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A Survey on the Status Quo and Influencing Factors of Health-Related Quality of Life Among Family Caregivers of People with Dementia: A Cross-Sectional Study

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Background: This study examined the current state of health-related quality of life among family caregivers of elderly individuals with dementia, analyzing associated influencing factors to provide a foundation for enhancing their health-related quality of life and developing pertinent intervention strategies and measures.

Methods: From September 2023 to February 2024, a convenient sampling method was used to investigate the status quo of Health-Related Quality of Life (HRQOL) among family caregivers for dementia patients, family caregivers for non-dementia patients, and people with no caregiving burdens in Sichuan, Chongqing and Guizhou in southwest China. The risk factors were analyzed by multiple regression.

Results: A total of 678 questionnaires were distributed, and 630 valid questionnaires were obtained, resulting in a response rate of 92.92%. The study found that family caregivers for elderly individuals with dementia exhibited the lowest scores in both physical and mental health, followed by family caregivers for elderly individuals without dementia, while people with no caregiving burdens scored the highest. The multiple linear regression analysis demonstrated that age, chronic disease, the relationship between the family caregiver and the person being cared for were dependent of physiological health scores. While females, caregivers with secondary-education, and caregivers with a chronic disease showed poorer mental health scores.

Conclusion: We need to focus on the role that family caregivers for dementia patients play in the health and quality of life of older people with dementia. Therefore, we should pay more attention to the physical and mental health of family caregivers for dementia patients and ensure that this should be taken into consideration in policy-making, which will contribute to a better quality of life for theses caregivers.

Keywords: dementia, family caregivers, general health, SF-36, health survey, associated factors

Introduction

Dementia encompasses Alzheimer's disease, vascular dementia, and Lewy body dementia, predominantly affecting individuals over the age of 60.[1,2] With the aging of the population, it is expected that by 2050, up to 68% of the increase in the prevalence and burden of dementia globally will be concentrated in low-income and middle-income countries, while the prevalence of dementia in people aged 60 and above in China is 6.04%, and a quarter of the world's

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dementia population is in China.[3–5] Influenced by traditional cultural values, the uneven development of elderly care institutions in China, and the limited awareness of dementia among family caregivers, the predominant caring model for elderly individuals with dementia in China is home-based care.

Family caregivers are commonly referred to as informal caregivers, and there is currently no international consensus on their definition. Chinese scholars Wang Ruibo et al defined family caregivers as individuals who provide continuous care and assistance to family members in need of external support due to physical, cognitive, or mental health issues, including non-employed individuals such as relatives and partners.[6] Influenced by traditional culture and the uneven development of elderly care institutions in China as well as the lack of awareness of this disease among their families, the elderly with dementia are predominantly cared for in a home-based model. Relevant data indicate that more than 11.5 million family caregivers and other unpaid caregivers provided about 18 billion hours of care for people with dementia in 2022, and the value of the care they provided was about $339.5 billion.[3]

Elderly people with dementia tend to have more care needs than elderly people with other diseases in terms of impaired cognitive functions such as memory, executive function, orientation, and activities of daily living, as well as concomitant psycho-behavioral symptoms. Family caregivers, particularly those tending to individuals with dementia, frequently experience significant physical and psychological stress.[7] These family caregivers often report symptoms of depression and a decline in physical health, characterized by disturbed sleep patterns, decreased immunity, and premature frailty syndrome.[8,9] Regrettably, due to insufficient public awareness regarding dementia, these caregivers often face misunderstanding and stigma, which further intensifies their mental and physical distress, adversely impacting their health and overall quality of life.[10] The increased caregiving burden may even lead to abusive tendencies and behaviors by family caregivers toward people with dementia, while seriously affecting disease progression and quality of life in people with dementia.[11]

HRQOL encompasses an individual's subjective assessment of their health status, alongside the changes and functional levels encountered in daily life, mental well-being, and social interactions.[12] Despite numerous studies, there remains a lack of consensus regarding the influencing factors on HRQOL among family caregivers of individuals with dementia. Currently, the 36-item Short Form Health Survey (SF-36) is frequently employed to provide a comprehensive evaluation of individual health status due to its concise content and strong applicability. The content of the scale is simple and has good applicability. At present, the scale has been extensively utilized across diverse populations, including family caregivers for dementia patients,[13–15] and it is also one of the most widely adopted standardized measurement tools for quality of life in large-scale surveys, health policy assessments, and clinical trials by both domestic and international researchers.[16] Consequently, this study aims to evaluate the current HRQOL status among family caregivers for dementia patients, family caregivers for non-dementia patients, and people with no caregiving burdens using the well-regarded SF-36 scale. It also seeks to examine how demographic characteristics and medical information may influence HRQOL in order to propose targeted interventions that mitigate negative outcomes for family caregivers for dementia patients in the future while scientifically enhancing their health-related quality of life. It is vital for clinicians and policymakers to ensure the physical and mental well-being of caregivers, especially those caring for people with dementia, and to provide the necessary support and training to prevent potential abuse and help ensure patient safety and quality of care at home.

Methodology

Research Team Composition, Division of Labor and Quality Control System

The research team was composed of two medical workers with senior professional titles, one nurse with intermediate professional title, four nurses with junior professional title, and one social worker recruited from the sample collection site. As a specialist in Case Report Form training and medical guidance, the doctor with a senior professional title provided comprehensive training to the investigators prior to the survey. The nurse with a senior professional title served as the quality control personnel, rigorously overseeing the integrity of the entire investigative process while conducting

spot checks on questionnaires. The intermediate-title nurse acted as the project implementation commanderand emergency support personnel; meanwhile, four junior nurses executed on-site investigations after undergoing specialized training and completing a simulation practice assessment. Those who did not pass this assessment were retrained until they successfully met evaluation standards.

