ABSTRACT

Objectives Our study aimed to investigate the relationship between the severity of frailty and the long-term care (LTC) needs of older adults from Chinese communities.

Design A cross-sectional study.

Setting Three Chinese community health centres. All data were collected by trained researchers through face-to-face collection.

Participants We surveyed a total of 540 older residents who aged 60 or older from community in Guangzhou, China.

Measures The Chinese version of the Tilburg frailty indicator was used to assess the frailty status of participants. LTC needs was evaluated by Integrated Home Care Services Questionnaire. Using non-adjusted and multivariate adjusted logistic regression analysis to evaluate frailty and LTC needs, then smoothed plots, threshold effect analysis and P for trend were used to further investigate the relationship between them.

Results The prevalence of frailty was 45.2% among the 540 older adults enrolled (aged 70.4±8.3 years; 65.7% females). 27% had higher LTC needs, which increased to 65.1% for individuals with frailty. Logistic regression analysis showed that frailty was strongly associated with LTC needs (OR 3.06, 95% CI 2.06 to 4.55, p<0.01). In the multivariate model, after adjusting for demographic characteristics, economic situation, activities of daily living and comorbidities, frailty remained significantly associated with LTC needs (OR 2.32, 95% CI 1.39 to 3.88, p<0.01). The smoothed plots showed a nearly linear relationship between frailty and LTC needs. Threshold effect analysis showed that every point increase in frailty, the score of LTC needs increased 1.3 points. The IQR to regroup individuals with frailty. Compared with the first quartile (scores ≤2), the incidence of LTC needs increased with the frailty status (p value for trend <0.01).

Conclusion There is a linear relationship between frailty and LTC needs. With the increasing degree of frailty, the LTC needs of older adults dramatically increases.

INTRODUCTION

Frailty is becoming an increasing health concern with the ageing of the world’s population. It is not a disease but rather a geriatric syndrome and has been defined as a state of vulnerability to adverse health factors. Rohrmann’s study reported that the prevalence of frailty ranges from 4% to 59%, which indicates that frailty is a common phenomenon among older adults. Frailty is a complex age-related clinical symptom, due to chronic inflammation, a gradual decrease in physiological reserve and function across multiple organ systems leads to an imbalance of homeostatic control mechanisms. Considering the physiological mechanisms of frailty, individuals with frailty are prone to adverse health outcomes involving falls, disabilities, hospitalisations, reduced quality of life or even death. Thus, there are varying degrees of demands for medical and care resources among the older persons with frailty.

Given the expanding frail older adults population and its major consequences on healthcare, studies on frailty have achieved increasing interest. Evidence suggests that sustainable long-term care (LTC) can promote health, reduce the harmful effects of chronic diseases, maintain functional autonomy
and respond to population ageing effectively. LTC is described as a care activity that ensures the maximum possible independence, autonomy, participation and personal satisfaction of individuals who fully take care of themselves. In Japan, the main reasons for the requirement of LTC include cerebrovascular disease (17.2%), dementia (16.4%), age-related frailty (13.9%), falls and fractures (12.2%) and joint disease (11.0%). It has been demonstrated that the unmet LTC needs were associated with negative outcomes such as falling, and the increasing use of primary, emergency, and acute healthcare services. And most of the older adults with frail require some form of long-term care. In addition, pre-frail and frail older adults had a significantly higher risk of needing long-term care insurance (LTCI) services than robust older adults. And it indicated that older persons with frail represent a dominant patient group for family practice, however, less attention has been given to the need for patients, and how frailty affects their needs. Previous studies have shown that frailty may be associated with LTC needs, but the specific relationship remains unclear. Thus, identifying and addressing the LTC needs of the frail is of great significance to reverse or delay the onset of frailty and improve the outcome of older adults.

The aim of this study was to classify the level of frailty and to explore the relationship between different severities of frailty and the resulting LTC needs. Our findings may provide empirical evidence for the development of intervention programmes for the frail older adults with their LTC needs.

