Life satisfaction of 511 elderly Chinese stroke survivors: Moderating roles of social functioning and depression in a quality of life model

Introduction

A theoretical quality of life model has outlined the complex relationships between level of physical dependence, social functioning, depression, and life satisfaction for older adults receiving long-term services and supports.[1] However, the model did not put forward the relative importance of different variables in contributing to life satisfaction. Moreover, the degree of satisfaction can be a function of the balance between interdependence and independence.[2] For elderly stroke survivors, loss of functional independence can sabotage their quality of life,[3] but previous inconclusive findings[3-6] imply a need to identify any possible underlying moderators. Research indicated that social functioning or social support[6, 7] as well as post stroke depression[8, 9] could moderate the effect of physical dependence on life satisfaction. In addition, the inclusion of distinct cultural values, such as individualist or collectivist beliefs, in the present quality of life model should provide a novel insight into the mechanism involved.

The objective of the present research is to test the validity of the published quality of life model in relation to predictions about the relationship between depression, physical functioning, social functioning and life satisfaction in elderly Chinese stroke survivors (Figure 1). There are two hypotheses in this research. First, stroke survivors with clinical depression should have poorer physical functioning and social functioning, as well as lower life satisfaction, compared with survivors without clinical depression. Second, post-stroke depression and social functioning should play moderating roles in buffering the relationship between physical dependence and life

satisfaction among elderly Chinese stroke survivors. It is hoped that this research will provide empirical findings to improve the validity and utility of the aforementioned model.[1]

Method

This research involves participants which were a subset of individuals from a territory-wide cross-sectional survey conducted by the School of Social Development and Public Policy, Beijing Normal University. The sampling process adopted a systematic approach with a two-step scheme from August 2017 to July 2018. First, we randomly selected four out of eight sub-districts in the Fangshan district of the Beijing Municipality in China. And then we obtained the full names of all registered older adults aged 60 years or above residing in these four sub-districts. Official approval was obtained from the Bureau of Civil Affairs of Beijing. This study was also approved by the Human Research Ethics Committee of Beijing Normal University (SSDPP-HSC2018003). Second, a systematic sampling method with fixed sampling intervals (K=6) and nonrepetitive random numbers was adopted. Individuals were included if they were diagnosed of stroke at least once in the past. We trained 60 interviewers with at least a master's degree in social work to conduct face-to-face interviews with the selected elderly people at their homes. Informed consent was obtained prior to conducting the interviews for those accepted the invitation to participate in this survey.

Measurements of life satisfaction and depressive symptoms were carried out using different corresponding scales. Measurements of physical functioning include basic and instrumental activities of daily living, self-perceived health, and number of comorbid chronic illnesses. Social functioning includes sense of loneliness, social

support network, and number of people living together.

Life satisfaction was measured using the Satisfaction With Life Scale.[10] The scale is a short five-item instrument designed to measure global cognitive judgments of satisfaction with one's life. It is rated on a five-point Likert scale. In our sample, the Cronbach's alpha of the scale was 0.86. A higher total score indicates a higher level of life satisfaction.

Depressive symptoms were measured using the Chinese version of the 10-item Center for Epidemiologic Studies Depression Scale.[11] It is a 10-item scale rated on a Likert scale. A higher total score indicates a higher level of severity. In our sample, the Cronbach's alpha of this scale was 0.609. Since a cut-off point of 10 for the diagnosis of mild to moderate depression showed high sensitivity and specificity,[11] elderly stroke survivors with clinical depression were defined with a score higher or equal to 10 points.

Basic activities of daily living was measured using the International Residential Assessment Instrument (interRAI) Activities of Daily Living Hierarchy scale.[12] The scale is a seven-item scale used to measure dependency level when performing across a spectrum of activities of daily living. It is rated on a seven-point Likert scale. In our sample, the Cronbach's alpha of the scale was 0.956. A higher total score indicates a higher dependency level when performing basic ADL.

Instrumental activities of daily living was measured using the interRAI Instrumental Activities of Daily Living Performance scale.[12] This scale is an eight-item scale used to measure the difficulty level experienced by individuals when performing instrumental ADL. It is rated on a seven-point Likert scale. The Cronbach's alpha of the scale was 0.955 in our sample. A higher total score indicates a higher level of difficulty when performing instrumental ADL.

Self-perceived health was assessed on a five-point scale by asking a single question: "How would you rate your perceived physical health?" A higher score indicates better self-perceived physical health.

Number of comorbid chronic illnesses was measured by asking a multiple-choice question: "How many chronic illnesses do you have?" Participants were asked whether or not they had any of 16 chronic illnesses, such as hypertension, heart disease, or dementia. A higher score indicates a higher number of comorbid chronic illnesses.

Sense of loneliness was measured using the Chinese version of the De Jong Gierveld Loneliness Scale.[13] The scale consists of six items used to measure overall, emotional, and social loneliness. It is rated on a three-point Likert scale. The Cronbach's alpha of the overall score was 0.669 in our sample. A higher score indicates a more severe sense of loneliness.

Social support network was assessed using the Lubben Social Network Scale.[14] The scale is a 10-item scale developed for use among older adult populations, to assess social networks and social support. It is rated on a six-point Likert scale. The Cronbach's alpha of the overall score was 0.699 in our sample. A higher score indicates higher levels of social support.

Number of people living together was assessed by a single question: "How many people are living with you?" A higher score indicates a higher number of people living together.

Statistical analyses

The data were analyzed using SPSS version 24.0. First, chi-square and t-tests were conducted to compare differences in sociodemographic factors and various

outcome measures between stroke survivors with and without clinical depression.

Second, sequential regression was employed to determine if adding information about social functioning and depressive symptom improved the prediction of life satisfaction beyond the sociodemographic factors and physical functioning.

Third, the proposed moderating effects of social functioning and depressive symptoms were determined by following the procedures recommended by Frazier, Tix, and Barron.[15] The predictor and moderator variables were standardized to reduce multicollinearity. First, the sociodemographic variables were entered in the first step as a control. Then, different components of physical functioning were included as independent variables (IVs), together with different components of social functioning. Depressive symptoms as moderators were entered individually in the second step. The interaction terms of respective IVs and moderators were entered in the final step. Life satisfaction was treated as a dependent variable during the entire analysis.

