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Investigation on the frailty status of the elderly inpatients in Shanghai using the FRAIL (fatigue, resistance, ambulation, illness, and loss) questionnaire

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Abstract

This study was to investigate the frailty status of inpatients older than 65 years old in Shanghai.

A 6-month cross-sectional survey was conducted using FRAIL (fatigue, resistance, ambulation, illness, and loss) questionnaire. Totally 587 patients were included. The data, including demographic characteristics, constipation, urinary retention, urinary incontinence, grip strength, and muscle strength, were collected. The data of serum prealbumin, serum albumin, serum total protein, and hemoglobin were obtained from laboratory blood tests.

The incidence of nonfrailty, prefrailty, and frailty was 0.249, 0.417, and 0.334, respectively. The high incidence age of frailty was 86 to 90 years old (0.342), and the high incidence age of prefrailty was 65 to 70 years old (0.282). There was significant difference in the grip strength among different degrees of frailty ($P < .01$). The influencing factors related to prefrailty included prealbumin, grip strength, urinary retention, constipation and education level of illiterate ($P < .05$). The populations with high prealbumin level, high grip strength and illiteracy population were not easy to enter the prefrailty period, while those with constipation (*OR* (odds ratio) = 1.867, 95% *CI* (confidence interval): 1.046–3.330) and urinary retention (*OR* = 7.007, 95% *CI*: 1.137–2.757) were more likely to enter the prefrailty period. Factors associated with frailty included age, prealbumin, grip strength, muscle strength, urinary incontinence, urinary retention, and constipation ($P < .05$). The populations with high prealbumin level, high grip strength, and high muscle strength were not easy to enter frailty period, while those with older age (*OR* = 1.141, 95% *CI*: 1.085–1.200), urinary incontinence (*OR* = 10.314, 95% *CI*: 1.950–54.548), urinary retention (*OR* = 3.058, 95% *CI*: 1.571–5.952), and constipation (*OR* = 3.004, 95% *CI*: 1.540–5.857) were easy to enter frailty period.

The high incidence ages of frailty and prefrailty are 86 to 90 years old and 65 to 70 years old, respectively. Age, low education level, low grip strength, low muscle strength, low serum prealbumin, urinary retention, urinary incontinence, and constipation are the risk factors of frailty. It is recommended to include frailty as an indicator in the existing assessment to rate the disease and develop a disease observation plan.

Abbreviations: ANOVA = analysis of variance, CI = confidence interval, FRAIL = fatigue, resistance, ambulation, illness and loss, OR = odds ratio.

Keywords: frail elderly, FRAIL scale, frailty, prefrailty

1. Introduction

According to statistics (http://www.who.int/ageing/zh/), the world's elderly population over 60 years old will increase from 11% to 22% from 2000 to 2050, and the absolute number of people older than 60 years old is expected to grow from 605 million to 2 billion in the same period. In many countries, elderly people over the age of 85 are the fastest growing population.[1] Frailty is a senile syndrome with increased body vulnerability and decreased ability to maintain steady state.[2] When faced with stress, the risk of accidents, illnesses, disabilities, and death is accordingly raised.[2–9] The morbidity and mortality rates of elderly patients with frailty syndrome are higher than those of nonfrail elderly people, causing heavy burden to families and society.[3] In an American community, the incidence of frailty in the people over 65 years old was 0.040 to 0.170, up to one-third in the people over 80 years old, and that of prefrailty was 0.190 to 0.530.[10] The results showed that the incidence of frailty was 0.068 to 0.149 in the communities from Taiwan and Hong Kong of China.[11–13] Frailty is an independent risk factor that leads to a variety of adverse health outcomes,[14] and the incidence of frailty in the elderly in medical institutions is much higher than

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that of the elderly in community.[15,16] The risk of adverse events (falls, nosocomial infections, prolonged hospitalization, and death) in elderly patients during hospitalization is significantly higher.[18] Currently, the study of frailty of the elderly population in China is still in the initial stage, and the epidemiological data about the frailty syndrome of the elderly patients in hospital are insufficient.

