Care utilisation in the last years of life in relation to age and time to death: results from a Swedish urban population of the oldest old

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Abstract The majority of older people experience progressive disability at the end of their lives and require long-term care as a result. This study analysed patterns of care utilisation during the 5 years prior to death, particularly the effects of age and time to death in relation to the use of public elder care (i.e. home help services and institutional care) and hospital care. A longitudinal study provided data on care utilisation among participants (aged 83+) who died between 1995 and 2004 ($n = 567$). Almost everyone received some kind of care in the last 5 years, 91% in the last year and 88% in the last 3 months preceding death. The number of days of elder care outnumbered the number of days in hospital by ten to one. Increasing chronological age was important for receipt of home help, whereas time to death was important for admission to hospital; there was a sharp increase in the proportion treated in hospital in the last 9 months before death. The proportion residing in institutional care facilities with around-the-clock care increased steadily with a sharper gradient 6 months before death. Both age and time to death had an effect on use of institutional care, but time to death had twice the effect of increasing age. In conclusion, age and time to death have different effects depending on the type of care studied, and

individual-based longitudinal data gives a very different picture of care utilisation among the oldest old compared to cross-sectional data.

Keywords End-of-life care · Institutionalisation · Hospitalisation · Swedish elder care

Introduction

The majority of older people experience a slow decline in health with progressive disability before dying (Covinsky et al. 2003; Lunney et al. 2003). Less than 10% of Medicare decedents in the United States die with little use of health care in the last year of life (Lunney et al. 2002). A Norwegian study of disability in a population who lived to or beyond age 80 found that three quarters of them spent an average of 3–5 years as seriously demented, severely dependent, or frail before death. Only a small percentage, less than one in ten, died without long-term ADL limitations (Romøren and Blekesæune 2003). The vast majority of older people will thus need long-term formal and/or informal care and services in the final stages of their lives.

Whereas patterns of functional decline at the end of life may be similar in most western countries, the way of organising long-term care varies considerably between nations. All OECD countries are agreed on the general policy direction of ageing in place, i.e. remaining in one's home for as long as possible, but the allocation of formal care for dependent older people varies substantially across nations (OECD 2005). International comparisons of the proportion of older people receiving long-term care have to be interpreted with caution, as different countries have different ways of defining care. Given these limitations, comparative statistics in the Scandinavian countries show

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that the proportion of older individuals (aged 65 years and older) receiving in-home services such as *home help* varies from 8% in Sweden to 21% in Denmark. Corresponding coverage rates are 14% in the Netherlands, 12% in France and 3% in Germany (Rauch 2005).

The provision and financing of elder care and health care in Sweden are a public sector responsibility. Municipalities are responsible for home-based elder care and institutional care facilities, and the county councils are responsible for hospital care and primary care. The greater part of the cost is covered by local or national taxes. User fees cover about 4% of elder care, and 3% of medical care (Swedish Association of Local Authorities and Regions 2006). Public elder care is a needs-tested benefit and a care manager is delegated by the municipal social welfare committee to make an assessment of such needs. There are no explicit rules for how much home help a person is entitled to, given the degree of dependency. Besides ADL limitations and dementia, living alone is found to be the most important predictor of receiving home help services, as well as care in institutional care facilities (Larsson et al. 2004, 2006). Home help facilitates the day-to-day life of older people, thereby enabling them to stay in their own homes for as long as possible. Depending on the individual's needs, help with domestic chores (e.g. shopping, cleaning, cooking/meals on wheels, washing clothes), physical care (e.g. help getting up from bed, dressing, showering, toileting), or a combination of the two is provided. (Home nursing is provided by primary care for people living in their own homes). Home help may be offered several times a day, and if necessary, also at the weekend and at night. Feeling the pressure of an ageing population (Sweden currently has the oldest population in the world with 5% of its population aged 80 and older), as well as budgetary reductions in the 1990s, Sweden developed a more targeted approach to the public care of the aged. Cut-backs primarily affected people with lesser need of help and younger elders, whereas the oldest old were less affected (Palme et al. 2003). In 1995, 21% of people aged 80 or older received public home help services in ordinary dwellings compared to 18% in 2000 and 20% in 2004 (National Board of Health and Welfare 1996, 2006).

