

Nasogastric tube feeding versus assisted hand feeding in-home health care older adults with severe dementia in Taiwan: a prognosis comparison

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Abstract

Backgrounds/Objectives All individuals with severe dementia should be offered careful hand feeding. However, under certain circumstances, people with severe dementia have a feeding tube placed. In Taiwan, tube feeding rate in demented elderly home care residents is increasing, yet the tube feeding's benefit in these groups is still unknown. We compared the clinical prognosis and mortality rate of demented elderly patients who received nasogastric tube feeding (NGF) or assisted hand feeding (AHF).

Methods This retrospective observational study enrolled 202 participants aged over 60 years in the setting of home health care between January 1 and December 31, 2017. All subjects with documented severe dementia suffered from difficulty in oral intake and needed either AHF or NGF. Data were collected from both groups to analyze pneumonia, hospitalization, and mortality rates.

Results A total of 202 subjects (61 males and 141 females, aged 85.7 ± 7.7 years) were analyzed. Of note, 61 had AHF, and 141 had NGF. Most subjects were in a bed-ridden status, with 83.7% on Eastern Cooperative Oncology Group (ECOG) scale 4 and 66.3% with a Barthel index less than score 10. Pneumonia risk was higher in NGF (46.8%) than in AHF (24.6%, $p = 0.0031$). Despite adjusting for multiple factors in the regression model, a higher incidence of pneumonia risk was still observed in the NGF group (aOR = 2.15, 95% CI 1.01–4.56). The one-year mortality rates in AHF and NGF were 8.3% and 14.2%, respectively, and no significant difference was observed after adjustment with logistic regression (aOR = 1.20, 95% CI 0.37–3.90). No significant differences were observed in hospitalization rate and duration.

Conclusions For in-home health care elderly demented patients, NGF is associated with a significantly higher pneumonia rate compared with AHF. Additionally, neither the mortality nor the hospitalization rates decreased in the NGF group. Therefore, on the basis of these findings, we should question the benefits of NGF for in-home health care elderly demented subjects. Continued careful hand feeding could be an alternative to tube feeding in severe dementia. Furthermore, we should consider the quality of life and make individualized decisions before deciding to use tube feeding.

Background

Dementia is a neurodegenerative disease characterized by a progressive, irreversible, and long-term disease course. Its recent high prevalence rate in Western and Asian countries has a significant impact on modern society (1). A recent study showed that, in Taiwan, dementia's prevalence was 26.8% in residential houses and 61.8% in assisted living facilities (2). Therefore, the National Health Insurance in Taiwan has been reimbursing the cost of palliative and home care systems in the case of severe dementia. However, owing to the lack of information in recognizing severe dementia, palliative care for severe dementia is not generally accepted as a standard treatment. Life-sustaining treatments in severe dementia are a big issue. Palliative care decreases life-sustaining interventions, with the exception of tube feeding (3).

In a Chinese-based culture, an eating disorder was considered a big problem. Therefore, most health care proxies will choose nasogastric (NG) tube insertion. As a consequence, NG feeding prevalence has increased over time in Taiwan (4). A study from a nursing home reported that tube feeding rate was 29.2%, among which 99% was nasogastric tube feeding (5).

Nevertheless, tube feeding in elderly individuals with severe dementia and eating difficulties is still controversial. Some studies showed that tube feeding could increase the survival rate and improve the nutritional condition (6) (7). On the contrary, more retrospective observational studies and a review article indicated that tube feeding brought no benefit in survival, pneumonia risk, pressure ulcers, and nutrition status while increasing physical suffering and impairing the quality of life (8) (9).

Additionally, guidelines published by several professional societies have shown no benefit and suggest that tube feeding should be avoided in patients with severe dementia (10) (11) (12). The first government-sponsored guidebook for palliative care in dementia was published in Taiwan in October 2016. The guidebook supports assisted hand feeding (AHF) in severe dementia and provides numerous feeding skills (13).

To date, data in previous studies were collected from hospitals, nursing homes, or geriatric institutions. On the contrary, studies on in-home health care systems were scantily represented.

Patients with advanced dementia are under-recognized for their high risk of death and are often treated at in-home care systems with life-sustaining interventions. A better understanding of the real-world situation of in-home care could provide us more information to improve severe dementia care. We conducted a 12-month retrospective observational study of 202 home care older adults with severe dementia to assess the prognosis between AHF and nasogastric feeding.

