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Place of living at end-of-life according to cause of death: a comparative analysis of all decedents 70 years or older in 2009–2013 in Finland and Norway

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Background: Time at home at end-of-life is perceived as valuable to individuals. Increasing home care is therefore often a political goal. Yet, little is known about where individuals live towards their end-of-life. Our aim was to describe where individuals reside their last 6 months of life in Finland and Norway, and how this differed by cause of death, sex, age, marital status, and income.

Methods: We used individual-leveled national registry data on all decedents aged >70 years in 2009–2013 to describe the number of days individuals spent at home, in hospital, in long-term care (LTC) and short-term care (STC) facilities. We described the place of residence for all and by causes of death: cancer, diseases of the circulatory system, disease in the respiratory system, and mental and behavioral disorders (primarily dementia). We analyzed how age, marital status (indicating informal care), and income associated with place of residence. Analyses were stratified by sex and country.

Results: During the last 6 months of life, decedents in Finland (n=186,017) and Norway (n=159,756) spent similar amounts of days in hospital (8 and 11 days) and in STC facilities (15 and 13 days). Finnish decedents spent more days at home (96 *vs.* 84 days) and fewer days in LTC facilities (64 *vs.* 80 days). Living arrangement differed similarly by cause of death in the two countries, e.g., decedents from cancer and mental and behavioral disorders spent 123 [113] *vs.* 29 [21] days at home in Finland (Norway). In both countries, for all causes of death, lower age and marital status were associated with more days at home, for both males and females. While those with higher income spent more days at home in Norway, the opposite was found in Finland.

Conclusions: Older individual's living arrangements in the last 6 months of life were similar in Finland and Norway but differed by cause of death. Younger individuals and those with access to informal care spent more days at home, compared to their counterparts. With aging populations, more individuals will likely need LTC at their end of life. Policies should align with these needs when developing future health care services.

Keywords: End-of-life; hospital care; long-term care (LTC); cause of death; register study

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Introduction

Background

Many individuals express a preference for dying at home (1-3), and home death is perceived as quality palliative care. Yet, the number of home deaths remain relatively low in many countries (4-8). For some, the preference for place of death changes as death approaches, most often from home to institution (6). Therefore, focus should be given to the number of days people spend at home at end-of-life, and not merely their place of death (6,9-11).

Rationale and knowledge gap

The preference and ability of individuals to stay at home towards the end of their lives depends on various factors, including the individual's need for care, as well as predisposing factors like age and gender, and enabling factors such as sociodemographic status and access to formal and informal care (12-15). In a previous study, Forma *et al.* [2020] compared the place of death in Finland and Norway, and found that among individuals aged 70 years or older, 15% died at home in Finland, compared to 11% in Norway (7). The study also revealed that younger individuals and males had a higher likelihood of dying in hospitals, while older individuals and women were more likely to die in nursing homes. Another study by Cohen *et al.* [2010] identified a variation (ranging from 13% to 45%) in the number of home deaths across different

European countries, highlighting the importance of cultural and social factors, and access to both formal and informal care in achieving a high number of home deaths (4).

Few have previously studied the place of care towards end-of-life, and those that, have primarily focused on cancer patients (12,13). The majority of deaths (>80%) occurs in those aged 70 years and above (16). As the population ages and longevity increases, the composition of causes of death at the population level will change (8,17). To address future requirements for palliative care, it is essential to gain a comprehensive understanding of where people currently receive care and how care depends on peoples cause of death, in addition to their predisposing and enabling factors—particularly for the oldest segment in the population (8).

Objective

In this study, our aim was to utilize national register data encompassing all deceased individuals in Finland and Norway between 2009 and 2013. The objective was to provide a comprehensive account of the number of days that individuals aged 70 years and above spent in various care settings during the last 6 months of their lives, including their own homes, hospitals, short-term care (STC) facilities, and long-term care (LTC) facilities. To explore the influence of factors related to care needs on the choice of care setting, we conducted stratified analyses based on the most common causes of death, including cancers, diseases of the circulatory system, diseases of the respiratory system, and mental and behavioral disorders (primarily dementia). Furthermore, we assessed how predisposing and enabling factors, including age, access to informal care (via marital status), and income, were associated with the duration of time spent in different care settings. Sex stratification was performed in the analyses, as sex interacts with the aforementioned enabling and predisposing factors. For instance, females tend to live longer than males, they die from different causes and are more likely to provide informal care, while being less likely to receive informal care (17,18). We present this article in accordance with the STROBE reporting checklist (available at https://apm.amegroups.com/article/view/10.21037/apm-23-269/rc).

Methods

The Norwegian Health Care System

In Norway, four Regional Health Authorities, which are

Highlight box

Key findings

- Compared to Norwegian decedents, Finnish decedents spent similar amounts of days in hospital (8 *vs.* 11 days) and in short-term care facilities (15 *vs.* 13 days), but more days at home (96 *vs.* 84 days) and fewer days in long-term care (LTC) facilities (64 *vs.* 80 days).
- Residency differed similarly by cause of death in the two countries.
- In both countries and for all causes of death, lower age and availability of informal care was associated with spending more days at home.

What is known and what is new?

- Time at home at end-of-life is perceived as valuable to individuals; increasing home care is thus a political goal.

What is the implication, and what should change now?

- Population aging and shifting causes of death might lead to increased need for LTC towards end-of-life. Policies should align with these needs when developing future healthcare services.

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state-owned and administered by the Norwegian Ministry of Health, are responsible for the organization and funding of specialist health care services, primarily hospitals (19). At the time of our analyses, approximately 425 municipalities were responsible for organizing primary care services, including general practitioners, home-based care, and various forms of institutionalized STC and LTC. LTC encompasses nursing homes, sheltered housing, round-the-clock care, and sheltered housing with 24-hour support.

Hospitals are funded by a combination of block grants, which is a fixed budget component that are not influenced by activity, and activity-based funding determined by diagnosis-related groups (DRGs) (20). Between 2009 and 2013, both funding sources contributed to approximately 50% of the total funding (21). The general practitioners (GPs) are funded by a combination of a per capita-component based on the number of patients on the GP's list, a fee-for-services component and user charges. Home- and community-based health care services are funded by block grants and patient co-payments, with the amount depending on the type of service. Nursing homes receive funding through a block grant from the municipalities. Nursing home residents are required to pay an income-dependent user charge to the municipality, with the maximum charge set at 80% of their income. Patient co-payments for other services, such as outpatient treatment and visits to general practitioners, are modest and subject to an annual upper limit per patient. The health care system is primarily funded through taxes, and opting out of the public system is not possible. Approximately 8% of the population has private insurance, mainly provided by their employers (22).

The Finnish Health and Social Care System

The responsibility for organizing health and social services for citizens in Finland was transferred from municipalities to wellbeing services counties at the beginning of 2023. During the period covered by this article [2009–2013], approximately 320 municipalities were responsible for organizing health and social care for their residents. Municipalities provided services independently, in collaboration with other municipalities, or they could procure services from other municipalities or the private sector, including non-profit organizations and for-profit enterprises. Specialized health care was organized by 20 hospital districts, which were federations of municipalities (23). Hospital inpatient services in Finland are divided into primary health care and specialized health

care. Primary health care is offered in primary care hospitals known as health centers, while specialized hospital care is provided in general hospitals, including central and district hospitals, as well as in university hospitals. Round-the-clock LTC is offered in two types of settings: institutional care and in round-the-clock housing services. Institutional LTC is available in nursing homes and in primary care hospitals, but the amount of this type of care has decreased rapidly. Currently, the primary form of LTC is sheltered housing with 24-hour assistance.

Services are predominantly funded through taxes, including municipal taxes and state transfers in the form of block grants. Service users are required to contribute a portion of the cost out of their pockets, with the specific share varying across different services. In Finland, clients of LTC services pay a larger share (about 20%) compared to other Nordic or European Union (EU) countries (24).

Data

Patient population

We identified all individuals 70 years or above, who died in Finland or Norway between 2009 and 2013 from the Norwegian Causes of Death Registry and the Causes of Death Register in Finland, which both cover 100% of the populations (25,26). From the registers, we got access to individual's date and underlying cause of death, the latter noted as ICD-10 codes. We classified individuals according to the underlying causes of death, focusing on the largest groups: cancer (C00–C99), diseases of the circulatory system (I00–I99), diseases of the respiratory system (J00–J99), or mental and behavioral disorders (primarily dementia) (F00–F99). In addition, we reported on all deaths in the period [2009–2013], herein referred to as 'all causes of death'.

Place of living during the last 6 months of life

In the paper, we divided place of living into days at home, days in STC facilities, days in LTC facilities, and days in hospital. Below, we describe how this information was identified in the registers in Norway and Finland separately.

Norway

In Norway, data regarding the patients place of living during their last 6 months of life was collected from the Norwegian patient registry (NPR) and the individual-based nursing and care statistics registry (IPLOS). Days in hospital was estimated using NPR, which includes information on all hospital treatments that individuals receive in Norway. Each

time a treatment is provided to a patient, a claim is sent to NPR which, in addition to other information, includes the number of days that patients have spent in hospital.

Days in STC and LTC were estimated using IPLOS. Since home- and community-based services are not funded based on their activity in Norway, no claims are gathered and reported from these care providers. However, for the purpose of research, quality assurance, future planning and control, all municipalities are required to gather information on the number of patients who have applied for and/or received home and community-based care. The information is gathered in IPLOS. From IPLOS, we got information on how many days the decedents lived in institutions, dividing between STC facilities and LTC facilities. In most analyses (with except the descriptive statistics), LTC was grouped into one category.

Days at home were estimated by subtracting the length of stay (LOS) individuals had in hospital, in LTC, and in STC from the total number of days during 6 months (180 days). Since a patient's place in a long-term facility is not used by others if she or he is absent (due to for example hospitalization), we allowed for an overlap between hospital stays and stays in LTC facilities.