Study Design and Population

A cross-sectional study was performed to evaluate the general health of voluntary participants. The study population was set to be: observation group (family caregivers for demented elderly people), blank control group (people with no caregiving burden), and control group (family caregivers for non-demented elderly people). According to the Kendall sample size estimation method, and taking into account the expected 20% missing rate in this study, we finally decided on a minimum sample size of 432 cases with at least 144 cases in each group.

The study was conducted from September 2023 to February 2024 using convenience sampling method to select study subjects in Sichuan, Chongqing and Guizhou. Previous studies have indicated that most informal caregivers are aged 45 and older.[17] Therefore, participants aged 45 years and above were selected for this study. Urban residents were recruited by their community residents' committees which advertised the recruitment of subjects one week in advance, and the researchers conducted the study at a fixed point. Similarly, township residents were recruited by the local neighborhood committees which advertised the recruitment of subjects one week in advance, and the researchers carried out the study at a fixed point or made door-to-door visits to conduct the study. All survey participants engaged with the researcher in an open and independent environment. Subjects meeting the inclusion criteria were assessed using the CRF and SF-36 scales. After researchers provided a comprehensive explanation regarding the purpose, significance, participation methods, and confidentiality principles of this study, respondents voluntarily agreed to participate by signing informed consent forms. The questionnaires were explained, instructed and distributed by the investigators to the participants, who completed the questionnaires anonymously, and the expected time to complete the questionnaires was approximately 15 to 20 minutes per person. Upon completion, the questionnaires were collected and verified on the spot to ensure all questions had been answered adequately.

Inclusion criteria for family caregivers: (1) Age above 45 years; (2) A person who has primary responsibility for the care of a demented elderly person or other elderly person in need of care and has lived with the elderly person being cared for at least three months. WHO defines an older person with dementia as a person with progressive cognitive deterioration that meets the diagnostic criteria of International Classification of Diseases, 10th Edition (ICD 10).[18]

Exclusion criteria for family caregivers: (1) Paid caregivers such as nursing workers and nannies; (2) Caregivers suffering from serious heart, brain, lung, kidney and other important organ diseases; (3) Caregivers with mental illness; (4) Caregivers with severe hearing impairment, speech communication impairment, comprehension impairment or severe cognitive impairment.

Data Collection Tool

SF-36 Scale

The self-designed general data questionnaire and the Chinese version of the SF-36 health Questionnaire were utilized for a cross-sectional survey of participants who met the inclusion criteria. Questions that were not understood by the respondents were explained at any time during the survey, and the questionnaire was checked for missing items at the end of the survey. If a returned questionnaire contained more than 20% of missing items, it was considered as an invalid questionnaire. The general data questionnaire included age, gender, marital status, education level, relationship with the person being cared for, disease status, etc. The Chinese version of the short form of medical outcomes survey, represented by SF-36, was utilized for evaluating the general health of participants. The SF-36 scale consists of 36 items with 8 dimensions: Physical Functioning (PF), Role-Physical (RP), Bodily Pain (BP), General Health (GP), General Health (GH), Vitality (VT), Social Functioning (SF), Role-Emotional(RE), and Mental Health (MH). The 8 dimensions of the SF-36 are categorized as follows: the first four are categorized as components of Physical Component Summary (PCS), while the last four are considered components of Mental Component Summary (MCS). The tool is a versatile instrument that encompasses a broad spectrum of life's facets, and due to its reliability and efficacy, it has

gained international recognition and support. The internal reliability of the questionnaire as indicated by Cronbach's Alpha was greater than the level of acceptance of 0.7 for all domains except for the Social Functioning and Vitality domains.[19] Currently, the scale has been extensively utilized across various demographics, including caregivers for individuals with dementia. It is also one of the most commonly used standardized measures of quality of life by scholars at home and abroad in large-scale surveys, health policy assessments and clinical trials.[20] The 36 items in the table are assigned positive or negative scores based on the specific context, and the eight dimensions are calculated individually. The total score ranges from 0 to 100, with higher scores indicating better quality of life. However, there is no specific cut-off point for SF-36 scores to distinguish different levels of quality of life.

CRF

Data were collected using the case report form (CRF) for study subjects who met the inclusion and exclusion criteria, and the CRF included basic information and medical information. Basic information includes name, gender, age, ethnicity, years of education, marital status, etc. Medical information mainly collects diseases of each system (nervous system, cerebrovascular system, cardiovascular system, respiratory system, endocrine system, urinary system, and digestive system).

Statistical Analysis

The data were collated and entered by two people and analyzed by SPSS 29.0 software. The data in this study were approximately normally distributed, with continuous variables expressed as mean and standard deviation, and count and grade information expressed as frequency and percentage. Spearman was used to determine the associations between scores and independent variables in eight domains. One-way ANOVA and multiple linear regression models were used to analyze the correlation of influencing factors. The test level was α=0.05, and the level less than 0.05 was statistically significant.

