in itself, and the criteria for selecting patients under normal circumstances should include a period of abstinence of at least six months in addition to an assessment of alcohol dependence. With the availability of organs likely to become an increasingly limiting factor as the number of liver transplant operations performed increases, such a policy would also be more likely to be acceptable to the general public and to the families granting permission for organ donation.

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Hospital care for the elderly in the final year of life: a population based study

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Abstract

***Objectives*—To determine whether among people aged 65 and over those who died at advanced old age spent more of their last year of life in hospital than those who died younger, and whether the increase in longevity in the elderly between 1976 and 1985 was accompanied by increased time spent in hospital in the last year of life.**

***Design*—Linkage of death records to abstracts of records of hospital inpatient care in the preceding year of patients' lives.**

***Setting*—Six health districts in England covered by the Oxford record linkage study.**

***Results*—People who died at advanced ages (85 and over) were less likely than people who died at younger ages (65-84) to have been admitted to hospital in the last year of life. Once admitted the very old tended to spend longer in hospital than others. The mean total time spent in hospital by the elderly in the year before death (based on all deaths including those among people not admitted at all) showed no appreciable change over time. The median time in hospital based on all deaths increased by about three days between 1976 and 1985. During that time there was a gain in life expectancy in the population of about one year from the age of 65.**

***Conclusion*—The gain in life expectancy in this population was not at the expense of any substantial increase in time spent in hospital in the final year of life.**

Introduction

Life expectancy after the age of 65 continues to increase. In England and Wales between 1975 and 1985 it increased from 12·4 to 13·4 years for men and from 16·4 to 17·5 years for women.[1] It has been suggested that such extra years of life gained by the elderly may represent increased duration of disability and dependency rather than longer active life.[2-5] This has been termed the "failures of success."[4] By contrast, Fries suggested that as longevity increases there may also be postponement of the onset of disability.[6] This possibility of "compression of morbidity"[6] carries the implication that with increases in longevity the need for medical care for the elderly at a given age may actually decrease.

This study was undertaken to estimate the extent to which elderly people spent time in hospital in the year before death. Its main purpose was to determine the extent to which increases in life span were accompanied by increased time in hospital in the final year of life. Time spent in hospital by the elderly is influenced not only by levels of ill health but also by such factors as family and social support, medical policies in respect of admission and duration of stay, the availability of hospital facilities, and the availability of alternative forms of residential care. Whatever the reasons for hospital care in any particular case we have assumed that in general elderly people prefer to be well enough and supported enough such that they do not spend long periods in hospital.

Methods

Data from the Oxford record linkage study were used. This is a series of brief abstracts of hospital records and death records collected such that it is possible to link together successive records relating to the same person. Data collection for the Oxford record linkage study began in 1963 in part of Oxfordshire, and coverage expanded over the years to include six districts of the Oxford region from 1975 (population 1·9 million).

Our analysis included records of all residents of the six districts who died over the age of 64 between 1976 and 1985. Their death records were identified and the general hospital files searched for all episodes of hospital care experienced by these people in the 365 days before death. All episodes of inpatient care in general hospitals were included; data on psychiatric care were not included. Data on residential and nursing homes were not available. The lengths of stay in all episodes of hospital care were linked together and summed to give total days in hospital in the final year of life.

The percentage of the study population who had been admitted to hospital at least once in the year before death was calculated. Total days in hospital were calculated, firstly, as means and medians based on all people who were admitted to hospital in the last year of life and, secondly, as means and medians based on the total population aged over 64 who were within a year of death and who were resident within the area covered by the study. Mean and median values were calculated because of the highly skewed distributions of times spent in hospital. The analyses were repeated excluding hospital admissions in the last week of life to identify the separate influence of such terminal care. Statistical significance of the trends over time was calculated by χ^2 test for trend in analysing admission rates and linear regression for analysis of trends in mean and median lengths of stay.

