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Impact of long term care and mortality risk in community care and nursing homes populations

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Highlights

- The Portuguese National Network for Long-Term Care was created in 2006
- Individuals receiving home care have a higher mortality rate
- Most individuals present no changes in their cognitive and physical status
- Quality and safety may improve if patient-reported outcomes measures are implemented

Objectives: To identify the survival time, the mortality risk factors and the individuals' characteristics associated with cognitive and physical status at discharge, among the Portuguese long-term care (LTC) populations.

Settings: Home-and-Community-Based Services (HCBS) and three types of nursing home (NH).

Participants: 20,984 individuals admitted and discharged in 2015.

Measurements: The Kaplan-Meier survival analysis and the Cox Proportional Hazards Models were used to study the mortality risk; the Wilcoxon signed-rank test to identify the number of individuals with cognitive and physical changes between admission and discharge; two cumulative odds ordinal logistic regressions to predict the cognitive and physical dependence levels at discharge

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Results: The mortality rate at HCBS was 30%, and 17% at the NH, with a median survival time of 173 and 200 days, respectively. The main factors associated with higher mortality were older age, male gender, family/neighbour support, neoplasms and cognitive/physical dependence at admission. In NH/HCBS, 26%/18% of individuals improve their cognitive status, while in physical status, the proportion was 38%/27%, respectively. Finally, older age, being illiterate and being classified at the lowest cognitive and physical status at admission decrease the likelihood of achieving a higher level of cognitive and physical independence at discharge.

Conclusions: The adoption of a robust and complete assessment tool, the definition of guidelines to enable a periodical assessment of individuals' autonomy and the adoption of benchmark metrics allowing the comparison of results between similar units are some of the main goals to be taken into account for future developments of this care in Portugal.

***Keywords*:** Nursing Homes; Home and Community-Based Services; Mortality risk; Outcomes assessment; Portugal

Background

Needs assessments nowadays play a fundamental role in the planning process of healthcare and social services and are even considered a means in the clinical context to reach a specific diagnosis [1]. Being the main premise of the long-term care (LTC) sector "*care* over *cure"*, it is important to define metrics of needs assessment in several areas to help healthcare providers to (re)design patient care, develop clinical pathways and predict with higher accuracy their rehabilitation outcome at discharge.

Although several studies analysed the differences between Nursing Homes (NH) and Home and Community-Based Services (HCBS) populations in order to identify factors determining admissions into each setting of care, it is not easy or consensual to define the best areas for outcome assessment. Usually, outcome measures are related either to mortality or to changes of cognitive and physical dependence levels. Thus, to assess these outcomes, it is important to incorporate different individual-mix factors, including socio-demographic characteristics, medical conditions as well as the physical and cognitive status [1–4].

Regarding the mortality assessment, because the number of deaths in LTC is usually high, it is important to estimate the expected length of survival after an individual's admission and identify the main mortality predictors so that policy makers can optimize the planning of services provision. For that matter, in spite of different magnitudes between studies, several authors concluded that the most relevant mortality risk factors include older age, male gender, the absence of a social support network, the presence of certain medical conditions (e.g., neoplasms, musculoskeletal or

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respiratory diseases) and high levels of cognitive and physical dependence [5–11]. After assessing the mortality rate, some authors found no differences between NH and HCBS, either after adjusting for baseline variables (age, gender, race, education, race, education, marital status, length of stay, cognition, and comorbidity) [12] or when comparing patients receiving care at NH, HCBS or combined care [13]. Others found a higher mortality among those at NH [6,14–16].

Concerning the physical outcomes, whereas some authors found no significant differences in the deterioration in performing activities of daily living (ADL) between the two settings of care [12,17–19], others found better outcomes among HCBS individuals [13,20–22] and others concluded that only the NH population showed some ADL improvements [23]. As for changes in cognitive status, although some authors found no statistical differences between the two settings of care [12,23], others found better outcomes among those at HCBS [13,20].

Besides the overall differences in outcomes between these two populations, several findings can be highlighted concerning the influence of different variables as predictors of physical and cognitive changes. Older age seems to be related to a higher cognitive impairment [24,25]; moreover, some studies concluded that younger age positively influences the physical improvement [2,4,16,18,26] but others found no significant effect [27–30]. In most health facilities with similar rehabilitation programmes, men and women are expected to achieve similar progress and outcomes. Despite gender being an independent risk factor for cognitive function [24,25], some authors found no statistically significant association between gender and changes in cognitive [19] and physical status [26,29–31]. Others concluded that women were twice as likely to show physical improvements compared to men [2]. Within HCBS individuals, one study concluded that women were more likely to achieve functional recovery [4], while others concluded the opposite [16,28].

Since LTC patients are usually elderly people with chronic diseases, what often influences their dependence levels, accurate information regarding medical diagnoses is essential for care planning and monitoring for predicting their rehabilitation outcomes. As concluded by several studies, individuals with fewer chronic diseases are more likely to achieve better outcomes [2,4,31]. Finally, whereas global limitations in motor functions at admission combined with cognitive impairment can influence the overall levels of disability at discharge [2–4,16,26,29,31,32], limitations in the ability to perform at admission single ADL like the use of a wheelchair [33], walking [34] or transfers (to the toilet and/or to the bed/chair) [35], can also be seen as important outcome predictors.

