


Health-related quality of life among elderly individuals living alone in an urban area of Shaanxi Province, China: a cross-sectional study

Ning Liu¹ , Nadine E. Andrew^{2,3},
Dominique A. Cadilhac^{3,4}, Xuewen Yu⁵,
Zhe Li⁶, Jue Wang⁷ and Yu Liang⁸

Abstract

Objectives: To describe health-related quality of life (HRQoL), sex differences in HRQoL, and factors affecting the HRQoL of elderly people living alone in urban areas of Shaanxi Province, China.

Methods: A cohort was obtained using multistage stratified cluster random sampling. We collected cross-sectional data using surveys. HRQoL was measured using the 36-item Short Form Health Survey. Multivariable multilevel linear regression analysis was used to examine factors associated with mental and physical health component summary scores.

Results: Overall, 442 elderly Chinese individuals who lived alone completed the survey (mean age 73 years, women: 59%). Women were more likely to report better mental health than men. Factors significantly associated with reduced mental health scores were older age, having never been married or being divorced, and having a history of cancer, urinary tract disease, fractures or gastrointestinal disorders. Factors associated with physical health were having never been married or being divorced and having hypertension.

¹School of Nursing, Zhu Hai Campus of Zunyi Medical University, Zhu Hai, GuangDong Province, P. R. China

²Department of Medicine, Peninsula Clinical School, Monash University, Clayton, VIC, Australia

³Translational Public Health Unit, Stroke and Ageing Research, Department of Medicine, School of Clinical Sciences at Monash Health, Monash University, Clayton, VIC, Australia

⁴Florey Institute of Neuroscience and Mental Health, Heidelberg, VIC, Australia

⁵The First Affiliated Hospital of Xi'an Jiaotong University, Xi'an, Shaanxi Province, P. R. China

⁶Network Operations Management Center, Zhu Hai Campus of Zunyi Medical University, Zhu Hai, GuangDong Province, P. R. China

⁷School of Life Science and Technology, Xi'an Jiaotong University, Xi'an, P. R. China

⁸School of Public Administration, Nanjing University of Finance & Economics, Nanjing, P. R. China

Corresponding author:

Yu Liang, School of Public Administration, Nanjing University of Finance & Economics, No. 3 Wenyuan Road, Nanjing 210023, P. R. China.

Email: yuliang210023@163.com



Conclusions: To our knowledge, this is the first study to describe HRQoL in a representative sample of elderly people living alone in urban areas of Shaanxi, China. Poor physical and mental HRQoL in this elderly Chinese population was mainly associated with chronic diseases and demographic factors.

Keywords

Health-related quality of life, Short Form Health Survey-36, living alone, older Chinese adults, mental health, physical health

Date received: 12 July 2019; accepted: 24 February 2020

Introduction

China has the largest number of older adults in the world; 17.3% of the Chinese population were aged 60 years and above at the end of 2017.¹ Older adults are expected to represent 33% of the total population by 2050; the absolute and relative numbers of elderly people living alone in China are both increasing.² Consequently, addressing problems that impact on the health-related quality of life (HRQoL) of elderly adults living alone has become an important global public health challenge.^{3,4} Loneliness is prevalent among elderly people living alone and may limit their access to social relationships and their ability to obtain sufficient social support.⁵

China is the world's most populous country and has undergone enormous and rapid social and economic change over the last few decades. The implementation of strict family planning policies, improved health and longevity and rapid urbanization have led to dramatic changes in family structures. Traditionally, in China, children are responsible for caring for their elderly parents. It used to be common for extended families to live together; this created strong family networks and it was unusual for elderly Chinese people to live alone. Following the introduction of the one-child policy in 1979, there was a shift from extended

families to nuclear families with fewer children available to support elderly parents. This change in family structure occurred more often in urban areas, where the one-child policy was most stringently adopted. Owing to the strong traditions associated with the family responsibility of caring for elderly relatives, many elderly adults in China are reluctant to live in supported geriatric care facilities, as they do in many Western countries.⁶ The combined impact of these factors has meant that the proportion of elderly adults living alone in China has increased from 16.7% in 1993 to 27.9% in 2007, and will possibly rise to 90% by 2030.⁷

Elderly adults encounter many health problems. Chronic diseases are common in old age and can affect both physical and emotional dimensions of life that impact on overall HRQoL.⁸ Public health organizations around the world emphasize the importance of a healthy lifestyle for reducing the prevalence of chronic diseases. Behavioural factors are also associated with reduced HRQoL in elderly people.^{9,10}

Several researchers have recently investigated the social and psychological effects on elderly Chinese people of living alone or with a spouse, but without the support of extended family.¹¹ However, most of these studies have focused on rural communities or the psychological effects of living unsupported. Little is known about

the full effects on HRQoL and factors that may influence HRQoL in those living alone in urban areas. Recent social and economic reforms in China have resulted in an increase in the number of elderly Chinese people living alone in urban areas. The effects of this situation on HRQoL in these older people is unknown. The study aims were to describe the overall HRQoL of urban dwelling individuals living alone, to explore sex differences in HRQoL and to identify factors associated with reduced HRQoL in this population.