Methods

Study design and data source

The present report is a retrospective observational study. Data were collected from the home health care system in Mackay Memorial Medical Center, Taiwan. Our government started developing the home health care system in 1987. With the increased aging population, the Ministry of Health and Welfare decided to include it in the National Health Insurance. To date, the home health care system is well developed and can provide good professional health care at home. The Barthel index was used as an initial screening tool for home care system registration. Specifically, the Barthel index uses scales to measure 10 basic items of self-care and physical dependency. Enrollment requirement was the score to be less than 60, which is associated with assisted independence (a normal score is 100) (14). Once the residents were enrolled in the home care system, each individual underwent baseline assessments. Owing to the high demands of home care quality, numerous physical examinations, questionnaires, and psychosocial status were carefully evaluated. The database contained the following regular home care records: patients' age, gender, enrolled condition, being cared by caregivers or family members, feeding status,

stool or urinary incontinence, and pressure sores. The Eastern Cooperative Oncology Group (ECOG) performance status was a measure of patients' performance status on a scale from zero to five. The higher the scales, the worse performance capacity the patients have. The Norton scale (15) was used to predict pressure-induced injuries. Specifically, a score of less than 14 indicated a high risk of pressure ulcer development. Mini Nutritional Assessment (MNA) was applied for global nutrition and the evaluation of various body measurements. The time-saving Mini Nutritional Assessment–Short Form (MNA-SF) uses six questions obtained from the full MNA and be validated good sensitivity as well (16). Body Mass Index (BMI) is a valid predictor of adiposity and can be a practical tool for obesity or underweight assessment. Laboratory data [i.e., serum albumin, hemoglobin (Hb), white blood count (WBC), creatinine, and electrolytes] were collected at baseline and during follow-up. Additionally, underlying comorbidities and hospitalizations were recorded. Home care doctors and nurses visited registered patients from two weeks to three months and annually, according to patients' medical conditions.

Selection of the study subjects

Subjects were selected from the home care registered system. In 2017, 386 individuals with documented cognitive impairment due to dementia were cared for in a home care system. Residents who met enrollment requirements were evaluated for dementia severity, which was assessed by the Functional Assessment Staging Test (FAST) (17). At stage 6c or higher on FAST, patients started having difficulties with toileting and feeding and urinary or stool incontinence. Patients progressed to a stage of inability, being characterized by total functional dependence. Exclusion criteria were as follows: age younger than 60 years, self-oral intake without any assistance, absence of outpatient or inpatient medical records in 2017, and missing information (i.e., MNA-SF, BMI, serum albumin, Hb, and WBC; Figure 1).

We classified dementia into three subgroups using the diagnosis obtained in medical records. Dementia types included Alzheimer's disease, vascular dementia, and other causes. Underlying comorbidities were defined based on inpatient or outpatient medical records (ICD–10-CM).

Outcome measurements

The outcomes were pneumonia rate, hospitalization rate, duration of hospitalization, and one-year mortality in both the AHF and NGF groups.

Statistical analysis

IBM SPSS Statistics 25.0 was used for the statistical analysis.

A chi-square test for categorical variables and Student's *t*-test for continuous variables were used to compare the differences between AHF and NGF. We aimed at evaluating the possible presence of a

significant difference in pneumonia, hospitalization, and one-year mortality rates among AHF and NGF individuals. Therefore, we performed a binary logistic regression, with the adjustment of gender, age, feeding status, Barthel index, ECOG, pressure sores, Hb, and WBC.

The p values were two-tailed and defined as statistically significant with p values < 0.05 .

Results

Characteristics of the subjects

Among the 2017 home care residents, 386 patients had medically documented dementia. Finally, a total of 202 individuals met the eligibility criteria and were enrolled in the study. In the hand-assisted feeding group, there were 61 (30.2%) individuals, and in the tube feeding group, there were 141 (69.8%).

The characteristics of AHF and NGF subjects with advanced dementia enrolled in the study can be found in Table 1. In short, the mean age of the study group was 85.7 years old (69.8% were female). In the AHF group, the ECOG scale and Barthel index were significantly different vs. the NGF group ($p < 0.0001$). Moreover, the mean serum albumin level in the NGF group was significantly lower than that in the AHF group (3.9 ± 0.6 and 3.7 ± 0.6 , respectively, $p = 0.0393$).