Finland

Data on the place of living during the last 6 months of life were collected from the Care Register for Health Care and the Care Register for Social Welfare, maintained by the Finnish Institute for Health and Welfare. Service providers collect information on the use of health and social services (i.e., the use of LTC), for example admission and discharge days, and deliver it to the administrator of the registers, who in turn delivers the instructions and framework for data collection.

The days in hospital were identified from the Care Register for Health Care, which includes information on all inpatient care use of university, central, district and private hospitals. In addition, use of STC (LOS <90 days) in primary care hospitals were collected from the register. The use of LTC, i.e., nursing homes and sheltered housing (with and without 24-hour assistance) were collected from the Care Register for Social Welfare, and LTC (LOS ≥90 days) in primary care hospitals from the Care Register for Health Care.

Days at home were estimated by subtracting the number of days the individuals spent in the health care facilities (i.e., hospitals) and in LTC from the total number of days during the 6 months (180 days). The calculation of care days and days at home was based on the admission and discharge days in the Care Registers, and in addition, the number of days when the client is on leave or absent from LTC.

Individual characteristics

Information on individual characteristics was gathered from Statistics Norway and Statistics Finland. We used information on the individuals age at death, sex, marital status, and income. Age was grouped into five age groups: 70–74, 75–79, 80–84, 85–89, or ≥90 years old. Marital status 6 months prior to death was divided into three groups: (I) never married; (II) those currently married/registered as partner; and (III) those previously married, meaning, divorcees, widows/widowers or previously registered as partner. Marital status was used as an indicator for access to informal care; compared to those who were never married, we assume that the married were more likely to both have a spouse and children who could potentially offer informal care, while those who were previously married were more likely to have children who could potentially offer informal care. Income was grouped by quartiles for the entire cohort of patients dying; this means that all individuals were divided by whether they were in the quartile 0–24%, 25–49%, 50–74%, or 75–100%. The quartiles were estimated separately by sex and country, i.e., in Norway, females were divided by quartiles when compared to other females in Norway and so forth.

Statistics

Data were analyzed in parallel, meaning similarly but separately for Finland and Norway. Before analyses were performed, we made a protocol for how to run the analyses to ensure that all analyses were applied similarly across the datasets.

We used descriptive statistics to display sociodemographic and disease characteristics for the total population, and for the population according to their causes of death. We also used descriptive statistics to describe individuals living situation during the last 6 months of life, meaning, the total number of days individuals spent either at home, in hospital, in LTC or in STC during their last 6 months of life.

To estimate how individual characteristics (age, marital status, and income) were associated with the individual's living situation, we ran separate multivariate regression models for all outcome variables (days at home, in hospital, in STC and in LTC). Regression model selection was done using the Norwegian data, by first assessing the characteristics of the outcome variables, and further, by

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assessing the best model fit among different appropriate models using the Akaike information criterion (AIC) and the Bayesian information criterion (BIC) (27-29). Since all outcome variables were count data, we tested the models ordinary least square regression, Poisson regression, and negative binomial. Since the distributions in the variables days at home and days in LTC contained a large number of non-users (many zero observations), we also tested whether a two-part model with a logistic regression in the first part and a generalized linear model in the second part could be appropriate to model these outcomes (29). After the above-mentioned procedure, we selected negative binomial regression as appropriate to model the number of days in hospital and in STC and two-part models with a logistic regression in the first part and a generalized linear model with a Gaussian family and an identity link in the second part to model the number of days at home and in LTC. These models were used both in the Norwegian and in the Finnish data. We used robust standard errors in all analyses.

The regression analyses were performed for all those dying, in addition, separately for patients depending on their cause of death: cancer, diseases of the circulatory system, diseases of the respiratory system and mental and behavioral disorders. All regression analyses were stratified by sex, since we expect the association between the individual characteristics of interest (age, marital status, and income) to differ between females and males. In the regression models we included the covariates age (70–74 years of age as reference category), marital status (never married as reference category) and income [low income (0–24%) as reference category].

Results from the regression models are presented as the average marginal effects (AMEs), thus variables are shown on their original scale (number of days) (30). We show the magnitude of the association for age, marital status, and income as the difference in the number of days at home, in hospital in LTC, and in STC between the reference category (the youngest age group, those never married, and those with the lowest income) to the categories: the oldest age group (90 years or older), currently or previously married, and those with the highest income (75–100%). Results from the full regression models can be seen in Tables S1-S8.

Ethics

The Norwegian Ethics Committee and the Norwegian Data Protection Authority, in addition to all the registry owners,

approved this study. Registry owners gave administrative permission to access and use the data. Registry owners include the Norwegian Directorate of Health, the Cancer Registry of Norway, the National Institute of Public Health, and Statistics Norway. The Ethics Committee of Pirkanmaa Hospital District has approved the COCTEL study. Registry administrators (Statistics Finland and Finnish Institute for Health and Welfare) have given permission to access and use the data. Since this was a registry study, we received exemptions from consent. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013).

Results

Descriptive statistics

In 2009–2013, a total of 186,017 and 159,756 individuals 70 years or older died in Finland and Norway, respectively (*Table 1*). Of these, in Finland (Norway), 20% (19%) died from cancer, 45% (30%) died from diseases of the circulatory system, 4% (9%) died from diseases of the respiratory system, and 6% (5%) died from mental or behavioral disorders (primarily constituting individuals dying from dementia). The majority of individuals (25%) were 85–89 years old when they died. In both countries, individuals dying from mental and behavioral disorders were older than individuals dying from cancers, and diseases of the circulatory and respiratory system. In both countries, most individuals were previously married (60%), while 30% were currently married and 10% were never married. Among cancer patients, more individuals were currently (45%), while fewer were previously (50%), married—while among those dying from mental and behavioral disorders, fewer were currently married (20%) and more were previously married (70%). In Finland, there were more individuals in the group never married (16%) compared to in the Norwegian patients dying from mental disorders (9%).

Description of individuals living situation

On average, decedents in Finland and Norway spent 96 and 84 days at home, 8 and 11 days in hospital, 64 and 80 days in LTC facilities, and 15 and 13 days in STC facilities, respectively. Individuals living arrangement differed according to cause of death; while individuals dying from cancer spent an average of 122 [113] days at home,

Table 1 Descriptive statistics for those aged ≥70 years dying according to cause of death in Norway and Finland in 2009–2013

Individual characteristics	Cancer (C00–C99)				Circulatory system (I00–I99)				Respiratory system (J00–J99)				Mental and behavioral (F00–F99)				Total			
	Norway		Finland		Norway		Finland		Norway		Finland		Norway		Finland		Norway		Finland	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Total	34,870	100	36,684	100	56,464	100	83,496	100	17,792	100	8,041	100	9,389	100	10,244	100	159,776	100	186,017	100
Specific diagnosis (ICD-10)																				
C00–C16, C22, C25	4,724	14	7,242	20	0	0	0	0	0	0	0	0	0	0	0	0	4,724	3	7,242	4
C18–C20	5,498	16	3,903	11	0	0	0	0	0	0	0	0	0	0	0	0	5,498	3	3,903	2
C32–C34	6,322	18	6,356	17	0	0	0	0	0	0	0	0	0	0	0	0	6,322	4	6,356	3
C50, C53–C56	3,289	9	4,014	11	0	0	0	0	0	0	0	0	0	0	0	0	3,289	2	4,014	2
Other cancers (C00–C99 not mentioned above)	15,037	43	15,169	41	0	0	0	0	0	0	0	0	0	0	0	0	15,037	9	15,169	8
F00–F99	0	0	0	0	0	0	0	0	0	0	0	0	9,389	100	10,244	100	9,389	6	10,244	6
I20–I25	0	0	0	0	20,550	36	46,731	56	0	0	0	0	0	0	0	0	20,550	13	46,731	25
I30–I33, I39–I52	0	0	0	0	13,298	24	4,825	6	0	0	0	0	0	0	0	0	13,298	8	4,825	3
I60–I69	0	0	0	0	14,034	25	18,865	23	0	0	0	0	0	0	0	0	14,034	9	18,865	10
I00–I99	0	0	0	0	8,582	15	13,075	16	0	0	0	0	0	0	0	0	8,582	5	13,075	7
J00–J99	0	0	0	0	0	0	0	0	17,792	100	8,041	100	0	0	0	0	17,792	11	8,041	4
All other causes	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41,261	26	47,552	26
Sex (females)	16,091	46	17,867	49	32,658	58	48,228	58	9,395	53	3,216	40	6,526	70	7,146	70	89,407	56	105,479	57
Age groups																				
70–74 years	6,623	19	8,893	24	3,972	7	8,855	11	1,658	9	1,277	16	367	4	458	4	15,995	10	24,813	13
75–79 years	7,683	22	9,061	25	6,550	12	12,291	15	2,512	14	1,596	20	723	8	723	7	22,634	14	30,807	17
80–84 years	8,886	25	9,096	25	11,415	20	19,370	23	4,035	23	2,165	27	1,621	17	1,753	17	34,345	21	43,657	23
85–89 years	7,241	21	6,417	17	16,339	29	22,069	26	4,618	26	1,743	22	2,855	30	2,703	26	42,374	27	45,878	25
90+ years	4,437	13	3,217	9	18,188	32	20,911	25	4,969	28	1,260	16	3,823	41	4,607	45	44,428	28	40,862	22
Marital status																				
Never married	2,312	7	3,512	10	4,523	8	9,195	11	1,465	8	980	12	843	9	1,613	16	12,885	8	20,342	11
Currently married/partner	15,478	44	16,426	45	16,448	29	25,024	30	5,418	30	3,008	37	2,031	22	1,757	17	51,171	32	61,153	33
Previously married/partner	17,050	49	16,729	46	35,478	63	49,266	59	10,905	61	4,051	50	6,515	69	6,874	67	95,646	60	104,470	56

