



Original Article

## Factors Associated with Unplanned Hospitalizations of Nursing Home Residents

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### SUMMARY

**Background:** Residents in nursing homes are generally highly dependent on others, and unplanned hospitalizations often have major impacts on their physical and cognitive functions. The purpose of this study was to investigate the factors that affect the unplanned hospitalization of nursing home residents.

**Methods:** This retrospective cohort study enrolled 98 residents from a nursing home affiliated with a regional hospital in northern Taiwan. A chart review was performed to transcribe variable data, including demographic characteristics, health status, nutritional status, and the length and frequency of unscheduled transfers to the hospital.

**Results:** A total of 64.3% of the residents experienced one or more unplanned hospitalization. The major causes of unplanned hospitalization were cerebrovascular accident, congestive heart failure, and pneumonia. The factors affecting the unplanned hospitalization of residents were a Barthel index of  $\leq 20$  and the use of a nasogastric or urinary catheter.

**Conclusion:** Strengthening the management of nursing homes and developing preventive guidelines for treating residents with poor ability to perform activities of daily living or using invasive devices are crucial. By implementing preventive measures early and improving the quality of monitoring care, nursing homes can reduce the incidence of unplanned hospitalization.

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## 1. Introduction

Older adults will comprise approximately 22% of the global population by 2050,<sup>1</sup> and population aging is an issue that will be faced by every advanced country. In Taiwan, those over the age of 65 years accounted for 16.2% of the total population in 2021.<sup>2</sup> As the number of older adults gradually increases, chronic diseases and disability become an increasingly major concern, as does the question of how older adults should be cared for. The trend of a low birthrate is additionally leading to a shortage of caregivers within family structures.<sup>3,4</sup> Therefore, increasing Taiwan's capacity for institutional care has become an urgent task.

Unplanned hospitalization is a measure of the continuance and quality of care in nursing homes.<sup>5</sup> In the Taiwan Healthcare Indicator Series, unplanned hospitalization monitoring has been strengthened to improve the quality of medical care and promote health.<sup>6</sup> Because nursing home residents are generally highly dependent on others, an unplanned hospitalization often has major impacts on their physical and cognitive functions. Unplanned hospitalizations are relatively common for nursing home residents because of their relatively unfavorable health status, their decreased ability to perform various activities, and the high likelihood that they will experi-

ence complications such as infection, pressure ulcers, catheter detachment, and asphyxia.<sup>3</sup> Unplanned hospitalizations and a long period of disease recovery result in high economic and medical resource burdens as well as psychological and economic burdens on residents and their family members; additionally, unplanned hospitalizations may contribute to mortality because complications can develop during hospitalization.<sup>7</sup> Therefore, reducing the number of unplanned hospitalizations of nursing home residents has become the primary goal of nursing home care.

Studies investigating the factors that contribute to unplanned hospitalizations of nursing home residents have focused on institutional characteristics, caregiver staffing, quality of care, and insurance benefits.<sup>7,8</sup> Recent studies exploring unplanned hospitalizations from the resident's perspective have examined educational and socioeconomic perspectives;<sup>7</sup> investigated demographic characteristics, levels of dependency, and health status;<sup>9,10</sup> accounted for various chronic diseases and comorbidities;<sup>11</sup> and analyzed variables including immunity, nutritional intake, and use of invasive devices.<sup>12–14</sup> These studies have discovered that advanced age, male sex, poor health condition, and functional disability were significant predictors of unplanned hospitalization. Few studies have holistically assessed unplanned hospitalization from the perspective of nursing home residents. In our study, a hematology test was conducted because the results of this test — such as body mass index (BMI), white blood cell (WBC) count, hemoglobin (Hb) level, and albumin level — may be related to nutrition.

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The purpose of this study was to use a retrospective chart review to investigate unplanned transfers of nursing home residents to hospitals and the factors influencing such transfers.

## 2. Materials and methods

### 2.1. Study design and enrollees

This was a retrospective chart review study conducted at a regional teaching hospital affiliated with a nursing home in northern Taiwan. A secondary data analysis was conducted using data from the hospital's computerized medical information system. The individuals enrolled in the study were residents admitted to the nursing home between January 1 and December 31, 2016. The inclusion criteria were being admitted to the nursing home during the data collection period and staying in the home for more than 1 month. The exclusion criterion was having a diagnosis of terminal stage cancer because such residents received medical care (Figure 1).