METHODS

Study design setting and participants

A cross-sectional study was conducted among Guangzhou community-dwelling older adults. A stratified random sampling method was applied. Using a stratified random sampling method. The specific sampling steps are as follows: First, The Guangzhou’s administrative regions were divided into three levels (high, moderate and low) based on its 2017 gross domestic product (GDP). Second, three districts (high: Yuexiu district; moderate: Haizhu district; low: Liwan district) were randomly selected from each level by lottery method. Finally, one street from each district was selected by convenience sampling. Participants were recruited through face to face with researchers at community health service centres. A total of 600 questionnaires were distributed and 597 were recovered. 57 questionnaires were removed from the analysis due to excessive missing data (data missing more than 25%). The inclusion criteria were: (1) aged 60 or older, (2) residing in the survey community for more than 5 years, (3) informed consent and (4) having suitable communicating and writing skills. The exclusion criteria were: (1) limited autonomy, such as physical limitations or mental incapacity.

Sample size

The sample size calculation formula \[ n=\frac{Z^2_{\alpha/2}pq}{\epsilon^2} \] for cross-sectional studies was used to calculate the minimum theoretical sample size for this study. And the prevalence of frailty as 5.9% in Taipei community. Details are as follows: (1) \( p=0.059 \), (2) \( q \) equals to \( 1-p \) \( =0.941 \), (3) \( Z_{\alpha/2} \) = 1.96 and (4) represents an allowable error and equals to 0.02. Thus the sizes of our samples were 533, considering the invalid questionnaire, we increased the sample size by 10%, and the final theoretical sample size was 586. Ultimately, a total of 600 questionnaires were distributed.

Data collection

The study was carried out from July 2018 to January 2019. Data was collected face-to-face by undergraduate or graduate students. We explained the specific purpose, significance, and how to fill out the questionnaires of the investigation and obtain informed consent before the participants fill in the questionnaire. Meanwhile, names were not required on the questionnaires, and the strict confidentiality of participants’ responses was assured.

Measurements

Demographic information

We used a self-designed questionnaire, including sex, age (60–69, 70–79, ≥80), educational level (primary, junior, senior or higher), economic situation [monthly income (<3000 RMB, 3001-4500 RMB, 4501-6000 RMB, 6001-7500 RMB, >7500 RMB), source of payment for medical expenses (free, medical or other)], and comorbidities (hypertension, osteoarthrosis, diabetes, stroke, cardiovascular disease).

Assessment of long-term care needs

The integrated home care services questionnaire was designed by our research group based on the Omaha system. It was validated to use with Chinese older adults and showed good reliability and validity in our previous research. The total of Cronbach’s \( \alpha \) coefficient was 0.969. The questionnaire was used to evaluate LTC needs of the older adults who are living in the community. It consisted of 43 items in four dimensions: physiological fields (23 items), psychosocial fields (7 items), health-related behavioural fields (5 items), and environmental fields (8 items). For each item, participants were asked to indicate their level of LTC needs, with a 5-point Likert scale (1=not at all; 2=a little bit; 3=neutral; 4=quite a bit satisfied; and 5=very satisfied). The total scores ranged from 43 to 215, with higher scores indicating a higher level of LTC needs. In this study, we divided the LTC needs of each domain into two groups: ‘no/low demand (including not at all/a little bit)’ and ‘moderate/high demand (including neutral/quite a bit satisfied/very satisfied)’, specifically, the score of item ≥3 points and total score ≥129 points defined as higher LTC needs.

Assessment of frailty

Gobbens et al. developed the Tilburg frailty indicator (TFI) in 2010. It is a scale of self-report assessment that...
includes three dimensions: physical frailty (8 items), psychological frailty (four items), and social frailty (three items), to measure the frailty status among community-dwelling older people. Xi et al.26 translated this scale into Chinese and applied the scale to older individuals with chronic diseases. The total score ranges from 0 to 15 points. 5 points and above are considered indicative of frailty, scores below five points are considered non-frail, while higher scores indicate a severe frailty state. The TFI is appropriate for the evaluation of frailty in the older adults Chinese population.

Assessment of activities of daily living
Barthel’s activities of daily living (ADL) index (range 0 to 100) was developed by Dorother and Florence et al.27 to evaluate functional ability in 1965. It comprises 10 items. Cronbach’s α was 0.916, with lower scores indicating more severe ability to live dependently. The dependence level was ranked according to the physical condition: severe dependence (≤40 points), medium dependence (41–60 points), minimum dependence (61–99 points), and independence (100 points).

