

Transtheoretical Model Approach to Explore the Factors Associated with Dementia Risk and Protection Behaviors at Agricultural Areas

Luna Chang^{1*}, Li-Ling Liao², Yi-Wen Liou³, Chao-Ying Yang⁴

¹Department of Nursing, National Tainan Junior College of Nursing, Taiwan

²Department of Health Management, I-Shou University, Taiwan

³Yujing Health Center, Taiwan

⁴Department of Nursing, Tzu Chi University of Science and Technology, Taiwan

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*For Correspondence:

Luna Chang, Department of Nursing, National Tainan Junior College of Nursing, No. 78, Sec. 2, Min-Zu Rd., Tainan 70043, Taiwan.

E-mail: cluna@ntin.edu.tw

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ABSTRACT

Dementia is an unavoidable serious problem worldwide in elderly society. This was a cross-sectional study through a community survey to estimate modifiable lifestyle factors for dementia prevention. The study subjects were conveniently sampled from five community activity centers and one primary health clinic from April to July 2018. The research tools used were the MMSE and a self-developed questionnaire (Cronbach's α , 0.73) on dementia-prevention behaviours based on the theory of behavioral change. The major finding was to identify education level (odds ratio [OR] 0.206), BMI (OR 0.23), hypertension (OR 5.12), social activities participation (OR 0.53), and degenerative joint disease (OR 7.28) as the related factors affecting brain health behavioral engagement by logistic regression analysis. The study result might be a reference for Dementia prevention through continually empowering aging population and providing accessible environments to adopt healthy life-style.

INTRODUCTION

Dementia is a chronic, progressive syndrome caused by different brain lesions and affects memory, thinking, behavior, and daily life function. Dementia affects not only the patient but also their family and other caregivers. Dementia has become the leading cause of disability in the elderly resulting in dependence on others. In most countries, the lack of awareness and understanding of dementia causes disease stigma as well as diagnostic barriers to care and has physical, psychological, and economic impacts on the family, caregivers, and society in general^[1].

The World Health Organization in 2016 (WHO)^[2] announced the 2017-2025 Draft Global Action Plan on the Public Health Response to Dementia, specifically calling for dementia to be a priority issue in public health. About 1.5 to 2% of the population in Europe is affected by dementia, which is already the 6th leading cause of death in the United States^[3] and one of the top 10 causes of death not curable by medicine. According to one epidemiological survey of dementia^[4], in 2016, 8.09% of the elderly aged over 65 had dementia-associated diseases in Taiwan. If patients under 65 are included, the total number of people with dementia in Taiwan was as high as 238,000. As the number of elderly people increases annually, the number of dementia cases will continue to grow rapidly. The Taiwanese dementia population is expected to reach 470,000 by 2030, and 860,000 by 2050.

Dementia often causes a slow decline in memory, thinking, and reasoning skills. Some people may experience changes in their ability to develop and follow a plan or work with numbers. Some individuals struggle with vocabulary, lack of orientation, withdrawal from work or activities, decreased drawing competence, decreased or poor judgment, etc. [5]. In addition to cognitive impairment, dementia often co-occurs with non-cognitive symptoms. The International Psychogeriatric Association [6] identified many behavioral and psychological symptoms associated with dementia: which include agitation, aberrant motor behavior, anxiety, elation, irritability, depression, apathy, disinhibition, delusions, hallucinations, and sleep or appetite changes [7].

Global Action Plan for Dementia

In 2016, the WHO announced the 2017-2025 Global Action Plan on the Public Health Response to Dementia [2], which aims to improve the lives of people with dementia, their caregivers, and their families while decreasing the impact of dementia on communities and countries. It provides a set of actions to achieve the vision of a world in which dementia is prevented and people with dementia and their caregivers receive the care and support they need to live with meaning and dignity. Areas for action include increasing prioritization and awareness of dementia; reducing the risk of dementia; developing earlier diagnosis, treatment, and care for the patient; support for dementia-patient caregivers; strengthening health information systems for dementia; as well as increased research and innovation. The Ministry of Health and Welfare in Taiwan [8], proposed a new version of the National Dementia Prevention Policy. It plans to complete 63 dementia care centers and 368 community service centers by 2020. In addition, it will build a diversified mental health care model with 1,000 accommodations for those with dementia and strengthen local government support for those with dementia and their caregivers.

