Research Article

Predictive Factors associated with Death of Elderly in Nursing Homes

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SUMMARY

Purpose: An increasing elderly population reflects a great need for readily accessible, clinically useful methods to identify mortality-related factors in nursing home residents. The purpose of this study was to identify factors associated with the deaths of nursing home residents.
Methods: Data was collected from a Minimal Data Set of 195 elderly nursing home residents, followed by analysis of demographic factors, disease and nursing condition factors, Activities of Daily Living (ADL), cognitive function, behavioral patterns, and dysfunctional status.
Results: Major factors associated with death among nursing home residents were identified as dyspnea (odds ratio [OR] = 4.88), problematic behaviors (OR = 3.95), and ADL (OR = 3.61). These variables accounted for 31.1% of the variance in death.
Conclusion: Dyspnea, problematic behaviors, and ADL data were identified as the key factors associated with death among nursing home residents. Future plans for the prediction of death among nursing home residents can be made by nursing staff, factoring in these identified variables, to ensure more comfortable conditions and more responsive care.

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Introduction

The proportion of elderly people in South Korea has been increasing rapidly. About 11.0% of the overall population is currently over 65 years of age, and this is expected to increase to 14.3% by 2018 (Statistics Korea, 2011). In addition, the growing number of nursing homes reflects this change in the elderly population of South Korea. Care and nursing of the elderly has been raised as an important social issue in light of population aging, the surge in chronic degenerative diseases following an increase in mean life expectancy, and the change of family structure in South Korea. The government has implemented a nationwide long-term care insurance policy since July 1st, 2008, in order to reduce the increasing social burden of caring for the elderly, and to prepare for an aging society. The requirements for receivers of long-term care include the following: that they be over 65 years old, have significant disabilities in administering self-care, have geriatric diseases, and have difficulty in activities of daily living (ADL) over the past 6 months. Among these, elderly persons evaluated as first grade (extremely severe) and second grade (severe) under the caring grade classification board according to need for care and for mental

and physical status, can use nursing homes for the elderly, which provide medical service (National Health Insurance Corporation, 2008).

Recently, there has been a nationwide trend with nursing homes, which is that the homes that care for the elderly in severe situations are rapidly increasing in numbers. In 2012, a total of 4,243 facilities were available (National Health Insurance Corporation, 2012). The Korean National Statistics Office reported that the number of residents in geriatric nursing homes was 28,060, and the number of deaths was 2,171. Thus, the incidence of death was 7.74% (Statistics Korea, 2007). Nursing home stays for the elderly have become more common worldwide. In Norway, almost 90% of residents lodge in nursing homes until they pass away, with 40% of all deaths occurring in nursing homes (Koch, Eriksen, Elstrøm, Aavitsland, & Harthug, 2009).

The number of elderly persons who die in geriatric nursing homes will increase in line with the rapid increase in the number of nursing homes in South Korea. As such, this study recognizes that prediction of resident risk of death in these facilities is crucial.

Evaluation methods for the survival duration of geriatric nursing home residents are complex. Generally, the most common cause of death in the geriatric population over 65 in South Korea is cancer, followed by cerebrovascular disease, cardiac disease, respiratory system disease, and diabetes (Statistics Korea, 2010). This presents a similar trend to the causes of death per 100,000 persons in Organization for Economic Cooperation and Development countries, where

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the most common cause is cardiovascular disease, followed by neoplasm, respiratory system disease, and digestive system disease (Organization for Economic Cooperation and Development, 2012). Other factors, excluding disease, in predictive evaluation regarding cause of death include age, sex (Barba et al., 2009; Koch et al., 2009; Lee, Chau, Hui, Chan, & Woo, 2009), physical and cognitive functional disorder (Lee et al., 2009; Mattison, Rudolph, Kiely, & Marcantonio, 2006; van Dijk et al., 2005), weight loss and low body mass index (Kaiser et al., 2010; Kimyagarov et al., 2009), and high blood pressure (Barba et al.; Satish, Freeman, Ray, & Goodwin, 2001). In addition, there are various predictive factors by time point. While individual chronic diseases such as diabetes, cardiac failure, chronic pulmonary disease, and renal failure are important factors for predicting the first year death rate, the fifth year death rate is more likely to be associated with cognitive and physical disorders rather than the presence of a specific disease (Lee et al.; Mattison et al.; van Dijk et al.). As factors for evaluation usually include a combination of geriatric diseases, and not a specific disease (Kiely & Flacker, 2000; Ravaglia et al., 2008), evaluation of predictive factors for geriatric nursing home resident deaths, is complex.

