Family Function and Health-Related Quality of Life Among Low-Income Residents with Hypertension: A Cross-Sectional Study in Central China

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Abstract

Backgroud Family is the most important social support available to hypertensive patients, which may affect their health-related quality of life (HRQOL) and health outcomes. However, data on the relationship between family function and HRQOL among hypertensive residents are sparse, particularly for those low-income residents with hypertension. In this study, we aimed to examine the effects of family function on physical and mental health among low-income residents with hypertension in Central China, and to explore the independent contributions of socio-demographic variables, health-related factors and family function to each domain of HRQOL.

Methods This cross-sectional, community-based survey, studied 295 low-income residents with hypertension. Family function was measured using the Family APGAR Index (Adaptation, Partnership, Growth, Affection, and Resolve). HRQOL was assessed using the SF-12 Questionnaire. Clustered multiple linear regressions were used to analyze the independent contributions of family function to each domain of HRQOL.

Results 35.90% of low-income hypertensive residents had highly functional family. Multiple regression analyses showed that those with higher Family APGAR scores obtained higher general health (β=0.168, *P*=0.008), bodily pain(β=0.167, *P*=0.008), mental component summary (β=0.330, *P*<0.001), role limitations due to emotional problems (β=0.138, *P*=0.022), mental health (β=0.302, *P*<0.001), vitality (β=0.264, *P*<0.001), and social function (β=0.312, *P*<0.001) scores, whereas no independent contribution of family function to physical component summary was observed. On these subscales, the independent contributions of family function accounted for 15.75%, 14.29%, 39.63%, 5.47%, 94.67%, 51.92% and 57.58%, respectively (more than all socio-demographic and health-related variables in the MH, VT and SF domains).

Conclusion Family function was significantly associated with HRQOL among low-income hypertensive residents. This relation holds for both mental component summary and each of its individual domains, as well as partial physical domains.

Background

Hypertension, an important public health problem around the world, is associated with an increased risk of cardiovascular disease, such as heart disease and stroke[1]. In China, 226 million adults suffered from raised blood pressure and hypertension could lead to 24.6% of deaths and 12.0% of Disability-Adjusted Life Years[2]. Population with hypertension have become a concern, however, those urban hypertensive residents in poverty are vulnerable groups that might be ignored.

Health-related quality of life (HRQOL) represents the perceived physical and mental health status of an individual or group over time[3]. A meta-analysis in China showed worsen quality of life in hypertensive patients[4]. Both physical and psychological factors attribute to the HRQOL level, but it seems that mental health factors made more contributions to HRQOL. To enhance the HRQOL and reduce some adverse

outcomes, it is important to identify and understand the related factors of HRQOL in hypertensive residents.

Family function in the context of illness is defined as family members' ability to maintain cohesive relationships with one another, fulfil family roles, cope with family problems, adjust to new family routines and procedures and effectively communicate with each other[5]. Family is the most important social support available to hypertensive patients, which may affect HRQOL and health outcomes. Support from family played a vital role in patients' performance within daily routine planning, such as meal planning, blood pressure monitoring, medication adherence, et al. Some scholars have studied the correlation of family function and HRQOL in different population, such as patients with knee osteoarthritis[6] and caregivers[7]. However, as far as we know, few studies fouced on hypertensive residents, especially those low-income hypertensive residents in the community.

In the context of national health poverty alleviation, it is of great significance to pay attention to the HRQOL of low-income hypertensive residents in the community for health management and life improvement. Thus, in this study, we selected low-income hypertensive residents in Central China and to explore factors, especially family function, impacting on HRQOL, in order to provide a reference for improving HRQOL and health outcomes of this vulnerable population.

Methods

Study design and participants

A cross-sectional community survey was carried out between September 2019 and November 2019 in three poverty communities in Wuhan, Hubei Province, Central China. We chose the poverty communities in three of the seven main regions in Wuhan, namely Hanshui bridge community, Tanhualin community, Zhiyin community, separately located in Qiaokou District, Hanyang District, and Wuchang District. The inclusion criteria were: (a) diagnosed as hypertension, (b) able to communicate in Mandarin, (c) willing to participate in this study, (d) dwelling in low-income communities for more than three months. The exclusion criteria were: (a) difficult in providing answers, (b) having mental disease, (c) unconscious, (d) long-time lying in bed.

The questionnaires were administered by three trained nurses in the community health service center for people or the participants' home. The research purpose, content, significance were well-informed by researchers and informed consents were signed before the investigation. If the participant had blurred vision or unable to write, researchers would read every item and have the answer what they chose. The sample size was decided according to ten times that of the largest item in the questionnaire, and 10% sample loss was considered, totaling at least 132 people. All information were obtained by face to face interviews with trained personnel. Of 326 participants, 31 provided incomplete questionnaire data and the response rate was 90.5%. Finally, a total of 295 were included in our final analysis.

Measurements and instruments

Participant characteristics

A self-designed questionnaire was used to collect information from participates on socio-demographic characteristics (age, gender, marital status, etc) and health-related factors such as course of disease, comorbidity, hospitalization in the past six months, etc. The body mass index (BMI) was calculated as weight (kg) divided by the square of height (m^2), according to the Chinese body mass index reference standard[8]. Information on hospitalization was obtained by the responses to the question: “Have you been hospitalized in the past six months? (yes/no) ”.

