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Original Research

Prediction of Physical Characteristics, Cognitive Function and Community Participation on Mental Health State of Frail Male Elderly Outpatients

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Abstract

Background: It has been pointed out that the elderly with frailty are more likely to be at risk of depression than the elderly without frailty. There are few researches that explored the predictability of physical characteristics, cognitive function, and community participation on the mental health state of male elderly outpatients with frailty. The purpose of this study was to explore the predictability of the basic attributes, physical characteristics, cognitive function, and community participation on the mental health state of male elderly outpatients with frailty. **Methods**: Through purposive sampling, the questionnaires were distributed and collected in the internal medicine clinic of a teaching hospital in northern Taiwan to include a total of 190 male elders as the cases of this study. The data collection included basic attributes, physical characteristics, cognitive function, community participation, and mental health state evaluation. **Results**: The results of the study show that scores of the male elderly with frailty were statistically different in mental health state in terms of age (t = –3.54, $p < 0.001$), domicile (t = 15.99, $p < 0.001$), income (t = 7.81, $p < 0.005$), self-perceived health status (t = 35.39, $p < 0.001$), drinking (t = 7.03, $p < 0.05$); left hand muscle strength (t = 2.15, $p < 0.05$), average muscle strength of both hands (t = 2.03, $p < 0.05$); in terms of physical characteristics between the instrumental activities of daily living total score (t = 5.03, $p < 0.001$) and instrumental activities of daily living scale grouping (t = 14.82, $p < 0.001$), and cognitive function score (t = 2.87, $p < 0.005$), as well as for community participation in Control (t = 2.57, $p < 0.05$), wholehearted devotion (t = 2.13, $p < 0.05$) and Community participation grouping (t = 5.66, $p < 0.05$). In addition, self-perceived good and normal health status (OR = 0.09, $p = 0.004$; OR = 0.12, $p = 0.026$), mild disability (OR = 4.74, $p = 0.021$), and mild dementia (OR = 0.18, $p = 0.044$) can all predict the mental health state of the elderly. **Conclusions:** Self-perceived health status, mild disability, and mild dementia could predict the mental health state of the male elderly with frailty and is worthy of attention.

Keywords: frailty; male; physical characteristics; cognitive function; community participation; mental health state

1. Introduction

According to the World Health Organization [1], societies in which 7, 14 and 20% of the population is over 65 years old are considered ageing, aged and super-aged respectively. Chang and Lin [2] reported that the world population aged 65 years and older comprised approximately 11% of the total and that the number of such people would reach 1 billion by 2030. According to the Department of Statistics of the Ministry of the Interior under the Executive Yuan, as of December 2021, the number of elderly people over 65 years old in Taiwan reached 3.939 million, accounting for 16.8% of the total population, and Taiwan has entered the aged society. It is estimated that the proportion of elderly people will be as high as 20% by 2026, and Taiwan will become a super-aged society [2]. Although aging is an inevitable biological process, being able to live independently and take care of themselves, as well as having confidence and dignity, are sources of the greatest happiness for the elderly.

Frailty can easily cause the elderly to become ill and die earlier than expected, and more and more evidence shows that frailty may become the most important global issue, as it is a degenerative disease instead of an infectious disease, and has a higher mortality rate in the same age group [3–5]. Frailty is an indicator of functional degradation among older people and regarded as the intermediate stage between independent living and death. The proportion of frailty increases with age, and frailty is a precursor of disability and is often accompanied by the characteristics of overall functional decline. When the body cannot maintain a constant status, it will lead to disability, hospitalization, dependence, and even death, which will increase the cost of social care and burden the family [2].

According to Chang and Lin [2], who conducted a systematic literature review and meta-analysis of frailty among 35,538 older adults and 7994 deaths, the study showed that the proportion of frailty among the 65–70-year-old was about 3.2%, while the 75–79 The proportion of frailty at

age is 10%, and the proportion of frailty is as high as 26–44% when the age is greater than 85. It can be seen that the prevalence of frailty increases with age. Meanwhile, the prevalence of frailty is higher in female than in male. Notably, the increased risk of mortality (frail compared to robust) was significantly higher for male compared to female (summary HR for male and female: 2.656 and 1.875, respectively; Q between $\chi^2 = 4.92$, $p = 0.027$). The above literature showed that male frail elders have a higher risk of death, therefore, more attention needs to be paid to the prevention of frailty.

In addition, previous study has showed that the high-level trajectories of the mental health status were significantly associated with gender, living arrangement, marital status, physical disabilities, poor self-perceived health status, poor life satisfaction, cognitive functions and social participation for male elderly [6,7]. Chu, Chang and Ho [8] conducted a systematic literature review and meta-analysis. A total of 84,351 older people, all 65 years of age or older, were analyzed. According to the meta-analysis, the relationship between the risk for frailty and depression was significant. Notably, correlation between frailty and depression was significantly higher in men than in women (pooled odds ratios for men and women: 4.76 and 2.25, respectively; Q between $\chi^2 = 9.93$, $p = 0.002$). Thus, screening the mental health state of the male elderly is an important part of the prevention and treatment of frailty [8–10].

While the majority of past researches on frailty and mental health state targeted community elders, few discussed the prediction of frailty related factors on the mental health state of outpatients male elders. Subsequently, this study conducted research on the predictability of the physical characteristics, cognitive functions, and community participation of male elderly outpatients with frailty on their mental health state. This study is expected to further understand the predictive factors that affect the mental health state of male elders with frailty, in order to provide a reference for future care plans and health policy formulation.

This study mainly explored the predictability of the basic attributes, physical characteristics, cognitive function, and community participation on the mental health state of male elderly outpatients with frailty.

2. Method

2.1 Research Design

This study adopted a cross-sectional research design, and questionnaires were collected in the internal medicine clinic of a teaching hospital in northern Taiwan with purposive sampling.