In a nursing setting, prediction of death is clinically useful and valuable. Predictive factors for nursing home resident deaths may help healthcare professionals inform residents and caregivers of remaining life expectancy, and consequently, provide long-term nursing plans according to expected hospitalization periods. Early intervention in a disease may reduce the incidence of death at an early stage and provide death-related information to healthcare professionals by identifying risk factors for death. The most important thing is that the prediction of death helps healthcare professionals be prepared for future needs in a clinical nursing setting (Flacker & Kiely, 2003).

Some countries evaluate prediction studies of death by type and duration of disease (Ahmed et al., 2010; Barba et al., 2009; Koch et al., 2009; Lee et al., 2009) in order to develop various health-care plans for those who become too old and weak. We see that dyspnea is the most common symptom in the last period of life in geriatric nursing homes in other countries. The primary causes of death are cardiac arrest (26.7%) and pneumonia (33.3%) (Goodridge, Bond, Cameron, & McKean, 2005). Recently, most studies regarding predictions of death in geriatric nursing homes have used the Minimum Data Set (MDS) which includes most nursing factors (Flacker & Kiely, 2003; Lee et al.; van Dijk et al., 2005). Van Dijk et al. reported in the study that lower ADL scores, aged 85 years and over, and the male gender are associated with a higher death rate within 1 year, using MDS evaluation tools. Lee et al. reported that elderly persons with lower ADL scores, cognitive functional disorder, and end stage diseases are likely to survive in the short term, and death rate within 5 years was 54.2%.

Several studies using MDS in geriatric nursing home residents including a study regarding cognitive behavioral disorder and mental health problems (Kim, Jung, & Lee, 2009) and a study regarding the comparison of cognitive function and grade of patients in long-term nursing has been reported (Kim, Jung, Lee, Cho, & Yoo, 2010). However, studies regarding predictive factors for geriatric nursing home resident deaths have rarely been reported.

In the future, the number of elderly who die in geriatric nursing homes will increase, in line with the rapid increase in the need for such facilities. This study was conducted to provide basic evidence for future nursing planning by identifying predictive factors for nursing home resident deaths.

Purpose

This study was designed to identify the predictive factors for nursing home resident deaths among those who entered such

facilities between July 2008 and June 2012. The detailed objectives were as follows: (a) To compare surviving and deceased groups according to demographic characteristics, disease characteristics, and nursing status; (b) to compare surviving and deceased groups according to ADL, cognitive function, problematic behaviors, and rehabilitation status; (c) to identify predictive factors associated with geriatric nursing home resident deaths.

Methods

Study design

This was a descriptive study using a retrospective review of secondary data from MDS in geriatric nursing homes for long-term care between July 2008 and June 2012.

Setting and sample

Samples were randomly selected from a list of geriatric nursing homes with at least 30 residents in city D. A total of 63 facilities including at least 30 residents, that were located in city D, were assigned identification numbers. The identification numbers were randomly assigned. Subsequently, six nursing homes were selected considering their total case number after excluding those managed by specific religious foundations and those including female residents only.

The participants comprised men and women over 65 years of age, who had entered the above geriatric facilities at the beginning of the study in July 2008. Participants whose "status of residents for long-term care evaluation table" data were at least 50% lost were excluded. Termination of the study was June 2012.

