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Hospital mortality in patients with and without dementia

By age group, speciality department and primary admission diagnosis

In-hospital mortality in patients with and without dementia across age groups, clinical departments and primary admission diagnoses

Background: Studies reported a higher in-hospital mortality in patients living with dementia (PlwD) with limited evidence across age groups, clinical departments and admission diagnoses. Study aim was to compare the in-hospital mortality rate of PlwD with non-demented controls across groups, clinical departments and admission diagnoses.

Methods: This case-control study included patients aged ≥ 60 years hospitalized in one of 36 German hospitals between January 2019 and July 2023. PlwD were matched to non-demented controls. The associations between dementia and in-hospital mortality across groups were assessed using univariable logistic regression analyses.

Results: 29,203patients with and 29,203 without dementia were included (mean age: 84 years, 60% female). PlwD had a significantly higher in-hospital mortality rate than non-dementia controls. The excess mortality rate was highest in the youngest age group (60–70 years), decreased with age, and became non-significant in the oldest age group (≥ 90 years). Significant differences were found for digestive system, cardiovascular and cerebrovascular disorders, endocrine, nutritional and metabolic diseases, and pneumonia, as well as for internal medicine and gastroenterology departments.

Conclusion: The excess mortality rate was highest in younger age groups, where the general mortality and complication rate is relatively low in the general population. Appropriate approaches are needed.

Keywords

dementia, Alzheimer's disease, mortality, hospital, elderly

In times of demographic change, the number of patients affected by Alzheimer's disease and other related dementias will increase dramatically [1]. This increasing prevalence will also have an impact on hospitals. They will be confronted with an increased workload due to rising admissions of dementia patients and their need for complex treatment and care measures [2]. A recent study by Sampson et al [3] examined the prevalence of dementia in older people over the age of 70 admitted to hospital as emergency cases. The study found that more than 42% of admitted patients suffered from dementia. These results are consistent with a cross-sectional study of patients aged 65 years and older in randomly selected general hospitals in Germany [4]. It confirmed that 40% of patients over the age of 65 suffered from mild cognitive impairment or dementia. These patients were more frequently treated for dehydration, electrolyte disturbances, urinary tract infections, bruises and fractures, as well as symptoms and findings of unknown nature [5]. Patients with severe impairments, such as dementia, require special care. A key aspect that requires attention is the hospital mortality of this population group. An observational cohort study from 2010 linked data from three national registers in the Netherlands, which included 40,500 patients aged 60 to 100 years. It showed that in addition to male gender (adjusted hazard ratio (HR) 1.52, 95% confidence interval (95% CI) 1.43-1.63) and older age (adjusted HR 1.03, 95% CI 1.03-1.04), the presence of Alzheimer's disease (adjusted HR 1.21, 95% CI 1.13-1.29) also increased the risk of hospital mortality [6]. Later studies confirmed this increased likelihood of hospital mortality in patients with Alzheimer's disease or other related dementias with comparable results (odds and hazard ratios between 1.1 and 1.2) [7, 8]. Dementia is therefore a predictor of hospital mortality in hospitalised persons.

>> Understanding the complexity of hospital mortality in patients with dementia requires a comprehensive examination of the various factors that contribute to it. Several studies have shown that hospital mortality was increased when dementia occurred in combination with other conditions, such as respiratory failure, acute renal failure, haemorrhagic stroke, bloodstream infections [8] and superimposed delirium in dementia (OR 2.60; 95% CI 1.39-4.85) [9]. Houttekier et al [10] also found that almost half of all dementia patients died from pneumonia and a quarter of residents of long-term care facilities die in hospital. Most studies focus on overall hospital mortality, mortality after acute admission or assess hospital mortality in relation to specific comorbidities or complications. However, there is a lack of evidence on the hospital mortality of dementia patients in different age groups, with different main admission diagnoses and in specific hospital departments. Knowledge of the influence of these factors on hospital mortality in dementia patients is crucial in order to introduce dementia-specific measures to prevent deaths in this population.

