Changes in the Mental Health Status of Frail and Pre-Frail Older Adults Over a 1-year Period

Claudia K. Y. Lai (claudia.lai@polyu.edu.hk)
Hong Kong Polytechnic University

Justina Y. W. Liu
Hong Kong Polytechnic University

Daphne S. K. Cheung
Hong Kong Polytechnic University

Kenny C. W. Chin
Centre for Gerontological Nursing, School of Nursing, Hong Kong Polytechnic University

Mimi M. Y. Tse
Hong Kong Polytechnic University

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Abstract

Background

This prospective observational study examined changes in the mental health status of frail and pre-frail older adults over a 1-year period, a topic lacking in-depth exploration in the literature.

Method

Fried Frailty Index was used to differentiate frailty status in participants recruited from community centres and residential care facilities in Hong Kong. Demographic and clinical data were collected using face-to-face interview at baseline and repeated after 12 months.

Results

Physical functioning, comorbidities, and psychological and environment domains (World Health Organization Quality of Life instrument) impacted the cognitive functioning, depressive symptoms, and sense of loneliness in the sample (N=107). Functional health and vision had a significant impact on cognitive status; depression negatively associated with comorbidity, functional health, and quality of life domains (psychological and environment); loneliness was affected by both age and environment.

Conclusion

The findings showed that frail and pre-frail older adults have complex needs in relation to their mental health even just over a 1-year period. Intervention programs on frailty that focus on physical aspects will not suffice. Programs for frailty also need to incorporate mental health components to enhance health and wellbeing.

Introduction

Frailty has emerged as a pertinent concept in understanding health changes in older age (1), and is a powerful indicator of people's health status and care needs (2). Researchers conceptualize frailty as a state of musculoskeletal, cardiovascular, metabolic, and immunologic systems sharing a common pathway that leads to progressive decline in physiological reserve and performance (3). Studies have thus far focused more on the physical and cognitive aspects of frailty, and less on frailty in relation to mental health. Yet mental health and frailty status can be dynamically related (4). Examining the mental health status of frail older adults, therefore, merits attention.

Frailty was found to be more significantly associated with lower scores on both physical and mental health-related QOL in a community sample of older adults (5). Cheng et al. (6) studied frailty-related

topics in veterans with heart failure (N=12,000) by examining electronic medical records. The frailty topics found were classified into five areas of deficit, namely physical functioning, role-physical, general health, social functioning, and mental health. The physical functioning and mental health deficit topics both had prevalence rates of over 50%, showing the importance of examining mental health issues in relation to frailty.

Physical ailments and the odds of having a mental health disorder

An increase in the number of physical diseases, as is the case with many frail patients, was associated with the odds of having a mental disorder (7). In a survey of young-old community-dwellers, the presence of one or more frailty criteria was positively associated with depression and negatively with a mental function test score and with fat-free mass (8).

That frailty is associated with cognitive decline has often been observed. In Ma et al.'s (9) community sample (N=3,202) recruited from seven Chinese cities, frailty, exhaustion, slowness, and inactivity were found to significantly associated with poor global cognition. Albaba et al. (10) studied the association between the phenotype of frailty and mental health and survival in community-dwelling obese older adults with disabilities. Frailty has been found to be strongly associated with cognitive impairment and depression. Such observations were confirmed by longitudinal studies. For instance, mental decline at a 3-year follow-up was predicted by pre-frail and frail status (11). However, not all studies found that frailty had a significant impact on health status. Mansur et al. (12) surveyed 61 patients with chronic kidney disease and observed that frailty had exerted no significant impact on the participants' physical and mental health scores.

Mental health can also have an impact on frailty status

Mental health status, on the other hand, can modify the impact of frailty on disability and mortality (13). In a cross-sectional study, mental impairment including anxiety, cognitive impairment, the number of chronic diseases, inflammation, and anemia were symptoms that predicts frailty in older patients (14). Chu et al.'s systematic review and meta-analysis of the literature between 2000-2016 found that depressed older subjects were more prone to becoming frail than those without depression (15).