G-power version 3.1 was employed to estimate the appropriate sample size, which was determined to be 94. The corresponding statistical parameters were as follows:  $\alpha = .05$ , power = .80, and medium effect size = 0.15. Cox regression was performed. The data analysis was ultimately completed using the data of 98 residents.

### 2.2. Data collection and procedure

This study was approved by the Institutional Review Board of Taoyuan General Hospital, Ministry of Health and Welfare of Taiwan (TYGH106008). After administrative procedures were followed, data were collected at a medical center in northern Taiwan by using the center's medical information system. The list of eligible residents was encrypted and coded. The data collected from nursing home charts comprised demographic characteristics, health status, and details of unplanned hospitalizations. In addition, data on the major cause of the first unplanned hospitalization and nutritional status were collected.

### 2.3. Definitions of variables

The dependent variable was unplanned hospitalization, which referred to the occurrence and frequency of acute hospitalization due to a change in the health status of a nursing home resident. The unplanned hospitalization rate was calculated by considering unplanned hospitalizations that occurred during the data collection period. An instance of unplanned hospitalization was not included in the calculation when the resident was transferred to a rehabilitation or observation ward. In addition, a resident making an outpatient or emergency department visit did not count as hospitalization.

The independent variables were demographic characteristics, health status, and nutritional status. The demographic characteristics included sex and age ( $\leq 65$ , 66–80, and  $> 80$  years). The health status variables were residents' activities of daily living (ADLs), presence or absence of invasive devices, and admission diagnosis. The Barthel index of ADLs<sup>15</sup> was used to examine the residents' degree of independence in terms of functional capacity. The total score of this index ranges from 0 to 100 points; total scores of 0–20, 21–60, 61–90, 91–99, and 100 represent complete dependence, severe dependence, mild dependence, slight dependence, and complete independence, respectively. The invasive devices considered were nasogastric tubes, a Foley catheter, tracheostomy tubes, and other catheters and tubes. Regarding the major diagnostic classification of a resident, this study used the diagnosis of the disease registered in the medical information system when the resident was initially admitted to the nursing home. The diagnoses encompassed cerebrovascular, endocrine, cardiovascular, respiratory, bone, urinary, and other diseases. The nutritional status of the residents was assessed using their measurement values upon their first transfer to an acute medical unit; the measurement values were their nutritional assessment score, BMI, WBC count, Hb level, and albumin level. In terms of nutritional assessment, this study used the Mini Nutritional Assessment (MNA) to evaluate changes in nutritional intake,<sup>16</sup> mobility, and major physiological stress within the preceding 3 months. The

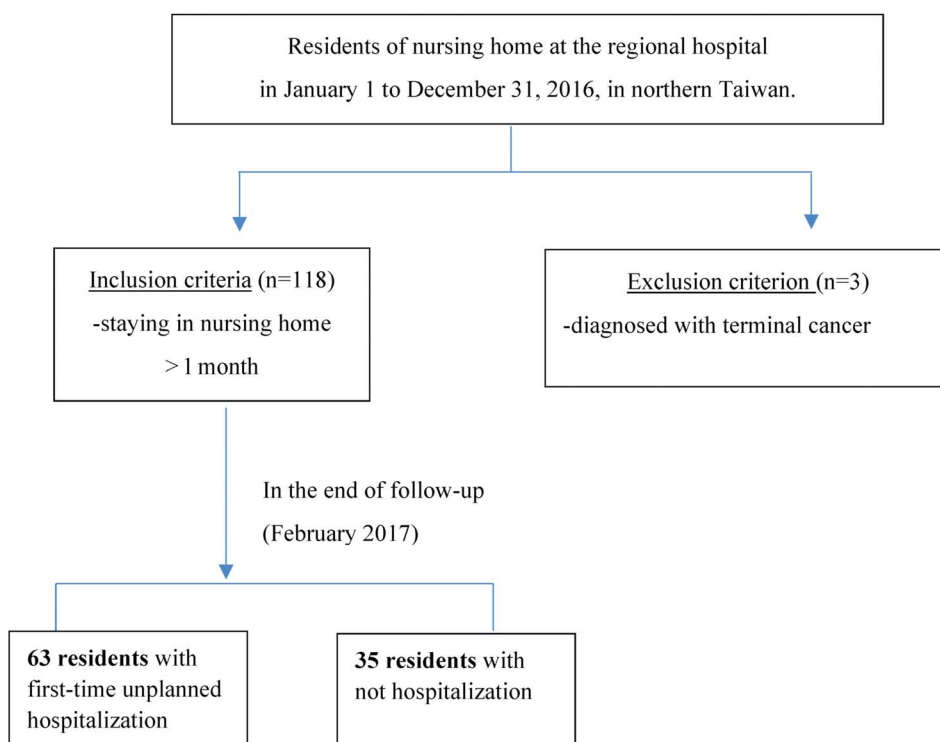


Figure 1. The flowchart of this study.

