ABSTRACT

Background
Deaths are rising fastest among the oldest old but data on their transitions in place of care at the end of life are scarce.

Aim
To examine the place of residence or care of ≥85 year-olds less than a year before death, and their place of death, and to map individual changes between the two.

Design of study
Population-based cohort study.

Setting
Cambridge City over-75s Cohort (CC75C) study, UK.

Method
Retrospective analysis of prospective data from males and females aged ≥85 years at death who died within a year of taking part in any CC75C survey (n = 320); death certificate linkage.

Results
Only 7% changed their address in their last year of life, yet 52% died somewhere other than their usual address at the time of death. Over two-thirds were living in the community when interviewed <1 year before death, but less than one-third who had lived at home died there (less than one-fifth in sheltered housing). Care homes were the usual address of most people dying there (77% in residential homes, 87% in nursing homes) but 15% of deaths in acute hospital came from care homes.

Conclusion
More than half the study sample of individuals of advanced old age had a change in their place of residence or care in their last year of life. These findings add weight to calls for improved end-of-life care in all settings, regardless of age, to avoid unnecessary transfers. The study data provide a baseline that can help plan and monitor initiatives to promote choice in location of care at the end of life for the very old.

Keywords
aged; aged 80 or over; aging in place; frail elderly; terminal care.

INTRODUCTION

End-of-life care for older people is now an acknowledged priority.1 Recent UK policy initiatives and reports recognise the increasing number of people who will be dying in very old age.2–4 Emphasis on a care pathway approach highlights the importance of the place of care, place of death, and transitions between them.3–6 The NHS End of Life Care Programme’s aims include reducing emergency admissions and transfers from care homes to hospital in the last week of life, alongside providing the support needed to enable people to die where they choose.7 The policy drive to facilitate ‘good deaths’ at home envisages savings on costly acute care, enhancing value for money at the same time as choice, quality, and equality.3,6,11

In many developed countries, deaths, including in-hospital deaths, are rising fastest among ≥85-year-olds,1,12,13 Data are scarce on older people’s place of care trajectories before death,14 particularly for the very old, but are important for planning and monitoring improvements. This study’s objective was
to provide new understanding by examining survey records and death certificates from individuals aged ≥85 years, interviewed less than a year before death in a longitudinal population-based study.

METHOD
The Cambridge City over-75s Cohort (CC75C) study is a population-based sample representative of Cambridge’s older people that began in 1985–1987. The study methodology has been described in detail elsewhere. Briefly, the baseline survey enrolled 9% of individuals aged ≥75 years, approached from six general practices. Participants were followed up with surveys repeated every few years (92% of extreme old age shortly before death. Figure 1 depicts the sampling frame, and Figure 2 depicts the construction of a subsample of ‘oldest old’ people in their last year of life for this analysis: \( n = 320 \) males and females who died aged ≥85 years within a year of participating in any of CC75C’s seven surveys (1985–2007).

A combination of data sources was used to identify changes in place of residence between final interview and death; the information available may not have included all transitions in this period. Interview data on ‘type of accommodation’ were cross-checked with administrative databases. ‘Usual address’ and ‘place of death’ details were retrieved from death certificates. All three loci were coded into categories reflecting changes since the 1980s (Box 1). In the UK, although a doctor must record causes of death, other death certificate details, such as the usual address, are usually provided by the relative registering the death.

All analyses were performed in Stata 9.2 (data version 2.2).

RESULTS
Study sample
A total of 321 people participated in surveys less than a year before they died aged at least 85 years, comprising 80% of participants still alive at survey (median time of last interview before death = 28 weeks, interquartile range = 16–41 weeks). Death certificate residence data were available for all but one participant (analysis sample \( n = 320 \)). Death certificate residence data were available for all but one participant (analysis sample \( n = 320 \)). Table 1 outlines their sociodemographic characteristics. Half these ‘oldest old’ participants were aged 85–89 years, and half were aged at least 90 years at death. Overall, two-thirds were female (male:female ratio 2:3 in the 85–89 years age-band, 1:4 in the older group). There were no demographic differences between those who were or were not interviewed in their last year of life.