Analysis of the results regarding the status of long-term care residents was performed by reviewing the evaluation table data. Some evaluation tables were completed on-site by two nurses who had over 5 years of experience and were pretrained regarding the proper methods of review and filling out of the table.

The number of cases was at 195 in six facilities. This was based on a calculated sample size of 194 when the significant variables were medium survival analysis effects (Chow, Shao, & Wang, 2008).

Ethical consideration

Data collection methods for this study were reviewed by the Daegu Catholic University Medical Center Institutional Review Board (IRB: CR-12-081-RES-001-R) to guarantee ethical access to participant management. Official documents with the IRB review results were then sent for approval from the heads of the selected facilities in order to obtain support from those institutions for data co-collection.

All information collected was treated confidentially and anonymously. All participants were assured that the information would never be used for any other purposes. A letter was drafted, providing information about the study and explaining the rights of participants. This letter was distributed to the participants, and the rights reiterated verbally before data collection. All participants agreed to informed consent.

Measurement

The range of Korean MDS evaluation in the table for evaluating the status of residents for long-term care (Ministry of Health and Welfare & National Health Insurance Corporation, 2007) is classified by demographics and need for long-term care. The demographics include demographic information on residents. Need for long-term care comprises physical capabilities (basic capabilities

for ADL), social function (instrumental function for daily living), cognitive function, behavioral changes, nursing care, rehabilitation, sight and hearing capabilities, and diseases and symptoms. While the table was revised in 2010, this study was based on the 2007 table.

This study used 64 items in 6 parts in the long-term care evaluation table: diseases and symptoms (12 items), nursing care (9 items), ADL (12 items), cognitive function (7 items), behavioral changes (14 items), and rehabilitation (10 items). Items in each part were evaluated through a goodness of fit test using Winsteps software 3.70 (Winsteps Inc., Chicago, IL, USA). Goodness of fit is the index of in fit and outfit among items showing a difference between the expected value and the response actually selected by a responder. If the goodness of fit score of an item is within a range of 0.70–1.30, the item is referred to as appropriate (Chi, 2001). The results of analysis regarding goodness of fit for all parts, including diseases and symptoms, nursing care, ADL, cognitive function, behavioral changes, and rehabilitation showed that the goodness of fit for all items score was within 0.70 and 1.30. Thus, all were considered appropriate. Korean MDS evaluation items were tested in several previous studies (Kim et al., 2009; Kim et al., 2010), and the test results indicated their fitness.

Diseases and symptoms

Diseases and symptoms include those items concerning diseases and symptoms. There were 12 items in all, including dementia, stroke, hypertension, diabetes mellitus, arthritis, lower back pain and sciatic pain, dyspnea, hearing loss, visual disturbance such as cataracts and glaucoma, sequelae of accidents such as fractures and dislocations, cancer, and other diseases and symptoms. Score indicates the presence of each item. If any diseases or symptoms are found, the score is 1. A score of 0 represents no diseases or symptoms.

Nursing care

Nursing care is the professional and technical intervention of a nurse or intervention under the supervision of a nurse, and comprises 9 items including tracheostomy care, aspiration care, oxidization therapy, care for pressure sores, tube feeding, care for cancer pain, insertion of urinary catheters, ostomy care, and dialysis care. Score indicates the presence of each item. If any intervention occurs, the score is 1. A score of 0 represents no intervention.

ADL

ADL evaluates the self-care capability of elderly persons and includes 12 items such as dressing and undressing, washing the face, brushing teeth, taking a bath, eating meals, changing position, sitting up, moving and sitting, moving out of the room, using the toilet, control of defecation, and control of urination. All items are scored 0 for complete self-care, 1 for partial self-care requiring help, and 2 for complete dependence on another person's help. The total score range is 0–24. A higher score means that a participant needs more help in ADL and the self-care capability of the participant is low. Participants were classified into three classes using a percentage of the total score (Agresti, 2002): 0–8 point group, 9–16 point group, and 17–24 point group.

