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ORIGINAL ARTICLE

Where do people die? An international comparison of the percentage of deaths occurring in hospital and residential aged care settings in 45 populations, using published and available statistics

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Abstract
Objective Place of death, specifically the percentage who die in hospital or residential aged care, is largely unreported. This paper presents a cross-national comparison of location of death information from published reports and available data.
Methods Reports of deaths occurring in hospitals, residential aged care facilities, and other locations for periods since 2001 were compiled.
Results Over 16 million deaths are reported in 45 populations. Half reported 54 % or more of all deaths occurred in hospitals, ranging from Japan (78 %) to China (20 %). Of 21 populations reporting deaths of older people, a median of 18 % died in residential aged care, with percentages doubling with each 10-year increase in age, and 40 % higher among women.
Conclusions This place of death study includes more populations than any other known. In many populations, residential aged care was an important site of death for older people, indicating the need to optimise models of end-of-life care in this setting. For many countries, more standardised reporting of place of death would inform policies and planning of services to support end-of-life care.

Keywords Location of death · End-of-life care · Health services for the aged · Cross-national research · Palliative care · Service utilisation · Epidemiology · Health services research

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Introduction

Improving care at the end-of-life has been identified as a global public health priority by the World Health Organisation (Davies and Higginson 2004) and the United Nations General Assembly (Grover 2011). Addressing the complex palliative and end-of-life care needs of growing older populations is a particular concern (Hall et al. 2011). Planning future services to address these needs requires consideration of how end-of-life care can be made more widely available and integrated across health and social care systems. Central to this process must be an understanding of where deaths occur and therefore where efforts to optimise end-of-life care provision should be directed. Informed decision-making relating to provision of care for older people nearing the end of their lives could be assisted by comparing and contrasting care systems around the world (Higginson 2005).

To date, research relating to location of death is most often considered in the context of palliative care for those with neoplastic conditions. "Ageing in place" policies draw attention to care of older disabled people as they approach end-of-life. This is particularly so in high-income

countries where population ageing has led to greater numbers living, and therefore dying, in institutional care. Little has been reported about place of death for whole populations or for less developed countries, though an urgent need for data to underpin palliative care development has been identified (Davies and Higginson 2004).

The largest international comparison of location of death for whole populations is for six European countries (Cohen et al. 2008). In this paper, we extend current knowledge and understanding by addressing the question of place of death regardless of cause of death. We emphasise use of residential aged care (RAC) where large numbers of older people in many countries now live, in order to receive social, personal, nursing and/or medical help for extended periods. The purposes are several. First, to make cross-population comparisons of the percentages of deaths occurring in hospitals, in RAC and elsewhere, so that countries may compare and contrast their data with those of other countries to inform service planning for future needs. Second, to consider how patterns in place of death vary by gender and age group. Third, to assess availability and comparability of reports for populations and consider a more consistent approach to data collection.

Methods

Searches were made of MedLine, PubMed and Web of Science using the terms "population" and either "place of death" or "location of death". Reports and databases using these terms were sought using Google. National websites for official statistics were also used to identify sources of population-level information about place of death, either in pre-prepared reports or available to summarise online. Finally, direct requests were made to offices of national health or demographic statistics.

We selected national or sub-national reports of place of death representing deaths since 2000 in large geographically defined populations and reporting 3,000 or more deaths. Reports including particular sub-groups only, e.g. those with a particular cause of death, were disregarded. Reports were included if they covered all deaths or were deemed to cover almost all deaths, e.g. if omitting deaths under the age of 1 year or traumatic deaths. We aimed to make three mutually exclusive classifications of place of death: deaths occurring in "Hospitals", "RAC facilities", and "Other" which includes deaths in private homes and if specified separately, those in public places (roads, workplaces, prisons, hospices). Reports for all deaths that differentiated at least between hospital and other (or home) deaths were included in total population analyses. For analyses of those aged over 65 years, reports were included only if they specified RAC data.

In many populations, more than 1 year of data were available. Where two or more sequential years of data were available in a single source, and no trends evident, data for all years were used. However, where trends were evident, only more recent year(s) were selected. Where multiple years were used, annual means were calculated to obtain more stable estimates.

Medians, upper and lower quartiles of percentages of deaths in each category are reported for all deaths, for those aged over 65 years, and by age group and gender where possible. Simple female:male risk ratios within age groups were used to compare percentages in those aged over 65 years. Ethical approval was not required due to the summary nature of the data.

Results

Search results

In all, 45 reports of place of death meeting our criteria were obtained for 36 nations from 2001 to 2010: Albania (INSTAT (Instituti I Statisitkave) 2010), Australia (ABS (Australian Bureau of Statistics) 2010; AIHW (Australian Institute of Health and Welfare) 2009, 2011), Austria (Q: Statistick Austria 2011), Belgium (Cohen et al. 2006, 2008; Houttekier et al. 2010), Botswana (Lazenby et al. 2010), Brazil (IBGE (Brazilian Institute of Geography and Statistics) 2010), Canada (Menec et al. 2007; Motiwala et al. 2006; Wilson et al. 2009), Chile (DEIS, Ministry of Health 2011), China (Chen 2008), Croatia (Croatian National Institute of Public Health 2011), Cyprus (Cyprus Ministry of Health 2011), Czech Republic (Czech Statistical Office 2011), England (National End-of-Life Care Programme 2010a, b; UK Statistics Authority 2009), Estonia (Ministry of Social Affairs of Estonia 2011), France (INSEE (Institut National de la Statistique et des Études Économiques) 2010, 2011), Iceland (Hagstofa Íslands | Statistics Iceland 2011), Ireland (CSO (Central Statistics Office) 2010), Japan (Hashimoto et al. 2010; National Statistics Center 2010), South Korea (Statistics Korea 2010), Lithuania (Institute of Hygiene, Lithuania 2011), Malta (Department of Health Information and Research, Malta 2011), Netherlands (Cohen et al. 2008), New Zealand (Ministry of Health 2011), Norway (Statistisk sentralbyrå | Statistics Norway 2010), Portugal (Machado et al. 2010), Scotland (Cohen et al. 2008), Serbia (Statistical Office of the Republic of Serbia 2010), Singapore (Beng et al. 2009), Slovenia (Health Data Centre: National Institute of Public Health 2011), South Africa (Statistics South Africa 2005), Spain (Ruiz-Ramos et al. 2011), Sweden (Cohen et al. 2008), Switzerland (Fischer et al. 2004), Taiwan (Taiwan 2008), USA (CDC (Centre for

Disease Control) 2006, 2008) and Wales (Ahmad and O'Mahony 2005; Cohen et al. 2008). A summary of reports and their sources is provided in the Appendix.

Most reports sourced data collected at time of death through routine official death reporting systems. Exceptions included Switzerland where results were based on a survey of physicians in German-speaking regions. For China, data were obtained from a population-based surveillance programme covering 158 counties, and are regarded as a more reliable source of information since death registrations are incomplete (Mathers et al. 2005). Australia and Estonia used routine reports of discharges from hospitals and RAC facilities to provide customised reports of deaths in RAC (including respite care) or in hospital. For those two populations, hospital and RAC deaths were expressed as percentages of deaths during the period, and other deaths were deduced by subtraction. For New Zealand, a customised report of place of death for 2004–2007 was obtained from the Ministry of Health. The Ministry used a previously developed algorithm to classify all registered deaths by place of death based on free text recorded on the Death Certificate.

Of all reports, 16 were found in peer-reviewed scientific literature, 13 from tables or microdata on official websites, 13 as tables provided following requests to official sources, two from online organisational reports and one from a published book. One source comprised returns from six countries (Cohen et al. 2008), but all others were from one country or part(s) of one country. In total, over 16.2 million deaths were categorised. The report with the largest number of deaths was Japan with 3.4 million deaths, and the smallest was Switzerland with 3.4 thousand, a median of 131,600 deaths per population. Five reports included data for deaths only of people aged over 65 (or 66) years, and 17 categorised results by age group allowing inclusion in the 65+ analyses.

All reports included percentages dying in hospital and home (or other). Of those that did not specify a percentage for RAC deaths, three—Brazil, Lithuania and Portugal—specifically stated that RAC deaths were included in hospital counts (entirely or mostly), and three—Serbia, Slovenia and Taiwan—included them as home or other locations. How RAC deaths were classified was not specified in the data sources for Sweden, Albania, Botswana and Chile. For South Africa, place of death was not recorded for a relatively large component, reported as a fourth, "not stated" category. In all other populations, any percentage reporting place of death as unknown was small (if stated) and has been included with "Other, including home".

Place of all deaths

Across the 40 populations reporting all deaths, the median percentage (inter-quartile range) of all deaths occurring in hospitals was 54 % (46–60 %), in RAC 12 % (0–20 %), and other 32 % (26–38 %) (Fig. 1). More than half of all deaths occurred in institutions (hospital or RAC) in all but six populations (Albania, China, Chile, Lithuania, Serbia and Taiwan). The highest was Japan with 78 % of deaths in-hospital. China and Albania were the only populations reporting under 20 % in hospital; these countries were also exceptional, in that more than 80 % reportedly died in "other" places, i.e. neither in hospital nor RAC. In contrast, Australia, Iceland, Japan, Malta and Norway reported between 15 and 20 % "other" deaths.

Place of death of those aged over 65 years

Of the 21 populations for which data, including for deaths in RAC, were available for people over 65 years, the median (inter-quartile range) of deaths occurring in hospitals was 54 % (49–59 %), and in RAC 18 % (14–29 %) (Fig. 2). Across these reports, a median of 77 % (70–81 %) of deaths occurred in institutions, either RAC or hospital. Japan, Korea, and Malta reported the highest in-hospital deaths, each with over 65 % (Fig. 2). New Zealand reported the lowest percentage (34 %) of in-hospital deaths of older people, accompanied by the greatest percentage, 38 %, in RAC. Few died in RAC in Korea (3 %) or Singapore (7 %). While Singapore (35 %), Cyprus (42 %) and Croatia (41 %) had the highest percentage of other deaths, Australia (14 %) and Iceland (14 %) reported least.

Place of death by age group over 65 years

Age group was clearly associated with death in RAC in the 17 studies reporting by age group over 65 years (Fig. 3). Compared to the 65–74 years age group, the percentage dying in RAC doubled for those aged 75–84 years, and doubled again for those aged 85+ years (mean risk ratios = 2.01 and 3.82, respectively). Conversely, the risk of dying in acute hospitals reduced in those aged over 85 years, with a mean risk ratio of 0.76, almost 20 % lower.

Death in RAC by gender and age group over 65 years

Six reports (for Australia, Czech Republic, England and Wales, Korea, New Zealand and USA) described results for older people by both gender and age. All showed that in each age group, a higher percentage of deaths of women (vs. men) occurred in RAC. For example, among those aged 75–84 years in England and Wales in 2008, 12 % of deaths of men and 18 % of deaths of women were in RAC, a risk ratio of 1.47. On average across the three age groups, women were 40 % (mean risk ratio = 1.40, range 1.20–1.89) more likely to die in RAC than men of similar age.

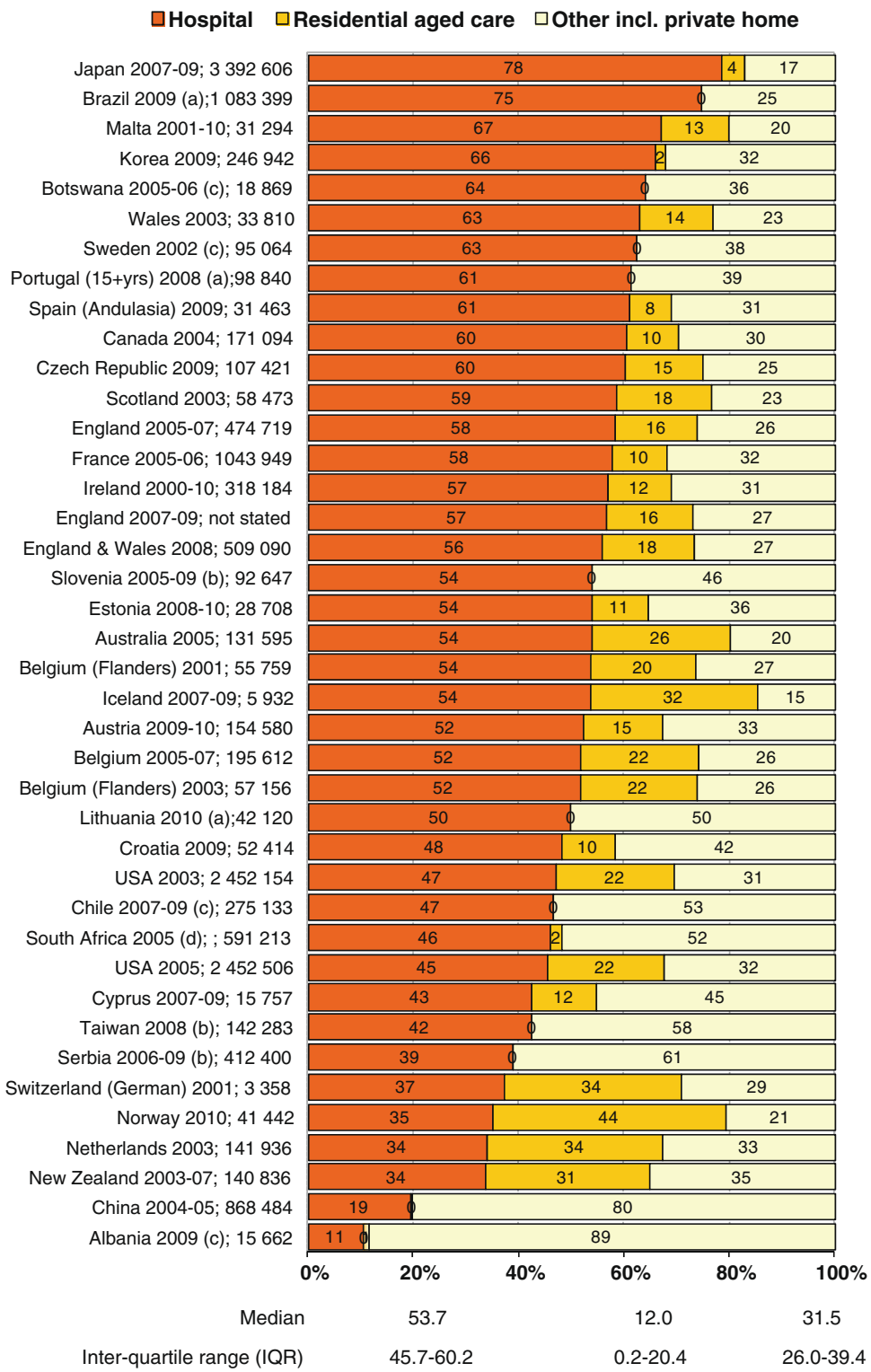

Fig. 1 Location of death [percentage of all deaths occurring in hospital, residential aged care (RAC) and Other incl. private home] for each of 40 populations, showing the years covered and total number of deaths in the period, ordered by percent of deaths in hospital. Ten reports did not differentiate RAC deaths. a. Three—Brazil, Lithuania and Portugal—specifically stated that RAC deaths were included in hospital counts (entirely or mostly). b. Three—Serbia, Slovenia and Taiwan—included them with home deaths. c. Data sources for Sweden, Albania, Botswana and Chile did not specify how RAC deaths were classified. d. Deaths reported as with place unknown was small (except South Africa, 14 %) and were included with "Other, including private home"

Discussion

Important new findings

This compilation of place of death data for total populations is the largest known to the authors. It includes 45 reports for 16.2 million people, from every continent. It provides much-needed evidence to inform design, implementation, monitoring and evaluation of new models of end-of-life care to meet the needs of ageing populations. The need is particularly challenging in developing nations where provision of care remains

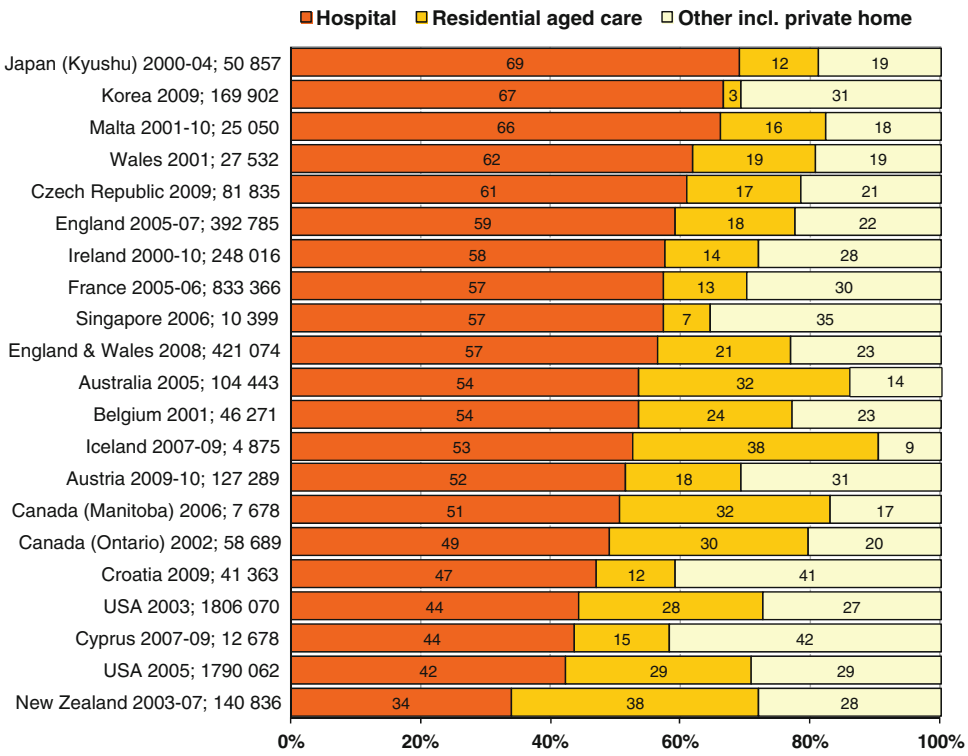

Fig. 2 Location of death among people aged 65+ years in 21 populations reporting deaths in residential aged care [percentage of all deaths occurring in hospital, residential aged care (RAC) and Other incl. private home], showing the years covered and total number of deaths in the period, ordered by percent of deaths in hospital

largely family-centred and where populations are ageing with unprecedented rapidity (Chi et al. 2001; Gysels et al. 2011; Seale 2000). In some countries including Korea and Singapore, population ageing is expected to increase from 7 % of their population aged over 65 years to 14 %, within one generation. These and similar countries may seek to avert fast growth in care costs (National Statistics Center 2010; Yun et al. 2006). Countries with already relatively high percentages of older people will continue to seek alternatives to expensive institutions for end-of-life care. Balancing these population-level needs is that individuals nearing end-of-life have a right to live as actively as possible until they die, and to die with dignity (Grover 2011).

As far as can be ascertained, in every population in this compilation, with the exception of China, Taiwan, Chile and three Eastern European countries (Albania, Lithuania, Serbia), deaths occurred predominantly in hospital or RAC, indicating high levels of end-of-life care provision in settings outside of home. This is important to note because research, policy and service provision relating to end-of-life care have predominantly focused upon optimising deaths at home (Cohen et al. 2011; Higginson 2005). Considerably less attention has been directed towards developing models of end-of-life care in RAC facilities. While we acknowledge the value of this emphasis, for some people, end-of-life care in a private home may require a too great resource or demand upon care-givers, or be impractical. Our results highlight the importance of appropriate palliative and end-of-life care in RAC settings in countries with high RAC use.

Preference for place of death

High rates of deaths occurring in institutional settings seem poorly aligned with population preferences. In systematic reviews covering many populations, people asked about their preferred place of death predominantly state a preference to die at home (Bell et al. 2009; Higginson and Sen-Gupta 2000). However, preference for home death reduces as death approaches (Higginson and Sen-Gupta 2000), and among older people (Gott et al. 2004). In one Canadian retrospective survey of caregivers, 92 % felt that where the care recipient dies was the appropriate place of death (Brazil et al. 2005), raising the possibility that survey methods may not have adequately considered changing health and circumstance. It appears that some surveys have allowed respondents to confuse preference for place of care at end-of-life with preference for place of death. In others, survey questions were not conditional upon respondents needing help. Further, the preference to die in institutional care may be motivated by the wish to avoid being a burden on families (Bell et al. 2009; Choi et al. 2005). Even so, it is salutary that in spite of widespread preference to die at home, in almost all populations, most deaths occur in institutions.

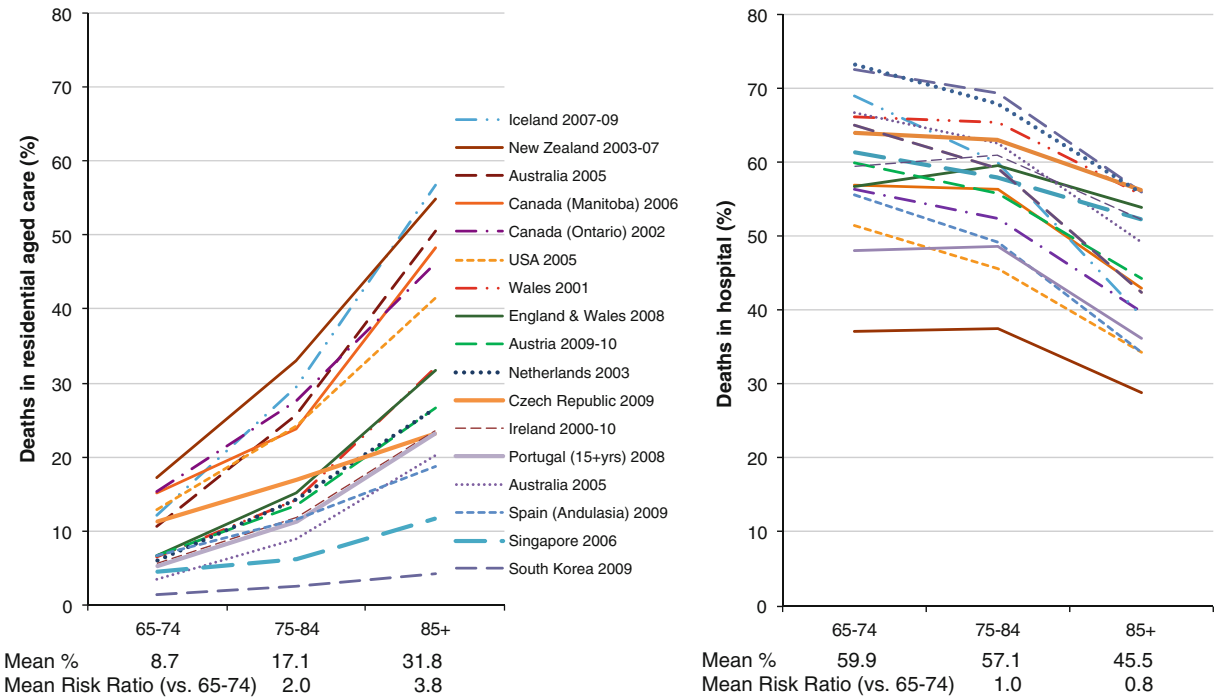

Fig. 3 Deaths in residential aged care and in hospital care of those aged over 65 years, for 17 populations, by age group

Variability in place of death between populations

Greatest consistency across populations was in the percentage of 'other' (including private homes) deaths: half were within the range 26–38 %. At the extremes were China and Japan where 80 and 17 %, respectively, died at home or elsewhere. In 2009, Japan had the largest number of hospital beds (13.7) and curative (acute) care beds (8.1) per 1,000 population and the longest mean length of stay in acute hospitals (18.5 days) among OECD countries, by a clear margin (National Statistics Center 2010). High death rates in hospital and low at home imply that Japanese people are actively treated until death, and/or that they are more likely to receive supportive, long-stay care within acute hospitals.

Korea had the lowest reported percentage of deaths in RAC among older people. Traditionally, older people in Korea were cared for by family at home and only if necessary admitted to hospital to pursue medical care until death, so RAC use was rare. This pattern is changing following the introduction of the national long-term care insurance scheme in 2008 (National Statistics Center 2010). Numbers of RAC residents and supply of RAC facilities have been rising rapidly. Acceptance of palliative care by the public is low but growing, and it is expected that increased provision of quality palliative care in RAC facilities will reduce dependence on hospitals among older Koreans (Yun et al. 2006).

In China too, where prior to the 1990s, the few government-sponsored institutions were for care of the destitute childless only, demand for RAC is increasing as adult children become increasingly unavailable. Since the late 1990s, privately run RAC facilities have been established. Traditional familial roles are beginning to change with use of RAC, increasingly seen not as stigma but as privilege (Zhan et al. 2011).

At the other end of the scale, in New Zealand, the relatively small percentage of deaths in hospital and the high percentage in RAC suggest that there may be more discharges of older people from acute hospital care into RAC near end-of-life than other countries, irrespective of recognised policies to support older people at home.

Of reports for people aged 65+ years, percentages of in-hospital deaths varied widely. Across populations, the percentage of deaths in RAC virtually doubled with each 10-year increase in age, and women were observed to have on average 40 % higher likelihood of death in RAC than men of similar age. This is consistent with cross-sectional studies showing that for both men and women, the percentage living in RAC approximately doubles with each 5-year increase in age, and that women are almost universally more likely to be in care than men.

Sources of variability in place of death

The literature explaining why or how variability occurs in place of death is limited. Within populations, place of death of individuals is associated with many factors: age,

gender, race, education, living alone or with others, socioeconomic status, rural or urban environments, availability of medical care, extent of disability and whether a preference for end-of-life care has been stated (Houttekier et al. 2009).

Differences between nations, however, are less well documented. It seems reasonable to consider that other population-level factors are relevant: age structures within populations, prevailing religious beliefs, cultural/family traditions, societal wealth, employment patterns (particularly of women), how home-based support services operate (e.g., participation by for-profit organisations) and availability of affordable help at home and of institutional beds are all likely to explain some variability in place of death. These should be explored further, but beliefs, cultural/family traditions are clearly very important.

In spite of the fact that in many populations, talking about death directly is regarded as taboo, as likely to bring bad luck, or at least as undesirable and distasteful; in western societies, there is growing emphasis on asking older people to discuss options for care at the end-of-life and to prepare advance care plans. In China, both long-established traditions and law have required children to care for their parents, expressing the strength of filial piety in attitudes and practice (Zhan et al. 2011). In Chinese society in Taipei, it was important to die at home, so the spirit could reunite with those of ancestors and not be left to wander (Lin et al. 2007). In western traditions where non-family options are available, determinants of place of death emphasise more who may best provide everyday support and meet physical and medical care needs. Traditions are evident too, in that an individual decides their own pathway. In Japan, the family group's preference may override those of the individual in interests of family harmony (Takezako et al. 2007). However, in western counties, when individuals express their preference for care, health care professionals are expected to respect their right to reach decisions about treatment and care (General Medical Council 2010). These are likely to be just a few of many instances of cultural and belief perspectives that impact on place of death.

It seems that each population must find its own balance between the interests of individual self-control and choice and needs of caregivers and the community. Improvements to institutional environments may encourage that balance (Brazil et al. 2005), but numerous perspectives are relevant, including those of public and insurance funders, economists and public policy makers, clinicians involved with end-of-life care and palliative care, operators of for-profit and not-for-profit RAC facilities, hospital and other health providers, and older people and their families.

Reporting systems

While this study is the first to collate place of death data across a large number of diverse countries, there are several methodological difficulties in assembling data from such mixed sources.

First, not all countries routinely compile and publish data from death registrations. Although efforts were made to source data that met our criteria from non-English speaking nations, from lower and middle-income and non-OECD populations in Asia, Oceania, Africa and South America, absence of data and our language limitations meant summaries were not found for many, including known-established RAC users, e.g. Germany and Denmark. Mathers et al. (2005) showed that among the countries reporting deaths, death registration is considered to be essentially complete in only 64 of the 115 countries reporting data. Compilation of global place of death is therefore not currently possible. Of the populations included in our study, only four were estimated in that study to have incomplete registration—Albania (60 %), Brazil (84 %) South Africa (88 %) and China (54 %, for which we used alternative sources). Inevitably, the study is limited by not including all countries, but 40 total populations (27 for older people) demonstrate the variations in care patterns.

Second, even among countries with nearly 100 % registration of deaths and with large RAC utilisation, many do not routinely collect or present data for deaths in non-hospital RAC settings, and where they do, definitions and classifications of locations are inconsistent. Some use tick-boxes on death certificates, but in nations where the death certificate includes no check-box to record residence type, e.g. New Zealand, it is left to coders and computer analysts to write text-based or postal-code-based coding systems. Recommendations for gathering statistical information about deaths are presented in the 'Principles and Recommendations for a Vital Statistics System, Revision 2' (United Nations Department of Economic and Social Affairs SD 2001). Priority items that all countries are recommended to collect and report include both place of occurrence of death and place of residence, but place of occurrence appears to include only geographic location, not the type of dwelling/building. Moreover, data collection does not imply that publication of summarised data necessarily follows, although certain tables are recommended.

Third, unlike some health data assembled internationally by WHO and other agencies, even where death locations are classified and summarised by type of dwelling/building, what constitutes a hospital or an RAC facility is variable (Cohen et al. 2007, 2008). An institution providing long-term medical and nursing care to an older person is classified as a place of death as 'hospital' in one population,

and as 'RAC' in another. Similarly, a facility providing social support rather than medical care is regarded as a "community facility" or "sheltered housing" and deaths there classified as 'at home' in one population, whereas in another society or in the same society at a different time, as 'RAC'. Further, where no separate category for RAC was provided, in this study such deaths were included with hospital deaths in three populations and as home deaths in another three. For others, such as Sweden, with a history of high RAC use, the classification is not stated and may be mixed.

In this study, as in many ecological analyses, lack of a standard classification and reporting is the main limitation; quite how differences in classification methods may impact interpretation is not known (Cohen et al. 2007). Further work is needed before hypothesis-based inter-population comparisons are possible.

Information about place of death has many uses. Most importantly, policy-makers can compare and contrast a nation's own place of death with those of other countries, to assist in development of health and support services for people nearing the end-of-life and to assist in anticipating trends associated with ageing populations. Other users may include individuals planning and providing for their futures, their national advocacy organisations, and health service and workforce planners. We support calls to standardise this aspect of death registration to facilitate monitoring of trends and cross-national comparisons (Cohen et al. 2007), and to further develop end-of-life care options appropriate for the needs and preferences of older people and their families within the current population context.

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Appendix: Sources of population data

	Population and years reported	Total number of deaths in period	Number of deaths in people aged 65+ years (if stated)	Restrictions	Source of data: paper = academic paper, report = published report, database = access to electronic database, by request = table/data provided on request	Data source or reference
1	Albania 2009	15,662		–	By request	INSTAT (Instituti I Statisitkave) (2010)
2	Australia 2005	131,595	104,443	–	By request	ABS (Australian Bureau of Statistics) (2010), AIHW (Australian Institute of Health and Welfare) (2009, 2011)
3	Austria 2009–10	154,580	127,289	–	By request	Q: Statistick Austria (2011)
4	Belgium (Flanders) 2003	57,156		–	Paper	Cohen et al. (2006)
5	Belgium (Flanders) 2001	55,759	46,271	–	Paper	Cohen et al. (2008)
6	Belgium 2005–07	195,612		Aged 1 year or older	Paper	Houttekier et al. (2010)
7	Botswana 2005–06	18,869		Non-traumatic deaths only	Paper	Lazenby et al. (2010)
8	Brazil 2009	1,083,399		–	Database	IBGE (Brazilian Institute of Geography and Statistics) (2010)
9	Canada 2004	171,094		–	Paper	Wilson et al. (2009)
10	Chile 2007–09	275,133		–	By request	DEIS, Ministry of Health (2011)

continued

	Population and years reported	Total number of deaths in period	Number of deaths in people aged 65+ years (if stated)	Restrictions	Source of data: paper = academic paper, report = published report, database = access to electronic database, by request = table/data provided on request	Data source or reference
11	China 2004–05	868,484		Surveillance of 158 counties	Report	Chen (2008)
12	Croatia 2009	52,414	41,363	–	By request	Croatian National Institute of Public Health (2011)
13	Cyprus 2007–09	15,757	12,678	–	By request	Cyprus Ministry of Health (2011)
14	Czech Republic 2009	107,421	81,835	–	Database	Czech Statistical Office (2011)
15	England and Wales 2008	509,090	421,074	–	Report	National End-of-Life Care Programme (2010b)
16	England 2005–07	474,719	392,785	–	Database	UK Statistics Authority (2009)
17	England 2007–09	Not stated		–	Database	National End-of-Life Care Programme (2010a)
18	Estonia 2008–10	28,708		–	By request	Ministry of Social Affairs of Estonia (2011)
19	France 2005–06	1,043,949	833,366	–	Database	INSEE (Institut National de la Statistique et des Études Économiques) (2010, 2011)
20	Iceland 2007–09	5,932	4,875	–	By request	Hagstofa Íslands | Statistics Iceland (2011)
21	Ireland 2000–10	318,184	248,016	–	By request	CSO (Central Statistics Office) (2010)
22	Japan 2007–09	3,392,606		–	Database	National Statistics Center (2010)
23	Korea 2009	246,942	169,902	–	Database	Statistics Korea (2010)
24	Lithuania 2010	42,120		–	By request	Institute of Hygiene, Lithuania (2011)
25	Malta 2001–10	31,294	25,050	–	By request	Department of Health Information and Research, Malta (2011)
26	Netherlands 2003	141,936		–	Paper	Cohen et al. (2008)
27	New Zealand 2003–07	140,836	140,836	–	By request	Ministry of Health (2011)
28	Norway 2009	41,342		–	Database	Statistisk sentralbyrå | Statistics Norway (2010)
29	Portugal (15+ years) 2008	98,840		Aged over 15 years	Report	Machado et al. (2010)
30	Scotland 2003	58,473		–	Paper	Cohen et al. (2008)
31	Serbia 2006–09	412,400		–	Database	Statistical Office of the Republic of Serbia (2010)
32	Slovenia 2005–09	92,647		–	By request	Health Data Centre: National Institute of Public Health (2011)
33	South Africa 2005	591,213		–	Database	Statistics South Africa (2005)
34	Spain (Andulasia) 2009	31,463		–	Paper	Ruiz-Ramos et al. (2011)
35	Sweden 2002	95,064		–	Paper	Cohen et al. (2008)
36	Switzerland (German) 2001	3,358		Aged over 1 year	Paper	Fischer et al. (2004)
37	Taiwan 2008	142,283		–	Database	Taiwan (2008)
38	USA 2003	2,452,154	1,806,070	–	Database	CDC (Centre for Disease Control) (2006)

continued

	Population and years reported	Total number of deaths in period	Number of deaths in people aged 65+ years (if stated)	Restrictions	Source of data: paper = academic paper, report = published report, database = access to electronic database, by request = table/data provided on request	Data source or reference
39	USA 2005	2,452,506	1,790,062	–	Database	CDC (Centre for Disease Control) (2008)
40	Wales 2003	33,810		–	Paper	Cohen et al. (2008)
41	Canada (Manitoba) 2000	–	7,678	Aged over 65 years	Paper	Menec et al. (2007)
42	Canada (Ontario) 2002	–	58,689	Aged over 66 years	Paper	Motiwala et al. (2006)
43	Japan (Kyushu) 2000–04	–	50,857	Aged over 65 years	Paper	Hashimoto et al. (2010)
44	Singapore 2006	–	10,399	Aged over 65 years	Paper	Beng et al. (2009)
45	Wales 2001	–	27,532	Aged over 65 years	Paper	Ahmad and O'Mahony (2005)

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