Other than cognitive changes, depression appears to be the most studied aspect of mental health in relation to frailty. In a longitudinal study on the impact of depression on frailty in older adults, depression was associated with a 59% increase in the risk of developing frailty (16). Vaughan et al.'s (17) review of large epidemiological studies reported a robust association between depressive symptoms and an increased risk of frailty. Yet, on the opposite relationship of how frailty affects depressive symptoms, the findings were less conclusive. For instance, a study reported that physical frailty predicted both the onset and course of late-life depression in a population-based cohort of older persons (18).

Aims of study

Little is known about the impact of frailty on the mental health of frail and pre-frail older adults. There have been few studies on the impact of mental health on frailty status, to say nothing of the dearth of studies on the mental health status (other than cognition and depression) of the frail or pre-frail. The aim of this study, therefore, was to (1) examine the prospective changes in the mental health of frail and pre-frail older adults over a 1-year period, and (2) investigate whether there was any interaction effect between physical and functional health variables and the mental health of frail and pre-frail participants.

Methods

This was a prospective observational study, which is part of a small-scale longitudinal study. The primary objective of the main study was to investigate factors associated with the development of frailty over a 5-year period (2013-2018). Details of the main study are found in two papers that arose from that study – one on frailty transition states (19) and the other on the use of a brief functional assessment to screen for the risk of comorbidities in older people (20). This study was approved by the Human Subjects Ethics Sub-Committee (synonymous to institutional review boards in Western countries) of the Hong Kong Polytechnic University (Ref. No. HSEARS20130609001). All procedures were performed according to the ethical principles as stipulated in the Declaration of Helsinki. A written informed consent was collected from all participants and/or their legal guardians.

Participants

The participants were recruited from community centres and residential care facilities for older adults in Hong Kong through convenience sampling. The inclusion criteria included those (1) aged 60 years or above and (2) who could communicate in Cantonese, a Chinese dialect predominantly used in Hong Kong and southern China. Informed written consent was obtained from all participants or their proxies prior to data collection. Excluded were those with a life expectancy of less than 6 months, those with an Abbreviated Mental Test (AMT) score of lower than 7 (i.e., indicative of cognitive impairment) (21), and those whose proxies we could not reach to obtain consent.

Measures

Demographic and clinical data, including age, gender, education level, marital status, economic profile, family status, and religion were collected. The Charlson Comorbidity Index (CCI) (22), which measures 19 illness conditions, was used to assess comorbidity. All measures used have a validated Chinese version, rendering them suitable for use in the local population. Their psychometric properties are presented in Supplementary Information.

Frailty

Frailty levels were assessed using the Fried Frailty Index (FFI) (23). It is a 5-item scale that measures five clinical syndrome criteria: unintentional weight loss; self-reported exhaustion; weakness; slow walking

speed; and low physical activity. Participants presenting with 0, 1-2, and 3-5 criteria are classified as “Robust”, “Pre-frail”, and Frail”, respectively.

Mental Health Status Measures

Cognitive function was assessed using the 10-item AMT (21). A correct answer will score one point and a total score of 0-3, 4-7, or 8-10 represents the cognitive function of a subject who is seriously disturbed, with moderate disability, or with normal mental efficiency, respectively.

The Geriatric Depression Scale – Short Form (GDS) was used to assess the severity of the subjects’ depressive symptoms. The GDS consists of 15 dichotomous items with overall scores ranging from 0 to 15. A higher score represents more depressive symptoms. The cut-off score is 7/8 (24).