This study investigated the current frailty status of the elderly patients in hospitals in Shanghai by using the fatigue, resistance, ambulation, illness, and loss (FRAIL) scale. The prediction of adverse outcomes by frailty would help healthcare workers and patients to clarify the potential risks and timely detect and reduce the occurrence of adverse events.

2. Materials and methods

2.1. Subjects

A total of 587 hospitalized elderly patients admitted to a tertiary general hospital and its 3 subsidiary branch hospitals in Shanghai from March to August 2017 were selected as subjects. Inclusion criteria: ≥ 65 years old; elderly patients hospitalized $>$ 1 week; having cognitive functions and able to fully understand and effectively communicate with the investigators; signed informed consent. Exclusion criteria: bedridden and cannot take care of themselves; mental illness; cognitive dysfunction; severe multiple organ failure. The data was collected from questionnaire, face interview and medical records of patients. This study was approved by the Ethics Committee of Fudan University, and the patients all signed informed consent. All data collection was in line with national and regional laws and regulations.

2.2. FRAIL questionnaire

The questionnaire was presented by the Elderly Panel of Experts in the International Nutrition, Health and Elderly Working Group in 2008, and was used for the screening of clinical elderly frail population after improvement.[17–20] The scale consists of 5 items: fatigue: whether the participants feel tired "most of the time" or "always" in the last 4 weeks; sense of resistance: whether the participants have difficulties in walking up 10 steps on their own without any help and without stopping; free activity decrease: whether the participants can walk 100 m on their own without any help; co-existence of more than 5 diseases (hypertension, diabetes, cancer [except for very small skin tumors], chronic lung disease, heart attack, congestive heart failure, sore throat, asthma, arthritis, stroke, and kidney disease); weight loss: unexplained weight loss $>$ 5.0% within 1 year.[21] Each "yes" choice is one point. The lowest score is 0 and the highest score is 5. The total score of zero is defined as nonfrail, 1-2 as prefrailty, and 3-5 as frailty. The degrees of frailty of the patients were judged according to the above scoring criteria. The interview time for each patient was commonly 20 minutes.

2.3. Other measurements

The patient's demographic information (including age, gender, education level, marriage status, and family per capita annual income) was obtained by talking with the patient. The grip strength data were measured by a dial type positioning pinch meter (Shanghai Xinjing Sports Co., Ltd, Shanghai, China). The body weight data and blood biochemical data collection were obtained from the hospital information system. The researchers combined face interviews with data collection from database.

2.4. Statistical analysis

The collected data were analyzed using SPSS 19.0 software (International Business Machines Co.). Numerical data were expressed as mean ± standard deviation or percentage. ANOVA (Analysis of Variance) was used to compare the differences among nonfrail, prefrail, and frail patients, while X^2 test was used for the comparison of the categorical data. Bonferroni (B) posthoc analysis for single factor ANOVA was used for pairwise comparisons of the hierarchical data and continuity data between the nonfrail, prefrail, and frail patients. In the bivariate correlation analysis, Pearson correlation coefficient was used for the analysis of continuous data with normal distribution, and Spearman correlation coefficient was used for the analysis of categorical variable with non-normal distribution. Multivariate logistic regression analysis was used to analyze the influencing factors of frailty. $P < .05$ was considered as statistically significant.

