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Research Letters

Hospitalisations before and after nursing home admission: a retrospective cohort study from Germany

SIR—The present foreseeable demographic development in Germany shows a strong increase in the proportion of older people in the total population, which is even stronger than in most other developed countries [1, 2].

Due to the concentration of expenditures at the end of life, provision of adequate medical care for frail disabled older persons is of particular relevance for the health care system [3]. Despite limited financial resources, the special needs of care-dependent old persons must be met. In 2001, two million Germans were in need of care and nearly 660,000 persons were institutionalised in nearly 9,000 nursing homes (NHs), with a decreasing trend for family care and an increasing trend for institutional care at the end of life [4]. Thus, more people will spend the end of their lives in NHs.

What constitutes a 'nursing home' varies by country. In Germany, a relatively comprehensive system of social insurance has been built up in the past, with nursing care insurance being responsible for nursing care, and health insurance for acute hospital care. NHs serve personal care needs (support in the activities of daily living) and specialised nursing needs (e.g. wound care). They do not provide primary health care (which is the domain of general practitioners), and nearly all cases of acute illness are referred to acute hospitals.

In the USA the complex relationship between nursing care and acute medical care, particularly the transfer of patients between NHs and acute care hospitals, has been studied over the years [5–10]. By contrast, basic descriptive data on hospitalisations and their determinants among NH residents are rare for European countries [11].

The aim of this study was to assess rates of hospitalisations and their determinants among NH residents in Germany.

Methods

Study design and study population

A retrospective cohort study was set up among 1,926 NH residents newly institutionalised between 1 January and 31 December 2000 in one of the 97 NHs in the cities of Heidelberg, Mannheim and the Rhine-Neckar area, a study region with 829,930 inhabitants, who applied for benefits from the German statutory nursing insurance system. According to statutory regulations, these benefits are provided to those people who need support in the activities of daily living (ADL). The benefits are granted contingent on the results of a standardised medical examination carried out by the medical service of the health insurance plans. In this retrospective cohort study, we linked sociodemographic data as well as data of these medical examinations with follow-up data regarding hospitalisations from the health insurance plans. For logistic reasons, the sample was restricted to members of the eight largest health insurance plans, which cover about 80% of the population.

The study was approved by the Ethics committee of the University of Heidelberg and the data protection commissioner of the state of Baden-Württemberg.

Statistical methods

Absolute rates of hospitalisations (HR), length of hospital stay (LOS) and relative time spent in hospital (RT) were calculated according to age, gender, leading diagnosis for dependency on permanent care, level of care dependency and vital status at the end of the observation time (Software SAS V8.2).

Results

Sample characteristics

The study population included 1,926 NH residents, newly institutionalised between 1 January and 31 December 2000. There were three times more women (1,451, 75.3%, mean age 82.3 years) than men (475, 24.7%, mean age 76.9 years), which reflects the considerably higher proportion of women among the older population caused by differences in life expectancy (Table 1). The leading medical diagnoses for dependency on permanent care were dementia ($n=392$, 23.1%), cerebrovascular diseases (13.8%) and diseases of the nervous and sensory system (10.2%).

Overall, 2,148 hospitalisations occurred within a total of 2,049 person-years at risk after hospital admission. The most common medical diagnoses for hospital stay were injuries and poisoning (14.4%), followed by cardiovascular diseases (13.9%) and infections (11.6%). The estimate for 1-year survival was 65.7%.

Hospitalisations before and after NHA

A comparison of hospitalisation rates before and after nursing home admission (NHA) was possible for a subset of 1,361 participants from two health insurance plans, covering 70% of all study participants. It seems obvious that the diseases during the last months before NHA are the deciding ones for NHA. Thus, when comparing hospitalisations before and after NHA, we separately analysed a time window of 3 months before NHA.

Although the first period beginning 1 January 1999 includes nearly five times the person-time (PT=1666

Table 1. Characteristics of the study population, hospitalisations after nursing home admission, and vital status at the end of the observation period

