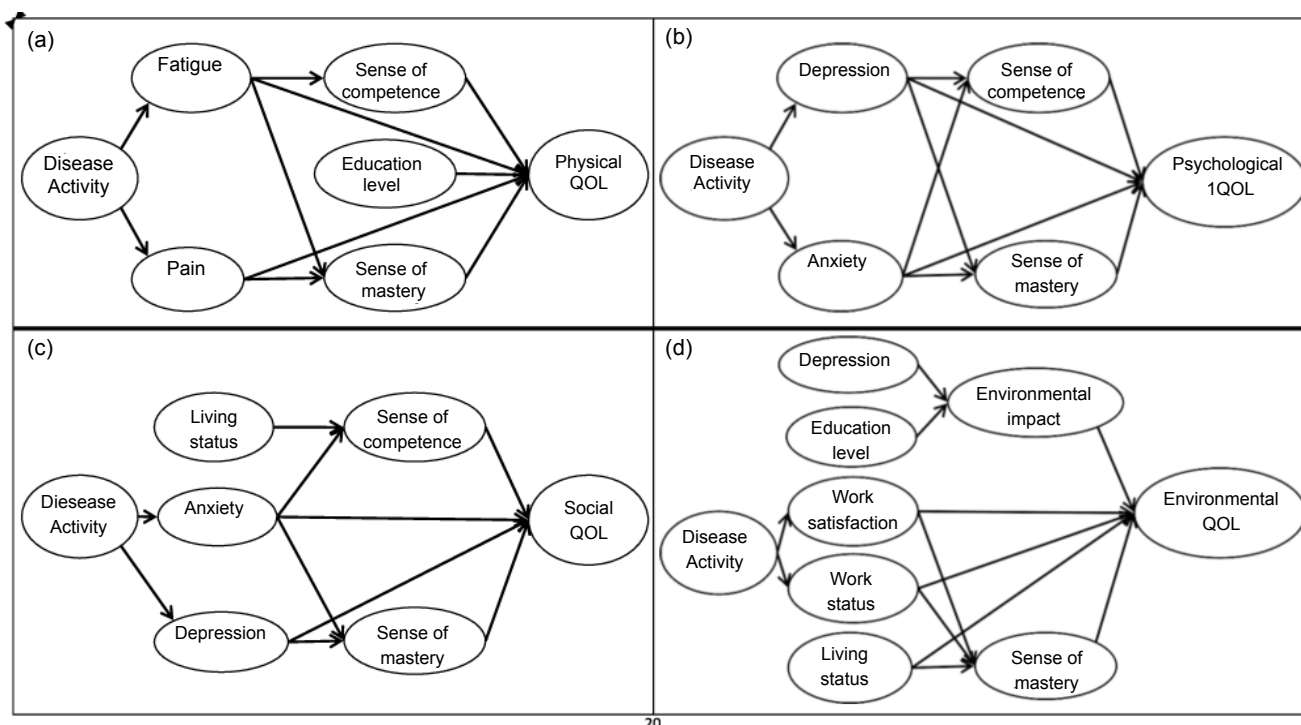


Figure 1: The initial model of 4 domain QOL.

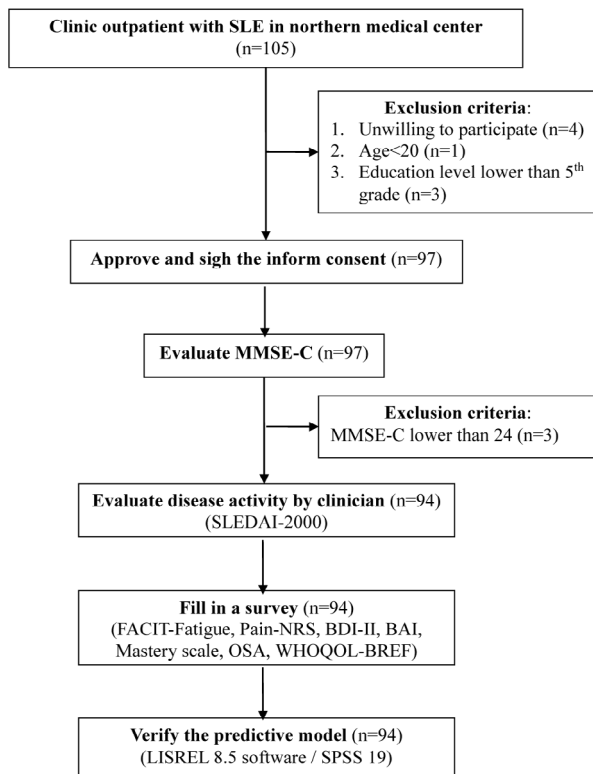


Figure 2: Enrollment procedure.