Results

Socio-Demographic Characteristics of Study Participants

Of the 678 questionnaires distributed in the study, 15 questionnaires were refused by potential respondents, 33 unqualified questionnaires were excluded, and 630 valid questionnaires were collected, which made the response rate 92.92%. There were 211 participants in the blank group, 213 in the control group and 206 in the observation group. The data regarding the demographic information is shown in Table 1. Four hundred (63.5%) were females, 407 individuals were under the age of 60 (64.6%), and the mean age of participants was 58.29 (SD=11.20) years. Among them, 249 individuals were engaged in manual labor (39.5%), while 375 resided in urban areas (59.5%). Additionally, there were

Table 1 Demographic Characteristics of Study Participants

Variable	Participants (n=630)	Blank Group (n=211)	Control Group (n=213)	Observation Group (n=206)	Statistical Value	*P*-value
Sex					0.426	0.653
Male	230 (36.5%)	75 (35.5%)	83 (39.0%)	72 (35.0%)		
Female	400 (63.5%)	136 (64.5%)	130 (61.0%)	134 (65.0%)		
Age ($\bar{x} \pm s$)	58.29±11.20	58.68±11.32	58.14±11.49	58.05±10.82	0.608	0.738
≤60 years	407 (64.6%)	134(63.5%)	139(65.3%)	134(65%)		
>60 years	223 (35.4%)	77(36.5%)	72(34.7%)	72(35%)		
Occupation					5.483	0.004
Manual labor	249 (39.5%)	94 (44.5%)	93 (43.7%)	62 (30.1%)		
Mental labor	166 (26.3%)	49 (23.2%)	57 (26.8%)	60 (29.1%)		
Others (unemployed or retired)	215 (34.1%)	68 (32.2%)	63 (29.6%)	84 (40.8%)		

(*Continued*)

Table 1 (Continued).

Variable	Participants (n=630)	Blank Group (n=211)	Control Group (n=213)	Observation Group (n=206)	Statistical Value	*P*-value
Relationship with the cared-for (n=419)					−0.156	0.876
Spouse	148 (35.3%)		76 (35.7%)	72 (35.0%)		
Children	271 (64.7%)		137 (64.3%)	133 (65.0%)		
Location of residence					2.370	0.095
Rural	255 (40.5%)	91(43.1%)	93(43.7%)	71(34.5%)		
Urban	375 (59.5%)	120(56.9%)	120(56.3%)	135(65.5%)		
Education level					1.895	0.151
Primary school or lower	180(28.6%)	70(33.2%)	65(30.5%)	45(21.8%)		
Middle school	198(31.4%)	63(29.8%)	59(27.7%)	76(36.9%)		
Higher education or above	252(40%)	78(37.0%)	89(41.8%)	85(41.3%)		
Marital status					5.223	0.006
Spouses	595 (94.4%)	189(89.6%)	206(96.7%)	200(97.1%)		
Having no spouse[a]	35 (5.6%)	22(10.4%)	7(3.3%)	6(2.9%)		
Number of chronic diseases					0.202	0.817
0	359 (57.0%)	120(56.9%)	118(55.4%)	121 (58.7%)		
1	138 (21.9%)	47(22.3%)	48(22.5%)	43 (20.9%)		
>1	133 (21.1%)	44(20.9%)	47(22.1%)	42 (20.4%)		

Notes: Having no spouse[a]: unmarried, divorced, widowed.

252 individuals with higher education (40%) and 595 individuals who were married (94.4%). Furthermore, 138 individuals (21.9%) had one chronic disease, while 133 individuals (21.1%) had two or more chronic diseases. The overall differences in the general demographic information of the three groups of respondents in terms of gender, age, location of residence, education, the number of chronic diseases, and the relationship between the caregiver and the person being cared for in the control and observation groups were not statistically significant (P>0.05), and the baseline of the respondents was consistent. There were statistically significant differences in the occupation and marital status among the three groups (P<0.05). Specifically, among the family caregivers for dementia individuals, 84 (40.8%) were unemployed or retired, and 200 had spouses (97.1%).

HRQOL Scores of Survey Subjects in Various Fields

The results showed that PF score (81.90±15.83) was the highest, BP score (23.60±7.98) was the lowest, PCS score was (58.00±11.13), and MCS score was (60.71±11.02). The health-related quality of life scores of the three groups were compared. As shown in Figure 1, there was no statistical difference in the scores of PF, BP, SF, MH, PCS and MCS among the three groups (P > 0.05), while there were statistical differences in the overall distribution of RP, GH, VT and RE scores among the three groups (P < 0.05).

Correlation Analysis in HRQOL of Survey Subjects

In Spearman correlation analysis, as depicted in Figure 2, PCS was negatively correlated with BP (r=−0.111), positively correlated with other domains, and strongly correlated with PF and RP (r=0.652 and r=0.785). MCS was negatively correlated with BP (r=−0.102), positively correlated with other fields, and strongly correlated with RE (r=0.714). PCS and MCS are less relevant across domains than within them.

Analysis of the Short Form Health Survey (SF-36) Related Factors in Survey Subjects

Using different demographic data as independent variables and PCS and MCS as dependent variables, *t*-test and one-way ANOVA were performed. The factors that showed significant differences among respondents in PCS included age,

