High feeding dependence prevalence in residents living in Italian nursing homes requires new policies: findings from a regionally based cross-sectional study

Alvisa Palese, MNS[a], Luca Grassetti, PhD[b], Davide Bandera, BNS[a], Ranieri Zuttion, MNS, BNS, RN,[c] Barbara Ferrario, MNS, [c] Sandra Ponta, MNS, BNS, RN,[c]

Mark Hayter, PhD[d], Roger Watson, PhD[d]

[a]Department of Medical Sciences, Udine University, Italy; [b] Department of Economics and Statistics, Udine University, Italy; [c]Welfare Unit, Friuli Venezia Giulia Region, Italy; [d]Faculty of Health & Social Care, Hull University, UK

Corresponding Author

Alvisa Palese, Associate Professor in Nursing Science, Udine University, Viale Ungheria 20, 33100 Udine, Italy, alvisa.palese@uniud.it; + 39(0)432 590926, 0039 (0) 4323 590918 (fax)

Highlights

- Feeding dependence is a complex need to satisfy in nursing homes.

- The 56.8% are at need of assistance in feeding on a daily basis.

- With the increased dependence in feeding, nursing home policies should be re-designed.

Abstract

Objectives: An increased amount of functional dependence has been reported among residents living in nursing homes. Among others, feeding dependence is one of the most complex needs to satisfy: behind the attempt to personalise meals with individual preferences and clinical regimens, all residents require help at the same moment and for long periods of time, three or more times a day. With the intent of debating policy implications, the aims of this study were to advance the knowledge in the field of feeding dependence prevalence and predictors in Italy, a country where life expectancy is among the highest in the World.

Method: A large retrospective regionally-based study approaching all nursing homes (n=105) was performed in 2014; all residents (n=10,900) were eligible and those with a completed assessment recorded in the regional database and aged > 65 years (n=8,875) were included.

Results: 1,839 residents (20.7%) were in total need of help in feeding on a daily basis. At the multilevel analysis, predictors were moderate/severe dementia (OR 4.044, CI 95% 3.213–5.090); dysphagia (OR 4.003 CI 95% 3.155–5.079); pressure sores (OR 2.317 CI 95% 1.803–2.978); unintentional weigh loss (OR 2.197 CI 95% 1.493–3.233); unsociability (OR 1.561 CI 95% 1.060–2.299); and clinical instability (OR 1.363 CI 95% 1.109–1.677).

Conclusions: The feeding dependence prevalence emerged seem to be unique compared to that documented at the international levels. Modifiable and unmodifiable predictors found require new policies regarding workforce skills-mix and shifts schedules; as well as alliances with families, associations and communities' stakeholders. According to the complexity of the resident profile emerged, staff education and training is also recommended.

1. Introduction

Different predictors have been documented as affecting nursing home (NH) admissions among the elderly and dependence in more than three activities of daily living (ADLs) has been identified as the strongest [1,2]. Specifically, some early- (dressing and personal hygiene) and mid-loss ADLs (toileting, transferring and locomotion [3,4]) have been indicated as the strongest predictors of subsequent NH placement [1]. By contrast, some late-loss ADLs such as eating [5] usually deteriorate in later stages of life, during the in-NH stay. At the individual level, dementia, other chronic diseases, geriatric syndrome, depression, and loneliness have been shown to affect self-feeding performance [6,7]. Moreover, at the NH level, poor care or mistreatments due to the lack of NH resources as well as NH size have been identified as predictors of excessive dependence [8], leading specifically to an increased need of assistance during meals.

Self-feeding partial or total dependence have been defined as failure in spoon-feeding, problems with manipulation of food in the mouth, adverse behaviour and food falling from the mouth [9,10]. At the individual level, feeding dependence may lead to malnutrition, dehydration, adverse events such as inhalation pneumonia and other complications associated with high 6-month mortality rates [11]. At the NH caregiver level, assisting an individual with feeding dependence represents one of the most challenging tasks: it requires a minimum participation of the individual (e.g. maintaining attention during mealtime, opening the mouth, swallowing), adequate time for assistance, a proper relationship between the dyad as well as an adequate environment [12]. Moreover, at the NH level, feeding dependence is also one of the most complex needs to satisfy: behind the attempt to personalise meals with individual preferences and clinical regimens, all residents require help at the same moment and for long periods of time, three or more times a day; conversely, other needs – such as transferring and bathing – can be prioritised at different times of the day. Therefore, feeding dependence prevalence, among other ADLs, should be continuously assessed, aiming at the early identification of trends requiring national and NH-level policies capable of addressing its complexity [13,14].

Different studies measuring the prevalence of NH residents with partial or total feeding dependence around the world have been published to date. Among the first studies performed in the eighties, 240 residents of a skilled US-nursing facility were included, and 32% were dependent in eating [15]; later, by involving 125 older adults living in three non-profit geriatric long-term care facilities in Brazil, around 14.6% were

dependent in feeding [16]. In Spain, among 3,921 residents living in 86 NHs, 373 residents in 23 NHs were selected and 60 (17.3%) were diagnosed with dysphagia and 50 (13.4%) with feeding difficulties [17]. In contrast, in 149 residents with dementia and living in long-term care facilities located in Seoul, 54.4% were in need of moderate or total assistance while eating [18]. In New Zealand, Boyd and colleagues [19], in their multiple cross-sectional study design evaluating functional decline in NH residents over 20 years, reported that the proportion of those highly dependent increased from 16% (1988) to 21% (2008); specifically, those residents requiring assistance in feeding were 35% and 25%, respectively. More recently, by including 199 residents living in US NHs, almost one-third of them had been more recently identified as needing help in eating and predictors were severe cognitive impairment and low physical capability [20].