3. Results

3.1. The frailty status of hospitalized elderly patients with different demographic characteristics

To understand the frailty status of elderly patients of different ages, gender, educational levels, marital status, and per capita annual income of the family, frail questionnaire was used. This study enrolled a total of 587 patients, including 456 males (0.777) and 131 females (0.223) (Table 1). Their ages ranged from 65 to 99 years old (averaged 79.80 ± 9.34 years old). The incidences of nonfrailty, prefrailty, and frailty in the hospitalized elderly patients were 0.249, 0.417, and 0.334, respectively. The frailty had high incidence in the age of 86 to 90 years old (0.342), while prefrailty had high incidence in the age of 65 to 70 years old (0.282). The incidence of frailty showed difference between male and female, which may be due to the larger sample number of male patients. The frailty incidence of the elderly patients with primary school education was the highest (0.474), while the prefrailty incidence of those with secondary school education was the highest (0.604). Compared with the widowed patients, the incidence of prefrailty in the married patients was significantly higher (0.763), while the incidence of frailty in widowed patients and married patients was the same (0.500). The analysis of family per capita annual income showed that the frailty status was different in the patients with different incomes. Frailty was easy to occur in the low income ($\leq$ 60,000¥/year) and high income ($>$ 120,000¥/year) population, and the proportions were 0.485 and 0.495, respectively. This suggests that old age, male, low education level, married, low- or high-family per capita annual income population is prone to frailty.

3.2. Comparison of physical status in hospitalized elderly patients with different degrees of frailty

The physiological status (weight, muscle strength, grip strength, and subcutaneous fat thickness), serological factors (serum prealbumin, albumin, total protein, and hemoglobin), and abnormal excretion status (constipation, urinary retention, and urinary incontinence) in the hospitalized elderly patients were analyzed. As shown in Table 2, the comparisons of constipation,

Table 1

The frailty status of hospitalized elderly patients with different demographic characteristics (n = 587).

Items	Cases	Percentage	Frailty baseline survey			*P* value
			Nonfrailty (n = 146)	Prefrailty (n = 245)	Frailty (n = 196)	
Age, years			75.12 ± 7.72 (0.249)	77.34 ± 8.76 (0.417)	86.37 ± 7.39 (0.339)	<.001[a,b,c]
65–70	126	0.215	0.322	0.282	0.051	<.001
71–75	88	0.150	0.226	0.200	0.031	
76–80	87	0.148	0.185	0.159	0.107	
81–85	82	0.140	0.144	0.122	0.158	
86–90	115	0.196	0.082	0.147	0.342	
> 90	89	0.151	0.041	0.090	0.311	
Sex						
Male	456	0.777	0.822	0.722	0.811	.027
Female	131	0.223	0.178	0.278	0.189	
Education level						
Illiteracy	16	0.027	0.027	0.008	0.051	<.001
Primary school	203	0.346	0.315	0.261	0.477	
Secondary school	310	0.528	0.527	0.604	0.434	
College	41	0.070	0.096	0.102	0.001	
Master and above	17	0.029	0.340	0.024	0.031	
Marital status						
Married	404	0.688	0.815	0.763	0.500	<.001
Widowed	183	0.312	0.185	0.237	0.500	
Family per capita annual income, ¥						
≤ 60,000¥	371	0.632	0.665	0.731	0.485	<.001[b]
60,000¥~120,000¥	14	0.024	0.027	0.024	0.020	
>120,000¥	202	0.344	0.308	0.245	0.495	

Note: ANOVA (Analysis of variance) was performed for continuous data and X^2 test was performed for categorical data;
[a] Prefrailty vs nonfrail, $P < .05$, by Bonferroni (B) posthoc analysis for ANOVA
[b] Frailty vs nonfrail, $P < .05$, by Bonferroni (B) posthoc analysis for ANOVA
[c] Frailty vs prefrailty, $P < .05$, by Bonferroni (B) posthoc analysis for ANOVA.

urinary retention, and urinary incontinence among different degrees of frailty had statistical significance ($P < .01$). The comparisons of serum prealbumin and hemoglobin between different degrees of frailty (frailty vs nonfrailty, prefrailty vs nonfrailty) were statistically significant ($P < .01$). There was no statistical significance ($P > 0.05$) for the comparisons of body weight, serum albumin, serum total protein and subcutaneous fat thickness among different degrees of frailty. Grip strength showed significant difference between different degrees of frailty ($P < .01$), which was 12.337 ± 14.806 kg for frailty, 25.322 ±

Table 2

Comparison of physical status in the hospitalized elderly patients with different degrees of frailty.