The long-term care in Portugal

In Portugal, the National Network for Long-term Integrated Care (*Rede Nacional de Cuidados Continuados Integrados*, RNCCI) was created in 2006 as a partnership between the Ministry of Health and the Ministry of Employment and Social Solidarity [36]. As defined by the Portuguese legislation, the RNCCI is organized into two main settings of care [36]: HCBS and NH.

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As for the HCBS, the care is provided between 8am and 8pm at home under the responsibility of the primary care centre teams, to people with functional dependence but who do not require acute care. Of the several services provided, stands out the personal hygiene, medical, nursing and rehabilitation care, occupational therapy, education and psychosocial support involving both patients and their caregivers [37,38]. Individuals with care needs during the night, in need for only social support or without informal caregivers, are excluded.

In order to respond to different needs, the NH in Portugal are organized into three types of care units [36]. Although services like personal hygiene, drugs prescription and administration, psychological and social support are provided to all patients [37,38], the intensity of nursing, medical and physiotherapy care differs according to the type of care units, namely [36,37]: (i) Convalescence Units (*Unidades de Convalescença,* UC), which provide nursing, medical and physiotherapy care on a daily basis for individuals discharged from hospitals in need of convalescence care up to 30 consecutive days; (ii) the Medium-Term and Rehabilitation Units (*Unidades de Média Duração e Reabilitação,* UMDR), which provide less intensive and differentiated care (while the nursing care is provided daily, the medical and rehabilitation care is provided two days per week) for individuals with an expected length of care between 31 and 90 consecutive days; and (iii) the Long-Term and Maintenance Units (*Unidades de Longa Duração e Manutenção,* ULDM), which provide daily nursing care (medical and rehabilitation care only once a week) for individuals with difficulties with community inclusion as well as for caregivers' respite care, with a length of care higher than 90 consecutive days.

Objectives

The main goal of this research is to contribute to a better understanding of two areas in the LTC sector that may help policy makers and staff to improve the way care is provided to such a fragile population: mortality and patients' outcomes. Regarding the first one, we aim to identify the median survival time within NH and HCBS settings of care and identify the predictive power of several variables on the mortality risk in each setting. Then, we aim to quantify the impact of care provided by looking at the number of individuals who showed changes in their physical and cognitive dependence level between admission and discharge as well as to identify the individuals' characteristics associated with each status at discharge.

Data and methods

Data source

The dataset contains records of 20,984 individuals aged ≥60 years, admitted and discharged in 2015 in Portugal mainland, of which 14,140 were from NH and 6,844 from HCBS.

Besides the identification of the length of care, referral entity, region and setting of care, this study includes results from the Portuguese screening tool used by LTC healthcare professionals to assess patients' dependence levels, called Integrated Bio-psychosocial Assessment Instrument [39]. The information collected by this tool and used in this study is divided in three areas [40]: (i) Biological: age, gender, medical conditions at admission and the ability to perform eight ADL

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using the Katz' ADL index [41] (toileting, dressing, bathing, transferring/bed, transferring/chair, continence/urination, continence/defecation and feeding) in two moments (admission and discharge); (ii) Psychological: assessment of the cognitive status through the ability to answer questions about temporal (year, month, day, season and day of the week) and spatial (country, province, city/town, home and floor) orientation using the Mini-Mental State Examination [42] in two moments (admission and discharge); and (iii) Social: level of education, marital status and the availability of family/neighbour support.

Regarding the assessment of the cognitive/physical status of each individual, this tool does it in three stages [39,40]. First, it assesses the ability to perform each activity using a four system score: score 0 (bad/ incapable); score 1 (unsatisfactory/ dependent); score 2 (satisfactory/ autonomous); and score 3 (good/ independent). Then, while the overall physical status is determined by considering the lowest score obtained in the eight activities assessed, the cognitive status is determined by the average score of the ten activities analysed. Finally, based on the previous cognitive/physical scores, each individual is further classified into one of the four dependence groups.

Methodology and model adopted

The Kaplan-Meier survival analysis (log-rank test) was conducted to determine the median survival time in the two main settings of care and within the three NH units of care. Then, a Cox Proportional Hazards Model was used to identify the predictive power of several variables (socio-demographic characteristics, medical conditions, cognitive and physical dependence level at admission, referral entity) for mortality risk in NH and HCBS settings of care. Third, the Wilcoxon signed-rank test was used to measure changes in cognitive and physical dependence level between admission and discharge, both for all population and for only those alive at discharge. Finally, two cumulative odds ordinal logistic regressions were run to determine the effect of several variables on the ability to predict the cognitive (Model 1) and physical (Model 2) status, using the dependence level at discharge as dependent variable. From the several aspects mentioned in the literature, which may influence the status at discharge, we selected as explanatory variables the socio-demographic characteristics, medical conditions, cognitive/physical dependence levels at admission and settings of care. Even though the direct association of other factors like the referral entity and length of care is not yet well proven [2,16,18,31], they were used as control variables. In this last analysis, only individuals alive at discharge were included.