Results

ADMISSIONS IN YEAR BEFORE DEATH

Death records were identified for 141 817 people aged 65 and over. The proportion of elderly people

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TABLE I—*Numbers (percentages) of elderly people in various age groups who died in hospital in 1976, 1980, and 1985*

	Age group (years)						
	65-69	70-74	75-79	80-84	85-89	≥90	χ^2†
1976	1088/2082 (52·3)	1487/2759 (53·9)	1629/2864 (56·9)	1565/2808 (55·8)	1072/2128 (50·4)	643/1448 (44·4)	75·8***
1980	1060/1995 (53·1)	1398/2619 (53·4)	1675/3036 (55·2)	1519/2809 (54·1)	1120/2110 (53·1)	640/1416 (45·2)	41·8***
1985	884/1702 (51·9)	1517/2745 (55·3)	1935/3340 (57·9)	2021/3402 (59·4)	1227/2321 (52·9)	764/1677 (45·6)	109·5***

***p<0·001. †χ^2 For heterogeneity (df = 1) comparing age groups within each year.

TABLE II—*Days spent in hospital in final year of life among elderly people who died in 1985. Figures are numbers (percentages) of people in each age group*

Days in hospital	65-74	75-84	≥85
Not admitted	1303 (29·3)	1925 (28·5)	1467 (36·7)
<7	866 (19·5)	1197 (17·7)	500 (12·5)
7-13	597 (13·4)	819 (12·1)	364 (9·1)
14-27	725 (16·3)	1026 (15·2)	510 (12·8)
28-89	778 (17·5)	1261 (18·7)	742 (18·6)
90-179	117 (2·6)	279 (4·1)	182 (4·5)
180-364	41 (0·9)	125 (1·8)	99 (2·5)
≥365	20 (0·4)	110 (1·6)	134 (3·3)
Total	4447 (99·9)	6742 (99·7)	3998 (100·0)

TABLE III—*Mean and median numbers of days spent in hospital in final year of life among elderly people admitted at least once, by age group*

Year death	Mean No of days			Median No of days		
	65-74	75-84	≥85	65-74	75-84	≥85
1976	33	46	63	17	20	25
1977	36	48	65	18	20	27
1978	33	49	69	16	19	26
1979	29	46	67	16	18	25
1980	33	45	66	16	20	25
1981	29	46	63	15	20	26
1982	30	45	66	15	19	25
1983	31	45	66	15	19	25
1984	31	42	61	16	20	25
1985	29	42	59	15	18	24
Slope of fitted regression line of mean or median on year (*t* test)	3·56**	−3·80**	−1·91	−3·27*	−1·00	−2·13

*p<0·05. **p<0·01.

TABLE IV—*Mean and median numbers of days spent in hospital among all elderly people who died, by age group*

Year of death	Mean No of days			Median No of days		
	65-74	75-84	≥85	65-74	75-84	≥85
1976	22	29	34	5	5	1
1977	24	31	38	6	6	4
1978	22	32	39	6	6	3
1979	22	30	39	5	5	4
1980	23	30	40	6	6	4
1981	20	32	40	6	8	7
1982	21	31	43	6	8	6
1983	22	31	43	7	8	7
1984	22	30	39	7	9	8
1985	21	30	37	7	8	7
Slope of fitted regression line of mean or median on year (*t* test)	−1·93	−0·09	1·71	4·06**	5·08**	6·28***

**p<0·01. ***p<0·001.

who died in hospital was significantly associated with age, increasing to a maximum at about 80 years and declining thereafter (table I). The proportion of people who died in hospital showed a small but significant increase over time among those aged 75 or over at the time of death (table I). The proportion of people who had at least one admission in the year before death increased significantly over time in all age groups ($p<0·01$) and was on average 8% lower in people aged 85 and over than in people aged 65-74 (figure). To take account of the effect of hospital admissions among people whose only admission was in the terminal days of life we also calculated the proportion of people admitted to hospital excluding those who were admitted only in the last seven days of life. The same pattern was evident as in the figure. People who died at advanced old age were less likely to have been admitted to hospital in the weeks preceding their final week of life than people who died at less advanced age. Admissions solely in the last week of life accounted for about 10% of all admissions, and this was consistent over time and across age groups.