2.2 Research Subjects

The inclusion criteria included (1) Men who have a clear consciousness and are older than 65 years of age. (2) Those who can communicate in Mandarin and Taiwanese. (3) Those who agreed to accept this study, and can fill in the questionnaire on the spot by themselves or with the assistance of graduate students or caregivers. (4) Elderly men in the internal medicine department of an outpatient clinic. (5) Those who are judged as frail by the Study of Osteoporotic Fracture (SOF). The exclusion criteria included (1) Those with severe vision or hearing difficulties or are unable to cooperate with the researcher. (2) Those with severe intellectual impairment, mental or cognitive impairment, or are unable to understand or follow instructions. (3) Those who have an acute injury or fracture that requires a plaster, which affects the movement of the upper and lower limbs.

2.3 Number of Samples

This study used the total number of variables as the basis for calculating the number of samples, which was 25 in total. To achieve an 80% power with an effect size (f^2) was 0.15 and an alpha set at 0.05, the required sample was 172 as calculated by the G*Power software (G-power 3.1.9.7, Heinrich Heine Universität, Düsseldorf, Germany). Considering the loss of samples and incorrectly filled questionnaires possibly affecting the response rate, this study added an extra 10% to the number of research participants, and thus 190 participants were recruited.

This study used the total number of variables as the basis for the calculation of the number of samples. There were a total of 25 variables, which were estimated by G-power software, and when the power was set to 0.8, the significance was $\alpha = 0.05$, and the number of samples was 172. When the loss of samples and mistakes in completing the questionnaire was considered, which would affect the recovery rate, the number of research subjects was increased by 10%, and 190 subjects were collected.

2.4 Research Tools

2.4.1 Basic Attributes

Basic attributes include age, education level, religious beliefs, self-perceived health status, income, nature of the previous occupation, the status of living with family members, marital status, smoking or drinking, types of chronic diseases, sleep status and history of falls.

2.4.2 Frailty Assessment

The research tool for assessing frailty in this study is the Study of Osteoporotic Fracture (SOF) Criteria for Frailty, as proposed by Ensrud *et al*. [11], which includes three indicators: (1) Have you experienced involuntary weight loss of more than 3 kg or more than 5% in the previous year? (2) Can you get up from the chair five times without using the armrests? (3) Do you feel full of energy? Scale scoring method: those who answered "yes" to two of the three indicators have "frailty", those who answered "yes" to one indicator are in "pre-frailty", and those who answer "yes" to none of the indicators do not suffer from "frailty".

Luciani *et al*. [12] conducted a study of the sensitivity, specificity, and accuracy of the SOF Index on 419 elderly patients with early-stage cancer and over 70 years old, and found that sensitivity was 89.0%, specificity was 81.1%, and accuracy reached 86.5%. Ensrud *et al*. [11], compared the SOF Index and CHS Index screening, and the results showed that the SOF Index had a good prediction of frailty.

2.4.3 Mental Health State Assessment

The Geriatric Depression Scale-Short Form 15, referred to as GDS-SF15 in this study, was simplified by Sheikh and Yesavage [13] in 1986 from the original Geriatric Depression Scale (GDS-30) developed in 1982. It is a 15-item self-short assessment scale mainly suitable to screen the depression tendency of the elderly. The total score of the scale ranges from 0 to 15 points; the higher the score, the higher the depression tendency. Generally, a 5-point cut point is used, and a score equal to or greater than 5 indicates a depression mental health state by Huang & Song [14].

Based on the simplified version of the Geriatric Depression Scale (GDS-30) developed in 1982, the Geriatric Depression Scale-Short Form (GDS-SF15) received the Cronbach's alpha coefficient of 0.72 in the original measurement of internal consistency reliability [13]. The GDS-SF15 was translated into a Chinese version by Chan, and the measured Cronbach's alpha coefficient was 0.89, with a sensitivity of 93.3% and specificity of 92.3%, which confirmed that GDS-SF15 has good reliability and validity.

2.4.4 Instrumental Activities of Daily Living Scale (IADL)

The Instrumental Activities of Daily Living Scale (IADLs) includes eight items, shopping on the street, going out for activities, food cooking, maintenance of housework, washing clothes, ability to use the phone, taking drugs, and ability to handle financial affairs. While the Instrumental Activities of Daily Living Scale (IADLs) is not necessary for determining basic functions, it does enable individuals to live independently in the community. The scoring method for each item is a dichotomy, that is, 1 point or 0 points, with a full score of 8. If the assessment determines that a person needs assistance for three or more items, this person is classified as having a disability.

Lawton and Brody [15] proposed this scale to assess the ability of the elderly in the subjects' community to perform complex activities in life during the previous month. The reliability among 15 subjects was 0.85, and the retest reliability was 0.96 for 97 males and 0.93 for 168 women, thus, there was good reliability and validity. Zhang, Li, Chen, and Xie [16] conducted an IADL questionnaire and analysis of 173 elderly residents in a support center in northern Taiwan and analyzed the IADL Demand Scale questionnaire survey for the same subjects at two week intervals, and the results showed consistency of 50%–100%. More than 80% of the items had high consistency (70%–100%), and the average consistency of all items was 82%, which indicated that the re-test reliability was good.

2.4.5 Grip Strength

Hand grip strength, muscle function, and daily life functions are all related. The hand grip strength test is a representative and simple method for testing muscle strength, as it evaluates the upper limb muscle strength to observe whether the elderly have enough strength for their daily activities, such as picking up bowls and chopsticks to eat, or carrying personal belongings out of the house; therefore, the upper limb muscle strength of the elderly is an indispensable and important factor of the activities of daily life. The measuring tool for grip strength is the Jamar® handheld dynamometer, which can be used for both left and right hands; adjust the grip of the dynamometer to fit the width of the subject's palm; ask the subject to sit in a sitting position with the joints of the elbows flexed at 90 degrees; use the maximum strength of the finger joints to hold the dynamometer for two seconds, measure three times, and record the maximum value [17].

