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Predictive Factors of Mortality in Older Adult Residents of Long-Term Care Facilities

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ABSTRACT

Background: Various factors affect the mortality of older adult residents of long-term care facilities. To provide adequate nursing care for older adults, it is necessary to understand the factors that affect their risk of mortality.

Purpose: This study was designed to (a) evaluate the 24-month survival rate and (b) identify the underlying cause of death in various dimensions, including cognitive, psychological, and physical function; nutritional status; and chronic disease.

Methods: A longitudinal study was carried out between 2011 and 2013 at seven long-term care facilities. The participants comprised 276 residents who were all older than 65 years old. Baseline measurements included cognitive function (Mini-Mental State Examination for Dementia Screening), psychological function (Cornell Scale for Depression in Dementia), physical function (Barthel Index), nutritional status (Mini Nutritional Assessment, mid-arm circumference, and calf circumference), and chronic disease status (hypertension, diabetes mellitus, chronic respiratory disease, heart disease, and urinary incontinence). Data analysis included univariate and multivariate logistic regression to identify the main factors affecting mortality.

Results: In 2011 (baseline), the mean age of the participants was 80.46 years (SD = 7.08) and most were female (73.6%). At the 24-month follow-up, 94 (34.1%) of the participants had died. The major factors affecting mortality were as follows: cognitive dysfunction (OR = 3.12, 95% CI [1.41, 6.90]), mid-arm circumference (< 22.5 cm; OR = 2.32, 95% CI [1.35, 3.96]), and urinary incontinence (OR = 2.04, 95% CI [1.16, 3.61]).

Conclusions: According to the findings, special attention is needed at the end of life to improve the quality of life of older adults with cognitive dysfunction, malnutrition (low mid-arm circumference), and urinary incontinence who reside in long-term care facilities.

KEY WORDS:
death, longitudinal study, long-term care, older adults.

Introduction

The proportion of persons older than 65 years in Korea was 13.8% in 2017, with this proportion expected to increase to 41.0% by 2060 (Statistics Korea, 2017). The increasing older adult population has an increased demand for long-term care services. In South Korea, the number of residents of long-term care facilities (LTCFs) rose from 8,100 in 2008 to 125,998 in 2016, after the implementation of long-term care insurance (Ministry of Health and Welfare, Korea, 2017).

Several studies have reported various factors related to mortality among residents in LTCFs. First, cognitive impairment and the increase of depressive symptoms have been associated with increased mortality (Damián, Pastor-Barriuso, Valderrama-Gama, & de Pedro-Cuesta, 2017; Kane, Yochim, & Lichtenberg, 2010). Second, physical dysfunction has been directly related to mortality in older adults living in LTCFs (Thomas, Cooney, & Fried, 2013), and previous studies identified the physical functions of the activities of daily living (ADLs) as strong predictors of death in residents (Chan, Shea, Luk, Chu, & Chan, 2013; Sung, 2014). Third, nutrition has been the factor most frequently and significantly associated with mortality in older adults in LTCFs, with several reports that malnutrition increases mortality risk (Lilamand et al., 2015; Saka et al., 2016; Thomas et al., 2013). Nutrition has been identified as a predictor of death using the Mini Nutritional Assessment (MNA) as well as anthropometric indicators such as body mass index (BMI), mid-arm circumference (MAC), and calf circumference (CC). These measurements are widely used indicators of nutritional status and functional decline in older adults and are effective predictors of mortality (Tsai, Lai, & Chang, 2012; Wijnhoven et al., 2010). Finally, chronic diseases (e.g., hypertension, diabetes mellitus, chronic respiratory disease, heart disease, and urinary incontinence [UI]; John, Bardini, Combescure, & Dällenbach, 2016; Shah, Carey, Harris, DeWilde, & Cook, 2013) have also been reported as predictors of death.

A high rate of mortality has been associated with residents of LTCFs, a physically, psychologically, and cognitively vulnerable group, in multiple studies conducted around the world (Chan et al., 2013; Shah et al., 2013). As the number of people who die in LTCFs increases, it is necessary to understand the factors related to their deaths (Heppenstall,

Broad, Boyd, Gott, & Connolly, 2015). However, reliable predictions are difficult to achieve because it is difficult to measure relevant factors in clinical settings and validation of related measures is insufficient (Kruse et al., 2010; Thomas et al., 2013). In addition, a lack of recognition by nursing staff of the predictors associated with death may cause excessive stress during end-of-life care, resulting in the inappropriate care of older adults (Sung, 2014). Understanding the predictors of death in older adults may assist nursing staff to plan individualized nursing care that reflects their actual needs (Hwang & Kim, 2014). Therefore, understanding the predictors of death and planning individualized nursing interventions may help improve the quality of life for older adults in LTCFs.