Data are shown as number (No.) and percentage (%). ICD-10 codes: C00–C14, malignant neoplasms of lip, oral cavity, and pharynx; C15, malignant neoplasm of esophagus; C16, malignant neoplasm of stomach; C22, malignant neoplasm of liver and intrahepatic bile ducts; C25, malignant neoplasm of pancreas; C18–C20, colorectal cancer; C32–C34, malignant neoplasms of the respiratory and intrathoracic organs, including the throat, trachea, bronchus, and lung; C50, malignant neoplasm of the breast; C53–C56, malignant neoplasms of the female genital organs, including the cervix uteri, corpus uteri, and ovary; I20–I25, ischemic heart diseases; I30–I33, other heart disease, including diseases of the pericardium and pericarditis as a manifestation of diseases classified elsewhere; I39–I52, other heart disease, endocarditis and heart valve defects in diseases classified elsewhere and acute myocarditis (myocarditis acuta); I60–I69, cerebrovascular diseases; I00–I99, diseases of the circulatory system; and J00–J99, diseases of the respiratory system.
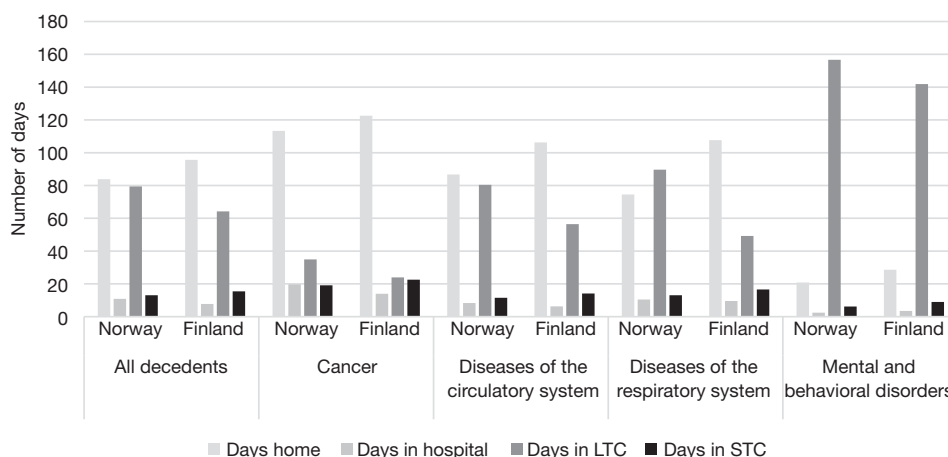
Figure 1 The number of days individuals spent at home, in hospital, in LTC, and in STC during their last 6 months of life. Findings are shown for the entire population and when separating between cause of death. LTC, long-term care; STC, short-term care.

14 [20] days in hospital, 24 [35] days in LTC, and 23 [19] days in STC in Finland [Norway], individuals dying from mental and behavioral disorders spent an average of 29 [21] days at home, 4 [2] days in hospital, 142 [157] days, in LTC and 9 [6] days in STC, *Figure 1* and *Table 2*.

Age, *marital status*, *and income*

There was an association between individual's age, marital status and income, and the number of days spent at home, in hospital, in STC and in LTC. *Tables 3,4* show results from the regression models for all decedents. (For similar tables for the decedents by cause of death, see Tables S1-S8).

Age
Age was highly associated with days at home and days in LTC: when compared to younger individuals (70–74 years), older individuals (90 years or older) spent fewer days at home and more days in LTC. *Figures 2,3* report this association by cause of death for females and males, displayed as the difference in the number of days spent in the different settings between the oldest age group compared to the reference category (70–74 years), which is at zero in the Y-axis.

The pattern was consistent between the different causes of death although age was more strongly associated with place of living in Norway than in Finland. For example, in Norway, the difference in the number of days at home for the oldest females (90 years or older) compared to the youngest

females (70–74 years) ranged from 50 to 71 fewer days between the different causes of death. In Finland, the difference in the number of days at home for the oldest females (90 years or older) compared to the youngest females (70–74 years) ranged from 28 to 60 fewer days. Corresponding numbers for the oldest males compared to the youngest males were 39 to 59 fewer days in Norway and 28 to 48 fewer days in Finland. Age also influenced the number of days individuals spent in hospital: for example, older females dying from cancer spent 16 and 12 fewer days in hospital compared to the youngest persons dying from cancer, in Norway and Finland respectively.

Marital status
When evaluating the total population, those who were married spent 29 and 14 days (for females) and 31 and 24 days (for males) more at home, in Finland and Norway, respectively, compared to the never married (*Tables 3,4*). If they were previously married, the number of days individuals spent at home increased by 6 days for females (in both countries) and by 8 and 12 days for males in Norway and Finland, respectively. *Figures 4,5* show this association by cause of death for females and males, displayed as the difference in the number of days spent in the different settings between those currently or previously married compared to the reference category (never married), which is at zero in the Y-axis. Across the different causes of death, marital status (i.e., access to informal care) influenced the number of days at home and in LTC more than the number of days spent in hospital or in STC. In both countries,

Table 2 Descriptive statistics of the number of days individuals spent in hospital, in LTC facilities, in STC facilities, and at home, and which type of LTC facility individuals spent time in

Place of residence	Cancer (C00–C99) Norway		Finland		Circulatory system (I00–I99) Norway		Finland		Respiratory system (J00–J99) Norway		Finland		Mental and behavioral (F00–F99) Norway		Finland		Total Norway		Finland	
	No.	SD	No.	SD	No.	SD	No.	SD	No.	SD	No.	SD	No.	SD	No.	SD	No.	SD	No.	SD
Secondary care																				
Hospital	19.71	18.39	14.00	19.32	8.33	13.28	6.27	15.11	10.48	15.09	9.57	18.22	2.47	7.27	3.51	−19.79	10.84	15.55	7.75	17.34
Home and community-based care																				
LTC	34.94	67.02	23.91	55.41	80.41	87.49	56.44	78.11	89.62	87.90	49.22	73.99	156.62	61.61	141.86	−68.46	79.39	87.32	64.18	81.09
Nursing home	25.13	58.54	5.68	28.26	62.89	84.15	17.11	49.74	71.07	86.35	15.55	47.13	143.11	73.21	58.73	82.28	63.76	84.37	21.11	55.09
Sheltered housing	4.70	26.68	1.07	11.80	7.79	34.83	2.11	17.12	7.95	35.03	2.19	17.12	3.39	23.03	1.44	14.35	6.65	32.11	1.76	15.59
Other round-the-clock care	2.30	18.84	0.30	6.65	3.61	24.06	0.33	7.24	3.59	23.79	0.78	10.92	1.37	14.45	0.68	10.40	3.06	22.05	0.36	7.49
Sheltered housing with 24-hour care	2.80	21.35	8.51	34.38	6.11	31.80	21.49	53.97	7.01	33.94	18.30	49.51	8.76	38.42	39.04	70.06	5.91	31.31	23.28	56.09
Primary care hospital (LOS ≥90 days)	0.00	0.00	8.36	34.23	0.00	0.00	15.39	47.57	0.00	0.00	12.39	42.62	0.00	0.00	41.97	74.21	0.00	0.00	17.67	50.85
STC	19.10	31.84	22.54	27.49	11.49	27.36	14.13	24.68	13.03	28.61	16.57	25.62	6.23	21.52	8.95	21.26	13.05	28.47	15.41	25.50
Home	113.30	64.20	122.51	55.69	86.75	81.68	106.26	75.95	74.49	78.18	107.63	71.44	20.84	51.25	28.63	57.27	83.85	78.70	95.64	75.58

Data are shown as total number of days (No.) and SD. ICD-10 codes: C00–C99, cancer; I00–I99, diseases of the circulatory system; J00–J99, diseases of the respiratory system; and F00–F99, mental and behavioral disorders (primarily dementia). LTC, long-term care; STC, short-term care; SD, standard deviation; LOS, length of stay.

Table 3 The association between income, marital status and age and the number of days that females dying from all causes spent at home, in hospital, in LTC, and in STC

Individual characteristics	Days at home Norway		Finland		Days in hospital Norway		Finland		Days in LTC Norway		Finland		Days in STC Norway		Finland	
	AME	%	AME	%	AME	%	AME	%	AME	%	AME	%	AME	%	AME	%
Age group																
70–74 years	115.8		122.5		17.8		12.3		40.4		33.3		12.1		14.6	
75–79 years	−17.4	15	−15.8	13	−3.1	17	−2.3	19	19.9	49	16.6	50	1.9	15	1.7	11
80–84 years	−34.9	30	−31.3	26	−6.6	37	−4.8	39	40.5	100	34.3	103	2.5	21	2.2	15
85–89 years	−48.3	42	−44.4	36	−9.4	53	−6.8	56	57.7	143	49.6	149	1.3	10	1.9	13
90+ years	−67.6	58	−60.1	49	−12.8	72	−8.6	70	82.1	203	69.5	209	−1.6	13	−0.6	4
Marital status																
Never married	60.8		77.3		7.2		5.7		107.8		85.9		11.2		14.7	
Currently married	28.7	47	13.8	18	4.2	59	1.5	26	−36.1	34	−18.5	22	3.5	32	1.5	10
Previously married	5.9	10	5.9	8	1.7	23	0.8	14	−8.6	8	−8.2	10	1.2	11	0.9	6
Income quartiles																
0–24%	67.0		93.5		7.7		6.5		100.7		67.1		10.6		15.6	
25–49%	1.3[NS]	2	−3.5	4	1.6	21	0.4	6	−3.5	3	2.4	4	2.5	23	1.0	7
50–74%	2.9	4	−16.0	17	2.3	29	−0.1[NS]	2	−6.1	6	16.5	25	3.0	28	0.0[NS]	0
75–100%	8.7	13	−19.6	21	2.8	36	0.1[NS]	1	−13.3	13	20.8	31	3.2	30	−0.8	5

Numbers are displayed as the total number of days at home, in hospital, in LTC, and in STC for the reference categories (AME), as the difference in the number of days from the reference category for other categories, and share of days from the reference category (%). Value for reference category provided in predicted absolute number of days. Values in other categories provided as difference in number of days relative to the reference category (i.e., the predicted number of days that individuals aged 70–74 years of age spend at home in Norway was 115.8). The predicted difference between those aged 75–79 years, when compared to the reference category (70–74 years), was −17.4 days. The predicted number of days those aged 75–79 years spend at home can be calculated as 115.8 − 17.4 = 98.4. "%" indicates relative change, estimated as the share of days out of the total days in the reference category (i.e., 17.4/115.8×100% = 15%). "NS" indicates findings that were not significant at a 5% level. LTC, long-term care; STC, short-term care; AME, average marginal effect.