The high variability in prevalence reported across the World is due to different factors: a) researchers considered different conceptual definitions of feeding dependence as well as using different instruments to measure this phenomenon; b) NHs with different missions and resident admission criteria were included, [21], thus influencing residents' needs of care as well as their length of stay (e.g., short vs. long NH stayers); moreover, c) studies have been performed in different years and in different National Health care System [22]. In recent years, residents have been more likely to be admitted to a NH in a worse condition than in the past. The increased presence of services in the community and the revision of eligibility criteria for NH admission in some countries have redesigned the residents' care needs. Residents admitted in NH are sicker and closer to death than community-dwelling people; only around 10–31% of newly admitted NH elders require minimal help in ADL tasks, while the remaining require greater assistance [23]. In this context, measuring functional decline in NH residents is more challenging due to the reported increased dependence at baseline, which is also a predictor of decline. Therefore, data available should be continuously updated, given that understanding functional changes in NH residents may affect different aspects of care: from staffing levels and skills-mix to staff education; from models of care delivery to preventive programmes aimed at intervening in cases of specific impairments and groups of at-risk residents.

Therefore, with a view of debating policy-making themes at the macro- and meso- levels, the aims of this study were to advance the knowledge in the field of feeding dependence prevalence and predictors in Italy, a country where life expectancy is among the highest in the World [24]. Two research questions were established: a) How many NH residents are totally and partially feeding-dependent and what is the profile of

those residents totally dependent as compared to those partially or totally independent in feeding? and b) What factors predict feeding dependence in residents living in NHs?

2. Methods

2.1 Study design

A retrospective regionally-based study was performed on 2014. Findings are reported here according to The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [25] and according to the Reporting of studies Conducted using Observational Routinely-collected Health Data (RECORD guidelines) [26].

2.2 Setting and participants

All residents living in each of the 105 existing NHs in Friuli Venezia Giulia in 2013 (Italy) with a total of beds of 10,900 (from 7 to 520) were eligible. The NH resident assessment was performed at the time of NH admission and every six months by trained Registered Nurses (RNs) using the Val.Graf tool [27] according to regional rules.

In the study there was included the last completed assessment for all NH residents aged > 65 years as recorded in the regional database. Assessments performed at the NH admission, as well as those performed for short-stay residents (< 6 months) discharged for death, hospital admission, or admission to another NH, with parenteral (via infusion) or enteral nutrition (via NGT or PEG) were all excluded.

A total of 10,900 residents were then eligible; those who did not receive any assessment, or who had received only one assessment performed at the time of admission, short stayers remaining less than 6 months in the NH (=1,724, 15.8%), or those with enteral or parenteral nutrition (=301, 2.8%) were not included; therefore, the study's total population was 8,875 residents (81.4%).

2.3 Variables, data sources and measures

Variables were classified at the resident and at the NH level; the end point was the self-feeding dependence as measured at the resident level, while explanatory variables were measured both at the resident and at the NH level as reported in Table 1.

Data were extracted from the regional database where the last assessment was recorded. Data were collected as following:

- data at the resident level were collected at the bedside by trained RNs through observation (e.g. pressure sores), interview (e.g. pain intensity) and nursing records (e.g. episodes of vomit) by considering as time reference the previous week. The nurse in charge of the assessment was responsible of the resident daily care. The assessment was performed by using the Val.Graf tool [74], developed in Italy in the early 1990s as a geriatric, multidimensional assessment instrument for evaluating functional, clinical, psychological and social conditions of residents living in NHs. In its residential form used for the purposes of this study, the tool comprises 99 items; its validity has been established and findings demonstrated that the tool is acceptable and comprehensive, requiring around 20 minutes to be completed; it has a coherent factorial structure (13 factors, with explained variance of 52.9%) and demonstrated a satisfactory concurrent validity with other measures (e.g., Katz index, Mini – Mental State Examination) as well as from adequate to excellent reliability in all dimensions [27].

- data at the NH level (e.g. bed size) were also extracted from the regional database where on annual basis, the managers of each NH populated the data set by filling in the minimum data set as required by the regional rules.

2.4 Strategies to address potential sources of bias

Different strategies aimed at preventing biases were put into place: a) to avoid any end point misclassification, a validated tool was used [27]; b) to ensure accuracy in data collection, certified RNs working in the NH and responsible of the nursing care were in charge of the resident's assessment; c) to avoid selection bias, residents were identified from the database by validating their identification; d) to avoid performance bias, such as differences in the care received by residents, the study period was selected when NH regional policies and accreditation processes were stable over time.

2.5 Ethical issues

This study was approved by the Ethics Committee (Reference Number 56449). According to the type of study which was observational in nature and based upon the analysis of a database currently populated by NHs, informed consent by residents or their caregivers was not required.

After receiving permission from the Ethical Committee, the regional database regarding residents and NHs was analysed, ensuring at all times no confidentiality breach during the entire process of data extraction and analysis. Identification of each resident was protected by removing the identifying codes.

2.6 Data analysis

The statistical Packages SPSS Version 24.00 and R Statistics (R Core Team, 2017 [33]) were used to perform data analysis. Descriptive statistic was preliminarily performed by calculating frequencies, percentages, averages and confidence intervals [CI] at 95%. Moreover, groups (totally, partially and independent in self-feeding) were compared by using the chi-square test, ANOVA or non-parametric tests in accordance with the nature of the variables and their normal (or not) distribution.

Aiming at identifying clusters effect at the NH levels, the Intra Class Correlation (ICC) was calculated. The ICC index was computed both under the random and fixed effect assumptions.

Then, accounting for the hierarchical data structure (residents nested within NHs), a multilevel analysis was performed. Given that the end point was considered as a dichotomic variable (residents' total feeding dependence or not) the Generalized Linear Mixed Model was applied where the model specification is aimed at estimating the odds ratios (OR, CI 95%) for each explanatory variable. Only those explanatory variables that emerged as significant in the comparisons among groups were inserted into the model by including all of them. The model goodness of fit has been measured by evaluating the pseudo R^2 measure. The significance was set at $p < 0.05$.