All analyses were made with SPSS *Statistics* software (v.20, IBM SPSS, Chicago, IL), using a significance level of 0.05.

Population characteristics

Comparing the two main settings of care, the NH population is slightly younger, has a higher percentage of females, lower percentage of married people and fewer individuals with family/neighbour support than the HCBS population (Table 1). The main group of medical

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conditions registered at admission are diseases of circulatory system, injury and poisoning and neoplasms, and the percentage of individuals classified into the two lowest levels of cognitive and physical independence is higher at NH (54.5% and 71.2%) than in HCBS (45.9% and 69.0%) setting of care. Regarding the referral entity, while most NH individuals are referred from hospital services, like internal medicine and orthopaedic, the majority of the HCBS individuals are referred by other entities, such as the primary care providers.

Results

Outcomes assessment: mortality risk

The overall mortality rate is 21.1%, with a median survival time of 197 days (Table 2). Comparing the two main settings of care, the HCBS population presents a higher mortality rate and a lower survival time when compared to the institutionalized population ($p<0.001$). Within the three NH units, the mortality rate increases as we go from a shorter (UC) to a longer (ULDM) care unit, and consequently, the median survival time has the opposite behaviour ($p<0.001$).

;

Table 3 identifies the variables with statistical significance for the mortality risk in each setting of care. Regarding the socio-demographic factors, older age and male gender increase the risk of mortality in both settings of care ($p<0.001$). On the other hand, the absence of family/neighbour support ($p<0.001$) decreases the mortality risk in both models, being illiterate ($p=0.045$) has the opposite effect but only at NH. Concerning the medical conditions, while having a diagnosis of neoplasms ($p<0.001$) or diseases of the skin and subcutaneous tissue (HCBS: $p=0.010$; NH: $p<0.001$) increases the risk of mortality in both settings of care, individuals with diseases of the musculoskeletal ($p<0.001$) or circulatory system (HCBS: $p=0.021$; NH: $p<0.001$) present the opposite result. Looking at dependence levels, compared to those classified as cognitively or physically independent at admission, being classified in the highest level of impairment increases the risk of mortality in both settings of care. Finally, regarding the referral entity, while individuals referred by internal medicine services have a higher probability to die ($p<0.001$), those referred by the orthopaedics services have the opposite chance (HCBS: $p=0.003$; NH: $p<0.001$).

Outcomes assessment: changes in the dependence level

Comparing the percentage of individuals with cognitive and physical changes between all population and only those alive at discharge, several differences can be highlighted (Fig. 1). Regarding the cognitive status, the percentage of individuals who maintained or improved their status was higher among those alive at discharge (61% and 24%) when compared to the whole population (48% and 19%). Despite a similar trend between HCBS and NH settings of care, the percentage of individuals with cognitive improvement was higher within the second group for both

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populations. Comparing the three NH units of care, although the percentage of individuals with some improvements decreases as we go from the UC to the ULDM, the majority maintained their cognitive status between admission and discharge. Concerning the physical status, despite a similar trend towards the cognitive status, the UC is the only setting of care where the percentage of individuals who improved is higher than those who worsened or maintained their function abilities, both in the whole population (44%) and in only those alive at discharge (45%).

Outcomes assessment: predicting the dependence level at discharge

Table 4 identifies the predictive power of each variable on the cognitive (Model 1) and physical status (Model 2) at discharge. Only family/neighbour support was excluded from both models, due to a lack of statistical significance.

The socio-demographic characteristics that most contribute to decreasing the odds of being classified at a higher cognitive and physical independence status at discharge are older age ($p<0.001$), being married (Model 1: $p=0.026$; Model 2: $p=0.006$) or being a widow(er) (Model 1: $p=0.052$, Model 2: $p=0.085$) when compared to single/divorced people and being illiterate (Model 1: $p=0.013$; Model 2: $p=0.006$). While male gender seems to have a negative influence on the physical status at discharge (Model 2: $p=0.057$), it has the opposite effect on the cognitive status at discharge (Model 1: $p=0.074$).

Compared to other medical conditions at admission, while having mental illness ($p<0.001$) decreases the probability of being classified at a higher level of cognitive independence at discharge, having musculoskeletal diseases ($p<0.001$) has the opposite effect. With respect to the physical status, while having diseases of the skin and subcutaneous tissue ($p<0.001$) or the circulatory ($p<0.001$) or respiratory ($p=0.038$) system decreases the probability of being classified at a higher independence level at discharge, having musculoskeletal diseases or mental illness ($p<0.001$) has the opposite effect.

