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Physical activity: A primary health quality determinant among community-dwelling geriatric women in Taiwan

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Abstract

Objective: To investigate the associations between frailty, physical activity and depression in community-dwelling geriatric women.
Design: A cross-sectional research design.
Setting: Community geriatric women in Illan County, Taiwan.
Study participants: Of note 216 participants, 65 years and older with full mobility, independent and able to communicate in Mandarin or Taiwanese Hokkien.
Main Outcome Measures: An average weekly physical activity score International Physical Activity Questionnaire-Short Form (IPAQ-SF) and Taiwan Geriatric Depression Scale. Classification and regression tree (CART) analysis was used to perform decision analysis.
Results: The average IPAQ-SF score for the 216 participants was 9109.52. When an IPAQ-SF score of 4452 or below was obtained by participants, 38% of them encountered depression-like syndromes, regardless of their frailty status. Diabetes, high risk of metabolic syndrome and lower education were the risk factors found to cause depression among participants with low physical activity levels.
Conclusions: As women have a longer life expectancy and experience twice the rates of depression of men particularly after menopause, healthcare providers should emphasize exercise and lifestyle changes in order to improve the quality of health in geriatric women.

Key words: depression, frailty, healthcare quality, geriatric women

Introduction

As of 2013, Taiwan joined many other nations in becoming one of the rapidly aging societies. Due to a sharp increase in the aging population and decline of birth rates, the elderly are estimated to surpass 35% of Taiwan's total population by 2050. As older adults lose the ability to live independently and fail to control their chronic

diseases adequately, the dependency ratio increases, resulting in elevated medical costs and increasing burdens on healthcare systems. Therefore, the quality of health can be enhanced by maintaining physical and mental health among older adults, an important issue in Taiwan [1].

Impaired functioning in daily living and low quality of life are frequent consequences of aging and decline in physical function which is also related to the quality of healthcare provided, as educating patients plays an important role. The term 'frailty' was first used in 1978 by the US Federal Council on Aging but has received increasing attention only in the past decade [2].

While higher risk of mortality is strongly associated with frailty, depression is also associated with increased mortality and the severity of somatic diseases. However, physical frailty could partly mediate among the two. Frail individuals are more likely to fall while suffering from osteoporosis. This may lead to sarcopenia and also hip fractures, thus, physical inactivity would happen because the above situations ad diseases. Moreover, frailty is associated with significantly greater risk of death especially in women [3]. Adequate physical activity training courses can offer a therapeutic intervention to prevent frailty; regular physical activity tends to reduce frailty, especially in people with higher risk for various disabilities [4–7]. These studies, however, have not taken into account that women have a longer life expectancy than men and also encounter higher rates of depression.

The quality of family relationships is strongly associated with late-life depression. It is believed Chinese elderly are well-respected and cared by their families, which reduces the depression situation. However, the depression rate might also be underestimated as traditional Chinese people are not used to expressing their feelings or health situations to others. While factors associated with depression in elderly might divert between ethnics, races and countries, the socio-demographic variables are found related to elderly depression globally. Age, gender, education status, current chronic disease and family support are well mentioned in most studies. Wada *et al.* used GDS-15 for screening depression subjects and came out with 33.8% of elderly in Indonesia, 30.3% in Japan and 17.2% in Vietnam suffered from depression. Significant lower activities of daily living and QoL scores were both mentioned as being associated with elderly depression; it is also mentioned that physical health and mild cognitive impairment are related to elderly depression among Asians [8–11].

In addition, throughout various countries including Asian countries women tend to have a lower health status than men due to gender inequality issues. Women also have frequent and abrupt changes in hormones and activities throughout their life (e.g. menstruation, pregnancy, childbirth and menopause) leading to higher rates of depression. The prevalence of depression among women over their lifetime is approximately twice that of men. During menopause, a woman's body produces fewer hormones, such as estrogen, which results in physiological and psychological effects leading to less motivation to engage in exercise or daily activity all of which ultimately lead to frailty, increased risk of osteoporosis, frailty and depression [12, 13].