Dementia's Modifiable Factors

In an extensive systematic literature review, modifiable risk and protective factors for dementia were discussed previously [9]. Excluding the non-modifiable factors of age, sex, and apolipoprotein E-epsilon 4 allele, identified risk factors were depression, diabetes, physical inactivity, (midlife) hypertension, coronary heart disease, renal dysfunction, and low unsaturated fat intake. In addition, modifiable factors of health behavior and lifestyle appear to have positive benefits in preventing cognitive decline, such as education attainment, psychological and emotional health, high vegetable and fruit intake, low/moderate alcohol consumption, etc. [10-12].

Podewils, pointed out that the type and amount of physical activity engagement is more important than the frequency, duration, and intensity of participation in modifying risk factors of dementia. It may be that engaging in more types of physical activity, arranging schedules, and participation require active organizational and memory processes. Regarding this, brain regions mediating these processes are negatively affected by dementia. Social factors may also indirectly impact the effectiveness of physical activity on cognitive health.

Stage of Change on Health Behavior

The primary theoretical basis for this proposed study is the Transtheoretical Model. The Transtheoretical Model of behavior change (“Stages of Change”) was first proposed by Prochaska and DiClemente [13,14] as a means of integrating the stages and processes of behavioral change. The Stages of Change are the temporal, motivational aspects of an individual's behavioral changes.



Figure 1. Stage of Change -Transtheoretical Model.

There are five distinct stages: (1) precontemplation, (2) contemplation, (3) preparation, (4) action, and (5) maintenance of change. To progress through the stages of change, people apply cognitive, affective, and evaluative processes. Ten processes of change have been identified, as shown in **Figure 1**. These processes result in strategies that help people make and maintain behavioral change.

The model was originally derived from studies conducted to compare smokers who successfully stopped smoking on their own with those involved in treatment programs. The stage-matched interventions also have successfully promoted a variety of health-promotion and protection behaviours such as exercising^[14], condom use^[15], maintaining appropriate dietary fiber and fat intake^[16], and reducing excessive alcohol consumption^[17].

Mini-Mental State Examination (MMSE)

The MMSE was developed by Folstein et al.^[18] in 1975. The items include orientation, attention, memory, language, oral comprehension, behavioral ability, and constructive ability. The assessment process was time-free with a full score of 30 points. A score below 24 indicates mild cognitive impairment, and a score below 16 indicates severe cognitive impairment. Fratiglioni et al.^[19] presented data showing that people with lower levels of education had lower scores on the MMSE, justifying the use of different cutoffs adjusted for schooling years. By applying this method, these authors achieved no diagnostic mistakes when assessing dementia cases. However, there are no standard cutoffs for the MMSE with regard to education since different studies suggested different cutoffs^[20-25].

Research Hypotheses

Multiple variables associated with risk behaviours and protection behaviours lead agricultural populations to oppose dementia prevention.

MATERIALS AND METHODS

Design and Sample

This study aimed to explore factors affecting lifestyles preventing dementia among an agricultural population. It was a cross-sectional study through a community survey to estimate risk and modifiable lifestyle factors for dementia prevention. The inclusion criteria for recruiting participants were age over 50 years, no serious vision problem, and no hearing-impairment. The study participants were conveniently sampled from five community activity centers and one primary health clinic between April to July 2018. The sample size was estimated based on a normal approximation to the binomial calculation. The expected positive result, in terms of sample size, was 97 subjects.