TIME SPENT IN HOSPITAL

Table II gives the frequency distribution of total days in hospital in the last year of life of people who died in 1985. Most people spent less than two weeks in hospital. Evidently the very old were less likely to be admitted to hospital than others, but once admitted they tended to stay longer.

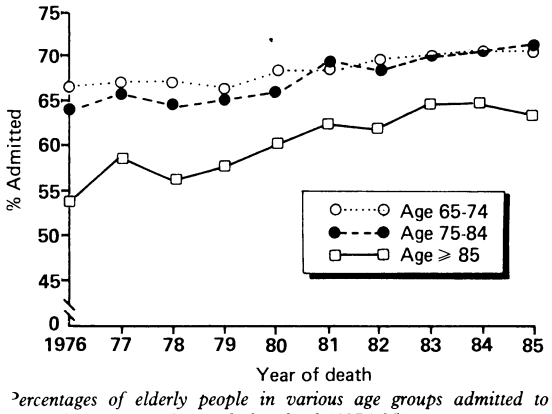
Although the proportion of people admitted increased between 1976 and 1985 (figure), the length of time spent in hospital by those admitted declined during the period (table III). Overall, when all deaths were considered—that is, including those of people not admitted at all—there was no significant change between 1976 and 1985 in the mean time spent in hospital by the elderly in the year before death (table IV). The median time spent in hospital showed increases over this time which were significant but not substantial (table IV).

LONG STAY PATIENTS

Table V shows the proportions of people in each age group of the resident population who died who spent 30 days or more, 90 days or more, and all of their final year of life in hospital in 1976, 1980, and 1984. The proportion of people in these long stay categories rose significantly with age within each time period ($p<0·01$) but did not change significantly or consistently over time.

Discussion

Several factors need to be considered when interpreting these results. Migration into the study area shortly before death may have reduced the recorded time spent in hospital. Such people would have had less time to be admitted to hospital in the study area during the full year before death. Census and family practitioner committee data suggest that the elderly are the



Percentages of elderly people in various age groups admitted to hospital at least once in year before death (1976-85)

TABLE V—*Numbers (percentages) of elderly people in the various age groups who died in 1976, 1980, and 1984 and who spent 30 days or more, 90 days or more, or all of their final year of life in hospital*

Age group (years)	≥30 Days			≥90 Days			≥1 Year		
	1976	1980	1984	1976	1980	1984	1976	1980	1984
65-69	433/2036 (21·3)	404/1984 (20·4)	322/1531 (21·0)	79/2036 (3·9)	100/1984 (5·0)	61/1531 (4·0)	5/2036 (0·2)	8/1984 (0·4)	6/1531 (0·4)
70-74	587/2675 (21·9)	574/2615 (21·9)	597/2653 (22·5)	155/2675 (5·8)	142/2615 (5·4)	124/2653 (4·7)	24/2675 (0·9)	27/2615 (1·0)	19/2653 (0·7)
75-79	697/2759 (25·3)	755/3016 (25·0)	783/3008 (26·0)	195/2759 (7·1)	211/3016 (7·0)	214/3008 (7·1)	27/2759 (1·0)	37/3016 (1·2)	32/3008 (1·1)
80-84	667/2640 (25·3)	713/2789 (25·6)	794/2875 (27·6)	261/2642 (9·9)	255/2789 (9·1)	254/2875 (8·8)	45/2640 (1·7)	54/2789 (1·9)	56/2875 (1·9)
85-89	487/2022 (24·1)	566/2082 (27·2)	610/2008 (30·4)	191/2022 (9·4)	225/2082 (10·8)	228/2008 (11·3)	44/2022 (2·2)	65/2082 (3·1)	59/2008 (2·9)
≥90	337/1389 (24·3)	382/1403 (27·2)	394/1478 (26·7)	161/1389 (11·6)	188/1403 (13·4)	174/1478 (11·8)	64/1389 (4·6)	65/1403 (4·6)	66/1478 (4·5)

least mobile of all age groups. Inward migration of people aged 60 and over to the counties covered by the Oxford region was only 2% in 1985.[7] Nevertheless, conceivably the terminally ill have different migration patterns, possibly including moving to live with relatives.