Materials and methods

Ethical statement

The study was approved by the ethics committee of Xi'an Jiaotong University (No. 2014209), and was performed in accordance with the Declaration of Helsinki.¹² All participants or their attending relatives, caregivers or guardians provided oral informed consent. Participants were informed of their right to refuse to participate or to withdraw from the study at any time. The anonymity and confidentiality of the participant data were assured.

Study design and setting

The study design was similar to that used in our previous survey of 424 elderly rural residents living alone.¹³ In brief, this was a cross-sectional survey of people aged ≥ 65 years. The study cohort was obtained using a multistage stratified cluster random sampling procedure. There are 34 provinces in China. Shaanxi Province is located in northwest China and has a geographic area of 205,800 km². This province was chosen because of geographic convenience, but also because it is demographically similar to most other provinces in China; it has the same proportion of urban and rural areas, a similar mix of wealthy and poor

areas, and an age distribution similar to most other provinces in China.¹⁴ Shaanxi Province can be divided into three geographical strata: south Shaanxi, central Shaanxi and north Shaanxi. Each stratum represents a different level of development. One city from each of these strata was randomly selected for the survey. The cities selected were Shang Luo, Yan'An and Wei Nan. Several communities were randomly selected from each town to achieve the required sample size, which was calculated using power analysis assuming an α of 0.05, a power of 0.80 and a medium effect size for multivariable analysis, and anticipating a 30% attrition rate for the responses of a potential sample of elderly people to a questionnaire survey.¹⁵

There were 12 regions (substrata) within each of the three selected cities, and nine different communities in each region were selected for the survey. Each region represented a substratum and one or two communities (clusters) from each region were randomly chosen for the survey. Using residential registration data from the Sixth Nationwide Census, all the available and eligible elderly adults in the chosen communities were informed of the study using posters and invited to participate. The cohort for this survey was selected from the local authority register. Eligibility criteria were (i) aged ≥ 65 years; (ii) residing in one of the three cities and (iii) living alone (not with any children, relatives or spouse). Therefore, participants were generally representative of elderly individuals living alone in Shaanxi Province. Study participation was completely voluntary, and respondents could decline to answer any questions if they wished. Exclusion criteria included cognitive disorders, defined by a score of less than 21 on the Mini-Mental State Examination, MMSE¹⁶), living with their families, not speaking Chinese, a physician-estimated life expectancy of

less than 12 months, or too ill to participate. A total of 115,014 elderly individuals aged ≥ 65 years were in the target community, and 4,004 of these individuals met the eligibility criteria. The most common reason for not participating in the study was because the individual could not be contacted/visited for an appointment. Only 63 of those contacted refused to participate. Finally, 442 completed questionnaires were returned (Figure 1).

Data collection

Participants answered questions about their sociodemographic status, medical history, and mental and physical health. Approval was first obtained from the local authority register in each target city. Participants were contacted first by telephone to explain the study. After informed consent was obtained, the household registration system was checked to confirm the self-reported age of the participants. Graduate

students and research assistants from the College of Medicine, Xi'an Jiaotong University, were trained as interviewers for the face-to-face field survey. They visited participants in the target communities in their homes and assisted them with completing the survey. The survey took an average of 18 minutes to complete and was collected by the research assistants immediately upon completion.

The following data collection instruments were used as a part of the survey:

1. A demographic researcher-developed survey was used to measure sociodemographic factors such as age, sex, yearly income, marital status and presence of comorbid conditions.
2. The Medical Outcomes Study 36-item Short Form Health Survey (SF-36).¹⁷

The SF-36 comprises 36 items that assess eight domains: social functioning (SF)

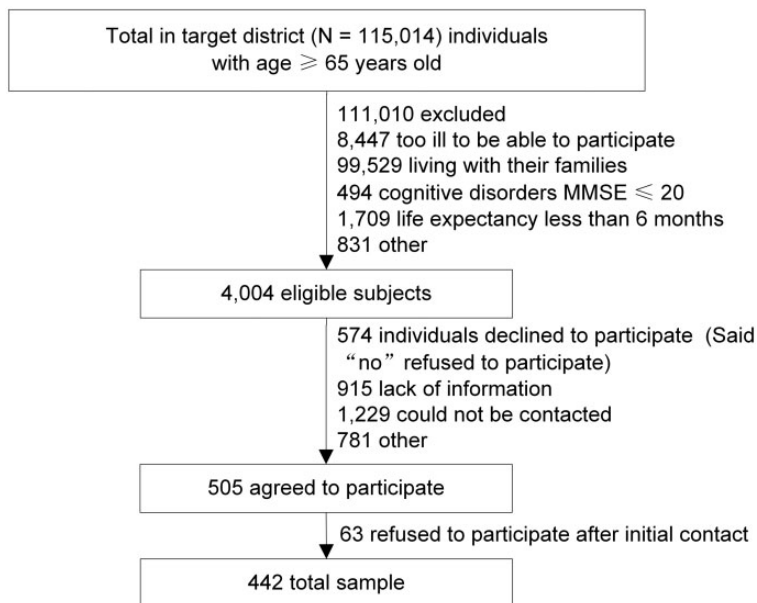


Figure 1. Flow chart of participant enrolment

Note: MMSE: Mini-Mental State Examination.