Measures

The research tools used were the MMSE and a self-developed questionnaire on dementia- prevention behaviours based on the theory of behavioral change. The questionnaire content included demographic information; health behavior variables of cognitive learning behavior, regular exercise, Mediterranean diet, social interaction, and lack of non-productive stress; as well as MMSE measurements.

The cognitive learning behaviours included taking classes, reading books and newspapers, playing mahjong, playing chess, writing calligraphy, gardening (planting vegetables), cooking, sewing, planning tourist trips, visiting museums, listening to concerts, etc. These activities were suggested in accordance with the instructions of National Dementia Prevention Policy in Taiwan^[8]. The criteria for coding dichotomous data was the frequency (in terms of at least once a week) with regard to engagement in the above-mentioned activities.

The stages of change for dementia prevention behaviours were divided into five levels: (Stage-1) will not change within six months, (Stage-2) will change within six months, (Stage-3) will change within one month, (Stage-4) has practiced the prevention behavior for less than half a year, and (Stage-5) has practiced the prevention behavior for more than half a year.

The questionnaire design process adopted expert content validity verification. The content validity index (CVI) value reached 0.75. In addition, five individuals were pre-interviewed to test the construct validity of the questionnaire, and then the questionnaire was revised. The semi-structured questionnaire of this study had a Cronbach's α of 0.73. The total number of valid samples was 112.

Analytical Strategy

Using the SPSS (18.0) statistical tool for quantitative data analysis, statistical methods, including Chi-square and logistic regression for inferential statistical analysis, were performed.

RESULTS

Participant Characteristics

According to the estimates, reported in **Table 1**, there were 116 participants in the study; 4 were excluded because of incomplete data, and there were 112 effective specimens: 45 men (40.18%) and 67 women (59.82%). For age distribution, 50-69-year-old participants accounted for about one fourth, and those aged 70 or above accounted for about three fourths. Education could be divided into three classes: no education, elementary school, and junior high school; 27.68% were uneducated. Most had elementary school education (40.18%) compared to 32.16% with a junior high school education.

Table 1. Characteristics of Agricultural Community Population.

Variables	N=112 n (%)
Gender	
Male	45 (40.18)
Female	67 (59.82)
Age	
50-69 years	29 (25.89)
≥ 70	83 (74.11)
Education	
None	31 (27.68)
Primary	45 (40.18)
Junior high and above	36 (32.14)
BMI	
<18.5	6 (5.36)
≤ 18.5~<24	48 (42.86)
≥ 24	58 (51.79)
MMSE	
No cognitive impairment (24-30)	66 (58.93)
Mild cognitive impairment (18-23)	25 (22.32)
Severe cognitive impairment (0-17)	21 (18.75)
Health Status	
Hypertension	49 (43.75)
Diabetes	32 (28.75)
Head trauma	21 (18.75)
Degenerative joint disease	15 (13.39)
Heart disease	10 (8.93)
Ever smoke	10 (8.93)
Health Promotion Program	
Multiple dementia prevention activity	59 (52.69)

Dancing club	15 (13.39)
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For body mass index (BMI), 6 participants (5.36%) belonged to the underweight level (BMI<18.5), 48 (42.86%) were in the ideal range (18.5~24), and over half (51.79%) indicated an overweight problem. Based on the standard patients' cognitive mental status scores^[18], 21 (19%) participants had Severe Cognitive Impairment (MMSE 0-17 points), 25 (22%) had Mild Cognitive Impairment (MMSE 18-23 points), and 66 (59%) had normal status (MMSE 24-30 points). The illness and health lifestyle estimates included hypertension, diabetes, degenerative joint diseases, heart disease, head trauma, smoking behavior, etc. The results showed that the prevalence rates of hypertension and diabetes were very high, reaching 43.75% and 28.75%, respectively. Twenty-one individuals reported head trauma, such as falling down, falling from trees, injury from farming, and car accidents. Fifteen (13.39%) had degenerative joint disease, and 10 had consumed tobacco in their life-time. In addition, 59 (52.69%) individuals participated in a short-term Multiple Dementia Prevention program, and 15 (13.39%) joined a dance club.