Items	Cases	Percentage	Frailty independent variable value			*P* value
			Nonfrailty	Prefrailty	Frailty	
Constipation	205	0.349	0.122	0.390	0.488	<.001
Urinary retention	45	0.077	0.000	0.289	0.711	<.001
Urinary incontinence	33	0.056	0.000	0.152	0.848	<.001
Body weight, kg			63.548 ± 10.962	63.723 ± 11.526	63.421 ± 10.463	.449
Prealbumin, g/L			216.934 ± 73.230	191.014 ± 65.737	195.479 ± 61.771	.002[a,b]
Albumin, g/L			39.212 ± 4.581	39.350 ± 11.632	38.623 ± 7.263	.685
Total serum protein, g/L			66.781 ± 5.822	66.914 ± 6.510	67.319 ± 8.990	.776
Hemoglobin, g/L			128.041 ± 16.982	122.354 ± 20.438	117.403 ± 19.569	<.001[a,b,c]
Subcutaneous fat thickness, cm			1.293 ± 0.900	1.334 ± 0.769	1.449 ± 0.861	.192
Grip strength, kg			34.843 ± 23.774	25.322 ± 22.744	12.337 ± 14.806	<.001[a,b,c]
Muscle strength						
Level 0	2	0.004	0.000	0.000	1.000	<.001
Level 1	0	0.000	0.000	0.000	0.000	
Level 2	4	0.007	0.000	0.000	1.000	
Level 3	10	0.018	0.200	0.200	0.600	
Level 4	60	0.106	0.033	0.167	0.800	
Level 5	496	0.866	0.224	0.431	0.345	

Note: ANOVA (Analysis of variance) was performed for continuous data and X^2 test was performed for categorical data.
[a] Prefrailty vs nonfrail, $P < .05$, by Bonferroni (B) posthoc analysis for ANOVA
[b] Frailty vs nonfrail, $P < .05$, by Bonferroni (B) posthoc analysis for ANOVA
[c] Frailty vs prefrailty, $P < .05$, by Bonferroni (B) posthoc analysis for ANOVA.

Table 3

Correlation analysis of independent variables and frailty.

Independent variables	Correlation coefficient	*P* value
Age, years	0.474[b]	<.001
Education level	−0.185[a]	<.001
Marital status	0.273[a]	<.001
Family per capita annual income, ¥	0.167[a]	<.001
Constipation	0.271[a]	<.001
Urinary retention	0.240[a]	<.001
Urinary incontinence	0.250[a]	<.001
Muscle strength	−0.332[a]	<.001
Prealbumin	−0105[b]	.015
Hemoglobin	−0.204[b]	<.001
Grip strength	−0.382[b]	<.001

[a] Spearman correlation analysis

[b] Pearson correlation analysis.

22.744 kg for prefrailty and 34.843 ± 23.774 kg for nonfrailty, respectively. In addition, muscle strength was also different in the patients with various degrees of frailty. This suggests that low muscle strength, low grip strength, low serum prealbumin, low hemoglobin, abnormal excretion patients are prone to frailty.

3.3. Analysis of the correlation between independent variables and frailty

In order to analyze the correlation of age, education level, marriage status, family per capita annual income, abnormal excretion, muscle strength, grip strength, serum prealbumin, and hemoglobin with frailty, statistical analysis was performed. Independent variables that had statistical significance in X^2 test or ANOVA were analyzed for the correlation with frailty. The results showed that age, marital status, family per capita annual income, constipation, urinary retention and urinary incontinence were positively correlated to frailty, while education level, muscle strength, serum prealbumin, hemoglobin, and grip strength were negatively correlated to frailty (Table 3).