(2 items); physical functioning (PF) (10 items); role limitations due to physical problems (RP) (4 items); role limitations due to emotional problems (RE) (3 items); mental health (MH) (5 items); bodily pain (BP) (2 items); vitality (VT) (4 items); and general perception of health (GH) (5 items). The remaining item measures health changes over the last year. The mental component summary (MCS) encompasses the domains of MH, RE, SF and VT; whereas the physical component summary (PCS) encompasses the domains of GH, BP, RP and PF. Total scores range from 0 to 100; higher scores indicate better HRQoL. The Chinese version of this questionnaire was used. This has been shown to have good validity and reliability, and is considered suitable for the evaluation of HRQoL in an elderly Chinese population.^{18,19}

3. A project-specific lifestyle survey developed by the research team was used to collect data on lifestyle factors. Information was collected on smoking habits, frequency of alcohol consumption, amount of physical activity, breakfast routine and amount of daily sleep.

Marital status was divided into the following categories: (1) never married or divorced (to encompass people not legally married); (2) widowed or married (i.e. married but living alone as their spouse was not living with them, otherwise referred to as separated). Frequency of consumption of alcoholic beverages such as beer, wine made from grapes, and rice wine during the previous 12 months was categorized as 'never' (no consumption of alcohol; 'a little' (alcohol consumption of less than once per week) and 'a lot' (alcohol consumption equal to, or more than, once per week). Smoking frequency was based on smoking during the previous 12 months. Non-smokers were defined as those who had not smoked during the previous

12 months. Sleep time was divided into three categories based on number of hours of sleep. Physical activity questions used definitions based on the International Physical Activity Questionnaire (IPAQ)²⁰ to define moderate and vigorous activity. For our analyses, this variable was dichotomized into those who performed moderate to vigorous physical activity at least 1 to 3 times/week and those who did not perform any moderate to vigorous physical activity.

All surveys and questionnaires were double-entered and coded using EpiData 3.02 (EpiData Association, Odense, Denmark) by two independent professional data-entry staff from the Department of Public Health, College of Medicine, Xi'an Jiaotong University. Both manual and computer checking of the data were conducted and any discrepancies identified were corrected. All analyses were conducted using SAS version 9.0 (SAS Institute Inc., Cary, NC, USA), and SPSS for Windows, version 13.0 (SPSS Inc., Chicago, IL, USA).

Descriptive statistics were used to summarize sociodemographic data and mean scores were calculated for the eight subscales and two summary scores of the SF-36. All statistical tests of significance were two-sided tests, and alpha was set at 0.05. Continuous variables were presented as mean values (\pm standard deviation [SD]). Categorical variables were presented as frequencies. Sociodemographic and clinical variables were expressed as percentages, frequencies and means (\pm SD). Proportions and means were compared between women and men for categorical and continuous variables using the chi-squared test or *t*-test, respectively.

A comparison of HRQoL scores between our sample and published Chinese population normative data (i.e. 8448)²¹ was conducted using the *t*-test. Backward stepwise multivariable multilevel linear regression was used to assess for factors associated with greater PCS and MCS scores, with

level defined as region. Multilevel multivariable analysis was chosen over standard multivariable regression to adjust for clustering of similar people within regions. Independent categorical variables included in the multivariable analyses were dichotomized for ease of interpretation and to maximize subgroup numbers. Dependent variables were the PCS and MCS scores. The independent variables included in the model were demographic factors (age and sex) and lifestyle factors (smoking, alcohol intake, physical activity and sleep) known to be associated with HRQoL. Additional demographic factors and chronic diseases that were significantly associated with the

dependent variable of interest in the univariable analysis were also included in the models.

Results

Basic participant characteristics

A total of 505 (46%) elderly individuals agreed to participate and 442 (183 males and 259 females) provided complete SF-36 data and were included in the analyses (Figure 1).

Table 1 shows the characteristics of the participants eligible to be included in this study. The age range was between 65 and

Table 1. Characteristics of study participants (N = 442).