Regarding *institutionalisation* rates, less variation among nations is found than with home help. This might reflect the fact that remaining in one's home is not a viable long-term option for older individuals with severe physical frailty or cognitive disorders, at least not for people living alone. In the Scandinavian countries, the percentage of older adults (aged 65 years and older) permanently living in institutional care facilities varies from 7% in Sweden to 12% in Norway. The corresponding coverage rates are 9% in the Netherlands, 7% in France and 5% in Germany (Rauch 2005). In Sweden, there has been a decline in the

institutionalisation rates among people aged 80 and older. In 1995, 23% lived in institutional care facilities compared to 20% in 2000 and 17% in 2004 (National Board of Health and Welfare 1996, 2006).

Besides variations in institutionalisation rates, there are national differences regarding, for example, the extent to which health care is provided in residential care facilities or in hospitals. In Germany, nearly all cases of sub-acute illness are referred to hospitals, unlike countries such as Great Britain, the United States, and the Netherlands where sub-acute hospital care is often provided by nursing homes (Ramroth et al. 2006; Hoek et al. 2000). In Sweden, nursing homes and other institutional care facilities with round the clock services offer health care interventions by registered nurses, thereby facilitating sub-acute care, whereas fewer institutions have access to general practitioner services outside office hours. The municipalities are responsible for nursing homes and for patients who still need medical treatment after discharge from hospital. To reduce the number of 'bed blockers' the municipalities are obliged to pay for hospital care of patients whose in-patient care is considered completed, thereby giving an economic incentive to offer less expensive care in nursing homes. A Swedish study of health care utilisation among patients (aged 18–98 years) in their last 3 months of life showed that the probability of using hospital-based in-patient care was much lower among residents in residential care facilities compared to people living in private homes (Jakobsson et al. 2007). Almost all people who lived permanently in institutions died there, and not in hospital, whereas the vast majority of those who lived in a private home died in hospital (Jakobsson et al. 2006). Similar results are reported from the Netherlands where nursing home residents were rarely moved the last 3 months before death, but the majority of community-dwelling individuals were moved, mainly to hospital. Most patients who were admitted to hospital during the course of the last 3 months died there (Klinkenberg et al. 2005).

Numerous studies have examined predictors of institutionalisation in older populations, but few have used longitudinal data and followed a cohort of older people over time to map out the total use of elder care and hospital care in the last years prior to death. A Norwegian study for which data was collected between 1981 and 1999 found that the study population (aged 80+) received home help on average 4.6 years prior to death, lived on average 2.3 years in a nursing home, and spent on average 30 days in hospital during the 10 years before death (Romøren 2003; Romøren and Blekesæune 2003). A previous study of the population in the present study (81+) illustrated the current Swedish policy of maintaining disabled older people in their homes by offering extensive domestic care and services to postpone or prevent institutionalisation.

Hardly anyone, 5% or less, moved to an institutional care facility without previously receiving home help services at some time in the preceding few years (Larsson et al. 2006).

Rapid growth in older populations, especially among the oldest old, has been blamed for the increment in care expenditure observed in many industrialised countries (Schulz et al. 2004). When looking at Swedish cross-sectional data (Lithman and Noreen 2006; National Board of Health and Welfare 2004) it is obvious that use of elder care (home help services and institutional care) rises steeply with age (Fig. 1). The proportion of older people in hospital care increases moderately to age 85–89 followed by a slight drop in the oldest age group. Numerous studies have shown that approaching death, rather than calendar age, is the main determinant of health care utilisation and costs (Dixon et al. 2004; Forma et al. 2007; Lagergren and Batljan 2000; Schulz et al. 2004; Seshamani and Gray 2004; Yang et al. 2003; Zweifel et al. 1999). The positive relationship between use of health care and age is due to the fact that as age increases, a higher proportion of people are in the final stages of their lives. With regard to elder care, less is known about determining factors for care utilisation. A Finnish study demonstrated that the number of days in public long-term care in the whole population (institutional care around-the-clock) increased regularly over the 2 years before death, but the increase stopped in the last 2 months of life. The increase seemed to be both an effect of age and time to death (Forma et al. 2007). A Swiss study, in contrast, found that ageing had an effect on long-term care expenditures (i.e. nursing home care and medical home care) regardless of proximity to death (Werblow et al. 2007). The current study complements caregiving literature by employing longitudinal data on elder care spanning a period of 5 years

before death. It adds to previous research by including both home help services and institutional care, in combination with hospital in-patient care. The objectives of this study were to map out use of formal care in a Swedish urban population in the last years prior to death, and to analyse the effect of age and time to death on use of home help services, institutional care and hospital care.