Muscle strength is graded to 6 levels.[22] Level 0 refers complete muscle paralysis, without muscle contractility when palpation. Level 1 refers that the muscles have active contractile force with slight muscle contraction, but cannot promote joint activity. Level 2 refers that the muscles can promote joint activities, but cannot resist gravity, and limbs can move in bed horizontally. Level 3 refers that the muscles can resist gravity and do active joint activities, but cannot resist resistance; limbs can overcome gravity and lift off the bed. Level 4 refers that the muscle can resist larger resistance, but less than normal person, and the limbs can excise against external resistance; Level 5 refers normal muscle strength with free movement. In order to analyze the effect of muscle strength on the degree of frailty, Bonferroni single factor covariance analysis was performed. Since none of the participants had a muscle strength of level 1, the Bonferroni single factor covariance analysis was performed pairwise between the levels of 0, 2, 3, 4, and 5. The results showed that the effect of Level 0 to 5 muscle strength on the hospitalized elderly patients had statistical significance ($F = 17.521$, $P < .001$). The frailty of patients with Level 4 and Level 5 muscle strength had statistical significance ($P < .001$), while there was no statistical significance between other levels of muscle strength and frailty ($P > .05$) (Table 4). These results suggest that the factors related to frailty include older age, low education level, marriage, high- or low-family per capita annual income, abnormal excretion, low muscle strength, low grip strength. and low hemoglobin level.

3.4. Analysis of the influencing factors of the frailty of hospitalized elderly patients

To analyze the influencing factors of frailty, logistic regression analysis was performed. The frailty stage was set as the dependent variable, and the variables that had statistical significance in the correlation analysis was set as independent variables (including

Table 4

Comparison between muscle strength and frailty.

	(*I*) Muscle strength	(*J*) Muscle strength	Mean difference (I−J)	Standard error	Significance (*P* value)	95% CI	
						Lower limit	Upper limit
Bonferroni	0	2	0.000	0.611	1.000	−1.721	1.721
		3	0.600	0.546	1.000	−0.939	2.139
		4	0.233	0.507	1.000	−1.195	1.661
		5	0.974	0.499	.518	−0.434	2.381
	2	0	0.000	0.611	1.000	−1.721	1.721
		3	0.600	0.417	1.000	−0.575	1.775
		4	0.233	0.364	1.000	−0.793	1.259
		5	0.974	0.354	.061	−0.024	1.971
	3	0	−0.600	0.546	1.000	−2.139	0.939
		2	−0.600	0.417	1.000	−1.775	0.575
		4	−0.367	0.241	1.000	−1.045	0.312
		5	0.374	0.225	.977	−0.261	1.008
	4	0	−0.233	0.507	1.000	−1.661	1.195
		2	−0.233	0.364	1.000	−1.259	0.793
		3	0.367	0.241	1.000	−0.312	1.045
		5	0.740	0.096	.000	0.469	1.012
	5	0	−0.974	0.499	.518	−2.381	0.434
		2	−0.974	0.354	.061	−1.971	0.024
		3	−0.374	0.225	.977	−1.008	0.261
		4	−0.740	0.096	.000	−1.012	−0.469

Note: Bonferroni single factor covariance analysis was performed, $F = 17.521$.

CI = confidence interval.

Table 5

Assignment of the influencing factors.

Independent variable	Assignment
Age, years	Continuous variable
Education level	Illiteracy=1, Primary school=2, Secondary school=3, College=4, Master and above=5
Marital status	Married=1, Widowed=2
Family per capita annual income, ¥	0-60,000¥=1, 60,000¥-120,000¥=2, >120,000¥=3
Prealbumin	Continuous variable
Hemoglobin	Continuous variable
Grip strength	Continuous variable
Constipation	Yes=1, No=2
Urinary retention	Yes=1, No=2
Urinary incontinence	Yes=1, No=2
Muscle strength	Continuous variable