	All	Male N	%	Female N	%	P-value
Sample size (N)	442	183	41.40	259	58.60	
Age, years, mean, (SD)	73.53, 8.76	71.81	SD 7.59	74.75	SD 9.32	
Education level						0.0042
Illiterate	201	70	38.25	131	50.58	
Uneducated	109	51	27.87	58	22.39	
Primary	74	42	22.95	32	12.36	
Secondary	58	20	10.93	38	14.67	
Occupation						0.0989
Worker/labourer	77	23	12.57	54	20.85	
Professional#	261	109	59.56	152	58.70	
Civil servant	104	51	27.87	53	20.46	
Smoking history						<0.0001
Never	290	76	41.53	214	82.63	
Current	152	107	58.47	45	17.37	
Alcohol use						<0.0001
No	263	58	31.69	205	79.15	
Yes	179	125	68.31	54	20.85	
Income (yearly, CNY)						0.5338
6,000–9,999	119	46	44.66	73	51.05	
3,000–5,999	103	46	44.66	57	39.86	
2,000–2,999	14	5	4.85	9	6.29	
1,000–1,999	8	4	3.88	4	2.80	
<1,000	2	2	1.94	0	0	
PCS score mean, SD	46.01, 6.69	46.52	SD 7.06	45.66	SD 6.92	0.187
MCS score mean, SD	42.05, 11.5	39.2	SD 11.35	44.04	SD 11.21	<0.0001

Note: PCS: physical component summary; MCS: mental component summary derived from the SF-36: Medical Outcomes Study 36-item Short Form Health Survey;¹⁸ SD: standard deviation.

#Professional: includes medical worker, civil servant, teacher.

90 years, with a mean of 73.53 (SD: 8.76) years (male: 71.81 ± 7.6 ; female: 74.75 ± 9.3). Of participants, 59% were female and 67% were married or widowed. The numbers of participants from south Shaanxi, central Shaanxi and north Shaanxi were 145 (33%), 195 (44%) and 102 (23%), respectively. Elderly Chinese men were more likely to have a higher educational level and to report more alcohol use and smoking than women. For HRQoL outcomes, the mean (SD) summary scores for our sample were 46.0 (6.7) for the PCS and 42.0 (11.5) for the MCS. Women were more likely to report better MCS than men in this study. The mean (SD) values on the eight SF-36 dimensions for our sample were all significantly lower (all $P < 0.001$) than those for the general population²¹ as shown in Table 2.

HRQoL of participants

Our univariable subgroup analyses identified several demographic characteristics, lifestyle factors and comorbid diseases that were significantly associated with MCS and PCS scores (Table 3). Elderly individuals who were married or widowed reported significantly greater MCS and PCS scores than

those who were never married or divorced ($P < 0.05$). Lower MCS scores were reported by those who had less than 5 hours sleep per day ($P < 0.05$) and by those with a medical history of gastrointestinal disease ($P < 0.001$), cancer ($P < 0.05$), urinary tract disease ($P < 0.001$) or a recent history of fractures ($P < 0.001$). Participants who had hypertension reported significantly lower PCS scores than those who did not have hypertension ($P < 0.001$).

Multivariable analysis of factors associated with HRQoL

The multivariable analyses results generally confirmed the descriptive comparisons, except for sleep time, which was no longer significant following the inclusion of other factors in the model. Being unmarried or divorced was significantly associated with lower PCS ($P < 0.01$) and MCS scores ($P < 0.001$). Having chronic diseases such as cancer ($P < 0.05$), urinary tract disease ($P < 0.001$), gastrointestinal disease ($P < 0.001$) and recent history of fractures ($P < 0.001$) were independently associated with reduced MCS scores. Hypertension was the only chronic disease independently associated with reduced PCS scores

Table 2. Short Form Health Survey-36 subscale results for all participants and by general population norms.

SF-36 subscales	All participants (n = 442)	General older adults (n = 8448) ²²	t	P-value	95% CI
	Mean \pm SD	Mean \pm SD			
Physical function	76.5 \pm 17.3	89.0 \pm 15.7	-15.1	$P < 0.001$ ***	-14.1, -10.8
Role function	61.7 \pm 29.2	82.0 \pm 31.7	-14.7	$P < 0.001$ ***	-23.1, -17.7
Bodily pain	69.6 \pm 21.6	80.4 \pm 19.8	-10.8	$P < 0.001$ ***	-12.9, -8.9
General health	49.3 \pm 26.4	66.0 \pm 20.9	-13.2	$P < 0.001$ ***	-19.0, -14.1
Vitality	55.4 \pm 21.3	71.1 \pm 18.1	-15.4	$P < 0.001$ ***	-17.7, -13.7
Social functioning	55.7 \pm 20.9	84.6 \pm 18.2	-15.7	$P < 0.001$ ***	-21.9, -17.0
Emotional role	62.9 \pm 32.9	77.0 \pm 35.5	-8.93	$P < 0.001$ ***	-17.1, -10.9
Mental health	57.4 \pm 19.7	75.2 \pm 16.1	-19.0	$P < 0.001$ ***	-19.7, -16.0

Note: SD: standard deviation; HRQoL: health-related quality of life; SF-36 = Medical Outcomes Study 36-item Short Form Health Survey; ¹⁸CI: confidence interval.

*** $P < 0.001$.

Table 3. Differences in physical and mental health summary scores by demographic characteristics, lifestyle and chronic disease factors for urban elderly individuals (N = 442).