The General Anxiety Disorder questionnaire-7 (GAD-7) was used to screen for common anxiety disorders and assess the severity of symptoms. The GAD-7 has seven multiple-choice questions relating to the frequency with which a subject is bothered by selected problems. A 4-point Likert scale was used, with 0=Not at all sure, 1=Several days, 2=Over half the days, and 3=Nearly every day. The range of the scores is from 0 to 21. Scores of 5, 10, and 15 are regarded as the cut-off points for mild, moderate, and severe anxiety, respectively. An increase in score was significantly associated with mental health related quality of life ($p < 0.0001$) (25).

The Subjective Happiness Scale (SHS) is a 4-item scale used to evaluate the self-reported happiness level of the participants. A 7-point Likert scale is used, and the scores could range from 0 to 28. A higher score means a happier state (26).

The UCLA Loneliness Scale (version 3), a 20-item scale, was used to assess subjective feelings of loneliness and social isolation (27). The items are rated as: 1 (Never), 2 (Rarely), 3 (Sometimes), and 4 (Often). The total score could range from 20 to 80. The higher the score, the lonelier the subject perceives himself/herself to be.

The social support network of the participants was assessed using the Lubben Social Network Scale-6 (LSNS-6) (28). This 6-item scale has two domains: family and friends. The total score ranges from 0 to 30. The higher the score, the better the social network. A score of <12 identified a subject as “Socially isolated”.

Physical and Functional Health Measures

Physical health and functional status influence mental well-being. The following measures of physiological and functional health were collected.

Three widely used functional performance tests for older adults – Grip strength, the Timed-up and Go (TUG), and Functional Reach (FRT) tests – were used. Grip strength (dominant hand) was tested with the Jamar handheld dynamometer (hydraulic). It is a good indicator of upper limb function (29) and also a popular clinical measure for examining general muscle strength (30). Three trials were undertaken, with

the mean score of the last two trials being taken as the final score (31). Older Chinese Singaporeans had a handgrip strength that ranged from 12.79 to 18.93 kg (30).

The TUG test calculates the number of seconds needed by a person to get up from a sitting position, walk three metres, and then turn around to return to the previously seated position (32). A shorter duration in completing TUG means a better ability to maintain balance (33).

The FRT is a commonly used test for measuring the distance that a person can attain when reaching forward from a standing position without losing balance (34). It is used to detect balance impairment over time (35), and was found to correlate with physical frailty (36). Three trials were undertaken with the first attempt serving as a practice trial. The mean value of two subsequent trials was computed as the final score. An inability to reach a distance of more than 15 centimetres implies that the subject is a high fall risk and is frail (36).

The ability to perform basic activities of daily living was assessed using the Modified Barthel Index (MBI). The MBI is a 10-item instrument in which an individual's performance is rated on a 5-point Likert scale. Scores of 0-20, 21-60, 61-90, 91-99, and 100 are classified as "Totally dependent", Severely dependent", "Moderately dependent", "Slightly dependent", and "Totally independent", respectively (37).

The Lawton's Instrumental Activities of Daily Living (IADL) scale (38) is used to evaluate a person's functional ability to perform instrumental activities of daily living, which include the use of a phone, transportation, shopping, medication management, money management, meal preparation, housework, laundry, and handyman work. Each item is rated on a 4-point Likert scale (0-3), and the scores range from 0 to 27. The higher the score, the higher is an individual's level of functioning.

Pain affects physical functioning (39). The Centre for Gerontological Nursing's Pain Scale (CGNPS) was developed by one of the authors (MT) to assess levels of pain. Items in the CGNPS include pain levels at different times during the day, pain locations, and the impact of different daily activities or postures on pain. A single dichotomous item (Yes/No) of the CGNPS was used in this study.

Activity Level and Well-being Measures

To examine if both physical and mental health status would affect the participants' physical activity levels and sense of well-being, the Physical Activity Scale for the Elderly (PASE) (40) was used. PASE consists of 12 items categorized under three types of activities: leisure time activities, household activities, and work-related activities. The total PASE score is calculated by adding the score of each item determined based on the time spent on each activity or the presence (or absence) of activity over the past 7 days. The total PASE score is calculated by multiplying activity weights by activity frequencies. A higher score indicates a higher level of physical activity.

