Gender Interaction in Association of Perceived Social Support and Health-Related Quality of Life among Iranian Older People: A cross-Sectional Survey

Maryam Tajvar (✉ mtajvar@tums.ac.ir)

Tehran University of Medical Sciences

Astrid Fletcher

London School of Hygiene and Tropical Medicine

Emily Grundy

London School of Economics and Political Science

Badrye Karami

Tehran University of Medical Sciences

Fatemeh Mohabbati

Zabol University of Medical Sciences

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**Gender Interaction in Association of Perceived Social Support and Health-Related
Quality of Life among Iranian Older People: A cross-Sectional Survey**

Maryam Tajvar^{1*}, Astrid Fletcher ², Emily Grundy³, Badrye Karami¹, Fatemeh Mohabbati⁴

¹ Department of Health Management and Economics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran.

² Faculty of Epidemiology & Population Health, London School of Hygiene and Tropical Medicine, London, United Kingdom.

³ Department of Social Policy, London School of Economics and Political Science, London, United Kingdom.

⁴ School of Public Health, Zabol University of Medical Sciences, Zabol, Iran.

* Corresponding author: Dr. Maryam Tajvar- Department of Health Management and Economics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran. Tel: +98 (0) 21429330, Email: mtajvar@tums.ac.ir.

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Abstract

Objective: The purpose of this study was to examine the relationship between perceived social support and dimensions of HRQoL and to examine possible gender interaction in the mentioned associations.

Method: A community-based cross-sectional study conducted among 644 participants over the age of 60 years old in Tehran. The data were collected through face-to-face interviews conducted in their own homes, by using a structured multi-sectional questionnaire. The version 1 of the SF-12 scale was used to measure the HRQoL, consisting of two summary measures; PCS and MCS. The Persian version of the Social Provisions Scale (SPS) was used to measure perceived social support. Four multilevel mixed-effects logistic regression models in STATA were used to examine the associations.

Results: Older people with poor SPS score were 1.8 times more likely to be in the worst quartile of the MCS distribution ($p=0.02$), and twice as likely to be in the worst quartile of the PCS distribution ($p=0.01$). We found a strong evidence ($p=0.02$) to support the hypothesis of gender interaction in the association between economic status and PCS, and a borderline evidence ($p=0.05$) for gender interaction in the association between physical activity and PCS.

Conclusions: Social support could be regarded as one of the main social determinants affecting HRQoL among elderly people. Men with poor economic status and poor physical activity, compared to women, are more likely to suffer from poor quality of life, thus men should be prioritized in intervention of financial support and life styles.

Keyword: Perceived Social Support, Health-Related Quality of Life, older people, Gender Interaction

Introduction

Population ageing in the world is unprecedented: by 2050, the number of people of 60+ years old in the world will exceed the number of young people under 15 years for the first time in history (1, 2). Iran has experienced one of the fastest fertility transitions in the world (3), So that, by 2030, the elderly population of Iran will increase from 5.6% to 17.5% (4) and life expectancy at birth increase to 78.2 years (5). Population ageing is usually associated with increased disability and disease in society (6). Thus, provision of health care would be one of the most important issue in future of Iran and that would be essential to pay attention to this age group, while improving their quality of life (QOL).

The QOL is an increasingly popular concept in the field of nursing and medicine (7). Based on Joyce's definition "Quality of life is how good or bad you feel your life to be" (8). This means that QOL is a subjective perception that represents different things to different people (9). Health-related quality of life (HRQOL), on the other hand, is "how well a person functions in their life and his or her perceived wellbeing in physical, mental, and social domains of health" (10). HRQOL is considered as one of the important indicators of the outcome of treatment and care interventions in the elderly (11). Based on the earlier studies (12, 13), HRQoL in different populations are associated with various factors including age, gender, level of education, economic status, outdoor leisure activity, physical activity, social support (14), type and duration of residence (15), comorbidities (16), and being afflicted by chronic diseases (17). Among these factors, "social support" (SS) is an important predictor of HRQoL that studies have greatly multiplied in last years (14, 18). The SS is an exchange of sources between at least two persons which is recognized by the provider or the recipient to be intended to improve the well- being of the recipient (19). "Perceived social support" (PSS) is defined as one's overall impressions on whether social network

is supportive enough or not” (20). The SS, might be even more essential in old age, due to functional limitations, loss of sources of income, and loss of spouse and confidants (21). There is evidence that, lack of which are associated with higher mortality, chronic diseases, cognition, depressive symptoms, and well-being (22). This reliance sensation among elderly may help them with strengthening their coping abilities to overcome the stressors of life.