The Oxford record linkage study collects data only from NHS hospitals. Data on other facilities used in the care of the elderly were not available. The recent increase in numbers of residential and nursing homes for the elderly may have taken some of the role of residential care from NHS hospitals, and our findings should be interpreted in the light of this.

The proportion of the population admitted to hospital in the year preceding death increased over time in all age groups. The increase was consistent with the general increase in admission rates reported elsewhere.[8] The finding that advanced age at death was associated with lower rates of prior hospital admission was unexpected but there are several possible explanations. Firstly, doctors may be unwilling to admit very old people to hospital because medical and surgical intervention may be considered inappropriate. Secondly, as noted above, the very elderly may already be in residential care other than hospital. For example, we estimate that 11% of people who died at age 90 and over in 1985 in our study were resident in part III accommodation before hospital admission compared with 0·4% of the 65-69 year age group. The very elderly may therefore not have been in need of hospital admission solely for residential or nursing care. Thirdly, people who live to a very old age may be basically healthy until shortly before death.

The increase over time in admission rates was, in general, counterbalanced by a decline in the total time spent in hospital by those admitted. Mean total days in hospital based on all deaths in the population did not increase over time, and the median total days in hospital increased by only about three days between 1976 and 1985. The proportion of people who spent 30 days or more in hospital did not change appreciably.

Stout and Crawford in Belfast found that duration of terminal dependency among long stay geriatric patients had increased.[9] Our study design contrasts with theirs in important respects. The Belfast study was confined to patients with lengths of stay of 90 days or longer; in our study these made up only about 4% of people aged 65-74 and 10% of people aged 85 and over. Our study relates lengths of hospital care to a total, defined population of the elderly who died, including those with short as well as long stays and including those who died without admission to hospital at all. In conclusion, our population based findings show that the gain in life expectancy between 1976 and 1985 was not at the expense of any substantial increase in time spent in hospital in the year before death.

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Hyperosmolality related to propylene glycol in an infant treated with enoximone infusion

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We report on an infant with heart failure in whom a potentially dangerous accumulation of propylene glycol occurred during enoximone infusion.

Case report

A 3·4 kg male infant could not be weaned from ventilatory support after open heart surgery for an atrioventricular septal defect, despite reoperation for a residual defect. His cardiac output remained unsatisfactory even with inotropic support from dopamine and dobutamine, after reduction of afterload with intravenous glyceryl trinitrate and captopril, restriction of fluids, and diuretics. Enoximone infusion (20 μg/kg/min) was begun on the 28th postoperative day. His serum osmolality, measured daily because of the diuretic treatment, rose from 304 mmol/kg before the start of the infusion to 385 mmol/kg by the fourth day of treatment. There was no corresponding rise in serum electrolyte or glucose concentrations. Urea and creatinine concentrations were 12·6 mmol/l and 43 μmol/l respectively.

The fluid restriction was eased until it became clear that the rise in osmolality was due not to dehydration but to the presence of additional dissolved material. A review of his drug treatment indicated that propylene glycol was the probable cause as it is a constituent of both glyceryl trinitrate and enoximone infusions. At the rates administered enoximone accounted for most of the propylene glycol infused (2·4 mg/kg/min compared with 0·3 mg/kg/min from the glyceryl trinitrate infusion). When enoximone was stopped the osmolality decreased to normal values over the next four