Bias
The participants with mobility difficulties and mental incapacity were excluded, which may lead to potential selection bias. And we adjusted for multi-model confounding factors to address potential sources of bias.

Statistical analysis
This study was categorised into two groups based on the individual’s LTC needs. Categorical variables were provided as numbers and percentages. All the categorical variables were analysed with the Chi-squared test. Univariate and multivariable logistic regression models were used to identify influencing factors of LTC needs. Several confounders were adjusted in the logistic models. Model one included frailty with no variables. Model two was adjusted for population characteristics. Model three was further adjusted for economic conditions. Model four was further adjusted for ADL. Model five adjusted comorbidities for all variables. Logistic regression determined the ORs and 95% confidence intervals (CIs). Next, the total frailty score was analysed as a continuous variable to construct smoothed plots of frailty and LTC needs. Threshold effect analysis used to found inflection point. For trend were <0.05 were considered statistically significant. 57 questionnaires were removed from the analysis because of missing more than 25%, then no missing value in this study.

RESULTS
600 participants questionnaires were distributed, 597 of whom returned questionnaires for a response rate of 99.5%. A total of 540 participants were included for analysis excluding 57 participants because of missing survival data. And 34.1% were from Yuxiu district, 43.5% were form Haizhu district, 22.4% were from Liwan district. The age of the 540 participants ranged from 60 to 94 years, with a mean±SD age of 70.4±8.3 and 65.7% of the participants were female. Overall, table 1 showed 9.6% of participants had a higher education level, while participants in the educational level of primary, junior, and senior represented 31.3%, 27.8%, and 31.3%, respectively. The prevalence of participants with independence, mild dependence, medium dependence, and severe dependence levels was 58.3%, 31.7%, 5%, and 5%, respectively. The participants had a mean score of 108.77±34.741 for LTC needs and the mean frailty score was 4.7±2.9 (median: 4 points; range: 0–15 points). The prevalence of participants with frailty was 45.2%. Their estimated LTC needs were classified into two levels: 27.0% of 540 participants had higher LTC needs and 65.1% of frail older adults had higher LTC needs. Table 1 reports the demographics and comorbidities of the participants. LTC needs showed dramatic differences in terms of age, education level, income, source of payment for expenses, and comorbidities including osteoarthrosis, stroke, cardiovascular disease, frailty level, and ADL (p<0.05).

The relationship between frailty and LTC needs was investigated using binary logistic regression analysis. Five multivariable models were estimated by adjusting for age, sex, education level, monthly income, source of payment of expenses, ADL, osteoarthrosis, stroke, and cardiovascular disease. The results showed that there was a significant relationship between frailty and LTC need and the ORs were 3.06, 3.1, 3.1, 2.5, and 2.3, respectively (table 2). We used the IQR to regroup the cases of frailty. Compared with Q1, the increase in the frailty score was closely related to the need for LTC (Pvalue for trend <0.01). After adjusting covariates, the Pvalues for trend were <0.01,<0.01,<0.01, and <0.02, respectively (table 3). This indicated a linear trend between frailty and LTC needs. The dose-response relationship between the state of frailty and LTC needs level is illustrated in figure 1. The smoothed plots showed that there was a nearly linear relationship between frailty and LTC needs. Threshold effect analysis showed every point increase in frailty, the score of LTC needs increased 1.3 points.

DISCUSSION
In this cross-sectional study, 540 older adults were enrolled to examine the relationship between frailty status and...
Table 1  Demographic and comorbidities of enrolled study subjects