Compared to those classified at a higher independence level at admission, being considered cognitively or physically impaired at admission decreases the probability of achieving a higher status at discharge ($p<0.001$). Regarding the NH units, compared to HCBS, while being admitted at UC increases the probability of achieving a better cognitive (Model 1: although not statistically significant) or physical (Model 2: $p<0.001$) status at discharge, being admitted at ULDM (Model 1: $p<0.001$; Model 2: $p=0.030$) has the opposite effect.

Discussion

Outcomes assessment: mortality risk

Because the mortality rate in the LTC sector is usually high and the predictive intensity of several variables may vary according to the setting of care, its assessment is clinically useful and valuable, not only for health care professionals but also for managers and policy makers. Contrary

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to the findings of several authors [6,14–16,43], in this study, the higher mortality rate among HCBS than in the NH population may be explained by the existence of different institutionalized units of care. Although the ULDM have a mortality rate five times higher and approximately half of the estimated time of survival than UC, reflecting the higher severity of the first population, both results are very similar to the results of those who received home care (HCBS). Because these two settings of care were designed to respond to different care needs, these results may indicate possible problems regarding the referral process that are worth to be explored.

Based on the Cox regression analysis, several factors have been found to predict the mortality risk in each setting of care. Concerning the socio-demographic characteristics, whereas older age and male gender increase the risk of mortality in both settings of care, not having family/neighbour support has the opposite effect. Although some authors concluded that the effect of these characteristics were not statistically significant [5], this finding is similar to previous studies [6–10,43]. Previous studies have concluded that individuals with minimal family/neighbour support and low social engagement levels present higher mortality risks [6,8,10,11], therefore finding the opposite effect in our study is rather surprising. Further research to understand this result is required.

Although some authors left out the comorbidities in their mortality risk model, arguing that those have been well captured by the scopes of cognitive and physical status given by the scales used respectively [7], others found that some medical conditions (such as neoplasms, respiratory or cardiovascular diseases) are important risk factors of mortality [6,9,43]. The fact that, in this study, individuals with neoplasms or diseases of the skin and subcutaneous tissue have a higher mortality risk is something to be considered by policy makers, referral entities and staff in order to adopt special care plan for these individuals, before and after their admission into each setting of care. Finally, as concluded by previous research, as well as by this study, being classified at a higher physical [5–9] and cognitive [6,7,9] dependence level at admission increases the risk of mortality in all settings of care. Thus, policy makers have to realize that the accurate assessment of a person's status plays an important role in the referral process and should be taken into consideration when selecting the *best* setting of care for each individual.

Outcomes assessment: changes in the dependence level

In this study, while 34% of those alive at discharge had improved their physical status (38% at NH; 27% at HCBS), the percentage of individuals who maintained the same status stood at 55% (51% at NH; 64% at HCBS). Looking to the literature, although a study among 600 community-dwelling elderly had reached a similar finding (improved: 33%; unchanged: 62%) [3], in a study with 2,754 patients aged ≥65 years admitted into a post-acute rehabilitation facility over a four-year period, 85% of the individuals improved their functional status (unchanged: 10%) [4]. On the other hand, whereas a study comparing two cohorts of patients with dementia concluded that 45% of the individuals improved (44% at NH; 48% at HCBS) or 20% maintained their physical status (similar percentage at NH and HCBS) [13], in a recent study at NH these percentages reached to 14% and 34% [29], respectively. Concerning the cognitive status, while the percentage

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of individuals with some improvement in this study stood at 24% (26% at NH; 18% at HCBS), 61% maintained the same status (57% at NH; 71% at HCBS). For that matter, after collecting data two months apart, a study on a subset of 2,275 older patients in England and Wales concluded that the percentage of individuals with cognitive improvement ranged between 14%-21%, and 58%-78% maintained their status [19]. In another study performed with a group of patients with dementia, the authors concluded that 38% showed some improvement (37% at NH and 39% at HCBS), and 36% maintained their status (36% at NH and 34% at HCBS) [13].

Given the overall results, an higher number of individuals improving their physical status compared to the cognitive improvement is in line with several studies [13,32,35], and may be explained by the greater tendency of the RNCCI to focus on the total or partial recovery of lost physical autonomy. Nevertheless, since the LTC sector focuses on elderly frail persons with a high level of dependence, it is deemed necessary that staff and policy makers work towards the implementation of standard control measures to insure that each setting offers a care programme tailored to individuals' needs. On the other hand, it is also vital to assess the ability of the Integrated Bio-psychosocial Assessment Instrument to accurately capture dependency levels and its performance when used in repeated measurements for the same individual (admission and discharge, for instance).

Outcomes assessment: predicting the dependence level at discharge

In this study, the main features that contribute to decrease the probability of being classified as a higher cognitive and physical independence status at discharge are older age, low social support and low levels of cognitive and physical independence at admission. These findings are important for empowering the policy makers to (re)adapt, if necessary, the provision of care whenever they encounter individuals with these characteristics in need of some kind of LTC services.