Multiple studies conducted to examine factors affecting SS and HRQoL among older adults in other countries (23, 24) and there is little such evidence on the older people of Iran (25). It is likely that differences in culture, societal conditions and settings make it difficult to generalize study findings from Western countries to other countries and populations. In addition, none of the previous studies have examined the strength of relationships among PSS and HRQoL in older population, controlling for the effects of potential individual-level and community-level covariates, extracted from literature, in separate analysis. The purpose of this study, thus, was to examine the relationship between PSS and HRQoL, with the hypothesis of lower levels of PSS are associated with poorer HRQoL among Iranian older adults. Additionally, interaction of gender and some other factors in the analysis of associations between PSS and HRQoL were examined. Finally, associations between community-level socio-economic status (SES) with HRQoL were checked. The results of the present study can be used in planning to improve the physical and mental health status, quality and living standards of the elderly and improve their social conditions.

Methods

Study design and data collection

A community-based cross-sectional study conducted among 644 participants over the age of 60 years old as a representative sample of older adults in Tehran. The study population selected using

a multistage stratified cluster sampling method in order to ensure representation of people from neighborhoods of different SES. Three municipal districts of Tehran chose from areas with different SES for the first stage of the sampling. At the second stage, from each district, one neighborhood was selected, randomly. Probability proportionate to size allocation method was used for selecting people within study cluster randomly. By using a structured multi-sectional questionnaire, the data were collected through face-to-face interviews conducted in their own homes. The response rate was 76%. There was not any systematic differences between characteristics of no respondents include age and gender compared with respondents. The ethical committee of the London School of Hygiene and Tropical Medicine (LSHTM) and the ethical committee of the Tehran University of Medical sciences (TUMS) approved this study as meeting the ethical standards of human subject research.

Measurement of study variables

In this study, HRQoL is the outcome variable and the SPS is the main independent variable. A long list of covariates were also measured and their effect on the associations between the main independent and dependent variables were controlled. To achieve the objectives of this research, the structured multi sectional questionnaire was used. It consist of three main part: 1) individual-level socio-demographic characteristics of participants (age, gender, number of children, marital status, economic status, employment, education ...), in addition to functional health status of participants (measured using the Nagi score) and community-level SES, 2 &3) questionnaires to measuring the HRQoL and PSS.

To measure the HRQoL, we used the version 1 of the 12-item Short Form Health Survey (SF-12), as a shorter alternative to the SF-36. The SF-12 is a self-reported multipurpose short form survey (10). Cross-cultural validation studies have shown substantial correlations between the summary

115 measures of the SF-36 and the SF-12 Health Survey. The result of SF-12 is reported by two
116 summary measures: the physical component score (PCS) and the mental component score (MCS).
117 A global score is derived from the sum of these two components, estimating an individual's
118 perception of global HRQoL. Montazeri et al (26) adopted this scale for Iranian cultural
119 characteristic. The validity and reliability of the SF-12 version1 was checked and suggested that
120 the SF-12 version1 is a reliable and valid measure of the HRQoL in Iranian population. This
121 questionnaire assesses four of the health concepts (physical functioning, role physical, role
122 emotional and mental health) using two items for each, whereas the remaining four concepts
123 (bodily pain, general health, vitality and social functioning) are represented by a single item. All
124 12 items are used to calculate the PCS-12 and the MCS-12 (27).

125 To select a suitable instrument for measuring PSS, a variety of available scales was reviewed (28-
126 30) and finally, the Persian version of the Social Provisions Scale (SPS) originally developed by a
127 research group at University of California at Los Angeles (UCLA) (31) based on the Weiss's
128 (1974) model of social provision, was selected. PSS consist of six dimensions: 1) Provision for
129 attachment, provided most often by marriage or other cross-sex relationships; 2) Social integration,
130 provided by a network of friends and colleagues who offer companionship and opportunity to share
131 interests and values; 3) Opportunity for nurturing behavior, provided most often to children which
132 develops a sense of being needed; 4) Reassurance of worth; 5) Guidance, provided most often by
133 supportive friends and relatives; 6) Reliable alliance, provided most often by kin relationships.
134 This scale has psychometric properties, contains simply worded questions and is relatively brief
135 (31). Also it has been recommended as a suitable scale for older people (30). This scale has been
136 translated to Persian by Zaki (32) in Iran as a reliable and valid instrument. Based on this study,
137 SPS has highly significant validity and reliability and is suitable for Iranian culture, although this

scale was not validated in older people in Iran. The SPS consisted of 24 items with a four-point Likert scale, ranging from "strongly disagree" to "strongly agree". Each item is placed in one of six dimensions as listed above. A total score for each dimension is computed, as the mean of the scores of the items falls in the range 4-16. Overall, the scores of the SPS ranged from 24-96, with higher scores indicating a higher degree of perception of Social Support.