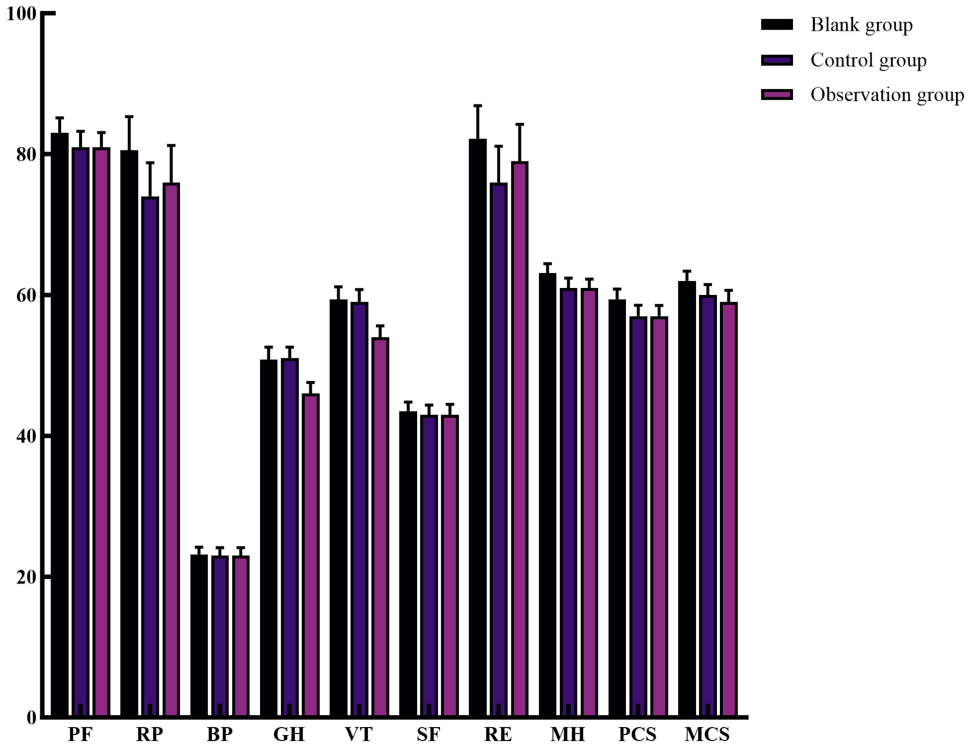

Figure 1 Mean Scores for the Eight SF-36 Domains and the Two Summary Measures (PCS and MCS) of the Study Participants among the three groups.

occupation, relationship with the person being cared for, location of residence, education level, and their own chronic diseases ($P<0.05$). The factors with significant differences in MCS domain included gender, occupation, location of residence, education level, and chronic disease ($P<0.05$). See Table 2.

The multiple regression assignment is shown in Table 3. The results of the multiple linear regression analysis, as presented in Table 4, indicate that age, relationship with the person being cared for, and disease status are significant factors influencing the PCS score. Respondents aged 60 and below had PCS scores that were on average 7.309 points higher than the scores of those aged 60 and above. The average PCS score for children of elderly individuals being cared for was 1.132 points higher than that for spouses. Additionally, PCS scores were on average 2.807 points lower for caregivers with one chronic disease compared with those for caregivers without any diseases, while PCS scores were on average 4.291 points lower for caregivers with two or more chronic diseases compared with those for caregivers without any diseases.

Furthermore, gender, disease status, and educational level were found to be influential factors for the MCS score, as presented in Table 5. Women had an average of 2.71 points lower MCS scores than men; individuals with one or more chronic diseases scored on average 3.549 points lower than those without chronic diseases; respondents with two or more chronic diseases demonstrated a decrease of 2.689 points in their MCS scores compared to those without chronic diseases; finally, MCS scores were on average 3.766 points lower for those with secondary education and 4.084 points lower for those with higher education, compared to those with primary education.

Discussion

In the process of providing home care for the elderly, family caregivers play a crucial role. However, they face significant challenges and potential threats to their physical and mental well-being. This study utilized the widely recognized SF-36 scale to evaluate the health-related quality of life of family caregivers, demonstrating its validity and reliability. The SF-36 scale encompasses personal functioning, emotional well-being (pain and overall wellness), as well as perceptions of one's own health and future prospects. By investigating the HRQoL of family caregivers, this study aims to lead them to recognize the importance of maintaining their own physical and mental health while caring for the elderly.