With respect to age, although several studies suggest similar findings, either among institutionalized [2,18,26] or non-institutionalized [4] individuals, others found no significant influence on physical outcomes, either at NH [27,29–31] or at HCBS settings of care [26,28]. Concerning the social support features, there is no consensus about their influence. In some studies, those living alone remained at increased probability of physical recovery [3,4]; others concluded the opposite [26]; and others found no relationship [18]. In our study, although the availability (or lack) of family/neighbour support was not statistically significant for cognitive or physical improvement, being married decreases the chance of being classified at a higher independence level at discharge. Although this seems contradictory, one possible explanation is that, instead of trying to perform certain tasks on their own, the fact that these individuals have some kind of help from third parties may limit the recovery of their lost functions.

Regarding the influence of the baseline dependence levels as predictors of the final status, this study has reached similar conclusions as previous research published: (i) being cognitively independent at admission has a positive influence on physical improvement, both among NH [2,26,29,31,35] and HCBS [3,4,26,32] populations; (ii) physical status at admission is also a good predictor of both physical and cognitive status at discharge. In this case, some studies at NH

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concluded that a higher independence level at admission not only increases the chances of being classified at a higher cognitive independence level at discharge [19,31], but it also has positive influences on the physical level at discharge, within both NH [26,29,31,35] and HCBS [3,4,26,28] populations. Based on these results, it becomes evident the importance of providing health professionals with reliable tools that allow an accurate assessment of the dependence levels of this population in order to predict with more certainty their outcomes.

As for medical conditions, although it was not possible to identify the burden of disease for each individual, one main conclusion stood out: those with musculoskeletal diseases have a higher probability of achieving both cognitive and physical improvements than those without these diseases. For that matter, after assessing the outcomes of patients admitted into post-acute care facilities, Gindin and colleagues (2007) found that, while those who had a stroke were less likely to show physical improvement than those who hadn't had a stroke, individuals with a hip fracture had more than double the probability of achieving improvement than those without a hip fracture [2]. On the other hand, in a cohort of 560 older people from Australia, although disability on admission was higher in individuals with a stroke and a hip fracture and lower for those with joint replacement, after six months, the group had a better chance of achieving physical and cognitive scores [31]. More recently, in a study conducted over a four-year period, whereas individuals with musculoskeletal diseases were more likely to achieve some functional recovery, those who did not recover more often presented some cerebrovascular diseases [4]. Thus, despite appearing to be contradictory, given the emphasis on the physical recovery of this population, the progressive improvement in their functionality during their length of care also has a consequently positive effect on their cognitive recovery. Therefore, it is vital that managers and staff of each setting of care become aware of the importance of having a more detailed record of all medical conditions of each individual in order to adapt the care plan to each situation to maximize the benefits of the care provided.

As for the length of care, even though several studies have found it positively associated with the chances of being classified into a more independent physical status at discharge in both settings of care [2,16,31], in our study, there seems to be a smaller but positive influence only regarding the cognitive improvement. Policy makers and staff should reflect upon such a conclusion in order to assess whether (or not) the length of stay is actually used to restore the lost autonomy, or if the intensity and frequency of the care provided is, in fact, adapted to the care needs. Thus, only when it is possible to combine the care needs, the intensity and the frequency of care, as well as the length of stay, will it be possible to leverage the existing resources in favour of these individuals.

Regarding the limitations, this study only considers individuals already admitted into an LTC setting, thus the results hold in identical settings. Second, because the mortality analysis only takes into account observations for a one-year period, it is not possible to verify whether these findings are (or have been) consistent over the years. Third, since only the admission diagnosis is available for each individual, it is not possible to identify the morbidity burden and assess its

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influence as a risk factor. Finally, although in this work we mainly used individuals' characteristics, other circumstances such as transfers to other care settings, number of hospital admissions, number of medications being taken, staff skill mix or the intensity of care received may play a role in cognitive/functional recovery but were not taken into account as information was not available.

Conclusions

This is the first work that uses the entire national database, providing a valid description of the LTC situation in Portugal and its main outcomes. Although it is difficult to draw definitive conclusions regarding the power of different predictors in forecasting the outcomes of LTC services, the knowledge about the mortality risk factors and the impact of care provision on dependence levels are critical to policy makers and staff to help them to shape a more suitable care plan for future patients.

From this work, two main conclusions have arisen. First, those receiving home care have a higher mortality rate than the ones staying in NH and NH treating more severe patients also present higher mortality rates, as could be anticipated. Second, most individuals present no changes in their cognitive and physical status from admission to discharge, especially those receiving home care. This is an important finding for policy makers and deserves further research as it puts at stake the current goals of the Portuguese LTC system.

Although the RNCCI has defined a set of indicators for quality monitoring and some are already publicly available [44], there are several challenges ahead for policy makers: (i) critically assess the reliability of the current screening tool in identifying individuals' dependence levels; (ii) use risk adjustment methods for measuring quality of care rather than interpreting raw incidence or prevalence rates; (iii) rethink the funding system as currently it is based on a per diem, which presents well known perverse incentives for the payer; and (iv) similar to what is currently in place in other countries, implement a patient-reported outcomes measures to support improvement in the quality and safety of healthcare delivery [45–47].

Conflict of Interest statement

Nothing to declare.