Factors	Groups	Physical component summary Mean (SD)	Mental component summary Mean (SD)
Demographic factors			
Sex	Male	45.7 (6.6)	40.2 (11.5)
	Female	46.2 (6.8)	43.2 (11.5)
Age, years	65–75	45.9 (6.8)	42.3 (11.3)
	76–85	45.9 (7.0)	41.6 (12.0)
	>85	46.8 (5.8)	40.8 (12.2)
Occupation	Worker/labourer	45.8 (7.0)	44.5 (11.2)*
	Civil servant	46.4 (6.3)	40.3 (11.3)*
	Professional#	45.5 (7.0)	41.3 (11.9)*
Marital status	Never married or divorced	38.9 (7.1)*	39.2 (10.9)*
	Married## or widowed	47.3 (5.9)*	48.5 (11.8)*
Lifestyle factors			
Smoking	Non-smoker	46.3 (6.7)	43.3 (10.5)*
	Smoker	45.6 (6.6)	39.9 (12.8)*
Sleep time (hours/day)	>8	46.7 (6.7)	42.3 (10.7)*
	5–7	45.8 (6.4)	42.9 (11.4)*
	<5	45.4 (8.0)	37.2 (13.1)*
Physical activity	Yes (≥1–3 times/month)	45.5 (6.8)	42.3 (12.0)
	No	46.3 (6.6)	41.7 (11.4)
Regular breakfast	Yes	46.1 (6.9)	42.2 (11.6)
	No	45.9 (6.53)	41.7 (11.7)
Chronic diseases			
Hypertension	Yes	45.3 (7.1)**	41.5 (12.2)
	No	47.2 (5.8)**	42.7 (10.5)
Asthma	Yes	45.4 (7.1)	41.3 (11.8)
	No	46.6 (6.4)	42.5 (11.4)
Gastrointestinal disease	Yes	45.5 (7.5)	39.9 (11.9)**
	No	46.6 (5.6)	44.2 (10.8)**
Chronic bronchitis	Yes	45.9 (6.4)	41.6 (11.5)
	No	46.1 (7.1)	42.3 (11.7)
Neurological disease	Yes	45.8 (7.1)	41.3 (11.4)
	No	46.5 (5.8)	43.3 (12.1)
Cancer	Yes	44.9 (7.0)	39.4 (13.3)*
	No	46.3 (6.6)	42.6 (11.0)*
Valvular heart disease	Yes	45.8 (7.0)	41.7 (12.3)
	No	46.1 (6.6)	42.0 (11.4)
Heart failure	Yes	45.2 (6.6)	41.8 (11.5)
	No	46.2 (6.7)	42.0 (11.6)
Cataract disease	Yes	45.3 (6.9)	42.4 (11.8)
	No	46.4 (6.6)	41.7 (11.5)
Urinary tract disease	Yes	46.1 (6.9)	37.7 (11.9)**
	No	46.0 (6.6)	43.5 (11.1)**

(continued)

Table 3. Continued.

Factors	Groups	Physical component summary Mean (SD)	Mental component summary Mean (SD)
COPD	Yes	45.7 (6.5)	42.8 (10.8)
	No	46.1 (6.8)	41.7 (11.8)
Diabetes mellitus	Yes	45.7 (6.7)	40.9 (11.9)
	No	46.2 (6.7)	42.6 (11.4)
Recent history of fracture	Yes	46.9 (6.7)	38.3 (12.2)**
	No	45.7 (6.7)	43.1 (11.2)**

Note: * $P < 0.05$, ** $P < 0.001$. SD: standard deviation, COPD: chronic obstructive pulmonary disease. #Professional: includes medical worker, civil servant, teacher.

###Married: still married but unable to live with their partner.

($P < 0.001$) (Table 4). None of the lifestyle factors (e.g. smoking) were independently associated with reduced HRQoL following multivariable adjustments.

Discussion

To the best of our knowledge, this study is the first to describe the HRQoL of elderly people living alone in urban areas of Shaanxi Province. Overall, the data showed lower mean (SD) values for MCS and all eight dimensions of the SF-36 compared with age-matched SF-36 population normative data.²¹ Although these SF-36 dimension comparisons are indirect, the differences were large and significant.

Unadjusted comparisons indicated that compared with individuals living in rural areas, those living alone in urban areas had better HRQoL, as indicated by scores on most of the SF-36 subscales except physical function.¹³ Previous research findings regarding differences in residential location are inconsistent. Some studies have found that elderly Chinese people living in rural areas have better mental and physical HRQoL than their urban counterparts, whereas other findings are similar to ours and indicate that elderly people living alone in rural areas^{13,21} have poorer HRQoL than those in urban areas. This

may be because of lower socioeconomic status and poorer literacy skills. Owing to recent urbanization in China, elderly people living in rural communities may be less likely to have children living nearby. Contrasting study results may stem from differences in the measurement tools used. The present findings are in accord with those from Chinese studies^{11,22} that used data from the 4th National Household Health Survey, conducted in 2008.²² These earlier studies showed that Chinese people, who are influenced by Confucianist teachings, place great value on familial responsibility. That is, children are expected to take on the responsibility of caring for their parents. However, urbanization and the increasingly nuclear family structure may have affected these traditional Chinese values. Older generations remain dependent on younger generations for financial and emotional support, but younger generations may fail to meet these expectations because of economic pressures. With the introduction of the Chinese one-child policy, there has been a shift from extended families to nuclear families with fewer children available to support elderly parents. This is indicated by findings from other studies in rural China, which show that elderly people are accustomed to relying on their children; when children move away, a lack of

Table 4. Multivariable multilevel results for factors associated with health-related quality of life (N = 442).