Measure of HRQOL

We used the SF-12 Questionnaire to measure HRQOL of low-income residents with hypertension. The SF-12, an abbreviated version of the SF-36, has been widely used in the field of HRQOL study[9]. It covers 8 domains with 12 items, including physical function (PF), role limitations due to physical problems (RP), bodily pain (BP), general health (GH), vitality (VT), social function (SF), role limitations due to Emotional problems (RE) and mental health (MH), and measures HRQOL in physical component summary (PCS) and mental component summary (MCS), ranging from 0 to 100[10, 11]. A score more than 50 indicates positive self-rated health[10]. A higher score indicated a better HRQOL and vice versa[12].

Measure of family function

Family function was measured using the Family APGAR Index, which was developed by Smilkstein in 1978[13-15].It is used to assess the satisfaction of family members in five domains: Adaptability, Partnership, Growth, Affection, and Resolve. A 3-point rating scale (0=hardly ever, 1=sometimes, and 2=almost always) was used to score the items. The total score ranged from 0 to 10. A good family function with a score of 7~10, moderate dysfunction of 4~6, and severe dysfunction of 0~3[13-15]. The Chinese version has been widely used with satisfactory validity and reliability[17].

Statistical analysis

Means and standard deviations (SD) were presented for continuous variables, while frequency and percentage were used for categorical variables. We assessed the associations between socio-demographic variables, health-related variables, the Family APGAR index and HRQOL scores using univariate and multivariate analyses. Univariate analyses included a *t*-tests and one-way ANOVA, whereas multivariate analysis was performed by the clustered multiple linear regression analysis (enter model), where domain scores of the SF-12 instrument were considered as dependent variables and those variables in the three clusters were independent variables. To properly assess the associations between the variables in the 3 clusters and HRQOL, we used dummy variables for disordered multicategory variables.

Specifically, clustered multiple linear regression analyses[18-20]were used to explore the impacts of socio-demographic characteristics, health-related factors, and Family APGAR (3 clusters based on the

nature of the study variables and study purpose) on each domain of HRQOL. There was the possibility of multidirectional links among the 3 clusters of independent variables and the dependent variable. In other words, socio-demographic variables (cluster 1) may affect health-related variables (cluster 2) and the Family APGAR (cluster 3) as well as the dependent variables (each domain of HRQOL). Similarly, cluster 2 may affect cluster 3 and the dependent variables. However, cluster 3 may only influence the dependent variables. Consequently, variables in the prior cluster may have impacts on variables in the subsequent cluster, but not vice versa[20].We determined the final regression model in 3 steps, which were described in a previous study[18]: (i) an enter regression of each domain of HRQOL for the cluster 1 variables; (ii) an enter regression for the cluster 2 variables with the equation derived from step 1 as a fixed part of the new regression model; and (iii) an enter regression for the cluster 3 variables, with the equation derived from step 2 as a fixed part of the new regression model. The variables' inclusion and exclusion criteria for the enter regression models were *P* values of 0.05 and 0.10, respectively.

The independent effect of each cluster on the dependent variables was determined by calculating the corresponding R^2 change. The independent contribution of each cluster was then calculated by (individual R^2 change / total R^2) ×100%[21].

All statistical analyses were conducted using the Statistical Package for the Social Sciences (SPSS), version 23.0 (SPSS Inc., Chicago, IL, USA). Two-tailed *P* values below 0.05 were considered statistically significant.

Results

Participant Characteristics

Among 295 low-income residents with hypertension, with an average age of (68.53 ± 9.98) years, the majority were women (73.20%), married (89.50%), retired (77.30%) and lived in the stair room (78.00%) with children (43.10%). 39.30% of the subjects had an education level of primary school or lower. Regarding health-related factors, there were 33.90% of residents with grade three hypertension. More than half of participants had at least 6 years of course of disease (76.60%), most did not see a doctor (68.50%) and could not be hospitalized (70.50%) in the past six months. About 56.30% of participants reported comorbidity. The average BMI was (24.66 ± 3.54) kg/m^2. The Family APGAR scores were 5.30 ± 2.99, and only 35.90% of subjects had highly functional family. More details of the participants' characteristics are shown in Table 1.

Table 1
Associations between HRQOL scores in physical and mental component summary among different subgroups (n = 295)

Variables	n	%	PCS, mean (SD)	MCS, mean (SD)
Cluster 1: Socio-demographic factors				
Age (years)	68.53	9.98		
Age groups (years)				
38 ~ 59 (1)	54	18.30	66.20 (22.98)	75.39 (17.19)
60 ~ 79 (2)	195	66.10	54.64 (23.27)*	72.50 (17.64)
≥ 80 (3)	46	15.60	42.17 (21.54) *,#	65.40 (18.67)*,#
P value (*F* statistics)			< 0.001 (13.623)	0.015 (4.251)
Gender				
Male (1)	79	26.80	61.01 (23.55)	73.94 (17.37)
Female (2)	216	73.20	52.55 (23.71)*	71.18 (18.10)
P value (*t* value)			0.007 (2.721)	0.241 (1.74)
Marital status				
Married (1)	264	89.50	54.75 (24.29)	72.30 (17.67)
Single (2)	31	10.50	55.32 (20.93)	68.68 (19.95)
P value (*t* value)			0.901 (-0.125)	0.288 (1.064)
Education level				
Primary school or lower (1)	116	39.30	49.48 (23.81)	69.90 (18.13)
Middle school (2)	108	36.60	57.50 (23.81)*	72.72 (17.44)

Note: Data presented are mean ± SD or n (%); Single: unmarried, divorced or widowed.