3. Findings

3.1 Feeding-dependence prevalence

A total of 8,875 NHs residents were included; as reported in the Table 2, 1,839 residents (20.7%) were in total need of help in feeding on a daily basis; 36.1% were partially at need while 43.2% were totally independent. Those totally feeding-dependent were significantly most often female (79.5%) as compared with other groups (77.6 and 70.6%, respectively); moreover, they reported a greater dependence in all ADLs on the Barthel Index (2.33 CI 95% 2.09–2.57) as compared to those partially dependent (17.33 CI 95% 16.76–17.90) and independent in feeding (54.34 CI 95% 53.44–55.30). The majority of residents totally in need of assistance in feeding were cognitively compromised (CPS > 4 = 86.9%), while those partially dependent or independent were less often compromised (40.4% and 10.0%, respectively). Minor or major depressive disorders were significantly more often reported by those partially dependent (47.7% and 36.1%, respectively), while those residents in total need of help were significantly less often depressed (30.2%).

From the clinical perspective, those totally dependent in feeding were significantly more often clinically unstable (56.5%), with a higher prevalence of pressure sores (25.3%), dysphagia (42.7%) and documented unintentional weight loss in the last month (10.1%) as compared to other groups; moreover, those in total need of help in feeding were significantly less often under analgesia (44.9%) compared to other groups (47.8% and 48.4%, respectively).

Residents in total need for help were significantly less often verbally aggressive on a daily basis (16.5% vs 26.2% and 20.2%) while they were significantly more often physically aggressive (13.4%) compared to those independent residents (6.4%) and similarly to those who were partially feeding-dependent (14.6%). Unsociability and lack of cooperation in care were also more often reported in totally dependent residents (96.4% and 30.3%, respectively) compared with the other groups. Moreover, dependent residents were significantly less often engaged in family relationships (38.5%), with health-care workers (16.4%) and with volunteers (6.1%) compared to those who were partially feeding-dependent or independent.

At the NH levels, the majority of totally dependent residents were living in public not for-profit, large NHs (54.9%) with > 150 beds; they were receiving an amount of nursing care significantly superior to that defined by regional rules, with statistically different percentages across groups as reported in Table 2.

Specifically, by considering the random effect paradigm, the ICC index at the cluster (NH) level was 0.13.

3.2 Predictors of feeding dependence

The multivariate multilevel analysis performed by using the Generalized Linear Mixed Model presented an acceptable value for the pseudo R squared (49.37%). Predictors of total dependence in self-feeding at the individual level were moderate/severe dementia (OR 4.044, CI 95% 3.213–5.090); dysphagia (OR 4.003 CI 95% 3.155–5.079); pressure sores (OR 2.317 CI 95% 1.803–2.978); unintentional weigh loss (OR 2.197 CI 95% 1.493–3.233); unsociability (OR 1.561 CI 95% 1.060–2.299); and clinical instability (OR 1.363 CI 95% 1.109–1.677).

Protective factors of self-feeding dependence were having close relationships with family caregivers (OR 0.566 CI 95% 0.454–0.705) and with volunteers (OR 0.762 CI 0.581-0.999), as well as higher scores in the Barthel Index (OR 0.691 CI 95% 0.673–0.710), and an increased age (OR 0.955 CI 95% 0.944-0.966), as reported in Table 3.

4. Discussion

4.1 Feeding-dependence prevalence and policy implications

This is the first large regionally-based study performed in Italy where less than 400 beds in nursing and residential care facilities for every 100,000 inhabitants are available [34] and life expectancy is one of the highest in the world [24]. The demand for long-term care services is likely to increase as the population ages [21], particularly in countries such as Italy where life expectancy is higher and the fertility ratio is limited [24]; thus, families may have an increased difficulty in supporting a dependent member and therefore decide on an NH placement for their loved one.

We have considered feeding dependence because it represents the most complex need to be satisfied, requiring time, competence and compassion: the ability to put in place evidence-based preventive measures in independent residents; evidence-based rehabilitation or specific interventions capable of increasing performance in those partially dependent [20]; and to assist appropriately in feeding those totally dependent residents, also collecting data necessary for decision-making processes, such as the need of enteral nutrition and the relevant ethical implications. Moral distress among nurses and nursing aides has been documented as a consequence resident with cognitive decline refusing to eat and the uncertainty regarding whether to suggest enteral nutrition or to insist with oral nutrition [35].

In accordance to our findings, more than half of the residents (56.7%) were in need of partial or total help in feeding: specifically, two patients out of ten required complete assistance by NH carers while around four patients out of ten required partial assistance. The feeding dependence that emerged is high and seems to be unique compared to that documented at the international levels, ranging from 14.6% [16] to 54.4% [18]. As a consequence of this high prevalence specific policies are required.

Thorsell et al. [36], in evaluating the time devoted to assisting feeding, have accounted for around an average of 11 min/resident; Liu and colleagues [7], more recently, have documented that individualised care in feeding has increased the time to feed patients with dementia from 5.9 min to 35.6 minutes. Therefore, taking into consideration that from 11 minutes (that could be considered as a poor care) to 35 minutes should be spent in case for those residents in total need of assistance, more than 1,011 hours/day ([11*1,839] * 3 meals/day) to 3,212 hours/day ([35*1,839] *3 meals/day) should be spent in feeding residents living in regional NHs. Considering that the average length of shifts is around six hours, a huge amount of resources at the regional level are needed, from 169 to 536 health-care workers at the time of feeding assistance. Last, they should also be trained in implementing appropriate interventions according to modifiable predictors.