Table 4 The association between income, marital status and age and the number of days that males dying from all causes spent at home, in hospital, in LTC, and in STC
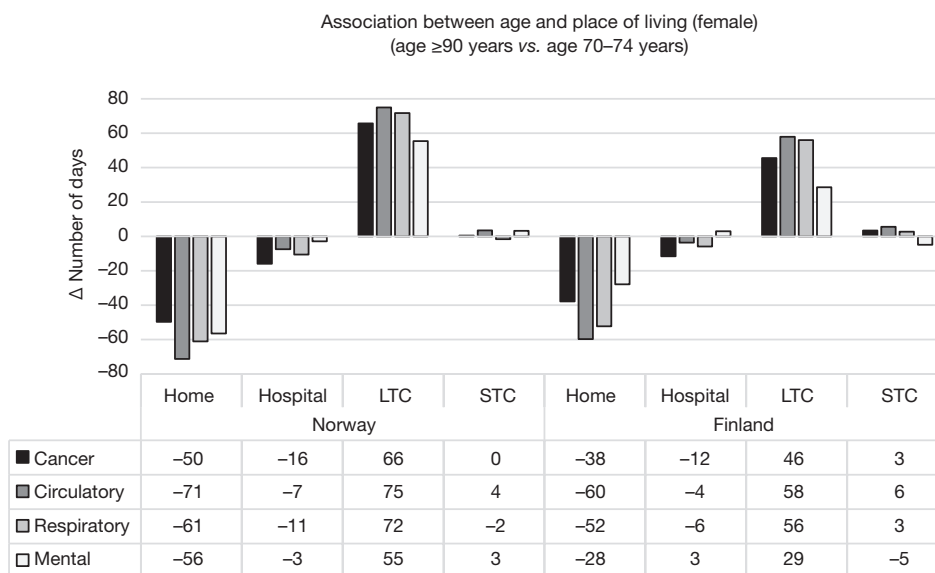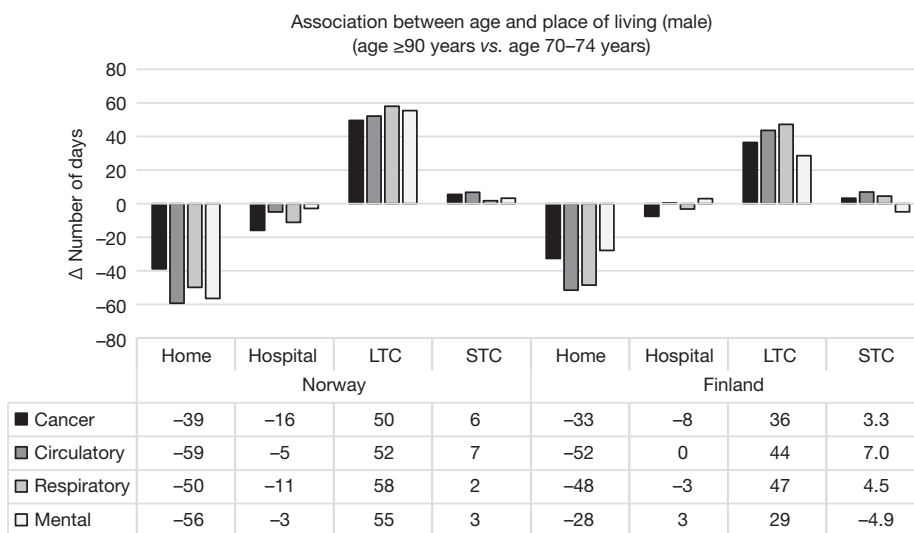
Individual characteristics	Days at home				Days in hospital				Days in LTC				Days in STC			
	Norway		Finland		Norway		Finland		Norway		Finland		Norway		Finland	
	AME	%	AME	%	AME	%	AME	%	AME	%	AME	%	AME	%	AME	%
Age groups																
70–74 years	129.8		135.3		18.6		11.6		27.8		23.6		10.1		12.5	
75–79 years	−13.0	10	−12.8	9	−2.4	13	−1.5	13	13.6	49	12.2	52	2.2	22	2.2	18
80–84 years	−25.3	20	−27.0	20	−5.2	28	−3.3	28	27.1	97	26.8	113	4.3	43	3.8	30
85–89 years	−37.6	29	−38.4	28	−7.7	42	−3.4	30	41.2	148	37.6	159	5.0	49	4.3	34
90+ years	−54.7	42	−51.5	38	−11.0	59	−2.9	25	61.8	222	51.3	217	3.9	38	2.5	20
Marital status																
Never married	82.2		93.6		10.0		7.3		82.9		68.9		13.1		14.5	
Currently married	31.1	38	24.5	26	4.0	40	2.5	34	−37.4	45	−29.4	43	0.5[NS]	4	0.8	5
Previously married	7.8	9	12.3	13	2.2	22	1.9	26	−11.3	14	−16.1	23	0.6[NS]	4	0.4[NS]	2
Income quartiles																
0–24%	97.8		122.9		11.4		8.5		64.9		36.3		12.6		15.0	
25–49%	3.5	4	−9.8	8	1.6	14	0.1[NS]	1	−5.7	9	8.7	24	1.1	9	1.5	10
50–74%	4.3	4	−21.5	17	2.1	18	0.7	8	−7.5	12	21.4	59	1.3	11	−0.5[NS]	3
75–100%	8.3	8	−15.5	13	2.5	22	2.4	28	−12.3	19	14.1	39	1.4	11	−0.4[NS]	3

Numbers are displayed as the total number of days at home, in hospital, in LTC, and in STC for the reference categories (AME), as the difference in the number of days from the reference category for other categories, and share of days from the reference category (%). Value for reference category provided in predicted absolute number of days. Values in other categories provided as difference in number of days relative to the reference category (i.e., the predicted number of days that individuals aged 70–74 years of age spend at home in Norway was 129.8). The predicted difference between those aged 75–79 years, when compared to the reference category (70–74 years), was −13.0 days. The predicted number of days those aged 75–79 years spend at home can be calculated as 129.8 − 13.0 = 116.8. "%" indicates relative change, estimated as the share of days out of the total days in the reference category (i.e., 13.0/129.8×100% = 10%). "NS" indicates findings that were not significant at a 5% level. LTC, long-term care; STC, short-term care; AME, average marginal effect.

Association between age and place of living (female)
(age ≥90 years *vs.* age 70–74 years)

	Home	Hospital	LTC	STC	Home	Hospital	LTC	STC
		Norway				Finland		
■ Cancer	–50	–16	66	0	–38	–12	46	3
▤ Circulatory	–71	–7	75	4	–60	–4	58	6
▥ Respiratory	–61	–11	72	–2	–52	–6	56	3
☐ Mental	–56	–3	55	3	–28	3	29	–5

Figure 2 The additional number of days that the oldest females (aged ≥90 years) stay at home, in hospital, in LTC, and in STC during the last 6 months of life, compared to the youngest females (70–74 years). The Y-axis represents the difference (AME) in the number of days females aged ≥90 years have at home, in hospital, in LTC, and in STC compared to females in those aged 70–74 years (who are at 0 on the Y-axis). LTC, long-term care; STC, short-term care; AME, average marginal effect.

Association between age and place of living (male)
(age ≥90 years *vs.* age 70–74 years)

	Home	Hospital	LTC	STC	Home	Hospital	LTC	STC
		Norway				Finland		
■ Cancer	–39	–16	50	6	–33	–8	36	3.3
▤ Circulatory	–59	–5	52	7	–52	0	44	7.0
▥ Respiratory	–50	–11	58	2	–48	–3	47	4.5
☐ Mental	–56	–3	55	3	–28	3	29	–4.9

Figure 3 The additional number of days that the oldest males (age ≥90 years) stay at home, in hospital, in LTC, and in STC during the last 6 months of life, compared to the youngest males (70–74 years). The Y-axis represents the difference (AME) in the number of days males aged ≥90 years have at home, in hospital, in LTC, and in STC compared to males in those aged 70–74 years (who are at 0 on the Y-axis). LTC, long-term care; STC, short-term care; AME, average marginal effect.

Association between marital status and place of living (female)
(currently or previously married *vs.* never married)

	Home (C)	Home (P)	Hospital (C)	Hospital (P)	LTC (C)	LTC (P)	STC (C)	STC (P)	Home (C)	Home (P)	Hospital (C)	Hospital (P)	LTC (C)	LTC (P)	STC (C)	STC (P)
				Norway								Finland				
■ Cancer	30	7	4	2	−35	−11	−1	1	18	8	1	1	−17	−8	−4	−1
▨ Circulatory	32	6	3	1	−38	−8	3	1	14	6	1	0	−18	−8	2	1
▤ Respiratory	31	7	5	1	−40	−9	7	1	32	10	4	2	−41	−15	1	0
□ Mental	10	−1	1	0	−14	1	5	0	17	1	1	0	−25	−2	7	0
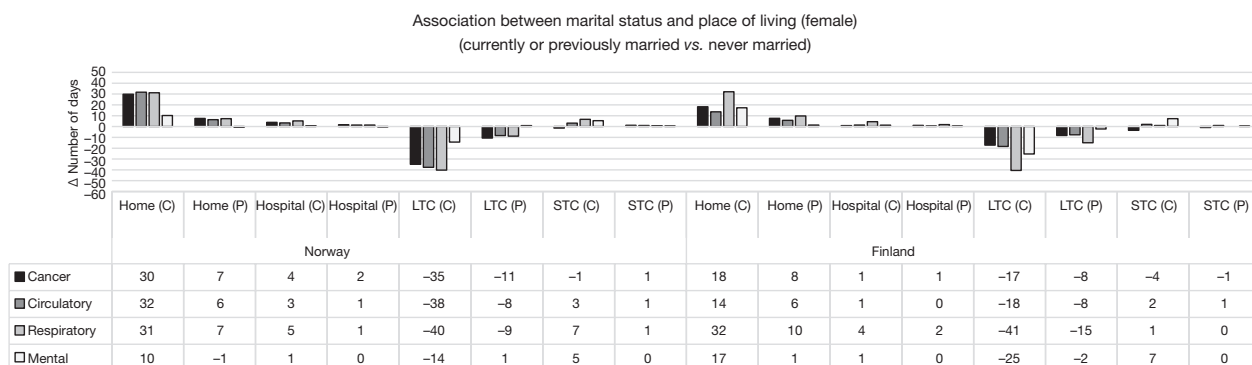
Figure 4 The additional number of days that the currently and previously married/partnered females stay at home, in hospital, in LTC, and in STC during the last 6 months of life, compared to the never married females. The Y-axis represents the difference (AME) in the number of days currently and previously married/partnered females have at home, in hospital, in LTC, and in STC compared to never married/partnered females (who are at 0 on the Y-axis). C, currently; P, previously; LTC, long-term care; STC, short-term care; AME, average marginal effect.