The Personal Well-being Index (PWI) (41) was used to explore how the participants felt about their lives in eight domains: standard of living, personal health, achieving in life, personal relationships, personal safety, community connectedness, future security, and spirituality/religion. Each domain is rated on an

11-point scale, from 0 (completely dissatisfied) to 10 (completely satisfied). The higher the score, the better is an individual's subjective well-being.

Last, because frailty affects a person's quality of life (42), the participants' quality of life was assessed using the World Health Organization Quality of Life Instrument (WHOQOL-BREF) (43), a 26-item version of the WHOQOL-100 with four domains, namely, Physical health, Psychological, Social relationships, and Environment.

Procedures

Assessments of inter-rater reliability and test-retest reliability were conducted prior to the data collection. The raters were final year undergraduate nursing students trained to attain no less than 95% agreement with CKYL or ASWW before certified as competent raters. Ninety-one senior centres in the list of community centres of the Home Affairs Department, and the list of Day Care Centres and Day Care Units for the Elderly of the Social Welfare Department in 2013, were contacted and six (15.2%) agreed to take part in the study. A total of 429 older persons who gave their written informed consent to participate in the study were recruited. In the second year, those participants who could not be contacted or who refused to meet with us were considered to have dropped out. The interviews to collect data took place either in a centre or in a participant's home. Each interview was between 45 minutes (for two sessions each) to 90 minutes (one session to complete the interview and assessments) in duration. Two interview sessions were needed for some to avoid fatigue.

Data Analysis

Statistical analyses were performed using IBM SPSS Statistics for Windows Version 21.0 (IBM Corp. Armonk, NY, USA). Descriptive statistics were used to summarize the characteristics of the participants. A Chi-squared test was used to examine the differences regarding categorical variables, and an independent T-test was used to test the differences with regard to continuous variables. A multilevel linear model (MLM) was first conducted to determine the time effect, group effect, and interaction effect on the selected mental health variables, namely AMT, GDS, GAD-7, SHS, UCLA Loneliness Scale, and LSNS-6. If changes in the variables were identified over a period of 2 years, MLM was further used to examine potential predictors of change in these mental health measures. The covariance structure autoregressive (AR)(1) was assumed under the model and was found to have fitness. AR(1) implies that the covariances between repeated observations of the same respondents are not equal. The degree of covariance decreases as the time distance between observations increases. Some of the respondents were not accessible during data collection points. The proportion that was missing for all variables was less than 10%, with the exception of the UCLA Loneliness Scale (52.3%), FRT (31.8%), and TUG (23.4%). Multiple imputation is used to treating missing data (44) as it produces less biased estimates than other approaches for missing observations of between 10% and 80% (75).Moreover, it can account for the underlying uncertainty (45). Five multiple imputations were conducted for the final pooled results of the MLM analyses. A two-sided level of significance was set at $p < 0.05$.

Results

A total of 429 participants took part in the first year of this study and 258 participants (60%) completed the assessment in the following year. Because the goal of this paper is to investigate if there were changes in the mental health status of those participants whose frail and pre-frail status had not changed, two groups of participants, the “Pre-frail” (PF, n=70) and “Frail” (FR, n=37), were selected for analysis. (Table 1)

Table 1
Frequency distribution of frailty status among participants at baseline and at the 12-month follow-up.