Yang [18] provided three months of exercise intervention to the elderly over 65 years old with mild to moderate mobility difficulties, divided the non-disabled elderly into a frailty group and a no frailty group, and then, conducted an analysis according to gender. The results showed that grip strength was highly specific to male frailty (96.7%), and while grip strength could not be confirmed for women, the grip strength was highly sensitive to women (85.5%). Chang *et al*. [19], carried out frailty cut-point research without distinguishing gender, and found that grip strength had acceptable discrimination; Rikli and Jones [20] conducted a national study on the basic attributes of the elderly, and the results showed that the total grip strength is the left-hand grip plus the right-hand grip, as measured in kilograms with one decimal place, and the Intraclass Correlation Coefficient (ICC) value of the test was 0.81. Bohannon and Schaubert [21] tested the retest reliability of the two hands, and found no significant difference between the subjects, the results showed 0.954 for the left hand and 0.912 for the right hand, and the content validity was 0.81 for males and 0.78 for females by James *et al*. [22].

2.4.6 30-second Sitting and Standing Test

This test measures the muscle strength of the lower limbs. The elderly were asked to sit down and stand up, and their ability in posture transfer from sitting to standing was observed for 30 seconds. The lower limb joints, muscle power, and the ability to transfer posture when a person changes their posture from sitting to standing require a certain degree of mobility. This test is an important indicator of whether the elderly can maintain functional independence, as well as a predictor of the fall risk.

This measurement method uses a chair with a fixed height of 43–46 cm without armrests, the subject sits on the chair with their back upright, hands crossed in front of the chest, feet on the ground, and stands from the chair after hearing the (Start) command. The subject must stand up straight, and then, sit down completely, which is counted as one complete action. A 30 second stopwatch is used to count the number of times the subject moved from a sitting posture to a fully standing posture, and then, back to the sitting posture. At the end of the 30 seconds, any movement not completed by half, that is, not fully standing up, is not included in the calculation. After resting for 2 minutes, the test is repeated, the average value of both tests is taken, and the value is rounded up.

According to the related research of Rikli *et al*. [20], a national basic data study for the elderly in the United States showed that the correlation coefficient was 0.71–0.78, and the retest reliability was 0.86–0.92 [23].

2.4.7 Community Participation Degree

The related scale of Wu [24] for research into community participation motivation, participation degree, and life adaptation of the elderly in the Huadong area was adopted as the community participation degree scale. However, due to the length and repetition of the questionnaire, only the community participation degree scale was applied in this study. The content included four factors: attendance, involvement, control, and wholehearted devotion, with a total of 16 questions scored according to a four-point sequential scale as the answering method. The degrees included "strongly disagree", "disagree", "agree", and "strongly agree", which were calculated from 1 to 4 points, respectively. Questions 1–4 are reverse questions, calculated from 1 to 4 points, with a minimum of 16 points and a full score of 64 points; the higher the score, the higher the degree of community participation.

Wu [24] recruited 1239 elders over the age of 65 in eastern Taiwan and used the "Questionnaire for Elderly Community Participation and Life Adaptation" as the research tool, which included the four parts: the basic personal data, community participation degree, community participation motivation, and life adaptation of the elderly. The result showed that the degree of community participation of the elderly was the highest in the dimension of "involvement and wholehearted devotion"; the level of education affected the degree of community participation; gender affected the degree of community participation; men's participation was mainly based on "attendance and control", while women focused on the dimension of "involvement and sharing". Then, the "community participation degree scale" was used to analyze the reliability of prediction, and the Cronbach α value of the scale was 0.67, attendance was 0.78, involvement was 0.77, control was 0.89, and wholehearted devotion was 0.57.

2.4.8 Mini-Mental State Examination (MMSE)

As age increases, weakness and cognitive dysfunction become more and more common. MMSE, as formulated by Folstein and McHuge [25], is currently widely used to assess seven items, including the subject's orientation to time and place, attention and arithmetic ability, immediate and short-term memory, language ability (reading, writing, naming, and comprehension), and visual drawing ability. The Chinese version of MMSE was translated by Guo *et al*. [26], and the evaluation takes about 5 to 10 minutes. This scale has a total of 11 questions, 1 point is given for each correctly answered question, and the full score is 30 points; the higher the score, the better the cognitive function. A score of greater than or equal to 25 points means normal intelligence, a score of 21 to 24 points means mild cognitive impairment, a score of 10 to 20 points means moderate cognitive impairment, and a score of less than or equal to 9 points means severe cognitive impairment. MMSE is widely employed due to its ease of use, short testing time, and quantifiable scoring method, which helps medical personnel to communicate with each other [25,27]. The MMSE-Short Form is affected by education level; if the subject's education level is illiterate, a score lower than 16 may indicate cognitive dysfunction; if the subject's education level is elementary school, a score less than 21 may indicate cognitive dysfunction; a score less than 24 may indicate cognitive dysfunction for a subject with the education level of junior high school or above [28].

Folstein *et al*. [25] conducted the MMSE scale test on psychiatric patients in elderly centers and retirement apartments, a total of 206 people participated, and the sensitivity of the MMSE scale was 0.85 and the specificity was 0.82; Guo [26] conducted MMSE tests and the Chinese version of MMSE in 1988, and the instrumental reliability research test was conducted in 1989. The tests were conducted on 441 normal adults with different education levels and over 30 years old, and the results found that the retest reliability was 0.89 and the consistency was 0.83 among the subjects.

3. Statistical Analysis

After coding and decoding the collected data, the present research performed data analyses by using the statistical analysis software of SPSS for windows 20.0 (SPSS, Inc, Chicago, IL, USA). The statistical methods included the distribution of frequency, percentages, averages, standard deviations (SDs), *t* test, chi-square testing, and logistics regression analysis.

4. Results

4.1 Descriptive Analysis of the Basic Attributes, Physical Characteristics, Cognitive Function, Community Participation, and Mental Health State of the Elderly

The effect size was calculated using the mean and standard deviation of the mental health score, in which the Power and alpha level were set at 0.95 and 0.05, respec-

tively. According to the result, the effect was at 0.4, indicating that the measurement variable featured favorable effects.