(Table 1)

Pneumonia rate

Throughout a 12 months follow-up, the pneumonia rate in the NGF group was significantly higher than that in the AHF group initially (46.8% and 24.6%, respectively, $p = 0.0031$) (Table 2). Multiple variables were examined to perform pneumonia risk assessment (i.e., sex, no pressure sores, and a Barthel index less than score 10 were risk factors of pneumonia; Table 3). The regression model adjusted for age, gender, feeding status, pressure sores, and Barthel index showed that NGF would increase pneumonia risk twice as much as AHF (aOR, 2.15; 95% CI, 1.01–4.56; Table 3).

(Table 2)

(Table 3)

Hospitalization rate and duration

Hospitalization rate was 50.8% in AHF and 64.5% in NGF ($p = 0.0672$). The factors associated with the risk of hospitalization were no pressure sores ($p = 0.0139$) and a lower Hb level ($p < 0.0001$; Table 2). After adjusting for age, gender, feeding status, pressure sores, and Barthel index, we found that pressure sores and higher Hb were related to protective factors (Table 3). Of note, we observed that the mean

hospitalization days were 13.1 ± 23.3 and 17 ± 21.9 days for AHF and NGF, respectively ($p = 0.2510$). Interestingly, the factors significantly associated with the duration of hospitalization were pressure sores and Hb level.

One-year mortality rate

The one-year mortality rate in the AHF was 8.3% (vs. 14.2% in the NGF group; $p = 0.2510$). We analyzed other factors to understand the association with one-year mortality rate. However, as shown in Table 2, the results demonstrated the absence of a significant association. After adjusting for gender, age, feeding status, Barthel index, pressure sores, and WBC level, the mortality rate in the NGF group was no insignificant difference vs. the AHF group (aOR = 1.20; 95% CI, 0.37–3.90; Table 3).

Discussion

The results in this study revealed that NGF is associated with a higher pneumonia risk in severely demented elderly individuals who are cared for with in-home health care. On the contrary, we found that hospital admission and mortality rates were similar compared with AHF. Our study showed that the risk of pneumonia diagnosis was significantly higher in the NGF than in the AHF group. In elderly demented patients, gradual impairment of swallowing develops along with disease progression. Owing to the loss of a normal clearance mechanism, the most frequent consequence is aspiration pneumonia. The latter usually occurs during eating when pharyngeal materials enter the lower way, followed by a lower airway infection caused by nonpathogenic flora (18).

A review article in 1996 on 19 cohorts suggested that tube feeding could not reduce the risk of aspiration pneumonia (19). Subsequently, a study compared the incidence of aspiration pneumonia in individuals with nasogastric feeding, gastrostomy, jejunostomy, and oral feeding. The authors found that, after a six months follow-up, 58% of tube feeding groups had aspiration pneumonia compared with the oral feeding group (54% in NG feeding, 67% in gastrostomy, 75% in jejunostomy, and 17% in oral feeding). Of note, the study demonstrated a significant difference between oral feeding and tube feeding ($p < 0.01$) (20). Importantly, a recent study indicated that tube feeding had approximately twice as high inspiration pneumonia diagnosis (RR = 2.32; 95% CI = 1.22–4.40) (21). Of note, oral secretions and regurgitated gastric contents are serious threats known to cause aspiration pneumonia, and feeding tubes provide no protection efficacy (19). As opposed to stroke, dementia is a progressively deteriorating disease (22). Individual strategies are required to manage different pathogenesis. Tube feeding was generally reserved for short-term, reversible, or unconscious individuals. Additionally, we found that female gender and pressure sores seemed to be protective factors for the study subjects. Proper positioning and regular position changing were useful strategies for the care of pressure sores (23). Given the limited data currently available, it is purported that position changing could also bring benefits in pneumonia care (24).