Statistical analysis

After collecting the data, the information from the 644 completed questionnaires entered into STATA for analyses. Analyses started with descriptive statistics to summarize the data. For continuous variables with normal distribution, mean and standard deviation, or where relevant median and inter quartile range were used for presentation of the data. Categorical variables were presented using numbers and percentages of groups. The results of the univariate analysis are presented in descriptive tables. After preliminary exploratory analysis, multivariable logistic regression was used to analyze associations between indicators of the HRQoL and PSS. The data collected were clustered and had a hierarchical structure. Individuals in the study were nested within households within neighborhoods within districts of Tehran. Thus, multilevel models instead of simple models were selected. As the outcome measure was binary, multilevel mixed-effects logistic regression model using 'xtmelogit' command in STATA was used.

In order to test the hypothesis of this research, the mixed-effect model was arrived at through a number of modeling stages. In all models, only questionnaires with complete data on all variables were included. In the first model, the association of the PSS (main independent variable) and other covariates with the HRQoL (dependent variable) were initially assessed one by one in a mixed-effect model adjusted for age and gender. The selection of covariates were based on the conceptual approach informed by theoretical considerations and results of the literature review. Then

correlation among independent variables were checked using a correlation matrix and one of the highly correlated variables in any pair was dropped from further multivariable analyses. In the second model, other covariates were added to the first model to check how the association between main independent and dependent variables changes in the presence of other covariates. The third model was the same as Model 2 but with an additional section to check the possible gender interaction. In addition, in the final model, community-level data were added to a model with the main exposure, age and gender and then to the model of stage 2 in order to explore how associations between independent and dependent variables vary according to community-level characteristics.

Results

Men and women comprised exactly the same number in this study (322 men and 322 women). Descriptive profile of the study participants for sociodemographic variables are available from our previous paper published from the same data (14). Sample characteristics were similar to census data for a similar age group for the city of Tehran.

Table 1 shows the descriptive information on the HRQoL. After scoring of the SF-12, the mean (SD) of the PCS and the MCS were calculated at 43 (29) and 53 (22) respectively indicating considerably better mental health than physical health among participants. The HRQoL of men was better than that of women in both components; the PCS (mean 52 vs. 34) and the MCS (mean 59 vs. 47). As Table 1 shows, women were twice more likely to be in the worst quartile of both the PCS and the MCS. Age was also associated with HRQoL; being older was more likely to be in the worst quartile of the HRQoL, especially in the PCS scores.

Table 1- Distribution of participants in the worst and other quartiles of the PCS and MCS (SF-12), by gender and age group

N (%) *	PCS		MCS	
	Worst quartile	Rest quartiles	Worst quartile	Rest quartiles
Gender				
Men (n=322)	53(17.1)	256(82.8)	56(17.5)	263(82.5)
Women(n=322)	104(32.9)	212(67.1)	111(35.1)	205(64.9)
Age groups				
60-69(n=329)	48(15.0)	272(85.0)	64(19.6)	263(80.4)
70-79(n=244)	71(30.2)	164(69.8)	80(33.6)	158(66.4)
80+ (n=71)	38(55.9)	30(44.1)	23(33.8)	45(66.2)

* The sum of numbers in some rows is less than total people in that row because of item non-response.

The mean (SD) score for the PSS of the participants as measured by the SPS was also calculated at 71.8 (9.7) (men 72.5, women 71.2) with a range of 24–96. A higher proportion of women than men (58% versus 42%) had scores in the worst quartile of the SPS. The highest score for both men and women was in the dimension of ‘attachment’ and the lowest score was in the dimension of ‘social integration’.