Variable	Coefficient	P-value	95% CI
SF-36, Mental health			
Age	-0.19	0.009**	-0.33, -0.05
Marital status			
Unmarried/divorced	-6.02	<0.001***	-8.27, -3.76
Widowed/separated			
Cancer			
Yes	-2.88	0.026*	-5.40, -0.35
No			
Urinary tract disease			
Yes	-4.17	<0.001***	-6.50, -1.84
No			
Recent history of fracture			
Yes	-4.54	<0.001***	-6.98, -2.11
No			
Gastrointestinal disease			
Yes	-4.40	<0.001***	-6.40, -2.39
No			
SF-36, Physical health			
Marital status			
Never married or divorced	-2.06	0.003**	-3.41, -0.71
Married/widowed			
Hypertension			
Yes	-1.88	0.006**	-3.23, -0.53
No			

Note: SF-36 = Medical Outcomes Study 36-item Short Form Health Survey; CI; confidence interval.

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

self-care ability is a contributing risk factor for mental health disorders.^{23,24} These findings suggest that health policymakers should make efforts to foster community-based integrated care for elderly people to tackle the current ageing problem in mainland China.

Interestingly, we found significant sex differences in HRQoL, with women reporting better mental health than men. These results are similar to those of previous studies in China and South Korea,^{25,26} which found that men are more likely to report poor mental health. In our study, we observed a difference in MCS but not in

PCS, which may stem from demographic factors and the distribution of chronic conditions.²⁷ Women in China are primarily responsible for domestic duties, whereas men are mainly engaged in social activities. It is unsurprising that men living alone struggle with behaviours such as healthy eating.²⁸ Older men with chronic diseases may need more support from their children because they are less able to cook or clean.²⁹ A study by Sun et al.³⁰ emphasized that the proportion of women living alone increases substantially with age. This suggests that China needs to urgently address social policy issues relating to the situation

of elderly women and support the elderly population in developing healthy lifestyles,²³ especially vulnerable groups such as those living alone.

Having never been married or being divorced, older age and having common comorbidities were independently associated with lower quality of life in our participants. The association between comorbid factors and HRQoL highlights the importance of access to basic medical care services to effectively manage medical conditions in elderly people in China. This is particularly important within the context of the ageing population in China, where access to primary care medical practitioners is limited.^{31,32} Although there have been great improvements in China's health system since the introduction of the health-care reform in 2009, lack of qualified medical practitioners and rising costs associated with privatization of primary healthcare services means that low income populations such as elderly individuals may be disadvantaged.^{32,33} To counter this, the Urban Residents Basic Medical Insurance scheme was introduced to provide basic medical cover for elderly and unemployed people. Although this system has improved health-care utilization by elderly people, it is primarily designed to subsidize hospital inpatient and outpatient services for acute catastrophic diseases.³³ Further development of the primary healthcare system is needed to provide services aimed at preventive action. These could help to promote healthy behaviours to postpone the onset of chronic disease and to effectively manage common chronic diseases in elderly individuals.

The present study highlights the importance of preventing and controlling these modifiable conditions. Those of our participants who were classified as married reported greater HRQoL than those who had never married or were divorced. This is consistent with current data indicating

that married individuals have reduced mortality and better physical and mental health than those who never married or are divorced, and that this effect is most apparent in people aged over 65 years.²⁹ Participants in the married group may have been more likely to have children and broader social networks that provide greater social interaction and support outside the home, which in turn is associated with better HRQoL.³⁴ Although marital status is not a modifiable risk factor for poor HRQoL, the provision of external support by local government or other local neighbourhood organizations may be one way of alleviating the effects of living alone among elderly people, especially those who are divorced or unmarried.

This study had several strengths. To our knowledge, this is the first study to describe the HRQoL of elderly individuals living alone in urban areas in Shaanxi Province, China. Moreover, this cohort was derived from a large representative sample of people living in Shaanxi Province, and the response rate was high when compared with other similar studies. The study limitations include the cross-sectional design, which makes it difficult to establish the direction of the associations observed over time. Second, the data were obtained from communities in only one Chinese province, which may limit the generalizability of the findings. Although the sampling methods produced a sample that was largely representative of this province, we do not know to what extent our results can be generalized to other populations. Future studies are required with larger sample sizes drawn from more provinces.