Results

General characteristics of elderly stroke survivors

From a total population size of 14,415 older adults within the four sub-districts, an initial sample consisting of 2161 subjects was selected through a systematic sampling method with fixed sampling intervals. The response rate was 90%. Among this sample pool, 511 community-dwelling elderly stroke survivors were further selected based on the inclusion criteria.

Detailed descriptive information regarding the basic sociodemographic factors of the 511 participants and the measured variables are shown in Table 1 and Table 2, respectively. Generally, participants were in the age range of 62 and 96 years, about half of them were male (52%), nearly two-thirds (68%) were married or engaged, and

only one-third (35%) had received a primary level education or below.

According to the scores obtained through the Center for Epidemiologic Studies Depression Scale, stroke survivors were further divided into two groups consisting of those with and without clinical depression. The results show that the former had significantly lower levels of life satisfaction and higher levels of depressed mood. Regarding physical functioning, the former tended to have significantly lower levels of perceived health, more comorbid illnesses, and more difficulties with instrumental ADL. In regard to social functioning, the former also had a significantly higher sense of loneliness and lower levels of social support.

Sequential multiple regression

When all stroke survivors were considered as a whole, the results of the regression analysis showed that the overall model comprising sociodemographic factors, physical functioning, social functioning, and depressive symptoms could explain 37% of the variance in life satisfaction (Table 3). Sociodemographic factors explained 5% of the variance in life satisfaction. Specifically, participants who were older, engaged (married or cohabiting), or had lower educational levels also had higher levels of life satisfaction. After the entry regarding physical functioning in the second step, it explained an additional 5% of the variance in life satisfaction. The results suggest that higher levels of self-perceived health and a smaller number of comorbid chronic illnesses lead to higher levels of life satisfaction. In the third model, social functioning was entered and explained an additional 16% of the variance. The results suggest that less loneliness leads to a higher level of life satisfaction. In the last model, depressive symptoms were entered and explained a further additional 12% of the variance, after controlling all of the above factors. The unique variance shown by

the respective constructs demonstrated that social functioning is more important than physical functioning or depressive symptoms in promoting life satisfaction among elderly stroke survivors.

When only stroke survivors without clinical depression were considered, the overall model could explain 19% of the variance in life satisfaction (Table 3). The unique variances shown by sociodemographic factors, physical functioning, and social functioning were significant in which social functioning demonstrating a relatively stronger level of variance.

Likewise, when only stroke survivors with clinical depression were considered, the overall model could also explain 19% of the variance in life satisfaction (Table 3). However, only social functioning showed significant and unique variance in explaining life satisfaction, whereas sociodemographic factors and physical functioning became insignificant.

Moderating effects

Only the results with significant interaction effects are shown in Table 4. For all stroke survivors, when the effects of the sociodemographic factors were controlled, depressed mood moderated the association between physical functioning (basic ADL and instrumental ADL) and life satisfaction.

When further scrutinized within elderly stroke survivors without clinical depression, loneliness and social support had buffering effects on the relationship between physical functioning (in terms of perceived health, instrumental ADL, and basic ADL) and life satisfaction.

For elderly stroke survivors with clinical depression, on the other hand, only loneliness moderated the relationship between physical functioning (perceived health

and instrumental ADL) and life satisfaction.

Moderators address "when" or "for whom" a predictor is more strongly related to an outcome.[15] As suggested by Cohen et al.,[16] significant moderating effects could be interpreted by computing the predicted values of the outcome variables for representative groups, including those who scored at the mean ± 1 standard deviation of the moderator variables. The various interaction effects are summarized in Figures 2 to 6. Specifically, Figure 2 represents the plot of the interaction between depressed mood and physical functioning in relation to life satisfaction. Figures 3 to 6 represent the corresponding plots of the interactions between social functioning and physical functioning in prediction of life satisfaction. A summary picture depicting different moderating effects is shown in Figure 7.

Discussion

Our study provides a preliminary test for improving the validity and utility of the theoretical quality of life model.[1] Specifically, the moderating roles of post-stroke depression and social functioning in buffering the relationship between physical dependence and life satisfaction among elderly stroke survivors are verified.

The findings from this study support our first hypothesis. Elderly stroke survivors with clinical depression have significantly poorer physical functioning and social functioning than those without clinical depression. This is consistent with previous research showing that post-stroke depression is highly associated with functional dependence,[17] poorer perceived health,[18] a higher sense of loneliness,[19] and lower levels of social support.[20] Moreover, findings from this study further confirm that depressive symptoms have an additional value in predicting life satisfaction, as indicated by the sequential multiple regression. This is concordant with previous

research positing that post-stroke depression is an important determinant of quality of life among stroke survivors.[21]

Our second hypothesis is also supported by confirming the moderating effect of depressive symptoms on the relationship between physical functioning and life satisfaction among elderly stroke survivors (Figure 2). Specifically, in a low depressed mood condition, higher independence levels lead to higher levels of life satisfaction. However, in a highly depressed mood condition, life satisfaction is independent of functioning level. When a depressed mood increases, it may conceal the significance of functional independence among stroke survivors. Perhaps this can be explained by the decrease in participation level due to post-stroke depression[22] or there could be greater underlying levels of apathy associated with poorer quality of life, independent of ADL difficulties.[23] It is also possible that a stroke may lead to an integrity-despair crisis, which can ultimately lead to depression. Such a weak sense of coherence may further lead to poor levels of gratification in life.[24]

Besides, our second hypothesis regarding the moderating role of social functioning (in terms of loneliness and social support) is supported for elderly stroke survivors without clinical depression. In general, there is a trend indicating a higher level of life satisfaction accompanied by a higher independence level in the context of a lower sense of loneliness (Figure 3) or a lower level of social support (Figure 4). That means under a condition of stable mood, elderly stroke survivors with a higher independence level should possess a favorable evaluation of their own life condition either when they have a subjective feeling of belonging or even with less social support. Nevertheless, results from this study showed that life satisfaction could be independent of instrumental ADL within a higher sense of loneliness (Figure 3) or a higher level of social support (Figure 4). In other words, individuals' level of life

satisfaction would remain low when under a higher sense of loneliness regardless of the level of independence. Or one's level of life satisfaction would remain high when under a higher level of social support irrespective of the level of dependence.