Association between marital status and place of living (male)
(currently or previously married *vs.* never married)

	Home (C)	Home (P)	Hospital (C)	Hospital (P)	LTC (C)	LTC (P)	STC (C)	STC (P)	Home (C)	Home (P)	Hospital (C)	Hospital (P)	LTC (C)	LTC (P)	STC (C)	STC (P)
				Norway								Finland				
■ Cancer	35	11	3	2	−36	−15	−5	1	26	12	3	2	−25	−13	−6	−3
▨ Circulatory	30	6	2	2	−36	−7	0	0	23	11	2	2	−27	−14	1	1
▤ Respiratory	37	10	5	2	−46	−13	2	0	33	16	3	3	−39	−22	1	2
□ Mental	15	6	2	1	−20	−6	4	0	16	3	0	2	−20	−5	4	0
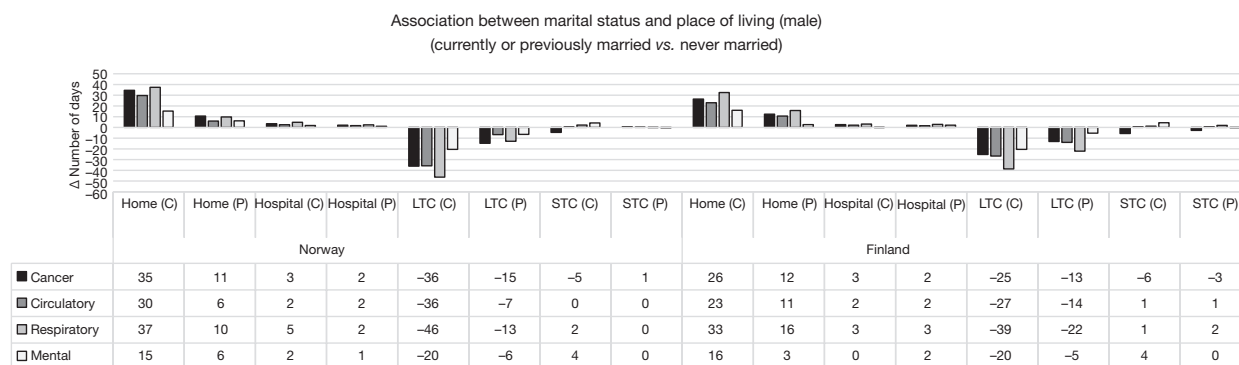
Figure 5 The additional number of days that the currently and previously married/partnered males stay at home, in hospital, in LTC, and in STC during the last 6 months of life, compared to the never married males. The Y-axis represents the difference (AME) in the number of days currently and previously married/partnered males have at home, in hospital, in LTC, and in STC compared to never married/partnered males (who are at 0 on the Y-axis). C, currently; P, previously; LTC, long-term care; STC, short-term care; AME, average marginal effect.
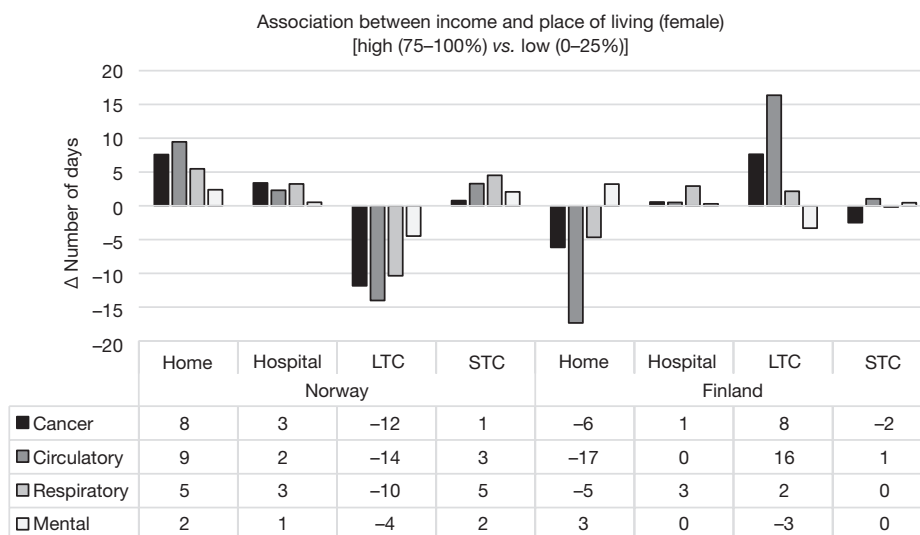
marital status was less associated with place of living for those dying from mental or behavioral disorders.
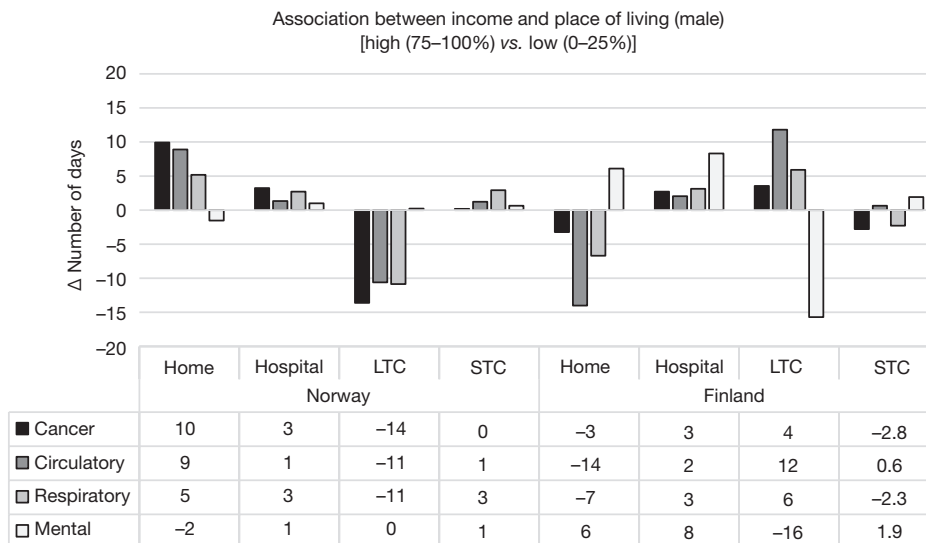
Income

Increasing income was associated with more days at home and fewer days in LTC in Norway. In Finland, income was, in contrast, associated with less days at home and more days in LTC. *Figures 6,7* show the association between income and place of living by cause of death, displayed as the difference in the number of days spent in the different settings between those in the highest income quartile (75–100%) compared to the reference category: those in the lowest income quartile (0–24%), which is at zero in the Y-axis.

This pattern (with contrasting findings as income increased) was consistent across individuals dying from the different diseases, except for in individuals dying from mental disorders, where there was a positive association between income and the number of days that females spent at home (in both countries).

Association between income and place of living (female)
[high (75–100%) vs. low (0–25%)]

	Home	Hospital	LTC	STC	Home	Hospital	LTC	STC
		Nor	way			Fin	land	
■ Cancer	8	3	−12	1	−6	1	8	−2
▨ Circulatory	9	2	−14	3	−17	0	16	1
▨ Respiratory	5	3	−10	5	−5	3	2	0
☐ Mental	2	1	−4	2	3	0	−3	0

Figure 6 The additional number of days that the females in the highest income group (75–100%) stay at home, in hospital, in LTC, and in STC during the last 6 months of life, compared to females in the lowest income group (0–25%). The Y-axis represents the difference (AME) in the number of days females in the highest income group have at home, in hospital, in LTC, and in STC compared to females in the lowest income group (who are at 0 on the Y-axis). LTC, long-term care; STC, short-term care; AME, average marginal effect.

Association between income and place of living (male)
[high (75–100%) vs. low (0–25%)]

	Home	Hospital	LTC	STC	Home	Hospital	LTC	STC
		Nor	way			Fin	land	
■ Cancer	10	3	−14	0	−3	3	4	−2.8
▨ Circulatory	9	1	−11	1	−14	2	12	0.6
▨ Respiratory	5	3	−11	3	−7	3	6	−2.3
☐ Mental	−2	1	0	1	6	8	−16	1.9

Figure 7 The additional number of days that the males in the highest income group (75–100%) stay at home, in hospital, in LTC, and in STC during the last 6 months of life, compared to males in the lowest income group (0–25%). The Y-axis represents the difference (AME) in the number of days females in the highest income group have at home, in hospital, in LTC, and in STC compared to females in the lowest income group (who are at 0 on the Y-axis). LTC, long-term care; STC, short-term care; AME, average marginal effect.

Discussion

Key findings

In summary, we examined the residency of individuals aged 70 years or older during the last 6 months of their lives in Finland and Norway between 2009 and 2013. Both countries had similar durations of hospital stays (8 and 11 days) and stays in STC facilities (15 and 13 days). However, Finnish decedents spent more time at home (96 days compared to 84 days) and less time in LTC facilities (64 days compared to 80 days) than their Norwegian counterparts. The living arrangements of individuals based on cause of death followed the same pattern in both countries. In both Finland and Norway, a lower age and the availability of informal care were associated with a greater number of days spent at home, for both males and females. In Norway, a higher income was associated with more days at home and fewer days in LTC facilities, whereas the opposite was observed in Finland. As the population ages, a larger number of individuals will likely need LTC at the end of their lives. Therefore, future healthcare services should be developed in accordance with these needs.

Strengths and limitations

The main strength of our paper was our access to rich data on service utilization from reliable national registries, which made it possible to model complete care pathways for all individuals, 70 years and above, dying in Norway and Finland. Based on information on composition of treatment and care, we were able to identify the number of days individuals spent at home during the last 6 months of life. In addition, we linked individual level data based on personal identification numbers which gave us a unique analytical opportunity allowing us to estimate the associations between the number of days individuals stayed at home, in hospital, in LTC or in STC at end of life, and socio-demographic variables (in terms of age), informal care (in terms of marital status), and socio-economic variables (in terms of income).

A weakness was, however, the requirement that the data in Norway had to be anonymous, because of requirements in the IPLOS. Consequently, we had to restrict the type of variables we could receive, and the level of accuracy for some variables. For instance, income had to be grouped into quartiles by sex. Also, we could not receive information on individual's municipality of residence. If we had access to the latter, we could have understood more of the underlying

mechanisms in our findings. For example, knowing an individual's municipality of residence would allow linkage to municipal characteristics, such as demography, budgets, total population, and coverage rate of home and institutionalized care services, which could provide more information about the supply side of health care services. There is open access to information on municipal level characteristics through Statistics Norway's web pages, and future analyses should exploit these variables (31).

Furthermore, the underlying cause of death of individuals can be difficult to determine, and particularly so due to multimorbidity. Information about individual's cause of death in the Cause of Death registries is based on notes from the physician who completes the death certificate. In the certificate, both underlying and immediate cause of death can be reported (25,26,32). As people age, the level of multimorbidity increases (33). Stating the exact cause of death might therefore be difficult, both because of the difficulty in distinguishing between the underlying and the immediate cause of death, and because individuals might have two or more chronic conditions simultaneously (multimorbidity), which can both be noted as their underlying cause of death (32). For example, if an individual has cancer and chronic obstructive pulmonary disease (COPD), but dies from influenza—what would be the correct cause of death? In the future we can linked data on the patients' diagnosis (from the hospital registers) to data on patients underlying cause of death, to be able to classify individuals more carefully according to disease and cause of death. The consequences of more information of the true underlying cause of death on place of residence according to cause of death is, however, not clear.

Also, the data used in our analyses are 10–14 years old. Changes that have occurred during the last decade might have influenced the number of days that people spend in different institutions and at home, at their end-of-life. For example, policymakers in both Norway and Finland have aimed at shifting care from the secondary care level to the primary care level, thus possibly influencing the number of days people spend in hospital and in short- and long-term nursing homes (34). Simultaneously, time at home and home deaths are increasingly encouraged, which might have shifted care from formal institutions to home-based care (9,11). Previous research on the place of death indicates that fewer individuals in Norway died in hospital (34% *vs.* 46%) or at home (14% *vs.* 18%) in 2011 compared to 1987 (8). Whether there has been a shift in place of care during the last decade is an empirical question that should be explored

in future analyses.

Comparison with similar research

To the best of our knowledge, few studies have previously analyzed the time that individuals spend in different care settings at end-of-life, as the focus has been given to place of death rather than place of residence during end-of-life (4,5,7,8). However, place of death seems to vary greatly between countries, for example, Cohen *et al.* [2010] found that home death among cancer decedents occurred in 12.8% in Norway—while home death was more common in England (22%), Wales (23%), and Belgium (28%), and even more so in Italy (36%) and in the Netherlands (45%) (4). Furthermore, Bekelman *et al.*, found that the percentage of individuals with cancer who died in acute care hospitals was substantial across the countries included in their analyses: 51% in Belgium, 52% in Canada, 45% in Norway, 42% in England, and 38% in Germany (5). Neither of these studies reported place of residence at end-of-life.

Explanations of findings

The current study is a descriptive study, and results should be interpreted as such. Still, our findings give new insight to the literature. The place of residence at end-of-life was similar in Finland and Norway giving an indication of the duration individuals 70 years or older live at home and in institutions during their last 6 months of life in countries where individuals are covered by national health insurance through taxes. These estimates can be used to indicate future need for of home and institutionalized care at end-of-life, given current composition of care services. However, it should be noted that we do not know the actual need for care in these individuals, nor whether the current level of care actually responds to individuals need.

We find that, in both Finland and Norway, the cause of death (as an indicator for underlying health condition) was associated with place of residence during the last 6 months of life. In addition, and for all health conditions, age was strongly associated with place of residence. In the future, the distribution of causes of death will change due to, among other explanations, an aging population. For instance, the age standardized rates of death from cancer, cardiovascular diseases, and diseases in the respiratory systems are declining, while death from dementia and mental disorder are increasing. However, because of the aging population, the absolute number of individuals dying

from all these causes might still increase, but dementia will likely increase at a faster relative pace (17). This should be carefully considered when organizing health care services in the future to meet the need for LTC which will likely increase.

We also find that marital status, which was used as a proxy for informal care, was associated with place of residence. Those who were currently married or with a partner lived longer at home indicating that a spouse or a partner was the most important informal caregiver. Those who were previously married also lived longer at home, indicating that children were also an important informal caregiver. It is important to point out that we did not observe the amount of informal care provided. When the population is aging, there might be a reduction in the likelihood that individuals will have access to informal care. As age and level of multimorbidity increases, the likelihood that spouses will be able to care for each other might decrease. Also, the aging population is expected to not only increase the demand for health care services, but also reduce the relative supply of people in the workforce; while the number of working-age people per person above the age of 60 years was 4.7 in 2000, it is expected to decrease to 3.5 in 2030 and 2.9 by 2050 (35,36). The pressure of the working-age population to participate in both full-time paid work and in informal care will be challenging.

The associations between income and place of residence vary between Norway and Finland. In Norway, higher income was associated with an increasing number of days at home, in hospital, and STC. In Finland, higher income was associated with fewer days at home and higher number of days in LTC. We cannot explain these findings, however, we can hypothesize why the associations were like this. First, in Norway, as in most other countries, individual incomes are higher in urban than in rural areas. The levels of LTC services are, on the other hand, higher in rural than in urban areas due to national distribution rules inherent in the grant system between the central state and the municipalities (37). Individual income at municipal level is therefore negatively correlated with total municipal revenues. The positive effect of income on number of days at home could therefore be a spurious effect and the 'real' effect could be one of low level of municipal services. Another explanation might be that LTC in Norway to a large degree is financed by income-dependent out-of-pocket payments, where residents pay up to 85% of their income (22). Consequently, those with high income have a lower incentive to move to a nursing home since they will have to pay more compared to their less

wealthy counterparts. A further explanation for the findings in Norway might be that individuals with higher income are more likely to live in urban areas. Their preference to stay at home might therefore be higher, because of the safety that closeness to acute care hospitals provides. If this was the case, income would be a confounder for urban *vs.* rural living. Also, the same pattern (of higher income in individuals living in urban areas) is true in Finland, thus, this would not explain the differences identified between Finland and Norway. We could hypothesize with several other explanations; however, the most important point is that these finding should be further explored in future analyses, where more detailed information is available. An important component is that a previous study from Finland found that LTC was more common among people with lower income, thus, why this was not the case in the population under analyses in this paper is puzzling (38).

Implications and actions needed

In the current study, we find that residency towards end-of-life differed similarly among older individuals (age >70 years) by cause of death in the two countries; individuals dying from mental and behavioral disorders (primarily dementia) spent nearly all their time in LTC facilities. In both countries, and for all causes of death, lower age, and availability of informal care (indicated by marital status) were associated with more days at home, for both males and females. As population's age and the causes of death shift, while the access to informal care is likely to decrease, individuals will likely need more formal care and spend less time at home and more time in LTC facilities towards end-of-life. This will increase the need for institutionalized end-of-life care. The political goals, which has currently been to increased home-based care, might need to shift to align with the populations' actual need for care during their last months of life.

Conclusions

In summary, we examined the residency of individuals aged 70 years or older during the last 6 months of their lives in Finland and Norway between 2009 and 2013. Both countries had similar durations of hospital stays (8 and 11 days) and stays in STC facilities (15 and 13 days). However, Finnish decedents spent more time at home (96 days compared to 84 days) and less time in LTC facilities (64 days compared to 80 days) than their Norwegian

counterparts. The living arrangements of individuals based on cause of death followed the same pattern in both countries. In both Finland and Norway, a lower age and the availability of informal care were associated with a greater number of days spent at home, for both males and females. In Norway, a higher income was associated with more days at home and fewer days in LTC facilities, whereas the opposite was observed in Finland. As the population ages, a larger number of individuals will likely need LTC at the end of their lives. Therefore, future healthcare services should be developed in accordance with these needs.

Footnote

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Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The Norwegian Ethics Committee and the Norwegian Data Protection Authority, in addition to all the registry owners, approved this study. Registry owners gave administrative permission to access and use the data. Registry owners include the Norwegian Directorate of Health, the Cancer Registry of Norway, the National Institute of Public Health, and Statistics Norway. The Ethics Committee of Pirkanmaa Hospital District has approved the COCTEL study. Registry administrators (Statistics Finland and Finnish Institute for Health and Welfare) have given permission to access and use the data. Since this was a registry study, we received exemptions from consent.