Several predictors of death in LTCFs have been identified in the literature. However, most of the relevant studies are based on data from European countries and the United States. Few studies related to mortality risk in LTCF residents in Korea have been published. Therefore, this study was designed to evaluate the 2-year survival rate for older adult residents of LTCFs in South Korea and to identify the factors affecting mortality, including multidimensional factors such as cognitive, psychological, and physical function; nutritional status; and chronic disease.

Methods

Study Design and Sample

A portion of the original data collected by the authors of this article from October 2011 to February 2013 for a longitudinal study was used in this secondary data analysis. The longitudinal study examined the cognitive, psychological, and physical function, nutritional status, and chronic disease of the participants at baseline along with the 24-month survival rate.

The baseline study (2011) described the data collection process in detail (Moon & Hong, 2015). The inclusion criteria for this study were as follows: at least 65 years old, resident of an LTCF for at least 1 month, able to communicate, and provided consent to participate. Data collection was conducted by trained nurses. Cognitive function and anthropometric measurements (weight, height, MAC, and CC) were taken by a research assistant who was a registered nurse, whereas the other measurements were taken by nurses at each of the LTCFs. In 2011, a survey of 305 residents in seven LTCFs located in Seoul, Kyunggi-do, and Kangwon-do, Korea, were used as baseline data, and a follow-up assessment of the survival of these residents was conducted in 2013. Twenty-nine residents were lost to follow-up because of the inability of researchers to confirm outcome status for reasons that included home discharge, transfer to a hospital, or transfer to another LTCF.

Ethical Considerations

The approval to collect data for this study was given by the institutional review board of Hanyang University in Seoul, Korea (2011: HY1-11-023-1, 2013: HYI-13-102-4). The managers of the LTCFs and all of the participants received information regarding the purpose and content of the study and provided written informed consent.

Measurements

Cognitive function

Cognitive function was evaluated using the Mini-Mental Status Examination for Dementia Screening (MMSE-DS; Han et al., 2010). The MMSE-DS consists of 19 items with a possible total score ranging from 0 to 30 and lower scores indicating poorer cognitive function. The level of cognitive impairment for each participant was determined taking into consideration her or his age, education, and gender (Han et al., 2010). The Cronbach's α coefficient of internal consistency for the MMSE-DS was .83 (Han et al., 2010), and the Kuder–Richardson Formula 20 was .90 in this study.

Psychological function (depression)

The 19-item Cornell Scale for Depression in Dementia (CSDD) was developed as an observational scale for assessing depression in older adults with dementia (Alexopoulos, Abrams, Young, & Shamoian, 1988). For the purposes of this study, data were collected by nursing staff. The possible total score for the CSDD ranges from 0 to 28 points, with a higher score indicating greater depression. In this study, a score of 0–7 was designated as "normal" and a score of 8 or higher was designated as "depressed" (Snowdon, Rosengren, Daniel, & Suyasa, 2011). The Cronbach's α of the CSDD was evaluated as .88 in a previous study (Alexopoulos et al., 1988) and as .88 in this study as well.

Physical function (dependence in activities of daily living)

Dependence in ADLs was assessed using the K-Barthel Index (K-BI; Kim, Won, & Rho, 2004), which has 10 items, including ADLs such as bathing, dressing, and eating. Nursing staff who were familiar with participants completed this instrument based on each participant's ability to perform the K-BI items independently. The possible total score for the K-BI ranges from 0 to 20, with higher scores indicating more independence. The Cronbach's alpha for K-BI was .97 in a previous study (Kim et al., 2004) and was .91 in this study.

Nutrition (nutritional status)

The 18-item MNA was used to evaluate the nutritional status of the participants (Guigoz, 2006). The possible total score for the MNA ranges from 0 to 30, with higher scores indicating better nutritional status. For the purposes of this study, scores lower than 17 were classified as malnutrition, 17–23.5 were classified as malnutrition risk, and 24 or higher were classified as normal nutritional status (Saka et al., 2016).