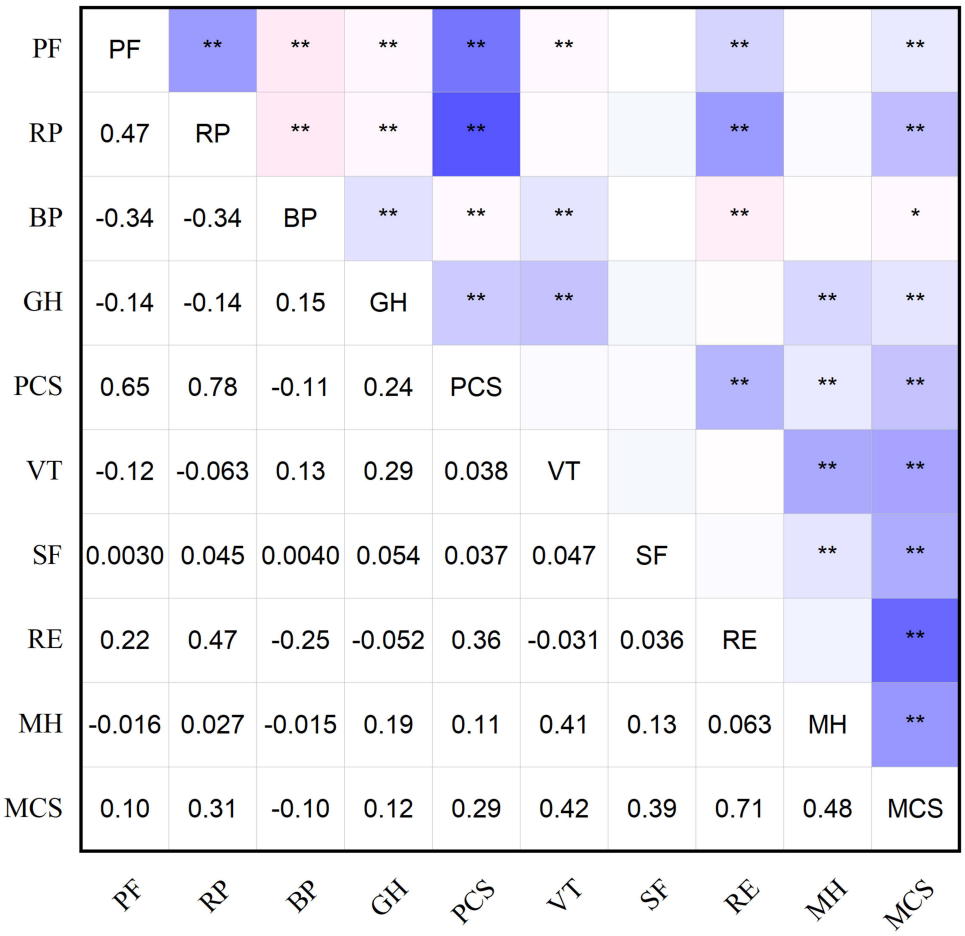

Figure 2 Correlation analysis of HRQoL (n=630, *r*); * p<=0.05, ** p<=0.01.

Status of Health-Related Quality of Life

The survey results indicated that the overall PCS score in this study was lower than the MCS score, with scores of 58.00 ±11.13 and 60.71±11.02 respectively, which aligns with the findings of a study on primary caregivers for type 2 diabetes elderly patients conducted by Li Min et al.[21] On one hand, this may be attributed to the suboptimal health status of caregivers as their physical burden gradually increases, leading to inevitable impairment in physical health. On the other hand, caregivers perceive family care as a fundamental responsibility and duty, providing not only comfort and support for their loved ones but also instilling hope in the elderly and helping them cultivate confidence in life. The satisfaction and sense of accomplishment derived from caregiving can serve as motivation for maintaining their role as caregivers, realizing their self-worth, enhancing their motivation to provide care, and ultimately improving their subjective well-being and mental health level.

Among the three groups, the PCS scores of those without caring burdens were higher than those of the other two groups, and PCS scores for family caregivers for non-demented older people were slightly higher than those for family caregivers for demented older people. Elderly people with dementia experience not only cognitive function deficits but also decline in self-care ability, requiring caregivers to dedicate more time and energy to assist them in daily life. Additionally, some elderly individuals exhibit behavioral abnormalities that further increase the caregiving burden. Furthermore, caregivers must invest significant time and energy into accident prevention and may even provide round-the-clock care, leading to physical fatigue and negative impacts on their health. In the present study, family caregivers for dementia had the highest PF score and the lowest BP score (Figure 2) among all domains. Similar to another study, the highest mean value is related to PF, while the lowest is associated to RE.[22] Most respondents reported “very slight pain”

Table 2 Comparison of the Scores of PCS and MCS in Each Group

Variable	Participants (n=630)		Blank Group (n=211)		Control Group (n=213)		Observation Group (n=206)	
	PCS	MCS	PCS	MCS	PCS	MCS	PCS	MCS
Sex								
Male	57.89±10.61	62.36±10.12	59.69±9.61	64.33±9.00	58.88±10.63	62.79±8.95	54.88±11.08	59.82±11.95
Female	58.07±11.42	59.75±11.41[a]	59.23±11.37	60.76±10.26[a]	56.60±11.83	58.51±11.68[a]	58.32±11.00[a]	59.94±12.20
t-value	−0.193	2.974	0.299	2.624	1.426	3.020	−2.137	−0.066
P-value	0.847	0.003	0.765	0.009	0.155	0.003	0.034	0.947
Age								
≤60 years	60.85±9.56	60.09±11.12	62.11±9.50	61.30±10.13	60.92±9.35	59.67±10.93	59.51±9.72	59.33±12.20
>60 years	52.81±11.90[a]	61.82±10.78	54.66±11.23[a]	63.30±9.59	51.04±12.16[a]	61.12±10.81	52.66±12.21[a]	60.97±11.88
t-value	8.663	−1.887	4.898	−1.405	6.095	−0.924	4.111	−0.933
P-value	<0.001	0.060	<0.001	0.161	<0.001	0.357	<0.001	0.352
Occupation								
Manual labor	56.78±10.75	62.03±10.23	56.62±10.91	62.83±9.74	56.66±10.73	62.00±9.77	57.21±10.72	60.88±11.59
Mental labor	59.96±9.89[a]	59.45±11.09[a]	62.04±9.23[a]	60.94±9.21	59.45±10.17	58.60±10.42	58.75±10.05	59.06±13.01
Others (unemployed or retired)	57.91±12.23	60.13±11.73	61.31±10.81[a]	61.71±10.79	56.94±13.26	58.91±12.51	55.89±12.07	59.78±11.85
F-value	4.113	3.188	5.950	0.630	1.160	2.357	1.157	0.353
P-value	0.017	0.042	0.003	0.533	0.315	0.097	0.316	0.703
Relationship (n=419)								
Spouse	52.83±12.16	60.78±11.46	-	-	52.72±12.01	61.45±10.63	52.95±12.41	60.08±12.31
Children	59.75±9.93[a]	59.63±11.49	-	-	60.13±10.18[a]	59.47±10.99	59.36±9.69[a]	59.80±12.01
t-value	−5.927	0.980	-	-	−4.550	1.272	−3.806	0.160
P-value	<0.001	0.327	-	-	<0.001	0.205	<0.001	0.873
Location of residence								
Rural	56.21±11.01	62.02±10.38	57.29±11.21	63.50±8.33	55.18±11.28	61.90±10.70	56.17±10.42	60.30±12.05
Urban	59.22±11.05[a]	59.81±11.37[a]	60.98±10.16[a]	60.91±10.93	59.27±11.23[a]	58.84±10.88[a]	57.62±11.48	59.69±12.15
t-value	−3.366	2.484	−2.498	1.950	−2.630	2.047	−0.892	0.341
P-value	<0.001	0.013	0.013	0.052	0.009	0.042	0.373	0.734
Education level								
Primary school or lower	55.16±11.25	62.86±9.27	55.33±11.49	63.12±8.98	54.51±11.18	62.82±8.73	55.83±11.17	62.54±10.61
Middle school	57.89±11.70[a]	59.93±12.22[a]	60.10±10.30[a]	61.67±11.86	57.90±13.15	60.03±11.60	56.06±11.44	58.42±12.91
Higher education or above	60.12±10.11[ab]	59.77±11.02[b]	62.47±9.32[a]	61.35±9.13	59.39±9.91[a]	58.34±11.51[a]	58.75±10.72	59.83±11.96
F-value	10.801	4.901	8.933	0.639	3.572	3.260	1.571	1.657
P-value	<0.001	0.008	<0.001	0.529	0.030	0.040	0.210	0.193
Marital status								
Spouses	58.10±11.11	60.66±11.09	59.96±10.69	61.95±9.99	57.54±11.21	60.26±10.82	56.94±11.23	59.85±12.24
Having no spouse	56.28±11.42	61.48±9.96	54.52±10.31[a]	62.72±9.88	55.99±17.38	57.63±13.32	63.06±2.89[a]	61.45±4.89