Cognitive function

Cognitive function measures cognitive capability and comprises 7 items, including short-term memory disorder, failure of date recognition, inconsistencies between birth date and aging, attention and calculation disorder, failure of instruction recognition, decreased judgment on situations, and communication disorder. In each item, a score of 1 means the presence of a symptom and 0 means no symptoms. The total score range is 0–7. A higher score

represents a more severe cognitive function disorder than the lower score counterparts. Participants were classified into two classes using total cognitive score percentage (Agresti, 2002): 0–3 point group and 4–7 point group.

Problematic behavior

Problematic behavior measures behavioral patterns and includes 14 items, such as delusions, hallucinations or auditory hallucinations, sadness, irregular sleep or confusion between day and nighttime, resistance to help, hanging around or nervousness, losing one's way, violent language or threatening behavior, eagerness to go out, breaking things, meaningless or inappropriate behavior, hiding money or items, wearing inappropriate clothes, and unclean behavior such as defecation or urination. All items are scored 1 for the presence of symptoms and 0 for no symptoms. The total score range is 0–14. A higher score means that a participant has many behavioral problems. Participants were classified into three classes using total score percentage (Agresti, 2002): 0–4 point group, 5–9 point groups, and 10–14 point groups.

Dysfunction

Dysfunction measures the level of movement disorder and limitations of articular movement. Level of movement disorder includes four items: left and right upper limbs, and left and right lower limbs. The level of limitation for articular movement comprises six items, including shoulders, elbows, wrists and hand digits, hip joints, knees, and ankles. The level of movement disorder is scored as 2 for complete movement disorder, 1 for incomplete disorder, and 0 for no disorder. The total score range is 0–8. The level of limitation for articular movement is scored as 2 for bilateral limitation, 1 for unilateral limitation, and 0 for no limitation. The total score range is 0–12. A higher score means that a participant needs more rehabilitation. Participants were classified into two classes using movement disorder total score percentage (Agresti, 2002): 0–4 point group and 5–8 point group. In addition, participants were also classified into three classes using articular movement limitation total score percentage: 0–4 point group, 5–8 point group, and 9–12 point group.

Identification of death

Death that occurred between July 2008 and June 2012 in the data accompanied by a physician's death certificate was clearly identified as death. Survival period was defined as the period from July 2008 until death.

Data analysis

Sets of *t* tests and chi-square tests were used to compare the surviving group and deceased group. The odds ratio (OR) and a 95% confidence interval (CI) to identify factors affecting death in older adult staying nursing homes were used.

Results

Demographic characteristics of participants

Participants comprised 46 males (23.6%) and 149 females (76.4%) with a mean age of 81.59 years ($SD = 7.66$). The participants' levels of education included "never received public education" ($n = 114$, 58.5%), "graduated from elementary school" ($n = 50$, 25.6%), and "graduated from middle school or above" ($n = 31$, 15.9%). The number of participants proclaiming religion was 118 (60.5%) with 39.5% of participants ($n = 77$) having no religion.

No demographic characteristics showed any statistically significant difference between the surviving and deceased groups (Table 1).

Comparison of diseases and symptoms between surviving and deceased groups

In comparing disease and symptoms status, including strokes, hypertension, diabetes, arthritis, lower back pain, dyspnea, hearing loss, sequelae of an accident, cancer, and other illnesses between the surviving and deceased groups, the presence of dyspnea ($\chi^2 = 15.96$, $p < .001$) and cancer ($\chi^2 = 7.81$, $p = .005$) exhibited a statistically significant difference. The deceased group showed a higher frequency of the dyspnea and cancer subgroups compared to the surviving group (Table 2).

Comparison of nursing care between surviving and deceased groups

In comparing nursing care, including tracheostomy, aspiration, oxidization therapy, care for pressure sores, tube feeding, care for cancer pain, insertion of urinary catheters, ostomy, and dialysis between the surviving and deceased groups, aspiration ($\chi^2 = 7.81$, $p = .005$) and oxidization therapy ($\chi^2 = 11.41$, $p = .001$) exhibited a statistically significant difference.

