



Dying in hospital among nursing home residents with and without dementia in Germany



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ABSTRACT

Objectives: Nursing home residents (NHR) often suffer from dementia. As end-of-life care of NHR with dementia and without might differ, our aim was to investigate patterns of in-hospital deaths in NHR with and without dementia.

Design: Retrospective observational study.

Setting: German nursing homes.

Participants: Deceased NHR.

Measurements: Using data of a large German health insurance fund, we included NHR aged 65+ years who died between January 1, 2010, and December 31, 2014. We assessed proportions of in-hospital deaths stratified by dementia status as well as by age, sex, level of care and length of stay. Multiple logistic regression models were applied to explore the association of these variables with in-hospital death.

Results: Data on 67,328 decedents were included (mean age 85.3 years, 69.8% female), of whom 43.1% suffered from dementia. Overall, 29.5% died in hospital, with similar figures found for those with dementia (29.2%) and those without (29.8%). Differences between NHR with and without dementia were noticeable regarding age and length of stay. In those with dementia, the proportion of in-hospital deaths decreased linearly with age from 37.0%–20.2% (65–74 to 95+ years). These results are supported by the multivariate analyses. The terminal hospital stay was up to 3 days in 32.6%. This length did not differ by dementia status.

Conclusions: Germany has a high proportion of NHR in-hospital deaths. Surprisingly, we found no differences in these figures between NHR with and without dementia, although predictors for in-hospital death seem to differ between these groups.

1. Introduction

Although hospitalizations of nursing home residents occur frequently (Grabowski, Stewart, Broderick, & Coots, 2008; Hoffmann & Allers, 2016), they may have unintended consequences (Dwyer, Gabbe, Stoelwinder, & Lowthian, 2014; Pedone et al., 2005) and are often considered inappropriate or avoidable (Ouslander et al., 2010; Renom-Guiteras, Uhrenfeldt, Meyer, & Mann, 2014). This is especially the case during end of life (Cardona-Morrell, Kim, Brabrand, Gallego-Luxan, & Hillman, 2017). Potentially, nursing home residents, who die soon after they have been transferred, may not benefit from hospitalization (Dwyer et al., 2014).

Dementia is commonly found among nursing home residents in many countries (Gordon et al., 2014; Hoffmann et al., 2016; Stewart et al., 2014). These residents differ from those without cognitive

impairment. For instance, residents with dementia are typically older (Allers, Dörks, Schmiemann, & Hoffmann, 2017; Li, Zheng, & Temkin-Greener, 2013), need more support in activities of daily living (Li et al., 2013; Mitchell, Kiely, & Hamel, 2004; Sloane, Zimmerman, Williams, & Hanson, 2008), but also have lower mortality (Hedinger, Hämmig, Bopp, & Swiss National Cohort Study Group, 2015; Magaziner et al., 2005) and fewer adverse health events compared to those without dementia (Magaziner et al., 2005). Furthermore, as dementia is often a slowly progressive disease, the required end-of-life care might differ from that for residents dying from other conditions (Sloane et al., 2008). This is likely to be the case for end-of-life hospitalizations, as well. Hospitalizations shortly before death are especially burdensome and of limited benefit in this vulnerable group or even entail adverse consequences (Gozalo et al., 2011). Moreover, residents with dementia could often be treated equally well in the nursing home setting (Givens,

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Table 1
Baseline characteristics of decedents, stratified by dementia status.

	Nursing home residents with dementia (n = 29,052)	Nursing home residents without dementia (n = 38,276)	Total (n = 67,328)
Mean age at death \pm SD (IQR)	86.4 \pm 6.5 (83–91)	84.6 \pm 7.9 (79–90)	85.3 \pm 7.4 (81–91)
Age groups			
65–74 years	13.6%	5.5%	10.1%
75–84 years	29.6%	28.7%	29.2%
85–94 years	49.5%	58.2%	53.2%
95+ years	7.3%	7.6%	7.5%
Sex			
Male	32.2%	28.7%	30.2%
Female	67.8%	71.3%	69.8%
Level of care at death			
None/Level I	22.0%	32.6%	28.0%
Level II	46.4%	47.1%	46.8%
Level III	31.7%	20.3%	25.2%
Mean length of nursing home stay at death \pm SD (IQR)	384.9 \pm 381.0 (75–598)	312.1 \pm 370.5 (33–488)	343.5 \pm 376.8 (47–540)
Time from nursing home admission to death (length of stay)			
\leq 47 days	17.7%	30.9%	25.2%
48–189 days	25.9%	24.0%	24.8%
190–540 days	28.0%	22.7%	25.0%
541–1819 days	28.4%	22.4%	25.0%

Selby, Goldfeld, & Mitchell, 2012; Gozalo et al., 2011).