Factor	Men	Women	Total
Age (years)			
<70	107 (22.5)	91 (6.3)	198 (10.3)
70–79	140 (29.5)	281 (19.4)	421 (21.9)
80–89	174 (36.6)	759 (52.3)	933 (48.4)
≥90	54 (11.4)	320 (22.1)	374 (19.4)
Main medical cause for dependency on permanent care (ICD-10/ICD-9)[a]			
Infections (A00–B99, J10–J18, L00–L08, N30, N39/001–139, 480–487, 595, 599, 680–686)	4 (1.0)	6 (0.5)	10 (0.6)
Cancer (C00–D48/140–199, 210–239)	43 (10.4)	60 (4.7)	103 (6.1)
Endocrine-, nutritional-, metabolic diseases (E00–E90, N18–N19/240–279, 585–586)	3 (0.7)	30 (2.3)	33 (1.9)
Psychiatric diseases (F00–F99/290–319)	118 (28.4)	429 (33.4)	547 (32.2)
– among these: Dementia (F00–F03/290)	73 (17.6)	319 (24.9)	392 (23.1)
Diseases of the nervous and sensory system (G00–G44, G47–G99/320–359)	54 (13.0)	120 (9.4)	174 (10.2)
Cerebrovascular diseases (G45–G46, I60–I69/430–438)	70 (16.9)	164 (12.8)	234 (13.8)
Cardiovascular diseases (D50–D89, I00–I59, I70–I99/200–208, 280–289, 390–429, 439–459)	23 (5.5)	65 (5.1)	88 (5.2)
Diseases of the musculoskeletal system (M00–M99/710–739)	23 (5.5)	138 (10.8)	161 (9.5)
Injuries and poisoning (R55, S00–T98/780, 800–999)	14 (3.4)	65 (5.1)	79 (4.7)
Diseases of the respiratory system (J00–J09, J19–J99/460–479, 488–519)	6 (1.4)	15 (1.2)	21 (1.2)
Diseases of the digestive system (K00–K93/520–579)	3 (0.7)	6 (0.5)	9 (0.5)
Other diseases	54 (13.0)	185 (14.4)	239 (14.1)
Level of care dependency (in minutes per day)[b]			
<60	96 (20.2)	325 (22.4)	421 (21.9)
>60 to ≤100	75 (15.8)	260 (17.9)	335 (17.4)
>100 to ≤145	92 (19.4)	285 (19.6)	377 (19.6)
>145	96 (20.2)	267 (18.4)	363 (18.8)
Main diagnosis for hospital stay (after nursing home admission)[c]			
Infections (A00–B99, J10–J18, L00–L08, N30, N39/001–139, 480–487, 595, 599, 680–686)	94 (15.6)	155 (10.0)	249 (11.6)
– among these: influenza and pneumonia (J10–J18/480–487)	55 (9.1)	81 (5.2)	136 (6.3)
Cancer (C00–D48/140–199, 210–239)	43 (7.1)	54 (3.5)	97 (4.5)
Endocrine-, nutrition-, metabolic diseases (E00–E90, N18–N19/240–279, 585–586)	37 (6.1)	137 (8.9)	174 (8.1)
Psychiatric diseases (F00–F99/290–319)	55 (9.1)	116 (7.5)	171 (8.0)
Diseases of the nervous and sensory system (G00–G44, G47–G99/320–359)	28 (4.6)	48 (3.1)	76 (3.5)
Cerebrovascular diseases (G45–G46, I60–I 69/430–438)	22 (3.6)	81 (5.2)	103 (4.8)
Cardiovascular diseases (D50–D89, I00–I59, I70–I99/200–208, 280–289, 390–429, 439–459)	70 (11.6)	228 (14.8)	298 (13.9)
– among these: congestive heart failure (I50/428)	26 (4.3)	64 (4.1)	90 (4.2)
Diseases of the musculoskeletal system (M00–M99/710–739)	2 (0.3)	15 (1.0)	17 (0.8)
Injuries and poisoning (R55, S00–T98/780, 800–999)	49 (8.1)	260 (16.8)	309 (14.4)
– among these: proximal femur fractures (S72/820)	16 (2.7)	109 (7.1)	125 (5.8)
Diseases of the respiratory system (J00–J09, J19–J99/460–479, 488–519)	55 (9.1)	92 (6.0)	147 (6.8)
Diseases of the digestive system (K00–K93/520–579)	65 (10.8)	171 (11.1)	236 (11.0)
Other diseases	83 (13.8)	188 (12.2)	271 (12.6)
Vital status at the end of the observation period			
Died before 31 December 2001	232 (48.8)	560 (38.6)	792 (41.1)
Alive and under observation until 31 December 2001	219 (46.1)	860 (59.3)	1079 (56.0)
Censored before 31 December 2001	24 (5.1)	31 (2.1)	55 (2.9)
Total	475 (100)	1451 (100)	1926 (100)

[a]228 persons without classification.
[b]430 records with missing values.
[c]Total 2148 hospital admissions (men 603, women 1545), 353 study participants without admission.

person-years) of the second (PT = 343 person-years), the frequency and duration of hospitalisation were much higher close to NHA, resulting in a more than 6-fold higher RT in the 3 months before NHA than in the preceding time window (27.2 versus 4.4%, see Table 2).

Although HR was slightly higher after NHA (1.1 versus 0.9 before NHA), RT was somewhat lower (4.0 versus 4.4%) due to a shorter mean duration of hospital stay (18.1 versus 13.7 days).

In all three time windows, hospitalisation rates and relative time spent in hospital decrease markedly with age. However, the age gradient was much stronger before (≤70 years, HR = 1.7; <90 years, HR = 0.5) than after (≤70 years, HR = 1.2; <90 years, HR = 1.0) NHA. Hospitalisation rates and the relative time spent in hospital were higher among men than among women, and the difference was even increasing after NHA (men HR = 1.5, women HR = 1.0). No clear trend was found for the association of hospitalisations with the level of care dependency.