Materials and methods

Study population

The data arises from a population-based longitudinal study in Stockholm, The Kungsholmen Study, the general aim of which was to examine ageing from medical, psychological, and sociological perspectives. It consists of all individuals aged 75 or older who were registered in the parish of Kungsholmen in 1987, whether living at home or in an institution, with 1,810 individuals participating in the baseline data collection (83% of eligible participants). The research design is reported in detail elsewhere (Fratiglioni et al. 1992, 1997).

The Kungsholmen area did not differ much from the whole inner-city area of Stockholm regarding sex distribution and marital status when the study started. But compared to the rest of Sweden, women were over-represented in the inner-city area of Stockholm, and were twice as likely never to have married. In spite of this, the Kungsholmen area was fairly representative of Sweden regarding care of the aged. In 1995, 24% of the participants in the follow-up survey (81+) lived in institutional care facilities compared to 23% (80+) in Sweden. Twenty-three per cent received home help services (81+) compared to 21% in Sweden (80+) (National Board of Health and Welfare 1996).

From the base-line sample we examined utilisation of health care and elder care services in the last 5 years prior to death among the 567 individuals who were still alive and participated in a follow-up survey conducted around 1995 (at which point they were aged 81 years or older) and who died between April 1995 and December 2004. Participants who died earlier were not included as there was no continuous data available regarding the use of home help services or stays in institutional care facilities. Care utilisation during the last 3 months before death could be studied for all 567 individuals, whereas corresponding 5-year analyses could be made for those 226 individuals who remained in the study for 5 years or longer (died between 2000 and 2004).

Measures

The analyses of care utilisation were calculated from the exact date of death for each participant. The number of

Fig. 1 Proportion of older people in Sweden, by age, using home help, living in institutional care facilities, and in hospital, in October 2003. (adapted from Lithman and Noreen 2006; National Board of Health and Welfare 2004)

days with elder care or hospital care in the last year preceding death for a person who died on, for example, 10th March 2003, was calculated from 11th March 2002, corresponding 5-year data from 11th March 1998.

Public elder care

Use of *home help services* and care in *institutional care facilities* was obtained from the computerised register held by Stockholm municipality, which maintains data on users of public elder care. Institutional care with service around the clock comprised nursing homes, old people's homes, and group accommodation for people with dementia. Time spent in respite or short-term care facilities was also included. As the register only contained month by month statistics, any data on the use of elder care was included with the actual number of days for that particular month. For the first month we approximated the starting date to be the 15th, with the last month ending on the 14th or the date of death where applicable.

Hospital care

Date of entry into and discharge from hospital in-patient care was obtained from the Swedish Hospital Discharge Register, from which the number of days in hospital was calculated.

Statistical methods

Table 1 describes age at death by time period prior to death, and Table 2 the proportion receiving care by period prior to death. Both tables present overlapping time periods, i.e. the last 3 months are included in the last 6 months etc. Table 3 demonstrates results from three logistic regressions, one for each type of care. Age and time to death are given linear representation and included simultaneously in the models. To capture the steep increase in

use of hospital care the last 9 months before death, an additional linear term is included in the regression analysis for that period.

Figure 2 shows the proportion with care in the whole study sample per 3-month period prior to death. Figure 3 shows average number of days with home help services, institutional care, and hospital care. It is based only on users of each type of care, that specific 3-month period preceding death.

Results

This study examined care utilisation in a cohort of the oldest old in the last years of their lives. As shown in Table 1, care utilisation could be studied for all participants the last 3 months prior to death whereas corresponding data for longer periods were available for a smaller number of individuals. The average age at death increased somewhat by length of study period due to rising minimum age in the study group. The mean age at death among women rose by 1 year when analysing the 5 years before death compared to corresponding analyses of the last 3 months; among men the mean age increased by 2 years. The median age at death did not vary among women; among men it increased by 1 year.

The majority of this study population of the oldest old received public elder care in the years prior to death. Over a 5-year period, three quarters (73%) received home help services in their homes on some occasion, and two-thirds (68%) resided in an institutional care setting. As the vast majority (87%) were at some time admitted to hospital, almost no one died without previously having received home help services, institutional care, or admission to hospital. Ninety-nine per cent received some kind of care in the last 5 years, 91% in the last year and 88% in the last 3 months (Table 2).