The deceased group showed a higher frequency of aspiration and oxidization therapy subgroups compared to the surviving group (Table 3).

Comparison of survival risk between the surviving and deceased groups

In comparing ADL, cognitive function, problematic behaviors, and articular movement disorder between the surviving and deceased groups, ADL ($\chi^2 = 8.86$, $p = .012$), behavioral changes ($\chi^2 = 8.58$, $p = .014$), and articular movement disorder ($\chi^2 = 5.52$, $p = .019$) exhibited a statistically significant difference.

The deceased group showed a lower frequency of the 17–24 score group in ADL, the 10–14 score group in problematic behaviors, and the 5–8 score group in articular movement disorder (Table 4).

Predictive factors associated with death

Analysis was performed using multiple logistic regression to identify predictive factors associated with participant deaths. Results from multiple logistic regression and independent variables as factors showed statistical significance in comparison to using chi-square test between the surviving and deceased groups (presence of dyspnea, presence of cancer, history of aspiration, history of

oxidization therapy, ADL, problematic behaviors, and articular movement) in identifying prediction factors associated with death as presented in Table 5.

This model was found appropriate ($\chi^2 = 49.12$, $p < .001$). Dyspnea (OR = 4.88, $p = .001$, 95% CI [1.92, 12.34]), the 5–9 score group in problematic behaviors (OR = 3.95, $p = .015$, 95% CI [1.30, 11.93]), the 9–16 score group in ADL (OR = 3.61, $p = .014$, 95% CI [1.29, 10.08]), and the 17–24 score group in ADL (OR = 3.22, $p = .004$, 95% CI [1.44, 7.16]) were considered predictive factors of death. These variables could characterize 31.1% of the total number of deaths of elderly persons in nursing homes.

Discussion

The purpose of this study was to identify factors associated with the death of nursing home residents. This study's objective was to identify predictive factors for nursing home resident deaths. Death incidence over a 4-year period was 32.3%, and the mean incidence for 1-year was 8.08% in this study. This result was slightly higher than the death incidence of elderly persons in nursing homes reported by the National Statistics Office in 2007 (7.74%) (Statistics Korea, 2007). In a 5-year follow-up study of 273 dementia patients living at geriatric nursing homes in Hong Kong, Lee et al. (2009) reported that it took an average of 6.42 years for 50% of facility residents to die after being admitted. Time until death after admission is difficult to predict according to type of disease and facility environmental factors. The higher death incidence in this study may be due to a higher frequency of elderly persons with strokes, hypertension, and diabetes than for those included in the study by Lee et al. Kwon, Lee, Han, and Park (2008) reported that 98.0%, 32.3%, and 25.6% of recipients were afflicted with 1, 2, and 3 or more chronic diseases including strokes, hypertension, arthritis, and dementia, which usually required continuous medical management.

Predictive factors associated with death in this study were the presence of dyspnea, problematic behaviors, and ADL. Among these, risk of dyspnea was the highest, followed by problematic behaviors, and ADL. The risk of dyspnea in this study was 4.88. The above results supported the results of Goodridge et al. (2005) in reporting that dyspnea was the most common symptom at the last stage of life and the primary causes of death were cardiac arrest (26.7%) and pneumonia (33.3%). Ahmed et al. (2010) reported that the most important and independent predictive factor of death incidence in hospitalized patients was acute respiratory failure (hazard ratio 7.11) with a much higher hazard ratio than septicemia (3.91) and acute renal failure (2.75). Respiratory disorders in nursing home residents were a predictive factor for death and should be subject to immediate nursing care. Nurses working in geriatric nursing homes should thus be trained in nursing

Table 1 *Baseline Demographic Characteristics of Participants Comparing Surviving Group with Deceased Group (N = 195).*