As shown in Table 1, in the basic attributes, ages were between 65 and 100 years old, with an average age of 78.38 years (SD = 9.28). Most subjects (90 subjects, accounting for 47.4%) had the education level of "elementary school". The previous occupation of the majority of the subjects (48 subjects, accounting for 25.3%) was "agriculture", and the marital status of most of the subjects (151 subjects, accounting for 79.5%) was "married". In terms of smoking history, 104 subjects (54.7%) were "smokers", most of them (145 subjects, 76.3%) did not drink alcohol, and most of them (137 subjects, 72.1%) had "normal" sleep. Most of them (142 subjects, 74.7%) had a history of chronic disease, and most of them (120 subjects, 84.5%) had "hypertension". Most of them (164 subjects, 86.3%) had no history of falls.

Among the physical characteristics, most BMIs were between 14.90 km/m^2 and 43.00 km/m^2, with an average of 23.76 kg/m^2 (SD = 4.14), and 95 subjects (50.0%) had normal BMI. The average left hand muscle strength was 23.52 kg (SD = 5.98), the average right hand muscle strength was 23.91 kg (SD = 6.40), and the average muscle strength of both hands was 23.61 kg (SD = 6.12). The number of times of completing 30-seconds of sitting and standing ranged from 0 to 19 times, with an average of 3.67 times (SD = 3.03). The WBC of the male elderly outpatients with frailty was between 1200 and 29,100, with an average of 13,423 (SD = 5.734); CRP was between 0.80 to 32.07, with an average of 8.64 (SD = 7.98); AC sugar was between 34 and 413, with an average of 158.08 (SD = 63.12). The disability degree of the male elderly outpatients with frailty was mostly "disabled", including 104 subjects (54.7%), with an average IADL score of 2.15 (SD = 1.91), the average IADL score of all subjects was 4.46 (SD = 2.95). The average cognitive level of MMSE was 19.39 (SD = 5.30). Community participation was mainly "low participation" (169 subjects, 88.9%), and the score of the overall average for community participation was 19.03 (SD = 7.22), where attendance had the highest score, followed by involvement and wholehearted devotion, and the control dimension had the lowest average score.

Regarding cognitive function, the average MMSE score of all elders was 19.39 (SD = 5.30), most subjects had "10–20 points, meaning moderate dementia" (102 subjects, 503.7%), with an average MMSE score of 16.24 (SD = 2.85).

Regarding community participation, the average community participation score of all elders was 19.03 (SD = 7.22), mainly with "low participation" (169 subjects, 88.9%), and the average community participation score was 16.73 (SD = 2.45).

4.2 Analysis of the Differences in Basic Attributes, Physical Characteristics, Cognitive Function, Community Participation, and Mental Health State of the Elderly

Table 2 shows that a significant level was reached in the basic attributes of age (t = 0.16, $p < 0.05$), domicile (F = 5.36, $p < 0.05$), income (t = 2.09, $p < 0.05$), self-perceived health status (t = 15.10, $p < 0.001$), and drinking (t = 2.65, $p < 0.05$), which indicated that the basic information of these cases was clearly related to the mental health state of the elderly. Further comparison indicated that; the higher the age of the subjects, the higher the level of depression; the level of depression of people living in nursing institutions was higher than that of those living with family members; the level of depression of those who needed subsidy was higher than that of those with sufficient income; in terms of the level of depression, the subjects with poor self-perceived health status were better than those with good and ordinary self-perceived health status; there were no obvious relationships among the other basic data of the cases.

Regarding the physical characteristics, the total score of IADL (t = 5.03, $p < 0.001$), IADL grouping (t = 14.82, $p < 0.001$) reached a significant level, meaning that there was a clear correlation between the physical characteristics of these subjects and their depression. Further comparison showed that, when the elderly's IADL total score was higher (the degree of disability was lower), the degree of depression was lower; the depression of the elderly with a mild disability was higher than that of those with no disability; there were no obvious relationships between the other physical characteristics.

The cognitive function score (t = 2.87, $p < 0.01$) reached a significant level, which indicated that the cognitive function MMSE was obviously related to the mental health state of the elderly. The higher the cognitive function score (the lower the degree of dementia), the lower the degree of depression of the elderly; the degree of the mental health state of the elderly with moderate dementia was higher than that of those with mild dementia. Regarding community participation, only the correlation coefficients of "Control" (t = 2.57, $p < 0.05$) and "wholehearted devotion" (t = 2.13, $p < 0.05$) showed significant negative value, which indicated that the higher the degree of conformity to wholehearted devotion, the lower the degree of depression. In addition, the statistics of "community participation degree grouping" (t = 5.66, $p < 0.05$) reached a significant level ($p < 0.05$), which showed a clear correlation between the community participation level grouping and the mental health state of the elderly. Further comparison revealed that the depression of the elderly with low-level community participation was higher than that of the elderly with high-level participation.

Table 1. Descriptive analysis of basic data, physical characteristics, cognitive function, community participation and mental health state of the elderly men with depression (n = 190).

Category	Number of people	Percentage (%)	Mean	Standard deviation
Basic data				
Age			78.38	9.28
63–74 years old	73	38.4		
75–84 years old	66	34.7		
85 years old or older	51	26.8		
Education level				
Illiterate	24	12.6		
Elementary school	90	47.4		
Junior high school	21	11.1		
Senior high school	34	17.9		
Junior college or above	21	11.1		
Previous occupation				
Military	10	5.3		
Public service	15	7.9		
Teacher	9	4.7		
Industry	41	21.6		
Commerce	27	14.2		
Service industry	32	16.8		
Agriculture	48	25.3		
Others	8	4.2		
Marital status				
Unmarried	4	2.1		
Married	151	79.5		
Cohabitation	2	1.1		
Divorce	12	6.3		
Widowed	21	11.1		
Domicile				
Living with family members	156	82.1		
Living alone	13	6.8		
Care institution	21	11.1		
Income				
Subsidy	48	25.3		
Sufficient	142	74.7		
Religious belief				
No religious belief	70	36.8		
Buddhism	40	21.1		
Taoism	38	20.0		
Christianity	9	4.7		
Folk beliefs	32	16.8		
Others	1	0.5		
Self-perceived health status				
Good	27	14.2		
Poor	50	26.3		
Normal	113	59.5		
Smoking				
No	86	45.3		
Yes	104	54.7		
Drinking				
No	145	76.3		
Yes	45	23.7		
Sleep status				
Normal	137	72.1		
Wake up easily	32	16.8		
Insomnia	21	11.1		

Table 1. Continued.