Furthermore, our second hypothesis regarding elderly stroke survivors with clinical depression is supported as well. A higher level of perceived health (Figure 5) or a higher independence level (Figure 6) could lead to a higher level of life satisfaction under the condition of a lower sense of loneliness. Alternatively, with a higher sense of loneliness, life satisfaction is independent of perceived health or level of instrumental ADL. Put differently, individuals' level of life satisfaction would remain low when under a high sense of loneliness despite of the level of perceived health or independence.

Our supported second hypothesis can be explained as follows. Loneliness and depression are always associated in older adults in particular.[25] This implies that, when elderly stroke survivors with post-stroke depression experience a strong sense of loneliness, this further leads to exaggerated long-term psychological distress.[19] Feeling lonely can involve living with loss in terms of suffering deteriorating physical health or the loss of a meaningful life.[26] Such losses are concomitant with the subjective feeling of isolation[27] and lead to a greater sense of loneliness. Thus, it is understandable that a higher subjective perception of loneliness can lead to poorer gratification in life among elderly stroke survivors. The findings from this study imply that the judicious elimination of sense of loneliness should help to buffer the effects of negative mood or functional dependence on life satisfaction. In addition, according to the stress-buffering hypothesis model,[28] a well-functioning social network not only facilitates the reception of functional support, but also provides a sense of stability and integration in one's own life situation. Thus, enhancing one's social support is

imperative and could take precedence over physical rehabilitation in promoting life satisfaction.

We continued by investigating the sociodemographic data in relation to life satisfaction. Specifically, we found that older stroke survivors have higher levels of life satisfaction than their younger counterparts. This is compatible with previous research regarding quality of life in elderly stroke survivors.[29] This phenomenon is also consistent with the emotion paradox in the aging process.[30] Specifically, when individuals grow older, they react less to negative situations. In other words, older individuals have a certain ability to insulate their emotional reactions after having a stroke. Such psychological resilience should contribute to better emotional well-being and ultimately leads to a higher level of life satisfaction. Compared with young-old, old-old individuals also tend to increasingly rely on disengagement from health-related goals. This self-protection, along with positive reappraisal, can preserve their motivational and physical resources when corresponding to the decline in physical health.[31]

Besides, engaged (in terms of married or cohabiting) elderly stroke survivors were shown to have higher levels of life satisfaction. This finding is in line with a previous study indicating that a high percentage of married people in the Chinese population can contribute to a higher degree of subjective well-being.[32] Essentially, marriage or cohabitation implies caregiving social support. Elderly people with a disability can enhance their well-being by receiving support from their spouses or cohabiters.[33]

Findings from this study also show that elderly stroke survivors without a high level of education tend to have a higher level of life satisfaction. This contradicts previous research, which signifies that stroke survivors with lower levels of education

are less satisfied with life.[34] Perhaps the opposing finding in this study can be explained by the "progress paradox" phenomenon in China. A recent Chinese livelihood survey indicated that educated respondents are more likely to report depression, while uneducated respondents are more satisfied with their lives.[35] Elderly stroke survivors without a high level of education may be easily satisfied with their current living conditions, whereas their highly educated counterparts may still have unsatisfied needs or expectations about their lives.

Cultural values can have significant implication in explaining the findings in this study. Among elderly stroke survivors in a Chinese culture, it seems that social functioning outweighs physical functioning in promoting life satisfaction. A subjective perception of loneliness should be more important than self-perceived health or even independence level in regard to contributing to the subjective evaluation of life. This concurs with the ideation of interdependence as valued in a collectivist culture, while contrasting with the emphasis on independence in an individualist culture.[36]

Individualism and collectivism, as espoused by Western and Chinese culture, can have a systematic influence on individuals' evaluation of what constitutes a good life. Specifically, autonomy and a sense of control over one's environment have been perceived as Western individualist principles of a good quality of life, whereas a focus on interdependency and fulfilling one's relation-oriented responsibilities is generalized as Chinese collectivist cultural beliefs regarding a good quality of life.[37]

The findings of this study echo previous research showing the importance of social connectedness, which is emphasized by stroke survivors within Chinese culture.[38] A strong sense of inclusion with a high level of social support should take precedence over independence levels in promoting life satisfaction among elderly

stroke survivors in China. It matches well with the collectivistic value of Chinese

culture, which emphasizes interdependence, rather than independence.[39]

In addition, older Chinese generations tend to preserve *mianzi*, which signifies

dignity or public image, by reducing isolation or enhancing a sense of belonging. As

such, *mianzi* is an important cultural feature in Chinese societies.[40] Thus, an

endorsement of positive Chinese cultural beliefs regarding adversity and a higher

degree of *mianzi* in social interactions among elderly Chinese people should lead to a

higher level of life satisfaction in this population.[41]

This study has some limitations. First, only cross-sectional correlation statistics

were utilized; thus, no definitive statement on causality can be made. Further

longitudinal research is needed to achieve an understanding of directionality. Second,

the sampling process may constitute a limitation, as this study was conducted only in

a small region in China. Further replication of this study in other areas, including rural

and urban regions of China, is needed. Moreover, a comparison with non-Chinese

participants should enrich the spectrum of different cultural beliefs affecting life

satisfaction. Third, the data were obtained exclusively through self-reports from

elderly stroke survivors. Future research could consider employing a mixed-method

design, including objective measurements or other observational data.

Despite these limitations, this study has significant clinical implications for

stroke rehabilitation. First, post-stroke depression should be carefully addressed when

promoting life satisfaction for stroke survivors. Both moderators, including social

functioning and depression, can be harnessed in the relationship between physical

functioning and life satisfaction among elderly stroke survivors. More specifically, the

judicious elimination of sense of loneliness or enhancement of social support should

help to buffer the effects of negative mood or functional dependence on life

satisfaction. Last but not the least, the theoretical quality of life model[1] has been improved with regard to its validity and utility. More specific, the hypothesized moderating roles of depression and social functioning in the relationship between physical functioning and life satisfaction are confirmed by the empirical findings in this study. Perhaps a longitudinal study by use of structural equation modeling can further fortify the modified model. In addition, inclusion of the collectivist cultural beliefs of Chinese populations should enrich the present theoretical model and clinical practice as applied in regard to elderly Chinese stroke survivors.