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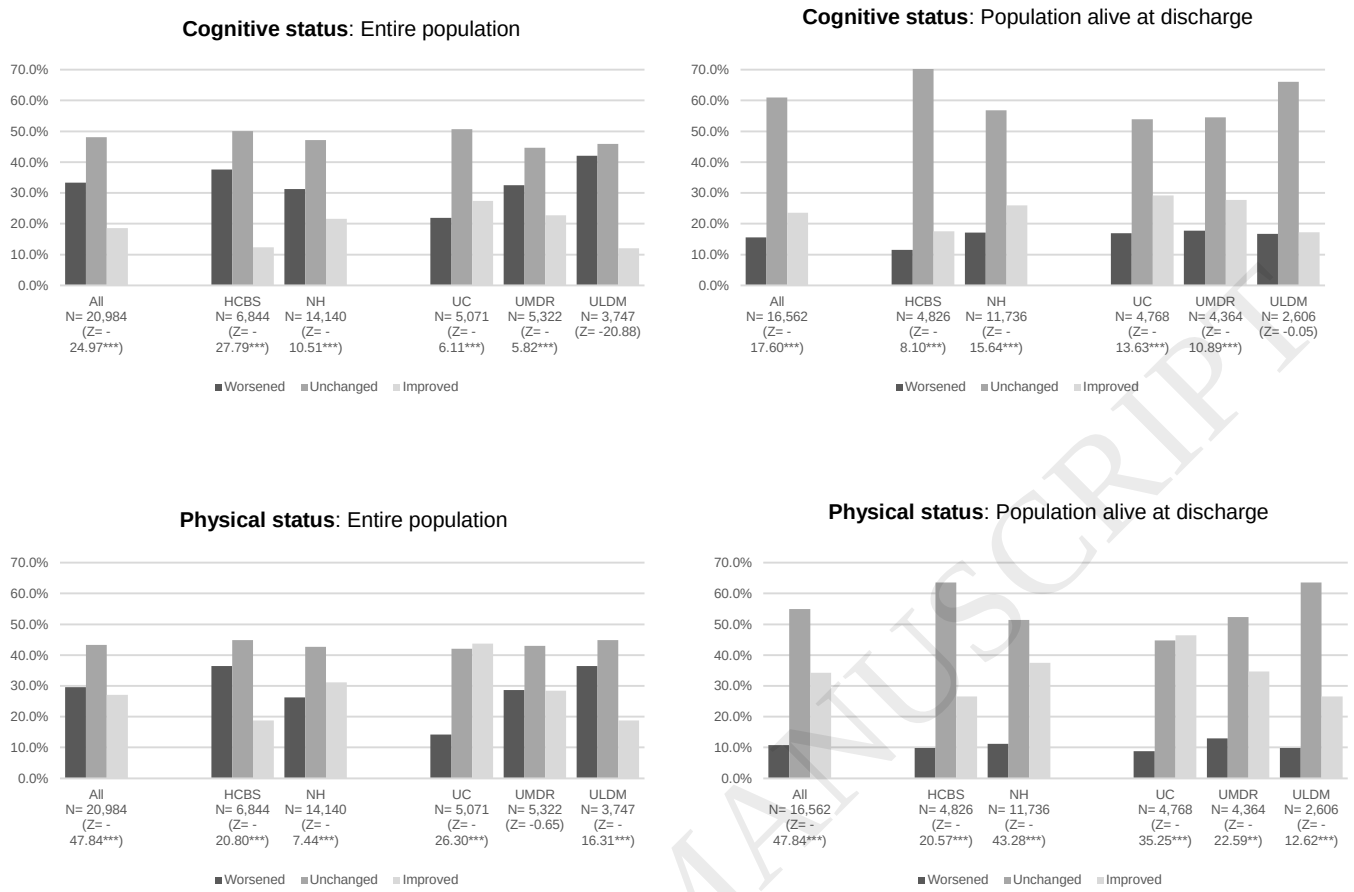

Fig. 1: Percentage of individuals who had changes in their cognitive and physical dependence level between admission and discharge

Legend: HCBS: Home and Community-Based Services; NH: Nursing Homes; UC: Convalescence Units; UMDR: Medium-Term and Rehabilitation Units; ULDM: Long-Term and Maintenance Units.
Wilcoxon signed-rank test, based on negative ranks. Difference in dependence level between admission and discharge: * significant at p<0.1; ** significant at p<0.05; *** significant at p<0.001

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Table 1: Population' characteristics in each setting of care