HRQOL = health-related quality of life; PCS = physical component summary; MCS = mental component summary; RMB = renminbi; BMI = body mass index; APGRA = adaptation, partnership, growth, affection, and resolve.

(1) = reference group.

* Compared with (1) $P < 0.05$.

Compared with (2) $P < 0.05$.

Variables	n	%	PCS, mean (SD)	MCS, mean (SD)
High school or above (3)	71	24.10	59.44 (22.92)*	74.00 (18.20)
P value (*F* statistics)			0.007 (5.020)	0.266 (1.329)
Employment status				
Employed	31	10.50	74.19 (18.71)	82.26 (12.50)
Retired	228	77.30	52.83 (23.89)*	71.53 (18.02)*
Unemployed	17	5.80	51.76 (22.57)*	61.27 (17.60)*,#
Other	19	6.40	49.74 (19.47)*	69.30 (17.74)*
P value (*F* statistics)			0.001(8.250)	0.001 (5.893)
Way of living				
Live alone (1)	61	20.70	51.56 (23.05)	68.24 (19.02)
Live with spouse (2)	107	36.30	56.64 (23.45)	71.50 (17.95)
Live with children (3)	127	43.10	54.84 (24.74)	74.05 (17.16)
P value (*F* statistics)			0.418 (0.875)	0.109 (2.233)
Housing situation				
Elevator room (1)	26	8.80	55.58 (19.25)	72.60 (17.33)
Stair room (2)	230	78.00	55.59 (24.19)	72.43 (17.95)
One-storey house (3)	39	13.20	49.74 (25.05)	68.48 (18.18)
P value (*F* statistics)			0.366 (1.009)	0.438 (0.827)
Monthly personal income				
1000 RMB/month (1)	19	6.40	37.89 (25.78)	60.31 (22.67)

Note: Data presented are mean ± SD or n (%); Single: unmarried, divorced or widowed.

HRQOL = health-related quality of life; PCS = physical component summary; MCS = mental component summary; RMB = renminbi; BMI = body mass index; APGRA = adaptation, partnership, growth, affection, and resolve.

(1) = reference group.

* Compared with (1) $P < 0.05$.

Compared with (2) $P < 0.05$.

Variables	n	%	PCS, mean (SD)	MCS, mean (SD)
1000 ~ 2000 RMB/month (2)	82	27.80	56.22 (24.29)*	70.78 (19.09)*
2001 ~ 3000 RMB/month (3)	194	65.80	55.88 (23.07)*	73.54 (16.48)*
P value (*F* statistics)			0.006 (5.231)	0.007 (5.086)
Cluster 2: health-related factors				
Hypertension grade				
Grade one hypertension (1)	97	32.90	56.03 (24.74)	70.45 (17.64)
Grade two hypertension (2)	98	33.20	55.10 (24.78)	75.21 (16.21)
Grade three hypertension (3)	100	33.90	53.35 (22.38)	70.13 (19.45)
P value (F statistics)			0.728 (0.318)	0.083 (2.510)
Comorbidity				
No (1)	129	43.70	60.54 (22.52)	72.59 (17.86)
Yes (2)	166	56.30	47.44 (23.73)*	71.06 (18.02)
P value (*t* value)			< 0.001 (4.840)	0.468 (0.727)
Hospitalization in the past six months				
No (1)	208	70.50	58.53(22.64)	73.68 (17.68)
Yes (2)	87	29.50	45.92 (24.68)*	67.72 (17.90)*
P value (*t* value)			< 0.001 (4.248)	0.009 (2.630)
See a doctor in the past six months				
No (1)	202	68.50	57.85 (22.82)	74.03 (18.06)

Note: Data presented are mean ± SD or n (%); Single: unmarried, divorced or widowed.

HRQOL = health-related quality of life; PCS = physical component summary; MCS = mental component summary; RMB = renminbi; BMI = body mass index; APGRA = adaptation, partnership, growth, affection, and resolve.

(1) = reference group.

* Compared with (1) $P < 0.05$.

Compared with (2) $P < 0.05$.

Variables	n	%	PCS, mean (SD)	MCS, mean (SD)
Yes (2)	93	31.50	48.23 (25.04)*	67.34 (16.82)*
P value (*t* value)			0.001 (3.261)	0.003 (3.021)
Course of disease (years)				
1 ~ 5 (1)	69	23.40	53.04 (24.91)	67.51 (17.28)
6 ~ 10 (2)	135	45.80	61.93 (20.57)	76.57 (14.80)*
11 ~ 20 (3)	54	18.30	45.83 (26.06)#	69.52 (19.44)
> 20 (4)	37	12.50	45.27 (22.73)#	66.67 (23.03)
P value (*F* statistics)			< 0.001 (9.334)	< 0.001 (6.114)
BMI (m, SD)	24.66	3.54		
BMI, kg/m^2 (n,%)				
Normal weight (1)	125	42.40	23.92 (2.14)	72.73 (17.67)
Underweight (2)	5	1.70	27.06 (12.10)	60.83 (25.96)
Overweight (3)	127	43.10	23.87 (2.12)*	70.96 (18.03)
Obese (4)	38	12.90	21.93 (3.56)	73.90 (17.27)
P value (*F* statistics)			0.036 (2.879)	0.394 (0.999)
Cluster3: Family APGRA				
Family APGRA scores	5.30	2.99		
Family APGRA index				

Note: Data presented are mean ± SD or n (%); Single: unmarried, divorced or widowed.

HRQOL = health-related quality of life; PCS = physical component summary; MCS = mental component summary; RMB = renminbi; BMI = body mass index; APGRA = adaptation, partnership, growth, affection, and resolve.