Methodology

Data source

This multi-centre case-control study is based on data from the Hospital Database (company: IQVIA), which contains data from 36 hospitals across Germany, including specialist hospitals, primary, standard and maximum care hospitals and university hospitals. The data set describes a standardised data format that the hospitals transmit to the Institute for the Hospital Remuneration System (InEK) in accordance with Section 21 of the Hospital Remuneration Act (KHEntgG). The individual treatment episodes contained in a case's § 21 data set are clustered using special grouping software developed by 3M Health Information Systems and IQVIA. In addition, the export files generated by the software are anonymised (e.g. case and patient number) before transmission for data protection reasons.

Study population

The case-control study included all patients aged ≥ 60 years

who were hospitalised between January 2019 and July 2023. For patients with more than one hospitalisation during the study period, only the last hospitalisation was included in the analysis. Patients were divided into patients with and without a dementia diagnosis based on their comorbidities (ICD-10: F00-F03, G30).

Study outcome

The main outcome of the study was the prevalence of hospital mortality in relation to dementia diagnosis. The dataset includes death as one of the discharge types. Patients with dementia were matched individually (1:1 ratio) to patients without dementia according to age, gender, department (internal medicine, geriatrics, surgery, cardiology, gastroenterology and others) and admission diagnosis (see Fig. 1). The proportion of deceased patients was calculated for patients with and without dementia overall and stratified by age groups (60-69, 70-79, 80-84, 85-89, 90+ years), women, men and admission diagnoses.

Admission diagnoses

Admission diagnoses were grouped into diagnostic categories based on ICD-10 codes, including injuries and fractures (S00-S99), cardiovascular and cerebrovascular diseases (G45, I00-I99), pneumonia (J12-J18), diseases of the digestive system (K20-K95), endocrine, nutritional and metabolic diseases (E00-E89), certain infectious and parasitic diseases (A00-B99), urinary tract infections (N30, N39.0), cancer (C00-C97), neurological diseases (G00-G99 without G45), musculoskeletal diseases (M00-M99), acute renal insufficiency (N17) and chronic obstructive pulmonary disease (COPD, J44). All other illnesses were only rarely documented as admission diagnoses and were summarised under 'Other'.

Statistical analyses

Univariate logistic regression analyses were performed to determine the associations between dementia and hospital mortality.

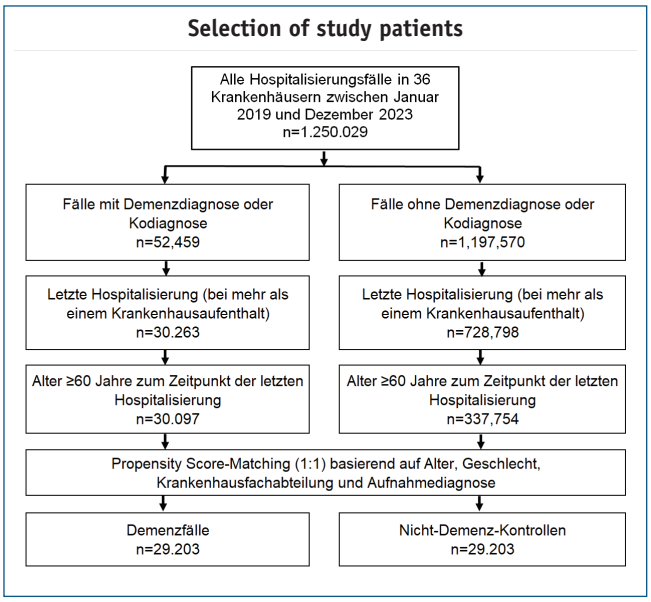


Fig. 1: *Selection of study patients. Source: own illustration.*

Hospital mortality (yes, no) served as the dependent variable and dementia (yes, no) as the predictor of interest. Models were created for the total population as well as for age groups, gender, admission diagnosis categories and departments. The results of the logistic regression models were expressed as odds ratios (OR) for patients with dementia compared to patients without dementia. Due to multiple comparisons, only p-values <0.005 were considered statistically significant. All analyses were performed with SAS 9.4 (SAS Institute, Cary, US).

Results

Baseline characteristics

The present study included 29,203 patients with dementia (cases) and 29,203 patients without dementia (controls). The baseline characteristics of the study patients are shown in Table 1.