Category	Number of people	Percentage (%)	Mean	Standard deviation
History of chronic diseases				
No	48	25.3		
Yes	142	74.7		
Hypertension	120	84.5		
Diabetes	70	49.3		
Cancer	30	21.1		
History of fall				
No	164	86.3		
Yes	26	13.7		
Physical characteristics				
BMI			23.76	4.14
Normal (18.5 km/m^2–24 km/m^2)	95	50.0	21.61	1.52
Low <18.5 km/m^2	14	7.4	17.19	1.10
>24 km/m^2	81	42.6	27.43	3.28
Left hand muscle strength			23.25	5.98
Right hand muscle strength			23.91	6.40
Average muscle strength of both hands			23.61	6.12
Number of sitting and standing in 30 seconds			3.67	3.03
WBC			13,423	5734
CRP			8.64	7.98
AC sugar			158.08	63.12
Disability level (IADL)				
No			7.24	0.77
Yes			2.15	1.91
Cognitive function (MMSE)				
>25 points, normal cognition			26.32	1.25
21–24 points, mild cognitive impairment			22.72	0.98
10–20 points, moderate cognitive impairment			16.24	2.85
<9 points, serious cognitive impairment			7.29	2.75
Community participation				
Attendance			5.06	2.41
Involvement			7.13	2.97
Control			3.25	0.87
Wholehearted devotion			3.58	1.54
Mental health state GDS-SF15			3.79	2.642

BMI, Body Mass Index; IADL, Instrumental Activities of Daily Living Scale; MMSE, Mini-Mental State Examination; GDS-SF15, The Geriatric Depression Scale-Short Form 15.

4.3 Main Predictors of Basic Attributes, Physical Characteristics, Cognitive Function, and Community Participation on the Mental Health State of Male Elderly Outpatients with Frailty

In terms of self-perceived health status, the regression coefficients of "good *vs.* poor" (B = –2.36, OR = 0.09, p = 0.004) and "normal *vs.* poor" (B = –2.13, OR = 0.12, p = 0.026) had significantly negative values, and their OR values were lower than 1, which meant that the risk of depression in the elderly who perceived good or normal health was lower than those who perceived poor health; in terms of IADL, "mild disability *vs.* normal" (B = 1.56, OR = 4.74, p = 0.021) had a significant positive regression coefficient, and its OR value was higher than 1, which meant that the risk of depression in mildly disabled elders was higher than normal elders; in terms of cognition, "mild dementia" *vs.* "normal intelligence" (B = –1.69, OR = 0.18, p = 0.044) had a significant negative regression coefficient, and its OR value was lower than 1, which meant that the risk of depression in mild dementia elders was lower than that of elders with normal intelligence; the other independent variables alone could not effectively predict the risk of depression in the elderly (see Table 3).

5. Discussion

5.1 Basic Attributes, Physical Characteristics, Cognitive Function, Community Participation, and Mental Health State of Male Elderly Outpatients with Frailty

This study focused on male elderly outpatients with frailty over 65 years old in the hospital as the research subjects. Most subjects had the education level of elementary school, most were married and living with family members.

Table 2. Basic data, physical characteristics, cognitive function, community participation and mental health state of elderly men with depression.

	The elderly's mental health state		χ^2 value	t value	*p* value
	Normal (n = 140)	Depression (n = 50)			
Age	77.00 ± 8.59	82.26 ± 10.11		–3.54***	<0.001
Age grouping			10.61**		0.005
(1) 63–74 years old	60 (82.19%)	13 (17.81%)			
(2) 75–84 years old	51 (77.27%)	15 (22.73%)			
(3) 85 years old or older	29 (56.86%)	22 (43.14%)			
Education level			2.46		0.977
(1) Illiterate	18 (75.00%)	6 (25.00%)			
(2) Elementary school	68 (75.56%)	22 (24.44%)			
(3) Junior high school	15 (71.43%)	6 (28.57%)			
(4) Senior high school	24 (70.59%)	10 (29.41%)			
(5) Junior college or above	15 (71.43%)	6 (28.57%)			
Previous occupation			3.23		0.605
(1) Military	7 (70.00%)	3 (30.00%)			
(2) Public service	9 (60.00%)	6 (40.00%)			
(3) Teacher	8 (88.89%)	1 (11.11%)			
(4) Industry	33 (80.49%)	8 (19.51%)			
(5) Commerce	17 (62.96%)	10 (37.04%)			
(6) Service industry	23 (71.88%)	9 (28.13%)			
(7) Agriculture	37 (77.08%)	11 (22.92%)			
(8) Others	6 (75.00%)	2 (25.00%)			
Marital status			3.12		0.156
(1) Unmarried	2 (50.00%)	2 (50.00%)			
(2) Married	115 (76.16%)	36 (23.84%)			
(3) Cohabitation	1 (50.00%)	1 (50.00%)			
(4) Divorce	10 (83.33%)	2 (16.67%)			
(5) Widowed	12 (57.14%)	9 (42.86%)			
Domicile			15.99***		<0.001
(1) Living with family members	123 (78.85%)	33 (21.15%)			
(2) Living alone	9 (69.23%)	4 (30.77%)			
(3) Care institution	8 (38.10%)	13 (61.90%)			
Income			7.81**		0.005
(1) Subsidy	28 (58.33%)	20 (41.67%)			
(2) Sufficient	112 (78.87%)	30 (21.13%)			
Religious belief			3.33		0.375
(1) No religious belief	50 (71.43%)	20 (28.57%)			
(2) Buddhism	32 (80.00%)	8 (20.00%)			
(3) Taoism	31 (81.58%)	7 (18.42%)			
(4) Christianity	5 (55.56%)	4 (44.44%)			
(5) Catholicism	0 (0.00%)	0 (0.00%)			
(6) Folk beliefs	21 (65.63%)	11 (34.38%)			
(7) Others	1 (100.00%)	0 (0.00%)			
Self-perceived health status			35.39***		<0.001
(1) Good	24 (88.89%)	3 (11.11%)			
(2) Poor	21 (42.00%)	29 (58.00%)			
(3) Normal	95 (84.07%)	18 (15.93%)			
Smoking			0.04		0.834
(1) No	64 (74.42%)	22 (25.58%)			
(2) Yes	76 (73.08%)	28 (26.92%)			
Drinking			7.03**		0.008
(1) No	100 (68.97%)	45 (31.03%)			
(2) Yes	40 (88.89%)	5 (11.11%)			
Sleep status			5.41		0.067
(1) Normal	107 (78.10%)	30 (21.90%)			
(2) Wake up easily	21 (65.63%)	11 (34.38%)			
(3) Insomnia	12 (57.14%)	9 (42.86%)			