t-value	0.944	−0.429	2.266	−0.342	0.352	0.629	−4.296	−0.319
P-value	0.346	0.668	0.024	0.733	0.726	0.530	0.001	0.750
Number of chronic diseases								
0	60.42±9.85	61.59±10.80	63.18±8.02	63.3837±9.43	58.95±10.79	60.41±11.42	59.12±10.03	60.97±11.29
1	56.46±11.75[a]	58.53±11.71[a]	56.58±11.24[a]	59.26±10.14[a]	57.80±11.75	59.14±11.12	54.84±12.35[a]	57.06±13.89
>1	53.08±11.86[ab]	60.57±10.65	52.06±12.17[ab]	61.30±10.69	53.49±11.87[b]	60.67±9.27	53.70±11.76[b]	59.72±12.18
F-value	24.481	3.899	23.368	3.111	3.976	0.286	5.033	1.679
P-value	<0.001	0.021	<0.001	0.047	0.020	0.752	0.007	0.189

Notes: [a] The first category of each demographic variable was selected as reference to do univariate logistic regression analysis $p < 0.05$ or less. [b] The second category of each demographic variable was selected as reference to do univariate logistic regression analysis $p < 0.05$ or less.

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Table 3 Assignment of Variables in Regression Analysis

variable	Assignment
Sex	Male=1; female=2
Age	Age≤60 years=1; age>60 years=2
Number of chronic diseases	None=1; 1=2; >1=3
Relationship	None=1; Spouse=2; Children=3
Education Level	Primary school or lower=1; Middle school=2; Higher education or above=3

Table 4 Results of Multifactor Linear Regression Analysis Model of PCS Influences on Survey Respondents (n=630)

	β	95% CI	SE	BS	*t*	*P*
Constant	69.772	66.332~73.212	1.752	–	39.828	<0.001
Age (ref:≤60 years)	−6.495	−8.874~-4.115	1.212	−0.279	−5.36	<0.001
Number of chronic diseases (ref:0)						
1	−2.829	−4.877~-0.781	1.043	−0.105	−2.712	0.007
>1	−4.263	−6.476~-2.049	1.127	−0.156	−3.782	<0.001
Relationship (ref: none)						
Spouse	−2.428	−4.901~0.045	1.259	−0.093	−1.928	0.054
Children	−2.06	−4.046~-0.074	1.011	−0.092	−2.037	0.042

Table 5 Results of Multifactorial Linear Regression Analysis Model of MCS Influencing Factors in Survey Respondents (n=630)

	β	95% CI	SE	BS	*t*	*P*
Constant	69.298	65.728~72.868	1.818	–	38.12	<0.001
Sex (ref: male)	−2.71	−4.477~-0.943	0.9	−0.118	−3.012	0.003
Education Level (ref:Primary school or lower)						
Middle school	−3.766	−6.017~-1.514	1.146	−0.159	−3.285	0.001
Higher education or above	−4.084	−6.266~-1.901	1.111	−0.182	−3.674	<0.001
Number of chronic diseases (ref:0)						
1	−3.549	−5.701~-1.398	1.095	−0.133	−3.24	0.001
>1	−2.689	−4.966~-0.412	1.159	−0.1	−2.319	0.021

or "pain that only slightly interferes with normal life activities" as their preferred options for pain levels. Research conducted by foreign scholars indicates that patients' self-assessment of pain does not necessarily align with objective measurements; rather, pain is a complex perception influenced by various factors including physical causes as well as individual's mental state, emotional state, and psychological resilience[23]