maximum score in the MNA is 30 points (< 17 points: malnutrition; 17–23.5: nutritional status at risk; and ≥ 24: well-maintained nutritional status). The BMI categories used in Taiwan are as follows: < 18.5 kg/m<sup>2</sup>: underweight, 18.5 to < 24 kg/m<sup>2</sup>: normal weight, and 24 to < 27 kg/m<sup>2</sup>: overweight.<sup>17</sup> WBC count was assessed as follows: < 5000 U: low, 5000–10,000 U: normal, and > 10,000 U: high. An Hb level < 13 g/dL for men and < 12 g/dL for women was used to signify anemia. Finally, a serum albumin level of < 3.5 g/dL indicated malnutrition.

2.4. Statistical analyses

SPSS 22 (IBM, Armonk, NY, USA) was used to perform statistical analyses. The distributions of the various variables are presented in terms of frequency, percentage, mean, and standard deviation. This study used the chi-squared test to analyze differences in the residents' demographic characteristics, health status, and presence or absence of invasive devices. For survival analysis, this study employed the Kaplan-Meier method to estimate the occurrence of unplanned hospitalizations. Cox proportional-hazard regression was used to analyze the factors affecting the likelihood of unplanned hospitalization.

3. Results

3.1. Incidence and frequency of unplanned hospitalization of nursing home residents

The study cohort comprised 98 nursing home residents, 63 of

whom experienced unplanned hospitalization; the annual prevalence of hospitalization was 64.3%. The mean frequency of transfer to the hospital was 1.02 ± 0.48 times/year, and 31.7% of the residents were repeatedly admitted to an acute medical unit (Table 1). A Kaplan-Meier curve was used to estimate the mean cumulative occurrence of unplanned hospitalization, which was discovered to be 30 weeks. The median amount of time to unplanned hospitalization was 32 weeks. The 50th and 75th percentiles were 32 and 8 weeks, respectively; hence, 75% of the residents enrolled in this study were transferred to the hospital in week 8, 50% were transferred in Week 32, and 35.7% experienced no unplanned hospitalizations (Figure 2).

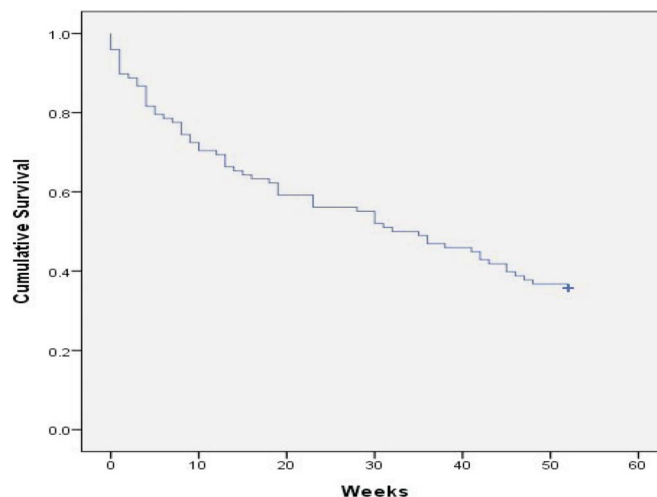


Figure 2. Kaplan-Meier curves for unplanned hospitalizations.

Table 1 Demographic characteristics and health status of residents with or without hospitalization (n = 98).