The average age was 84 years, 60% of the patients were women. 29% were treated in internal medicine, 17% in surgery, 11% in geriatrics, 9% in cardiology, 9% in gastroenterology and 25% in other specialist departments. The most common admission diagnoses were injuries and fractures (19%), followed by cardiovascular and cerebrovascular diseases (16%), pneumonia (11%), disorders of the digestive system (9%) and endocrine, nutritional and metabolic diseases (9%). The median length of stay in hospital was one day longer for patients with dementia than for healthy controls (7 vs. 6 days).

Prevalence of hospital mortality

Figure 2 compares the study parameters of the proportions of deceased patients with and without dementia. Overall, hospital mortality was significantly higher in patients with dementia than in controls (13.9% vs. 12.4%, p<0.001). The difference in hospital mortality between patients with dementia and control subjects without dementia was greatest in the youngest age group (60-70 years: 10.7% vs. 6.8%, p<0.001) and decreased steadily with increasing age, so that the smallest difference was found in the age group 90 years and older (15.9% vs. 16.9%). This difference was not significant. There were significant differences in hospital mortality between men and women, with overall hospital mortality being higher in men (16.8% in PmD vs. 14.6% in controls) than in women (12.0% in PmD vs. 11.0% in controls). The differences in hospital mortality between patients with dementia were also greater for men than for women.

Association between dementia and hospital mortality

Based on a multivariate regression model, dementia was significantly associated with slightly higher hospital mortality regardless of the primary diagnosis (OR; 1.14; 95% CI: 1.08-1.19) (Fig. 2). The odds ratio of hospital mortality for patients with dementia was significantly higher in the age group 60 to 70 years (OR: 1.64; 95% CI: 1.24-2.29) and decreased with increasing age until it reached a non-significant OR of 0.90 in the age group over 90 years (95% CI: 0.80-1.10).

Taking into account the admission diagnosis, there was an association between dementia and mortality in patients whose primary admission diagnosis was diseases of the digestive system

Basis-Charakteristika der Studienpopulation nach 1:1-Matching		
	Patienten mit Demenz (n = 29.203)	**Patienten ohne Demenz (n = 29.203)**
Durchschnittsalter		
Durchschnittsalter (SA)	84,2 (6,8)	84,3 (7,0)
60–70 Jahre, %	3,7	3,8
71–80 Jahre, %	22,0	21,6
81–75 Jahre, %	30,0	29,4
86–90 Jahre, %	27,0	26,7
>90 Jahre, %	17,3	18,4
Geschlecht, %		
Weiblich	60,3	60,2
Männlich	39,7	39,8
Krankenhausfachabteilung, %		
Innere Medizin	28,7	29,2
Chirurgie	16,8	17,4
Geriatrie	11,6	10,8
Kardiologie	8,5	8,9
Gastroenterologie	9,1	8,6
Andere Fachabteilungen	25,3	25,1
Hauptdiagnose, %		
Verletzungen und Frakturen	18,8	19,0
Herz-Kreislauf- und zerebrovaskuläre Erkrankungen	15,5	15,8
Pneumonie	10.8	10.7
Erkrankungen des Verdauungssystems	8,7	8,6
Endokrine, Ernährungs- und Stoffwechselkrankheiten	8,5	8,6
Bestimmte infektiöse und parasitäre Krankheiten	5,5	5,7
Harnwegsinfektionen	4,6	4,9
Krebs	2,9	2,9
Neurologische Erkrankungen	3,0	3,0
Erkrankungen des Muskel-Skelett-Systems	1,8	1,7
Niereninsuffizienz	1,6	1,6
Chronisch obstruktive Lungenerkrankung	1,0	1,0
Sonstige Erkrankungen	17,3	16,3

Table 1: *Baseline characteristics of the study population after 1:1 matching.*

(OR: 1.43; 95% CI: 1.20-1.72), cardiovascular and cerebrovascular diseases (OR: 1.21; 95% CI: 1.08-1.32), endocrine, nutritional and metabolic diseases (OR: 1.32; 95% CI: 1.07-1.62) and pneumonia (OR: 1.16; 95% CI: 1.04-1.29) (see Tab. 2). For all other disease groups, no or no significant association between dementia and hospital mortality was observed.