Table 2- Mean and SD of scores of the SPS and its dimensions to measure PSS of participants, by gender

Mean (SD)	Total SPS (Score range 24-96)	Reliable alliance	Attachment	Guidance	Opportunity for nurturance	Social Integration	Reassurance of worth
Men	72.5(9.0)	12.4(2.1)	12.9(1.9)	11.8(2.0)	12.5(2.3)	11.0(1.9)	11.6(1.7)
Women	71.2(10.3)	12.6(2.5)	12.8(2.4)	11.2(2.6)	11.7(2.6)	10.7(2.3)	11.7(1.8)
Total	71.8 (9.7)	12.5(2.3)	12.8(2.2)	11.5(2.4)	12.1(2.4)	10.9(2.1)	11.7(1.8)

The results of the association between SPS and two subscales of HRQoL (measured by SF-12) including the MCS and the PCS, which cannot be combined, are shown in two separate Tables as 3 and 4. In this analysis, the SPS scores was dichotomized into the lowest score quartile (27%)

versus the rest, as it was interested to check whether low SPS scores were associated with poorer HRQoL.

The analysis of association between SPS and MCS (Table 3) in the first model showed that those in the worst quartile of SPS were 2.7 times more likely to be in the worst quartile of the MCS ($p<0.001$). Age, gender, economic status perceived, social participation, physical activity, disability and Nagi score showed also significant associations with the MCS. After dropping the highly correlated covariates and those not showing significant contribution based on the results of Model 1 and LR tests, Model 2 was run with the refined variables. In this model, although the OR of SPS in association with MCS was nearly halved compared to the earlier model, the association was still significant ($p=0.02$). Age lost its association with MCS ($p=0.40$) and gender's association was highly attenuated in this model but remained significant ($p=0.01$). Social participation and Nagi score were two other factors that remained significant in this model. In particular, Nagi score showed the most important contribution in association with MCS, suggesting that being socially active was a protective factor ($OR=0.29$, $p=0.005$) but having poor physical health was a risk factor for MCS ($OR=3.7$, $p<0.001$). In gender-specific analysis, the factor with the greatest difference between men and women was the Nagi score, which was most significantly associated with men's MCS than women. Thus, we formally tested for the interaction of gender in the association between Nagi and MCS in Model 3. There was no significant interaction between gender and Nagi score however ($p=0.30$). Association of other variables in Model 3 were almost the same as for Model 2. In the final model, the association between SPS and MCS was slightly stronger than the two previous models but the p-value was the same as before ($OR=1.84$, $p=0.02$). In this model, being female had a slightly smaller association with MCS ($OR=1.82$, $p=0.02$). Poor Nagi score and higher social participation had the same effects as before. As with the previous

models, the association between SPS and other aspects of health in this objective showed no significant association between SES of neighborhood and MCS.

[Table 3, here]

Analysis for association between SPS and PCS are shown in Table 4. In Model 1, those in the worst quartile of SPS were 2.5 times more likely to be in the worst quartile of PCS ($p=0.002$). Age, gender, economic status perceived, social participation, and physical activity also showed significant associations with PCS, similar to factors associated with MCS as explained previously. In Model 2, when other covariates were included, the OR of being in the worst quartile of the SPS in association with the worst quartile of the PCS was decreased to 2 fold, but still significant ($p=0.01$). In this model, of other covariates, age, gender and physical activity were also factors showing significant associations with PCS. As shown in Model 3 and Model 4 of Table 4, there was strong evidence ($p=0.02$) to support the hypothesis of gender interaction in the association between economic status and PCS, and borderline evidence ($p=0.05$) for the hypothesis that gender modified the association between physical activity and PCS. These analyses showed that the men who rarely took part in physical activity had a much greater chance of reporting worst PCS compared to women with the same level of physical activity (OR 5.3 vs. 1.8). Additionally, having a better economic status was found to be important for men's PCS, while women with poor or non-poor economic status reported similar PCS scores (OR 0.3 vs. 1.0). In the last model, when the effect of SES of neighbourhood was included, there was even stronger evidence compared to interaction models to support the significant association between SPS and PCS (OR=2.09, $p=0.01$). The association of other factors in Model 5 with PCS was similar to before, but individual SES (economic status) here showed more association with PCS with borderline evidence (OR=0.6, $p=0.06$), while neighbourhood SES had no significant effect. The analysis showed that a high

quality relationship with family members are associated with PSS of older people. Moreover, PSS showed significant associations with HRQoL.