Variable	Overall n (%) / M (SD)	Unplanned hospitalization		χ <sup>2</sup>	p
		Yes n (%) / M (SD)	No n (%) / M (SD)		
Unplanned hospitalization	98 (100.0)	63 (64.3)	35 (35.7)		
Frequency of admissions		1.02 ± 0.48			
1		43 (68.3)			
2–3		15 (23.8)			
≥ 4		5 (7.9)			
Sex				1.02	.311
Male	57 (58.2)	39 (61.9)	18 (51.4)		
Female	41 (41.8)	24 (38.1)	17 (48.6)		
Age (y)	80.84 (12.41)	81.89 (12.86)	79.60 (11.94)	0.56	.754
≤ 65	11 (11.2)	6 (9.5)	5 (14.3)		
66–80	22 (22.4)	14 (22.2)	8 (22.8)		
> 80	65 (66.4)	43 (68.3)	22 (62.9)		
Barthel Index	33.88 (32.55)	23.68 (29.24)	45.89 (32.45)	13.80	< .001
61–90	26 (30.6)	9 (14.3)	17 (48.6)		
21–60	23 (10.2)	13 (20.6)	10 (28.6)		
0–20	49 (59.2)	41 (65.1)	8 (22.8)		
Number of tubes				7.80	.023
0	46 (46.9)	23 (36.5)	23 (65.7)		
1	28 (28.6)	21 (33.3)	7 (20.0)		
≥ 2	24 (24.5)	19 (30.2)	5 (14.3)		
Nasogastric tube	40 (51.3)	32 (53.3)	8 (44.4)	7.27	< .01
Foley tube	16 (20.5)	13 (21.7)	3 (16.7)	2.40	.126
Tracheotomy tube	11 (14.1)	8 (13.3)	3 (16.7)	0.39	.545
Other tube	11 (14.1)	7 (11.7)	4 (22.2)	0.01	.960
Major diagnosis at NH					
Cerebrovascular	41 (41.8)	25 (39.7)	16 (45.7)	0.55	.655
Endocrine	19 (19.5)	15 (23.8)	4 (11.4)	1.67	.281
Cardiovascular	17 (17.3)	10 (15.9)	7 (20.0)	0.02	.541
Respiratory	9 (9.2)	6 (9.5)	3 (8.6)	0.38	.341
Urinary tract	6 (6.1)	4 (6.3)	2 (5.7)	0.42	.412
Musculoskeletal	5 (5.1)	3 (4.8)	2 (5.7)	0.19	.618
Other	1 (1.0)	0 (0)	1 (2.9)	1.78	.222

Abbreviations: NH, nursing home.

### 3.2. Demographic characteristics and health status of residents

The nursing home residents enrolled in this study were mainly men (58.2%); their mean age was  $80.84 \pm 12.41$  years. Their mean Barthel index was 33.8 points (range: 0–90 points); 69.4% of the residents were found to be completely and severely dependent (index  $\leq 60$ ), and more than half of residents had an invasive device (53.1%). At the time of their admission to the nursing home, 41 residents (41.8%) had a diagnosis of a cerebrovascular system disorder. As displayed in Table 1, a comparison of the demographic characteristics and health status statistics of the two groups of residents indicated significant differences in Barthel index score ( $p < .001$ ), the presence of a nasogastric tube ( $p < .01$ ), and the number of catheters ( $p = .023$ ).

### 3.3. Major cause and nutritional status of residents during unplanned hospitalizations

In the 63 residents who experienced unplanned hospitalization, the major cause of the first hospitalization was cerebrovascular accident ( $n = 29$ , 46.0%). Regarding nutritional status, 25.4% ( $n = 16$ ) of the residents exhibited malnutrition, and 71.4% ( $n = 45$ ) were at risk of malnutrition. Most residents had normal weight ( $n = 39$ , 61.9%), an abnormal WBC count ( $> 10,000$  or  $< 5000$  U,  $n = 32$ , 50.8%), and an Hb level of  $< 12$  or  $< 13$  g/dL (for women and men, respectively;  $n = 42$ , 66.7%). Additionally, 76.2% of the residents had a serum albumin concentration of  $< 3.5$  mg/dL (Table 2).

### 3.4. Relevant risk factors affecting the occurrence of unplanned hospitalization

This study used Cox proportional-hazard regression to analyze the risk factors associated with the unplanned hospitalization of

nursing home residents; the variables examined were sex, age, Barthel index, and pattern of catheter use. The results revealed that the hazard ratio (HR) of unplanned hospitalization for a Barthel index of  $\leq 20$  was 2.74 [adjusted HR, 2.74; 95% confidence interval (CI): 1.70–3.88] when the reference group had a Barthel index of 20–60. The risks of unplanned hospitalization in residents using a nasogastric tube (adjusted HR, 1.11; 95% CI: 1.04–1.18) or a Foley catheter (adjusted HR, 1.09; 95% CI: 1.03–1.15) were higher than those of residents who did not use them (Table 3).