Discussion

In this case-control study, the hospital mortality of 29,203 hospitalised patients with and 29,203 hospitalised patients without dementia was examined by age, clinical specialty and main admission diagnosis. The difference in hospital mortality between patients with dementia and control subjects without dementia was greatest in the youngest age group between 60 and 70 years, decreased steadily with increasing age and disappeared in the age group of patients aged 90 years and older. In addition, hospital mortality was increased in patients with the main admission diagnoses of digestive system disorders, cardiovascular and cerebrovascular diseases, endocrine, nutritional and metabolic diseases or pneumonia. No association was found between hospital mortality and dementia in patients treated in geriatric wards. However, differences in mortality were found in patients in the departments of gastroenterology, internal medicine, cardiology and surgery.

Previous studies reported a hospital mortality risk of between 11% and 19% depending on the primary admission diagnosis [3, 11, 12]. The cumulative hospital mortality in the present study (14%) is therefore consistent with these studies. Older people are generally more susceptible to diseases, complications and functional limitations that significantly reduce their likelihood of survival [13]. The presence of multiple chronic diseases, as is the case in patients with dementia [14], leads to a decrease in physiological reserves and contributes to the complexity of the necessary treatment and care of this population in hospital. Taudorf et al [15] showed that mortality in patients with dementia is more than twice as high as in the general population, even after adjustment for comorbidities, suggesting that dementia itself contributes to increased mortality.

However, our study also showed differences in cumulative hospital mortality in the different age groups, indicating that excess mortality, defined as the difference in mortality rates between patients with dementia and controls without dementia, was highest in the youngest group (60 to 70 years). The correlation between age and in-hospital mortality is complex, both in and out of hospital, and mortality increases with age [16]. The study by Walicka et al [17] examined hospital mortality in a large population and confirmed that the average odds ratio for hospital mortality increased with patient age, reaching a 229-fold higher rate in the ≥ 95 years age group than in the 18-24 years age group. A comparison of the age groups analysed in the study by Walicka et al [17] revealed a hospital mortality rate of 4.1% in patients aged 65-74 years, which increased to 7.5% in patients aged 75-84 years, 15.0% in patients aged 85-94 years and 26.4% in patients aged 95 years and older. Our results confirmed this general trend of increasing hospital mortality in the older age groups.

Most importantly, our results also showed that the differences in mortality rates between patients with dementia and controls without dementia were greatest in the youngest age group studied, 60 to 70-year-old patients. The differences in mortality rates decreased with increasing age and were no longer significant in patients aged 90 years and older. The effects of

The impact of dementia and the risk factors and complications associated with the disease on mortality may therefore vary with