Conclusions

To the best of our knowledge, this is the first study to assess the factors associated with HRQoL in a cohort of elderly people living alone in urban areas of Shaanxi

Province, China. Several lifestyle factors, sociodemographic factors and pre-existing chronic diseases or comorbidities were found to be associated with mental and physical health. To improve the HRQoL of elderly populations living alone, closer monitoring of health and improved access to services related to the treatment and management of chronic diseases is needed. Family members should be encouraged to provide support; where this is not available, local governments should develop programs to fill this gap. This is crucial from both a local and global perspective, as the full effects of the one-child policy and increased life expectancies in China have yet to be determined. Addressing the health and support needs of the elderly is crucial and would provide social and economic advantages in preventing severe catastrophic health events and optimizing the health and well-being of the increasing numbers of elderly Chinese people living alone.

Ethics approval and consent to participate

The study was approved by the ethics committee of Xi'an Jiaotong University (No. 2014209) and was performed in accordance with the Declaration of Helsinki. All participants or their attending relatives, caregivers or guardians provided informed consent. Participants were informed of their right to refuse to participate or to withdraw from the study at any time. Anonymity and confidentiality of participant data were assured, and participants were presented with a gift (valued at approximately 3 USD) on completion of the survey.

Acknowledgements

We thank all the study participants, the leaders of the communities who gave their assistance and support in the data collection, and the

trained research assistants for their contribution to this study. We would also like to acknowledge Megan Reyneke and Mr. Joosup Kim for their assistance with proofreading and English language editing.


Declaration of conflicting interest

The authors declare that there is no conflict of interest.

Funding

This research was funded by the Guizhou provincial science and technology project (Qian: Science and technology cooperation foundation project; Grant No: [2017]1223,1226), the Scientific research project of '15851' talents and elites in ZunYi City ([2017]1223), the Startup Foundation for Doctors (Masters) of ZunYi Medical University (Grant No: F-750, No: 24) and the National Social Science Foundation of China (Grant No: 17CSH078). Dr. Cadillac was supported by a National Health and Medical Research Council (NHMRC) Fellowship cofunded with the Heart Foundation (1063761). Dr. Andrew has a postdoctoral fellowship from the NHMRC (1072053).

ORCID iD

Ning Liu  <https://orcid.org/0000-0001-9023-4254>

References

1. <http://www.mca.gov.cn/article/sj/tjgb/201808/20180800010446.shtml>. *Statistical Bulletin on the Development of China's Social Services in 2017* 2017.
2. Wu ZQ, Sun L, Sun YH, et al. Correlation between loneliness and social relationship among empty nest elderly in Anhui rural area, China. *Aging Ment Health* 2010; 14: 108–120. DOI: 10.1080/13607860903228796.
3. Zheng J, Pan Y, Hua Y, et al. Strategic targeted exercise for preventing falls in elderly people. *J Int Med Res* 2013; 41: 418–426. DOI: 10.1177/0300060513477297.