Table 1 Sample characteristics of age at death, by gender and period prior to death, in the Kungsholmen study population, Sweden, 1995–2004

Period (in years) prior to death	Women				Men			
	n	Age at death in the sample			n	Age at death in the sample		
		Mean	Median	Min–max		Mean	Median	Min–max
0–5	184	94	93	88–105	42	93	92	88–99
0–4	235	94	93	87–105	52	93	92	87–99
0–3	282	93	93	86–105	63	92	92	86–99
0–2	334	93	93	85–105	78	92	92	85–99
0–1	397	93	93	84–105	110	91	91	84–100
0–0.75	419	93	93	83–105	119	91	91	83–100
0–0.50	426	93	93	83–105	125	91	91	83–100
0–0.25	438	93	93	83–105	129	91	91	83–100

The time periods prior to death are overlapping

Table 2 Proportion receiving public elder care or hospital care by time period prior to death in the Kungsholmen study population, Sweden, 1995–2004

Period (in years) prior to death	<i>n</i>	Public elder care ^a % (95% CI)		Hospital care ^b % (95% CI)	Total % (95% CI)
		Home help services	Institutional care		
0–5	226	73 (67–79)	68 (62–74)	87 (82–91)	99 (97–100)
0–4	287	68 (62–73)	64 (58–70)	83 (78–87)	97 (95–99)
0–3	345	60 (55–65)	60 (55–65)	78 (73–82)	94 (91–96)
0–2	412	53 (48–58)	56 (51–61)	68 (63–72)	91 (88–94)
0–1	507	41 (37–46)	54 (50–59)	60 (55–64)	91 (88–93)
0–0.75	538	39 (35–44)	53 (49–57)	57 (53–61)	90 (87–92)
0–0.50	551	36 (33–41)	52 (48–56)	54 (50–59)	89 (86–91)
0–0.25	567	31 (27–35)	50 (46–54)	49 (45–53)	88 (85–90)

The time periods prior to death are overlapping

^a There is no overlap between home help services and institutional care for a specific day

^b Hospital care may overlap home help services and institutional care

Table 3 The relative importance of age and time to death for the likelihood of receiving home help services, institutional care and hospital care the last 5 years before death, in the Kungsholmen study population, Sweden, 1995–2004

	Home help services OR (95% CI)	Institutional care OR (95% CI)	Hospital care OR (95% CI)
Age	1.06 (1.05–1.08)	1.05 (1.04–1.06)	0.96 (0.94–0.98)
Time to death the last			
The last 5 years	0.99 (0.98–1.00)	1.10 (1.09–1.11)	1.02 (1.00–1.03)
The last 9 months	–	–	1.75 (1.61–1.89)

All odds ratios are statistically significant, $P < 0.05$

Fig. 2 Proportion using home help, residing in institutional care facilities or in hospital, per 3-month period preceding death in the Kungsholmen study population, Sweden, 1995–2004

The pattern of elder care utilisation in the study population changed in the last years prior to death. The proportion that received *home help services*, per 3-month period, was relatively stable for 5 years before death. About one-third received home help. As indicated by Fig. 2 there was a tendency towards an upwards trend until

Fig. 3 Average number of days per 3-month period preceding death with home help, in institutional care and in hospital among recipients of respective type of care in the Kungsholmen study population, Sweden, 1995–2004

2 years prior to death, followed by a slight down turn the last 2 years before actual death. The percentage residing in *institutional care facilities* increased steadily during the follow-up period, with a sharper gradient 6 months before death. During the last 3 months, half of the population resided in an institutional care setting. With regard to

in-patient care, about 10–15% had been admitted to hospital except for in the last 9 months, when the proportion cared for in hospital increased dramatically to 50%. In the last 3 months before death, half of the study population had been admitted to hospital for at least 1 day (Fig. 2).

The point prevalence of care utilisation in Sweden (Fig. 1) demonstrates that the greater number of the oldest old receive home help and institutional care, not in-patient care. There is only a minor increase in the proportion of older people admitted to hospital as their age increases, and the proportion of admissions actually decreases for the highest ages. When comparing cross-sectional data in Fig. 1 with results from this study presented by time preceding death, Fig. 2, a different picture emerges. The sharp increase in the proportion treated in hospital in the last 9 months before death indicates that hospital care was strongly correlated to proximity to death, and not to age. Utilisation of home help, on the other hand, was fairly stable when it was related to time to death. Thus, home help seemed to be determined by general frailty in advanced age rather than proximity to death. Regarding institutional care, the steady increase may be attributed to increasing age, as well as time to death.