Most studies have examined the relationships among frailty, physical activity and depression in older adults as well as methods to prevent frailty. However, studies focusing on physiological and psychological attributes combining to cause higher rates of depression in specific women populations are limited. Therefore, the objective of this study was to determine the factors that cause depression among geriatric women as it is common for the elderly to suffer from a variety of health-related issues which lead to depression.

Methods

Study design

A quantitative, cross-sectional design, using structured questionnaires, was used to collect the data. Participants were women, aged 65 and older, who lived in any township in Ilan County, Taiwan, had full mobility, and were independent in terms of assistance or assistive tools. Any chronic systemic diseases or psychiatric conditions were not excluded because we focused on the variety of senior female citizen. Women who could not communicate in Mandarin or Taiwanese Hokkien or who had severe hearing or visual impairments were excluded from the study.

Data collection

The geriatric women who met the sample criteria were invited physically by the researchers in a health promotion center in the community that is owned by the local municipal government. Potential participants visited the health promotion center for community activities such as nutrition education for the geriatric population. Participants were informed of the risks and benefits of the study as well as their right to withdraw from the study at any time without any consequence. Prior to conducting the research, institutional review board approval was received from the related institution. Participants filled out the questionnaire and were assessed for their health condition by a researcher in a separate quiet room in the health promotion center.

Four categories of data were collected for this study: demographics, frailty, physical activity and depression.

Demographics: These data comprised date of birth; height; weight; blood pressure; waist circumference; education level; smoking and drinking habits; and risk of diabetes, hypertension, dyslipidemia and metabolic syndrome.

Frailty: Frailty was defined according to the phenotypes developed by Fried and colleagues in their Cardiovascular Health Study [14, 15]. Frailty was assessed using the following criteria: unintentional weight loss (lost more than 10 pounds or >5% of body weight accompanied by sarcopenia with the prior year), weakness (located at lowest level of grip strength in each range of BMI), slowness (walking 15 feet in 6 min or more), low physical activity level, and self-reported exhaustion (felt everything done over the past week required great effort, measured by the Center for Epidemiological Studies Depression Scale), which are predictors of disability, incident falls, hospitalization and mortality over three to seven years. The sensitivity of these criteria was 70% and specificity was 89.2% [16].

Physical activity: The International Physical Activity Questionnaire-Short Form (IPAQ-SF) provides a means to record the time that participants spent being physically active within the prior 7 days, including the time expended in regard to work, household chores, commuting and exercising. The sensitivity of IPAQ for identifying individuals was 18.7% and specificity was 97.2%; for inactive participants the sensitivity was 74.2 % and specificity was 79.7%. Comparing among English vision and Chinese versions, the content validity indices was 0.994, the consistency values for the two versions in terms of intraclass correlation coefficient was 0.704 [17, 18]. Liou reported a test-retest reliability of 0.67 for the short-form version, which is consistent with the results obtained from studies conducted in other countries [19].

Depression: The Taiwan Geriatric Depression Scale is used to assess older adults' satisfaction with life, sense of feeling low, loss of

interest in going out, and perceptions of hopelessness. This scale registers a sensitivity of 72% and specificity of 95% [20].

Data analysis

The data collected were analyzed using SPSS, Version 19.0. The level of significance was set at 0.05 (95% confidence interval). The data were subjected to classification and regression tree (CART) analysis to identify the best predictors of community-dwelling geriatric women's depression status for decision analysis; Pearson's correlation tests were used to determine correlations.

Results

A total of 216 women served as participants. Participants revealed an average weekly physical activity score of 9109.52. CART was performed to analyze the demographics and measurements for frailty, physical activity, and depression. According to the CART analysis, using an IPAQ-SF score of 4452 as a node, when the IPAQ-SF score was 4452 or below, 38% of the participants had depression, regardless of frailty status. When the IPAQ-SF score was greater than 4452, frailty status was a significant predictor of depression. Specifically, 11.7% of the participants had frailty and depression, whereas 3.6% had depression but no frailty (Fig. 1). Diabetes and high risk of metabolic syndrome were the risk factors for depression among the participants with low physical activity levels (Table 1).