Category		Total (N = 195)	Surviving (n = 132)	Deceased (n = 63)	χ^2 (p) or t (p)
		n (%)	n (%)	n (%)	
Gender	Men	46 (23.6)	29 (22.0)	17 (27.0)	0.59 (.441)
	Women	149 (76.4)	103 (78.0)	46 (73.0)	
Age (yr)	65–74	34 (17.5)	26 (19.7)	8 (12.7)	1.54 (.674)
	75–79	40 (20.5)	27 (20.5)	13 (20.6)	
	80–84	50 (25.6)	33 (25.0)	17 (27.0)	
	≥ 85	71 (36.4)	46 (34.8)	25 (39.7)	
	M ± SD	81.59 ± 7.66	81.08 ± 7.97	82.67 ± 6.92	−1.35 (.178)
Level of education	Illiteracy	114 (58.5)	79 (59.8)	35 (55.6)	1.57 (.456)
	Elementary	50 (25.6)	35 (26.5)	15 (23.8)	
	≥ Middle school	31 (15.9)	18 (13.6)	13 (20.6)	
Religion	Have	118 (60.5)	84 (63.6)	34 (54.0)	1.67 (.196)
	Have not	77 (39.5)	48 (36.4)	29 (46.0)	

Table 2 *Baseline Diseases and Symptoms Comparing Surviving Group with Deceased Group (N = 195).*

Category		Surviving (n = 132)	Deceased (n = 63)	χ^2 (p)
		n (%)	n (%)	
Dementia	No	59 (44.7)	37 (58.7)	3.36 (.067)
	Yes	73 (55.3)	26 (41.3)	
Stroke	No	88 (66.7)	40 (63.5)	0.19 (.662)
	Yes	44 (33.3)	23 (36.5)	
Hypertension	No	57 (43.2)	31 (49.2)	0.63 (.429)
	Yes	75 (56.8)	32 (50.8)	
Diabetes mellitus	No	87 (65.9)	48 (76.2)	2.12 (.146)
	Yes	45 (34.1)	15 (23.8)	
Arthritis (degenerative, rheumatic)	No	101 (76.5)	52 (82.5)	0.92 (.339)
	Yes	31 (23.5)	11 (17.5)	
Low back pain	No	110 (83.3)	55 (87.3)	0.52 (.473)
	Yes	22 (16.7)	8 (12.7)	
Dyspnea (heart failure, COPD, asthma)	No	120 (90.9)	43 (68.3)	15.96 (< .001)
	Yes	12 (9.1)	20 (31.7)	
Hearing loss	No	118 (89.4)	54 (85.7)	0.56 (.456)
	Yes	14 (10.6)	9 (14.3)	
Visual disturbance (cataract, glaucoma, etc.)	No	122 (92.4)	58 (92.1)	0.01 (.930)
	Yes	10 (7.6)	5 (7.9)	
Sequelae (fracture, dislocation, etc.)	No	108 (81.8)	56 (88.9)	1.60 (.207)
	Yes	24 (18.2)	7 (11.1)	
Cancer	No	124 (93.9)	51 (81.0)	7.81 (.005)
	Yes	8 (6.1)	12 (19.0)	

Note. COPD = chronic obstructive pulmonary disease.

principles and clinical guidelines related to dyspnea, to effectively respond to those situations.

The second predictive factor associated with death in this study was problematic behavior, with the risk being 3.95. Problematic behaviors of residents in facilities include delusions, hallucinations or auditory hallucinations, sadness, irregular sleep or confusion of day and nighttime, resistance to help, hanging around or nervousness, losing one's way, and violent language or threat behavior. Although this study did not investigate which specific behavior showed a higher incidence, the incidence of problematic behaviors was lower in the surviving group than the deceased group. Considering that residents in facilities took a mean of six types of medications, and over a third of the residents took

Table 3 *Baseline Nursing Care Comparing Surviving Group with Deceased Group (N = 195).*