People who died during the study period (n = 792, 41.1%) were transferred more often into hospital but with shorter length of stay (LOS) than survivors. The difference

Table 2. Hospitalisations before and after nursing home admission

		>3 months before NH admission			≤3 months before NH admission			After NH admission		
	N	HR	LOS	RT	HR	LOS	RT	HR	LOS	RT
Age										
<70	136	1.7	21.5	9.2	8.9	27.2	39.9	1.2	15.4	5.0
70–79	294	1.2	18.6	5.7	7.4	24.2	33.0	1.2	14.7	4.6
80–89	656	0.8	17.0	3.8	5.9	21.5	25.8	1.1	13.5	3.9
≥90	275	0.5	15.3	2.0	4.2	19.1	17.9	1.0	11.6	3.0
Gender										
Men	335	1.1	17.3	5.0	6.3	23.1	28.6	1.5	13.5	5.1
Women	1026	0.9	18.4	4.2	5.9	22.3	26.7	1.0	13.8	3.7
Care level										
0–≤60	299	1.1	18.6	5.5	5.7	22.2	25.6	1.1	14.0	4.1
>60–≤100	240	0.9	17.8	4.1	5.6	22.4	25.6	1.2	15.5	4.7
>100–≤145	280	0.9	17.6	4.2	5.7	20.2	23.9	1.1	14.0	3.9
145<	252	1.0	17.2	4.3	5.5	23.0	25.7	1.1	11.9	3.3
Vital status[a]										
Alive	802	0.8	20.1	4.2	5.5	23.2	26.0	0.8	14.6	3.0
Dead	559	1.1	16.0	4.7	6.8	21.6	28.8	2.5	12.5	7.9
Total	1361	0.9	18.3	4.4	6.0	22.6	27.2	1.1	13.7	4.0

N, number of study participants.
HR, hospitalisation rate per person-year at risk.
LOS, length of stay in hospital (in days).
RT, relative time spent in hospital (%).
[a]Vital status at study end.

was particularly large after NHA, i.e. nearest time to death (HR = 2.5 for people who died, HR = 0.8 for others).

Discussion

To our knowledge, this was the first longitudinal European study regarding hospitalisation rates in a population-based sample of NH residents. A cohort of 1,926 persons, newly admitted into a NH in the year 2000, was followed for a mean of 388 days, with a rate of 1.1 hospitalisations per person-year and an average LOS of 13.7 days.

The hospitalisation rates of NH residents found in our study are much higher than those reported from the USA and the UK, where hospitalisation rates ranged from 0.21 to 0.55 per NH bed and relative time spent in hospital ranged from 0.14 to 1.7% [8, 11]. These differences are likely to be explained by fundamental differences in the health and payment system [12]. Many US and UK nursing homes also provide medical care, which is the domain of general practitioners and hospitals in Germany.

The weak inverse relationship between age and the rate of hospitalisation after NHA, which are in agreement with recent findings [13] in the general German population, reflect a trend to deal more cautiously with hospital transfers of frail old people, to avoid high-technology interventions [10, 14] or 'risky' treatments, with uncertain benefit in the oldest old [15, 16]. Interestingly, the inverse relationship with age was much weaker after than before NHA in our study.

The findings of higher hospitalisation rates in male than female NH residents are consistent with results of analyses of aggregated data considering the general German population [13]. However, the gender differences did not persist after control for age in additional, multivariable analyses, therefore it might be ascribed to the observed age differences.

Excluding the last 3 months before NHA, the relative time (RT) spent in hospital was lower (4.0%) after than before NHA (4.4%), possibly because patients find a competent care network in NHs which was lacking at home. The last 3 months before NHA might be characterised by progression of chronic diseases or onset of new disability. Thus, we found by far the most frequent and longest hospitalisations for this study period.

The findings regarding increased hospitalisation rates after NHA of people who died during follow-up are consistent with results of longitudinal studies from the USA [17, 18].

Our analysis is based on data collected during medical examinations that were not performed for the specific purpose of this study. As in a previous study among disabled community-dwelling older people from Germany [14], there was no clear relationship between dependency on level of care and the rates of hospitalisation. A weak inverse trend with lower rates (LOS, RT) for higher dependence on permanent care persisted after control for age in multivariate analyses, possibly because nursing care for high care dependent people covers the needs of this person group.

In summary, this study extends the scarce database on hospitalisations of NH residents in Europe and their determinants. Injuries, cardiovascular disease and infections were the three leading causes of hospitalisation. These findings suggest that measures to control or manage infections, closer monitoring of cardiovascular disease and prevention of falls and fractures have the potential to reduce hospitalisations in NH residents [19–26]. This study will be an important basis for assessing the impact of major changes in

the social security system which are currently implemented in Germany, including implementation of a DRG-based prospective payment system.

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Having had a hip fracture—association with dependency among the oldest old

SIR—The demands for healthcare and services among older people will be higher in the future and it is of great importance to increase our knowledge about the health status and living conditions of the oldest old.

The incidence of hip fracture increases rapidly with advancing age [1]. Hip fracture is a common reason for being institutionalised [2–4], as it is associated with mobility decline [5] and difficulty in performing activities of daily living (ADL) [6]. There is also a high mortality after hip