However, the literature on the comparison of in-hospital deaths of nursing home residents with and without dementia is somewhat inconclusive. Few studies examined the differences between these two groups (Allers & Hoffmann, 2018; Li et al., 2013; Sloane et al., 2008; Temkin-Greener, Zheng, Xing, & Mukamel, 2013). While most of these studies found that nursing home residents with dementia are less likely to be hospitalized shortly before death than those without dementia (Krishnan, Williams, & Maharaj, 2015; Li et al., 2013; Sloane et al., 2008; Temkin-Greener et al., 2013), a study from Germany did not observe any differences in hospitalization rates in the last weeks before death (Allers & Hoffmann, 2018). To the best of our best knowledge, no study has yet examined predictors of in-hospital death in nursing home residents stratifying for dementia.

The aim of this study was to investigate the patterns of in-hospital deaths in nursing home residents with and without dementia in Germany.

2. Methods

2.1. Database, study population and outcome

We used administrative data of a large health insurance fund, DAK-Gesundheit, with about 6 million members (7.5% of the German population) from all over Germany. The study population included all people aged 65 years and older who were admitted to a nursing home between January 1, 2010, and December 31, 2014, following a continuous insurance period of at least 365 days without nursing home placement. Of those, all residents who died between January 1, 2010, and December 31, 2014 were studied.

Data on nursing home placement were obtained from the German Long-Term Care Insurance (“Gesetzliche Pflegeversicherung”), and also included dates and levels of care dependency. Levels of care dependency range from level I (considerable need of care), to level II (severe need of care) and level III (most severe need of care) and were used as indicators for physical disabilities, as done in previous studies (Hoffmann & Allers, 2017; Hoffmann, van den Bussche, Wiese, Glaeske, & Kaduszkiewicz, 2014). We included the level of care dependency on the day of death. Further information on the German long-term care system and on the German health care system are provided in the literature (Busse & Blümel, 2014; Rothgang, 2010).

Outpatient diagnoses at the time of nursing home admission were

used to identify residents with dementia. According to other studies (Hoffmann et al., 2014; Koller et al., 2012), the following ICD-10 codes were considered eligible: F00.x, F01.x, F02.0, F02.3, F03, G30.x, G31.0, G31.1, G31.82, G31.9, and R54. At least one of these diagnoses had to be documented in the calendar quarter of nursing home admission. In Germany, all diagnoses made in an outpatient care setting are documented per calendar quarter without an exact date.

Our main outcome variable was in-hospital death, defined as being in hospital on the day of death. Data on hospitalizations also included the date of admission and discharge as well as hospital diagnoses (and the corresponding ICD-10 codes).

2.2. Statistical analysis

First, we descriptively analysed the baseline characteristics. Second, we calculated the proportion of in-hospital deaths and estimated 95% confidence intervals (95% CIs) using the exact (Clopper-Pearson) method. Third, we fitted multiple logistic regression models to estimate odds ratios (OR) with 95% CIs to investigate which variables were associated with in-hospital death. Besides dementia, we included sex (2 categories), age at the time of death (4 categories: 65–74, 75–84, 85–94 and 95+ years), level of care dependency at the time of death (3 categories) and days from institutionalization to death (4 categories, grouped into quartiles) in these multiple adjusted models. Fourth, we assessed the main discharge diagnoses in those who had died in hospital. Diagnoses were classified according to Ramroth et al. in 12 distinct groups (Ramroth, Specht-Leible, & Brenner, 2005). The results of all analyses were reported for the whole population as well as stratified by dementia.

We used a level of significance of 0.05. All statistical analyses were performed with SAS for Windows version 9.4 (SAS Institute Inc, Cary, North Carolina).