Hospitalizations cause distress and are associated with poor outcome in advanced dementia patients. However, elderly demented patients are frequent visitors to hospitals for several reasons. A 2009 prospective cohort study of 617 patients investigated the prevalence and mortality in acute hospital. The results of this study revealed a rising admission rate with age: 29.6% for patients aged 70–79 and 75% for patients >90. Urinary tract infection or pneumonia was the primary cause. These patients had a higher mortality rate (adjusted mortality risk 4.02, 95% CI 2.24–7.36) (25). Most hospitalizations among elderly patients with dementia are avoidable. Of note, invasive treatments in acute hospital care may not meet the needs of these groups and would cause injuries. Even infectious diseases such as pneumonia could be treated effectively in a nursing home rather than in the hospital (26). In the present study, the major cause of hospital admission was pneumonia. Hospitalization rate and duration in both groups showed no significant difference. Higher Hb levels seemed to be a protective factor for decreasing hospitalization rates and duration of stay. Importantly, Hb could be an early indicator of nutritional status, related to hospitalized elderly patients (27). The home care system in my country made great efforts to advocate the avoidance of frequent admissions and provided phone consultation when needed (13).

The present retrospective observational study of home care residents showed no difference in mortality rate between AHF and NGF in advanced dementia patients. An earlier study suggests that 85.8% of the patients with advanced dementia (stage 7 on the Global Deterioration Scale) had an eating problem, with 6-month mortality of 38.6% (28). Furthermore, a longitudinal study in Taiwan investigated the survival prediction in demented patients. The authors concluded that 77% of the patients who were placed with a nasogastric tube died within six months. Therefore, nasogastric tube placement was recognized as a risk factor with a 6-month mortality rate (29). A 2009 Cochrane systemic review, which included seven observational studies, revealed insufficient evidence of increasing survival rate in tube feeding groups (9). In line with earlier reports, our study did not favor tube feeding decreasing the mortality rate. Such observation may indicate that, once dementia progressed to a severe stage, with the development of eating problems, the 6-month mortality rate was high whether the patient was tube fed or not.

Despite significant efforts to improve oral intake, most dementia patients will develop eating difficulties during their lives' severe stage. A nasogastric tube was considered a convenient and efficient approach for individuals with feeding problems. However, NG feeding frequently presented complications (e.g., blockage, dislodgement, pneumonia, trauma from insertion, and use of physical or chemical restraints) (30) (31). When comparing NG with gastrostomy groups, a significantly higher number of tube-related complications were reported in the NG group (aOR = 0.18, 95% CI = 0.05–0.65) (32). Hand-assisted oral feeding in advanced dementia patients should be considered an alternative to tube feeding (33). Management of difficulty in eating in advanced dementia is still controversial. The goals should emphasize on avoiding functional decline and adopting safe and effective oral feeding. A comprehensive swallowing assessment could help in identifying dysphagia's etiology and provide adequate strategies for improved swallowing function. Furthermore, several approaches can increase the efficiency of careful hand feeding (e.g., modifying the feeding position, feeding skills, and changing both the feeding environment and the texture of food). Of note, feeding skills are essential strategies for the prevention of aspiration (e.g., the chin tuck posture and head rotation toward the weak side). Patients with an impaired

oropharyngeal musculature can more easily control thickened rather than thin fluids. Modifying the food texture of solids or liquids also increased effectiveness, especially for severe dementia (34). Nevertheless, making the modified food acceptable and appetizing is vital in order to increase compliance.

Furthermore, an adequate environment setting (e.g., removing distractions and scheduling mealtime with family) could make patients enjoy their social time, as opposed to isolated tube feeding. In the present study, well-trained nurses provided all of these useful strategies for oral feeding residents of the home health care system. To date, tube feeding still plays a role because of individuals' concerns over the discomfort of being thirsty or hungry. However, the consequences of forgoing tube feeding (e.g., discomfort or pain) have not been investigated so far. A prospective observational study of 178 nursing home patients tried to address this issue. They observed different items creating a discomfort index. Shortness of breath, restlessness, observation of pain, and dehydration were related to higher levels of discomfort. Given the evidence that discomfort levels were not associated with forgoing tube feeding (35), we believe that additional efforts should be placed on evaluating the patients' quality of life (36).

Our study widened the study group from nursing home to home health care in community settings, which was one of the significant care systems for severe dementia in Taiwan. Furthermore, the relatively large number of NG feeding groups is a useful comparison with other Asian countries, where there is a high prevalence of NG feeding.

In hospitals or nursing homes, well-equipped facilities and specialized health care provide a high quality of care. On the contrary, there was only one or no caregiver in the home care system, with inadequate training. Results from the home care system are essential for community practice. We believe that is a pilot study on tube feeding issues in severe dementia residents of home health care in Taiwan. This study's results will help in providing health care providers, patients, and families with a more realistic understanding of nutritional support in severe dementia.

The present study has several limitations. First, for ethical reasons, conducting randomized controlled trials would be extremely challenging. In this retrospective study, the recruited subjects were already under NGF or AHF conditions, not randomly enrolled. Therefore, the baseline characteristics of both groups were different. We could only use statistical methods to make corrections and eliminate these factors. Second, a selection bias was inevitable. Of note, the enrolled subjects were home health care cases in a single medical center. Furthermore, intervention (NGF) and control (AHF) groups were not well matched, and the difference of sample size between these two groups was not small. However, this could also explain the high preference of NGF in severely demented patient care because of its convenience and efficiency. If it becomes possible to collect outcome data from multi-centers, the problem of sample size may be solved. Lastly, no data were available for the following aspects: quality of life, objective assessment of discomfort, pain scale, use of physical and chemical restraints, and physical function. Quality of life is more important than the life span, and it is usually neglected.

Conclusions

The hallmarks of severe dementia are the lack of insight and capacity to make an independent decision. However, life-sustaining interventions have been widely performed, especially with the use of eating tube. Our study demonstrated that nasogastric feeding compared with AHF was responsible for twice the risk of pneumonia and had no benefits in hospitalization and mortality rates. The burdens of NG tube placement could impair quality of life and cause numerous complications. We believe that a dedicated attempt at oral feeding by hand should be provided to most conscious patients. Future studies with better design are required in order to provide strong evidence. Additionally, further studies should play more emphasis on quality of life assessment of in-home care settings so that more people with dementia can die with dignity in a place of their choosing.

Declarations

Abbreviations

NGF: nasogastric tube feeding; AHF: Assisted hand feeding; BMI: Body Mass Index; ECOG: Eastern Cooperative Oncology Group; FAST: Functional assessment staging; MNA: Mini Nutritional Assessment; MNA-SF: Mini Nutritional

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Availability of data and materials

The datasets and analyzed during the current study is available from the corresponding author on reasonable request.

Author contributions

The conception, design, results measurement and statistical analysis were by Hsiao-Hui Chou MD.

Meng-Ting Tsou PhD provided the assistance in organizing datasets and statistical analysis. In addition, Lee-Ching Huang PhD provided precious recommendations and contributed to critical and final revision.

Ethics approval and consent to participate

This study has been approved by the MacKay Memorial Hospital Review Board. The constitution and operation of this review board are according to the guidelines of ICH-GCP. According to ICH-GCP, IRB will have to review each clinical research case annually and decided whether continue it or not.

(IRB number: 17MMHIS123)

Consent for publication

Not applicable.

Competing interests

There are no potential conflicts of interest with respect to the research, and authorship of this article

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Tables

Table 1. Characteristics of subjects with advanced dementia in AHF and NGF.

	Total	AHF	NGF	<i>p</i>
Numbers no. (%)	202	61 (30.2)	141 (69.8)	
Gender (Female) no. (%)	141 (69.8)	49 (34.6)	92 (65.3)	0.0321
Age (years, mean ± SD)	85.7 ± 7.7	85.8 ± 7.5	85.7 ± 7.8	0.9289
ECOG 4 no. (%)	169 (83.7)	39 (63.9)	130 (92.2)	<0.0001
Barthel index (<10) no. (%)	134 (66.3)	22 (16.4)	112 (83.6)	<0.0001
Caregiver no. (%)	112 (55.4)	29 (47.5)	61 (43.3)	0.5740
Diagnosis				
Alzheimer's disease no. (%)	32 (15.8)	10 (16.4)	22 (15.6)	
Vascular dementia no. (%)	37 (18.3)	12 (19.7)	25 (17.7)	
Others no. (%)	133 (65.8)	39 (63.9)	94 (66.7)	
Pressure sores no. (%)	28 (13.9)	7 (11.5)	21 (14.9)	0.5186
BMI (kg/m ² , mean ± SD)	21.7 ± 3.6	22.2 ± 3.6	21.5 ± 3.6	0.2175
MNA-SF (mean ± SD)	9.3 ± 2.6	9.8 ± 2.3	9.1 ± 2.7	0.1090
Norton scale (mean ± SD)	10.5 ± 2.5	11.5 ± 3.4	10.0 ± 1.8	<0.0001
Serum albumin (g/dL, mean ± SD)	3.8 ± 0.6	3.9 ± 0.6	3.7 ± 0.6	0.0393
Hb (g/dL, mean ± SD)	11.0 ± 1.7	10.9 ± 1.9	11.1 ± 1.6	0.6451
WBC (10 ³ /μL, mean ± SD)	10.3 ± 3.7	9.7 ± 3.0	10.6 ± 4.0	0.1233