age, education level, marital status, annual per capita income of family, serum prealbumin, hemoglobin, grip strength, constipation, urinary retention, urinary incontinence, and muscle strength). The assignments were listed in Table 5. All variables were conducted for parallel line test and the results showed $P < .05$, indicating that multivariate logistic regression analysis was appropriate. Using nonfrail patients as control, factors related to prefrailty included prealbumin, grip strength, urinary retention, constipation, and education level of illiteracy ($P < .05$) (Table 6). The populations with high prealbumin levels, high grip strength, and illiteracy were not easy to enter the prefrailty stage, while the populations with constipation (OR (odds ratio) = 1.867, 95% CI (confidence interval): 1.046–3.330) and urinary retention ($OR = 7.007$, 95% CI: 1.137–2.757) were easier to enter the prefrailty stage. Factors associated with frailty included age, prealbumin, grip strength, muscle strength, urinary incontinence, urinary retention, and constipation ($P < .05$). The populations with high prealbumin level, high grip strength,

Table 6

Logistic regression analysis of the influencing factors of frailty.

Frailty stage[a]	B	Standard error	Wald	Df	Significance (*P* value)	Exp(B)	95% CI for Exp(B)	
							Lower limit	Upper limit
Prefrailty								
Intercept	2.187	3.671	0.355	1	.551			
Age, years	0.024	0.020	1.421	1	.233	1.024	0.985	1.066
Prealbumin	−0.006	0.002	8.000	1	.005	0.994	0.990	0.998
Hemoglobin	−0.012	0.008	2.516	1	.113	0.988	0.974	0.997
Grip strength	−0.014	0.006	5.788	1	.016	0.986	0.974	0997
Muscle strength	−0.230	0.529	0.189	1	.664	0.795	0.282	2.239
Marital status=Married	0.009	0.367	0.001	1	.981	1.009	0.491	2.071
Marital status= Widowed	0[b]			0				
Family per capita annual income=0-60,000¥	0.170	1.161	0.021	1	.884	1.185	0.122	11.535
Family per capita annual income= 60,000¥-120,000¥	−0.004	0.843	0.000	1	.996	0.996	0.191	5.191
Family per capita annual income= >120,000¥	0[b]			0				
Urinary incontinence=Yes	−0.325	0.884	0.135	1	.713	0.723	0.128	4.090
Urinary incontinence=No	0[b]			0				
Urinary retention= Yes	1.947	0.413	22.209	1	.000	7.007	1.137	2.757
Urinary retention= No	0[b]			0				
Constipation= Yes	0.624	0.295	4.465	1	.035	1.867	1.046	3.330
Constipation= No	0[b]			0				
Education level= Illiteracy	−3.278	1.476	4.937	1	.026	0.038	0.002	0.679
Education level= Primary school	0.460	1.299	0.125	1	.723	1.584	0.124	20.198
Education level= Secondary school	0.689	0.648	1.131	1	.288	1.992	0.559	7.092
Education level= College	1.406	0. 827	2.889	1	.089	4.078	0.806	20.626
Education level= Master and above	0[b]			0				
Frailty								
Intercept	−4.023	3.992	1.016	1	.314			
Age, years	0.136	0.026	26.071	1	.000	1.141	1.085	1.200
Prealbumin	−0.005	0.002	4.175	1	.041	0.995	0.990	1.000
Hemoglobin	−0004	0.009	0175	1	.675	0.996	0.978	1.015
Grip strength	−0.038	0.009	15.670	1	.000	0.963	0.945	0.981
Muscle strength	−1.356	0.516	6.900	1	.009	0.258	0.094	0.709
Marital status= Married	0.319	0.451	0.591	1	.441	1.375	0.610	3.101
Marital status= Widowed	0[b]			0				
Family per capita annual income=0-60,000¥	1.422	1.184	1.443	1	.230	4.145	0.407	42.190
Family per capita annual income= 60,000¥-120,000¥	−0.520	1.224	0.180	1	.671	0.595	0.054	6.551
Family per capita annual income= >120,000¥	0[b]			0				
Urinary incontinence= Yes	2.334	0.850	7.540	1	.006	10.314	1.950	54.548
Urinary incontinence= No	0[b]			0				
Urinary retention= Yes	1.118	0.340	10.824	1	.001	3.058	1.571	5.952
Urinary retention= No	0b			0				
Constipation= Yes	1.100	0.341	10.420	1	.001	3.004	1.540	5.857
Constipation= No	0[b]			0				
Education level= Illiteracy	1.524	1.301	1.370	1	. 242	4.589	0.358	58.812
Education level= Primary school	1.852	1.393	1.768	1	.184	6.371	0.416	97.611
Education level= Secondary school	0.443	0.799	0.307	1	.579	1.557	0.325	7.462
Education level= College	−1.095	1.373	0.635	1	.425	0.335	0.023	4.938
Education level= Master and above	0[b]			0				