The MNA includes anthropometric measurements of weight, height, MAC, and CC, which were taken in this study by trained nurses. Body weight and height were

measured while the participants were standing independently. In cases where a participant was bedridden or unable to walk, the values measured at the LTCFs were used. However, the ability of researchers to obtain accurate weight and height measurements in these cases was limited, as many of the participants could not walk independently and some of the LTCF sites lacked a bed scale or chair scale. BMI was calculated using weight and height.

MAC and CC were measured to the nearest 1 mm using a flexible and elastic plastic tape measure to gauge the circumference of limbs that are unaffected by disease or disability. MAC was measured in millimeters at the middle point of the arm, between the olecranon and acromion. CC was measured by wrapping the plastic tape around the greatest circumference of the calf. We classified anthropometric scores using the following cutoff scores: MAC of less than 22.5 cm constituted low MAC, and CC less than 28 cm constituted low CC (Tsai et al., 2012). The Cronbach's α for MNA was .92 in Guigoz (2006) and was .70 in this study.

Chronic disease

The chronic diseases considered in this study included hypertension, diabetes mellitus, chronic respiratory disease, heart disease, and UI. A "yes" designation for chronic disease meant that the disease had been diagnosed by a doctor, was suggested based on associated symptoms, or was indicated by the participant using associated chronic-disease medication. Data on chronic disease were collected by nurses.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics Version 21.0 (IBM, Inc., Armonk, NY, USA). The characteristics of participants were reported as descriptive statistics. To determine the factors related to death, multivariate logistic regression using the forward method was performed to select the significant variables in the univariate analysis. Results were presented as an odds ratio (OR) and 95% confidence interval (CI). All results were judged to be significant at the level of $p < .05$. Multicollinearity among independent variables was confirmed by the variance inflation factor. In the final analysis, BMI was excluded because of inaccuracies in measuring both weight and height.

Results

Baseline Characteristics

Data from 276 older adult residents of LTCFs were analyzed; baseline characteristics are summarized in Table 1. The average age of the participants was 80.46 (SD = 7.08) years. Three quarters (n = 203, 73.6%) were female, 216 (78.3%) showed cognitive impairment, and 105 (38.0%) had a depressive mood. The mean K-BI score was 9.33 (SD = 5.95). Approximately nine of 10 participants (n = 242, 87.7%)

were malnourished or at risk of malnourishment (MNA total score of < 24).

Factors Associated With Death

In 2013, 2 years after baseline data were collected, 94 (34.1%) of the 276 participants had died. The results of univariate logistic regression analyses revealed a significant association between cognitive dysfunction (OR = 3.11, 95% CI [1.44, 6.70]), depression (OR = 2.00, 95% CI [1.20, 3.33]), BI (OR = 0.93, 95% CI [0.89, 0.97]), MNA (< 17 points; OR = 3.69, 95% CI [1.39, 9.83]), MAC (< 22.5 cm; OR = 2.62, 95% CI [1.58, 4.38]), CC (<28 cm; OR = 2.01, 95% CI [1.21, 3.34]), and UI (OR = 2.40, 95% CI [1.40, 4.10]) and death (Table 2). After conducting multivariate logistic regression on these seven variables, cognitive dysfunction (OR = 3.12, 95% CI [1.41, 6.90]), lower MAC (< 22.5 cm; OR = 2.32, 95% CI [1.35, 3.96]), and UI (OR = 2.04, 95% CI [1.16, 3.61]) were confirmed as significant predictors of mortality (Table 3).

Discussion

The purpose of this study was to evaluate the 24-month survival rate and identify the factors that predicted mortality, including cognitive, psychological, and physical function, nutritional status, and chronic disease in older Korean residents of LTCFs. One third (34.1%, n = 94) of the participants died within 2 years of baseline data collection. Other similar studies, including a 3-year follow-up study of 672 older adults living in nursing homes in Hong Kong that found a 2-year mortality rate of 26.0% (Chan et al., 2013) and another study of 1,423 older French and Italian adult residents living in nursing homes that found a 2-year mortality rate of 23.5% (Benetos et al., 2015), reported rates of death that were lower than this study. The high mortality rate in this study may be attributed to the relatively high level of frailty, as indicated by the high rates of cognitive dysfunction (78.3%), dependence in ADLs (97.8%), and malnutrition (87.7%), compared with other studies (cognitive dysfunction: 61.7%, Su et al., 2014; dependence in ADLs: 87.5%, Chan et al., 2013; and malnutrition: 43.5%, Saka et al., 2016).