| Variable                  | Total  | Level 1 | Level 2 | $c^2$ | P-value |
|---------------------------|--------|---------|---------|-------|---------|
| All                       | 540    | 394 (73.0) | 146 (27.0) |       |         |
| Sex                       |        |         |         |       |         |
| Male                      | 185 (34.3) | 128 (32.5) | 57 (29.0) | 2.032 | 0.154   |
| Female                    | 355 (65.7) | 266 (74.5) | 89 (40.0) |       |         |
| Age Group                 |        |         |         |       |         |
| 60–69                     | 269 (49.8) | 212 (53.8) | 57 (39.0) | 16.096 | <0.001** |
| 70–79                     | 174 (32.2) | 126 (32.0) | 48 (32.9) |       |         |
| ≥80                       | 97 (18.0) | 56 (14.2) | 41 (28.1) |       |         |
| Education                 |        |         |         |       |         |
| Primary                   | 169 (31.3) | 130 (33.0) | 39 (26.7) | 10.507 | 0.015*  |
| Junior                    | 150 (27.8) | 115 (29.2) | 35 (24.0) |       |         |
| Senior                    | 169 (31.3) | 120 (30.5) | 49 (33.6) |       |         |
| Higher                    | 52 (9.6) | 29 (7.4) | 23 (15.8) |       |         |
| Income                    |        |         |         |       |         |
| <3000                     | 137 (25.4) | 113 (28.7) | 24 (16.4) | 22.089 | <0.001** |
| 3001–4500                 | 280 (51.9) | 208 (52.8) | 72 (49.3) |       |         |
| 4501–6000                 | 61 (11.3) | 41 (10.4) | 20 (13.7) |       |         |
| 6001–7500                 | 18 (3.3) | 10 (2.5) | 8 (5.5) |       |         |
| >7500                     | 44 (8.1) | 22 (5.6) | 22 (15.1) |       |         |
| Payment of Expenses       |        |         |         |       |         |
| Free                      | 61 (11.3) | 32 (8.1) | 29 (19.9) | 14.659 | 0.001** |
| Medical                   | 459 (85.0) | 347 (88.1) | 112 (76.7) |       |         |
| Other                     | 20 (3.7) | 15 (3.8) | 5 (3.4) |       |         |
| Frailty                   |        |         |         |       |         |
| No                        | 296 (54.8) | 245 (62.2) | 51 (34.9) | 31.940 | <0.001** |
| Yes                       | 244 (45.2) | 149 (37.8) | 95 (65.1) |       |         |
| Hypertension              |        |         |         |       |         |
| No                        | 250 (46.3) | 179 (45.4) | 71 (48.6) | 0.438 | 0.508   |
| Yes                       | 290 (53.7) | 215 (54.6) | 75 (51.4) |       |         |
| Osteoarthrosis            |        |         |         |       |         |
| No                        | 422 (78.1) | 322 (81.7) | 100 (68.5) | 10.928 | 0.001** |
| Yes                       | 118 (21.9) | 72 (18.3) | 46 (31.5) |       |         |
| Diabetes                  |        |         |         |       |         |
| No                        | 403 (74.6) | 297 (75.4) | 106 (72.6) | 0.434 | 0.510   |
| Yes                       | 137 (25.4) | 97 (24.6) | 40 (27.4) |       |         |
| Stroke                    |        |         |         |       |         |
| No                        | 336 (62.2) | 261 (66.2) | 75 (51.4) | 10.026 | 0.002** |
| Yes                       | 204 (37.8) | 133 (33.8) | 71 (48.6) |       |         |
| Cardiovascular disease    |        |         |         |       |         |
| Yes                       | 452 (83.7) | 339 (86.0) | 113 (77.4) | 5.834 | 0.016*  |
| No                        | 88 (16.3) | 55 (14.0) | 33 (22.6) |       |         |
| Activities of daily living|        |         |         |       |         |
| Severely dependence       | 27 (5.0) | 8 (2.0) | 19 (13.0) | 42.746 | <0.001** |
| Medium dependence         | 27 (5.0) | 12 (3.0) | 15 (10.3) |       |         |
| Minimum dependence        | 171 (31.7) | 125 (31.5) | 46 (31.5) |       |         |
| Independence              | 315 (58.3) | 249 (63.2) | 66 (45.2) |       |         |

Level 1: Long-term care scores<129; Level 2: Long-term care scores≥129.
*indicates a dramatic difference (p<0.05); **indicates a dramatic difference (p<0.01).
need for LTC. We found the LTC need increased significantly with the increasing severity of frailty. There is a linear relationship between LTC need and frailty status. Older adults with severe frailty showed a greater demand for LTC. Moreover, the risk of LTC needs increased 30% with each point increase in frailty.