[Table 4, here]

Discussion

In this study, we examined the influence of PSS on HRQoL (using the SF-12) among older people. Our results showed that those in the worst quartile of the SPS score, versus other quartiles, were 1.8 times more likely to be in the worst quartile of the MCS distribution ($p=0.02$), and twice as likely to be in the worst quartile of the PCS distribution ($p=0.01$) (Tables 3 and 4). These findings corroborated other studies conducted in Iran indicating a positive association between PSS and HRQoL (33), and emotional SS and HRQoL (34). Also the findings of our study are consistent with prior cross-sectional research on the association of PSS and HRQoL among Turkish (35, 36) and Israeli adults and older people (37). In the study of Filazoglu and Griva (35) PSS showed the strongest association with MCS and the second strongest association with the PCS among all other variables in regression models. The results of a longitudinal study in Israel (38) found SS as to have a stable, significant contribution to the QoL of participants in all three-time points of this study.

Few studies have considered the mechanisms whereby PSS may act positively to improve HRQoL. It is suggested that PSS may help people with strengthening their coping abilities to overcome the stressors of life or may have direct effect on their HRQoL through biological, psychological or behavioural pathways. Regarding people with different illnesses, Filazoglu and Griva (2008) (35) discussed that SS can directly influence their adjustment process and HRQoL in two ways; (i) tangible or instrumental SS which may aid patients in the process of physical recovery or in dealing

with the physical challenges of illness and associated treatments hence allowing them to maintain a reasonable level of physical HRQoL (PCS); (ii) emotional support which can provide reassurance in the process of dealing the emotional disorder of illness diagnosis and treatment and by making patients feel loved and valued in these times of hardship hence minimising emotional distress and impairments in mental HRQoL (MCS). According to some studies (36, 39), low levels of SS tend to be associated with poorer physical and mental aspects of HRQoL of chronically ill diabetic patients, while higher levels of SS contribute to better adjustment, a sense of purpose, less uncertainty and better compliance and control of these patients.

Further, the analysis in this study showed that the strength of the relationship between SPS and MCS decreased considerably in the presence of poor physical functioning status (Table 3), as poor physical functioning showed the strongest association with poor MCS even after controlling for many other factors in the model ($OR=3.87$, $p<0.001$). Given the reported inverse relationship between functional health and QoL (40) it is not surprising that the SS was less influential on HRQoL when physical functioning is poor. This finding lends support to the importance of managing and improving functional health of older people, as any SS interventions to improve HRQoL of older people would not be effective enough while these people are suffering from poor functioning. However, based on the findings (Table 3) PSS considerably decreased the strength of negative effects of poor functional status on HRQoL (MSC). This finding may lend some support to the stress-buffering model of SS as it enables older people to cope better with their poor physical situation, although it was not strong enough to eliminate most negative effects of poor physical health.

In addition, in this study, we found a significant interaction of gender in the association between physical activity and the PCS; men with the lowest level of physical activity versus those with

regular physical activity were more likely than women in the same situation to be in the worst quartile of the PCS score. This is consistent with the findings of Asfar (41) in Syria indicating that low physical activity is important for men's health only. This finding may reflect the fact that in conservative societies, physical activity is more feasible for men than women, particularly in old age, where certain recreational activities may not be an option for many women. Additionally, in this study we observed that gender can also modify the association between economic status and PCS ($p=0.02$), so that for men but not women, having a better economic status was associated with a lower risk of being in the worst quartile of PCS. One possible explanation for this finding might be that women's economic well-being depends more on family or spouse (such as what husband and others give them) than individual economic position. Another possibility is that the male breadwinner role means that men feel inadequate in some way if their economic status is poor and this affects their health. It is also possible that men with better economic status compared to poorer men had better access to health services or better life style. This is anyway a very complicated subject associating with many other factors.

The main weakness of this study is that it was cross-sectional and the temporal relationships between social support and health cannot be ascertained and reverse association cannot be excluded. For example, people with poor MCS and PCS may underestimate their SS resources. The temporality of this association could not be determined in this research and longitudinal studies are required. Another limitation was that this study was underpowered to examine interaction effects. Future research should employ larger samples to allow for analysis of gender interaction and the role of different sources of support in health and QoL of men and women. Additionally, the results of the study are only generalizable to community- living older people but not to older people living in institutions, those hospitalized at the time of the survey or those living

۳۱۱ in other parts of Iran. Future studies should try to include these groups for whom associations may
 ۳۱۲ differ and have a wider geographical scope. Importantly, further research is needed to elucidate
 ۳۱۳ the possible pathways and mechanisms whereby PSS influences the mental and physical
 ۳۱۴ components of HRQoL of older people in Iran.