Category		Surviving (n = 132)	Deceased (n = 63)	χ^2 (p)
		n (%)	n (%)	
Tracheostomy care	No	123 (93.2)	4 (85.7)	2.84 (.092)
	Yes	9 (6.8)	9 (14.3)	
Aspiration care	No	124 (93.9)	51 (81.0)	7.81 (.005)
	Yes	8 (6.1)	12 (19.0)	
Oxidization therapy	No	123 (93.2)	48 (76.2)	11.41 (.001)
	Yes	9 (6.8)	15 (23.8)	
Care for pressure sores	No	113 (86.3)	50 (79.4)	1.51 (.220)
	Yes	18 (13.7)	13 (20.6)	
Tube feeding	No	116 (87.9)	51 (81.0)	1.66 (.197)
	Yes	16 (12.1)	12 (19.0)	
Care for cancer pain	No	121 (91.7)	54 (85.7)	1.64 (.200)
	Yes	11 (8.3)	9 (14.3)	
Insertion of urinary catheters	No	108 (81.8)	52 (82.5)	0.02 (.902)
	Yes	24 (18.2)	11 (17.5)	
Ostomy care	No	128 (97.0)	61 (96.8)	0.01 (.956)
	Yes	4 (3.0)	2 (3.2)	
Dialysis care	No	128 (97.0)	59 (93.7)	1.19 (.275)
	Yes	4 (3.0)	4 (6.3)	

Table 4 *Baseline Survival Risk Variables Comparing Surviving with Deceased Group (N = 195).*

Category		Surviving (n = 132)	Deceased (n = 63)	χ^2 (p)
		n (%)	n (%)	
ADL score	0−8	35 (26.5)	10 (15.9)	8.86 (.012)
	9−16	62 (47.0)	23 (36.5)	
	17−24	35 (26.5)	30 (47.6)	
Cognitive function score	0−3	48 (36.4)	23 (36.5)	0.01 (.984)
	4−7	83 (63.6)	40 (63.5)	
Problematic behaviors score	0−4	79 (59.8)	24 (38.1)	8.58 (.014)
	5−9	39 (29.5)	31 (49.2)	
	10−14	14 (10.6)	8 (12.7)	
Dysfunction in ROM score	0−4	108 (81.8)	42 (66.7)	5.52 (.019)
	5−8	24 (18.2)	21 (33.3)	
Dysfunction in joint score	0−4	79 (59.8)	29 (46.0)	3.30 (.192)
	5−8	31 (23.5)	20 (31.7)	
	9−12	22 (16.7)	14 (22.2)	

Note. ADL = activities of daily living; ROM = range of motion.

psychiatric medications (Park, Cho, Lee, & Seo, 2011), it is understood that psychiatric medicines were prescribed to control problematic behaviors. Kim et al. (2009) reported that the incidence of problematic behaviors such as meaningless or inappropriate behavior, losing one's way, and depression was higher in facility residents than residents of standard hospitals.

The deceased participants were older, more poorly educated, had a lower Mini Mental State Examination score as an index of cognitive function, showed a more severe exacerbation of dementia as evaluated by Global Deterioration Scale, and had more history of cerebrovascular diseases than the survivors did in the Lee et al. (2009) study investigating death incidence, mortality, and prediction factors in dementia patients. As the elderly exhibit various diseases, symptoms, and examination findings, objective evaluation of prediction factors associated with death is very difficult to achieve. Recent reports spanning several years showed that chronic diseases and functional disorders in elderly persons were effective prediction variables (Lee et al.).

The third predictive factor associated with death in this study involved ADL, with a risk of 3.61. MDS measuring the physical, cognitive, and functional status of elderly persons in geriatric nursing homes predicts mortality and clinical risk (Lee et al., 2009; van Dijk et al., 2005). Finne-Soveri and Tilvis (1998) reported that MDS evaluation showed 29% sensitivity and 89% specificity to predict signs of end-stage disease, and showed 47% positive prediction in prediction of death within 6 months. These results identified that ADL for elderly persons is the most common index for evaluating activities and chronic disease and an important measure for predicting mortality and clinical risk. Thus, nurses in