3. Results

3.1. Baseline characteristics

Of 127,227 nursing home residents newly admitted between 2010 and 2014, a total of 67,328 died during that period (52.9%). The decedents were on average 85.3 (SD: 7.4) years old, and more than two thirds were women (69.8%). Almost half of them had care level II at the time of death (46.8%). The mean length of stay in the nursing home was

Table 2
Proportion of nursing home residents dying in a hospital (with 95% CI), stratified by dementia status.

	Nursing home residents with dementia (n = 29,052)	Nursing home residents without dementia (n = 38,276)	Total (n = 67,328)
Age groups			
65–74 years	37.0% (34.6–39.4%)	24.6% (23.5–25.8%)	27.5% (26.5–28.6%)
75–84 years	32.3% (31.3–33.3%)	32.0% (31.2–32.9%)	32.1% (31.5–32.8%)
85–94 years	28.1% (27.5–28.8%)	30.9% (30.2–31.6%)	29.6% (29.1–30.1%)
95+ years	20.2% (18.5–21.9%)	22.9% (21.4–24.5%)	21.7% (20.6–22.9%)
Sex			
Male	32.2% (31.2–33.1%)	32.7% (31.8–33.6%)	32.4% (31.8–33.1%)
Female	27.8% (27.2–28.4%)	28.6% (28.1–29.2%)	28.3% (27.9–28.7%)
Level of care at death			
None/Level I	41.2% (40.0–42.4%)	41.4% (40.5–42.2%)	41.3% (40.6–42.0%)
Level II	31.0% (30.2–31.8%)	27.5% (26.8–28.1%)	29.0% (28.5–29.5%)
Level III	18.3% (17.5–19.1%)	16.6% (15.7–17.4%)	17.5% (16.9–18.1%)
Time from nursing home admission to death (length of stay)			
≤ 47 days	27.9% (26.7–29.1%)	21.2% (20.5–22.0%)	23.2% (22.6–23.9%)
48–189 days	33.0% (32.0–34.1%)	33.1% (32.1–34.0%)	33.1% (32.3–33.8%)
190–540 days	30.9% (29.9–31.9%)	35.4% (34.4–36.4%)	33.2% (32.5–33.9%)
541–1819 days	24.9% (23.9–25.8%)	32.4% (31.4–33.4%)	28.7% (28.0–29.4%)
Total	29.2% (28.7–29.7%)	29.8% (29.3–30.3%)	29.5% (29.2–29.9%)

343.5 days, but this varied widely as the median time was 189 days (Table 1). Of all decedents, 43.1% had suffered from dementia. Residents with dementia were older than those without dementia (on average 86.4 vs. 84.6 years), more often had care level III at the time of death (31.7% vs. 20.3%) and spent a longer period in the nursing home before death (on average 384.9 vs. 312.1 days).

3.2. In-hospital deaths

There were 19,887 in-hospital deaths (29.5%) (Table 2). The most striking differences were found regarding levels of care. The percentage of nursing home residents dying in hospital linearly decreases with increasing level of care, from 41.3% (none/ level I) to 29.0% (level II) and 17.5% (level III). The influence of age and length of stay is less clear. The proportion of in-hospital deaths ranges from 27.5%–32.1% in nursing home residents aged up to 94 years and declines thereafter to 21.7% in those aged 95+ years. Residents who spent up to 47 days in a nursing home died less often (23.2%) in hospital than those with a longer length of stay (28.7–33.2%). Men died more often in a hospital than women (32.4% vs. 28.3%).

The proportion of in-hospital deaths did not differ between nursing home residents with and without dementia (29.2% vs. 29.8%). As shown in Table 2, there were also no differences regarding sex and level of care in residents with and without dementia. However, some differences concerning age and length of stay are noticeable. In nursing home residents with dementia, the proportion of in-hospital deaths decreased linearly with age from 37.0% in residents aged 65–74 years to 20.2% in those being 95+ years, while no linear trend was observed in residents without dementia. The proportion of residents dying in hospitals is higher for those with dementia when the length of stay is short (27.9% vs. 21.2%), but smaller for those with dementia when length of stay is higher than 540 days (24.9% vs. 32.4%).