Factors Associated with Cognitive Learning Behavior for Dementia Prevention

The behaviours to establish brain health include taking classes, reading books and newspapers, playing mahjong, playing chess, writing calligraphy, gardening (planting vegetables), cooking, sewing, planning tourism, visiting museums, as well as listening to concerts. The dementia prevention behaviours survey shown in **Table 2** indicated that 80.36%~93.69% of individuals adopted the lifestyle behaviours of (a) cognitive learning activity, (b) regular physical activity, (c) social interaction, (d) Mediterranean diet, (e) weight control, (f) transportation with a helmet, and (g) practiced relieving stress. The proportions described above belonged to the “action” and “maintaining stages” of behavioral change.

Table 2. Health Behavior for Dementia Prevention. Note: Pre-contemplation: PC; Contemplation: CO; Preparation: PR; Action: AC; Maintenance: MA.

Variables	n (%) p	Chi-square
Cognitive Learning Activities		
PC*	18 (16.07)	n=112
CO	2 (1.79)	<0.001
PR	1 (0.89)	
AC	9 (8.04)	
MA	82 (73.21)	
Physical Activity		
PC	14 (12.50)	n=112
CO	0 (0)	<0.001
PR	4 (3.57)	
AC	5 (4.46)	
MA	89 (79.46)	
Mediterranean Diet		
PC	21 (18.75)	n=112
CO	1 (0.89)	<0.001
PR	0 (0)	
AC	2 (1.79)	
MA	88 (78.57)	
Social Interaction		

PC	17 (15.18)	n=112
CO	0 (0)	<0.001
PR	1 (0.89)	
AC	5 (4.46)	
MA	89 (79.46)	
Weight Control		
PC	14 (12.50)	n=112
CO	2 (1.79)	<0.001
PR	6 (5.36)	
AC	2 (1.79)	
MA	88 (79.57)	
Transportation with Helmet		
PC	5 (5.26)	n=95
CO	1 (1.05)	<0.001
PR	0 (0)	
AC	2 (2.11)	
MA	87 (91.58)	
Relieve Stress		
PC	19 (16.96)	n=112
CO	1 (0.89)	<0.001
PR	1 (0.89)	
AC	2 (1.79)	
MA	89 (79.46)	

In **Table 3**, through the logistic regression analysis method, the result pointed out five variables impacted the performance of cognitive learning behavior which reached statistical significance (P=0.021). Logistic regression analysis identified education level (odds ratio [OR] 0.206, 95% confidence interval [CI] 0.71-0.06), BMI (OR 0.23, 95% CI 0.081-0.07), hypertension (OR 5.12, 95% CI 25.43-1.03), social activities participation (OR 0.53, 95% CI 0.77-0.36), and bone and joint disease (OR 7.28, 95% CI 44.76-1.19) as the related factors affecting cognitive health behavioral engagement and change. In **Table 3**, it was indicated that different reference categories were used to measure the association with significant values, particularly when the stage of 5 people was compared to the stage of 1~4 people, and the stage of 2~5 people was compared to the stage of 1 group.

Table 3. Factors Associated with Cognitive Learning Behavior by Logistic Regression. Note: *P ≤ 0.05; **P ≤ 0.01; ***P ≤ 0.001.

Variables	OR	P	OR	P
	(reference level 5)		(reference levels 5, 4, 3, 2)	
Age	0.961 (1.060~0.872)	0.428	1.019 (1.159~0.896)	0.771
Education	0.206 (0.712~0.060)	0.013**	0.809 (2.438~0.268)	0.706
Sex	4.155 (22.958~0.752)	0.102	0.624 (4.768~0.082)	0.649