4. Taylor WD. Depression in the elderly. *N Engl J Med* 2014; 371: 1228–1236. DOI: 10.1056/NEJMcpl402180.
5. Sorokin D, Rook KS and Lu JL. Loneliness, lack of emotional support, lack of companionship, and the likelihood of having a heart condition in an elderly sample. *Ann Behav Med* 2002; 24: 290–298.
6. Pan B, Yuan Z, Zou J, et al. Elderly hospitalization and the New-type Rural Cooperative Medical Scheme (NCMS) in China: multi-stage cross-sectional surveys of Jiangxi province. *BMC Health Serv Res* 2016; 16: 436. DOI: 10.1186/s12913-016-1638-5.
7. Damayanthi HDWT, Moy FM, Abdullah KL, et al. Health related quality of life and its associated factors among community-dwelling older people in Sri Lanka: a cross-sectional study. *Arch Gerontol Geriatr* 2018; 76: 215–220.
8. Awang H, Mansor N, Nai Peng T, et al. Understanding ageing: fear of chronic diseases later in life. *J Int Med Res* 2018; 46: 175–184. DOI: 10.1177/0300060517710857.
9. Bădicu G. Physical activity and health-related quality of life in adults from Braşov, Romania. *Educ Sci* 2018; 8: 52.
10. Anokye NK, Trueman P, Green C, et al. Physical activity and health related quality of life. *BMC Public Health* 2012; 12: 624. DOI: 624 10.1186/1471-2458-12-624.
11. Huang LJ, Du WT, Liu YC, et al. Loneliness, stress, and depressive symptoms among the Chinese rural empty nest elderly: a moderated mediation analysis. *Issues Ment Health Nurs* 2019; 40: 73–78. DOI: 10.1080/01612840.2018.1437856.
12. World Medical Association. Declaration of Helsinki, ethical principles for medical research involving human subjects. Amended by the 64th WMA General Assembly, Fortaleza, Brazil, October 2013. <https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/>
13. Liu N, Zeng L, Li Z, et al. Health-related quality of life and long-term care needs among elderly individuals living alone: a cross-sectional study in rural areas of Shaanxi Province, China. *BMC Public Health* 2013; 13: 313. DOI: 10.1186/1471-2458-13-313.
14. Zeng Y, Schultz TP, Wang DD, et al. Association of divorce with socio-demographic covariates in China, 1955–1985: event history analysis based on data collected in Shanghai, Hebei, and Shaanxi. *Demogr Res* 2002; 7: 407–432.
15. Newton R and Rudestam K. *Your statistical consultant: answers to your data analysis questions*. 2nd ed. London: Sage Publications, Ltd., 2013.
16. Yoelin AB and Saunders NW. Score disparity between the MMSE and the SLUMS. *Am J Alzheimers Dis Other Demen* 2017; 32: 282–288. DOI: 10.1177/1533317517705222.
17. Ware JE, Jr. and Sherbourne CD. The MOS 36-item short-form health survey (SF-36): I. Conceptual framework and item selection. *Med Care* 1992; 30: 473–483.
18. Ngai SP, Cheung RT, Lam PL, et al. Validation and reliability of the physical activity scale for the elderly in Chinese population. *J Rehabil Med* 2012; 44: 462–465. DOI: 10.2340/16501977-0953.
19. Li L, Wang H and Shen Y. Chinese SF-36 Health Survey: translation, cultural adaptation, validation, and normalisation. *J Epidemiol Community Health* 2003; 57: 259–263. DOI: 10.1136/jech.57.4.259.
20. Craig C, Marshall A, Ström M, et al. International physical activity questionnaire: 12-country reliability and validity. *Med Sci Sports Exerc* 2003; 35: 1381–1395. DOI: 10.1249/01.mss.0000078924.61453.fb.
21. Li N, Liu C, Li J, et al. [The norms of SF-36 scale scores in urban and rural residents of Sichuan province]. *Hua Xi Yi Ke Da Xue Xue Bao* 2001; 32: 43–47.
22. Lei P, Xu L, Nwaru BI, et al. Social networks and health-related quality of life among Chinese old adults in urban areas: results from 4th National Household Health Survey. *Public Health* 2016; 131: 27–39. DOI: 10.1016/j.puhe.2015.10.009.
23. Zhang C, Xue Y, Zhao H, et al. Prevalence and related influencing factors of depressive symptoms among empty-nest elderly in Shanxi, China. *J Affect Disord* 2019; 245: 750–756. DOI: 10.1016/j.jad.2018.11.045.

24. Zhang C, Hou L, Zheng X, et al. Risk factors of mental disorders among empty and non-empty nesters in Shanxi, China: a cross-sectional study. *Health Qual Life Outcomes* 2019; 17: 18. DOI: 10.1186/s12955-019-1088-y.
25. Ko H, Park YH, Cho B, et al. Gender differences in health status, quality of life, and community service needs of older adults living alone. *Arch Gerontol Geriatr* 2019; 83: 239–245. DOI: 10.1016/j.archger.2019.05.009.
26. Zhou Z, Zhou Z, Gao J, et al. Urban-rural difference in the associations between living arrangements and the health-related quality of life (HRQOL) of the elderly in China—Evidence from Shaanxi province. *PLoS One* 2018; 13: e0204118. DOI: 10.1371/journal.pone.0204118.
27. Yu T, Enkh-Amgalan N, Zorigt G, et al. Gender differences and burden of chronic conditions: impact on quality of life among the elderly in Taiwan. *Aging Clin Exp Res* 2019; 31: 1625–1633. DOI: 10.1007/s40520-018-1099-2.
28. Conklin AI, Forouhi NG, Surtees P, et al. Gender and the double burden of economic and social disadvantages on healthy eating: cross-sectional study of older adults in the EPIC-Norfolk cohort. *BMC Public Health* 2015; 15: 692. DOI: 10.1186/s12889-015-1895-y.
29. Va P, Yang WS, Nechuta S, et al. Marital status and mortality among middle age and elderly men and women in urban Shanghai. *PLoS One* 2011; 6: e26600. DOI: 26610.21371/journal.pone.0026600.
30. Sun X, Lucas H, Meng Q, et al. Associations between living arrangements and health-related quality of life of urban elderly people: a study from China. *Qual Life Res* 2011; 20: 359–369. DOI: 10.1007/s11136-010-9752-z.
31. Liu Q, Wang B, Kong Y, et al. China's primary health-care reform. *Lancet* 2011; 377: 2064–2066. DOI: 10.1016/S0140-6736(11)60167-0.
32. Liu L, Wang D, Wong L, et al. Stroke and stroke care in china huge burden, significant workload, and a national priority. *Stroke* 2011; 42: 3651–3654.
33. Tang S, Tao J and Bekedam H. Controlling cost escalation of healthcare: making universal health coverage sustainable in China. *BMC Public Health* 12 Suppl 1: S8. DOI: 10.1186/1471-2458-12-S1-S8.
34. Gallardo-Peralta LP, de Roda ABL, Ángeles Molina-Martínez M, et al. Family and community support among older Chilean adults: the importance of heterogeneous social support sources for quality of life. *J Gerontol Soc Work* 2018; 61: 584–604.