4.2 Factors affecting feeding-dependence and policy implications

At the NH level, the ICC regarding the feeding dependence was 0.13, thus indicating that 13% of the residual variability (not explained by the fixed component of the model) can be attributable to each NH cluster. Therefore, contextual variables, even taking into account other control variables, affect the degree of dependence in self-feeding. This can be explained from different perspectives, such as the quality of the nursing care offered in each NH, which can be different in the standards as well as in their intent, more focused on rehabilitation vs. on assisting residents [37]; different policies implemented at the NH level, aiming at increasing the quality of nutrition; or the quality of the environment (e.g. calm, without noises), which has been documented as affecting dependence among residents [38]. Reasons affecting the degree of dependence in self-feeding at the NH levels should be considered also in further studies.

The multilevel analysis showed that some clinical and social factors have increased the likelihood of feeding dependence by explaining 49.37% of the total variance. From the clinical point of view, those residents with moderate/severe dementia were more than four times more at risk of being feeding-dependent and this was also the case in those with dysphagia, which has been associated with dementia [19,39]. Clinical instability increases the risk of being dependent in feeding by about 36%; moreover, pressure sores and unintentional weight loss were associated with a twofold increase in the likelihood of dependence in self-feeding. These findings may be interpreted in two different directions: as a consequence of malnutrition due to the lack of nutritional care [40] but also as an antecedent of increased dependence in self-feeding in those residents at the end of life [41]. Among these variables at the individual level, age has emerged as a protective factor (an increasing of one year reduced the likelihood to develop self-feeding dependence) suggesting that the clinical (e.g. dementia) and the social conditions of elderly play a role in developing dependence. However, this contro-deductive finding should be addressed with future research.

From the social point of view, unsociability has increased the likelihood of being dependent in feeding by around 56%. This manifestation, considered by the literature as a behavioural symptom of dementia, is particularly challenging for carers, given its effect on stress and on possible ethical implications concerning the need of providing nutritional care and respecting residents' preferences [42]. Moreover, having close relationships with family cares and volunteers was the main protective factor, reducing by around 44% and 24%, respectively, the likelihood of being totally dependent in feeding. Family or volunteer presence may limit the sense of loneliness [43,44,45] and increase motivation and personalised nutritional care. In addition, an increased independence in all ADLs has prevented feeding dependence by around 31%, thus confirming that feeding is among the late-loss ADLs [3,4]. Differently, no explanatory variables have emerged at the NH levels. Possibly some latent variables affecting the end point, as emerged in the ICC findings, should be further studied aiming at understanding those NH factors influencing the degree of dependence in feeding. Predictors evident at the resident level, specifically the clinical ones which seem to be unmodifiable, suggest the need to redesign some NHs' policies regarding educational priorities, skill-mix, shifts schedules, alliance strategies with families/volunteers' communities, and research priorities.

As recently established by Pavolini and Kuhlman [46], the number of nurses in the Italian health-care sector has been static in recent years while a large number of migrant nursing assistants have been employed

in long-term care. The complex clinical and social frailty profiles of residents in total need of assistance in feeding require more competences than those currently possessed by nursing care assistants; appropriate training advancing their competence and supervision by competent RNs is strongly recommended. Moreover, given the cultural relevance of nutrition, there is a need to also develop cultural sensitivity among migrant health-care workers, aimed at ensuring that feeding remains a pleasant experience connected with the residents' preferences and needs for as long as possible. Furthermore, in preparing the future workforce, students should be offered learning experience in NH settings aiming at learning how to prioritise these complex needs, supervising nursing aides as well as intervening clinically in the case of complex residents (e.g. with behavioural and psychological symptoms). Revising the amount of RN and nursing aides direct care time per resident per day according to the increased needs is also suggested, given that this has been strongly associated with better outcomes, specifically a decrease in pressure sores occurrence as well as in unintentional weight loss and ADLs deterioration [47].

Alliances with families as well as public strategies aimed at facilitating their presence at meals (e.g. public transports) is also required [47,48]. Moreover, strict alliances with communities and reference associations where NHs are located with the purpose of involving other resources in helping those less complex residents with a lower need for help in feeding, are recommended. Projects developed by Italian secondary schools aimed at exposing younger generations to the complexity of work experience and social needs through planned weeks spent in real workplaces may also be an opportunity: NHs opened to these experiences, hosting and training students in helping not-complex elderly in basic care, may also be a great occasion for creating intergenerational connections and a more integrated society.

The amount of care time available during mealtimes should be periodically measured. When health-care workers perceive time scarcity, they implicitly ration activities of daily living [49]; moreover, time scarcity may lead to predominantly task-oriented instead of person-centred approaches [35]. Overlapping shifts (e.g. from 7 a.m. to 2 p.m. the morning shift and from 1 p.m. instead of 2 p.m. the afternoon shifts) thus doubling the personnel available may also be a strategy: shifts are usually arranged to have no or limited overlap in NHs mainly for handover reasons; their redesign based on these emerging needs may be necessary. Moreover, there is the need to assess periodically trends in the need of care in daily activities in NHs within and across countries, which may be affected by policies implemented among community dwelling elderly as

well as by those implemented at the NH levels, such as rehabilitation services; trend analysis may elucidate priorities [50] and monitor their effectiveness [51]. Furthermore, there is the need to increase economic resources dedicated to intervention studies aimed at identifying the best evidence-based approach to maintain independence in feeding specifically among individuals affected by dementia. In designing these studies, specific attention to pragmatic approaches, considering also long-term intervention feasibility in times of resources scarcity, is strongly recommended.

4.3 Limitations

This study has several limitations: firstly, we have performed a retrospective study and therefore predictors emerged should not be considered in their casual relationships with feeding dependence. Secondly, we have approached databases populated for clinical and administrative purposes; although RNs were trained in the use of the Val.Graf tool [27] and its compilation was not affected by any external bias (e.g. reimbursement on the basis of the functional dependence declared in the database), data accuracy may have been threatened. Thirdly, the feeding performance was measured with a simple method used by RNs to rank the degree of dependence and to consequently prioritise the needs of care. Fourthly, in establishing the inclusion criteria, we have considered only those residents without enteral/parental nutrition, postulating that these residents have already lost their self-feeding ability. By analysing this subgroup, data regarding the degree of self-feeding abilities were almost missed and therefore we have decided to remove.