In previous studies, physical function, malnutrition (Lilamand et al., 2015; Thomas et al., 2013), and cognition (Kane et al., 2010) were most frequently associated with mortality in older adults living in LTCFs. Thus, the high levels of dependence in ADLs, malnutrition, and cognitive impairment in this study are presumed to be key factors underlying the high mortality rate.

Cognitive dysfunction, depression, dependence in ADLs (K-BI), malnutrition (lower MNA, MAC, and CC), and UI were found in the univariate analysis to be significant predictors of mortality. These results suggest that not only cognitive function but also psychological and physical function and nutritional status were related to the death of the participants. A systematic review reported that cognitive and

TABLE 1.

General Characteristics of Participants at Baseline (2011; N = 276)

Variable	Total (*N* = 276)		Alive in 2013 (*n* = 182)		Deceased in 2013 (*n* = 94)	
	n	%	*n*	%	*n*	%
General characteristics						
Age (years; *M* and *SD*)	80.46	7.08	79.88	6.93	81.59	7.28
Gender						
Female	203	73.6	135	74.2	68	72.3
Male	73	26.4	47	25.8	26	27.7
Educational level (*M* and *SD*)	4.85	5.16	4.85	5.30	4.85	4.93
Cognitive function						
Cognitive dysfunction (*M* and *SD*)	14.79	6.33	15.82	6.33	12.80	5.85
Yes	216	78.3	132	72.5	84	89.4
No	53	19.2	44	24.2	9	9.6
Missing	7	2.5	6	3.3	1	1.0
Psychological function						
Depression (*M* and *SD*)	6.45	5.43	5.85	5.32	7.62	5.48
Yes	105	38.0	59	32.4	46	48.9
No	171	62.0	123	67.6	48	51.1
Physical function						
Dependency in ADLs (*M* and *SD*)	9.33	5.95	10.18	6.03	7.67	5.43
Nutrition						
Nutritional status (*M* and *SD*)	18.81	3.99	19.29	3.79	17.87	4.21
≥ 24	34	12.3	28	15.4	6	6.4
17–23.5	156	56.5	106	58.2	50	53.2
< 17	86	31.2	48	26.4	38	40.4
MAC (cm; *M* and *SD*)	23.24	3.21	23.77	3.06	22.21	3.25
≥ 22.5	163	59.1	122	67.0	41	43.6
< 22.5	113	40.9	60	33.0	53	56.4
CC (cm; *M* and *SD*)	27.60	3.80	28.15	3.63	26.54	3.92
≥ 28	140	50.7	103	56.6	37	39.4
< 28	136	49.3	79	43.4	57	60.6
Chronic disease						
Hypertension						
Yes	198	71.7	128	70.3	70	74.5
No	78	28.3	54	29.7	24	25.5
Diabetes mellitus						
Yes	85	30.8	57	31.3	28	29.8
No	191	69.2	125	68.7	66	70.2
Heart disease						
Yes	36	13.0	24	13.2	12	12.8
No	240	87.0	158	86.8	82	87.2
Chronic respiratory disease						
Yes	28	10.1	15	8.2	13	13.8
No	248	89.9	167	91.8	81	86.2
Urinary incontinence						
Yes	163	59.1	95	52.2	68	72.3
No	113	40.9	87	47.8	26	27.7

Note. ADL = activities of daily living; MAC = mid-arm circumference; CC = calf circumference.

physical function and nutritional status were most frequently associated with mortality in nursing home residents and hospitalized older adults, which is consistent with our results (Thomas et al., 2013). As functional status is fairly easy to assess by close observation and simple questionnaires (Thomas et al., 2013), nursing staff in LTCFs should use these two approaches appropriately to determine a higher mortality risk among residents.

TABLE 2.
Univariate Logistic Regression Models for Death (N = 276)