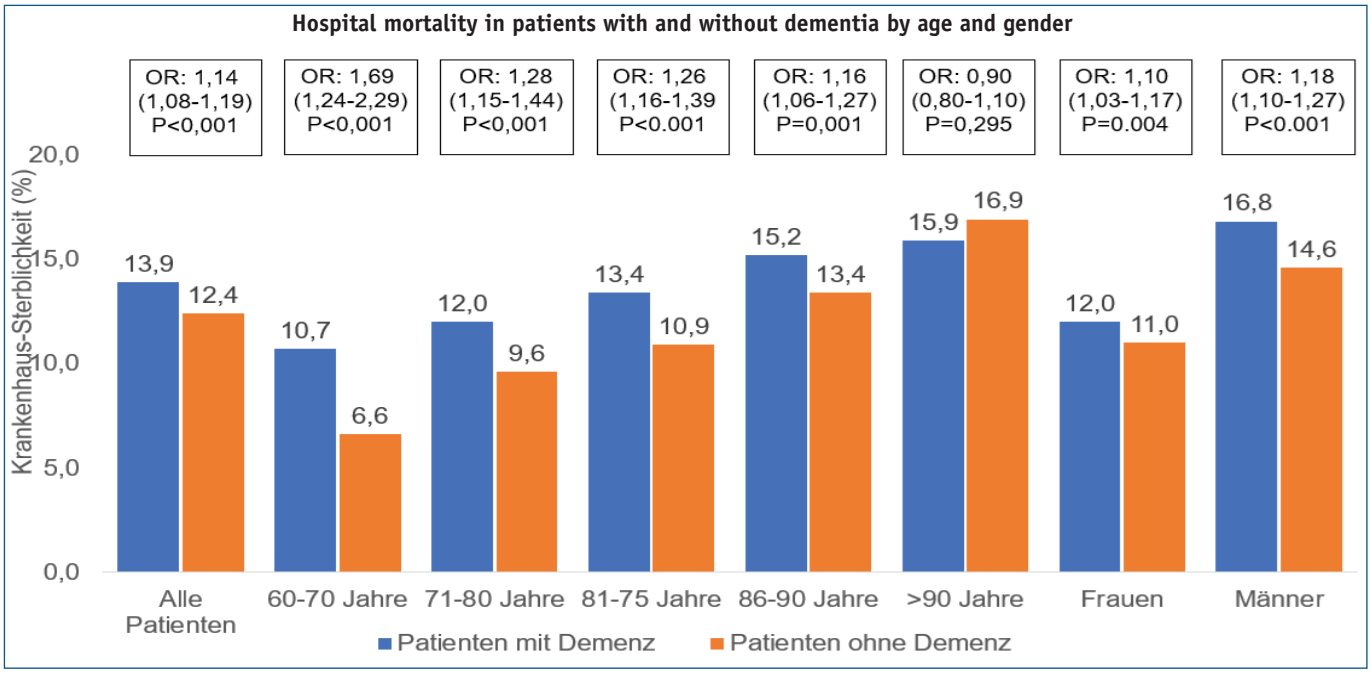


Fig. 2: *Hospital mortality in patients with and without dementia by age and gender. Source: own illustration.*

patient age. They appear to have a greater impact in younger dementia patients, although their overall mortality rate is lower and the likelihood of infections and complications, as described above, is higher than in control subjects of the same age without dementia.

In line with this, the likelihood of hospital complications in the general population increases with age [13]. Thus, our results show that the interaction of different health conditions and their relative contributions to hospital mortality change with increasing age and that causes of death may differ in people with dementia in different age groups. This was confirmed by our department-specific analyses, which showed significant associations between dementia and mortality for all departments except geriatrics, where significantly older people are admitted and treated.

However, it is important to note that age is not the only determinant of hospital mortality. General health status, comorbidities, quality of medical care and social support also play a crucial role. Further studies are urgently needed to assess the impact of all these determinants on hospital mortality of hospitalised dementia patients.

In addition, a more holistic approach to clinical care is essential to effectively address the diverse and complex needs of hospitalised dementia patients. There are a number of publications on dementia-friendly initiatives, mostly implemented in geriatric departments [18-20]. Such approaches have beenimplemented based on a more person-centred approach and various architectural criteria and equipment elements as key features to address the challenges faced by dementia patients during hospitalisation [20].

However, these approaches do not primarily focus on reducing the complications and risk factors in hospital that can lead to increased hospital mortality in patients with dementia. They are often implemented in geriatric departments, where patients with and without dementia have similar mortality rates according to our analysis. The impact of such holistic and dementia-focussed approaches should therefore be closely examined, especially in younger populations treated in non-geriatric wards, such as internal medicine.

Our results are of interest for a better understanding of the differences in hospital mortality between patients with dementia and control subjects without dementia in different age, speciality department and admission diagnosis groups.

Therefore, appropriate approaches to avoid hospitalisation, improved access to clinical care and tailored management of comorbidities, complications and acute events are crucial to avoid poor clinical outcomes in this population. Further studies should investigate the impact ofsuch innovative approaches on mortality and unfavourable hospital outcomes, particularly in relatively younger patient groups where the highest reduction potential can be achieved.

The present study is subject to several limitations that should be mentioned at this point. Firstly, the diagnoses and codiagnoses were based exclusively on the ICD-10 classification. Secondly, data were included from 2019 to 2023, a period in which the Covid-19 pandemic had a persistent and significant impact on hospital care and patient mortality, particularly in the elderly population. Therefore, the results presented here may be limited to this impact and not transferable to a situation without Covid-19 influence. Third, no data were available on lifestyle variables such as residence in a nursing home or family situation. Fourthly, there was no information on medication that would have made it possible to analyse the influence of different medications on mortality. Furthermore, as the data set only contains information from hospitals, the study results cannot be transferred to the outpatient population.