This study showed the overall prevalence of frailty in our study sample was 45.2%. However, the prevalence of frailty among older adults living in communities in the Asia-Pacific region is about 3.5%–27%.²⁸ It indicating that frailty has become a common problem for the older adults.²⁹ The major reasons for this inconsistency in the present study compared with a previous study might be the geographical variations and differences in measurement tools. And the rapidly ageing population and those with chronic diseases may result in a significantly increased need for LTC. Moreover, the risk of LTC needs increased 30% for LTC. Furthermore, the risk of LTC need increased 30% for LTC. We found that frailty, an important factor for LTC needs, was not always affected by other factors. Unlike the previous study, in our study further regrouping the frailty status into quartiles underlined the positive correlation between frailty and LTC needs. The risk of LTC need was demonstrated. Multi-model analysis indicated that the LTC demand of older adults in the frail status were 3.063-fold higher than for non-frail adults. The significant association between frailty and LTC need persisted even after adjustment of confounding factors, however, this association weakened after adding the ADL and comorbidities to the analyses. One possible explanation for the difference is as follow. The LTC need among older adults with chronic disease or disability is higher than frailty.³⁵ Compared with non-frail older persons, LTC needs increased by 2.328-fold in frail older individuals. We found that frailty, an important factor for LTC needs, was not always affected by other factors. Unlike the previous study, in our study further regrouping the frailty status into quartiles underlined the positive correlation between frailty and LTC needs. The risk of LTC need increased by 6.015- and 2.750-fold in the highest quarter group 4 (>7) and medium quarter group 3 (4≤7) than the lowest quarter group 1 (≤2), respectively. After adjustment of confounders, the LTC needs added 4.375 fold in the highest quartile group (Q4) (>7), which was in contrast with the lowest quarter group 1 (Q1) (≤2). It indicated that there was a strong association between frailty severity

### Table 2: Association of frailty and long-term care needs in the study subjects (n=540)

| Variable | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 |
|----------|---------|---------|---------|---------|---------|
| OR       | 3.063   | 3.111   | 3.105   | 2.501   | 2.328   |
| 95% CI   | 2.060 to 4.553 | 2.024 to 4.782 | 2.005 to 4.811 | 1.525 to 4.101 | 1.394 to 3.887 |
| Wald     | <0.001** | <0.001** | <0.001** | <0.001** | <0.001** |

Model 1: Frailty.  
Model 2: Adjusted demographic characteristics (gender, education level and age).  
Model 3: Adjusted model two and economic situation (monthly income and payment manner of expenses).  
Model 4: Adjusted model three and Activities of daily living (ADL).  
Model 5: Adjusted for model four and comorbidities (osteoarthrosis, stroke and cardiovascular).  
*indicates a dramatic difference (p<0.05); **indicates a dramatic difference (p<0.01).

### Table 3: Trend of frailty and long-term care needs in the study subjects (n=540)

| Fraility state | Q2 (1.2≤4) | Q3 (4≤7) | Q4 (7+) | P-value for trend |
|----------------|------------|----------|---------|------------------|
| Case           | 152        | 144      | 134     | 110              |
| Model 1        | 1.0        | 1.642 (0.891 to 3.026) | 2.750 (1.526 to 4.958) | 6.015 (3.324 to 10.887) | <0.001** |
| P-values       | 0.112      | 0.001**  | <0.001** |                  |
| Model 2        | 1.0        | 1.584 (0.850 to 2.95)  | 2.908 (1.578 to 5.358) | 5.898 (3.131 to 11.110) | <0.001** |
| P-values       | 0.148      | 0.001**  | <0.001** |                  |
| Model 3        | 1.0        | 1.542 (0.818 to 2.907) | 2.738 (1.470 to 5.098) | 6.141 (3.224 to 11.700) | <0.001** |
| P-values       | 0.181      | 0.001**  | <0.001** |                  |
| Model 4        | 1.0        | 1.614 (0.848 to 3.073) | 2.664 (1.373 to 5.169) | 4.981 (2.353 to 10.548) | <0.001** |
| P-values       | 0.145      | 0.004**  | <0.001** |                  |
| Model 5        | 1.0        | 1.436 (0.747 to 2.758) | 2.374 (1.203 to 4.685) | 4.375 (2.00 to 9.568)  | <0.002** |
| P-values       | 0.277      | 0.013*   | <0.001** |                  |