In the case of MCS scores, the dementia group scored lower than the remaining two groups, but the difference was not statistically significant, probably related to the small sample size. As for the MCS scores for each dimension, RE scored the highest (79.53±37.13) and SF scored the lowest (43.45±10.16). Similar to previous studies,[24] most family caregivers lacked specialized caregiving knowledge, such as daily living care skills, emergency situation management skills, and hospice services, such that they spent less time on social, leisure, and spare time activities, and became more isolated, resulting in reduced social functioning. Among the MCS scores in each domain of the three groups, the overall differences in VT and MH scores were statistically significant ($P<0.05$), and the overall means of the scores in the VT (Vitality) domain were statistically different between the observation group and the blank group, and between the observation group and the control group ($P<0.001$), and the overall means of the scores in the MH (Mental Health) domain between the observation group and the blank group, and between the control group and the blank group were

statistically different (P=0.049). The above result is similar to the findings of Mandy et al that caregivers of dementia patients have poorer mental health compared to the general population.[25] And another retrospective study that included 16,650 people found that caring for a spouse with dementia increased depressive symptoms by 30–35% compared to caring for a spouse without dementia.[26] As the disease progresses, the demented elderly become more dependent on their family caregivers, the caregivers have less time at their own disposal, leisure and recreational activities are reduced, and they are more likely to develop psychological problems such as anxiety and depression. In addition, some of the demented elderly not only have decreased memory ability, but also suffer from mental behavioral symptoms such as apathy, fantasy, agitation, aggression, etc. Lack of professional knowledge makes caregiving difficult, leading to feelings of helplessness, suffering, fear, and other painful emotions. The psychological burden becomes heavier as a result. Fifty-nine percent of family caregivers for dementia patients reported experiencing high or very high emotional stress during their caregiving duties.[3] Studies have shown that a variety of non-pharmacological interventions, including psychosocial support, cognitive behavioral therapy, health education, and aerobic exercise, are effective in improving depressive symptoms in family caregivers for dementia and their quality of life.[27]

Factors Affecting Physical Health

To further explore the influencing factors, this study used PCS as the dependent variable and stepwise regression method to screen the factors associated with HRQoL. The results showed that age, relationship with the patient, and own illness were risk factors for PCS in HRQoL. The mean PCS score of those over 60 years old decreased by an average of 7.309 points compared to those ≤60 years old, and the physical fitness dimension score decreased with age, similar to the findings of Tseng et al.[20] As they aged, the participants all voiced concerns regarding their health, including declines in physical function and an increase in chronic diseases. In individuals over 60 years old, there is a gradual decrease in the function of molecules, cells, tissues and organisms; on average, muscle strength decreases by 1.5% to 3.5%, making the body more susceptible to various diseases.[28] Aging leads to an up-regulation of inflammatory conditions and inflammatory cytokines in metabolic tissues, which is not conducive to maintaining or improving health. For example, tumor necrosis factor-α, interleukin-6 and interleukin-1 are such cytokines that can directly interfere with insulin signaling pathways and lead to metabolic dysfunction.[29]

Family caregivers who are children of the person being cared for are also risk factors for PCS. One hundred and forty eight respondents (35.3%) of the survey were spouses, while 271(64.7%) were children, which indicates that the offspring plays an indispensable role in providing caregiving services for the elderly, and at the same time, they also have to bear certain social responsibilities, which cause damage to their health (P=0.042). Consistent with the results of Kunicki et al,[30] as the main caregivers of elderly people with dementia, children face a heavier burden of care, and this pressure may lead to hospitalization of the caregivers themselves. Elderly people can be co-cared by several family members in the process of family caregiving. Siblings, neighbors, and other relatives of the elderly can provide some spiritual and material support and help in their daily lives as a complementary care model to that provided by their children. At the same time, the provision of "community care" service model, "Internet +" mutually beneficial elderly care services, day care and other models of mutual assistance can not only meet the wishes of the elderly to live at home, but also make up for the inadequacy of medical facilities, the time constraints of family members, and the lack of timely provision of care services. It can also promote the enthusiasm of the elderly for social participation, thus helping to ease the pressure on their children's caregiving.

Self-illness was a risk factor for PCS in health-related quality of life, and those with 2 or more chronic diseases had the lowest scores (53.08±11.86), with a higher correlation with PCS (β=4.291). All three groups showed statistically significant differences in the overall mean of PCS scores compared to those without the disease ($p < 0.05$). Similar to the findings of several scholars,[24,31,32] each chronic disease imposes a certain burden on physical health; patients with multiple diseases have higher rates of disability and mortality, as well as a greater burden of disease and management needs, which affects the overall health status. In addition, illness in the elderly, as a stressful event in the family, affects the caregiver, sometimes positively but usually negatively, and the caregiver is often referred to as the "invisible second patient". Chronic high-intensity caregiving tasks and substantial physical stress can result in diminished immune function, promote tissue damage and inflammation, and ultimately contribute to the impairment of target organs, thereby

increasing the risk of developing cardiovascular disease, diabetes, osteoporosis, and various forms of cancer.[33] A meta-analysis examining the relationship between family caregivers, inflammation, and immune function showed that family caregivers had a slight decrease in immune function and elevated inflammatory response compared to non-caregivers, and this was more pronounced in dementia caregivers.[34]

In view of the heavy burden of family care, the government should continuously improve its policy on the protection of patients with dementia and other diseases. This includes establishing a long-term care insurance system that is collaboratively funded by the government, institutions, and various stakeholders, while integrating it with existing medical security frameworks and elderly allowance systems to create a cohesive and coordinated social security network. Furthermore, to ensure a robust talent pool in the long-term care sector, the government should incentivize higher education institutions to develop specialized nursing programs and augment educational and vocational training support for informal caregivers within society.