		12-month Follow-up			Total
		Robust	Pre frail	Frail	
Baseline	Robust	14	50	3	67
	Pre frail	20	70	18	108
	Frail	1	25	37	63
Total		35	145	58	238
Note: 20 participants did not complete their frailty assessment					

Participants Profile

More participants in the FR group came from nursing homes (70.0% (FR) vs 30.0% (PF), $\chi2=15.937$, $p<0.001$). Compared with the PF group, the FR group were older (83.4 (FR) vs 78.6 (PF), $t=-2.997$, $p=0.003$), more of them lived with a person other than their spouse or child (70.3% (FR) vs 32.9% (PF), $\chi2=17.515$, $p=0.004$), and had more diagnosed diseases on average (5.59 (FR) vs 3.56 (PF), $t=-4.302$, $p<0.001$). About 70% of them were vision impaired or moderately impaired (70.3% (FR) vs (31.4%), $\chi2=21.585$, $p<0.001$). (Table 2)

Table 2
Profile of the participants

		Prefrail		Frail		
		(N=70)		(N=37)		p^a
Community or Nursing home, N (%)	Community	49	(70.0%)	11	(29.7%)	0.000
	Nursing home	21	(30.0%)	26	(70.3%)	
Age, mean (SD)		78.6	(8.1)	83.4	(7.5)	0.003^b
Gender, N (%)	Male	18	(25.7%)	10	(27.0%)	0.883
	Female	52	(74.3%)	27	(73.0%)	
Marital status, N (%)	Never married	2	(2.9%)	1	(2.7%)	0.478
	Married	28	(40.0%)	11	(29.7%)	
	Widowed/divorced/separated	40	(57.1%)	25	(67.6%)	
Educational attainment, N (%)	Without formal education	27	(38.6%)	18	(50.0%)	0.653
	Primary	25	(35.7%)	12	(33.3%)	
	Secondary	15	(21.4%)	5	(13.9%)	
	University	3	(4.3%)	1	(2.8%)	
Monthly income, N (%)	<$2,000	12	(17.1%)	9	(24.3%)	0.251
	$2,000-$3,999	35	(50.0%)	25	(67.6%)	
	$4,000-$5,999	13	(18.5%)	3	(8.1%)	
	$6,000-$7,999	2	(2.9%)	0	(0.0%)	
	$8,000-$9,999	3	(4.3%)	0	(0.0%)	
	$10,000-$14,999	2	(2.9%)	0	(0.0%)	
	$15,000-$19, 999	1	(1.4%)	0	(0.0%)	
	>=$20,000	2	(2.9%)	0	(0.0%)	
Living with family, N (%)	Living alone	19	(27.1%)	4	(10.8%)	0.000
	Living with family	28	(40.0%)	6	(16.2%)	
	Living with others	23	(32.9%)	27	(73.0%)	
Religion, N (%)	Christian / Catholic	25	(35.7%)	7	(19.0%)	0.097
	Buddhist/Ancestors	21	(30.0%)	10	(27.0%)	

		Prefrail		Frail		
	No religion	24	(34.3%)	17	(45.9%)	
	Others	0	(0.0%)	3	(8.1%)	
VHT hearing, N (%)	Adequate	56	(80.0%)	22	(59.5%)	0.137
	Minimal difficulty	7	(10.0%)	6	(16.2%)	
	Moderate difficulty	6	(8.6%)	8	(21.6%)	
	Severely impaired	1	(1.4%)	1	(2.7%)	
VHT Vision, N (%)	Adequate	48	(68.6%)	9	(24.3%)	0.000
	Impaired	19	(27.1%)	20	(54.1%)	
	Moderately impaired	3	(4.3%)	6	(16.2%)	
	Severely impaired	0	(0.0%)	2	(5.4%)	
Number of diseases, mean (SD)		3.56	(2.3)	5.59	(2.5)	0.000[b]
Sleeping difficulty, N (%)	No	53	(75.7%)	27	(73.0%)	0.756
	Yes	17	(24.3%)	10	(27.0%)	
Pain, N (%)	No	37	(52.9%)	21	(56.8%)	0.700
	Yes	33	(47.1%)	16	(43.2%)	