*indicates a dramatic difference (p<0.05); **indicates a dramatic difference (p<0.01).
and LTC need. A 6-year prospective study showed a significant association between physical frailty and increased risk of LTC needs. In the risk of LTC needs, being pre-frail and frail increased by 1.5- and 2-fold compared with robust patients at baseline respectively. These estimates were lower than our study. A possible reason for this may include the different tools for assessing LTC needs and frailty status, and differences in the educational levels of the participants. We found the prevalence of frailty was 45.2% and in the Japan study, the prevalence of frailty was 9.46%. Furthermore, concerning the education level, participants with low education (high school degree or below) accounted for most of the participants in this study (83%), compared with a relatively smaller proportion of participants in the Japan study (48.3%). Previous studies revealed that educational level was one of factors influencing frailty and LTC needs. Higher education levels were generally associated with more opportunities, higher incomes, and increased health awareness. Meanwhile, the older adults with a lower level of education had less access to health treatments and rehabilitation information, which increases susceptibility for frailty and may affect LTC needs. The smoothing plot analysis, revealed that LTC needs increased with frailty status and specifically, LTC needs increased 1.3 points with one-point increment in frailty score, which further described frailty and LTC needs as an almost linear relationship. Overall, we affirmed a significant correlation between frailty and LTC needs. And possible mechanisms underlying this association may include the following: first, the ageing population will lead to an unprecedented surge in the number of frail older adults with complex care needs. Unfortunately, traditional family care is far from meeting the multi-level care needs of older adults in the current society. Second, frailty increased the susceptibility to disease and it requires specific support and care. Thirdly, frailty was considered to be the antecedent of disability, when the needs of frail older adults are unmet this frequently leads to disability. This is further corroborated from the association weakened after adding the ADL and co-morbidities to the analyses.

Frailty is a dynamic, changing process. Early identification and management might reduce the risk of frailty and may even retard the progress of frailty. Understanding the relationship between frailty and LTC needs will allow to steps to manage frailty and improve the quality of life. Hence, there is an urgent need to address the frailty and LTC needs of older adults and to provide quality services for the transition between ageing and disability. There were some limitations to this study. First, the study was a cross-sectional study, thus, frailty and LTC needs may not have a causal relationship. Furthermore, there is potential selection bias in population in this study, because we only included the older adults mainly self-dependent or partially disabled with normal language comprehension. In general, this study revealed a correlation between frailty and LTC needs among older people in the community. It can be used as a pilot study for future research.

CONCLUSION

This study identified a linear relationship between LTC needs and frailty state. It suggested that frailty is closely related to LTC needs, especially in older adults with a severe frailty status. Therefore, the LTC needs of the frail older adults deserve more attention. Based on the results of our study, future research should identify the LTC needs of frail patients, formulate targeted intervention programmes, and contribute to achieve healthy ageing.

Author affiliations
1 Second Clinical Medical College of Guangzhou University of Chinese Medicine, Guangzhou, Guangdong, China
2 Guangdong Provincial Hospital of Traditional Chinese Medicine, Guangzhou, Guangdong, China
3 Neurology, The Second Affiliated Hospital of Guangzhou University of Traditional Chinese Medicine, Guangzhou, Guangdong, China
4 Nephrology, Third Affiliated Hospital of Sun Yat-Sen University, Guangzhou, Guangdong, China
5 Nursing, The Second Affiliated Hospital of Guangzhou University of Traditional Chinese Medicine, Guangzhou, Guangdong, China
6 Neurology, Foshan Hospital of TCM, Foshan, Guangdong, China
7 Nursing, Hunan University of Chinese Medicine, Changsha, Hunan, China

Acknowledgements We acknowledge all the staff and colleagues who participated in the study.

Contributors Study concept and design: LW, RC, WBZ. Acquisition of data: XPZ, HL, NNS, ZYL, HK, XTP, YS, RTL and WHL. Analysis of data, interpretation of data, drafting the manuscript: LW, RC, WBZ. Manuscript revision for important intellectual content: XPZ, HL and ZYL. LW, being guarantor, is revising it critically for important intellectual content and final approval of the version to be submitted.

Funding This study was supported by grant from the Planning Project of Philosophy and Social Sciences in Guangzhou (2017GZJYB52) and the Research on the reengineering of perioperative nursing for the older adults, Institute of Science and Technology, National Health Commission(2021YKSH016010201).