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۳۱۶ **List of Abbreviations**

HRQOL: health-related quality of life	QOL: quality of life
SS: social support	PSS: perceived social support
MCS: Mental Component Score	PCS: Physical Component Score
SPS: Social Provisions Scale	SF-12: 12-item Short Form
SES: Socio-Economic Status	TUMS: Tehran University of Medical sciences
LSHTM : the London School of Hygiene and Tropical Medicine	

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۳۲۹ **Declarations**

۳۳۰ **Acknowledgements**

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۳۳۲ to the participants of this study.

۳۳۳ **Authors' contributions**

۳۳۴ MT designed the study, gathered data, carried out the statistical analysis and drafted the manuscript
۳۳۵ under supervision of EG and AF. EG and AF also contributed to interpretation of data significantly.
۳۳۶ BK and FM helped in literature review and using them in writing up the manuscript. They both
۳۳۷ also helped in data collection and data entry process. All authors read and approved the final
۳۳۸ manuscript

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۳۴۱ study.

۳۴۲ **Availability of data and materials**

۳۴۳ Please contact Dr. Maryam Tajvar (mtajvar@tums.ac.ir) for any data request.

۳۴۴ **Ethics approval and consent to participate**

۳۴۵ The ethical committee of the LSHTM as well as the ethical committee of the TUMS approved the
۳۴۶ research included in this thesis. An identification letter and card for all the people involved in the
۳۴۷ fieldwork was obtained from TUMS before starting the study. The purpose of the interview
۳۴۸ described for participants. Fieldworkers gave assurances to participants that the data collected
۳۴۹ would be treated as confidential and only used in an anonymous format for research purposes.

350. Participants' freedom to discontinue participation whenever they wished was stated in the
351 information sheets. The consent forms had to be signed or fingerprinted before interviews.
352 Anonymity and confidentiality of all participants interviewed was ensured through numeric coding
353 during all stages of the research. Questionnaires contained no identification of participants.

354 **Competing interests**

355 The authors reported no potential conflict of interest.

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Table 3: Mixed-effects logistic regression models for analysing the association of PSS and MSC (worst quartile of the MCS distribution)

Variables	Model 1** Univariable		Model 2 Multivariable		Model3 Model 2+ Interaction of Gender		Model4 Model 2+ Community- Level Covariate	
	Each Factor+ Age+ GenderSPS+ Other Individual-level Covariates		Each Factor+ Age+ GenderSPS+ Other Individual-level Covariates		Each Factor+ Age+ GenderSPS+ Other Individual-level Covariates		Each Factor+ Age+ GenderSPS+ Other Individual-level Covariates	
	OR (95% CI)	P*	OR (95% CI)	P	OR (95% CI)	P	OR (95% CI)	P
Individual-level variables								
Perceived social support (PSS)								
Rest quartiles	Ref.		Ref.		Ref.		Ref.	
Worst quartile	2.66(1.57-4.50)	<0.001	1.80(1.11-2.93)	0.02	1.76(1.09-2.85)	0.02	1.84(1.11-3.04)	0.02
Age								
Continuous	1.05(1.02-1.09)	0.002	0.98(0.95-1.02)	0.40	0.98(0.95-1.02)	0.40	0.98(0.95-1.02)	0.39
Gender								
Man	Ref.		Ref.		-		Ref.	
Woman	3.08(1.85-5.14)	<0.001	1.84(1.12-3.03)	0.01	-	-	1.82(1.10-3.01)	0.02
Ethnicity								
Fars (main ethnicity)	Ref.		-		-		-	
Non-Fars (minor ethnicities)	1.02(0.68-1.53)	0.93	-	-	-	-	-	-
Religious beliefs								
Strong	Ref.		-		-		-	
Less strong	1.50(0.74-3.02)	0.26	-	-	-	-	-	-
Married or not								
No	Ref.		-		-		-	
Yes	0.72(0.4-1.18)	0.19	-	-	-	-	-	-
Having children								
No	Ref.		-		-		-	
Yes	0.74(0.23-2.34)	0.61	-	-	-	-	-	-
Family size								
0-10 members	Ref.		-		-		-	
11+ members	0.88(0.49-1.59)	0.68	-	-	-	-	-	-
Living arrangement								
Living alone/others	Ref.		-		-		-	
Living with child/children only	0.61(0.30-1.24)		-		-		-	
Living with spouse only	0.65(0.33-1.26)	0.37	-	-	-	-	-	-
Living with spouse& child/children	0.56(0.28-1.10)		-		-		-	
Quality of relationships with spouse****								
Less than very good	Ref.		-		-		-	
Very good	0.65(0.41-1.04)	0.07	-	-	-	-	-	-
Quality of relationships with at least 1 family member								
Less than very good	Ref.		-		-		-	
Very good	0.62(0.37-1.05)	0.08	-	-	-	-	-	-
Education								
Illiterate	Ref.		-		-		-	-