Discussion

This study was the first to examine the relationships among physical activity, frailty and depression related symptoms which influence the quality of life in geriatric women. The results may vary from those

Figure 1 CART for depression.

obtained in other studies because the sample population is different from that of previous research which included both men and women, demographics also playing a role [21]. Further, due to limited time and funding as well as limited divergence and accuracy of the data, the CART analysis generated only two branches.

In the Cardiovascular Health Study conducted by Fried and colleagues, five criteria for frailty were provided, among which weakness and slowness are the key factors that cause dissatisfaction, as well as frailty, among older adults. As noted, frailty is not an inevitable process of aging; rather, it is a dysregulation of physical function that causes the body to become increasingly susceptible to diseases [22, 23]. Previous studies have shown that frail older adults perceive a low level of health, poor memory, unstable emotions and depressive symptoms as compared to their peers with no frailty [24, 25]. When examined the associated factors for elder women depression, frailty was not significantly related to depression status ($F = 1.690$, $P = 0.209$).

It is widely believed that depression and frailty is an 'overlapping syndrome' in general for the reason that frailty and depression share 'exhaustion' as criteria from a measure of depression at outset. Elderly with depressive symptomatology who had anemia, sarcopenia/osteopenia were identified with an increased concurrent risk of frailty; with co-occurring depressive symptomatology and underweight (BMI $< 20 \, kg/m^2$), and antidepressant use increased greater risk of incident frailty [26].

Some endocrine systems of both depression and frailty have also been proposed, such as hypothalamic-pituitary-adrenal axis dysregulation of hormones, low levels of adrenal androgen dehydroepiandrosterone sulfate and insulin-like growth factor 1, and age-related depletion in testosterone [27]. The possible reason for the lack of significant correlation between depression and frailty in our study is the average BMI of participants being $24.56 \, kg/m^2$ and mildly overweight, which is not evidenced as related to elderly depression and frailty status.

CART is a machine-learning method done by fitting a simple prediction model with each partition. It is well suited to the generation of clinical decision rules unlike multivariable logistic regression, the prediction model approaches used in statistics, data mining and machine-learning. CART is an important method used to identify previously unclear patterns between different data. It can illustrate association among variables not suited to traditional regression analysis [28].

The results of this study indicated that insufficient physical activity is a significant factor for depression among geriatric women. Physical activity has been deemed a means to predict depression and cardiovascular disease as well as to contribute to the risk of death from cardiovascular disease. Further, adequate physical activity diminishes the effects of depressive symptoms and risk of stroke [29, 30]. For geriatric women who live in the community, low levels of physical activity indirectly reflect infrequent participation in community events and interpersonal interaction. Specifically, the effects of various diseases such as cardiovascular disease, stroke, obesity, diabetes and hypertension, as well as falling caused by reduced lower extremity strength, lead to reduced interpersonal interaction, which results in geriatric depression and a decrease in the quality of life [29, 31].

Increased risk of metabolic syndrome is related to the development of diabetes which was shown to be correlated with depression [32]. According to Tuomilehto *et al.*, dietary intervention, lifestyle modification, and increasing physical activity minimize the risk of metabolic syndrome as well as prevent 58% of prediabetes patients
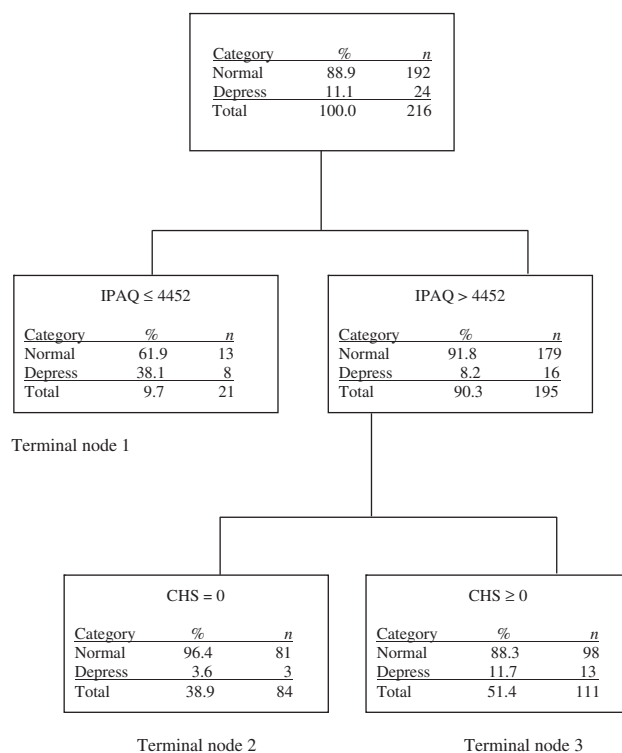
Table 1 Relationship between demographics and depression among the low-level physical activity group (IPAQ < 4452)