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.
Chen R, et al. BMJ Open 2022;12:e051801. doi:10.1136/bmjopen-2021-051801

Ethics approval This study involves human participants and was approved by The ethical committee of Guangdong Provincial Hospital of Chinese Medicine (BE2018.005.01). Participants gave informed consent to participate in the study before taking part.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement Data are available upon reasonable request. Data can be obtained from the corresponding author upon reasonable request.

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/.

ORCID iD
Lin Wei http://orcid.org/0000-0003-2129-1380

REFERENCES
1 He B, Ma Y, Wang C, et al. Prevalence and risk factors for frailty among community-dwelling older people in China: a systematic review and meta-analysis. J Nutr Health Aging 2019;23:442–50.
2 Khan MS, Segar MW, Usman MS, et al. Frailty, Guideline-Die-Budko medical therapy, and outcomes in HFpEF: from the GUIDE-IT trial. JACC Heart Fail 2022;10:266–75.
3 Rohrmann S. Epidemiology of frailty in older people. Adv Exp Med Biol 2020;1216:21–7.
4 Hoogendijk EO, Afitalo J, Ensrud KE, et al. Frailty: implications for clinical practice and public health. The Lancet 2019;394:1365–75.
5 Morley JE, Vellas B, Abellan van G, et al. Frailty consensus: a call to action. J Am Med Dir Assoc 2013;14:392–7.
6 Pot AM, Briggs AM, Beard JR. The sustainable development agenda needs to include long-term care. J Am Med Dir Assoc 2018;19:725–7.
7 Feng Z, Glinskaya E, Chen H, et al. Long-Term care system for older adults in China: policy landscape, challenges, and future prospects. Lancet 2020;396:1362–72.
8 Kim H, Kwon S. A decade of public long-term care insurance in South Korea: policy lessons for aging countries. Health Policy 2021;125:22–6.
9 Yeung W-JJ, Chang LL. Long-Term care for older adults in ASEAN plus three: the roles of family, community, and the state in addressing unmet eldercare needs. J Aging Health 2018;30:499–515.
10 World Health Organization,. WHO. Global strategy and action plan on ageing and health. Geneva: WHO, 2016.
11 Someya Y, Tamura Y, Kaga H, et al. Skeletal muscle function and need for long-term care of urban elderly people in Japan (the Uberco health study): a prospective cohort study. BMJ Open 2019;9:e31584.
12 Tobis S, Wieczorowska-Tobis K, Talaraks D, et al. Needs of older adults living in long-term care institutions: an observational study using Camberwell assessment of need for the elderly. Clin Interv Aging 2018;13:389–96.
13 Meng D, Xu G, Davidson PM. Perceived unmet needs for community-based long-term care services among urban older adults: a cross-sectional study. Geriatr Nurs 2021;42:740–7.
14 Makizako H, Shimada H, Tsutsunimoto K, et al. Physical frailty and future costs of long-term care in older adults: results from the NCGG-SGS. Gerontology 2021;67:695–704.
15 Yamada M, Arai H. Predictive value of frailty scores for healthy life expectancy in community-dwelling older Japanese adults. J Am Med Dir Assoc 2015;16:1002.e7–1002.e11.
16 Koresvain C, Famiyeh I-M, Dunn S, et al. Identifying frailty in primary care: a qualitative description of family physicians’ gestalt impressions of their older adult patients. BMC Fam Pract 2018;19:61.
17 Chen S, Honda T, Narazaki K, et al. Physical frailty and risk of needing long-term care in community-dwelling older adults: a 8-year prospective study in Japan. J Nutr Health Aging 2019;23:856–61.
18 Satake S, Shimokata H, Senda K, et al. Validity of total Kihon checklist score for predicting the incidence of 3-year dependency and mortality in a community-dwelling older population. J Am Med Dir Assoc 2017;18:550.e1–552.e6.
19 Makizako H, Shimada H, Doi T, et al. Impact of physical frailty on disability in community-dwelling older adults: a prospective cohort study. BMJ Open 2015;5:e8462.
20 Gu C, Wang X, Zhang Z, et al. Pregnant women’s clinical characteristics, inrapidtrum interventions, and duration of labour in urban China: a multi-center cross-sectional study. BMJ Pregnancy Childbirth 2020;20:386.