	All	HCBS	NH	NH units of care		
				UC	UMDR	ULDM
Population	20,984	6,844	14,140	5,071	5,322	3,747
Age						
Mean (SD)	79.2 (8.3)	79.9 (8.5)	78.9 (8.3)	77.7 (8.3)	78.4 (8.0)	81.2 (8.1)
Gender (%)						
Female / Male	57.7 / 42.3	55.7 / 44.3	58.7 / 41.3	60.9 / 39.1	57.3 / 42.7	57.9 / 42.1
Marital Status (%)						
Married	45.5	49.9	43.3	42.4	43.3	44.5
Widow	37.0	34.2	38.3	37.9	37.9	39.4
Single/Divorced	17.6	15.9	18.4	19.7	18.8	16.1
Family/neighbour support (% yes)	44.4	58.2	38.7	42.5	31.4	43.8
Education level (%)						
Illiterate	50.5	55.7	48.1	46.1	48.8	49.7
Literate	49.5	44.3	51.9	53.9	51.2	50.3
Medical conditions (%)						
Circulatory system	31.8	22.3	36.2	31.1	40.9	36.4
Injury and poisoning	23.8	21.5	24.9	34.6	26.2	9.7
Neoplasms	7.2	12.3	4.9	3.6	3.8	8.1
Musculoskeletal system	6.8	7.5	6.5	12.5	3.3	2.9
Respiratory system	5.8	7.3	5.1	4.6	4.4	6.8
Nervous system	5.6	5.3	5.6	4.2	4.7	8.9
Skin and subcutaneous tissue	5.6	9.7	3.6	1.6	6.5	2.3
Mental illness	5.4	4.6	5.8	1.2	3.3	15.7
Cognitive status admission (%)						
Bad	41.0	37.0	42.9	27.3	45.7	60.2
Unsatisfactory	10.8	8.9	11.6	11.4	13.4	9.4
Satisfactory	10.1	8.4	10.9	13.4	10.9	7.5
Good	38.1	45.7	34.5	47.8	30.0	22.9
Physical status admission (%)						
Incapable	17.7	18.3	17.4	7.4	18.7	29.3
Dependent	52.8	50.7	53.8	51.8	60.1	47.6
Autonomous	14.0	13.5	14.2	18.2	11.4	12.8
Independent	15.5	17.5	14.5	22.6	9.8	10.3
Referral entity (%)						
Hospital: General Surgery	6.4	5.7	6.7	8.9	7.2	3.2
Hospital: Internal Medicine	27.5	18.4	31.9	30.3	36.7	27.2
Hospital: Neurology	4.5	1.4	6.0	5.9	7.8	3.6
Hospital: Orthopaedics	18.9	14.6	21.0	35.3	18.8	4.7
Other entities	42.7	59.8	34.4	19.6	29.6	61.2
Length of care (days)						
Mean (SD)	57.9 (47.3)	64.2 (56.9)	54.9 (41.4)	35.4 (18.3)	68.9 (40.4)	60.5 (53.3)

Legend: HCBS: Home and Community-Based Services; NH: Nursing Homes; UC: Convalescence Units; UMDR: Medium-Term and Rehabilitation Units; ULDM: Long-Term and Maintenance Units; SD: Standard Deviation.

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Table 2: Mortality rate and survival time in each setting of care

Settings of care	Mortality rate	Estimate median survival time (days)	95% C.I.		p-value
			Lower	Lower	
All	**21.1%**	197.0	186.6	207.4	
Home and Community-Based Services	**29.5%**	173.0	159.5	186.5	X^2 =173.3 ***
Nursing Homes	**17.0%**	200.0	189.2	210.8	
UC	**6.0%**	288.0	75.5	500.5	
UMDR	**18.0%**	202.0	183.0	221.0	X^2 =412.3 ***
ULDM	**30.5%**	158.0	141.7	174.3	

Legend: C.I.: confidence interval; UC: Convalescence Units; UMDR: Medium-Term and Rehabilitation Units; ULDM: Long-Term and Maintenance Units.
X^2: Log Rank test (Mantel-Cox); * significant at p<0.1; ** significant at p<0.05; *** significant at p<0.001

Table 3: Cox Proportional Hazard models predicting the time to death in individuals upon admission in NH and HCBS settings of care