How this fits in
Numbers of deaths are rising fastest in many developed countries among ≥85 year olds. Current policy is to enable people to be cared for until death where they would prefer. However, not only are preferences difficult to assess, but even data on the transitions in place of care of the oldest old at the end of life are scarce. This study found that only 7% of individuals aged ≥85 years in a population-based sample changed their address in their last year of life, yet more than half died somewhere other than their usual address at the time of death. Over two-thirds were living in the community when last interviewed less than 12 months before death, but fewer than one-third who had lived at home died there. Of the individuals who died in acute hospitals, 15% came from care homes, predominantly residential homes. The findings will help planning to implement the End of Life Care Strategy.

Address less than a year before death
Just over two-thirds of participants were community dwelling when last surveyed (Table 1), including 17% in sheltered housing. Excluding these partially supported settings, more males still lived at home than females (70% versus 44%). Twice as many ≥90 year olds were living in care (38%: 27% in residential homes, 9% in nursing homes) as...
85–89 year olds (19%; 16% in residential homes and 3% in nursing homes).

**Usual address at death**

Table 2 details what proportions were subsequently in different accommodation according to death certification — usual address at death and place of death — but these changes are best understood in conjunction with the individual-level data illustrated in Figure 3. By the time of death the percentage living in care homes was virtually unchanged among those in their late 80s, but had risen to 44% of those dying in their 90s or older (from 38% when interviewed), with a further 5% whose ‘usual address’ was a long-stay hospital (Table 2). Living in residential care was twice as common at death for older males than for 85–89 year-old males (18% versus 9%), and higher for females, but the age-band difference was less marked (32% versus 21%). There was a three- to four-fold increase in the need for long-term nursing care by the time of death for both sexes, from just a few per cent aged <90 years whose usual address was a nursing home, compared with 14% of ≥90 year olds (25% including long-stay wards: males 17%, females 24%).

**Place of death**

Just over half the sample died in hospital (10% on long-stay wards, 41% in acute settings). Table 2 shows age and sex differences. Almost half those dying in their late 80s were in acute settings, compared with one-third of the older group; overall 50% of males and 37% of females died in acute hospitals; 7% more died in long-stay hospitals than had these units recorded as their usual address. Only 2% died in hospices.
Transitions before death

Figure 3 represents the movements between different places of residence or care during the last year of life from where participants lived when last interviewed, to where their usual address when they died and where they actually died. The direction of movement is predominantly up the ‘ladder of care’, with only a handful of exceptions: a few transfers

Table 1. Sociodemographic profile of the sample.

<table>
<thead>
<tr>
<th>Age at death, years</th>
<th>Sex</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td>85–89 (n = 160), n (%)</td>
<td>97 (61)</td>
<td>63 (39)</td>
</tr>
<tr>
<td>≥90 (n = 160), n (%)</td>
<td>63 (39)</td>
<td>97 (61)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>School leaving age, years</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤14</td>
<td>160 (50)</td>
</tr>
<tr>
<td>&gt;15</td>
<td>160 (50)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Accommodation when interviewed</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own home</td>
<td>160 (50)</td>
</tr>
<tr>
<td>Sheltered housing</td>
<td>160 (50)</td>
</tr>
<tr>
<td>Residential home</td>
<td>160 (50)</td>
</tr>
<tr>
<td>Nursing home</td>
<td>160 (50)</td>
</tr>
<tr>
<td>Hospital, long-stay</td>
<td>160 (50)</td>
</tr>
</tbody>
</table>

| SD = standard deviation. Marital status was unknown for three people. School-leaving age was unknown for six people. Own home includes living in a house, flat, or granny flat. Significant differences between age-bands and sex groups are highlighted in bold print (P<0.05 Pearson χ²/Fisher’s exact test as appropriate). |

Table 2. Usual address at time of death and place of death by age and sex.