Furthermore, different data (e.g. medications) were not considered in the multilevel analysis, given that the Val.Graf tool [27] did not include this information; this may justify the fact that around 50% of factors predicting feeding dependence was not explained by the regression model designed.

5. Conclusions

More than a half of Italian residents (56.7%) were in need of partial or total help in feeding and the feeding dependence that emerged seems to be unique compared to that documented at the international levels. Modifiable (e.g., encouraging family members or volunteers to be present during meals) and unmodifiable predictors (e.g. the degree of cognitive decline) have emerged suggesting that the profile of residents' dependent in self-feeding are complex and require appropriate assistance for this basic need. Moreover, 13%

of the degree of dependence in self-feeding is associated with NH cluster even when taking into account other control variables.

Aiming at dealing with the high prevalence of self-feeding dependent residents, there is the need to revise policies regarding workforce skills-mix and shifts schedules aiming at ensuring the appropriate care during meals; developing strong relationships with families, associations and different communities' stakeholders is also advisable. Moreover, according to the complexity of the resident profile emerged, staff education and training is also strongly recommended. Comparing dependence trends across NHs and countries, as well as the effects of specific policies implemented, may increase professional and social awareness with regard to this emerging issue, also offering an insight into innovative solutions.

Competing interest

The authors declare that they have no competing interest.

References

[1] Fong JH, Mitchell OS, Koh BS. Disaggregating activities of daily living limitations for predicting nursing home admission. Health Service Research 2015; 50(2):560-78.

[2] Gaugler, JE, Duval S, Anderson KA, Kane RL. Predicting Nursing Home Admission in the U.S: A Meta-analysis. BMC Geriatrics 2007; 7:13.

[3] Cohen-Mansfield J. Assessment of disruptive behaviour/agitation in the elderly: function, methods, and difficulties. Journal of Geriatric Psychiatry and Neurology 1995; 8(1):52-60.

[4] Kempe GI, Myers AM, Powell LE. Hierarchical structure in ADL and IADL: analytical assumptions and applications for clinicians and researchers. Journal of Clinical Epidemiology 1995; 48(11):1299-305.

[5] Morris JN, Fries BE, Morris SA. Scaling ADLs within the MDS. Journals Gerontology. Series A, Biological Sciences Medical Sciences 1999; 54(11): M546-53.

[6] Lane NE, Wodchis WP, Boyd CM, Stukel TA. Disability in long-term care residents explained by prevalent geriatric syndromes, not long-term care home characteristics: a cross-sectional study. BMC geriatrics 2017; 17(1).

[7] Liu W, Galik E, Boltz M, Nahm ES, Resnick B. Optimizing Eating Performance for Older Adults With Dementia Living in Long-term Care: A Systematic Review. Worldviews on Evidence-Based Nursing 2015; 12 (4), 228–235.

[8] Slaughter S, Eliasziw M, Morgan D, Drummond N. Incidence and predictors of eating disability among nursing homes residents with middle – stage dementia. Clinical nutrition 2011; 30: 172-177.

[9] Watson R. Measuring feeding difficulty in patients with dementia: perspectives and problems. Journal of Advanced Nursing 1993; 18(1):25-31.

[10] Aselage MB, Amella EJ, Watson R. State of the science: Alleviating mealtime difficulties in nursing home residents with dementia. Nursing Outlook 2011; 59: 210-214.

[11] Mitchell SL, Teno JM, Kiely DK, Shaffer ML, Jones RN, Prigerson HG, et al. The clinical course of advanced dementia. The New England Journal of Medicine 2009; 361(16):1529-38.

[12] Liu W, Cheon J, Thomas SA. Interventions on mealtime difficulties in older adults with dementia: a systematic review. International Journal of Nursing Studies 2014; 51(1):14-27.

[13] Basso I, Dimonte V. Nurses' decisions in the care of advanced dementia patients: a survey. Assistenza Infermieristica e Ricerca 2013; 32(2):73-83.

[14] Hjaltadóttir I, Hallberg IR, Ekwall AK, Nyberg P. Health status and functional profile at admission of nursing home residents in Iceland over 11-year period. International Journal of Older People Nursing 2012; 7(3):177-87.

[15] Siebens H, Trupe E, Siebens A, Cook F, Anshen S, Hanauer R, Oster G. Correlates and consequences of eating dependency in institutionalized elderly. Journal of American Geriatric Society 1986; 34(3):192-8.

[16]   Marinho LM, Vieira MA, Costa Sde M, Andrade JM. Degree of dependence of elderly residents in geriatric long-term care facilities in Montes Claros, MG. Rev Gaucha de Enfermagem 2013; 34(1):104-10.

[17]   Irles Rocamora JA, Sánchez-Duque MJ, de Valle Galindo PB, Bernal López E, Fernández Palacín A, Almeida González C, Torres Enamorado D. A prevalence study of dysphagia and intervention with dietary counselling in nursing home from Seville. Nutricion Hospitalaria 2009; 24(4):498-503.

[18]   Lee KM, Song JA. Characteristics of eating behavior in elders with dementia residing in long-term care facilities. Journal of Korean Academy of Nursing 2012; 42(4):466-76.

[19]   Boyd M, Broad JB, Kerse N, Foster S, von Randow M, et al. Twenty years trends in dependency, in Residential aged care in Auckland, New Zealand. A descriptive study. Journal of the American Medical Directors Association 2011; 12:535-540.

[20]   Liu W, Galik E, Boltz M, Nahm ES, Lerner N, Resnick B. Factors associated with eating performance for long-term care residents with moderate-to-severe cognitive impairment. Journal of Advanced Nursing 2016; 72(2):348-60.

[21]   Ansah JP, Eberlein RL, Love SR, Bautista MA, Thompson JP, Malhotra R, Matchar DB. Implications of long-term care capacity response policies for an aging population: a simulation analysis. Health Policy 2014; 116(1):105-13.