21 Chang Y-W, Chen W, Lin F-G, et al. Frailty and its impact on health-related quality of life: a cross-sectional study on older community-dwelling preventive health service users. PLoS One 2012;7:e38079.
22 Peng X, Wei L, Zhang X. The development of services system of integrated home care for the elderly based on Omaha system. Chin J Prac Nurs 2019;35:1526–32.
23 Shi X, Zhang H, Sui J. Investigation of long-term care needs and its influencing factors among old people with chronic diseases in nursing homes in rural area of Liaoning. Chin J Prac Nurs 2016;32:2099–103.
24 Jie Y, Wang Y, Chen J, et al. Unmet supportive care needs and its relation to quality of life among adult acute leukemia patients in China: a cross-sectional study. Health Qual Life Outcomes 2020;18.
25 Gobbens RJJ, van Assen MALM, Luijkx KG, et al. The Tilburg frailty indicator: psychometric properties. J Am Med Dir Assoc 2010;11:344–55.
26 Xi X, Guo G, Sun J. Reliability and validity of Chinese version of Tilburg frailty indicator. Journal of Nursing 2013;20:1–5.
27 Mahoney FI, Barthel DW. Functional evaluation: the BARTHEL index. MD State Med J 1965;14:61–5.
28 Dent E, Lien C, Lim WS, et al. The Asia-Pacific clinical practice guidelines for the management of frailty. J Am Med Dir Assoc 2017;18:564–75.
29 Nani F, Jang BN, Youn HM, et al. Frailty transitions and cognitive function among South Korean older adults. Sci Rep 2021;11:10658.
30 Lloyd-Sherrlock P, Pot AM, Sasat S, et al. Volunteer provision of long-term care for older people in Thailand and Costa Rica. Bull World Health Organ 2017;95:774–8.
31 Zhang L, Zeng Y, Wang L, et al. Urban-Rural differences in long-term care service status and needs among home-based elderly people in China. Int J Environ Res Public Health 2020;17:1701–28. doi:10.3390/ijerph17051701
32 Verver D, Merten H, Robben P, et al. Care and support for older adults in the Netherlands living independently. Health Soc Care Community 2018;26:2004–14.
33 Wee S-L, Liu C, Goh S-N, et al. Determinants of use of community-based long-term care services. J Am Geriatr Soc 2014;62:1801–3. doi:10.1111/jgs.13003
34 Fu YY, Guo Y, Bai X, et al. Factors associated with older people’s long-term care needs: a case study adopting the expanded version of the Anderson model in China. BMC Geriatr 2017;17:38. doi:10.1186/s12877-017-0436-1
35 Hu H, Si Y, Li B. Decomposing inequality in long-term care need among older adults with chronic diseases in China: a life course perspective. Int J Environ Res Public Health 2020;17:2595.
36 Wee S-L, Li Y, Sun Y, et al. Determinants of long-term care needs of community-dwelling older people in Singapore. J Am Geriatr Soc 2014;62:2453–4.
37 Gale CR, Westbury L, Cooper C. Social isolation and loneliness as risk factors for the progression of frailty: the English longitudinal study of ageing. Age Ageing 2018;47:392–7.
38 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.
39 Fernandes Bolina A, Rodrigues RAP, Tavares DMdSoS, et al. Factors associated with the social, individual and programmatic vulnerability of older adults living at home. Rev Esc Enferm USP 2019;53:e3429.
40 Zhang L, Zeng Y, Wang L, et al. Urban-Rural differences in long-term care service status and needs among home-based elderly people in China. Int J Environ Res Public Health 2020;17:1701. doi:10.3390/ijerph17051701
41 Salinas-Rodriguez A, Mannique-Espinoza B, Heredia-Pi I, et al. Healthcare costs of frailty: implications for long-term care. J Am Med Dir Assoc 2019;20:102–3.
42 Vermeiren S, Vella-Azzopardi R, Beckwée D, et al. Frailty and the prediction of negative health outcomes: a meta-analysis. J Am Med Dir Assoc 2016;17:1163.e1–1163.e17.
43 Siriwadrathana D, Weerasinghe MC, Rait G, et al. Association between frailty and disability among rural community-dwelling older adults in Sri Lanka: a cross-sectional study. BMJ Open 2020;10:e34189.

BMJ Open: first published as 10.1136/bmjopen-2021-051801 on 29 April 2022. Downloaded from http://bmjopen.bmj.com on September 14, 2023 by guest. Protected by copyright.