1-9 years	1.00(0.63-1.57)	0.99	-	-	-	-	-	-
10 years and more	0.98(0.50-1.95)		-		-		-	
Economic status perceived								
Poorer than average	Ref.		Ref.		Ref.		Ref.	
Same or better than average	0.58(0.36-0.94)	0.02	0.79(0.50-1.25)	0.33	0.81(0.51-1.28)	0.37	0.83(0.51-1.30)	0.38
Having medical insurance								
Yes	Ref.		-		-		-	
No	1.58(0.84-3.00)	0.16	-	-	-	-	-	-
Participating in social activities								
0-2 activities out of 10 (poor)	Ref.		Ref.		Ref.		Ref.	
3-10 activities (non poor)	0.13(0.05-0.36)	<0.001	0.29(0.12-0.68)	0.005	0.30(0.13-0.69)	0.005	0.29(0.12-0.70)	0.006
Smoking								
Regularly/Sometimes	Ref.		-		-		-	
Never	1.03(0.58-1.81)	0.92	-	-	-	-	-	-
Physical activity(exercise)								
Regularly/Sometimes	Ref.		Ref.		Ref.		Ref.	
Never	2.03(1.23-3.34)	0.005	1.27(0.77-2.10)	0.34	1.23(0.75-2.04)	0.41	1.35(0.80-2.29)	0.25
Disability limiting daily life								
Yes	Ref.		-		-		-	
No	0.22(0.11-0.45)	<0.001	-	-	-	-	-	-
Nagi (functional health)								
Rest quartiles	Ref.		Ref.		-		Ref.	
Worst quartile	5.15(2.47-10.74)	<0.001	3.66(1.89-7.12)	<0.001	-	-	3.87(1.94-7.72)	<0.001
Interaction of Nagi and Gender P						0.30		
Nagi in men								
Rest quartiles	-		-		Ref.		-	
Worst quartile	-	-	-	-	4.89(1.97-12.10)	0.001	-	-
Nagi in women								
Rest quartiles	-		-		Ref.		-	
Worst quartile	-	-	-	-	3.07(1.52-6.18)	0.002	-	-
Community-level variable								
SES of neighbourhood								
Poor	Ref.		-		-		Ref.	
Middle	1.17(0.73-1.87)	0.80	-	-	-	-	1.18(0.70-1.98)	0.40
High	1.06(0.61-1.83)		-		-		1.58(0.81-3.07)	
LR test vs. logistic regression P-value			0.99		0.99		0.96	
Neighbourhood-level ICC			≈ 0		≈ 0		≈ 0	
Household-level ICC			0.09		0.06		0.14	

* P-value of OR reported for each dummy variable compared to the baseline category controlled for other variables. For categorical variables overall P-value was reported using 'testparm' in STATA. In all models only people with complete data on all variables were included. **In Model 1, ICC for levels of analysis were not reported as separate univariable models were fitted for each variable and each model had different ICC for each level *** For these variables, analysis excluded those without a spouse/ a child

Table 4: Mixed-effects logistic regression models for analysing the association of PSS and PCS (worst quartile of the PCS distribution)