(1) = reference group.

* Compared with (1) $P < 0.05$.

Compared with (2) $P < 0.05$.

Variables	n	%	PCS, mean (SD)	MCS, mean (SD)
Severely dysfunctional family (Family APGAR 0 ~ 3) (1)	79	26.80	51.01 (24.06)	64.77 (19.89)
Moderately dysfunctional family (Family APGAR 4 ~ 7) (2)	110	37.30	55.73 (22.69)	72.35(16.40)*
highly functional family (Family APGAR 8 ~ 10) (3)	106	35.90	56.70 (24.95)	76.81 (16.21)*
P value (*F* statistics)			0.246 (1.410)	< 0.001 (10.965)
Note: Data presented are mean ± SD or n (%); Single: unmarried, divorced or widowed.				
HRQOL = health-related quality of life; PCS = physical component summary; MCS = mental component summary; RMB = renminbi; BMI = body mass index; APGRA = adaptation, partnership, growth, affection, and resolve.				
(1) = reference group.				
* Compared with (1) $P < 0.05$.				
# Compared with (2) $P < 0.05$.				

Hrqol In The Physical And Mental Dimensions

The SF-12 physical and mental component summary scores are shown in Table 1. The results obtained from univariate analyses showed that PCS was associated with age groups, gender, education level, employment status, monthly personal income, comorbidity, hospitalization in the past six months, see a doctor in the past six months, course of disease, and BMI (all $P < 0.05$). However, MCS was associated with age groups, employment status, monthly personal income, hospitalization in the past six months, see a doctor in the past six months, course of disease and the Family APGAR (all $P < 0.05$). Apparently, only the Family APGAR was significantly associated with HRQOL in the mental component summary. Higher the Family APGAR scores, better MCS scores.

Associations between the Family APGAR and HRQOL in the physical and mental domains examined by clustered multiple linear regressions

To explore the relative importance of the Family APGAR in predicting HRQOL and estimate their independent contributions to HRQOL, several clustered multiple linear regression models are shown in Table 2 and Table 3.

Table 2
Clustered multiple linear regression models explaining physical domains of HRQOL by socio-demographic factors, health-related factors, and the Family APGRA scores (n = 295)

Independent variables [a]	Beta [b]	*P* value	Adjusted R^{2} [c]	Independent contribution [d] (%)
PCS				
Cluster 1				
Age, years	-0.356	< 0.001		
Gender (female)	-0.112	0.042		
Employed status (unemployed)	-0.179	0.007		
Employed status (other)	-0.139	0.031		
Monthly personal income, RMB	0.165	0.006		
Total			0.201	71.28%
Cluster 2				
Comorbidity (yes)	-0.166	0.002		
Hospitalization in the past six months (yes)	-0.160	0.003		
See a doctor in the past six months (yes)	-0.115	0.037		
Total			0.275	26.24%
Cluster 3				
Total			0.282	2.48%
GH				
Cluster 1				
Education level (middle school)	-2.053	0.041		
Employed status (retired)	-0.244	0.006		
Employed status (unemployed)	-0.201	0.006		
Employed status (other)	-0.295	< 0.001		
Total			0.057	44.88%
Cluster 2				
Comorbidity (yes)	-0.158	0.007		

Independent variables [a]	Beta [b]	*P* value	Adjusted R^2 [c]	Independent contribution [d] (%)
Hospitalization in the past six months (yes)	-0.214	< 0.001		
Total			0.107	39.37%
Cluster 3				
Family APGAR scores	0.168	0.008		
Total			0.127	15.75%
PF				
Cluster 1				
Age, years				
Total			0.129	67.54%
Cluster 2				
Hospitalization in the past six months (yes)				
Total			0.194	34.03%
Cluster 3				
Total			0.191	0%
RP				
Cluster 1				
Age, years	-0.359	< 0.001		
Gender (female)	-0.119	0.043		
Employed status (unemployed)	-0.144	0.038		
Monthly personal income, RMB	0.177	0.005		
Total			0.166	79.43%
Cluster 2				
Comorbidity (yes)	-0.164	0.004		
Total			0.208	20.10%
Cluster 3				
Total			0.209	0.48%

Independent variables [a]	Beta [b]	*P* value	Adjusted R^2 [c]	Independent contribution [d] (%)
BP				
Cluster 1				
Age, years	-2.822	0.005		
Employed status (unemployed)	-2.302	0.022		
Employed status (other)	-2.044	0.042		
Total			0.089	66.92%
Cluster 2				
See a doctor in the past six months (yes)	-2.248	0.025		
Total			0.114	18.80%
Cluster 3				
Family APGAR scores	0.167	0.008		
Total			0.133	14.29%

HRQOL = health-related quality of life; APGRA = adaptation, partnership, growth, affection, and resolve;

PCS = physical component summary; GH = general health; BP = bodily pain; PF = physical function; RP = role limitations due to physical problems.

Enter regression was applied in the multiple linear regression analysis.

[a] Only variables with $P < 0.05$ were included in the model.

[b] Beta is the standardized regression coefficient derived from the multiple linear regression, indicating the change in standard units of dependent variable for each increase of one standard unit in the independent variable, controlling for all other independent variables.

[c] R^2 is the proportion of variance in the dependent variable (each domain of HRQOL) explained by the independent variables included in each regression model.

[d] The independent contribution of each cluster of predictors to the variation in each domain of HRQOL calculated as individual corresponding R^2 change / total R^2 change in each final model × 100%.