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Table S1 The association between income, marital status and age and the number of days that females dying from cancer spent at home, in hospital, in LTC, and in STC

Individual characteristics	Days at home				Days in hospital				Days in LTC				Days in STC			
	Norway		Finland		Norway		Finland		Norway		Finland		Norway		Finland	
	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value
Age groups																
70–74 years	127.5		132.0		25.5		18.7		15.0		11.5		17.5		20.5	
75–79 years	−10.1	<0.001	−6.5	<0.001	−2.3	<0.001	−2.7	<0.001	11.4	<0.001	5.7	<0.001	2.8	<0.001	3.8	<0.001
80–84 years	−19.7	<0.001	−14.7	<0.001	−7.0	<0.001	−5.1	<0.001	22.5	<0.001	15.5	<0.001	6.4	<0.001	4.6	<0.001
85–89 years	−30.5	<0.001	−24.7	<0.001	−10.4	<0.001	−8.5	<0.001	37.9	<0.001	28.7	<0.001	4.9	<0.001	4.5	<0.001
90+ years	−49.7	<0.001	−37.8	<0.001	−15.9	<0.001	−11.6	<0.001	65.7	<0.001	45.5	<0.001	0.4	0.61	3.4	<0.001
Marital status																
Never married	92.6		107.8		16.4		12.9		58.5		37.5		20.3		25.3	
Currently married	29.8	<0.001	18.2	<0.001	3.8	<0.001	0.8	0.16	−34.8	<0.001	−17.1	<0.001	−1.5	0.22	−3.5	<0.001
Previously married	7.5	<0.001	7.5	<0.001	1.7	0.01	1.0	0.07	−10.6	<0.001	−8.2	<0.001	1.2	0.27	−0.9	0.25
Income quartiles																
0–24%	102.7		120.7		16.9		13.4		47.5		24.2		20.1		24.8	
25–49%	−0.5	0.77	−1.5	0.18	1.1	0.01	0.4	0.29	−1.3	0.46	1.4	0.22	0.9	0.26	−0.3	0.65
50–74%	1.4	0.36	−6.8	<0.001	2.3	<0.001	0.5	0.24	−4.0	0.02	7.7	<0.001	0.9	0.29	−1.6	0.01
75–100%	7.6	<0.001	−6.2	<0.001	3.4	<0.001	0.6	0.18	−11.8	<0.001	7.6	<0.001	0.8	0.36	−2.5	<0.001

Numbers are displayed as the total number of days at home, in hospital, in LTC, and in STC for the reference categories, and as the difference in the number of days from the reference category for other categories. LTC, long-term care; STC, short-term care; AME, average marginal effect.

Table S2 The association between income, marital status and age and the number of days that males dying from cancer spent at home, in hospital, in LTC, and in STC

Individual characteristics	Days at home				Days in hospital				Days in LTC				Days in STC			
	Norway		Finland		Norway		Finland		Norway		Finland		Norway		Finland	
	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value
Age groups																
70–74 years	133.4		137.0		26.9		17.4		11.7		10.2		13.8		18.1	
75–79 years	−4.6	<0.001	−4.7	<0.001	−3.1	<0.001	−2.1	<0.001	5.2	<0.001	4.4	<0.001	2.9	<0.001	2.8	<0.001
80–84 years	−11.0	<0.001	−11.7	<0.001	−7.2	<0.001	−4.8	<0.001	13.9	<0.001	11.9	<0.001	5.5	<0.001	5.2	<0.001
85–89 years	−23.1	<0.001	−21.4	<0.001	−10.6	<0.001	−6.1	<0.001	28.8	<0.001	21.3	<0.001	6.1	<0.001	7.0	<0.001
90+ years	−38.8	<0.001	−32.6	<0.001	−15.9	<0.001	−7.6	<0.001	49.6	<0.001	36.4	<0.001	5.5	<0.001	3.3	<0.001
Marital status																
Never married	96.6		107.8		17.9		12.1		53.8		39.0		20.4		25.7	
Currently married	34.6	<0.001	26.4	<0.001	3.4	<0.001	2.6	<0.001	−36.1	<0.001	−25.2	<0.001	−4.7	<0.001	−5.7	<0.001
Previously married	10.6	<0.001	12.3	<0.001	2.1	<0.001	2.0	<0.001	−14.7	<0.001	−13.1	<0.001	0.6	0.57	−2.8	<0.001
Income quartiles																
0–24%	116.2		131.4		18.5		13.3		34.1		16.1		17.6		22.2	
25–49%	3.9	<0.001	−4.3	<0.001	2.1	<0.001	0.4	0.32	−5.4	<0.001	3.4	<0.001	0.1	0.83	0.5	0.40
50–74%	4.1	<0.001	−8.7	<0.001	2.7	<0.001	1.1	0.01	−6.9	<0.001	8.5	<0.001	0.4	0.59	−1.1	0.06
75–100%	9.9	<0.001	−3.2	<0.001	3.2	<0.001	2.7	<0.001	−13.6	<0.001	3.6	<0.001	0.2	0.79	−2.8	<0.001

Numbers are displayed as the total number of days at home, in hospital, in LTC, and in STC for the reference categories, and as the difference in the number of days from the reference category for other categories. LTC, long-term care; STC, short-term care; AME, average marginal effect.

Table S3 The association between income, marital status and age and the number of days that females dying from circulatory diseases spent at home, in hospital, in LTC, and in STC

Individual characteristics	Days at home				Days in hospital				Days in LTC				Days in STC			
	Norway		Finland		Norway		Finland		Norway		Finland		Norway		Finland	
	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value
Age group																
70–74 years	125.6		134.2		12.6		7.4		40.8		31.0		7.7		10.1	
75–79 years	−20.5	<0.001	−15.7	<0.001	−2.3	<0.001	−0.3	0.42	20.3	<0.001	13.4	<0.001	2.8	<0.001	2.6	<0.001
80–84 years	−39.9	<0.001	−29.9	<0.001	−3.4	<0.001	−0.9	0.01	39.5	<0.001	25.8	<0.001	4.4	<0.001	5.3	<0.001
85–89 years	−53.1	<0.001	−42.0	<0.001	−5.0	<0.001	−2.1	<0.001	53.9	<0.001	37.3	<0.001	5.0	<0.001	7.1	<0.001
90+ years	−71.3	<0.001	−59.7	<0.001	−7.4	<0.001	−3.6	<0.001	75.0	<0.001	57.9	<0.001	3.5	<0.001	5.6	<0.001
Marital status																
Never married	62.9		87.8		5.8		4.8		107.7		76.4		10.4		14.5	
Currently married	31.7	<0.001	13.6	<0.001	3.3	<0.001	1.4	<0.001	−37.7	<0.001	−18.4	<0.001	3.1	<0.001	2.0	<0.001
Previously married	6.3	<0.001	5.7	<0.001	1.4	<0.001	0.5	0.02	−8.4	<0.001	−7.6	<0.001	1.0	0.08	1.0	0.01
Income quartiles																
0–24%	69.1		102.5		6.0		5.1		101.4		60.5		9.7		14.5	
25–49%	0.8	0.50	−3.5	<0.001	1.4	<0.001	0.4	0.02	−2.8	0.03	1.8	0.07	1.9	<0.001	1.8	<0.001
50–74%	3.7	<0.001	−15.8	<0.001	2.1	<0.001	0.2	0.28	−7.0	<0.001	14.7	<0.001	2.7	<0.001	1.2	<0.001
75–100%	9.5	<0.001	−17.3	<0.001	2.3	<0.001	0.5	0.01	−14.0	<0.001	16.4	<0.001	3.3	<0.001	1.0	<0.001

Numbers are displayed as the total number of days at home, in hospital, in LTC, and in STC for the reference categories, and as the difference in the number of days from the reference category for other categories. LTC, long-term care; STC, short-term care; AME, average marginal effect.

Table S4 The association between income, marital status and age and the number of days that males dying from circulatory diseases spent at home, in hospital, in LTC, and in STC

Individual characteristics	Days at home				Days in hospital				Days in LTC				Days in STC			
	Norway		Finland		Norway		Finland		Norway		Finland		Norway		Finland	
	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value
Age groups																
70–74 years	139.7		147.4		12.0		7.7		27.9		20.5		6.7		7.4	
75–79 years	−14.8	<0.001	−12.7	<0.001	−0.9	0.05	−0.1	0.81	13.6	<0.001	9.3	<0.001	2.4	<0.001	3.4	<0.001
80–84 years	−28.6	<0.001	−25.6	<0.001	−1.6	<0.001	−0.6	0.01	27.3	<0.001	20.6	<0.001	4.5	<0.001	6.1	<0.001
85–89 years	−40.0	<0.001	−35.8	<0.001	−2.8	<0.001	−0.4	0.23	37.4	<0.001	28.8	<0.001	6.6	<0.001	7.4	<0.001
90+ years	−59.3	<0.001	−51.5	<0.001	−4.9	<0.001	0.4	0.35	52.1	<0.001	43.7	<0.001	6.8	<0.001	7.0	<0.001
Marital status																
Never married	89.1		107.2		7.7		5.9		79.6		59.2		11.2		11.8	
Currently married	29.8	<0.001	23.0	<0.001	2.5	<0.001	2.1	<0.001	−35.8	<0.001	−26.7	<0.001	0.3	0.67	0.6	0.19
Previously married	6.0	<0.001	10.6	<0.001	1.7	<0.001	1.5	<0.001	−6.7	0.01	−14.0	<0.001	0.0	0.99	0.6	0.24
Income quartiles																
0–24%	102.7		133.7		8.8		6.7		64.8		30.6		10.6		11.6	
25–49%	3.8	<0.001	−10.7	<0.001	1.2	<0.001	0.1	0.54	−4.6	0.01	9.4	<0.001	1.5	<0.001	1.7	<0.001
50–74%	5.7	<0.001	−19.4	<0.001	1.1	<0.001	1.0	<0.001	−6.8	<0.001	18.2	<0.001	0.7	0.14	0.7	0.05
75–100%	8.9	<0.001	−14.0	<0.001	1.3	<0.001	2.1	<0.001	−10.6	<0.001	11.8	<0.001	1.2	0.03	0.6	0.08

Numbers are displayed as the total number of days at home, in hospital, in LTC, and in STC for the reference categories, and as the difference in the number of days from the reference category for other categories. LTC, long-term care; STC, short-term care; AME, average marginal effect.

Table S5 The association between income, marital status and age and the number of days that females dying from respiratory diseases spent at home, in hospital, in LTC, and in STC

Individual characteristics	Days at home				Days in hospital				Days in LTC				Days in STC			
	Norway		Finland		Norway		Finland		Norway		Finland		Norway		Finland	
	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value
Age group																
70–74 years	103.6		125.7		15.0		10.7		57.8		31.7		11.4		13.8	
75–79 years	−14.9	<0.001	−6.7	0.12	−0.9	0.28	0.1	0.88	14.2	<0.001	6.4	0.15	2.5	0.05	0.8	0.63
80–84 years	−32.9	<0.001	−26.2	<0.001	−4.6	<0.001	−1.7	<0.001	35.5	<0.001	25.4	<0.001	2.5	0.04	3.7	0.01
85–89 years	−42.9	<0.001	−32.9	<0.001	−7.1	<0.001	−3.5	<0.001	48.0	<0.001	33.2	<0.001	1.7	0.12	4.2	0.01
90+ years	−61.0	<0.001	−52.3	<0.001	−10.5	<0.001	−5.8	<0.001	71.7	<0.001	56.0	<0.001	−1.6	0.15	2.7	0.08
Marital status																
Never married	52.9		86.0		6.4		6.1		116.5		77.1		10.7		14.9	
Currently married	31.2	<0.001	32.1	<0.001	5.2	<0.001	4.5	<0.001	−40.2	<0.001	−40.5	<0.001	6.7	<0.001	1.0	0.59
Previously married	7.3	0.02	9.8	0.02	1.9	<0.001	1.8	0.04	−8.9	0.01	−15.0	<0.001	0.7	0.51	1.9	0.20
Income quartiles																
0–24%	63.0		99.9		6.9		6.9		106.6		60.1		8.9		16.1	
25–49%	−0.3	0.89	1.9	0.59	2.0	<0.001	1.2	0.10	−2.5	0.32	−4.1	0.27	3.9	<0.001	0.8	0.56
50–74%	−3.4	0.13	−3.2	0.38	2.7	<0.001	1.6	0.06	−0.8	0.75	1.3	0.74	5.4	<0.001	0.5	0.69
75–100%	5.5	0.03	−4.7	0.21	3.2	<0.001	2.9	<0.001	−10.4	<0.001	2.1	0.59	4.5	<0.001	−0.2	0.90

Numbers are displayed as the total number of days at home, in hospital, in LTC, and in STC for the reference categories, and as the difference in the number of days from the reference category for other categories. LTC, long-term care; STC, short-term care; AME, average marginal effect.

Table S6 The association between income, marital status and age and the number of days that males dying from respiratory diseases spent at home, in hospital, in LTC, and in STC

Individual characteristics	Days at home				Days in hospital				Days in LTC				Days in STC			
	Norway		Finland		Norway		Finland		Norway		Finland		Norway		Finland	
	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value
Age groups																
70–74 years	115.8		132.3		18.5		12.1		41.9		25.0		11.6		13.3	
75–79 years	−13.4	<0.001	−7.1	0.01	−2.5	<0.001	−0.8	0.34	14.2	<0.001	6.1	0.02	1.3	0.28	2.3	0.05
80–84 years	−27.9	<0.001	−19.2	<0.001	−5.1	<0.001	−2.3	<0.001	29.7	<0.001	17.5	<0.001	3.6	<0.001	4.6	<0.001
85–89 years	−33.7	<0.001	−29.5	<0.001	−7.7	<0.001	−2.0	<0.001	37.9	<0.001	27.0	<0.001	3.7	<0.001	5.3	<0.001
90+ years	−49.8	<0.001	−48.5	<0.001	−11.1	<0.001	−3.2	<0.001	58.0	<0.001	47.3	<0.001	1.8	0.14	4.5	<0.001
Marital status																
Never married	64.7		91.5		9.1		7.9		102.1		69.8		13.0		15.4	
Currently married	37.4	<0.001	32.5	<0.001	4.7	<0.001	3.1	<0.001	−46.3	<0.001	−38.6	<0.001	2.2	0.07	1.2	<0.001
Previously married	9.8	<0.001	15.7	<0.001	2.4	<0.001	2.8	<0.001	−12.9	<0.001	−22.1	<0.001	0.0	0.99	1.9	0.12
Income quartiles																
0–24%	83.2		120.0		10.5		9.5		81.2		35.8		12.3		17.3	
25–49%	4.3	0.05	−4.7	0.06	2.5	<0.001	−0.3	0.64	−7.6	<0.001	4.7	0.07	1.6	0.06	1.1	0.28
50–74%	7.3	<0.001	−15.2	<0.001	2.9	<0.001	1.6	0.05	−12.8	<0.001	16.1	<0.001	3.4	<0.001	−1.8	0.08
75–100%	5.2	0.05	−6.7	0.02	2.7	<0.001	3.1	<0.001	−10.9	<0.001	5.9	0.04	2.9	0.01	−2.3	0.04

Numbers are displayed as the total number of days at home, in hospital, in LTC, and in STC for the reference categories, and as the difference in the number of days from the reference category for other categories. LTC, long-term care; STC, short-term care; AME, average marginal effect.

Table S7 The association between income, marital status and age and the number of days that females dying from mental and behavioral disorders spent at home, in hospital, in LTC, and in STC

Individual characteristics	Days at home				Days in hospital				Days in LTC				Days in STC			
	Norway		Finland		Norway		Finland		Norway		Finland		Norway		Finland	
	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value
Age group																
70–74 years	40.7		29.8		3.9		2.4		136.7		143.9		4.3		7.2	
75–79 years	−18.3	<0.001	−9.1	0.08	−0.6	0.57	2.2	0.12	19.2	0.01	7.9	0.20	0.3	0.82	−0.8	0.62
80–84 years	−25.3	<0.001	−5.8	<0.001	−1.3	0.21	0.8	<0.001	25.3	<0.001	2.9	>0.99	1.9	0.20	1.5	<0.001
85–89 years	−23.7	<0.001	−3.6	<0.001	−1.7	0.09	−0.3	>0.99	24.6	<0.001	1.4	>0.99	1.4	0.32	2.2	<0.001
90+	−28.1	<0.001	−5.0	<0.001	−2.6	0.01	−0.6	<0.001	31.1	<0.001	5.3	<0.001	−0.5	0.73	0.1	>0.99
Marital status																
Never married	14.9		22.7		2.0		1.8		164.6		151.5		3.9		7.1	
Currently married	10.2	<0.001	17.3	<0.001	0.7	0.10	1.3	<0.001	−14.3	<0.001	−25.4	<0.001	5.4	<0.001	7.3	<0.001
Previously married	−0.6	0.77	1.4	0.44	−0.2	0.41	0.5	0.31	0.8	0.72	−2.3	0.26	0.4	0.59	0.3	0.59
Income quartiles																
0–24%	13.7		22.4		1.5		1.8		166.9		150.7		3.6		7.6	
25–49%	2.9	0.06	4.6	0.01	0.5	0.01	1.3	0.03	−4.2	0.02	−6.0	0.01	1.3	0.06	1.0	0.17
50–74%	3.9	0.02	2.8	0.10	0.8	<0.001	0.3	0.48	−6.4	<0.001	−2.8	0.17	2.5	<0.001	0.1	0.93
75–100%	2.4	0.14	3.2	0.07	0.5	0.02	0.3	0.55	−4.5	0.02	−3.3	0.11	2.1	0.01	0.5	0.52

Numbers are displayed as the total number of days at home, in hospital, in LTC, and in STC for the reference categories, and as the difference in the number of days from the reference category for other categories. LTC, long-term care; STC, short-term care; AME, average marginal effect.

Table S8 The association between income, marital status and age and the number of days that males dying from mental and behavioral disorders spent at home, in hospital, in LTC, and in STC

Individual characteristics	Days at home				Days in hospital				Days in LTC				Days in STC			
	Norway		Finland		Norway		Finland		Norway		Finland		Norway		Finland	
	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value	AME	P value
Age groups																
70–74 years	78.8		60.1		5.1		5.8		97.7		103.4		5.1		14.1	
75–79 years	−40.3	<0.001	−24.8	<0.001	−0.1	0.89	−0.7	0.66	37.5	<0.001	27.8	<0.001	4.1	0.03	−1.8	0.41
80–84 years	−46.4	<0.001	−23.9	<0.001	−1.2	0.23	−2.6	<0.001	41.4	<0.001	28.3	<0.001	6.0	<0.001	−2.5	<0.001
85–89 years	−51.1	<0.001	−24.8	<0.001	−1.3	0.19	1.2	<0.001	47.3	<0.001	24.8	<0.001	5.0	<0.001	−2.4	<0.001
90+	−56.4	<0.001	−27.8	<0.001	−2.9	<0.001	3.0	<0.001	55.4	<0.001	28.6	<0.001	3.2	0.05	−4.9	<0.001
Marital status																
Never married	22.7		29.5		2.4		5.4		153.4		138.7		7.6		9.6	
Currently married	15.2	<0.001	16.0	<0.001	1.8	<0.001	0.0	>0.99	−20.5	<0.001	−20.4	<0.001	4.2	0.02	4.3	<0.001
Previously married	6.1	0.07	2.6	0.41	1.1	0.02	2.1	0.09	−6.5	0.11	−5.4	0.16	−0.3	0.85	−0.2	0.86
Income quartiles																
0–24%	32.3		34.5		3.2		3.3		141.4		134.6		9.6		9.7	
25–49%	1.1	0.72	7.2	0.03	0.7	0.10	1.1	0.15	−1.8	0.62	−11.5	<0.001	0.0	>0.99	3.9	<0.001
50–74%	−0.3	0.92	−2.9	0.35	0.4	0.30	2.2	0.03	1.1	0.77	1.2	0.75	−1.3	0.32	0.3	0.76
75–100%	−1.5	0.64	6.1	0.07	1.0	0.03	8.3	<0.001	0.2	0.95	−15.7	<0.001	0.6	0.71	1.9	0.12

Numbers are displayed as the total number of days at home, in hospital, in LTC, and in STC for the reference categories, and as the difference in the number of days from the reference category for other categories. LTC, long-term care; STC, short-term care; AME, average marginal effect.