To sort out the effect of age on care utilisation from the effect of time to death, they were included simultaneously as independent variables in logistic regression analyses performed separately for each type of care (Table 3). Regarding *home help services*, increasing chronological age raised the likelihood, measured as odds, of receiving care by 6% per year ($OR = 1.06$), whereas time to death lowered the odds by 1% ($OR = 0.99$) for each year approaching death. As regards *institutional care*, both chronological age and time to death increased the likelihood of receiving care. The effect of time to death ($OR = 1.10$) was about double the effect of age ($OR = 1.05$). When it came to *hospital care*, the analysis confirmed that proximity to death was the major reason for in-patient care in the last 9 months before death; the odds increased by 75% per ($OR = 1.75$) calculated on a yearly basis. Over a 5-year period both age and proximity to death influenced the likelihood of staying in hospital, but in different ways. Increasing chronological age decreased the odds of being cared for in hospital by 4% ($OR = 0.96$) per year, whereas the odds of staying in hospital increased by 2% ($OR = 1.02$) for each year approaching death. Taking the whole 5-year period into account, the odds of being in hospital increased by 65% ($OR = 1.65; 1.02^5 \times 1.75^{0.75}$).

Figure 2 shows an increase in the proportion residing in institutional care facilities and admitted to hospital in the last months of life. This could either be due to an increased proportion of the whole study population using elder care or hospital care, or to longer periods of care among those who were already care recipients. In order to test the two

differing explanations, non-users were excluded from the analyses. Figure 3 shows the average number of days with care among users of each type of care, per 3-month period prior to death. It reveals that the numbers of days among care recipients were stable in the last months of life. The sharp gradients in hospital care and institutional care shown in Fig. 2 were thus explained by an increasing proportion using institutional care or treated in hospital in the last period of life and not by length of stay among care recipients. Figure 3 also highlights that the number of days of elder care was approximately ten times the number of days in hospital care, as there was no overlap between days with home help services and days in institutional care facilities.

Discussion

In the last years prior to death almost no-one died without having received elder care either in their own homes or at an institutional care facility, or without having been admitted to hospital. The different kinds of care utilisation did not, however, follow a set pattern.

About one-third of the participants received home help services over a 5-year period before death. The stable proportion indicated that use of home help was not influenced by proximity to death, and the regression analysis confirmed that increasing chronological age raised the likelihood of using home help by 6% per year. Previous studies of this study population have shown that needs-related factors such as limitations in activities of daily living or dementia were the main determinants of home help utilisation, both at a certain point in time (Larsson et al. 2004) and over a longer time period (Larsson et al. 2006). The stable percentage of home help recipients may thus be explained by the onset of general frailty in advanced age, and an associated long-standing need for assistance with household chores and personal care in order to ‘age in place’. However, the proportion of home help recipients in the community depends on ‘in-flow’ of new eligible recipients and ‘out-flow’ of people with burdensome care needs, those moving from their own homes into institutional care facilities. Almost no one in this study population moved to institutions without having previously received home help at some point in the last few years (Larsson et al. 2006), thereby confirming that such transitions are common. The small drop in the proportion of the population receiving home help in the last year of life can thus be explained by increased transition from home- and community-based care to institutional care at the end of life, and the regression analysis revealed a small negative effect of time to death.

The percentage of older individuals in institutional care increased steadily, with a steeper gradient the last 6 months

before death. We found that institutionalisation was explained by proximity to death, and to a lesser extent also by chronological age. This agrees with findings from the United States that nursing home expenditures increase with both age and closeness to death (Yang et al. 2003). Similar results are reported from Switzerland regarding long-term care (Werblow et al. 2007).

The proportion cared for in hospital increased dramatically towards the end of life and the regression analysis showed that time to death increased the odds of hospital admission by 75% in the last 9 months prior to death. This confirms previous research showing that approaching death, rather than chronological age, is the major determinant of health care utilisation in Sweden like in other western countries.

Whether or not the Swedish results regarding changes in care utilisation in the last years of life can be assumed for other countries is a matter for discussion, given differences in coverage rates and ways of organising long-term care. The proportion of older Swedes in institutional care settings is comparable to that of many European countries, but place of death may differ depending on the extent to which health care can be provided in institutional care facilities. Still, a common feature in many countries seems to be an inverse association between the probability of in-hospital death and age. Among older people, the likelihood of dying in hospital decreases with increasing age, and the likelihood of dying in an institutional care facility increases, as is evident in Belgium (van Rensbergen et al. 2006), Wales (Ahmad and O'Mahony 2005), and Sweden (Jakobsson et al. 2006). This is in line with results from the present study of the oldest old. Even though hospital care utilisation was driven mainly by time to death, a negative correlation between age and hospital care was found as well.