## 4. Discussion

The purpose of this study was to identify the factors associated with the unplanned hospitalization of nursing home residents. The average age of the residents enrolled in this study was 80.84 years; more than half were male, were completely or severely dependent, and had an invasive device. Our study revealed that the unplanned hospitalization rate in the residents was 64.3% and that 31.7% had more than two repeated admissions to the acute ward of a hospital. The significant predictors of unplanned hospitalization were a Barthel index of  $\leq 20$  and the use of a nasogastric tube or a Foley catheter.

A systematic review revealed that the rates of unplanned hospitalization of nursing home residents ranged from 11.6% to 35%.<sup>18</sup> An increasing number of health organization administrators are attaching importance to the high rate of hospitalization in this population.<sup>19</sup> A survey of residents in two large nursing homes showed that unplanned hospitalization occurred in the period between 3.2 and 15.2 months after entering the home.<sup>20</sup> Our residents had a higher rate of hospitalization, with 75% of the residents hospitalized at week 8 and 31.7% readmitted to the acute ward of a hospital. Two reasons may explain this high rate. First, the average age of the residents was  $> 80$  years; in terms of ADLs, these residents were completely or severely dependent on others, and most used an invasive device. Related studies have reported that because nursing home residents are old and frail and have declining immune function, they are at high risk of infection.<sup>21,22</sup> Second, the enrollees were from a nursing home affiliated with a hospital. In Taiwan, hospital-affiliated nursing homes are as streamlined as possible in terms of staffing. Therefore, when the condition of a resident changes or they require acute medical care, they are usually directly admitted to the emergency department and then transferred back to the nursing home after their condition has stabilized; this may have been the reason for the high incidence of repeated admissions. Related studies have shown that in nursing home residents, the risk of adverse events during hospitalization is high. Up to two-thirds of the unplanned

**Table 2**  
Major cause and nutritional status of first unplanned hospitalization ( $n = 63$ ).

Variable	n (%)	M (SD)	Range
<b>Major cause</b>			
CVA	29 (46.0)		
CHF	18 (28.6)		
Pneumonia	11 (17.5)		
CKD	5 (7.9)		
<b>Nutritional status</b>			
<b>MNA scores</b>			
< 17	16 (25.4)	18.48 (3.13)	12.5–24.0
17–23.5	45 (71.4)		
$\geq 24.0$	2 (3.2)		
<b>BMI (%)</b>			
< 18.5	13 (20.6)	21.14 (3.51)	15.8–30.0
$\geq 18.5$ – $< 24$	39 (61.9)		
$\geq 24$	11 (17.5)		
<b>WBC (U)</b>			
< 5000	15 (23.8)	8900 (5198.16)	2340–29170
5000–10000	31 (49.2)		
$> 10000$	17 (27.0)		
<b>Hb (g/dl)</b>			
< 12 or 13	42 (66.7)	10.79 (2.12)	4.0–15.0
$\geq 12$ or 13	21 (33.3)		
<b>Albumin (mg/dl)</b>			
< 3.5	48 (76.2)	3.19 (0.51)	1.7–4.1
$\geq 3.5$	15 (23.8)		

Abbreviations: BMI, body mass index; CHF, congestive heart failure; CKD, chronic kidney disease; CVA, cerebrovascular accident; Hb, hemoglobin; MNA, Mini Nutritional Assessment; WBC, white blood cell count.

**Table 3**  
Factors associated with unplanned hospitalization based on Cox regression analysis ( $n = 98$ ).

Variable	aHR	95% CI	<i>p</i>
Sex (male)	1.01	0.82–2.11	.131
<b>Age (<math>\leq 65</math>)</b>			
66–80	1.03	0.91–1.05	.331
$> 80$	1.01	0.83–1.17	.073
<b>Barthel Index (score 61–90)</b>			
Score 21–60	1.84	0.67–3.21	.063
Score 0–20	2.74	1.70–3.88	$< .01$
Nasogastric tube (no)	1.11	1.04–1.18	$< .001$
Foley tube (no)	1.09	1.03–1.15	$< .01$
Tracheotomy tube (no)	1.00	0.87–1.14	.684

Abbreviations: aHR, adjusted hazard ratio; CI, confidence interval; NH, nursing home.

hospitalizations of nursing home residents are thought to be potentially preventable.<sup>10</sup>