In terms of clinical application, therapists or clinicians should not overlook the impact of emotion management, reduction of sense of loneliness, and enhancement of social support prior to providing physical rehabilitation for elderly stroke survivors. In addition, the data from the above sociodemographic data reveals that more attention should be paid for those young-old stroke survivors. Comparatively the impact of stroke may easily intensify their vulnerability when they start to engage in an aging process. Besides, elderly stroke survivors who are not engaged or highly educated should be an important indicator for paying additional care when promoting their quality of life after having stroke.

Clinical Messages

- Elderly Chinese stroke survivors with clinical depression have poorer physical functioning and social functioning, as well as lower life satisfaction, compared with survivors without clinical depression.
- The quality-of-life model is supported with depression and social functioning buffering the relationship between physical dependence and life satisfaction among elderly Chinese stroke survivors.

Author contributions

S.H.W.C. is responsible for writing the paper, contributing to the concept and design of the study, and data analysis. Y.P. is responsible for initiating the study, monitoring the progress, and data collection and interpretation. Y.X. made substantial contributions to the conception and design of the work. S.H.W.C. and K.C.Y. made critical revision of the work for important intellectual content, and final approval of the version to be published

References

1.   Zubritsky C, Abbott KM, Hirschman KB, et al. Health-related quality of life: Expanding a conceptual framework to include older adults who receive long-term services and supports. *The Gerontologist* 2013; 53: 205-210.

2.   Clark PG. Autonomy, personal empowerment, and quality of life in long-term care. *Journal of Applied Gerontology* 1988; 7: 279-297.

3.   Fallahpour M, Jonsson H, Joghataei MT, et al. "I am not living my life": Lived experience of participation in everyday occupations after stroke in Tehran. *Journal of Rehabilitation Medicine* 2013; 45: 528-534.

4.   Kitson AL, Dow C, Calabrese JD, et al. Stroke survivors' experiences of the fundamentals of care: A qualitative analysis. *International Journal of Nursing Studies* 2013; 50: 392-403.

5.   Hartman-Maeir A, Eliad Y, Kizoni R, et al. Evaluation of a long-term community based rehabilitation program for adult stroke survivors. *NeuroRehabilitation* 2007; 22: 295-301.

6.   Boosman H, Schepers VPM, Post MWM, et al. Social activity contributes independently to life satisfaction three years post stroke. *Clinical Rehabilitation* 2011; 25: 460-467.

7.   Northcott S, Moss B, Harrison K, et al. A systematic review of the impact of stroke on social support and social networks: Associated factors and patterns of change. *Clinical Rehabilitation* 2016; 30: 811-831.

8.   Oosterveer DM, Mishre RR, van Oort A, et al. Depression is an independent determinant of life satisfaction early after stroke. *Journal of Rehabilitation Medicine* 2017; 49: 223-227.

9.   Blöchl M, Meissner S and Nestler S. Does depression after stroke negatively

influence physical disability? A systematic review and meta-analysis of longitudinal studies. *Journal of Affective Disorders* 2019; 247: 45-56.

10. Diener E, Emmons R, Larsen J, et al. The satisfaction with life scale. *Journal of Personality Assessment* 1985; 49: 71-75.

11. Boey KW. Cross-validation of a short form of the CES-D in Chinese elderly. *International Journal of Geriatric Psychiatry* 1999; 14: 608-617.

12. Hirdes JP, Ljunggren G, Morris JN, et al. Reliability of the interRAI suite of assessment instruments: A 12-country study of an integrated health information system. *BMC Health Services Research* 2008; 8: 277.

13. Leung GTY, de Jong Gierveld J and Lam LCW. Validation of the Chinese translation of the 6-item De Jong Gierveld Loneliness Scale in elderly Chinese. *International Psychogeriatrics* 2008; 20: 1262-1272.

14. Lubben JE. Assessing social networks among elderly populations. *Family & Community Health* 1988; 11: 42-52.

15. Frazier PA, Tix AP and Barron KE. Testing moderator and mediator effects in counseling psychology research. *Journal of Counseling Psychology* 2004; 51: 115-134.

16. Cohen J, Cohen P, West SG, et al. *Applied multiple regression/correlation analysis for the behavioral sciences*. 3rd ed. Mahwah, NJ: Erlbaum, 2003.

17. Brown C, Hasson H, Thyselius V, et al. Post-stroke depression and functional independence: A conundrum. *Acta Neurologica Scandinavica* 2012; 126: 45-51.

18. Baiyewu O, Yusuf AJ and Ogundele A. Depression in elderly people living in rural Nigeria and its association with perceived health, poverty, and social network. *International Psychogeriatrics* 2015; 27: 2009-2015.

19. Hilari K, Northcott S, Roy P, et al. Psychological distress after stroke and

aphasia: The first six months. *Clinical Rehabilitation* 2010; 24: 181-190.

20. Greco A, Steca P, Pozzi R, et al. Predicting depression from illness severity in cardiovascular disease patients: Self-efficacy beliefs, illness perception, and perceived social support as mediators. *International Journal of Behavioral Medicine* 2014; 21: 221-229.

21. Sarfo FS, Jenkins C, Singh A, et al. Post-stroke depression in Ghana: Characteristics and correlates. *Journal of the Neurological Sciences* 2017; 379: 261-265.

22. Silva SM, Corrêa JCF, da Silva Mello T, et al. Impact of depression following a stroke on the participation component of the International Classification of Functioning, Disability and Health. *Disability and Rehabilitation* 2016; 38: 1830-1835.

23. Tierney SM, Woods SP, Weinborn M, et al. Real-world implications of apathy among older adults: Independent associations with activities of daily living and quality of life. *Journal of Clinical and Experimental Neuropsychology* 2018; 40: 895-903.

24. Dezutter J, Wiesmann U, Apers S, et al. Sense of coherence, depressive feelings and life satisfaction in older persons: A closer look at the role of integrity and despair. *Aging & Mental Health* 2013; 17: 839-843.

25. Domènech-Abella J, Lara E, Rubio-Valera M, et al. Loneliness and depression in the elderly: The role of social network. *Social Psychiatry and Psychiatric Epidemiology* 2017; 52: 381-390.

26. Graneheim UH and Lundman B. Experiences of loneliness among the very old: The Umeå 85 + project. *Aging & Mental Health* 2010; 14: 433-438.