[22]   Douper M, John PJ, Chateau D, Strang D, Smele S, Bozat-Emre S, Fransoo R, Dik N. Profiling the multidimensional needs of new admitted Nursing home residents: evidence to support planning. Journal of the American Medical Directors Association 2012; 487e9 – 487e17.

[23]   Palese A, Menegazzi G, Tullio A, Zigotti M, Hayter M, Watson R. Functional Decline in Residents Living in Nursing Homes: A Systematic Review of the Literature. Journal of the American Medical Directors Association 2016; 1;17(8):694-705.

[24]   World Health Statistics 2016: Monitoring health for the SDGs Annex B: tables of health statistics by country, WHO region and globally. World Health Organization. 2016. Retrieved 18 October 2017.

[25]   Elm E, Altman DG, Egger M, Pocock SJ, Gotzsche PC, Vandenbroucke JP. The Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement: guidelines for reporting observational studies. PLoS Medicine 2007; 4(10): e296.

[26]   Benchimol EI, Smeeth L, Guttmann A, Harron K et al. The REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) Statement. PLoS Medicine 2015; 12: e1001885.

[27]   Pascazio L, Morosini P, Bembich S, Nardone I, Clarici A, Barbina L, et al. Description and validation of a geriatric multidimensional graphical instrument for promoting longitudinal evaluation. Archives of Gerontology and Geriatrics 2009; 48(3):317-24.

[28]   Mahoney FI, Barthel DW. Functional evaluation: the Barthel Index. Maryland State Medical Journal 1965; 14:61-5.

[29]   Morris JN, Fries BE, Mehr DR, Hawes C, Phillips C, Mor V, Lipsitz LA. MDS Cognitive Performance Scale. Journal of Gerontology 1994; 49(4):M174-82.

[30]   Burrows AB, Morris JN, Simon SE, Hirdes JP, Phillips C. Development of a Minimum Data Set-Based Depression Rating Scale for Use in Nursing Homes. Age and Aging 2000; 29: 165-72.

[31]   Fries BE, Simon SE, Morris JN, Flodstrom C, Bookstein FL. Pain in U.S. nursing homes: validating a pain scale for the minimum data set. The Gerontologist 2001; 41(2):173-9.

[32]   European Pressure Ulcer Advisory Panel and National Pressure Ulcer Advisory Panel. Prevention and treatment of pressure ulcers: quick reference guide. Washington DC: National Pressure Ulcer Advisory Panel; 2009

[33]   R Core Team (2017). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

[34]   Health Care Resource Statistics, 2010; http://ec.europa.eu/eurostat/statistics-explained/index.php/Healthcare_resource_statistics_-_beds Accessed date 25 October 2017.

[35]   Tuinman A, de Greef MH, Krijnen WP, Nieweg RM, Roodbol PF. Examining Time Use of Dutch Nursing Staff in Long-Term Institutional Care: A Time-Motion Study. Journal of the American Medical Directors Association 2016; 17(2):148-54.

[36]   Thorsell KBE, Nordstrom BM, Fagerstrom L, Sivberg BV. Time in Care for Older People Living in Nursing Homes. Hindawi Publishing Corporation Nursing Research and Practice 2010; 1-10.

[37]   Fauth EB, Zarit SH, Malmberg B, Johansson B. Physical, cognitive, and psychosocial variables from the Disablement Process Model predict patterns of independence and the transition into disability for the oldest-old. Gerontologist 2007; 47(5):613-24.

[38]   Bååth C, Idvall E, Gunningberg L, Hommel A. Pressure-reducing interventions among persons with pressure ulcers: results from the first three national pressure ulcer prevalence surveys in Sweden. Journal of Evaluation Clinical Practice 2014;20(1):58-65.

[39]   Andresen M, Puggaard L. Autonomy among physically frail older people in nursing home settings: a study protocol for an intervention study. BMC Geriatrics 2008; 8 (32).

[40]   Moreira NC, Krausch-Hofmann S, Matthys C, Vereecken C, Vanhauwaert E, Declercq A, et al. Risk Factors for Malnutrition in Older Adults: A Systematic Review of the Literature Based on Longitudinal Data. Advances in Nutrition 2016; 7(3):507-22.

[41]   Chen Li-Li, Hong Li, Rong Lin, Jian-Huang Zheng, Yan-Ping Wei, Jing Li, et al. Effects of a feeding intervention in patients with Alzheimer's disease and dysphagia. Journal of Clinical Nursing 2015; 25, 699–707.

[42]   Lindbloom EJ, Brandt J, Hough LD, Meadows SE. Elder mistreatment in the nursing home: a systematic review. Journal of the American Medical Directors Association 2007; 8(9):610-6.

[43]	Vandervoort A, Van den Block L, van der Steen JT, Volicer L, Vander Stichele R, Houttekier D, Deliens L. Nursing home residents dying with dementia in Flanders, Belgium: a nationwide post-mortem study on clinical characteristics and quality of dying. Journal of the American Medical Directors Association 2013; 14(7):485-92.

[44]	Hazelhof TJ, Schoonhoven L, van Gaal BG, Koopmans RT, Gerritsen DL. Nursing staff stress from challenging behaviour of residents with dementia: a concept analysis. International Nursing Review 2016; 63(3):507-16.

[45]	Drageset J, Kirkevold M, Espehaug B. Loneliness and social support among nursing home residents without cognitive impairment: a questionnaire survey. International Journal of Nursing Studies 2011; 48(5):611-9.

[46]	Pavolini E, Kuhlmann E. Health workforce development in the European Union: A matrix for comparing trajectories of change in the professions. Health Policy 2016; 120(6):654-64.

[47]	Horn SD, Buerhaus P, Bergstrom N, Smout RJ. RN staffing time and outcomes of long-stay nursing home residents: pressure ulcers and other adverse outcomes are less likely as RNs spend more time on direct patient care. The American Journal of Nursing. 2005; 105(11):58-70.