Table 2. Continued.

	The elderly's mental health state		χ^2 value	t value	*p* value
	Normal (n = 140)	Depression (n = 50)			
History of chronic disease			0.02		0.889
(1) No	35 (72.92%)	13 (27.08%)			
(2) Yes	105 (73.94%)	37 (26.06%)			
Hypertension			0.24		0.627
(1) No	53 (75.71%)	17 (24.29%)			
(2) Yes	87 (72.50%)	33 (27.50%)			
Diabetes			0.68		0.408
(1) No	86 (71.67%)	34 (28.33%)			
(2) Yes	54 (77.14%)	16 (22.86%)			
Cancer			0.73		0.392
(1) No	116 (72.50%)	44 (27.50%)			
(2) Yes	24 (80.00%)	6 (20.00%)			
History of fall			1.07		0.301
(1) No	123 (75.00%)	41 (25.00%)			
(2) Yes	17 (65.38%)	9 (34.62%)			
Physical characteristics					
BMI	23.84 ± 4.35	23.56 ± 3.49		0.41	0.679
Grouping of BMI			0.23		0.89
(1) Normal	69 (72.63%)	26 (27.37%)			
(2) Low	11 (78.57%)	3 (21.43%)			
(3) Overweight	60 (74.07%)	21 (25.93%)			
Left hand muscle strength	23.81 ± 5.76	21.71 ± 6.36		2.15*	0.033
Right hand muscle strength	24.43 ± 6.06	22.46 ± 7.13		1.88	0.062
Average muscle strength of both hands	24.14 ± 5.84	22.11 ± 6.68		2.03*	0.044
Number of sitting and standing in 30 seconds	3.93 ± 3.06	2.96 ± 2.83		1.96	0.052
IADL total score	5.06 ± 2.79	2.76 ± 2.74		5.03***	<0.001
IADL grouping			14.82***		<0.001
(1) No disability	75 (87.21%)	11 (12.79%)			
(2) Mild disability	65 (62.50%)	39 (37.50%)			
WBC	13527.08 ± 55210.05	13230.77 ± 6224.07		0.21	0.834
CRP	8.54 ± 7.94	8.93 ± 8.19		–0.25	0.802
AC sugar	161.58 ± 67.95	149.37 ± 48.70		1.07	0.286
Cognitive function					
Cognitive function score	20.04 ± 5.12	17.58 ± 5.42		2.87**	0.005
Cognitive degree grouping			12.69**		0.005
(1) Normal intelligence	29 (76.32%)	9 (23.68%)			
(2) Mild dementia	40 (93.02%)	3 (6.98%)			
(3) Moderate dementia	66 (64.71%)	36 (35.29%)			
(4) Serious dementia	5 (71.43%)	2 (28.57%)			
Community participation					
Community participation score	19.46 ± 8.01	17.82 ± 4.14		1.83	0.069
Attendance	5.14 ± 2.65	4.84 ± 1.57		0.96	0.338
Involvement	7.30 ± 3.18	6.64 ± 2.20		1.6	0.111
Control	3.32 ± 0.97	3.06 ± 0.42		2.57*	0.011
Wholehearted devotion	3.69 ± 1.69	3.28 ± 0.93		2.13*	0.035
Community participation grouping			5.66*		0.017
(1) Low	120 (71.01%)	49 (28.99%)			
(2) High	20 (95.24%)	1 (4.76%)			

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

BMI, Body Mass Index; IADL, Instrumental Activities of Daily Living Scale.

The income of most subjects was sufficient, and most subjects were without any religious belief. The previous occupation of the majority of subjects was agriculture, and the majority of subjects perceived their health status and their sleep condition as normal. There were more subjects with chronic diseases than those without, and hypertension was the disease of most subjects. The majority of the subjects had a long-term history of medication, took 4–6 types of drugs, and had no history of falls. These findings are similar to the results of related studies. Tur-Sinai *et al.* [29] pointed out that the most important source of emotional support for frail elderly men is from family members whether they are

Table 3. Predictors affecting mental health state of elderly men with frailty.