Socio-demographic, socio-economic or clinical variables of the patients would also have been helpful to improve our models.

Assoziation zwischen Demenz und Krankenhaussterblichkeit bei Patienten, die wegen verschiedener Krankheiten hospitalisiert wurden				
Hauptdiagnose	**Krankenhaussterblichkeit bei Patienten mit Demenz (%)**	**Krankenhaussterblichkeit bei Patienten ohne Demenz (%)**	**OR (95% KI)**	**P-Wert**
Verletzungen und Frakturen	7,0	7,3	0,96 (0,83-1,11)	0,586
Herz-Kreislauf- und zerebrovaskuläre Erkrankungen	17,2	14,7	1,21 (1,08-1,35)	<0,001
Pneumonie	34,5	31,3	1,16 (1,04-1,29)	0,006
Erkrankungen des Verdauungssystems	12,6	9,2	1,43 (1,20-1,72)	<0,001
Endokrine, Ernährungs- und Stoffwechselkrankheiten	8,7	6,8	1,32 (1,07-1,62)	0,010
Bestimmte infektiöse und parasitäre Krankheiten	21,1	20,4	1,05 (0,88-1,24)	0,605
Harnwegsinfektionen	8,4	8,7	0,96 (0,74-1,25)	0,766
Krebs	16,5	14,7	1,15 (0,88-1,50)	0,299
Neurologische Erkrankungen	8,4	8,7	0,97 (0,69-1,35)	0,836
Erkrankungen des Muskel-Skelett-Systems	4,9	4,5	1,09 (0,61-1,95)	0,774
Niereninsuffizienz	26,1	24,6	1,08 (0,81-1,45)	0,609
Chronisch obstruktive Lungenerkrankung	19,9	14,9	1,42 (0,92-2,17)	0,111
Sonstige Erkrankungen	7,9	6,7	1,20 (1,03-1,40)	0,021

Table 2: *Association between dementia and hospital mortality in patients hospitalised for various diseases (univariate logistic regression). Own representation.*

However, as this analysis was based on performance data, these variables are not available, which may have influenced the results and prevented the detection of important associations. Finally, a patient's treatment and care, and therefore death, depends on the quality of care provided by a particular hospital. The inclusion of hospital identifiers and regions as clusters would have been helpful in adjusting for such differences.

However, due to data protection regulations, no information on the region or hospital identifier was available, which limits the generalisability of the results presented. Finally, the data analyses were based on a 1:1 matching procedure of PmD with controls without dementia, which excluded some patients with dementia. However, matching all individuals would have led to differences between the populations. The reduced population for these analyses therefore limits the generalisability of the results presented. <<

Assoziation zwischen Demenz und Krankenhaussterblichkeit bei Patienten, die in verschiedenen Krankenhausabteilungen stationär behandelt wurden				
Hauptdiagnose	**Krankenhaussterblichkeit bei Patienten mit Demenz (%)**	**Krankenhaussterblichkeit bei Patienten ohne Demenz (%)**	**OR (95% KI)**	**P-Wert**
Innere Medizin	17,6	14,8	1,23 (1,13–1,34)	<0,001
Chirurgie	10.0	8,9	1,13 (0,99–1,29)	0,076
Geriatrie	5,3	6,1	0,86 (0,70–1,06)	0,153
Kardiologie	18,2	16,3	1,14 (0,98–1,32)	0,080
Gastroenterologie	16,6	12,0	1,45 (1,24–1,70)	<0,001
Andere Fachabteilungen	13,9	13,7	1,02 (0.93–1,12)	0,726

Table 3: *Association between dementia and hospital mortality in patients hospitalised in different hospital departments (univariate logistic regression). Own representation.*

Literature

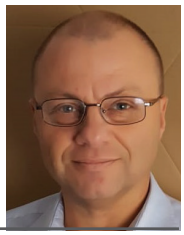
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Zitationshinweis

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The authors declare that there are no conflicts of interest.



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