[48]	Durkin DW, Matthew S.S, Simmons SF. The Impact of Family Visitation on Feeding Assistance Quality in Nursing Homes. Journal of Applied Gerontology 2014; 33(5) 586–602.

[49]	Zúñiga F, Ausserhofer D, Hamers JP, Engberg S, Simon M, Schwendimann R. The relationship of staffing and work environment with implicit rationing of nursing care in Swiss nursing homes--A cross-sectional study. International Journal of Nursing Studies 2015; 52(9):1463-74.

[50]	Ellen ME, Panisset U, Araujo de Carvalho I, Goodwin J, Beard J. A Knowledge Translation framework on ageing and health. Health Policy 2017; 121(3): 282–291.

[51]	Herr A, Nguyen TV, Schmitz H. Public reporting and the quality of care of German nursing homes. Health Policy 2016; 120(10):1162-1170.

Table 1.

End-point and explanatory variables extracted from the regional database at a resident and NH level

Level	Variables: description	Items, metrics and cut-off if available	Validity[a]
	End point: Feeding dependence was conceptualized using a single item scored in four levels. Those requiring daily physical assistance to ensure nutritional and liquid intake at all meals were considered totally feeding-dependent; those requiring supervision, prompts or physical assistance at times and/or those cooperating and capable of using at least one utensil (e.g. spoon) but in need of surveillance were instead considered partially dependent; the remaining indicate that a resident was totally independent in feeding	1 item, 4 points Likert scale, from 0 (totally independent) to 4 totally dependent	[27]
	Explanatory variables		
	Age; Gender	Years; Male, Female	-
	Dependence in other ADLs (bathing, bowel control, dressing, personal/body care, stairs, walking, mobility on level surfaces)	7 items, 4 points Likert scale, from 0 (totally independent) to 4 totally dependent	[27]
	Barthel Index (BI) measuring the degree of dependence in all ADLs	10 items, from 0 totally dependent to 100 totally independent	[28]
Resident	Cognitive Performance Scale (CPS)	Total score from 0 (cognition preserved) to 6 (very severe cognitive impairment) scores >4 indicate moderately severe/very severe cognitive impairment	[29]
	Depression Rating Scale (DRS)	Total score ranging from 0 to 14 scores ≥3 indicate minor or major depressive disorders	[30]
	Clinical instability	1 item, ranging from 0 (stable) to 4 (requiring close monitoring) ≥ 3 identified clinical instability	[27]
	Pain Scale	1 item, ranging from 0 (no pain) to 3 (severe pain) >1 identified pain	[31]
	Administration of analgesics; pressure sores dysphagia; episodes of vomit; unintentional weight loss (> 5% in the last month or > 10% in the last six months)	Dichotomous variables, yes/no	[27,32]
	Physical and/or verbal aggressiveness; unsociability (e.g. avoiding social contact); resisting cooperation in daily care	Dichotomous variables, yes/no	[27]
	Close relationships with family, health-care professionals, and volunteers/spiritual supporters	Dichotomous variables, yes/no	[27]
Nursing Home	For-profit or not-for-profit mission	Dichotomous variable, yes/no	-
	NH size	Number of beds	

	Rural vs. city NHs	City > 50,000 inhabitants
	Amount of nursing care delivered by RNs and nurse assistants (NAs) as superior (or not) with regard to the amount required by regional law (60 minutes/day or 75 minutes/day) in accordance to the NH profile	Dichotomous variables, yes/no

[a] as validity, reliability or other psychometric measures documented to date

ADL, activity of daily living; NH, nursing home; NAs, nurse assistants; RNs, registered nurses

Table 2

Residents' and NH's characteristics according to their self-feeding degree of dependence