Measures

The Systemic Lupus Erythematosus Disease Activity Index 2000 (SLEDAI-2000): The SLEDAI was constructed by a panel of experts of rheumatologists in 1958 [13]. The newer modified SLEDAI-2000 has 24 items with a total possible score of 105. The higher the score is, the more severe the disease activity. A score of 6 or below indicates inactive or mild disease activity; scores of 7 to 12 points represent moderately active disease activity; and scores of 13 and above is considered severe disease activity. The SLEDAI-2000 was proven to be a predictor of mortality and was sensitive to change [14].

The Functional Assessment of Chronic Illness Therapy – Fatigue Scale (FACIT-F): The FACIT-Fatigue scale is a multi-facet assessment used to evaluate an individual’s level of fatigue [15]. It includes items from multiple dimensions that take into account the physical, functional, or emotional aspects of fatigue. Items are scored on a 4-point rating scale, with 0 indicating “not at all” and 4 representing “very much”. The scores can range from 0 to 52, with a higher score indicating a higher level of fatigue perceived by the patient.

The Pain – Numerical Rating Scale (Pain – NRS): The Pain–NRS is a free questionnaire that can be downloaded and is composed of a 100 millimeter horizontal line with descriptions on both sides. At the extreme left of the line, 0 indicates “no pain” and on the opposite end, 10 indicates “I’ve never experienced that kind of pain” [16]. The psychometrics of using this type of scale has previously been proven to be excellent in determining an individual’s true feelings and ratings are clinically significant [17].

The Beck Depression Inventory – Second Version (BDI-II): The BDI was developed by Aaron T Beck in 1961 [18]. The scale includes somatic-affective (12 items) and cognitive

(9 items) dimensions culminating in a total of 21 questions. The client is asked to choose a description for his (her) status regarding the intensity, or degree, of disturbance of the symptom based on a 4-point rating scale (0-3) [19]. The Chinese version of the BDI-II was published in 2000. It has proven to have acceptable internal consistency (Cronbach α 92), construct validity, and sensitivity [20].

The Beck Anxiety Inventory (BAI): The BAI was developed for measuring common symptoms of clinical anxiety by Aaron T Beck [21]. It is a 21-item scale where all items are scored between 0 to 3, with 0 corresponding to “not at all” and 3 corresponding to “severely, I could barely stand it”. Therefore, the higher the score on the BAI, the higher the overall severity of anxiety that is perceived by the patient. The Chinese version of the BAI showed excellent internal consistency (Cronbach α 95). The study identified two dimensions which are similar to the results from the English version [22].

The Occupational Self-Assessment (OSA): The OSA was developed based on the model of human occupation (MOHO) [23]. It includes two parts: “myself” (21 items) and “environmental impact”, (8 items) and is rated on a 4-point rating scale. There are two domains for each rating. One is value and the other is competence. We chose to use the competence domain in the study [24]. The Chinese version of the OSA was developed and yielded good construct validity, moderate test-retest reliability, and moderate concurrent validity [25,26].

The Mastery Scale (MS): The mastery scale was introduced by Pearlin and Schooler in 1987 [27]. There are 7 items within the scale and it is rated on a 5-point rating scale. A score of 1 indicates “strongly disagree” and score of 5 indicates “strongly agree” [28]. The Chinese version of the mastery scale was developed and has demonstrated uni-dimensional construct and acceptable clinical utility among different groups of patients [29].