[a] Chi-square test

[b] Independent T-test

Changes in Mental Health Status

MLM was then used to investigate whether there was a time effect, a group effect, and a time by group interaction effect on the six mental health variables. All six mental health variables had a significant group difference. AMT (t=3.009, p=0.003) and GDS (t=-3.130, p=0.002) had also a significant time effect. Both groups, therefore, had a change in both AMT and GDS scores

over time. In the FR group, AMT decreased by 0.97 and in the PF group, it decreased by 0.56. At year 2, the GDS score increased by 1.78 for the FR group and 0.51 for the PF group, respectively. Only with the UCLA Loneliness Scale was a significant interaction effect observed (t=3.238, p=0.001). The UCLA Loneliness Score of the FR group at year 2 increased dramatically by a score of 8.76 from year 1; while the increase in score for the PF group was only 2.25. (Table 3)

Table 3 is available in supplementary section.

Changes in Physical and Functional Status

To explore whether the physical and functional variables would also change over time between groups, MLM was employed to test if there was a time effect, a group effect, and a time by group interaction effect on measures of physical and functional health variables. The physical, functional health, and wellbeing measures that were tested in univariate MLM included CCI, Grip strength, TUG, FRT, MBI, IADL. The four domains of WHOQOL (WHOQOL-Physical health, WHOQOL-Psychological, WHOQOL-Social relationships & WHOQOL-Environment) were also included in this model. The results show that MBI ($t=-2.278$, $p=0.023$), FRT ($t=-6.356$, $p<0.001$), and WHOQOL-Environment ($t=2.426$, $p=0.015$) had a significant time effect. MBI ($t=2.044$, $p=0.041$), Grip strength ($t=2.186$, $p=0.029$), WHOQOL-Physical health ($t=3.241$, $p=0.001$), and WHOQOL-Psychological ($t=3.000$, $p=0.003$) had significant interaction effects. (Table 3)

Factors Affecting Mental Health Status

Variables with a significant time effect were put into the multivariate MLM to test physical health and functional status, and were found to have a significant correlation with mental well-being, namely the AMT, GDS, and UCLA Loneliness Scale. Significant demographic characteristics and physical health and functional status variables were included in the model for testing, and a backward elimination approach was adopted. These variables included age, normal vision or not, living in a nursing home or in the community, living with family or not, plus all physical and functional health measures. After the deletion of insignificant variables, a decrease in the Vision, MBI, IADL, and FRT scores were found to be associated with a lower AMT score. The GDS was affected by the CCI, IADL, WHOQOL-Psychological, and WHOQOL-Environment. Those who had a lower score in the CCI, IADL, WHOQOL-Psychological, and WHOQOL-Environment were more likely to have symptoms of depression. The UCLA Loneliness Scale scores were affected by age and the WHOQOL-Environment, with a decrease in the WHOQOL-Environment score being more likely to be associated with a higher level of loneliness. (Table 4)

Table 4
Factors affecting the AMT, GDS and UCLA scores of frail and prefrail participants (N=107).

Dependent						**95% C.I.**	
Variable	Factors	B	S.E	t	*p*	Lower Bound	Upper Bound
AMT	Intercept	3.942	.793	4.970	.000	2.387	5.497
	Time (Yr2 vs Yr.1)	-1.277	.328	-3.890	.000	-1.926	-.628
	Group (Frail vs Prefrail)	1.452	.519	2.796	.005	.434	2.469
	Time x Group	-.497	.371	-1.338	.181	-1.225	.231
	Normal Vision	-.605	.266	-2.279	.023	-1.126	-.085
	IADL	.105	.021	5.036	.000	.064	.145
	MBI	.018	.008	2.336	.019	.003	.034
	FRT	.079	.026	3.045	.004	.027	.132
GDS	Intercept	13.984	1.538	9.094	.000	10.968	17.001
	Time (Yr2 vs Yr.1)	.011	.415	.026	.979	-.802	.824
	Group (Frail vs Prefrail)	.253	.759	.333	.739	-1.236	1.742
	Time x Group	1.823	.718	2.539	.011	.415	3.230
	CCI	-.363	.129	-2.809	.005	-.616	-.110
	IADL	-.059	.030	-1.954	.051	-.119	.000
	WHOQOL-Psy	-.083	.019	-4.386	.000	-.120	-.046
	WHOQOL-Env	-.043	.021	-2.083	.037	-.084	-.003
UCLA	Intercept	88.635	8.418	10.529	.000	72.131	105.139
	Time (Yr2 vs Yr.1)	-7.624	2.202	-3.462	.001	-11.951	-3.296
	Group (Frail vs Prefrail)	-5.517	2.293	-2.406	.016	-10.020	-1.013
	Time x Group	7.960	2.639	3.017	.003	2.783	13.136
	Age	-.464	.099	-4.693	.000	-.658	-.270
	WHOQOL-Env	-.210	.061	-3.420	.001	-.331	-.090