Independent variable	B	SE	OR (95% CI)	Wald's χ^2	p
Age grouping					
(1) 63–74 years old	–0.02	0.80	0.98 (0.20–4.67)	0.00	0.976
(2) 75–84 years old	–0.22	0.53	0.80 (0.28–2.26)	0.18	0.673
(3) 85 years old or older	Ref.				
Domicile					
(1) Living with family members	–1.14	0.71	0.32 (0.08–1.28)	2.60	0.107
(2) Living alone	–0.69	1.02	0.50 (0.07–3.71)	0.45	0.501
(3) Care institution	Ref.				
Income					
(1) Subsidy	–0.70	0.58	0.50 (0.16–1.55)	1.45	0.229
(2) Sufficient	Ref.				
Self-perceived health status					
(1) Good	–2.36	0.83	0.09 (0.02–0.48)	8.12**	0.004
(2) Poor	Ref.				
(3) Normal	–2.13	0.52	0.12 (0.04–0.33)	16.93***	<0.001
Drinking					
(1) No	1.34	0.60	3.84 (1.18–12.52)	0.78	0.126
(2) Yes	Ref.				
Average muscle strength of both hands	–0.03	0.04	0.97 (0.90–10.05)	0.56	0.454
IADL grouping					
(1) No disability	Ref.				
(2) Mild disability	1.56	0.67	4.74 (1.27–17.73)	5.35*	0.021
Cognitive degree grouping					
(1) Normal intelligence	Ref.				
(2) Mild dementia	–1.69	0.84	0.18 (0.04–0.95)	4.07*	0.044
(3) Moderate dementia	–1.08	0.79	0.34 (0.07–1.60)	1.87	0.172
(4) Serious dementia	–2.20	1.28	0.11 (0.01–1.36)	2.96	0.085
Community participation score					
Control	–0.11	0.63	0.90 (0.26–3.08)	0.03	0.867
Wholehearted devotion	0.12	0.37	1.13 (0.55–2.32)	0.12	0.733
Community participation grouping					
(1) Low	2.09	2.08	8.07 (0.14–474.04)	1.01	0.315
(2) High	Ref.				
Constant					

Note: Ref. is set as reference category *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$; IADL, Instrumental Activities of Daily Living Scale.

married or widowed. Kojima *et al.* [30] conducted a survey on elderly men with frailty and the results showed that the average age of the frail elderly men was 74.6 years old, and the majority had average self-perceived health status. Palomo-Vélez *et al.* [31], which indicated the frailty status in men is negatively associated to self-perceived health status; similarly, in foreign studies, the average age of elderly men with frailty was 73.4 years old, and they rarely drank [32,33]. In addition, the mental health status of elderly men with frailty with poor economic and health status also increased significantly [34–36]. Some scholars have studied whether frailty is a predictor of mental health status. The results showed that people who smoke less and drink less alcohol had a high risk of mental health problem [37], which is the same as this study.

In terms of physical characteristics, the average BMI of male elderly outpatients with frailty was 23.76 kg/m^2, with "normal" BMI being the most, followed by "high BMI". Kojima *et al.* [30] pointed out that a BMI greater than 25 kg/m^2 is an independent factor for frailty especially for men. In order to understand the research of the relevant factors that affect the hand grip performance of older people with frailty, Serra-Prat *et al.* [38], collected the composite health check data to estimate the physical frailty of men. The results showed that the BMI values are higher than in this study. It is speculated that the research subjects of this study were rural residents, as the majority of people with normal BMI are those who earn a living from agriculture and worked frequently, thus, their BMI is normal. Regarding the hand grip strength of male elderly outpatients with frailty, less than 26 kg for males and less than 16 kg for females are mostly considered as low grip strength at present [38,39]. Lin, Yen, Kuo, Hu, and Wang [40] used the body menu to set a cut-off point between disability and

non-disability of the elderly in eastern and central communities, and enrolled 268 men with an average age of 75.3 years, and 251 women. The average hand grip strength of all men was 31.9 kg, and the cut-off point between disability and non-disability grip strength was 30.5 kg. In order to understand the relevant factors affecting the hand grip performance of Taiwanese people, scholars collected composite health check data from 2015 to 2016 from southern Taiwan for analysis, in order to estimate the physical frailty of men and women and people of different age groups, and the results showed that the average grip strength of the dominant hand of males over 65 years of age was 29.59 [38]. The average grip strength of the research subjects in this study was less than 26, as the subjects of this study were all men with frailty, which belongs to the low grip strength of frailty, thus, the grip strength was set lower than the standard. The average number of times of sitting and standing in 30 seconds of the male elderly outpatients with frailty in this study was 3.67 times. The study of Hou *et al*. [41] on male elders over 65 years old in the community found the average number of times of sitting and standing in 30 seconds was 14.5 times. According to the Sports Administration Ministry of Education [42], if the average number of sitting and standing times in 30 seconds for male elders over 65 years is less than 12 times, it means the muscle strength of the lower limbs is poor. Since the results are better than those of the research subjects of this study, it is speculated that the research subjects of this study are all elderly men with frailty. Kojima *et al*. [30] also mentioned that 30-second sitting and standing are negatively correlated with frailty, thus, as the number of 30-second sitting and standing was worse in this study, it shows that the lower limb muscle strength of the research subjects was worse than that of normal male elders. Taiwan's "National Health Interview Survey 2005" conducted a cross-sectional study with national representative sample data (n = 2727) of residents over 65 years old in communities, and found that less physical activity and difficulties in activities of daily living (ADL) were considered significant factors related to the mental health state of the elderly [40]. Chou *et al*. [43] found that the subjects in the group frailty were significantly worse than the non-frailty subjects in terms of self-care and normal activities. Chen *et al*. [44] explored depression and active aging, as well as their influencing factors, among the elderly in the community, and found that the working elderly with "no exercise " had the highest degree of depression, and the elderly with "exercise" had the lowest degree of depression. Fang, Fang, and Fang [45] used a systematic literature review and integrated analysis to collect literature from 2004 to 2019 and examined the effects of exercise intervention on the depression of the elderly. The literature review analyzed 13 studies, and a total of 1477 subjects were grouped according to the location of inclusion in the "community", "home care", "institution", and "nursing home" for analysis, and it was found in the "community" group that the depression mental health state of the elderly in the community was significantly reduced after exercise intervention.