Variable	OR	95% CI	p
Age (years)	1.04	[1.00, 1.07]	.059
Gender			
Female	Ref.		
Male	1.10	[0.63, 1.92]	.743
Cognitive dysfunction			
Yes	3.11	[1.44, 6.70]	.004
No	Ref.		
Depression			
Yes	2.00	[1.20, 3.33]	.008
No	Ref.		
Dependency in ADLs	0.93	[0.89, 0.97]	.001
Nutritional status			
< 17	3.69	[1.39, 9.83]	.009
17–23.5	2.20	[0.86, 5.66]	.101
≥ 24	Ref.		
Mid-arm circumference			
< 22.5 cm	2.62	[1.58, 4.38]	< .001
≥ 22.5 cm	Ref.		
Calf circumference			
< 28 cm	2.01	[1.21, 3.34]	.007
≥ 28 cm	Ref.		
Hypertension			
Yes	1.23	[0.70, 2.16]	.470
No	Ref.		
Diabetes mellitus			
Yes	0.93	[0.54, 1.60]	.794
No	Ref.		
Heart disease			
Yes	0.96	[0.46, 2.02]	.963
No	Ref.		
Chronic respiratory disease			
Yes	1.79	[0.81, 3.93]	.149
No	Ref.		
Urinary incontinence			
Yes	2.40	[1.40, 4.10]	.001
No	Ref.		

Note. Ref. = reference; ADLs = activities of daily living.

In the final model, the predictors of death in this study were cognitive dysfunction, dependency in ADLs, malnutrition (low MAC), and UI.

In this study, cognitive dysfunction showed a significant positive association with mortality risk. A study of 171 older adult LTCF residents in the United States found a significant association between mortality and cognitive dysfunction (Kane et al., 2010). Another study of patients older than 65 years receiving secondary care for mental health reported an association between cognitive impairment and mortality (hazard ratio = 4.1) after adjusting for general characteristics (Su et al., 2014). In contrast, in a systematic review of studies of older adult residents of nursing homes, no relationship between mortality and cognitive function was found, although a relationship was found between mortality and hospitalization rate (Thomas et al., 2013). Although some studies have reported no relationship between cognitive dysfunction and mortality among nursing home residents, the findings of this study revealed that older adults with cognitive impairment face a higher risk for hospitalization and mortality because cognitive dysfunction and functional capacity are interrelated (González-Vélez et al., 2015). Cognitive dysfunction leads to decreased ADL ability and has a negative impact on mobility and balance (Ha & Kim, 2014). Eventually, declining cognitive function may threaten physical safety or increase the risk of death (Kane et al., 2010). Nursing staff in LTCFs should perform regular cognitive function testing and closely monitor their older adult residents for changes in cognitive function. Additional longitudinal studies are necessary to verify the causal relationships between mortality and cognitive impairment in older adults living in LTCFs.

As regards nutritional factors, the anthropometric indicator MAC was shown to be a significant predictor of death, a result that is partially consistent with previous studies (Tsai et al., 2012; Wijnhoven et al., 2010). A study of 1,667 community-dwelling older adults in the Netherlands found a strong association between MAC and 15-year mortality (Wijnhoven et al., 2010). Another study of institutionalized older adults in Taiwan reported that both MAC and CC, adjusted for age, predicted mortality, with MAC identified as a particularly useful indicator of mortality risk (Tsai et al., 2012). On the other hand, CC has also been highlighted as a good indicator of functional status, as this factor reflects the decrease in muscle mass because of immobility (Tsai

TABLE 3.
Forward Multivariate Logistic Regression Models for Death (N = 276)

Affecting Factor	Reference	β	SE	p	OR	95% CI
Cognitive dysfunction (yes)	No	1.14	.40	.005	3.12	[1.41, 6.90]
MAC (< 22.5 cm)	≥ 22.5 cm	0.84	.27	.002	2.32	[1.35, 3.96]
Urinary incontinence (yes)	No	0.72	.29	.014	2.04	[1.16, 3.61]
Constant		−2.42	.44	< .001	0.09	

Note. Hosmer–Lemeshow test: χ^2 = 3.65, *df* = 5, *p* = .601; model summary: Nagelkerke R^2 = .141. MAC = mid arm circumference.

et al., 2012; Wijnhoven et al., 2010). Although CC was excluded in the final model in this study, several studies have proposed both MAC and CC as key indicators of mortality risk in older adults. Therefore, neither should be overlooked. Further studies will be necessary to confirm the current evidence. The anthropometric indicators MAC and CC are more cost effective, easier to measure, and more clinically applicable than other predictors of mortality reported in previous studies (Tsai et al., 2012; Wijnhoven et al., 2010). In addition, regular assessment of anthropometrics may be a useful inclusion in nursing care plans and interventions for older adult residents of LTCFs.

Among the chronic diseases, only UI was identified as a significant predictor of mortality in the final model, which is consistent with previous studies. A systematic review reported an association between UI and increased mortality (hazard ratio = 1.27) after adjusting for confounding factors; this association increased according to the severity of UI (John et al., 2016). In particular, a 15-year longitudinal study found UI to be a predictor of death in older adult residents of LTCFs (Damián, Pastor-Barriuso, García López, & de Pedro-Cuesta, 2017). UI is a major factor for geriatric syndromes and is directly associated with mortality and frailty (Berardelli et al., 2013). The result of this study supports the importance of nursing management of UI, which is a marker for mortality as well as a general health problem in LTCFs. Although effective nursing interventions such as physical activity have been attempted to improve UI in frail, older women (Talley, Wyman, Bronas, Olson-Kellogg, & McCarthy, 2017), there remains a tendency to overlook UI in LTCFs. Active and effective nursing management must occur to improve UI symptoms in LTCFs.

In this study, depression was not identified in the final model as a predictive factor for mortality. This result is inconsistent with a previous study that found a significant relationship between depression and mortality (Kane et al., 2010). Kane et al. (2010) reported that depressive symptoms were related to 12-month and all-cause mortality. On the other hand, Damián, Pastor-Barriuso, Valderrama-Gama, et al. (2017) reported depressive symptoms as not significantly associated with 2-year mortality. Although previous studies have reported conflicting findings regarding the relationship between death and depression among older adult residents of LTCFs, the detection and treatment of depressive symptoms should not be overlooked.

Dependency in ADLs was significantly associated with mortality in this study only in the univariate analysis, a finding partially supported by previous studies. The multidimensional factors considered in this study make direct comparisons with previous studies difficult, as a direct causal relationship between ADLs and death was identified (Chan et al., 2013) or the characteristics of disease and negative emotion were included (Hwang & Kim, 2014) in previous research on this topic. However, dependency in ADLs cannot be overlooked because it is related to the dependence that is consistently reported as associated with death in institutionalized older adults. Nurses in LTCFs need to observe changes in ADLs closely, and a reliable and valid instrument similar to that used to assess ADLs may be used to assess physical functioning.

Nutritional status was not identified as a predictive factor of death in the final model. However, the weight and height of the participants who were unable to walk could not be accurately measured, which may have contributed to the low reliability of MNA and related results. Although MNA is very sensitive in detecting malnutrition in older adults (Guigoz, 2006), the power of MNA to predict mortality in older adults in LTCFs is unclear (Cereda et al., 2011). Further research is necessary to identify a causal relationship between mortality and nutritional status using an assessment tool that reflects the characteristics of older adult residents of LTCFs. In addition, although BMI was excluded because of inaccuracies in measuring weight and height, BMI provided a good measure for nutritional status in this study and was found to be related to mortality and health status in older adults, as in previous studies (Tsai et al., 2012; Wijnhoven et al., 2010). Therefore, it is necessary to determine whether BMI is predictive of mortality using accurate weight and height measurements in physically limited older adult residents of LTCFs.

In this study, factors that were predictive of mortality for residents of LTCFs were as follows: cognitive dysfunction, malnutrition (low MAC), and UI. These factors are the markers of individuals at a high risk of death. The findings of this study are important for clinical practice in LTCFs. The MMSE is a general screening test tool that is routinely administered in most LTCFs in Korea, whereas MAC is easily measured and utilized. Regular assessment of these factors, combined with active nursing interventions, may improve the quality of life of older adult residents of LTCFs. Furthermore, awareness of these factors may help reduce the fear among nursing staff of providing end-of-life care to older adults and allow them to provide individualized nursing care to these individuals.

This study was affected by several limitations. First, the results may not be generalizable to the larger population because of the convenience sampling approach used. Using a larger sample from randomly selected LTCFs will be necessary to generalize these results. Second, the number of participants lost to follow-up ($n = 29$, 9.5%) because of discharge, transfer to another LTCF, or hospitalization was excessively high. In addition, in some cases, the date and/or cause of death could not be determined, which also resulted in loss to follow-up. The strength of this study is that it identifies multidimensional factors predicting death in LTCF residents in Korea.

Conclusions

This study identified factors that predicted mortality in older adults in LTCFs in Korea. Identification of these factors is expected to help guide nursing and individualized care planning in LTCFs. On the basis of the findings, older adult

residents of LTCFs affected by cognitive dysfunction, low MAC, and UI should be given special attention and care to reduce their risk of mortality.

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Author Contributions

Study conception and design: GRSH
Data collection: SHM
Data analysis and interpretation: SHM
Drafting of the article: GRSH, SHM
Critical revision of the article: GRSH, SHM

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