CI = confidence interval.

[a] Compared to frailty.

[b] the factor was set as 0 due to redundancy.

Pseudo R^2: Cox and Snell: 0.439; Nagelkerke: 0.499; McFaden: 0.272.

and high muscle strength were not easy to enter the frailty stage, while the populations with older age (*OR* = 1.141, 95% *CI*: 1.085–1.200), urinary incontinence (*OR* = 10.314, 95% *CI*: 1.950–54.548), urinary retention (*OR* = 3.058, 95% *CI*: 1.571–5.952), and constipation (*OR* = 3.004, 95% *CI*: 1.540–5.857) were more likely to enter frailty stage.

4. Discussion

4.1. The status of hospitalized elderly patients is closely related to demographic characteristics

In 2014, an investigation on the frailty status of 683 elderly people in 8 communities in Beijing, China showed that the incidence of nonfrailty, prefrailty, and frailty were 0.432, 0.457, and 0.111, respectively.[23] The results of this study showed that the incidence of nonfrailty, prefrailty, and frailty of the hospitalized elderly over 65 years old was 0.249, 0.417 and 0.334, respectively. The incidence of frailty in the hospitalized elderly was higher than that of the elderly in the reported community.[23] This is consistent with the opinion of Evans et al that the incidence of frailty in the elderly in medical institutions was much higher than that of the elderly in the community of Belgium.[15,16] The results suggest that healthcare workers should implement the intervention and management of a frailty evidence-based guide in a timely manner to the hospitalized elderly patients with a risk of frailty.

This study showed that the high incidence age of frailty was 86 to 90 years old, and that of prefrailty was 65 to 70 years old. The hospitalized elderly population of 65 to 70 years old starts to enter prefrailty due to their own diseases and complications,[10,24] but this prefrailty stage is usually able to be delayed or even reversed.[25] In 2014, the British geriatric society, together with the Royal Society of General Practitioners and the British Elderly Charity, developed and published 2 guidelines for the identification, management and service of elderly frailty (fit for frailty part I and II).[26] The guidelines state that any health or care professional institute or person associated with the elderly should assess whether the elderly have a frailty potential. The guidelines also suggest that healthcare workers can conduct targeted and effective management after assessing the extent of frailty in the elderly population, and thus predict the outcome of a range of mid- and long-term health outcomes. The results of this study suggest that healthcare workers should master the assessment and diagnosis methods of frailty, and implement early identification, early diagnosis, early intervention and comprehensive management. For different age groups of elderly patients, individualized risk management should be conducted. If no effective intervention and management is performed in a timely manner, frailty will further develop and bring huge health and financial burdens to individuals, families and society.

This study also analyzed the effect of education level on frailty and the result showed that the incidence of frailty was the highest in the population with primary school education. This patient population are relatively lack of medical knowledge and have limited access to information. Thus, they have limited understanding about the relationship between disease and frailty.[27] The results of this study suggest that healthcare personnel should conduct personalized health education in order to make patients with different levels of education understand and master the assessment methods and significance of frailty, and thus promote self-management of the patients.