27. Tomstad S, Dale B, Sundsli K, et al. Who often feels lonely? A cross-sectional

study about loneliness and its related factors among older home-dwelling people. *International Journal of Older People Nursing* 2017; 12: 1-10.

28. Cohen S and Wills TA. Stress, Social Support, and the Buffering Hypothesis. *Psychological Bulletin* 1985; 98: 310-357. DOI: 10.1037/0033-2909.98.2.310.

29. Ostwald SK, Godwin KM and Cron SG. Predictors of life satisfaction in stroke survivors and spousal caregivers after inpatient rehabilitation. *Rehabilitation Nursing* 2009; 34: 160-174.

30. Mather M. The emotion paradox in the aging brain. *Annals of the New York Academy of Sciences* 2012; 1251: 33-49.

31. Hall NC, Chipperfield JG, Heckhausen J, et al. Control striving in older adults with serious health problems: A 9-year longitudinal study of survival, health, and well-being. *Psychology and Aging* 2010; 25: 432-445.

32. Shu X and Zhu Y. The quality of life in China. *Social Indicators Research* 2008; 92: 191-225.

33. Lawler FH, Mold JW and McCarthy LH. Do older people benefit from having a confidant? An Oklahoma Physicians Resource/Research Network (OKPRN) study. *Journal of The American Board of Family Medicine* 2013; 26: 9-15.

34. Jeon NE, Kwon KM, Kim YH, et al. The factors associated with health-related quality of life in stroke survivors age 40 and older. *Annals Of Rehabilitation Medicine* 2017; 41: 743-752.

35. Graham C, Zhou S and Zhang J. Happiness and health in China: The paradox of progress. *World Development* 2017; 96: 231.

36. Yu S, Levesque-Bristol C and Maeda Y. General need for autonomy and subjective well-being: A meta-analysis of studies in the US and East Asia. *Journal of Happiness Studies* 2018; 19: 1863-1882.

37. Wang R and Langhammer B. Predictors of quality of life for chronic stroke survivors in relation to cultural differences: A literature review. *Scandinavian Journal of Caring Sciences* 2018; 32: 502-514.

38. Lau A and McKenna K. Perception of quality of life by Chinese elderly persons with stroke. *Disability and Rehabilitation* 2002; 24: 203-218.

39. Wai Li LM and Hamamura T. Cultural fit and life satisfaction: Endorsement of cultural values predicts life satisfaction only in collectivistic societies. *Journal of Psychology in Chinese Societies* 2010; 11: 109-122.

40. Chou SY, Yang W and Han B. What happens when "younger" helpers meet "older" recipients? A theoretical analysis of interpersonal helping behaviour in Chinese organizations. *Journal of Organizational Change Management* 2014; 27: 677-691.

41. Huang Y and Wu L. Correlates of life satisfaction among older people in China: An examination of two cultural variables. *Aging & Mental Health* 2012; 16: 1028-1038.

Table 1. Descriptive statistics of different sociodemographic factors

	All stroke survivors (n=511)	Stroke survivors without clinical depression (n=384)	Stroke survivors with clinical depression (n=127)	Statistics
	%	%	%	
Gender				$X^2 = 5.91$*
Male	51.9	54.9	42.5	
Female	48.1	45.1	57.5	
Marital				$X^2 = 3.10$
Alone	30.7	29.2	37.6	
Married/engaged	67.5	70.8	62.4	
Education				$X^2 = 13.46$**
Primary or below	35.2	31.9	44.9	
Junior secondary	31.1	31.1	31.5	
Senior secondary	20.0	21.1	16.5	
Tertiary or above	13.7	15.9	7.1	
	X (SD)	X (SD)	X (SD)	
Age	76.82 (6.67)	76.91 (6.73)	76.54 (6.48)	$t = -.54$

*p< .05; **p<.01; X = mean; SD = standard deviation; X^2 = chi-square; t = t-test

Table 2. Descriptive statistics of different measured variables

	All stroke survivors (n=511)	Stroke survivors without clinical depression (n=384)	Stroke survivors with clinical depression (n=127)	Statistics
	X (SD)	X (SD)	X (SD)	
Life satisfaction	19.86 (4.94)	21.20 (4.50)	15.80 (3.90)	t = -12.11***
Depressed mood	6.59 (5.45)	4.02 (2.79)	14.35 (3.95)	t = 27.31***
Social functioning				
People together	2.20 (.97)	2.22 (.97)	2.13 (.97)	t = -.91
Loneliness	1.17 (1.26)	.83 (.99)	2.21 (1.41)	t = 10.23***
Social support	28.45 (8.65)	29.27 (8.61)	25.99 (8.34)	t = -3.75***
Physical functioning				
Perceived health	2.65 (.86)	2.79 (.84)	2.26 (0.77)	t = -6.19***
IADL	11.67 (17.12)	10.59 (16.85)	14.92 (17.59)	t = 2.48*
BADL	.57 (1.36)	.53 (1.35)	.68 (1.39)	t = 1.05
Comorbid illnesses	5.04 (2.33)	4.81 (2.27)	5.72 (2.37)	t = 3.86***

*p< .05; **p<.01; ***p<.001; X = mean; SD = standard deviation; X^2 = chi-square; t = t-test; Life satisfaction as measured by the Satisfaction With Life Scale; Depressed mood as measured by the Center for Epidemiologic Studies Depression Scale; People (living) together as measured by asking a single question; Loneliness as measured by the De Jong Gierveld Loneliness Scale; Social support as measured by the Lubben Social Network Scale; Perceived health as measured by asking a single question; IADL as measured by the interRAI Instrumental Activities of Daily Living Performance scale; BADL as measured by the International Residential Assessment Instrument (interRAI) Activities of Daily Living Hierarchy scale; Comorbid illnesses as measured by asking a multiple-choice question

Table 3. Hierarchical regression analysis of factors contributing to life satisfaction for all stroke survivors, stroke survivors without clinical depression and with clinical depression