These results are supported by the multivariate analyses (Table 3). Level of care was the factor that had the greatest influence on dying in a hospital with higher levels being associated with a lower chance. Being younger than 95 years and having been admitted to a nursing home for more than 47 days affected the likelihood of in-hospital death but no linear patterns were discernible. Male sex was also associated with in-hospital deaths, but we found no clinically relevant association between dementia and in-hospital deaths (OR: 1.04). When stratifying the models by dementia status, no differences were found regarding the influence of sex and level of care in nursing home residents with versus without dementia. The linear influence of age was only observed in

persons with dementia, while length of stay had a stronger influence on residents without dementia.

3.3. Duration and main diagnoses

On average, the terminal hospitalization lasted 9.0 days, but the distribution is skewed, with a median of 6 days. There were no differences between nursing home residents with and without dementia. The length of hospital stay was 1 day in 9.8% (10.7% with vs. 9.2% without dementia), up to 3 days in 32.6% (33.3% with vs. 32.2% without dementia) and up to 7 days in 58.8% (59.9% with vs. 57.9% without dementia).

The most common main discharge diagnoses were infections (22.4%) and cardiovascular diseases (21.7%). There were only slight differences between residents with and without dementia (Table 4). Infections were more frequent in patients with dementia (24.7% vs. 20.6%), whereas cardiovascular diseases and cancer were more frequent in residents without dementia, with 19.9% vs. 23.0% and 3.6% vs. 8.7%, respectively.

4. Discussion

4.1. Comparison with other studies and interpretation of results

In our study of over 67,000 deceased nursing home residents, we found that 29.5% died in hospital with no apparent differences between persons with and without dementia. Lower level of care and male sex were associated with a higher chance of dying in hospital. We found different patterns in the influence of age and length of nursing home stay between residents with and without dementia.

Interestingly, we found no difference in the proportion of in-hospital deaths between nursing home residents with and without dementia. In contrast, most existing studies identified very large differences: A study from the United States reported consistently lower proportions of in-hospital death in nursing home residents with dementia compared to those without the condition over a five-year period (2007: 14.2% vs. 19.7%) (Li et al., 2013). A similar difference was found for Alzheimer's disease (14.4% and 20.7%) (Temkin-Greener et al., 2013), while another study from the United States found comparable results but smaller proportions of 6.9% and 13.8%, respectively (Sloane et al., 2008). Apart from these three studies from the United States, a study from Australia also showed that residents with dementia were less likely to die in hospital (Krishnan et al., 2015), which may reflect less aggressive

Table 3
Multivariate logistic regression for factors associated with nursing home residents dying in a hospital, stratified by dementia status.

	Nursing home residents with dementia	Nursing home residents without dementia	Total
	OR (95% CI)	OR (95% CI)	OR (95% CI)
Dementia			
Yes			1.04 (1.002–1.08)
No			1
Age groups			
65–74 years	2.32 (2.00–2.70)	1.33 (1.19–1.49)	1.50 (1.37–1.64)
75–84 years	1.85 (1.65–2.08)	1.76 (1.59–1.94)	1.77 (1.64–1.91)
85–94 years	1.50 (1.35–1.68)	1.51 (1.37–1.66)	1.49 (1.39–1.60)
95+ years	1	1	1
Sex			
Male	1.18 (1.12–1.25)	1.26 (1.20–1.32)	1.24 (1.19–1.28)
Female	1	1	1
Level of care at death			
None/Level I	3.19 (2.96–3.44)	3.81 (3.55–4.09)	2.03 (1.94–2.13)
Level II	2.03 (1.90–2.17)	2.03 (1.90–2.18)	3.59 (3.42–3.78)
Level III	1	1	1
Time from nursing home admission to death (length of stay)			
≤ 47 days	1	1	1
48–189 days	1.32 (1.22–1.42)	1.79 (1.68–1.91)	1.65 (1.57–1.73)
190–540 days	1.34 (1.23–1.45)	2.18 (2.04–2.32)	1.85 (1.76–1.95)
541–1819 days	1.15 (1.06–1.24)	2.16 (2.02–2.31)	1.72 (1.63–1.81)

Table 4
Main discharge diagnoses of nursing home residents dying in a hospital, stratified by dementia status.