Family per capita annual income analysis in this study showed that elderly population with income > 120,000/year and < 60,000¥/year had a higher proportion of frailty, while those patients with a family annual income of 60,000¥-120,000¥ had the lowest proportion of frailty. This study reveals that high-income and low-income people are more likely to enter the frailty state. High-income population may have long been engaged in mental work. However, they may have limited or basically do not engage in physical labor, and are also less involved in aerobic exercise and resistance exercise. Thus, their muscle strength is weak. Although low-income population has long-term physical labor, they are mostly overloaded and have a certain mental stress. Therefore, the above 2 populations are easier to have frailty. For the elderly with a family income of 60,000¥-120,000¥/year, mental and physical labors are easier to achieve a balance, and hence have the lowest proportion of frailty.

4.2. The present frailty management situation of hospitalized elderly patients

In recent years, the management of frail patients has become an increasingly prominent problem due to the increased life expectancy of the elderly population, the complexity of the disease and the long-term need for health care.[28] In 2012, the Consensus of American and European Geriatric Experts clearly proposed that all people older than 70 should be screened for frailty, thus benefiting from the early screening and intervention of frailty.[29] The geriatric evaluation and management, which is completed by a multidisciplinary team (including doctors, nurses, rehabilitation physicians, physiotherapists and nutritionists), has become an effective assessment and care guidance to improve the frailty status of elderly population.[30,31] The simplicity and maneuverability of the FRAIL Questionnaire makes it possible to be done not only by a professional medical practitioner but also by a patient or his family.[18] In this study, the influencing factors of prefrailty were low serum prealbumin, low grip strength, urinary retention, and constipation, while those of frailty included age, urinary incontinence, urinary retention, and constipation. The results suggest that clinical care personnel should implement targeted intervention and strategy according to the different factors, when compressively assessing and managing the elderly inpatient population.

Low grip strength is considered the most serious problem of the elderly.[32] The grip strength analysis in our study showed that there was a significant difference in the grip strength of different degrees of frailty. Frail elderly people are at increased risk of morbidity and mortality under stress,[29] so frailty assessment is considered a very useful tool for risk stratification in the elderly. Many large-scale cohort studies confirm that frailty assessment can predict adverse outcomes such as falls, disability, length and times of hospitalization and mortality, and early intervention can significantly improve the prognosis.[2,14,17,33–35] The type of frailty assessment can vary depending on the environment. Healthcare staff can help predict the adverse outcomes and risks by assessing and diagnosing the frailty of elderly population in the hospital, together with laboratory diagnosis and multiple other variables related to frailty.[2,35,36] They can strengthen targeted intervention to delay the process of frailty from multiple perspectives, and maintain the integrity of the physical function of elderly patients to reduce a variety of adverse outcomes as far as possible.[29]

Frailty assessment and diagnosis are more and more used in clinical medical care for the elderly.[32] A comprehensive risk

assessment of frailty can suggest the care level and help develop the observation plan for patients' condition.[37] However, Chinese hospitals have not yet incorporated frailty into the admission assessment program. Evaluating the frailty status of the elderly population through the FRAIL Questionnaire will provide an effective evaluation basis for their transition to home care and continuous management.

5. Conclusions

This study found that the factors of age, education level, marital status, family per capita annual income, constipation, urinary retention, urinary incontinence, serum prealbumin, hemoglobin, grip strength, and muscle strength were correlated to frailty. Populations with constipation and urinary retention were more likely to enter prefrailty. Populations with older age, urinary incontinence, urinary retention and constipation were more likely to enter frailty. It is recommended that the frailty assessment should be included in the existing assessment. Appropriate assessment tools should be chosen for the evaluation of elderly population, and applied at multiple stages, such as admission, preoperation, discharge, etc., and the assessment results should be used to rate the disease and develop the disease observation plan.

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