Factors Influencing Mental Health

Using MCS as the dependent variable, a stepwise regression method was used and found that gender, education and illness were related to MCS scores. Women scored an average of 2.71 points lower compared to men. It was found that in women during menstruation, postpartum and late menopause, decreased levels of estradiol and progesterone reduce the responsiveness of the SNS-adrenal and HPA axes, which regulate people's sensitivity to mental health through brain neurotransmitter pathways, and are more susceptible to psychosocial environmental stressors, which can weaken their ability to regulate their mental health.[35] The higher occurrence of psychological problems such as anxiety/depression in women is not only related to hormonal differences in the body and different responses to stressful situations, but also to social factors that contribute to gender differences in mental health.[36] Influenced by traditional cultural and family attitudes, the responsibility of caring for the elderly is often considered to be a female duty, and the findings of this study found that females in the observation group accounted for 65% of their total number, and females in the control group accounted for 61% of the total number. This is similar to the results of the 2018 National Health and Wellness Survey in the United States[37] that female caregivers accounted for 61.5% of all caregivers in the United States, 51.9% in Japan, and 56.3% of caregivers in five European countries (France, Germany, the United Kingdom, Italy, and Spain). Female family caregivers are likely to be more burdened, emotionally and psychologically impaired compared to males. These differences arise because female caregivers tend to spend more time caring for others and take on more caregiving tasks, and they also appear to be more vulnerable to role conflict and less psychologically resilient.

The present study found that education was associated with MCS scores, with those with secondary education scoring a mean of 3.766 points lower and those with higher education scoring a mean of 4.084 points lower compared to those with primary education. Similar to the research results of Mauricio et al,[38] we found that prolonging the time of education may not improve mental health, and may increase the psychological distress of some people. With the improvement of education level, more and more people have higher degrees, and individuals face higher pressure and expectations, which may affect their self-evaluation of mental health. Mental health is a unique state of an individual formed under the combined influence of genetics, neurodevelopment, psychological processes, and social and environmental factors.[39] It is reflected in an individual's ability to think, feel, and act in ways that enable the individual to reach his or her full potential, cope with life's stresses, and learn and work effectively while contributing to the community. As the level of education improves, there are more and more people with advanced degrees, and the social competition for those with secondary education becomes more intense. At the same time, they are under even more pressure in the face of caring for the elderly at home and need to work harder in order to pay for their medical bills and living expenses. Furthermore, the highly educated have high expectations in terms of career and life. They hope that they can achieve better results and higher status. When their expectations cannot be realized, they may feel frustrated and lost, which in turn affects their mental health.

The results of this study showed that people with chronic diseases had poorer overall mental health scores compared to normal people, with a mean lower MCS score of 3.549 for people with one chronic disease and a mean lower MCS score of 2.689 for people with more than one chronic disease. Consistent with the findings of Li Ying et al,[40] we found that some patients may still have to work when they are ill, not only needing to cope with interpersonal conflicts at work,

at home, and in life, but also needing to bear the physical discomforts brought about by their illnesses as well as the side effects produced by the medication process. Therefore, they display more pronounced psychiatric symptoms and poorer mental health than the normal population. Those with more than one chronic disease scored better than those with one chronic disease, probably because as the duration of their illnesses lengthened and chronic disease became an accepted fact, their knowledge of their illnesses increased, and they took the initiative to adjust and adapt to their bodies and learned to live with chronic diseases.

Studies had shown that regular light to moderate physical activity, whether aerobic or mind-body exercises such as brisk walking, jogging, and swimming, as well as yoga and tai chi, had shown positive effects on regulating stress and improving sleep quality. These exercises help relieve stress and improve sleep by promoting the body's release of endorphins, lowering cortisol levels, and increasing parasympathetic nervous system activity.[41] Therefore, it is recommended to incorporate these types of exercise into the daily routine of family caregivers for dementia patients to maintain or enhance the individual's stress management ability and sleep quality.

Conclusion

Caring for the elderly is considered to be the most basic responsibility and obligation of family caregivers, not only can they take comfort in providing care for their loved ones, but at the same time give hope to the demented elderly and help them build up confidence in life. In addition, family caregivers gain satisfaction and a sense of accomplishment in the process of taking care of patients with dementia at home, motivating them to maintain their caring role, increasing their caring motivation, and helping them realize their self-worth. However, the health-related quality of life of family caregivers for dementia patients is poor, so developing personalized physical activity programs for family caregivers for dementia patients, along with professional and targeted assistance, is critical to building an integrated support system that includes family, health care facilities, community resources, and social engagement. The aim is to improve the physical and mental health of family caregivers for people with dementia and ultimately improve their overall quality of life.

Limitations, and Future Studies

Nevertheless, this study exclusively selected Zunyi, Chongqing, and certain regions of Sichuan as its sample locations. This methodology may lead to biased outcomes that do not accurately represent the broader context. Furthermore, this research is a cross-sectional survey with a limited range of variables; thus, the findings warrant further validation through large-scale, multi-center, and longitudinal studies in the future.

Ethics Statement

The study received ethical approval from the Ethics Committee of the Affiliated Hospital of Zunyi Medical University (Ethics No.KLL-2022-460), and was conducted in compliance with the Declaration of Helsinki.

Informed Consent

Prior to completing the survey, each participant provided informed consent after being thoroughly briefed on the study's objectives. Upon agreeing to participate in the survey, participants were issued a Case Report Form (CRF) and the SF-36 questionnaire before reading and signing the informed consent document located on the front page of the survey.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically

reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest in this work.

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