Dependent	95% C.I.

AMT, Abbreviated Mental Test; GDS, Geriatric Depression Scale; UCLA, UCLA Loneliness Scale; CCI, Charlson Comorbidity Index; IADL, Lawton's Instrumental Activities of Daily Living Scale; MBI, Modified Barthel Index; FRT, Functional Reach Test; WHOQOL-Psy, WHOQOL Psychological domain; WHOQOL-Env, WHOQOL Environment domain

Discussion

Many of the studies examining correlations between frailty and various factors have been cross-sectional in design. Few have examined the same question that is the focus of our study. The closest study to ours that we have been able to find was that by Mulasso et al. (46). They investigated the differences in psychosocial factors among healthy, pre-frail, and frail older people (N=210) and examined the presence of any interactions between frailty status and psychosocial factors. They reported a close relationship between frailty and psychosocial factors, and recommended that when studying human functioning, both the physical and psychological aspects of a person must be considered. We have made a similar observation but have identified the environment (WHOQOL-Environment domain) as also playing an important role in mental health.

The environmental domains of the WHOQOL include the concepts of financial resources, home environment, physical safety and security, accessibility and quality of health and social care, transportation, chances to participate in leisure activities, and the physical environment such as pollution and climate (47). Because physical functioning, comorbidities, and aspects of quality-of-life domains (WHOQOL-Psychological and Environment) were found in our sample to affect cognitive functioning, depressive symptoms, and the sense of loneliness, these three aspects will be discussed.

Despite the methodological differences in the reviewed studies, Miyamura et al. (48) observed that most studies reported that frailty syndrome is a trigger for cognitive decline. Another systematic review (49) revealed that all 19 eligible studies confirmed a link between cognition and frailty. However, we found that cognition would be affected even when the individual’s frailty status remained the same. One of the main findings in our study is the significant association between vision and functional health variables and deterioration in cognitive performance. Like Armstrong et al. (50), our results showed an association between cognitive change and functional performance and vision.

Lohman et al. (51) studied the correlation between frailty and depression and found significant correlations (correlation coefficients 0.61-0.70) between the two conditions in older age. Our study observed that depressive symptoms were predicted by comorbidity, IADL, and WHOQOL-Psychological and WHOQOL-Environment. Jafari et al. (52) examined the relationship between frailty state and mood, cognition, quality of life, and level of independence over a 1-year period in patients with chronic kidney disease. In their study, the trajectory for depression and cognitive impairment exhibited no change at the 12-month follow-up (N=97 at baseline and n=62 at the 1-year follow-up). The decline in the quality of life

dimensions (mobility and self-care) in their study pointed to a need to provide more caregiving support over a 1-year period; whereas our study found that depressive symptoms increased in the presence of poor vision, a decline in the performance of IADL, and a deterioration in the WHOQOL psychological and environmental domains, even though there was no change in the baseline frailty status (frail or pre-frail) in the participants. Our findings are in line with those reported by Lohman et al. (51) that the strongest predictors of comorbid depression and frailty were variables related to personal and environmental resources, referring to variables such as less educational attainment, lower levels of income, and less health insurance coverage. Regardless of the direction of the relationships and interactions between frailty and depression, depression is treatable. Early identification and treatment of depressive symptoms in frail older adults would be useful in reducing morbidity and mortality (16).