Demographic variable	Mean	SD	F/t/r	CI	P
Age	76.167	5.25	0.111	−6.15–4.225	0.660
Height	148.03	4.25	−0.404	−0.827–0.096	0.096
Weight	53.75	11.80	0.015	−9.779–12.704	0.954
Body mass index	24.56	5.68	0.130	−6.138–4.816	0.607
Systolic pressure	135.44	22.39	0.413	−32.839–6.147	0.088
Diastolic pressure	79.33	12.81	0.434	−18.944–3.425	0.072
Waist circumference	87.14	11.65	0.063	−11.139–10.177	0.804
Grip strength of dominant hand	16.47	5.04	−0.120	−3.722–5.639	0.634
Speed walking for 6 m	0.76	0.26	0.314	−0.327–0.210	0.607
Smoking			0.402	−0.889–0.446	0.693
Drinking			−0.239	−1.078–1.002	0.814
Type 2 diabetes mellitus			176.429	−0.670 to −0.080	<0.001**
Hypertension			0.402	−0.371–0.602	0.693
Dyslipidemia			−1.127	−0.377–0.241	0.276
Risk of metabolic syndrome	2.67	1.33	12.812	−2.205 to −0.083	0.002
Education level	0.33	0.84	0.879	−0.654–2.095	0.023*
Physical activity	3455.81	818.51	5.019	−1043.411–515.766	0.037*
Frailty status	2.76	0.831	1.690	−0.827–0.096	0.209

*$P < 0.05$ and **$P < 0.001$.

from progressing into diabetes and effectively reduce glycated hemo-globin levels in diabetic patients. Frail elderly populations will also have higher serum levels of HbA1c level which is related to insulin resistance. [11, 33]. The education level in this study also showed to have significant influence in geriatric women with less weekly activity ($F = 0.879$, $P = 0.023$). Job losses or joblessness may be associated with reduced physical activity; therefore, the education level is a protective factor and could prevent adverse health outcomes. Moreover, individuals with less education were less likely to obtain financial resources or seek for medical care [34].

This study determined that, for geriatric women living in the community, inadequate physical activity was more likely to be related to geriatric depression than was frailty. When geriatric women engage in an adequate amount of exercise, however, frailty becomes the key factor that associated with depression. Thus, to alleviate depression and depression-like symptoms in community-dwelling geriatric women, the quality of health can be improved by first educating them about the importance of regular exercises and maintaining an appropriate lifestyle. The quality of healthcare received is also an important aspect of overall health as the elderly visit hospitals, clinics, and other healthcare providing institutions more often than younger adults [35, 36].

Limitations

This study has some limitations, such as the use of a cross-sectional research design, fixed-area sampling and convenience sampling. In the future, we may be able to establish the level of physical activity among geriatric women by using simple assessment instruments and use the results to promote the importance of physical activity, particularly in regard to reducing the incidence of geriatric depression.

Conclusions

This study was the first to focus on geriatric women and to examine the relationships among physical activity, frailty, and depression using CART analysis in order to derive better healthcare quality approaches in the elderly. This study is significant due to a rapid increase in the elderly population worldwide of which women are the majority due to longer lifespan and suffer from depression twice as much as men, particularly after menopause. Moreover, previous studies showed only frailty is the primary determinant of depression, whereas, this research additionally reveals that a low level of physical activity is directly related to depression in geriatric women. Furthermore, those individuals with a low level of physical activity are also at greater risk of metabolic syndrome, those with diabetes and lower education levels are at higher risk of depression.

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