	All stroke survivors (n=511)			Stroke survivors without clinical depression (n=384)			Stroke survivors with clinical depression (n=127)		
	β	R²	R² change	β	R²	R² change	β	R²	R² change
Model 1: Sociodemographic factors		.045	.045***		.095	.095***		.046	.046
Age	.192***			.250***			.125		
Gender	-.025			.047			-.088		
Married / engaged	-.104*			.088			.100		
Educational level	-.096*			-.194***			-.149		
Model 2: Physical functioning		.097	.052***		.121	.027*		.091	.045
Perceived health	.157**			.092			-.031		
IADL	.078			.036			-.168		
BADL	.110			.141			.044		
Comorbid illnesses	-.125**			-.057			-.187		
Model 3: Social functioning		.254	.158***		.190	.069***		.188	.097**
People living together	-.024			-.053			-.151		
Loneliness	-.414***			-.264***			-.270**		
Social support	-.042			.009			-.188		
Model 4: Depressive symptoms		.372	.118***						
Depressed mood	-.454***								

β = Beta coefficient which represents the strength of the effect of each individual independent variable to the dependent variable. The higher the absolute value of the beta coefficient, the stronger the effect; R² = R-squared which is a goodness-of-fit measure for hierarchical regression models. This statistic indicates the percentage of the variance in the dependent variable that the independent variables explain collectively; R² change = R-squared change denotes the unique variance as explained by each model. IADL = Instrumental ADL; BADL = Basic ADL; *p< .05; **p<.01; ***p<.001

Table 4. Moderating effects of depressive symptoms in the relation between physical functioning and life satisfaction

Interaction effects	All stroke survivors (n=511)		
	B	SE B	β
Depressive symptoms			
Depressed mood X IADL	.790	.195	.152***
Depressed mood X BADL	.987	.220	.176***

	Stroke survivors without clinical depression (n=384)				Stroke survivors with clinical depression (n=127)		
	B	SE B	β		B	SE B	β
Social functioning							
Loneliness X perceived health					-.749	.326	-.264*
Loneliness X IADL	1.545	.287	.287***		.648	.287	.236*
Loneliness X BADL	1.338	.309	.264***				
Social support X Perceived health	.440	.211	.115*				
Social support X IADL	.599	.262	.121*				
Social support X BADL	.717	.312	.151*				

B = unstandardized regression coefficients; SE = standard error; β = Standardized Regression Coefficients of the interaction term; X = interaction; IADL = Instrumental ADL; BADL = Basic ADL; *p <.05, **p<.01, ***p<.001
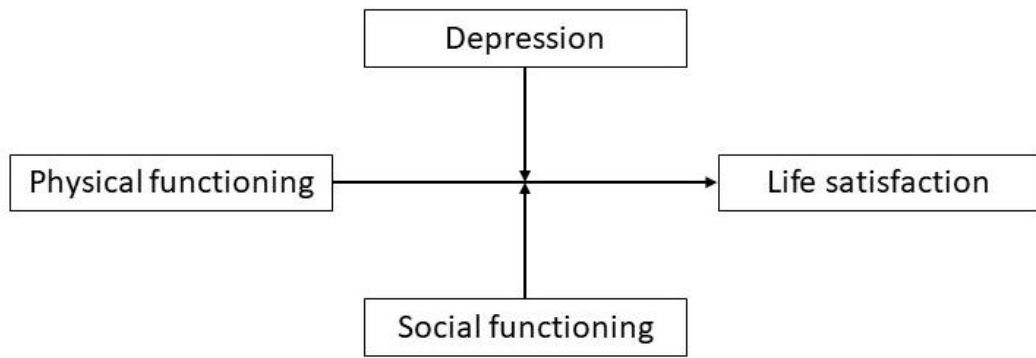
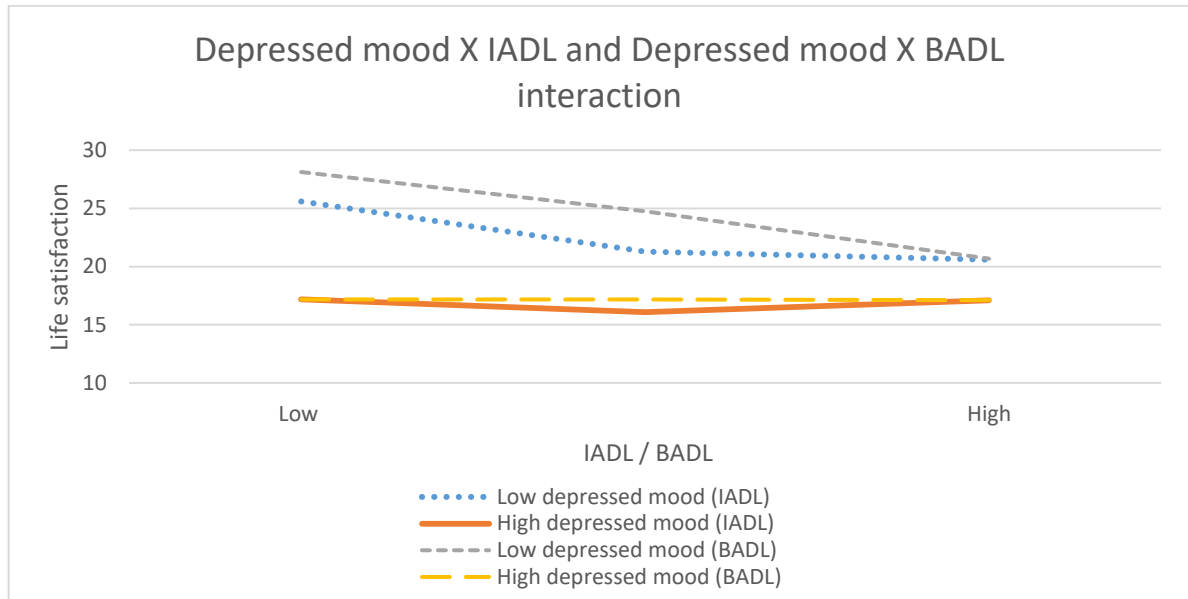**Figure 1.** Conceptual model