Loneliness has been defined as an individual's personal, subjective sense of lacking desired levels of affection, closeness, and social interaction with others (50). We found that increasing age was not associated with increasing levels of loneliness, which was different from the views in other studies, which generally report that the risk of loneliness increases with age (52, 53). A possible reason for this difference is that slightly more than 50% of the data in this measure were missing. Statistical references suggest that an analysis that is conducted when more than 40% of the data are missing should be considered only as hypothesis generating (54). The UCLA Loneliness Scale has several positively worded items that our participants found to be difficult to understand and rate, therefore, led to a higher percentage of incompletions.

Reportedly, groups experiencing loneliness and/or isolation are more likely to have both poorer physical and mental health (55). People with multi-morbidities such as people who are frail, are indeed more vulnerable to social isolation. Yet not all socially isolated people feel lonely, and not all who feel lonely are socially isolated (56).

In our study, loneliness was affected by a decrease in the level of WHOQOL-Environment. Previously, discussions in the health care field about the environment focused on how it impacted people's functional performance. In recent decades, the influence of various facets of the environment upon psychosocial well-being has gained greater recognition. van Herwijnen (57) suggested that factors such as accessibility and green space influenced loneliness among her participants. van den Berg et al. (58) found that characteristics of the built environment explained a substantial part of the variance in levels of loneliness. The relationship between environmental factors and loneliness is likely complex and warrants further study.

Visual impairment is known to be associated with a pronounced loss that significantly affects the quality-of-life of individuals because of prolonged period of morbidity (59). Yet the global prevalence of preventable visual impairment and blindness in people aged 50 years and above is 9.58 cases per 1000 persons, a rate that has not changed since the last decade (60). Because effective interventions are available for the prevention, treatment, and rehabilitation of eye conditions (61), clinicians should actively promote eye health and engage their patients in self-management. Many interventions, such as self-

management and disease management efforts, show promise for use among visually impaired older adults (62).

Depression is a major cause of disability worldwide (63). It is more common in late life, yet it is often underdiagnosed and undertreated (64). As the largest group of healthcare providers, nurses come into contact with older adults on many occasions and in different contexts. Evidence-based interventions are available for nurses to use in caring for affected older adults (65). The same can be said of physicians and other healthcare professionals.

Supportive environments are a key determinant of health, and frail older adults will require a broad range of support services to age in their own home. A systematic review of the evidence supports that a holistic response to frailty would optimize functional performance among older adults across care settings (66). Ageing and health has long been dichotomized into medical (or health) and social perspectives. In recent decades there have been calls for an integration of both perspectives so that a person-centred approach can be adopted (67). This certainly would be an appropriate direction for the healthcare sector to move forward.

Limitations

The small sample size is a clear limitation. As such, caution is needed when interpreting the results. Future research with larger samples will be needed to examine pathways and possible interactions in the relationships between physical and mental health in older adults. Funding constraints affected our ability to closely follow up the participants. The large percentage of missing data on the UCLA Loneliness Scale generated hypotheses for testing, but unable to offer more insights to help clinicians better understand the phenomenon of interest. The use of a more culturally sensitive tool may facilitate researchers to capture data in future studies. Since little attention has been paid to factors associated with the psychological, cognitive, and social aspects of health and frailty, our findings add value to the literature in this regard.

Conclusion

An ageing population is a global phenomenon that is occurring much more quickly in Asia than in other parts of the world. Frail and pre-frail older adults have mental health needs that are impacted by multiple factors across the physical, functional, psychosocial, and environmental domains. When implementing intervention strategies to mitigate frailty, we must pay attention to the complex needs of these individuals.

Declarations

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Competing interests

The authors declare that they have no competing interests.

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