	Model 1: HCBS (N= 6,571)				**Model 2: NH (N= 14,020)**			
	OR		**Hazard Ratios (95% C.I.)**		**OR**		**Hazard Ratios (95% C.I.)**	
			Lower	**Lower**			**Lower**	**Lower**
Age	1,019	***	1,013	1,025	1,030	***	1,025	1,036
Gender								
Male	1,237	***	1,124	1,362	1,446	***	1,329	1,573
Female	Reference				Reference			
Family or neighbour support								
Without support	0,695	***	0,630	0,767	0,759	***	0,699	0,825
With support	Reference				Reference			
Education level								
Illiterate	-		-	-	1,088	**	1,002	1,182
Literate	Reference				Reference			
Medical conditions								
Neoplasms	3,666	***	3,043	4,417	2,389	***	1,997	2,858
Mental illness	1,012		0,786	1,304	0,657	***	0,525	0,823
Diseases of the nervous system	0,776	*	0,593	1,017	0,803	*	0,644	1,001
Diseases of the circulatory system	0,796	**	0,656	0,967	0,669	***	0,575	0,779
Diseases of the respiratory system	1,122		0,898	1,402	1,383	**	1,150	1,663
Diseases of the skin and subcutaneous tissue	1,304	**	1,065	1,597	1,523	***	1,258	1,843
Disease of musculoskeletal system	0,416	***	0,278	0,622	0,413	***	0,277	0,616
Injury and poisoning	0,491	***	0,376	0,640	0,675	***	0,550	0,828
Other	Reference				Reference			
Cognitive status at admission								
Bad	1,779	***	1,568	2,019	1,789	***	1,587	2,018
Unsatisfactory	1,358	**	1,128	1,634	1,261	**	1,073	1,482
Satisfactory	1,113		0,920	1,348	1,136		0,946	1,365
Good	Reference				Reference			
Physical status at admission								
Incapable	1,453	**	1,051	2,010	1,398	*	0,956	2,045
Dependent	1,130		0,823	1,552	0,961		0,659	1,401
Autonomous	0,983		0,659	1,467	1,119		0,695	1,802
Independent	Reference				Reference			
Referral entity								
Hospital: General Surgery	0,576	***	0,454	0,730	0,993		0,838	1,176
Hospital: Internal Medicine	1,250	***	1,108	1,411	1,219	***	1,101	1,349
Hospital: Neurology	0,643	*	0,391	1,057	0,837	*	0,682	1,027
Hospital: Orthopaedics	0,622	**	0,455	0,850	0,546	***	0,441	0,676
Other entities	Reference				Reference			

Legend: C.I.: Confidence Interval; HCBS: Home and Community-Based Services; NH: Nursing Homes; UC: Convalescence Units; UMDR: Medium-Term and Rehabilitation Units; ULDM: Long-Term and Maintenance Units.
* significant at p<0.1; ** significant at p<0.05; *** significant at p<0.001

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Table 4: Ordinal regressions predicting the cognitive and physical dependence levels at discharge

	Model 1 Cognitive status at discharge				**Model 2 Physical status at discharge**			
	OR		**95% C.I.**		**OR**		**95% C.I.**	
			Lower	**Lower**			**Lower**	**Lower**
Age	0.957	***	0.953	0.962	0.967	***	0.963	0.971
Gender								
Male	1.069	*	0.994	1.150	0.937	*	0.877	1.002
Female	Reference				Reference			
Marital Status								
Married	0.897	**	0.816	0.987	0.888	**	0.815	0.967
Widow	0.907	*	0.821	1.001	0.924	*	0.845	1.011
Single/divorced	Reference				Reference			
Education level								
Illiterate	0.917	**	0.857	0.982	0.918	**	0.863	0.976
literate	Reference				Reference			
Medical conditions								
Neoplasms	1.462	***	1.194	1.790	0.956		0.798	1.144
Mental illness	0.374	***	0.307	0.456	2.496	***	2.098	2.971
Diseases of the nervous system	0.894		0.749	1.068	0.980		0.829	1.158
Diseases of the circulatory system	0.913		0.800	1.043	0.710	***	0.627	0.804
Diseases of the respiratory system	1.019		0.842	1.234	0.825	**	0.689	0.989
Diseases of the skin and subcutaneous tissue	0.860		0.703	1.052	0.457	***	0.375	0.556
Disease of musculoskeletal system	2.381	***	1.945	2.916	2.004	***	1.705	2.356
Injury and poisoning	1.172	**	1.007	1.363	1.079		0.940	1.240
Other	Reference				Reference			
Cognitive status at admission								
Bad	0.088	***	0.081	0.096	0.359	***	0.332	0.390
Unsatisfactory	0.253	***	0.228	0.282	0.454	***	0.408	0.505
Satisfactory	0.540	***	0.483	0.604	0.814	***	0.735	0.902
Good	Reference				Reference			
Physical status at admission								
Incapable	0.433	***	0.334	0.560	0.018	***	0.014	0.022
Dependent	0.687	**	0.533	0.886	0.061	***	0.049	0.075
Autonomous	1.211		0.868	1.690	0.233	***	0.178	0.304
Independent	Reference				Reference			
Settings of care								
UC	1.044		0.946	1.152	2.031	***	1.866	2.210
UMDR	0.712	***	0.649	0.781	1.094	**	1.004	1.192
ULDM	0.516	***	0.463	0.575	0.894	**	0.807	0.989
HCBS	Reference				Reference			
Referral entity								
Hospital: General Surgery	1.449	***	1.250	1.678	1.105		0.969	1.261
Hospital: Internal Medicine	1.202	***	1.094	1.320	1.200	***	1.098	1.311
Hospital: Neurology	1.260	**	1.074	1.479	1.122		0.962	1.310
Hospital: Orthopaedics	1.430	***	1.268	1.613	1.198	**	1.081	1.329
Other entities	Reference				Reference			
Length of care (days)	1.001	**	1.000	1.002	-		-	-

Legend: CI: Confidence Interval; HCBS: Home and Community-Based Services; NH: Nursing Homes; UC: Convalescence Units; UMDR: Medium-Term and Rehabilitation Units; ULDM: Long-Term and Maintenance Units;
* significant at p<0.1; ** significant at p<0.05; *** significant at p<0.001;

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