Main diagnoses groups (ICD–10 codes)	Dementia status		
	Yes	No	Total
Infections (A00–B99, J10–J18, L00–L08, N30, N39)	24.7%	20.6%	22.4%
Cardiovascular diseases (D50–D89, I00–I59, I70–I99)	19.9%	23.0%	21.7%
Diseases of the digestive system (K00–K93)	9.3%	9.6%	9.5%
Diseases of the respiratory system (J00–J09, J19–J99)	10.2%	8.8%	9.4%
Injuries and poisoning (R55, S00–T98)	8.5%	8.0%	8.3%
Other diseases (not in the other groups)	8.1%	7.8%	7.9%
Cancer (C00–D48)	3.6%	8.7%	6.5%
Cerebrovascular diseases (G45–G46, I60–I69)	6.8%	6.1%	6.4%
Endocrine–, nutritional–, metabolic diseases (E00–E90, N18–N19)	4.5%	4.0%	4.2%
Diseases of the nervous and sensory system (G00–G44, G47–G99)	2.1%	1.8%	1.9%
Psychiatric diseases (F00–F99)	1.5%	0.7%	1.1%
Diseases of the musculoskeletal system (M00–M99)	0.6%	0.8%	0.7%

end-of-life treatment in nursing home residents with dementia. In summary, few studies have investigated differences in in-hospital deaths between nursing home residents with and without dementia and further studies on this topic from outside the United States are needed. More research is particularly required on the reasons for the high proportions of in-hospital deaths of nursing home residents with dementia in Germany as our data did not include this information, nor did the analysis of main hospital diagnoses explain those findings.

Irrespective of dementia status, the proportions of in-hospital deaths vary widely between different countries, but also between studies from the same country (Krishnan et al., 2015; Morin, Johnell, & Aubry, 2015; Mukamel et al., 2012; Pekmezaris et al., 2004; Shinoda-Tagawa & Ikegami, 2005; Sloane et al., 2008). The proportion of in-hospital deaths found in this study is comparable to those observed in an earlier study from Germany (Ramroth, Specht-Leible, König, & Brenner, 2006), but higher than those reported in most other studies from different countries (Finucane, Stevenson, & Murray, 2017; Kelly et al., 2010; Li et al., 2013; McGregor, Tate, Ronald, & McGrail, 2007; Menec, Nowicki, Blandford, & Veselyuk, 2009; Morin et al., 2015). We found that levels of care had the strongest influence on in-hospital deaths, with no identifiable differences between residents with dementia and those without. The lower the level of care, the higher was the proportion of residents dying in hospitals. These findings are similar to those from

other studies, which showed that the odds of dying in hospital were higher among nursing home residents who had required less care (McGregor et al., 2007; Menec et al., 2009). This suggests that a less aggressive treatment approach is taken when residents become more disabled (McGregor et al., 2007).

The influence of age and length of nursing home stay differed between residents with and without dementia. In both groups, the proportion of residents dying in hospitals was lowest in those aged 95 years and older, with no differences between residents with and without dementia. This seems to be in line with the literature on overall hospitalizations of nursing home residents, although most studies used 90 or even 85 years as the cutoff for the highest age group (Hoffmann & Allers, 2016). In our recent cohort study, we also found that nursing home residents aged 95 years and older had the lowest hospitalization rate (Hoffmann & Allers, 2017), which might reflect less aggressive treatment of the oldest (Ramroth et al., 2005; Ronald, McGregor, McGrail, Tate, & Broemling, 2008), irrespective of whether they have dementia.

Although the absence of a clear age trend for in-hospital deaths we found has also been reported for hospitalization rates after nursing home entry (Hoffmann & Allers, 2017), our study showed that the proportion of in-hospital deaths decreased linearly with age in those with dementia. This could mean that nursing home residents without dementia are more diverse and more ill and hence have a lower life expectancy. A longer time span between nursing home admission and death might also be a proxy for illnesses that progress more slowly. While some studies found no association between length of stay and in-hospital deaths (Krishnan et al., 2015; Shinoda-Tagawa & Ikegami, 2005), studies from the United States comparing short-stay (< 90 days) and long-stay (≥ 90 days) residents found that the latter were less likely to die in hospital (Gozalo & Miller, 2007; Temkin-Greener et al., 2013). However, the comparability of studies is limited as length of stay is operationalized with various cut-offs and the types of nursing homes differ between health care systems. While in some countries, including Germany, most residents remain in the nursing home, in the United States there are many short-stay residents who are discharged from the nursing home after they receive rehabilitative or post-acute care (McGregor et al., 2007; Temkin-Greener et al., 2013).