Resident variables	Total feeding dependence 1,839 (20.7%)	Partial feeding dependence 3,201 (36.1%)	Totally independence 3,835 (43.2%)	p-value
Age (years), mean (95% CI)	85.3 (84.8–85.8)	86.5 (86.3–86.8)	83.5 (83.2–83.8)	<0.001
Females (n, %)	1,462 (79.5)	2,484 (77.6)	2,708 (70.6)	<0.001
Bathing (0–4)[b]	3.96 (3.95–3.97)	3.40 (3.37–3.42)	2.40 (2.36–2.43)	<0.001
Bowel control (0–4)[b]	3.76 (3.72–3.79)	2.84 (2.78–2.89)	1.05 (1.00–1.10)	<0.001
Dressing (0–4)[b]	3.93 (3.92–3.94)	3.28 (3.26–3.31)	1.89 (1.85–1.93)	<0.001
Personal/body care (0–4)[b]	3.95 (3.93–3.96)	3.13 (3.09–3.16)	1.50 (1.46–1.54)	<0.001
Stairs (0–4)[b]	3.96 (3.95–3.98)	3.61 (3.57–3.64)	2.46 (2.41–2.51)	<0.001
Walking (0–4)[b]	3.87 (3.85–3.89)	2.95 (2.91–3.00)	1.40 (1.35–1.45)	<0.001
Mobility on level surfaces (0–4)[b]	3.71 (3.67–3.75)	2.45 (2.39–2.50)	0.84 (0.79–0.88)	<0.001
BI (0−100)[a]	2.33 (2.09–2.57)	17.33 (16.76–17.90)	54.34 (53.44–55.30)	<0.001
CPS (> 4)[c]	1,599 (86.9)	1,292 (40.4)	382 (10.0)	<0.001
DRS (≥3)[d]	555 (30.2)	1,526 (47.7)	1,386 (36.1)	<0.001
Clinical instability (n, %)	1,039 (56.5)	1,446 (45.2)	1,219 (31.8)	<0.001
Pain Scale (0−3)[e]	0.69 (0.65–0.73)	0.69 (0.66–0.72)	0.68 (0.65–0.70)	0.714
On medication for pain (n, %)	826 (44.9)	1,531 (47.8)	1,856 (48.4)	0.043
Pressure sores (n, %)	466 (25.3)	300 (9.4)	159 (4.1)	<0.001
Dysphagia (n, %)	786 (42.7)	259 (8.1)	59 (1.5)	<0.001
Episodes of vomit (n, %)	41 (2.2)	43 (1.3)	22 (0.6)	<0.001
Unintentional weight loss (n, %)	185 (10.1)	161 (5.0)	72 (1.9)	<0.001
Verbal aggressiveness (n, %)	304 (16.5)	840 (26.2)	776 (20.2)	<0.001
Physical aggressiveness (n, %)	247 (13.4)	468 (14.6)	246 (6.4)	<0.001
Unsociability (n, %)	1,772 (96.4)	2,644 (82.6)	2,135 (55.7)	<0.001
Lack of cooperation in daily care (n, %)	558 (30.3)	967 (30.2)	585 (15.3)	<0.001
Relationships with families (n, %)	708 (38.5)	2,122 (66.3)	2,832 (73.8)	<0.001
Relationships with health-care workers (n, %)	302 (16.4)	1,163 (36.3)	1,819 (20.5)	<0.001
Relationships with volunteers (n, %)	113 (6.1)	405 (12.7)	739 (19.3)	<0.001
NH variables				
For-profit (n, %)	148 (8.0)	390 (12.2)	846 (22.1)	<0.001
Bed size				<0.001
<80 (n, %)	309 (16.8)	681 (21.3)	1,297 (33.8)	
80−115 (n, %)	521 (28.3)	871 (27.2)	837 (21.8)	
>115 (n, %)	1,009 (54.9)	1,469 (51.5)	1,701 (44.4)	
NH site				<0.001
Rural (n, %)	1,162 (63.2)	1,996 (62.4)	2,820 (73.5)	
City (n, %)	667 (36.8)	1,205 (37.6)	1015 (26.5)	
Care delivered by NAs > standards[f] (n, %)	1,738 (94.5)	2,905 (90.8)	3,079 (80.3)	<0.001
Care delivered by RNs > standards[f] (n, %)	1,728 (94.0)	2,936 (91.7)	3,205 (83.6)	<0.001

CI, confidence interval; NH, nursing home; NAs, nurse assistants; RNs, registered nurses.

[a] BI, Barthel Index = from 0, dependent on activities of daily living, to 100, independent.

[b] 0, totally independent; 4, totally dependent.

[c] CPS, Cognitive Performance Scale, scores >4 indicate severe/very severe cognitive impairment.

[d] DRS, Depression Rating Scale, ≥ 3 indicates moderate or severe depression.

[e] Pain Scale = from 0, no pain, to 3, severe pain.

^f Amount of care delivered by RNs and by NAs ≥60 or > 75 minutes/day in accordance with the NH profile.

Table 3

Self-feeding total dependence predictors: findings from a multilevel analysis

Resident variables	Coefficient B	SE	OR	CI 95%		p-value
Age (years)	-0.046	0.006	0.955	0.944	0.966	<0.001
Females vs. male	-0.042	0.126	0.959	0.749	1.226	0.737
BI (0–100)[a]	-0.369	0.014	0.691	0.673	0.710	<0.001
CPS > 4[b]	1.397	0.117	4.044	3.213	5.090	<0.001
DRS ≥3[c]	-0.100	0.110	0.905	0.730	1.122	0.362
Clinical instability vs. no	0.310	0.106	1.363	1.109	1.677	0.003
On medication for pain vs. no	-0.021	0.106	0.979	0.795	1.205	0.841
Pressure sores vs. no	0.840	0.128	2.317	1.803	2.978	<0.001
Dysphagia vs. no	1.387	0.121	4.003	3.155	5.079	<0.001
Episodes of vomit vs. no	0.471	0.381	1.602	0.759	3.380	0.216
Unintentional weight loss vs. no	0.787	0.197	2.197	1.493	3.233	<0.001
Verbal aggressiveness vs. no	-0.237	0.146	0.789	0.592	1.051	0.105
Physical aggressiveness vs. no	-0.175	0.164	0.840	0.608	1.159	0.288
Unsociability vs. no	0.445	0.198	1.561	1.060	2.299	0.024
Lack of cooperation in daily care vs. no	0.237	0.124	1.268	0.994	1.618	0.056
Relationships with families vs. no	-0.569	0.112	0.566	0.454	0.705	<0.001
Relationships with health-care workers vs. no	-0.272	0.138	0.762	0.581	0.999	0.049
Relationships with volunteers vs. no	0.134	0.202	1.144	0.769	1.701	0.507
NH variables						
For-profit vs. no	-0.040	0.343	0.960	0.490	1.882	0.906
Bed size						
Middle NH (80-150) vs. small NH (<80)	-0.308	0.263	0.735	0.439	1.230	0.241
Large (> 150) vs. small NH (<80)	-0.452	0.247	0.637	0.392	1.033	0.068
Care delivered by NAs > regional standards[d]	0.308	0.426	1.360	0.591	3.133	0.470
Care delivered by RNs > regional standards[d]	0.405	0.437	1.500	0.636	3.536	0.354
(Intercept)	3.643	0.619	38.209	11.364	128.471	<0.001
R^2	49.37%					

B coefficient indicates the weight of each independent variable in the model; CI 95%, confidence interval; NAs, nurse assistants; OR, odds ratio; RNs, registered nurses; SE, standard error.

[a] BI, Barthel Index = from 0, total dependence in activities of daily living; to 100, totally independent.

[b] CPS, Cognitive Performance Scale, scores >4 indicate severe/very severe cognitive impairment.

[c] DRS, Depression Rating Scale, ≥ 3 indicates moderate or severe depression.

[d] Amount of care delivered by RNs and by NAs ≥60 or > 75 minutes/day in accordance with the NH profile.