A number of nations have taken steps to make more intensive domestic care available as an alternative to institutionalisation. Both Sweden and the United Kingdom have developed a more targeted approach to public home care involving more hours of care provided, but to fewer, more disabled people (OECD 2005). Denmark, on the other hand, has comparatively high coverage levels of home help but lower service intensity per recipient compared to Sweden (Szebehely 2003). A German study concludes that the increased female labour force participation and decreased proportion of older people living with their children will decrease the opportunity for older people to receive care from family members. This will lead to a dramatic rise in the need for professional home care and long-term care, but only a moderate increase in the need for inpatient care (Schulz et al. 2004). Results from the present study confirm that the percentage using elder care in advanced age is many times greater than the percentage

admitted to hospital, and that the number of days spent in institutional care facilities is five times the number of days spent in hospital.

This study has some limitations. The study population was recruited from an urban area and over-represented unmarried women, a group for which cohabiting caregivers were absent. In spite of this, the proportion of the study population using home help services and residing in institutional care facilities were similar to the nation as a whole. A second limitation is that data on home help services were restricted to information regarding whether or not the participants used municipal home help services, and we lacked knowledge about the number of hours of help received per month and the frequency of visits. Thus, it was not possible to study intensity of in-home care in relation to remaining length of life. Nor was there any information on occurrence of home-based healthcare interventions provided by the county council's primary care. A third limitation is that we only had data on elder care utilisation from the register held by Stockholm municipality and that no information was available for those who moved away from Stockholm. But given that people in advanced age in Sweden seldom move longer distances (Fransson 2004), and that it is uncommon for older people to move in with their children in the last years of their lives (Larsson 2007), we consider this limitation of data of little consequence. A fourth limitation is that data were collected over a 10-year period. As shown in Table 1, this resulted in increasing age at death in the study population. But as care utilisation was analysed in relation to time to death, irrespective of when the death occurred, the mean and median age were increased only marginally, 1–2 years, by the length of the study period. The long data-collection period could also entail that the results were affected by societal changes. In many European countries increasing female labour force participation may have influenced the opportunity to receive family care and thereby increased the demand for formal care. But this was not the case in Sweden where the proportion of women in employment (aged 16–64) was 71% in 1995 and 72% in 2004 (Statistics Sweden 2007). Cut-backs in public spending were carried out in the 1990s and the proportion of older people residing in institutional care facilities dropped between 1995 and 2004. However, these reductions concerned mostly younger elders and people with lesser care needs. Running the analyses with only the 226 participants who died in 2000–2004 gives the same results, but with more random variations.

Despite these limitations, the study has several strengths. Firstly, information on in-patient care and elder care utilisation was based on registered data. The Swedish Hospital Discharge Register uses the Swedish personal

identification number that makes it possible to follow a patient between different hospitals and over time. Use of home help and residence in institutional care facilities was based on registered data from the city of Stockholm. These data may be deemed reliable since the register is the basis for user fees, something that the municipality has an interest in collecting and seniors have an interest in to ensure they are only paying for services rendered. Both registers use the same personal identification number, facilitating the match of different kinds of care utilisation to the individual. Secondly, the data was collated from a longitudinal population-based study where the base-line interviews had already been conducted between 1987 and 1989. The design of the Kungsholmen study allowed people who had agreed to interviews with relatives at base-line to remain in the study by means of proxy interviews, even though they developed dementia or other long-standing illnesses, thereby reducing the dropout rate among people with extensive care needs. As information from hospital records and documents from the public elder care is classified, it is only possible to have access to this information and merge it for a particular individual within the scope of a research project where the participants have given their consent.

In conclusion, the results of the current study showed that among the oldest old almost everyone used formal care services at the end of their lives, either in-home support, institutional care or were admitted to hospital on some occasion in the last 5 years of their life. The number of days of elder care outnumbered the number of days in hospital by ten to one. Increasing chronological age was important for receipt of home help, whereas time to death was important for admission to hospital; there was a sharp increase in the proportion treated in hospital in the last 9 months before death. The proportion residing in institutional care facilities with around-the-clock care increased steadily with a sharper gradient 6 months before death. Both age and time to death had an effect on use of institutional care, but time to death had twice the effect of increasing age. The increasing proportion in institutional care facilities and admitted to hospital in the last months of life was not due to longer care periods, but to a larger proportion of older people receiving care. This study showed that age and time to death have different effects depending on the type of care studied, and individual-based longitudinal data gives a very different picture of care utilisation among the oldest old compared to cross-sectional data.

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