Abbreviations:

AHF: assisted hand feeding

NGF: nasogastric tube feeding

ECOG: Eastern Cooperative Oncology Group

MNA-SF: Mini Nutritional Assessment–Short Form

BMI: Body Mass Index

$p < 0.05$ for significant difference

Table 2. Variables associated with pneumonia rate, hospitalization rate, and one-year mortality rate.

Variables	Pneumonia			Hospitalization			Mortality		
	Yes	No	P	Yes	No	P	Yes	No	P
Total no. (%)	81 (40.1)	121 (59.9)		122 (60.4)	80 (39.6)		25 (12.4)	177 (87.6)	
Age (years, mean ± SD)	86.1 ± 8.1	85.5 ± 7.5	0.5694	86.0 ± 7.5	85.3 ± 8.0	0.4978	88.2 ± 5.7	85.4 ± 7.9	0.0899
Gender (F)	47 (33.3)	94 (66.7)	0.0029	81 (57.5)	60 (42.5)	0.1926	21 (14.9)	120 (85.1)	0.1094
Weight (kg, mean ± SD)	66 (46.8)	75 (53.2)	0.0031	91 (64.5)	50 (35.5)	0.0672	20 (14.2)	121 (85.8)	0.3516
Weight gain (NGF)	15 (24.6)	46 (75.4)	0.0031	31 (50.8)	30 (49.2)	0.0672	5 (8.2)	56 (91.8)	0.3516
Weight loss (AHF)	73 (42.6)	97 (57.4)	0.1003	107 (63.3)	62 (36.7)	0.0550	22 (13.0)	147 (87.0)	0.7730
ECOG performance scale 4	61 (45.5)	73 (54.5)	0.0273	82 (61.2)	52 (38.8)	0.7448	20 (14.9)	114 (85.1)	0.1742
Pressure sore	5 (17.9)	23 (82.1)	0.0118	11 (39.3)	17 (60.7)	0.0139	3 (10.7)	25 (89.3)	1.0000
BMI (kg/m ² , mean ± SD)	21.5 ± 3.0	21.9 ± 4.0	0.4316	21.6 ± 3.4	21.9 ± 4.0	0.6033	21.4 ± 2.7	21.8 ± 3.7	0.7016
MNA-SF	9.6 ± 2.2	9.1 ± 2.8	0.1577	9.5 ± 2.5	9.1 ± 2.7	0.3976	9.2 ± 2.6	9.4 ± 2.6	0.7586
Alkaline phosphatase (U/L, mean ± SD)	10.4 ± 2.0	10.5 ± 2.8	0.6507	10.5 ± 2.0	10.4 ± 3.0	0.8591	9.6 ± 2.4	10.6 ± 2.5	0.0645
Urea nitrogen (mg/dL, mean ± SD)	3.7 ± 0.6	3.9 ± 0.6	0.0806	3.7 ± 0.6	3.9 ± 0.6	0.2083	3.7 ± 0.7	3.8 ± 0.6	0.6677
White blood cell count (WBC, 10 ³ /μL, mean ± SD)	10.9 ± 1.4	11.1 ± 1.9	0.3351	10.6 ± 1.4	11.6 ± 1.9	<.0001	10.5 ± 1.4	11.1 ± 1.7	0.1147
Neutrophils (%)	10.4 ± 3.3	10.3 ± 4.0	0.8010	10.4 ± 4.1	10.2 ± 3.1	0.7401	12.3 ± 6.9	10.1 ± 2.9	0.0053

Abbreviations:

AHF: assisted hand feeding

NGF: nasogastric tube feeding

ECOG: Eastern Cooperative Oncology Group

MNA-SF: Mini Nutritional Assessment–Short Form

BMI: Body Mass Index

$p < 0.05$ for significant difference

Table 3. Risk factors of pneumonia risk and hospitalization rate, and one-year mortality rate with logistic regression.