The World Health Organization Quality of Life – BREF – Taiwan Version (WHOQOL-BREF-TW): The WHOQOL – BREF is the shorter version of the WHOQOL. A total of 26 items and 2 national items (overall QOL and overall health QOL) are grouped into 4 domains and include physical health, psychological health, social relationships, and environmental QOL [30]. All questions are rated on a 5-point rating scale. A higher total score indicates a better QOL. The Chinese version of the WHOQOL – BREF was translated and validated in 1991. The questionnaire has adequate validity, excellent discriminant validity, construct validity, and responsiveness [31].

Data Analysis

Statistical analysis including descriptive, inferential statistics, and path analysis was used. We will describe the central tendency and divergent trend for each variable in the path models. We will also compute the correlation coefficients among all variables to validate the QOL models. An independent t-test was applied to examine the relationships between QOL (4 domains QOL, overall QOL, and overall health QOL) and different variables including frequency of hospitalization, work status, marital status, glucocorticoids dosage, and disease activity. Hospitalization frequency was grouped into two groups (<4 times or \geq 4 times). Work status was categorized as having a

job or no job. Marital status was grouped into married or single groups. glucocorticoids dosage was divided based on dosage being above or equal to 15 mg, or lower than 15 mg per day. And disease activity was grouped into SLEDAI < 6 or SLEDAI \geq 6. The significance level of p-value was set at 0.05.

We first tested the model fitness. If there was an insignificant path, it would be eliminated or retained based on its importance. Then, the model fit was checked again and the coefficients for each path were calculated until all paths were deemed significant. The following indices were used to indicate an acceptable model fit. Chi-square (χ^2) and p-value is higher than 0.05. The goodness of fit index (GFI), adjusted goodness of fit index (AGFI), comparative fit index (CFI), and normed fit index (NFI) is greater than 0.9 [31,32]. The direct and indirect effect and total effect of the predictive variables in 4 predictive models were computed. All of the above analyses were performed using SPSS (version 19.0) and LISREL version 8.5.

Results

The Characteristics of Subjects

The demographics of the participants are presented in Tables 1 and 2. Amongst the 105 patients who participated in the study, 11 were excluded, resulting in a total of 94 participants. The rejection rate for the subject recruitment was 3.2%. The reasons for rejection included unwillingness to participate (n=4), participant whose age was lower than the inclusion criteria set forth of 20 (n=1), insufficient educational levels (n=3), and insufficient cognitive functioning (n=3). The mean age of the participants was 49.47 years (SD = 11.03 years) (ranging from 20 to 70 years old). A majority of the participants were female (92.6%), had completed a college education (46.8%), and were married (68.1%).

The Relationship between QOL and Predictive Variables

The results of the correlation coefficient amongst the QOL, demographics and illness variables showed that the only significant correlation is between the health-related QOL and the dosage of glucocorticoids intake. The results of the t-test showed that there was a significant difference of the overall quality of life for groups who were admitted to the hospital in comparison to those who were not ($p = 0.024$). The less often hospitalized group had an overall higher QOL. There was also a significant difference in the overall health QOL between the groups with higher (>15 mg/per day) dosages of glucocorticoids intake and lower use group ($p = 0.032$). The lower use group demonstrated a better overall health QOL (Table 3).

The Initial and Final Path Model

The results of the path analysis for the initial models were presented in Table 4. After eliminating insignificant paths for all models, the resulting final models were shown in Table 5. The fit indices of the final path models were presented in Table 5 and Figures 3-6. The Chi-square was adequate (p -value > 0.05). The indices of fitness were acceptable (GFI > 0.9, AGFI \geq 0.9, NFI > 0.9, and CFI > 0.9). The decomposition of the direct, indirect, causal, non-causal, and total effects of the final path models were presented in Table 6.

In terms of the proportion of the variance explained in the 4 predictive QOL models, the predictive variables explained

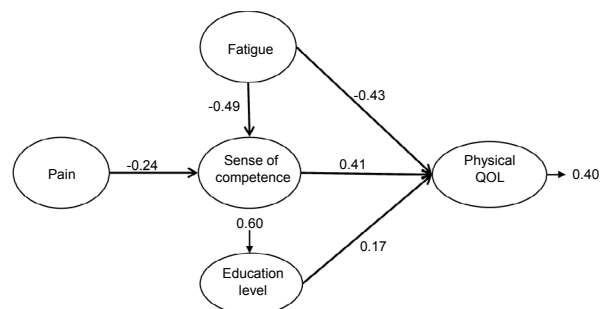


Figure 3: The final model of physical health QOL.