Variables	Model 1**		Model 2		Model3		Model 4		Model 5	
	Univariable		Multivariable		Model 2+ Interaction of		Model 2+ Interaction of		Model 2+ Interaction of	
	Each Factor+ Age+ Gender	P*	SPS+ Other Individual-level Covariates	P	Gender& Physical Activity	P	Gender& Economic Status	P	Community-Level Covariate	P
OR (95% CI)										
Individual-level variables										
Perceived social support (PSS)										
Rest quartiles	Ref.		Ref.		Ref.		Ref.		Ref.	
Worst quartile	2.53(1.38-4.60)	0.002	2.04(1.18-3.54)	0.01	1.92(1.12-3.27)	0.02	1.99(1.13-3.49)	0.02	2.09(1.19-3.65)	0.01
Age										
Continuous	1.14(1.07-1.21)	<0.001	1.08(1.04-1.13)	<0.001	1.08(1.03-1.12)	<0.001	1.08(1.03-1.13)	<0.001	1.08(1.03-1.13)	<0.001
Gender										
Man	Ref.		Ref.		-		-		Ref.	
Woman	4.33(1.07-9.20)	<0.001	2.36(1.29-4.33)	0.005	-	-	-	-	2.18(1.20-3.94)	0.01
Ethnicity										
Fars (main ethnicity)	Ref.		-		-		-		-	
Non-Fars (minor ethnicities)	1.13(0.66-1.93)	0.64	-	-	-	-	-	-	-	-
Married or not										
No	Ref.		-		-		-		-	
Yes	0.82(0.44-1.53)	0.54	-	-	-	-	-	-	-	-
Having children										
No	Ref.		-		-		-		-	
Yes	0.87(0.19-3.96)	0.86	-	-	-	-	-	-	-	-
Living arrangement										
Living alone/others	Ref.		-		-		-		-	
Living with children only	0.87(0.37-2.06)		-		-		-		-	
Living with spouse only	0.91(0.40-2.07)	0.84	-	-	-	-	-	-	-	-
Living with spouse& children	0.70(0.30-1.65)		-		-		-		-	
Education										
Illiterate	Ref.		Ref.		Ref.		Ref.		Ref.	
1-9 years	0.74(0.41-1.35)	0.12	1.15(0.67-1.98)	0.56	1.12(0.65-1.90)	0.52	1.11(0.63-1.95)	0.77	1.03(0.58-1.84)	0.21
10 years and more	0.33(0.11-0.95)		0.70(0.26-1.85)		0.65(0.25-1.70)		0.79(0.29-2.14)		0.38(0.11-1.26)	
Economic status perceived										
Poorer than average	Ref.		Ref.		Ref.				Ref.	
Same or better than average	0.44(0.24-0.80)	0.008	0.63(0.37-1.05)	0.08	0.63(0.38-1.05)	0.08			0.59(0.34-1.02)	0.06
Having medical insurance										
Yes	Ref.		-		-		-		-	
No	1.14(0.50-2.61)	0.75	-	-	-	-	-	-	-	-
Participating in social activities										
0-2/10 activities (poor)	Ref.		-		-		-		-	
3-10/10 activities (non poor)	0.09(0.02-0.35)	0.001	-	-	-	-	-	-	-	-

Smoking										
Regularly/Sometimes	Ref.		-		-		-		-	
Never	0.93(0.45-1.92)	0.84	-	-	-	-	-	-	-	-
Physical activity(exercise)										
Regularly/Sometimes	Ref.		Ref.		-		Ref.		Ref.	
Never	4.09(1.94-8.63)	<0.001	3.18(1.63-6.20)	0.001	-	-	3.27(1.62-6.60)	0.001	3.33(1.68-6.60)	0.001
Interaction of Physical activity & Gender P					0.05					
Physical activity in men										
Regularly/Sometimes			-		Ref.		-		-	
Never			-	-	5.32(2.14-13.20)	<0.001	-	-	-	-
Physical activity in women										
Regularly/Sometimes			-		Ref.		-		-	
Never			-	-	1.80(0.82-3.93)	0.14	-	-	-	-
Interaction of Economic status & Gender P					0.02					
Economic status in men										
Poorer than average			-		-		Ref.		-	
Same or better than average			-	-	-	-	0.28(0.11-0.71)	0.007	-	-
Economic status in women										
Poorer than average			-		-		Ref.		-	
Same or better than average			-	-	-	-	1.00(0.53-1.88)	0.99	-	-
Community-level variable										
SES of neighbourhood										
Poor	Ref.		-		-		-		Ref.	
Middle	0.72(0.39-1.34)		-		-		-		0.86(0.48-1.53)	
High	0.78(0.38-1.58)	0.54	-	-	-	-	-	-	2.11(0.86-5.18)	0.16
LR test vs. logistic regression P-value			0.69		0.79		0.62		0.65	
Neighbourhood-level ICC			≈0		≈0		≈0		≈0	
Household-level ICC			0.22		0.20		0.24		0.22	

* P-value of OR reported for each dummy variable compared to the baseline category controlled for other variables. For categorical variables, overall P-value was reported using 'testparm' in STATA. In all models, only people with complete data on all variables were included. **In Model 1, ICC for levels of analysis were not reported as separate univariable models were fitted for each variable and each model had different ICC for each level