Figure 2. Plot of significant Depressed mood X IADL (instrumental ADL) interaction and Depressed mood X BADL (Basic ADL) interaction for all stroke survivors
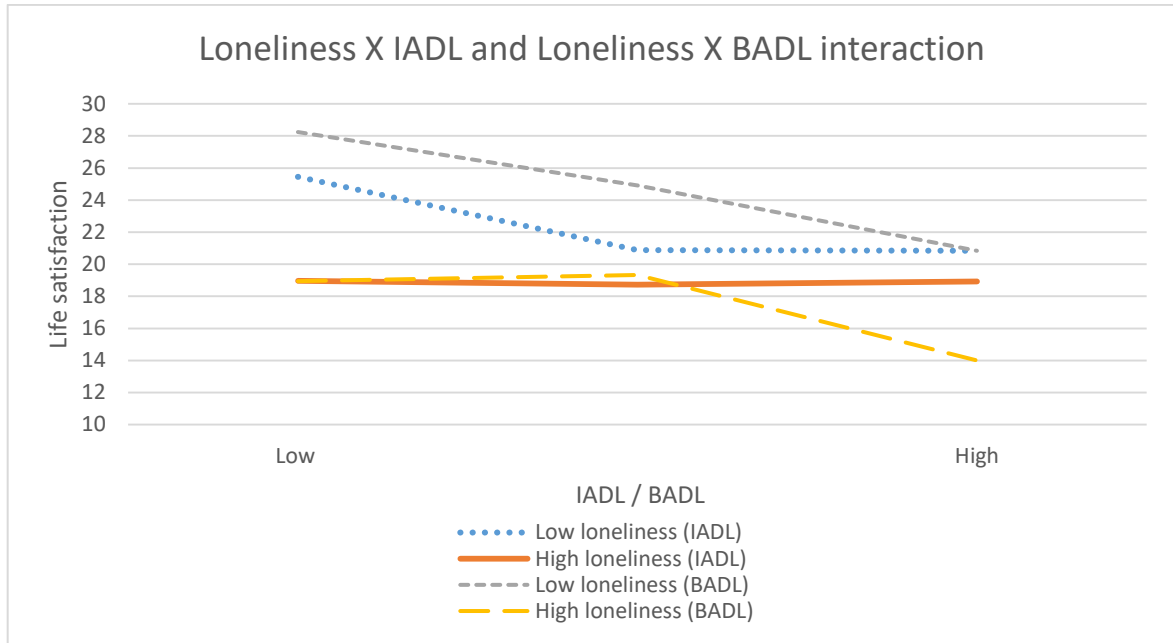
Figure 3. Plot of significant Loneliness X IADL (instrumental ADL) interaction and Loneliness X BADL (basic ADL) interaction for stroke survivors without clinical depression
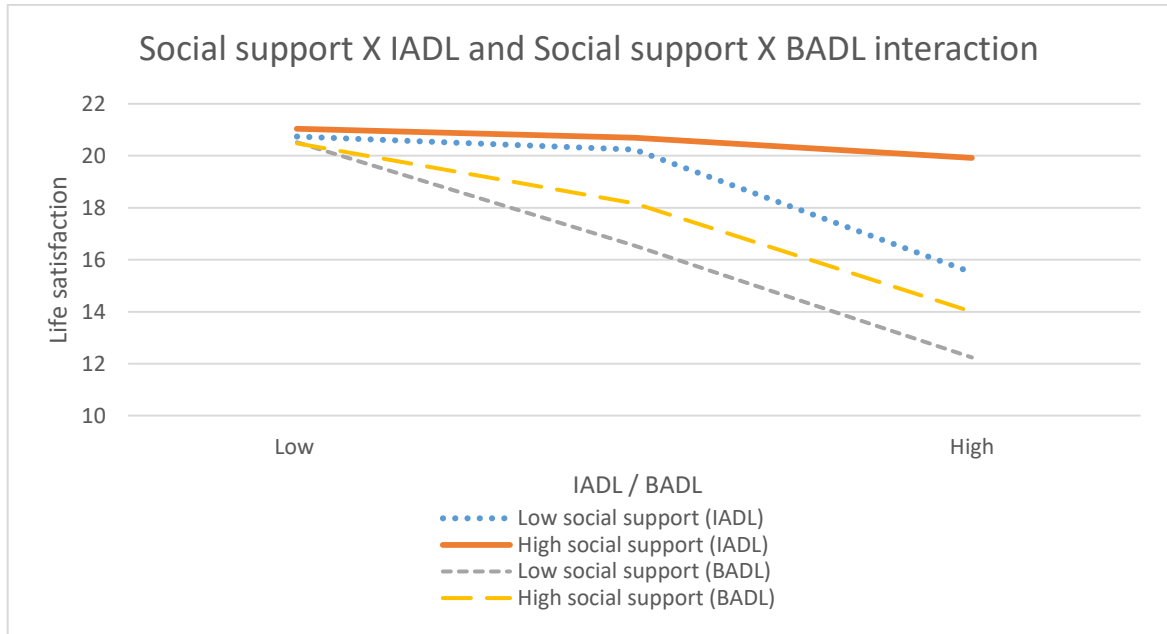
Figure 4. Plot of significant social support X IADL (instrumental ADL) interaction and social support X BADL (basic ADL) interaction for stroke survivors without clinical depression
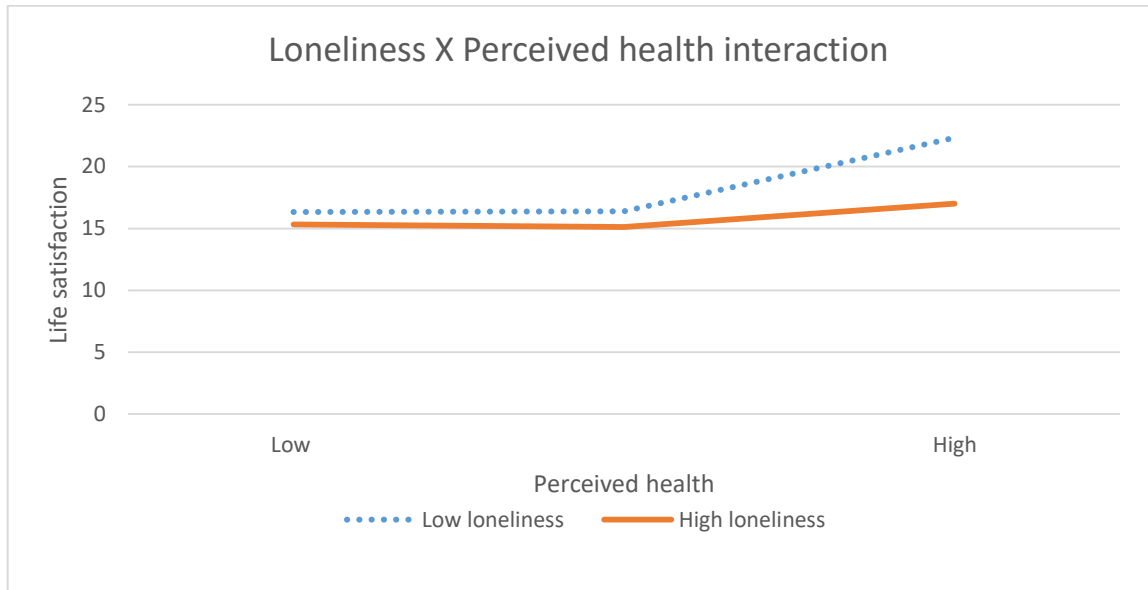
Figure 5. Plot of significant loneliness X perceived health interaction for stroke survivors with clinical depression
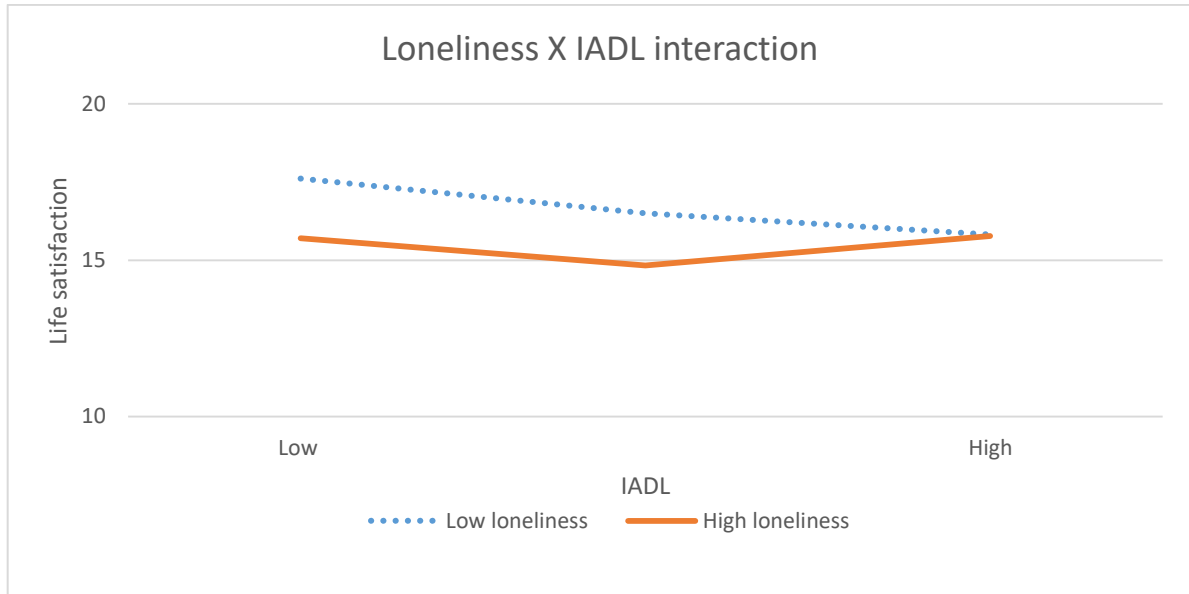
Figure 6. Plot of significant loneliness X IADL (instrumental ADL) interaction for stroke survivors with clinical depression
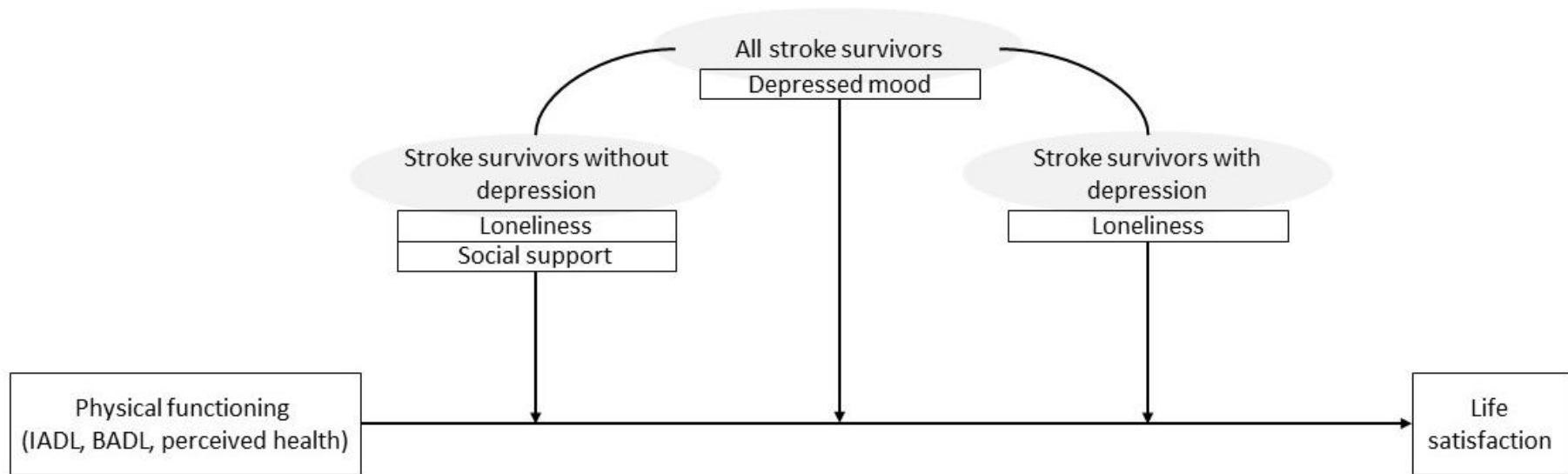
Figure 7. A summary picture depicting different moderating effects of depressed mood and social functioning in the relationship between physical functioning and life satisfaction. For all stroke survivors, depressed mood moderated the effects between IADL / BADL and life satisfaction. For stroke survivors without depression, loneliness and social support moderated the effects between IADL / BADL / perceived health and life satisfaction. For stroke survivors with depression, loneliness moderated the effects between IADL / perceived health and life satisfaction.