Factors	Pneumonia		Hospitalization		Mortality	
	aOR	95% CI	aOR	95% CI	aOR	95% CI
Age	1.02	0.98-1.06	1.01	0.97-1.05	1.06	0.99-1.13
Gender	2.38	1.23-4.58	1.98	0.96-4.12	0.29	0.08-1.00
Feeding (NGF)	2.15	1.01-4.56	1.95	0.92-4.13	1.20	0.37-3.90
Pressure sore	0.23	0.08-0.66	0.25	0.10-0.62	0.65	0.17-2.47
Barthel index	0.60	0.30-1.22	0.97	0.46-2.04	0.50	0.16-1.61
Hb	∅	∅	0.62	0.51-0.77	∅	∅
WBC	∅	∅	∅	∅	1.16	1.04-1.31

Figures

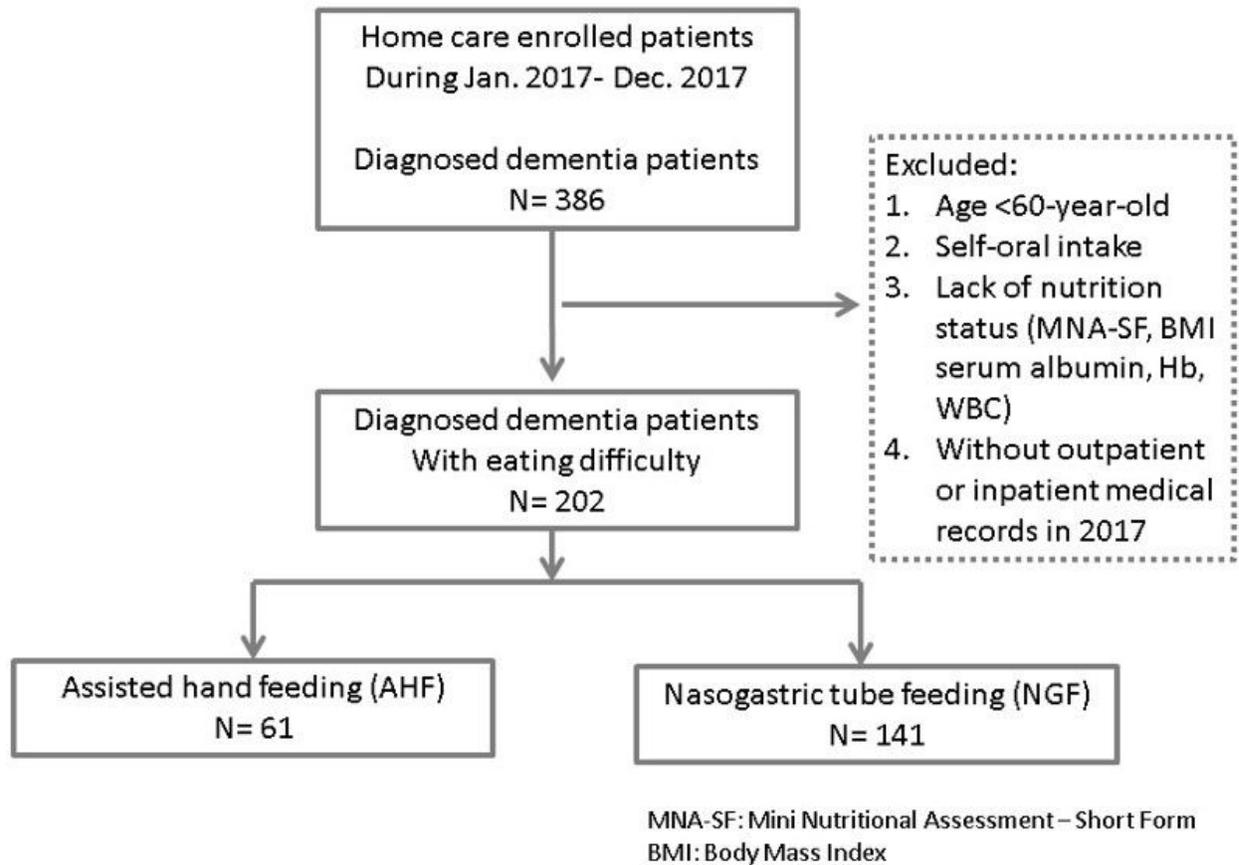


Figure 1

Participants recruiting process