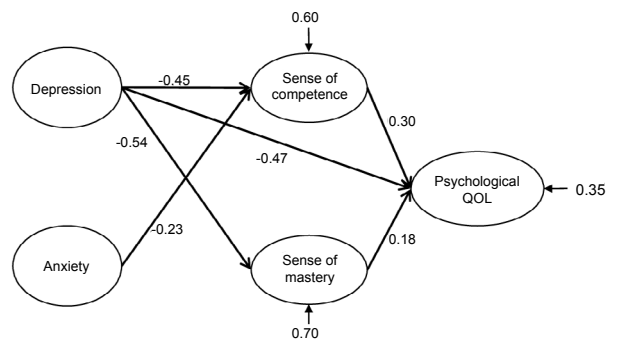


Figure 4: The final model of psychological health QOL.

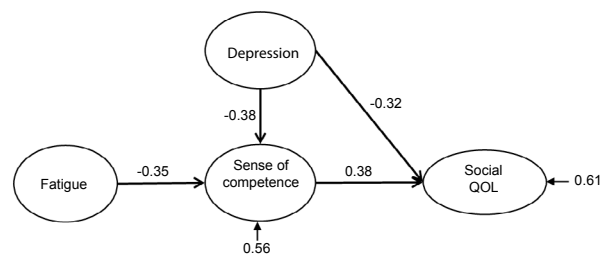


Figure 5: The final model of social relationships QOL.



Figure 6: The final model of environmental QOL.

the highest variance in the psychological health model (65%), followed by 60% in the physical health model, 40% in the environmental model, and 38% in the social relationships model. Fatigue, depression, a sense of competence, and environmental impacts were the most influential predictors in 4 domains of predictive QOL model. In the physical health QOL model, fatigue had the highest total effect (-0.63), followed by a sense of competence (0.41), education level (0.17), and pain (-0.10). In the psychological health QOL model, depression had the highest total effect in the model (-0.70), followed by a sense of competence (0.30), sense of mastery (0.18), and anxiety (-0.07). In the social relationships QOL model, depression symptoms had the highest total effect in the model (-0.46), followed by sense of competence (0.38) and fatigue (-0.13). In the environmental QOL model, environmental impact had the highest total effect in the model (0.57), followed by depression (-0.21), work satisfaction (0.21), and education level (0.13).

Table 1: Characteristics of subjects (n=94).

Age (range, mean \pm SD years)	20.32~70.42, 49.47 \pm 11.03	
Gender (n, %)		
Men	7, 7.4%	
Female	87, 92.6%	
Education level (n, %)		
Elementary school	3, 3.2%	
Junior high	10, 10.6%	
Senior high	29, 30.9%	
College	44, 46.8%	
Higher education	8, 8.5%	
Disease duration (range, mean \pm SD years)	1~42, 14.77 \pm 8.84	
Onset age (range, mean \pm SD years)	13.8~60.4, 34.7 \pm 13.06	
Marital status (n, %)		
Single	24, 25.5%	
Married	64, 68.1%	
Divorced	5, 5.3%	
Widowed	1, 1.1%	
Working status (n, %)		
Full-time	48, 51.1%	
Part-time	5, 5.3%	
Unemployed	11, 11.7%	
Retired	30, 31.9%	
Glucocorticoids (range, mean \pm SD mg per day)	0~30, 7.85 \pm 6.55	
Quinine per day (range, mean \pm SD)	0~4, 1.32 \pm 0.79	
Immunosuppressant (n, %)		
Yes	34, 36.2%	
No	60, 63.8%	
Hypnotics (n, %)		
Yes	24, 25.5%	
No	70, 74.5%	

Table 2: The descriptive data of predictive variables.

Predictive Variable	Mean	Standard deviation	Median	Interquartile range	Shapiro-Wilk test	
					Statistics	p-value
Fatigue	14.36	8.26	13	8	0.9	<.001*
Pain	2.21	2.85	0.5	4.1	0.78	<.001*
Depressive symptoms	10.31	10.3	8	12	0.827	<.001*
Anxiety	10.69	10.35	8	11	0.827	<.001*
Disease activity	5.12	2.66	4	2	0.911	<.001*
Sense of competence	63.2	9.56	63	8	0.924	<.001*
Sense of mastery	19.35	3.23	20	4	0.976	0.076
Environmental impact	25.07	4.29	24	5	0.918	<.001*
Quality of life						
Physical QOL	13.29	2.72	13.61	4	0.981	0.199
Psychological QOL	12.72	2.95	12.67	5	0.973	.047*
Social QOL	13.52	2.05	14	3	0.939	<.001*
Environmental QOL	14.34	2.08	14.67	3.11	0.978	0.116

* not normally distributed

In terms of the direct and indirect effects, fatigue, a sense of competence, and education level had direct effects on the physical health QOL, while pain and fatigue had indirect effects on the physical health QOL through sense of competence. Depression, a sense of competence, and a sense of mastery had direct effects on the psychological health QOL, while anxiety

and depression had indirect effects on the psychological health QOL through sense of competence. Depression, a sense of competence, and functional statuses all had direct effects on the social relationships QOL, and fatigue and depression had indirect effects on the social relationships QOL through sense of competence. Environmental impact and work satisfaction

Table 3: The comparison of the mean differences between groups of predictive variables.

Variables	Groups	Physical QOL	Psychological QOL	Social QOL	Environmental QOL	Overall QOL	Overall health QOL
SLEDAI (raw score)	≥6	0.482	0.351	0.223	0.195	0.217	0.252
	<6						
Hospitalized (times)	≥4	0.891	0.339	0.887	0.725	0.024*	0.371
	<4						
Glucocorticoids (mg/day)	≥15	0.709	0.686	0.441	0.535	0.577	0.032*
	<15						
Work status	Employed	0.849	0.828	0.999	0.911	0.277	0.567
	Unemployed						
Marital status	Single	0.955	0.632	0.681	0.913	0.413	1
	Married						

*significance : p<0.05

Table 4: Regression coefficients and variance explained for initial predictive QOL models.

Dependent Variable	Independent Variable	R	SE	t value	R ²
Physical health QOL					
Physical QOL	Fatigue	-0.38*	0.08	-4.21*	0.56
	Pain	-0.11	0.07	-1.54	
	Sense of competence	0.33*	0.08	3.95*	
	Mastery	0.12	0.07	1.67	
	Education level	0.15	0.07	2.31	
Sense of competence	Fatigue	-0.49*	0.08	-6.07*	0.34
	Pain	-0.24*	0.08	-2.99*	
Mastery	Fatigue	-0.33*	0.1	-3.42*	0.13
	Pain	-0.12	0.1	-1.27	
Fatigue	Disease activity	0.17	0.1	1.6	0.03
	Pain	0.21*	0.1	2.03*	
Psychological health QOL					
Psychological QOL	Depression	-0.47*	0.08	-5.90*	0.63
	Anxiety	0.01	0.06	0.17	
	Sense of competence	0.31*	0.08	3.92*	
	Mastery	0.18*	0.07	2.45*	
	Depression	-0.45*	0.08	-5.57*	
Sense of competence	Anxiety	-0.23*	0.08	-2.80*	0.31
	Depression	-0.54*	0.09	-6.11*	
Mastery	Anxiety	-0.01	0.09	-0.15	0.29
	Depression	0.26*	0.1	2.60*	
Depression	Disease activity	0.26*	0.1	2.60*	0.07
	Anxiety	0.17	0.1	1.65	
Social relationships QOL					
Social QOL	Living status	0.13	0.08	1.61	0.38
	Depression	-0.30*	0.1	-2.95*	
	Fatigue	-0.09	0.09	-1.01	
	Sense of competence	0.33*	0.11	3.06*	
	Mastery	0.07	0.1	0.73	
Sense of competence	Living status	0.04	0.08	0.44	0.34
	Depression	-0.39*	0.08	-5.00*	
Mastery	Fatigue	-0.35*	0.08	-4.47*	0.27
	Living status	-0.02	0.09	-0.25	
	Depression	-0.50*	0.09	-5.73*	
Depression	Fatigue	-0.05	0.09	-0.54	0.07
	Disease activity	0.26*	0.1	2.59*	
Fatigue	Disease activity	0.17	0.1	1.6	0.03

Environmental QOL					
Environmental QOL	Work satisfaction	0.16*	0.08	2.01*	0.38
	Work status	-0.03	0.08	-0.32	
	Living status	-0.07	-0.08	-0.9	
	Environmental impact	0.43*	0.08	5.35*	
	Mastery	0.25*	0.08	3.05*	
Environmental impact	Work satisfaction	-0.01	0.09	-0.11	0.22
	Work status	-0.13	0.09	-1.42	
	Living status	0	0.1	-0.01	
	Depression	-0.37*	0.1	-3.59*	
	Education level	0.19*	0.09	2.01*	
Mastery	Work satisfaction	0.21*	0.1	-2.08*	0.11
	Work status	-0.14	0.1	-1.42	
	Living status	-0.21*	0.1	-2.08*	
Work satisfaction	Disease activity	-0.19	0.1	-1.8	0.04
Work status	Disease activity	0.19	0.1	1.81	0.04

Abbreviations: R (regression coefficient); SE (standardized error); R² (r-squared; explained variance) *significance: p<0.05

Table 5: Regression coefficients and variance explained for final predictive QOL models.

Dependent variable	Independent variable	R	SE	t-value	R ²
Physical health QOL					
Physical QOL	Sense of competence	0.41*	0.08	4.92*	0.6
	Fatigue	-0.43*	0.08	-5.17*	
	Education level	0.17*	0.07	2.56*	
Sense of competence	Fatigue	-0.49*	0.09	-5.42*	0.4
	Pain	-0.24*	0.09	-2.67*	
Psychological health QOL					
Psychological QOL	Sense of competence	0.30*	0.08	3.96*	0.65
	Depression	-0.47*	0.09	-5.41*	
	Mastery	0.18*	0.07	2.44*	
Sense of competence	Depression	-0.45*	0.11	-4.09*	0.4
	Anxiety	-0.23*	0.11	-2.05*	
Mastery	Depression	-0.54*	0.09	-6.18*	0.3
Social relationships QOL					
Social QOL	Sense of competence	0.38*	0.1	3.70*	0.39
	Depression	-0.32*	0.1	-3.09*	
Sense of competence	Depression	-0.38*	0.1	-3.71*	0.44
	Fatigue	-0.35*	0.1	-3.38*	
Environmental QOL					
Environmental QOL	Environmental impact	0.57*	0.08	6.98*	0.41
	Work satisfaction	0.21*	0.08	2.52*	
Environmental impact	Depression	-0.37*	0.09	-3.97*	0.21
	Education level	0.23*	0.09	2.40*	

Abbreviations: R (regression coefficient); SE (standardized error); R² (r-squared; explained variance) *significance: p<0.05

had direct effects on the environmental QOL, while education level and depression had indirect effects on the environmental QOL through environmental impact. A sense of competence and depression were the leading predictors for three predictive QOL models. The existence of depression had the greatest indirect effect on all models, with this effect being mediated through the level of sense of competence and sense of mastery.

Discussion

The findings from the study indicate that patients with SLE are more satisfied within the domain of the environmental QOL, but are less satisfied within the domain of the psychological QOL. They were satisfied with the medical resources available

Table 6: Decomposition of direct, indirect, and total effect of final predictive quality of life models.

QOL Domain Bivariate Relationships	Direct	Indirect	Casual	Non-casual	Total
Physical health QOL					
Sense of competence	0.41	—	0.41	0.28	0.69
Fatigue	-0.43	-0.2	-0.63	-0.03	-0.66
Pain	—	-0.1	-0.1	-0.38	-0.48
Education level	0.17	—	0.17	0.05	0.22
Psychological health QOL					
Sense of competence	0.3	—	0.3	0.38	0.68
Sense of mastery	0.18	—	0.18	0.41	0.59
Depression	-0.47	-0.23	-0.7	-0.05	-0.75
Anxiety	—	-0.07	-0.07	-0.47	-0.54
Social relationships QOL					
Sense of competence	0.38	—	0.38	0.19	0.57
Depression	-0.32	-0.14	-0.46	-0.09	-0.55
Fatigue	—	-0.13	-0.13	-0.34	-0.47
Environmental QOL					
Environmental impact	0.57	—	0.57	0.03	0.6
Depression	—	-0.21	-0.21	-0.26	-0.47
Education level	—	0.13	0.13	0.11	0.24
Work satisfaction	0.21	—	0.21	0.07	0.28

to them, their living status, and the transportation system. However, they were dissatisfied with their sleep condition and ability to concentrate. Furthermore, they believed that they could not enjoy their daily lives. In fact, patients with SLE were observed to worry more about their health condition and have greater negative feelings towards their appearance and ability to deal with the circumstances of their lives [33,34]. Moreover, their self-perceived levels of stress were relatively higher than the other rheumatological illness due to issues in their marriages, complications in pregnancies, and inadequate social adaptations. These concerns may provide explanations for their overall lower psychological QOL [35]. The other explanation may be the neurologic manifestations of SLE. Neuronal cytotoxicity and atrophy of dendritic spine were found in the center nervous system among individuals with SLE [36]. These evidence may support the psychological distress among individuals with SLE in our study.

Since the dose of glucocorticoids derived an effect on the QOL, we found that individuals with SLE who were prescribed more glucocorticoids were more likely to perceive lower overall health QOL than those who took fewer glucocorticoids. Additionally, if individuals with SLE had more hospitalized experience, they felt less in control of lives and yield thoughts of helplessness. The results were consistent with previous studies that found glucocorticoids dosage and the experience of hospitalization were indicators in the flare up of SLE disease activity [8].

For the physical health QOL model, pain symptoms only derived indirect influences on physical QOL via sense of competence. The result is consistent with findings from a previous study indicating that although pain exists during the illness process [37-39] it is better for the clients to move on to participate in more activities [36].

Anxiety symptoms only derived indirect effects on the psychological QOL, which is also similar to previous research, showing that anxiety would increase the likelihood of physical illness, causing physical problems. These physical problems reduced the capacity in which the clients were able to deal with life's daily challenges and caused them to associate with poorer functional outcomes resulting in a decreased QOL [40].

Our study is unique in that we adapted the WHOQOL-BREF-TW as the outcome measure which includes environmental aspects regarded as relevant to the Asian culture [41]. For the environmental QOL model, educational level had an indirect effect on the environmental QOL through environmental impact. The finding is consistent with a study conducted in Brazil that revealed a higher educational level correlated to a better environmental QOL. The researchers stated that SLE individuals with higher educational levels may be more apt to adopt useful cognitive or behavior strategies in order to better cope with their situations [42,43].

There are limitations in this study. The sample size is small and the SLE participants were recruited from a single resource. This will have an effect on the variation of the disease activity and the generalizability of our findings [44,45]. Predictive variables were most non-normally distributed except for sense of mastery, physical QOL and social QOL, thus, the interpretation of the results need to be cautious. The non-normally distributed nature of predictive variables may bias the results of study. Finally, the glucocorticoids we collected is self-reported current dose. It may be interested to look at the average dose of glucocorticoids from medical chart review in the future.

The findings of our study provide directions for future study and clinical application. Since depression, fatigue, and a sense of competence are 3 variables that have the largest effect on self-perceived QOL, intervention targeted on strategies of

management of depression, anxiety, fatigue and pain is important towards helping individuals with SLE achieve a better QOL. It would also be beneficial to educate the effect of medication to prevent recurrence and admission to the hospital, which has shown to greatly deteriorate perceived QOL among individuals with SLE. From these educational and training efforts, individuals with SLE will have a better sense of competence. Self-help courses, telephone counseling, or psycho-educational intervention may also help individuals with SLE to feel more in control of their illness [46].

In the future, variables such as self-rated disease activity and sleep quality index should be incorporated into the model. There is also a need to enlarge the sample population and to recruit subjects from a variety of resources. Finally, clinical trials targeting improvement of the QOL of the persons with SLE can be constructed and tested.

Acknowledgements

This study was supported by research grants funded by the Ministry of Science and Technology of Taiwan (MOST 102-2511-S-002-004-MY2; MOST 103-2314-B-002 -179 -MY3).

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Submitted May 19, 2016

Accepted August 02, 2016