In addition, this study found that the average white blood cells and average CRP of the elderly were higher than normal, the blood glucose level before meals was also higher than normal, and the number of the elderly with depression accounted for a quarter of the total. These results are similar to related researches that focused on biochemical values, frailty, and mental health state. The integrated analysis study of Soysal [7] indicated that the elderly with frailty had a higher concentration 1of white blood cells in their blood; the integrated analysis study of Lindqvist [46] showed an increased CRP in patients with depression; Fried and Haslbeck [47] noted that poor blood glucose control had a higher risk of depression. These results are also similar to the study of Chiu and Du [48], meaning the higher the score of the mental health assessment, the higher the blood glucose control. In addition, the IADL of the majority of the subjects in this study was "disabled". The research of Lai *et al*. [31] compared the elderly with disabilities in institutions and communities, and the results showed that 5–6 disability items were the highest proportion among the community elderly with IADL disability items, which is similar to the findings of this study.

In addition, this study found that male elderly outpatients with frailty with moderate cognitive impairment and an elementary school education level accounted for the largest number. Lin *et al*. [28] pointed out that MMSE will be affected by education level, and it will be lower than 21 points if the education level of the subjects is elementary school, which is similar to this study. Chou *et al*. [43] found that the male elderly in the frailty group had worse depression and cognitive problems than in the non-frailty group, and a higher depression mental state was relevant to lower cognitive function. In addition, the degree of community participation by male elderly outpatients was mainly "low participation", which shows that the degree of participation of male elderly outpatients with frailty in community activities was quite low. These results are similar to those in the literature. Wu and Chen [32] pointed out that the higher the degree of community participation, the better the quality of life, and the social participation of the elderly has a significant positive influence on the social aspect of active aging ($\beta = 0.59$). Cheng and Lee [3] indicated that instead of regular participation, occasional participation in community activities will weaken the benefits of mental health promotion for the elderly. Tseng [49] pointed out that the average total score and the scores of attendance, involvement, control, and wholehearted devotion of the social participation degree scale for people with depression were all significantly lower than those for people without depression. It is reported that women are more willing to participate in health-related activities than men, and the participation rate of male elders in participating in activities is lower than that of female elders; the factors affecting male participation in

activities may include personal motivation and confidence, family support, environmental atmosphere (care units and peers), the human and venue resources of the care unit, activity methods (male elderly may prefer to walk and use equipment), leaders, and whether the activity generates expectations and a sense of pleasure [18]. Kojima *et al*. [30] stated that the elderly who live with their spouses and children are better able to arrange their lives, they are more active in their life attitudes, and the ratio of their being willing to participate in social activities or helping groups is also higher. Furthermore, social participation of the elders with better health is higher than those with poor health.

5.2 Predictability of Basic Attributes, Physical Characteristics, Cognitive Function, and Community Participation on the Mental Health State of Male Elderly Outpatients with Frailty

This study shows that the mental health of male elders with self-perceived good or normal health with frailty was better than that of those with self-perceived poor health. In addition, elderly male patients with frailty, mild disability, and mild dementia had poorer mental health than those with normal intelligence. This result is similar to the study of Wei [7] stated that domicile, marital status, income, self-perceived health status, IADL, MMSE, and community participation can significantly predict mental health status, in which the better the self-perceived health status, MMSE and social participation, the lower the depression of the male older people with frailty [50]. Chu *et al*. [8], investigated the correlation between depression and frailty in older frail adults, which found that the only factor that had a significant influence was sex; older men with depression were at a higher risk for frailty than were older women with depression. Moreover, He *et al*. [51] collected frail male elders over 65 years old as the subjects to conduct correlation analysis and regression analysis with demographic variables, self-perceived health status, disability status, and functional testing as the independent variables, and the GDS-SF15scores as the dependent variables. The results indicated that sociodemographic variables and self-perceived health status were significantly related to mental health. Lin [52] employed secondary data analysis to target people over 50 in a community from 2007 to 2009, and made household visits for data collection, in order to conduct this large-scale study on 43,103 people. The result suggested that cognitive dysfunction and decreased activities in daily lives were important factors for predicting mental health.

5.3 Limitations

Cross-sectional research was adopted for this study, and samples of male elderly outpatients with frailty over 65 years old were collected in the internal medicine clinic of a medical center in Taipei via purposive sampling, thus, these results can only reflect the current situation of a single research hospital, and cannot be inferred to other units due to different regions and hospital attributes. Even so, this study is the first one to focus on the relevance between the basic attributes, physical characteristics, cognitive function, community participation, and mental health state for male elderly outpatients with frailty in Taiwan. Thus, these research results can be used as an important basis for nursing staff to care for male elderly patients with frailty.

6. Conclusions

This study found that the physical characteristics, cognitive function, and community participation of male elderly outpatients with frailty were related to their mental health state. In particular, as the self-perceived health state and IADL can significantly predict mental health state, attention should be paid to them. Therefore, it is recommended that medical professionals, long-term caregivers, or family members actively observe and evaluate the emotional and psychological status of the frail male elderly, especially those with poor self-perceived health status and physical activity dysfunction, while interacting with them on a daily basis. Early detection of frail male elder's emotional distress will facilitate the timely provision of necessary emotional and instrumental social support to alleviate depressive moods and maintain physical and mental health and quality of life.

7. Clinical Significance

This study confirmed that physical characteristics, cognitive function, and community participation are closely related to elderly men and frailty. Nursing staff must first inquire about the self-perceived health state and self-care ability of elderly men, which can slow down the occurrence of early disability and maintain their mental health state.

Author Contributions

SFC designed this study. HCL performed collection and analysed the data. HCL, SFC, PHW, and CYK made the first draft of the manuscript and all authors contributed to editorial changes in the manuscript. All authors read and approved the final manuscript.

Ethics Approval and Consent to Participate

This study was reviewed and approved by the Institutional Review Board (IRB) of the hospital (plan number: 18MMHIS085e). To collect the samples, the researcher first obtained the consent of the doctor of the internal medicine clinic, who selected the qualified male elderly outpatients that met the requirements of this study at the time of consultation and referred them to the researcher for collection. Before collecting the data, the researcher personally explained the purpose of the research, as well as the test methods and procedures, to the male elderly outpatients, and after obtaining their consent, the consent form was filled out to conduct the research.

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Conflict of Interest

The authors declare no conflict of interest.

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