Differences between the sexes are also noticeable and were found in nursing home residents with and without dementia. Men had a higher chance of dying in hospitals than women (32.4% vs. 28.3%; OR: 1.24). As our systematic review shows, this is well in line with the literature

on overall hospitalizations of nursing home residents (Hoffmann & Allers, 2016). In a recent cohort study, we found that this difference was greater after nursing home entry than before (Hoffmann & Allers, 2017). Since hospitalization rates are highest after being newly admitted to a nursing home and shortly before death (Boyd et al., 2016; Hoffmann & Allers, 2017; Ramroth et al., 2006), one might suggest that this sex difference is due to the shorter life expectancy of men. However, we found that male nursing home residents are more likely to die in hospital as well, which is also in line with the literature (Li et al., 2013; McGregor et al., 2007). Taken together, there is strong evidence that men are more often hospitalized between institutionalization and death than women, irrespective of the country where the study was conducted. The reasons for that are still unclear and should be the subject of further research.

4.2. Strengths and limitations

The main strength of this study was its large sample size of about 67,000 deceased nursing home residents, which gave us the opportunity to stratify our results by dementia status and other important variables including age and level of care dependency. As we used administrative data, no proxy interviews had to be conducted. We were able to study in-hospital deaths without the typical shortcomings of field studies, such as non-response or recall bias.

Nevertheless, several limitations must be considered as well. Since we defined our main outcome as nursing home residents being in hospital on the day of their death, some of them might have been discharged and died later that day in the nursing home. However, this proportion ought to be small, and these residents were still in hospital on the day of death.

Dementia was assessed during the calendar quarter of institutionalization as dementia is one of the main reasons for nursing home placement (Luppa et al., 2010; Schulze, van den Bussche, Katuszkiewicz, Koller, & Hoffmann, 2015). Therefore, it is possible that some residents have developed dementia after their institutionalization. However, as survival times vary, using the whole length of stay in the nursing home would lead to different times at risk. Furthermore, we did not choose a later point during the nursing home stay for assessing diagnoses because conditions that are no longer treated might also no longer be documented in claims data. This would have led to an underestimation of the prevalence of dementia. However, when considering the whole period after admission, the proportions of in-hospital death remained unchanged (29.4% and 29.8% in those with and without dementia), although the prevalence of dementia increased from 43.1%–55.9%.

As is the case for all analyses that use administrative data, some health-related information of interest (e.g., cognitive status or whether a do-not-hospitalize order exists) and facility factors (e.g., ownership and qualification of nursing staff) that could have an influence on in-hospital deaths were not available. One further limitation might be that we only included residents aged 65 years and older. Therefore, we cannot draw any conclusions regarding younger nursing home residents. However, those nursing home residents often differ from older residents with regard to their clinical profile and underlying diseases and are excluded in many studies on nursing home residents.

Finally, we used data of just one German health insurance fund. Compared to other health insurance funds, the DAK-Gesundheit insures a higher proportion of women and a population whose burden of chronic diseases is generally higher (Hoffmann & Icks, 2012). However, the annual hospitalization rates of members of the DAK-Gesundheit are comparable to those of the whole German population (Luque Ramos & Hoffmann, 2017).

5. Conclusions

We found a comparably high proportion of in-hospital deaths

among nursing home residents with and without dementia, with virtually no differences between these groups. More attention should be paid to recognizing the end of life and initiating less aggressive treatment, especially in persons with dementia. Since some predictors of in-hospital death might differ depending on dementia status, we suggest that further studies on hospitalizations near the end of life should stratify their results by dementia or cognitive status.

Conflict of interest

The authors declare that they have no competing interests.

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