<table>
<thead>
<tr>
<th>Usual address at time of death</th>
<th>85–89 years, n (%)</th>
<th>≥90 years, n (%)</th>
<th>Males, n (%)</th>
<th>Females, n (%)</th>
<th>Total, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own home</td>
<td>49 (72)</td>
<td>47 (51)</td>
<td>96 (60)</td>
<td>20 (59)</td>
<td>45 (36)</td>
</tr>
<tr>
<td>Sheltered housing</td>
<td>10 (15)</td>
<td>20 (22)</td>
<td>30 (19)</td>
<td>3 (9)</td>
<td>14 (11)</td>
</tr>
<tr>
<td>Residential home</td>
<td>6 (9)</td>
<td>19 (21)</td>
<td>25 (16)</td>
<td>6 (18)</td>
<td>40 (32)</td>
</tr>
<tr>
<td>Nursing home</td>
<td>5 (3)</td>
<td>15 (9)</td>
<td>20 (16)</td>
<td>3 (3)</td>
<td>17 (8)</td>
</tr>
<tr>
<td>Hospital</td>
<td>3 (2)</td>
<td>10 (6)</td>
<td>13 (4)</td>
<td>2 (2)</td>
<td>11 (5)</td>
</tr>
<tr>
<td>Total</td>
<td>68 (100)</td>
<td>92 (100)</td>
<td>160 (100)</td>
<td>34 (100)</td>
<td>126 (100)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Place of death</th>
<th>85–89 years, n (%)</th>
<th>≥90 years, n (%)</th>
<th>Males, n (%)</th>
<th>Females, n (%)</th>
<th>Total, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own home</td>
<td>13 (19)</td>
<td>17 (19)</td>
<td>30 (19)</td>
<td>7 (21)</td>
<td>15 (12)</td>
</tr>
<tr>
<td>Sheltered housing</td>
<td>1 (2)</td>
<td>6 (7)</td>
<td>7 (4)</td>
<td>1 (3)</td>
<td>1 (1)</td>
</tr>
<tr>
<td>Residential home</td>
<td>3 (4)</td>
<td>2 (2)</td>
<td>5 (3)</td>
<td>1 (3)</td>
<td>0 (0)</td>
</tr>
<tr>
<td>Nursing home</td>
<td>5 (7)</td>
<td>15 (16)</td>
<td>20 (13)</td>
<td>3 (9)</td>
<td>39 (31)</td>
</tr>
<tr>
<td>Hospital, long-stay</td>
<td>2 (3)</td>
<td>5 (5)</td>
<td>7 (4)</td>
<td>4 (12)</td>
<td>18 (14)</td>
</tr>
<tr>
<td>Hospital, acute</td>
<td>7 (10)</td>
<td>7 (8)</td>
<td>14 (9)</td>
<td>5 (15)</td>
<td>13 (10)</td>
</tr>
<tr>
<td>Total</td>
<td>37 (54)</td>
<td>40 (43)</td>
<td>77 (48)</td>
<td>13 (38)</td>
<td>40 (32)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transitions</th>
<th>85–89 years, n (%)</th>
<th>≥90 years, n (%)</th>
<th>Males, n (%)</th>
<th>Females, n (%)</th>
<th>Total, n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place of death not usual address</td>
<td>44 (68)</td>
<td>51 (55)</td>
<td>97 (61)</td>
<td>18 (53)</td>
<td>51 (41)</td>
</tr>
</tbody>
</table>

*Own home* includes living in a house, flat, or granny flat. Significant differences between age-bands and sex groups are highlighted in bold print (P<0.05 Pearson χ²/Fisher’s exact test as appropriate).
Long-stay hospital deaths included all those usually resident, but also included less permanent patients, presumably more recently admitted. Care homes were the usual address of most people dying there (77% in residential homes, 87% in nursing homes) but 15% of deaths in acute hospital came from (predominantly residential) care homes. Overall, whereas only 7% had a ‘usual address’ recorded on their death certificate that differed from where they lived when interviewed less than a year before, for 52% the registered place of death was not their usual address (see Table 2 and, for details by age-band and sex, Table 3). Individuals in their 90s or 100s were more likely to have died at their usual address than 85–89 year olds, as were females, regardless of age.