Our study and the relevant literature point to ADL dependency, nasogastric tubes, and Foley catheters as important indicators of unplanned hospitalization in nursing home residents.<sup>21</sup> Scholars have discovered that the level of dependence of nursing home residents has a significant effect on unplanned transfers to hospital. The higher the level of dependence is, the greater is the incidence of unplanned hospitalizations and the frequency of hospitalization. Residents with a Barthel index of < 50, reduced mobility, or dependence on others after discharge have heightened risks of unplanned hospitalization.<sup>23,24</sup> The main diseases of the 63 residents who were unexpectedly transferred to an acute medical unit in this study were cerebrovascular accident, congestive heart failure, and pneumonia, in that order. This finding differs from that in relevant studies.<sup>21,25</sup> The results of this study showed that although the major diagnosis of the residents was not significantly associated with unplanned hospitalization, the need for a nasogastric tube or Foley catheter due to the major disease led to unplanned hospitalization. The findings were similar to those of Hsiung et al., who reported that presence versus absence of intubation and total number of catheters and tubes were key variables affecting the likelihood of a first unplanned hospitalization in nursing home residents.<sup>20</sup>

In Taiwan, the Ministry of Health and Welfare has developed items for assessing nursing homes and standard operating procedures (SOPs). However, the implementation of these SOPs has been limited by the nature of the organization, the number of staff in homes, and the job grade and ability of staff, resulting in an implementation gap.<sup>26</sup> This study recommends the following. (1) Warning mechanisms related to high-risk groups — residents with a Barthel index  $\leq 20$  or those using a nasogastric tube or Foley catheter — should be enhanced to enable early and proactive preventive strategies to be implemented, such as daily physical assessment and follow-up management, with the aims of reducing resource depletion and the number of unplanned hospitalizations. (2) Strengthening of on-the-job training for staff should be continued, with a focus placed on disease care, functional mobility, and health issues arising from catheterization and infection control. The application of concepts to clinical practice should be emphasized. (3) Finally, SOPs should be modified in accordance with the attributes of the nursing home to create certainty in the implementation of care standards.

In this study, a retrospective analysis was conducted using chart data from a single hospital. Because of a lack of consistent standards and the incompleteness of nursing home assessment records in Taiwan, no big data were available for analysis. The results of this study will be used to identify demographic and health-status-related predictors of unplanned hospitalization of nursing home residents. The factors identified in this study can be used to modify the existing assessment estimates of hospitalization risk, providing a reference for the design of hospitalization assessments for nursing home residents in Taiwan.

Multimorbidity is most prevalent in the older population.<sup>27</sup> A Swedish study on people over 60 years of age demonstrated that having multiple chronic conditions (i.e., multimorbidity) increases the risk of hospitalization in older adults.<sup>28</sup> Different patterns of multimorbidity were associated with unplanned hospitalization. Cardiovascular disease, anemia, and dementia patterns; psychiatric disease patterns; and metabolic and sleep disorder patterns were strongly associated with a higher risk of unplanned hospitalization. Similar data were not available in our study. In the future, we will analyze the relationship between first unplanned hospitalization, number of in-hospital days, and 30-day unplanned readmission in

nursing home residents with multimorbidity by conducting a prospective study to obtain data on residents' transition to the acute ward of hospitals.

This study had some limitations. First, the integrity of the data at the time of hospitalization was limited, which may affect the application of the present findings to other types of nursing home. Second, this study only analyzed the impact of unplanned hospitalization from the perspective of residents and did not account for staff allocation in the nursing home or how that home implemented infection control. Therefore, the results cannot fully explain the unplanned hospitalization situation of nursing home residents in Taiwan.

## 5. Conclusion

This study discovered that unplanned hospitalization remains a common event for nursing home residents. In the analysis, 75% of the residents were found to have had their first hospitalization by week 8. Complete dependence and use of a nasogastric tube or Foley catheter were significant predictors of unplanned hospitalization for nursing home residents. To reduce the number of unplanned hospitalizations of residents and prevent avoidable hospitalizations, this study suggests strengthening the staffing management of nursing homes, training institutional nursing staff, enhancing the home's emergency response capacity and care, establishing preventive care guidelines for residents in high-risk groups, and effectively monitoring the quality of care.

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## Declaration of competing interest

The authors declare that there are no conflicts of interest.

## Author contributions

P.-W. C., H.-F. H., S.-H. C. and F.-L. W. conceived, conceptualized and designed the study; P.-W. C., and F.-L.W. performed the data collection and reviewed the article drafts. P.-W. C., H.-F. H. and F.-L. W. participated in collection, curation, and organization of all clinical data. P.-W. C. funding acquisition. All authors prepared the original draft and supervised the study. All authors have read and agreed to the published version of the manuscript.

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