Table 3
Clustered multiple linear regression models explaining mental domains of HRQOL by socio-demographic factors, health-related factors, and Family APGRA scores (n = 295)

Independent variables [a]	Beta [b]	*P* value	Adjusted R^{2} [c]	Independent contribution [d] (%)
MCS				
Cluster 1				
Age, years	-0.250	< 0.001		
Gender (female)	-0.147	0.012		
Employed status (Unemployed)	-0.221	0.001		
Monthly personal income, RMB	0.149	0.017		
Total			0.110	50.69%
Cluster 2				
See a doctor in the past six months (yes)	-0.189	0.001		
Total			0.131	9.68%
Cluster 3				
Family APGAR scores	0.330	< 0.001		
Total			0.217	39.63%
RE				
Cluster 1				
Age, years	-0.281	< 0.001		
Gender (female)	-0.165	0.005		
Employed status (retired)	-0.168	0.047		
Employed status (unemployed)	-0.239	0.001		
Housing situation (One-storey house)	-0.220	0.007		
Monthly personal income, RMB	0.206	0.001		
Total			0.178	88.56%
Cluster 2				
See a doctor in the past six months (yes)	-0.150	0.010		

Independent variables [a]	Beta [b]	*P* value	Adjusted R^2 [c]	Independent contribution [d] (%)
Total			0.189	5.47%
Cluster 3				
Family APGAR scores	0.138	0.022		
Total			0.201	5.97%
MH				
Cluster 1				
Total			0	0%
Cluster 2				
See a doctor in the past six months (yes)	-0.076	0.221		
Total			0.004	5.33%
Cluster 3				
Family APGAR scores	0.302	< 0.001		
Total			0.075	94.67%
VT				
Cluster 1				
Gender (female)	-0.138	0.027		
Total			0.050	48.08%
Cluster 2				
Total			0.050	0%
Cluster 3				
Family APGAR scores	0.264	< 0.001		
Total			0.104	51.92%
SF				
Cluster 1				
Age, years	-0.230	0.001		
Monthly personal income, RMB	0.153	0.020		

Independent variables [a]	Beta [b]	*P* value	Adjusted R^2 [c]	Independent contribution [d] (%)
Total			0.030	22.73%
Cluster 2				
Comorbidity (yes)	0.122	0.037		
See a doctor in the past six months (yes)	-0.240	< 0.001		
Total			0.056	19.70%
Cluster 3				
Family APGAR scores	0.312	< 0.001		
Total			0.132	57.58%
HRQOL = health-related quality of life; APGRA = adaptation, partnership, growth, affection, and resolve;				
MCS = mental component summary; RE = role limitations due to emotional problems; MH = mental health; VT = vitality; SF = social function;.				
Enter regression was applied in the multiple linear regression analysis.				
[a] Only variables with *P*0.05 were included in the model.				
[b] Beta is the standardized regression coefficient derived from the multiple linear regression, indicating the change in standard units of dependent variable for each increase of one standard unit in the independent variable, controlling for all other independent variables.				
[c] R^2 is the proportion of variance in the dependent variable (each domain of HRQOL) explained by the independent variables included in each regression model.				
[d] The independent contribution of each cluster of predictors to the variation in each domain of HRQOL calculated as individual corresponding R^2 change / total R^2 change in each final model × 100%.				

For the physical domains, after adjustment for variables in clusters 1 and cluster 2, the Family APGAR were proven to be significant predictors of the GH and BP domains (Table 2). On these subscales, those with higher Family APGAR scores obtained higher GH (β = 0.168, *P* = 0.008) and BP (β = 0.167, *P* = 0.008) scores. Besides, the independent contributions of the Family APGAR in these domains were 15.75% and 14.29%, respectively.

However, for the mental domains, the Family APGAR were proven to be significant predictors of the MCS dimension and all domains (Table 3). On these subscales, those with higher Family APGAR scores obtained higher MCS (β = 0.330, *P* < 0.001), RE (β = 0.138, *P* = 0.022), MH (β = 0.302, *P* < 0.001), VT (β = 0.264, *P* < 0.001), and SF (β = 0.312, *P* < 0.001) scores. Additionally, the independent contributions of the

Family APGAR in these domains were 39.63%, 5.47%, 94.67%, 51.92% and 57.58%, respectively (more than all socio-demographic and health-related variables in the MH, VT and SF domains).

The independent contributions of three clusters to the HRQOL among low-income residents with hypertension in physical and mental domains are illustrated in Fig. 1.

Discussion

Main findings

This study was to examine the associations of family function and physical and mental HRQOL among low-income hypertensive residents, and to explore the independent contributions of socio-demographic variables, health-related factors and family function to each domain of HRQOL. The results showed that both family function and HRQOL scores among low-income hypertensive residents were not high. The Family APGAR were significantly associated with HRQOL in MCS and its all domains, and its independent contributions to certain domains (MH, VT and SF) were larger than that of socio-demographic characteristics and health-related factors. However, except GH and BP, no contribution of family function was observed in PCS and its other domains. These findings suggested that further research should focus on increasing the level of family function of low-income hypertensive residents to improve their mental health[22] and HRQOL.

Comparing with previous studies

Our study showed that the Family APGAR were significantly associated with the HRQOL in certain domains among Chinese low-income residents with hypertension after adjusting for socio-demographic and health-related factors. Participants with higher Family APGAR scores had higher GH and BP scores in physical domains and higher RE, MH, VT, SF and MCS scores in mental domains, and no significant influence of family function on PCS was observed. HRQOL included mental health and physical health, it is obvious that family function was more beneficial to mental health not physical health, even so, can also improve their quality of life. Previous studies indicated that mental health contributed more than physical health to quality of life[23]. Predictors to promote the mental status of hypertensive patients should be highlighted, especially their family function.

Our results were consistent with some studies conducted in other populations[6, 7]. A cross-sectional study including 153 caregivers conducted in Spain [6, 7]found that, family function (Family APGAR-Q) was the only one of the variables evaluated that presented an association both with global QOL and with each of the four individual dimensions. Unfortunately, the relationships between them were simply mentioned and failed to be deeply studied. Therefore, it is important and necessary to comprehensively explore the associations of family function with physical and mental HRQOL and with each of individual domains. Besides, a previous study in Chongqing [24] also found that hypertensive respondents with positive relationship with family had better HRQOL in middle-aged people with hypertension. It was reported that patients' family are a valued source of affection and communicative support, improving

HRQOL[25]. However, a quantitative study with retrospective designs among hypertensive patients in Teluk Kenidai Village found no correlation between family support and quality of life[26], which might due to the majority of participates in their study suffered from mild hypertension and got good level of family support, and plus only 30 were analysed so that it might be hard to ensure Chi-square test results. More importantly, they also emphasized that role of family is to provide family support since onset of the disease such as could provide required diet and ensure medication to recover the disease quickly further able to carry out their normal role and functions. Based on the above studies, the association of family support and quality of life could not be completely clear yet and more studies are needed in the future.

Our results also indicated that the independent contributions of the third cluster (the Family APGAR scores) to 3 mental domains of HRQOL (MH, VT and SF) were even larger than those of socio-demographic and health-related factors. This finding might be partially explained by the fact that family function was a major determinant in mental health, vitality and social function for low-income hypertensive residents. Patients with hypertension rely on their family members for informational, instrumental and emotional supports, which can inverse affect their mental status[27]. Therefore, family social support could deserve more attention regarding mental HRQOL of low-income hypertensive patients.

Moreover, of the socio-demographic and health-related factors, age, gender, employed status, monthly personal income and seeing a doctor in the past six months were common significantly influencing factors of MCS and PCS. In agreement with previous studies [28-34], residents with hypertension who were more elderly, female, unemplyed, with lower monthly personal income and seeing seeing a doctor in the past six months got worse HRQOL. There was no doubt that, physical and mental health deteriorates with age[29, 30]. With the aging process, a variety of physiological functions are gradually degraded, and the opportunity to contact with society and the ability to adapt to society are gradually reduced, then may affecting the social interaction and psychological status of low-income hypertensive patients. Female got lower HRQOL[31, 34, 35], perhaps because men are more concerned about their health, and more physical exercise and social activities than women also contribute to their physical and mental health. Employment status was one of the influencing factors of HRQOL for hypertension residents, in accordance with previous studies[30]finding that employed patients showed a higher score than unemployed and retired patients. It is suggested that the employment opportunities of low-income hypertensive patients can be provided in the future, which can improve their family conditions and quality of life. As for those participants with lower monthly personal income, due to the economic pressure, tend to neglect their own health, which makes it difficult to ensure the sustained and effective treatment of hypertension, thus resulting in poor health and quality of life[28].

However, this study has several limitations that should be noted. First, the data in our analyses were based on self-reports, which could lead to biases or inaccuracies. Second, although the sample size was sufficient in our analyses, a larger sample size community surveys in multiple regions are needed. Lastly, this was a cross-sectional study, so the observed associations could not be assumed to be causal

relationships. Further in-depth studies with longitudinal follow-up data are warranted to explore the cause-effect relationships.

Conclusion

This is the population-based study concerning family function and HRQOL of individuals in hypertensive groups, where the focus was on low-income Chinese residents with hypertension. We found that HRQOL was, to some degree, independently and differentially affected by family function. With the significant associations between family function and HRQOL (especially in mental domains), there might be great implications for highlighting the importance of family support and promulgating relevant policies to increase the level of family function, thus improving their mental health and HRQOL.

Abbreviations

HRQOL, Health-related quality of life

APGAR, Adaptation, partnership, growth, affection, and resolve

SD, Standard deviation

BMI, Body mass index

SF-12, The MOS 12-item short form health survey

PF, Physical function

RP, Role limitations due to physical problems

BP, Bodily pain

GH, General health

VT, Vitality

SF, Social function

RE, Role limitations due to Emotional problems

MH, Mental Health

PCS, physical component summary

MCS, mental component summary

Declarations

Ethics approval and consent to participate

Ethical approval for this survey was obtained from the ethics committee of Tongji Hospital, Tongji Medical college, Huazhong University of Science and Technology, Wuhan, China (approval number: TJ-IRB20190903). Informed consent was obtained from all study participants prior to the survey.

Consent for publication

Not applicable.

Availability of data and materials

Data might not be shared directly, because it's our team work and informed consent should be attained from team members.

Competing interests

The authors declare that there is no conflict of interest associated with this publication.

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Authors' contributions

All authors contributed to the development of the study framework, interpretation of the results, revisions of drafts of the manuscript, and approved the version submitted for publication. XXW, WYZ, and MZ conducted the data analyses. XXW drafted the manuscript. WYZ and YL checked the paper. JZ, ZMM, and YL finalized the manuscript with inputs from all authors.

Authors' information

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References

1. WHO. World health statistics 2019: monitoring health for the SDGs, sustainable development goals. In.; 2019.
2. Yang G, Wang Y, Zeng Y, Gao GF, Liang X, Zhou M, Wan X, Yu S, Jiang Y, Naghavi M et al. Rapid health transition in China, 1990-2010: findings from the Global Burden of Disease Study 2010. LANCET. 2013; 381(9882):1987-2015.
3. National Center for Chronic Disease Prevention and Health Promotion , Division of Population Health. Health-related quality of life (HRQOL). (2018-10-31) [2020-10-1] https://www.cdc.gov/hrqol/
4. Ye R, Liu K, Zhang Z, Gong S, Chen X. Health-related quality of life of hypertension in China: a systematic review and meta-analysis. J Cardiovasc Med (Hagerstown) . 2018; 19(8):430-438.
5. Zhang Y. Family functioning in the context of an adult family member with illness: A concept analysis. J CLIN NURS. 2018; 27(15-16):3205-3224.
6. Lim AT, Manching J, Penserga EG. Correlation between Family APGAR scores and health-related quality of life of Filipino elderly patients with knee osteoarthritis. INT J RHEUM DIS. 2012; 15(4):407-413.
7. Rodriguez-Sanchez E, Perez-Penaranda A, Losada-Baltar A, Perez-Arechaederra D, Gomez-Marcos MA, Patino-Alonso MC, Garcia-Ortiz L. Relationships between quality of life and family function in caregiver. BMC FAM PRACT. 2011; 12:19.
8. Chen CM. Overview of obesity in Mainland China. OBES REV. 2008; 9 Suppl 1:14-21.
9. Cote I, Gregoire JP, Moisan J, Chabot I. Quality of life in hypertension: the SF-12 compared to the SF-36. Can J Clin Pharmacol. 2004; 11(2):e232-e238.
10. Brazier JE, Roberts J. The estimation of a preference-based measure of health from the SF-12. MED CARE. 2004; 42(9):851-859.
11. Ware J, Kolinski M, Keller S. How to score the SF-12 physical and mental health summaries: a user's manual. Boston, MA: The Health Institute, New England Medical Center; 1995.
12. Wyrwich KW, Tierney WM, Babu AN, Kroenke K, Wolinsky FD. A comparison of clinically important differences in health-related quality of life for patients with chronic lung disease, asthma, or heart disease. HEALTH SERV RES. 2005; 40(2):577-591.
13. Good MD, Smilkstein G, Good BJ, Shaffer T, Arons T. The family APGAR index: a study of construct validity. The Journal of Family Practice. 1979; 8(3):577-582.
14. Smilkstein G.Assessment of Family Function. 1983.
15. Smilkstein G, Ashworth C, Montano D. Validity and reliability of the family APGAR as a test of family function. J Fam Pract. 1982; 15(2):303-311.
16. Mengel M. The use of the family APGAR in screening for family dysfunction in a family practice center. J Fam Pract. 1987; 24(4):394-398.

17. F L, G Z, S L, T Z, Z Z. A study on validity and reliability of the family APGAR. Chin Public Health (Chinese) .1999; 15:987-988.
18. Li BB, Liu N, Li B, Huang LL, Wang XX, Wu X, Fu LY, Wu YL, Su ZZ, Wang PX. Sexuality-Related Factors and Quality of Life Among Reproductive-Aged Married Female Migrant Workers: A Cross-Sectional Study in Southern China. Sex Med. 2019; 7(4):384-395.
19. Wang XX, Chen ZB, Chen XJ, Huang LL, Song XY, Wu X, Fu LY, Wang PX. Functional status and annual hospitalization in multimorbid and non-multimorbid older adults: a cross-sectional study in Southern China. Health Qual Life Outcomes. 2018; 16(1):33.
20. Nagelkerke N. A note on a general definition of the coefficient of determination. Biometrika 1991; 73:691-692.
21. Chen T, Li L. Influence of health-related quality of life on health service utilization in addition to socio-demographic and morbidity variables among primary care patients in China. INT J PUBLIC HEALTH .2009; 54(5):325-332.
22. Cao W, Hou G, Guo C, Guo Y, Zheng J. Health-promoting behaviors and quality of life in older adults with hypertension as compared to a community control group. J HUM HYPERTENS. 2018; 32(8-9):540-547.
23. Younsi M, Chakroun M. Measuring health-related quality of life: psychometric evaluation of the Tunisian version of the SF-12 health survey. QUAL LIFE RES. 2014; 23(7):2047-2054.
24. Xu X, Rao Y, Shi Z, Liu L, Chen C, Zhao Y. Hypertension Impact on Health-Related Quality of Life: A Cross-Sectional Survey among Middle-Aged Adults in Chongqing, China. INT J HYPERTENS. 2016:7404957.
25. Lee MK, Yun YH. Family Functioning Predicts End-of-Life Care Quality in Patients With Cancer: Multicenter Prospective Cohort Study. CANCER NURS. 2018; 41(3):E1-E10.
26. Nurchayati S, Utomo W, Karim D. Correlation between family support and quality of life among hypertensive patients. Enferm Clin. 2019; 29 Suppl 1: 60-62.
27. Zhu S, Hu J, Efird JT. Role of social support in cognitive function among elders. J CLIN NURS. 2012; 21(15-16):2118-2125.
28. Alefishat E, S JA, Abu FR. Factors affecting health-related quality of life among hypertensive patients using the EQ-5D tool. INT J CLIN PRACT. 2020; 74 (9): e13532.
29. Wang C, Lang J, Xuan L, Li X, Zhang L. The effect of health literacy and self-management efficacy on the health-related quality of life of hypertensive patients in a western rural area of China: a cross-sectional study. INT J EQUITY HEALTH. 2017; 16(1):58.
30. Zhang Y, Zhou Z, Gao J, Wang D, Zhang Q, Zhou Z, Su M, Li D. Health-related quality of life and its influencing factors for patients with hypertension: evidence from the urban and rural areas of Shaanxi Province, China. BMC HEALTH SERV RES. 2016; 16:277.
31. Zygmuntowicz M, Owczarek A, Elibol A, Chudek J. Comorbidities and the quality of life in hypertensive patients. Pol Arch Med Wewn. 2012; 122 (7-8): 333-340.

32. Youssef RM, Moubarak II, Kamel MI. Factors affecting the quality of life of hypertensive patients. East Mediterr Health J. 2005; 11(1-2):109-118.
33. Klocek M, Kawecka-Jaszcz K. [Quality of life in patients with essential arterial hypertension. Part I: The effect o socio-demographic factors]. Przegl Lek. 2003; 60(2):92-100.
34. Xiao M, Zhang F, Xiao N, Bu X, Tang X, Long Q. Health-Related Quality of Life of Hypertension Patients: A Population-Based Cross-Sectional Study in Chongqing, China. INT J ENV RES PUB HE. 2019; 16(13):2348.
35. Park B, Ock M, Lee HA, Lee S, Han H, Jo MW, Park H. Multimorbidity and health-related quality of life in Koreans aged 50 or older using KNHANES 2013-2014. Health Qual Life Outcomes. 2018; 16(1):186.

Figures

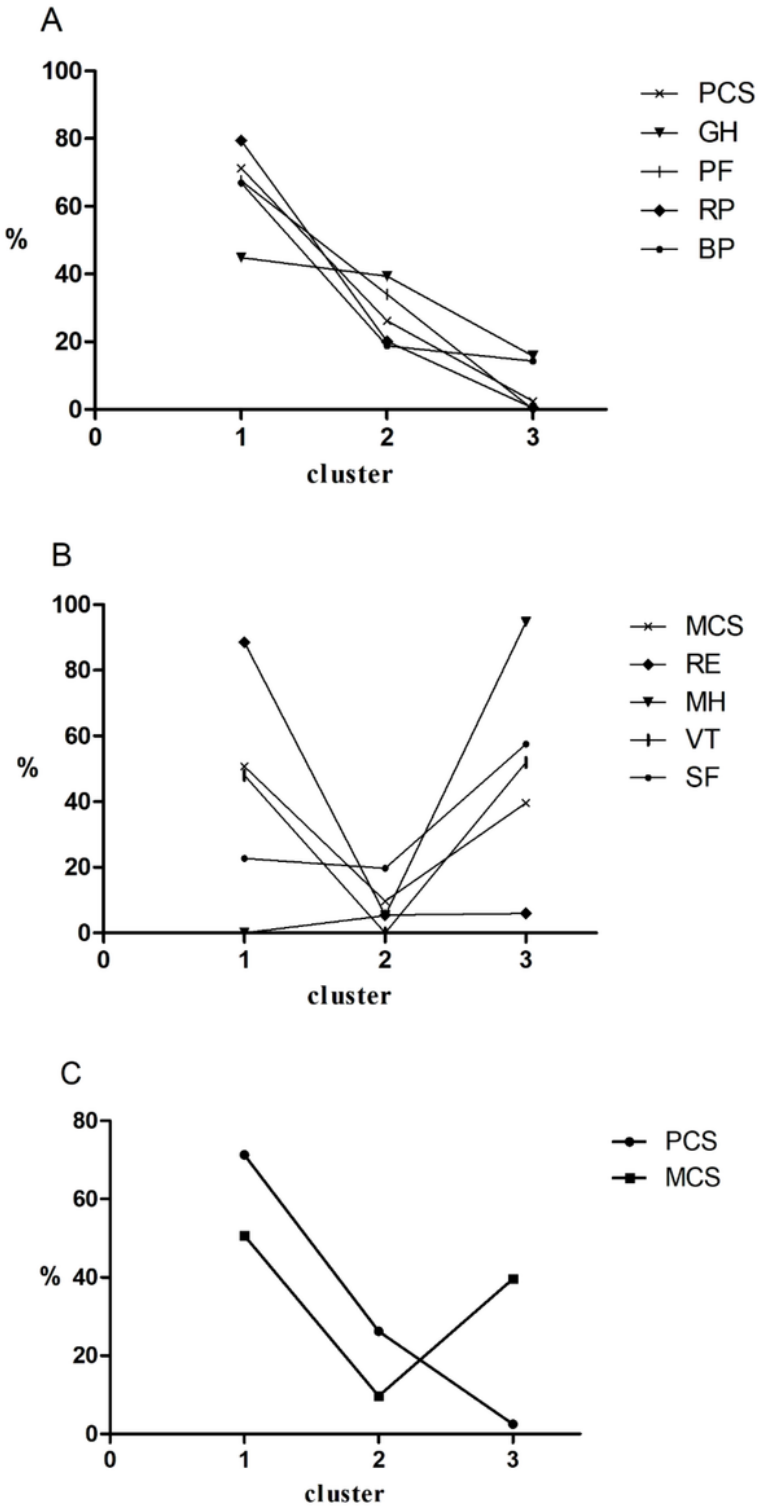

Figure 1

The independent contributions of three clusters to the HRQOL among low-income hypertensive patients in physical and mental domains