Age and time

As the study findings draw on interview data spanning over two decades, a check was carried out to ensure the findings were robust. Table 3 shows the usual address at death by age and sex. From long-stay hospital to care homes and one person who moved from residential care to her son’s home. Compared with death certificate-recorded ‘usual address’, community addresses appear considerably less frequently as the registered ‘place of death’. Only 16% of all deaths were at home: fewer than one-third of the 50% of participants who still lived in their own or a relative’s home died there. People whose usual address at death was in sheltered housing (15%) were even less likely to die there: less than one-fifth. The 19% dying in residential care was only slightly less than the 22% with a residential home as their ‘usual address’. However, as Figure 3 shows, these were not all the same people: 16/71 (23%) people living in residential homes died in acute hospitals and 7/62 (11%) people who died in residential care usually lived at home. Settings that provided nursing care transferred fewer people to other institutions. Similar numbers died in nursing homes as were living there.

Figure 3. Movements between residential or care settings during the last year of life (n = 320 people who died aged ≥85) from their place of residence when interviewed less than a year before death, to their ‘usual address’ registered at death and where they died.

Table 3. Deaths at usual address by age and sex.

<table>
<thead>
<tr>
<th>Place of death</th>
<th>≤85–89 years, n (%)</th>
<th>&gt;90 years, n (%)</th>
<th>Total, n</th>
<th>Total as % of all deaths at the usual address</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own home</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>13</td>
<td>7</td>
<td>20</td>
<td>32</td>
</tr>
<tr>
<td>Females</td>
<td>17</td>
<td>15</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>Males + Females</td>
<td>30</td>
<td>22</td>
<td>52</td>
<td></td>
</tr>
<tr>
<td>Sheltered housing</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Residential home</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Nursing home</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>8</td>
</tr>
<tr>
<td>Hospital, long-stay</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>All deaths where</td>
<td>place of death</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>usual address was usual address</td>
<td>22 (32)</td>
<td>16 (47)</td>
<td>38 (37)</td>
<td>153</td>
</tr>
</tbody>
</table>

* “Own home” includes living in a house, flat, or granny flat. Significant differences between age-bands and sex groups are highlighted in bold print (*P*<0.05 Pearson χ²/Fisher’s exact test as appropriate).
for temporal trends, stratifying by age to avoid confounding. Figure 4 plots proportions for earlier and later study periods of (a) study participants living in different settings at death, and (b) their place of death, showing separately 85–89 year olds and ≥90 year olds. Percentages of community dwellers and home deaths have declined in both age-bands. While it has become slightly more common to live, and die, in sheltered housing before the age of 90 years, this is increasingly uncommon for anyone older. Nursing home residence has risen steeply in both age-bands, as have nursing home deaths but in residential care homes, the number of residents aged ≥90 years has risen only slightly, and deaths of individuals aged ≥90 years have shown no increase. Acute hospitals have remained the location with the highest proportion of deaths across the years for very old people dying before or after 90 years of age.

DISCUSSION

Summary of main findings

This is the first study linking death certificate records with population-based data gathered prospectively from very old people in the last year of life. With CC75C study data for participants who died aged ≥85 years, place of residence less than a year before death was compared with usual address at death and place of death. About two-thirds were living in the community, but of the half who still lived at home, fewer than one-third died at home, and in sheltered housing only one-fifth. Just over half died in hospital: 41% in acute and 10% in long-stay wards. The majority of transfers to both were from the community, with a sizeable minority from residential care. The numbers living and dying in nursing homes appeared more constant than in residential homes, but included different individuals, typifying the tendency for people to move up the ‘ladder of care’. The proportions dying in any long-term-care setting were almost twice as high for ≥90 year olds (51%) as for 85–89 year olds (26%). Conversely, only one-third of the oldest old died in acute hospitals, compared with almost half the younger age-band. Overall, more than half these very old people died somewhere other than their usual address.