Table 5 *Predictive Factors Associated with Death.*

Variables	OR	p	CI (95%) Lower	CI (95%) Upper
Dyspnea (no vs. yes)	4.88	.001	1.92	12.34
Care for cancer pain (no vs. yes)	2.14	.165	0.72	6.21
Aspiration care (no vs. yes)	1.69	.465	0.41	6.88
Oxidization therapy (no vs. yes)	1.86	.336	0.52	6.62
ADL (0−8 vs. 9−16)	3.61	.014	1.29	10.08
ADL (9−16 vs. 17−24)	3.22	.004	1.44	7.16
Problematic behaviors (0−4 vs. 5−9)	3.95	.015	1.30	11.93
Problematic behaviors (5−9 vs. 10−14)	1.29	.648	0.43	3.78
ROM (0−4 vs. 5−8)	1.99	.086	0.90	4.35
χ^2 (p) = 49.12, p < .001				

Note. ADL = activities of daily living; ROM = range of motion; OR = odds ratio; CI = confidence interval.

geriatric nursing homes should closely monitor any changes to ADL among elderly persons with both chronic disease and functional disorders, and develop individualized and systematic physical exercise programs to improve the situation for ADL.

In international studies predicting the risk for the elderly in nursing homes using the MDS evaluation tool (Flacker & Kiely, 2003; Lee et al, 2009; van Dijk et al, 2005), risks were high in participants with low ADL scores, more cognitive functional disorders, and more chronic diseases. The survival rate at year 5 was low when participants experienced more symptoms and signs of end-stage diseases in the MDS health change score. An increase of 1 point in the MDS health change score could lead to an increase of 1.15 times in hazard ratio (Lee et al.).

In a Korean study using the MDS evaluation tool, Kim et al. (2009) reported that elderly persons in geriatric hospitals or geriatric nursing care facilities showed significantly higher psychiatric problems and cognitive behavioral disorders than those hospitalized in standard hospitals. In addition, Kim et al. (2010) reported that the score of basic ADL, cognitive function, and rehabilitation was higher in geriatric hospitals while the score of behavioral changes was higher in nursing care facilities, and the score for nursing care was highest in hospitals in the study comparing long-term functional status and grade of care by institution.

There are not enough Korean studies inclusive of the nursing care field utilizing the MDS evaluation tool. We expected that there would be more studies evaluating factors associated with the deaths of geriatric nursing home residents than studies comparing using MDS data (Kim et al., 2009; Kim et al., 2010).

Geriatric nursing homes exhibited critically inadequate medical staff for the care of the symptoms and signs associated with survival risk for physically fragile elderly persons. Nurses working at geriatric nursing homes usually experience excessive stress due to the need for them to watch for symptoms and signs of ailment in elderly persons at survival risk, despite their relatively few numbers (Kim, Choi, & Sung, 2010). Management of symptoms associated with death is based on exact nursing assessments. Intervention and evaluation are as important as correct nursing assessment. Studies on constructing a theoretical basis for developing prediction factors associated with death and basic research regarding the prediction factors associated with death in geriatric nursing homes are considered very important and practical requirements.

Nursing implications

The factors identified that are associated with resident deaths will be helpful in planning future long-term care in an aging community. Based on the results of this study, nurses working at geriatric nursing homes will be able to predict expected risk of death when making nursing plans for elderly persons with dyspnea, problematic behaviors, and low ADL.

We suggest the development of a prediction index for death encompassing the entire country, through further studies identifying prediction factors associated with geriatric nursing home resident death, as well as studies identifying the variables associated with death, including physiological variables such as intake and output, hemoglobin, creatinine, blood urea nitrogen, and total protein.

Limitations

Limitations of this study included the fact that the results could not be generalized because participants living in specific region were selected, not the whole country, with potential differences in case-mix, culture, and reasons for institutionalization.

Conclusions

Prediction factors associated with the deaths of geriatric nursing home residents in this study were dyspnea, problematic behavior, and activities in daily living. These variables account for 31.1% of the deaths of elderly persons in care facilities.

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