Body Mass Index	0.228 (0.805~0.065)	0.022*	0.633 (3.000~0.134)	0.565
Hypertension	5.116 (25.428~1.029)	0.046*	1.255 (6.435~0.245)	0.785
Diabetes	0.916 (4.569~0.184)	0.915	0.469 (3.784~0.058)	0.478
Degenerative joint disease	2.189 (20.143~0.238)	0.489	7.282 (44.756~1.185)	0.032*
Head collision	0.523 (3.378~0.081)	0.496	1.218 (7.977~0.186)	0.837
Physical activity	1.067 (1.704~0.668)	0.787	1.180 (2.326~0.599)	0.632
Mediterranean diet	0.7 (1.175~0.418)	0.177	0.831 (1.434~0.482)	0.506
Social activities participation	0.529 (0.774~0.361)	0.001***	1.125 (2.213~0.572)	0.734
Relieve stress	0.457 (2.146~0.097)	0.321	0.881 (6.170~0.126)	0.899

DISCUSSION

Barriers to Establishing Cognitive Learning Behaviours

Health Status: The study pointed out some health variables, such as BMI, hypertension, and arthritis, which have become barriers that cause rural populations to hesitate when it comes to engaging in protective behaviours for dementia prevention. The study subjects, who suffered from high blood pressure, obesity, and degenerative joint disease, were most unwilling to participate in activities that enhanced brain health in the agriculturally dominant community. Degenerative joint disease limited individuals' ability to engage in some activities. Although, these individuals did not engage in much protective behaviours, the health care system might provide more empowerment environment to increase their awareness with regard to preventing dementia.

Aging and Low Education Experience: Using the MMSE tool, 18.75% of the study subjects were estimated to have Severe Cognitive Impairment status in this rural area. 74.11% of the study targets were aged 70 years and above; in additions, 67.86% of them were low education experience or none-literature. In this agriculture area, the populations are particularly high risk for developing the illness of dementia depending on the demographic factors of age and education. As aging population growing up speedily, it is important to prevent the dementia disease effectively for elderly with low educational experience.

Building Healthy Diet and Stress-Relief Lifestyle

This study used “behavioral change theory” to investigate the modifiable health behaviours associated with dementia prevention that community members are currently adopting. It was found that up to 83%-93% of participants tended to use helmets during transit, engage in physical activity, and maintain social interaction lifestyles. However, 16.07% to 18.75% of individuals were still undergoing to the Pre-contemplation stage of the study, which targeted the acquisition of a Mediterranean diet, stress relief, and cognitive learning activities. People in the agricultural area tended to prefer strong tastes and were less willing to follow a light diet.

In addition, nearly 20% of the elderly did not adopt stress relief methods to avoid stress. Rural populations did not value stress relief methods such as exercise, positive thinking, talking with friends, traveling, and gardening. Kivipelto and Solomon's^[26] research showed that depression and dementia are related. Therefore, ways to avoid depressive moods and the concept of early treatment when depression occurs should be promoted further.

Enhance Social Activities Participation

In the present study, the social activity participation factor was assigned a lot of importance when it was associated with engagement in protective behaviours for dementia prevention. Some researchers, such as Deckers et al.^[9], discussed the limitations of community health promotion programs with regard to Dementia. Most of the programs were usually implemented for short-term periods (3 months). The participants lacked support in terms of their progress, actions carried out, and maintaining stages of behavioral change. However, how can we enhance the rural populations' participation in social activities to receive social network supports and well partnerships? In this present study, some individuals (13.39%) organized a dancing club; they practiced once weekly and held a competition annually. Regularly

engaging in a healthy activity to promote social activity participation might be an effective strategy for preventing dementia^[27-29].

CONCLUSION

The present study determined the factors that influenced engagement in cognitive learning behaviours in order to prevent dementia. The present study suggests that decreasing barriers by controlling of illnesses and health problems as well as building protective behaviours, including following a healthy diet, engaging in stress relief, and expanding social activity participation, can prove beneficial for dementia prevention. Primary health centers can provide more health information to increase awareness with regard to dementia prevention. This study's results could thus be a reference for dementia prevention in agricultural communities.

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