Strengths and limitations of the study

A particular strength of the study is the opportunity to examine changes at an individual level, revealing movements between residential categories that are not apparent from group statistics that large national datasets provide. For example, from death certification there was a difference of just 3% between the proportions with a residential home recorded as their usual address and as their place of death, but individual trajectory tracing showed that nearly one-quarter of these residents died elsewhere. The authors’ prospective cohort study provided data from the year before death for a section of the population — predominantly frail individuals in advanced old age — which is now difficult to access due to current research ethics and governance regulatory procedures that are intended to protect vulnerable people. Individually linking anonymised study and death certificate data offered a unique additional perspective to public records, meriting examination as there is scant information on which to base urgently needed planning for the rising numbers of deaths in very old age.

CC75C is one of the longest running studies of the very old, with inevitable contemporary contextual changes and study design issues. Approaches to these challenges include consistency in accommodation classification (Box 1), age-band stratification to clarify cohort effects (Figure 4), and comparison with national trends. Although the present study attempted to identify all address changes through administrative databases, the study design did not include tracking all transitions between surveys and death, so some may have been missed. Likewise, no data are available on significant changes after interview that could affect transitions; for example, health or marital status. Moreover, given that the interval from last interview to death ranged from less than a week to almost a year, the study findings do not describe the full final year of life and so most likely underestimate transitions.

Death certificates, despite acknowledged limitations, are a valuable tool for examining place of death, but ‘usual address’ data are less frequently used and, to the authors’ knowledge, less validated. In the study sample, study personnel were familiar with circumstances of the recently deceased, so noticed inconsistencies, for example a former private address was given by the next-of-kin as the usual residence despite the participant’s permanent move into care. These moves are complex, so such perceptions are perhaps not uncommon. Similar misclassifications are unquantifiable but the effect would again mean the study findings may underestimate transitions.

Comparison with existing literature

Comparisons with national mortality statistics suggest that CC75C’s low proportions of home deaths and negligible hospice deaths are in line with nationwide trends. Care home residence in CC75C has risen more sharply than national trends in long-term-care availability, and the proportions of residential care and nursing home deaths are both higher and increasing more than national rates. There is growing evidence that, just as home deaths are
Although both nursing and residential care homes have become more common places of residence for the oldest old at the end of life over the last 2 decades and more since the CC75 study began, only nursing homes have become a more common place of death. The majority of ≥90 year olds and the vast majority of 85–89 year olds in the study continued to die in hospital.

Figure 4. Study participants’ usual address at time of death and place of death by age-band.
Some older people prefer to die in supported settings rather than at home, where they may fear either being alone or becoming a ‘burden’. Sadly, many care homes lack the staffing levels, awareness, or expertise to provide the support that dying older people deserve: over 60% of residents in a US residential homes study were alone when they died. Initiatives to improve end-of-life care in care homes need to be extended, but likewise general hospital acute care must address the needs of the rising numbers of very old people dying in hospital. The current study’s findings provide important data to help inform the planning necessary to implement the UK’s new End of Life Care Strategy.

Funding body
We thank all the past CC75C sponsors for financial support spanning two decades (http://www.cc75c.group.cam.ac.uk/pages/grant/default.htm for full list of project grants) and the BUPA Foundation for current support under their Health and Care of Older People grant. The funders had no role in the study design, analysis, or writing this paper. CC75C is a member study of the Cambridgeshire and Peterborough Collaboration for Leadership in Applied Health Research & Care (CLAHRC).

Ethics committee
Each CC75C study phase was approved by Cambridge Research Ethics Committee (current reference numbers: 09/Q0108/308 and 08/H0308/3).

Competing interests
The authors have stated that there are none.

Acknowledgements
The authors wish to thank particularly the CC75C study responders, their families, friends, and the staff in many care homes and collaborating general practices without whose help none of this research would be possible. The current homes and collaborating general practices without whose collaboration for Leadership in Applied Health Research & Care (CLAHRC).

REFERENCES
31. Addington-Hall JM, Karlsten S. Age is not the crucial factor in determining how the palliative care needs of people who die from cancer differ from those of people who die from other causes. J Palliat Care 1999; 15(4): 13–19.
34. Scottish Partnership for Palliative Care. Making good care better:


