Mortality differences according to living arrangements

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Background Research has revealed mortality differences between marital status groups in different societies and different periods of time. Due to the increase in consensual unions, living alone and other changes in living arrangements, it is necessary to apply a more detailed classification of living arrangements that incorporates partnership situation and household composition.

Methods We analyse mortality by cause-of-death in the total Finnish population aged 30 or over in 1996–2000. The linked register dataset includes 15.7 million person-years and 210,139 deaths.

Results In the working aged population, cohabiters had nearly 70% excess mortality when compared with married people. Among working aged men living with someone other than a partner and among men living alone, mortality was three times higher than among married men. Among women, mortality in these groups was close to that of cohabiters. In the older population, mortality in the other groups was 15–40% higher than among married persons. Adjusting for education, social class and employment status attenuated the mortality differences by 7–31%. Having no children was associated with excess mortality in working aged women and men in each living arrangement group. The relative differences were greatest in deaths from alcohol-related causes, followed by deaths from accidents among men and working aged women and lung cancer in women.

Conclusions We observed wide mortality differences according to living arrangements, particularly among the working aged. These differences were partly explained by socioeconomic factors. Excessive alcohol use seems to be one major cause of mortality differences.

Keywords Living arrangements, marital status, mortality, cause-of-death, socioeconomic factors

Introduction

Studies in widely different societies and at different periods of time have consistently shown that mortality is much lower among married persons than among single, divorced and widowed persons.1–3 These differences are usually more pronounced in men than in women. Single, divorced and widowed persons usually show excess mortality in all major cause-of-death groups. The relative differences tend to be largest in alcohol-related causes of death as well as in accidents and violence.4–6 During the past few decades, relative mortality differences between married and non-married persons have increased substantially in a number of countries.2,7 Mortality differences have been attributed to both the beneficial health effects of marriage and the tendency of poor health to increase the probability of divorce or remaining single.3,4,6–10

Mortality differences between official marital status groups may be obscured by the sharp and sustained increase in the prevalence of consensual unions, as a growing proportion of...
persons classified as never married, divorced and widowed are in fact living with a partner. At the same time, there has been a decrease in the proportion of older non-married persons living in households including other adults than a partner. It is therefore necessary to broaden the analysis of mortality differentials between official marital status groups and to develop and apply a more detailed classification of living arrangements that incorporates both partnership situation and household composition. For example, living alone, cohabitation and the presence of children in the household have been found to be associated with health.

This study uses linked register data to analyse mortality differences in the Finnish adult population in 1996–2000 according to living arrangements. In addition to total mortality, we examine cause-of-death patterns of these differences in order to enhance our understanding of the mechanisms whereby living arrangements affect the risk of death. Moreover, we examine mortality variation according to number of children and official marital status as well as their interactions with living arrangements in order to elaborate their connections and relative importance. By adjusting for socioeconomic factors, we also assess to what extent mortality differentials according to different aspects of family situation arise from selection on the basis of socioeconomic position.

Data and methods

Participants

The study population consists of all persons aged 30 or over who were included in the Finnish population census at year-end 1995. A 5-year mortality follow-up of each member of the study population was carried out by linking the cause-of-death registers for 1996–2000 with the census records. More than 99.5% of all deaths in Finland during this period could be linked. The linkage was carried out by Statistics Finland based on the personal identification code, which was erased from the data before making them available to the researchers.

We excluded people living in non-private households (1.4% of all person-years). In addition, we excluded persons with missing information on marital status, household size or household composition, as well as married women and men who according to the population census, did not live together (altogether 1.3% of all person-years). After these exclusions, the dataset includes 15.7 million person-years and 210,139 deaths.

Variables

The exposure variables are based on information drawn from the population records at the beginning of the follow-up. Living arrangements were classified into four groups: (i) married, (ii) cohabiting, (iii) persons living with someone other (or others) than a partner and (iv) persons living alone. Cohabited persons were defined by Statistics Finland as persons living in the same dwelling, aged 18 or over, of different sex, not being siblings and with an age difference not exceeding 15 years. This definition does not cover same sex partners, and on the other hand some persons who do meet these criteria do not in fact live in a relationship. Number of children below the age of 18 was classified in three groups: (i) no children, (ii) one child and (iii) two or more children. Marital status was categorized as (i) married, (ii) single, (iii) divorced or separated and (iv) widowed.

The analyses make use of three indicators of socioeconomic position. Educational categories were based on the highest completed educational degree or certificate. The seven categories were (i) basic education, usually less than 10 years of education; (ii) lower intermediate education, 10–11 years; (iii) higher intermediate education, 12 years; (iv) lowest level of tertiary education, 13–14 years; (v) lower-degree level of tertiary education, 15 years; (vi) Master’s level of tertiary education, 16+ years and (vii) doctorate or equivalent level of tertiary education.

Eight social classes were used: (i) upper white-collar, (ii) lower white-collar, independent work, (iii) lower white-collar, dependent work, (iv) skilled manual, (v) unskilled manual, (vi) farmers, (vii) other self-employed and (viii) students, others and unknown. Unemployed and retired persons were classified according to their previous occupation; other economically inactive persons whose main activity was household work were categorized according to the occupation of the head of the household. Persons aged 30–64 years were further classified according to their main activity during the year preceding the baseline. Three categories were distinguished: (i) economically active, including people who were working or unemployed and seeking work, (ii) retired, including persons on disability or old age pension and (iii) others, including home makers (mostly housewives), students and other family members and persons whose source of income was not known.

Age was classified into 5-year groups from 30–34 to 85–89 years. The oldest age group consisted of all persons aged 90 or over.

Information on cause of death is based on the Finnish modification of the ninth revision (for deaths in 1996) and tenth revision (for deaths in 1997–2000) of the International Classification of Diseases and Causes of Death. Causes of death were further classified into 11 groups for women and 10 groups for men. Alcohol-related causes of death included alcohol-induced diseases of the nervous system, myocardium and digestive system as well as poisonings and foetal injuries caused by alcohol (ICD10: F10, G312, G4051, G621, G721, I426, K292, K70, K860, K8600, O354, P043, X45).

Statistical methods

The deaths and person-years were cross-tabulated according to each variable simultaneously. The cross-table was analysed by means of Poisson regression using Stata 8, with the cell as the unit of analyses. Each cell in the table included information on the number of deaths and the number of person-years lived. The results of the Poisson regression models are presented as relative mortality rates (RR). The analyses were carried out separately for women and men in the age groups 30–64 years and 65 years or over. The percentage change in the association between living arrangements and mortality after adjusting for other variables was calculated as \[
\frac{\text{RR}_{\text{base model}} - \text{RR}_{\text{base model + additional variables}}}{\text{RR}_{\text{base model}} - 1}] \times 100.
\]

Results

Table 1 describes the numbers of person-years and deaths, as well as basic sociodemographic characteristics according to
Living arrangements and gender in two age groups. Over 60% of women and men in the age group 30–64 years were married while each of the other three living arrangement groups accounted for 10–15% of the population. Among women aged 65 or over, less than 40% were married, nearly one-half lived alone and 13% lived with someone other than a partner. Among men aged 65 or over, over 70% were married, almost 20% lived alone and 6% lived with someone other than a partner. In this age group only 2% were cohabiting.

All-cause mortality by living arrangements
Among women and men aged 30–64 years, cohabiters had nearly 70% excess mortality when compared with married people (Table 2). Mortality among men living with someone other than a partner and among men living alone was three times as high as among married men. In women, the corresponding excess mortality was lower resembling that of cohabiting women. In the older population, relative mortality differences by living arrangements were smaller: mortality in other groups was 35–40% higher than in married persons, except for older women living alone whose mortality was only 15% higher than the mortality of married women aged 65 or over.

Adjusting for the three indicators of socioeconomic position reduced the excess mortality of non-married groups by 21–31% in the age group 30–64 years and by 7–14% in the older age group, with each socioeconomic measure contributing equally.

Cause-specific mortality differences
The excess mortality of cohabiters, persons living with someone or some people other than a partner and persons living alone as compared with married persons was observed in almost all causes of death (Table 3). In lung cancer the relative mortality rates roughly corresponded to those observed for all causes of death.
death or, among women they were even higher. Mortality from breast cancer and other cancers, on the other hand, varied only little according to living arrangements. In alcohol-related causes of death the relative mortality of non-married groups was higher than in any other cause of death, except for the groups of older women living with someone other than a partner and those living alone. In working aged women, all non-cancer causes of death showed a clearer mortality difference between the non-married groups and married persons than was observed in total mortality. In working aged men, only mortality from alcohol-related causes, ‘other diseases’ and other accidents (excluding alcohol poisonings) showed wider differences than were observed in total mortality. In the older age group mortality differences were particularly pronounced in accidents for both genders, and in lung cancer for women and in alcohol-related causes for men. Older persons living alone also had high mortality from suicide.

**Number of children**

Among working aged women and men, having no children was associated with a large excess mortality in all living arrangement groups not living alone (Figure 1). Compared with persons in the same living arrangement category with at least two children in the household, the relative mortality of childless persons ranged from 1.4 in cohabiting men to 2.0 in cohabiting women when age and socioeconomic position were adjusted for. Those who had two or more children had somewhat lower mortality than those with only one child.

**Official marital status and living arrangements**

In both the working aged and the older population, mortality was lower among widowed than among single and divorced persons when socioeconomic factors were adjusted for. This finding was replicated in each of the non-married living arrangement classes, except for the group of older cohabiting women (Figure 2). Divorced men had the highest mortality in both age groups and in each living arrangement group except for older cohabiting men. In women, there were only marginal differences in the mortality of divorced and single persons.

**Discussion**

**Contribution of the main findings to the earlier literature**

Several earlier studies have shown that non-married persons and those living alone have higher mortality than married persons and those who do not live alone. Mortality research using more detailed classifications of living arrangements has been scarce and often limited to women or men in a fairly narrow age band. Little is known, for example, about the mortality of persons living in consensual unions and on cause-specific mortality by living arrangements.

We observed wide variation in mortality according to living arrangements in both the working aged and the older Finnish population. Persons living in a consensual union and those living with someone other than a partner had approximately

**Table 2 Relative mortality by living arrangement, gender and broad age group in 1996–2000 standardized for age and socioeconomic characteristics**

<table>
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<tr>
<th>Age Group</th>
<th>Marital Status</th>
<th>Relative Mortality</th>
<th>95% CI</th>
<th>Marital Status</th>
<th>Relative Mortality</th>
<th>95% CI</th>
<th>Marital Status</th>
<th>Relative Mortality</th>
<th>95% CI</th>
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<th>Relative Mortality</th>
<th>95% CI</th>
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<td>1.57</td>
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<td>2.56–2.72</td>
<td>2.53</td>
<td>2.45–2.62</td>
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Table 3 Relative mortality by living arrangements, gender, broad age group and cause of death, standardized for age and socioeconomic characteristics

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<th>Other cardiovascular diseases</th>
<th>Lung cancer</th>
<th>Breast cancer</th>
<th>Other cancer</th>
<th>Alcohol-related causes</th>
<th>Other diseases</th>
<th>Suicide</th>
<th>Other accidents</th>
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<td>1.08 0.95–1.22</td>
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<td>1.61 1.29–1.99</td>
<td>1.18 1.04–1.34</td>
<td>1.18 1.08–1.28</td>
<td>3.03 2.59–3.55</td>
<td>2.06 1.84–2.30</td>
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<td>1.19 1.03–1.38</td>
<td>7.21 4.50–11.5</td>
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<td>0.88 0.49–1.56</td>
<td>1.40 1.34–1.46</td>
<td>1.17 0.72–1.90</td>
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<td>1.10 1.06–1.14</td>
<td>1.60 1.42–1.82</td>
<td>1.18 1.06–1.30</td>
<td>1.11 1.06–1.15</td>
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<td>1.07 1.03–1.11</td>
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<td><strong>Men aged 65+</strong></td>
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<td>Married</td>
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<tr>
<td>Cohabiting</td>
<td>1.27 1.17–1.38</td>
<td>1.20 1.07–1.35</td>
<td>1.43 1.23–1.67</td>
<td>–</td>
<td>1.24 1.12–1.38</td>
<td>3.46 2.57–4.66</td>
<td>1.28 1.16–1.41</td>
<td>1.34 0.84–2.13</td>
<td>1.81 1.45–2.25</td>
<td>1.31 1.25–1.37</td>
</tr>
<tr>
<td>Persons living with someone other than a partner</td>
<td>1.30 1.24–1.37</td>
<td>1.23 1.15–1.32</td>
<td>1.31 1.18–1.46</td>
<td>–</td>
<td>1.08 1.01–1.16</td>
<td>3.42 2.70–3.44</td>
<td>1.39 1.31–1.46</td>
<td>1.30 0.95–1.78</td>
<td>1.76 1.54–2.02</td>
<td>1.30 1.27–1.34</td>
</tr>
<tr>
<td>Persons living alone</td>
<td>1.36 1.32–1.40</td>
<td>1.26 1.21–1.32</td>
<td>1.37 1.28–1.46</td>
<td>–</td>
<td>1.13 1.09–1.18</td>
<td>3.56 3.03–4.19</td>
<td>1.26 1.21–1.30</td>
<td>1.84 1.54–2.20</td>
<td>1.79 1.64–1.96</td>
<td>1.31 1.28–1.33</td>
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</table>

*Education, occupational class and employment status (in age group 30–64).*
the same level of mortality, considerably higher than the mortality rate for married persons. Mortality was clearly lower among cohabiting persons than among those living with someone other than a partner only in working aged men. In the working aged population persons living alone had the highest mortality, but older men living alone did not differ from other non-married groups and older women living alone had only slightly higher mortality than married women. Mortality differences according to living arrangements were roughly similar in each marital status group. Adjusting for socioeconomic factors attenuated the mortality differences only slightly, which is consistent with earlier results. 16,20,21,23

The largest relative differences were observed in deaths from alcohol-related causes. Moreover, wide differences were observed in accidents among men and working aged women and lung cancer in women. Earlier Swedish results have emphasized the contribution of excessive alcohol use and various types of accidents and violence to the excess mortality of working aged men living alone. 17 According to our findings, deaths caused by alcohol use or accidents also play an important role in the excess mortality of cohabiting persons and those living with someone other than a partner. In addition to working aged men, this is seen in working aged women and in the older population. However, other causal factors also play an important role as clear mortality differences are seen in causes not closely associated with excessive alcohol use.

It has been reported that persons not having children have higher mortality than persons who do have children but most previous studies have only dealt with women. 13,24–26 Very little work has been done to address the possible confounding or mediating impact of other aspects of living arrangements as well as socioeconomic position on the association between parity and mortality. In our data, having no children aged 17 or under in the household was associated with high mortality in working aged women and men in each living arrangement class when socioeconomic status was adjusted for.

Interpretation of the findings: selection or causation?
Explanations of mortality differentials by living arrangements can be divided into two broad categories, namely those referring to direct or indirect selection and those assuming a causal effect of living arrangements on health. 3,4,8–10 Direct selection refers to processes that increase the likelihood that persons with poor health remain or become non-married, remain childless or will live alone. There is evidence from several studies that direct selection contributes to the observed mortality differences. 17,27–30 The contribution of this type of health-based selection to mortality differences cannot be
estimated in more detail on the basis of our data which provide no direct information on the subjects’ health career. However, a major part of the persons who are most likely to be affected by direct selection are not included in our data as they live in institutions, and many of those with a serious illness from early age probably belong to the group who live with someone other than a partner. Thus, the effects of direct health-related selection on the mortality differences between married persons, cohabiters and those living alone are likely to be small.

Indirect selection refers to factors that affect both health and living arrangements. For example, in Finland less-educated
men are less likely to get married than those with a higher level of education. People with poor health habits or psychosocial characteristics, such as alcohol problems or hostility, are also likely to be subject to indirect selection since they may be unable to find a partner, or their partnership is more likely to end. In our analyses, the excess mortality of the non-married living arrangement groups was reduced by approximately one-quarter among the working aged and by 10% among the older persons when education, occupation and employment status were adjusted for. Our results and those from earlier studies indicate that material socioeconomic factors account for only a small part of the living arrangement differences in mortality. The wide differences in mortality from alcohol-related causes may partly result from selection of persons with drinking problems into the non-married groups. Our data do not allow for an assessment of indirect selection on the basis of psychosocial characteristics.

The causal effects of living arrangements on health and mortality may be mediated through various mechanisms, including the economic advantages of being married, social support and social integration and control provided by marriage and other living arrangements including a proximate adult or children. Furthermore, the termination of a partnership is a stressful life event and thereby appears to predispose to poor health. Living alone may also cause stress if this is not based on the individual’s free choice.

Different kinds of support from the partner and other members of the household are thought to have a major role. We assumed our classification of living arrangements to be a rough ordinal scale indicator of social bonds and the availability of support within the household. Being married and living in a consensual union imply that the person has a partner who may provide support and comfort. Marriage, in particular, may reflect a long-term commitment between the spouses. Similarly, living with someone other than a partner may often mean that the person has access to emotional, instrumental and material support. Living alone means that there is no immediate support available in the household.

In working aged men, mortality increased monotonously according to our indicator of living arrangements. The lowest mortality was observed for married men, followed by men living in a consensual union. Men living with someone other than a partner had higher mortality than those with a partner, and the highest rate was observed in men living alone. In working aged women, however, cohabiters and persons living with someone other than a partner had similar mortality rates. Furthermore, there were no mortality differences between the three non-married groups of older men, and mortality among older women living alone was clearly lower than in the other two non-married groups. Our findings thus reinforce the importance of social support as a cause of mortality differences according to living arrangements particularly among working aged men. In the older population, living arrangements either do not reflect the availability of support in a similar way, or other determinants of mortality associated with living arrangements gain in importance as people grow older. In particular, being able to live alone at older ages demands a certain basic level of health and functional ability.

Due to its unofficial nature, the measurement of cohabitation is difficult and never entirely accurate. The definition of cohabitation applied in our data has obviously resulted in the misclassification of some persons. However, it is unlikely that this has significantly affected our results. In the working aged population, the prevalence of cohabiting obtained from these data for the beginning of 1996 (11% in women and 13% in men) corresponds very well with that obtained from survey data for 2000–2001 (13% in women and 14% in men).

For many cohabiting persons, the partnership is likely to provide less social support than married partners generally enjoy. Cohabiting persons may choose not to marry if they feel that they have a poor quality relationship or if they are not even serious about making a long-term commitment. However, the decision of cohabiting persons not to marry may also be connected with their low level of education, low income, unemployment or other perceived financial obstacles. Our adjustments for the level of education, occupational class and employment status may not have fully controlled for all these associations. Furthermore, consensual unions, whether childless or not, are more likely to break up than marriages, and many of the persons cohabiting at baseline may have separated from their partner during the follow-up. Consequently, the mortality difference between cohabiting and married persons is likely to result partly from factors other than social support.

The social support and social control provided by marriage and the family may affect people’s health partly via health behaviour. Many healthy habits are more common among the married persons than among other marital status groups or those living in a consensual union, and having children also seems to be associated with health-promoting life styles. However, health-endangering behaviour, such as heavy drinking and smoking, may also be a selective factor that both increases the risk of death and the probability of remaining single or becoming separated from one’s partner and family. Earlier results concerning the importance of selection as a reason for excessive alcohol consumption among the non-married groups are inconsistent. In our data, mortality differences according to living arrangements were observed in all cause-of-death groups but the relative mortality differences were by far the highest in alcohol-related causes of death, followed by those in other accidents, suicides and ‘other diseases’ which may also quite often be related to excessive alcohol use. In Finland, also the rapid increase in mortality differences between marital status groups seems to be largely attributable to an increase in alcohol-related causes of death in the non-married groups. The relative contribution of selective and causal mechanisms to the large mortality differences in alcohol-related causes of death cannot be assessed on the basis of our data.

Conclusion

We observed wide mortality differences according to living arrangements, particularly in the working aged population. Socioeconomic factors explained only a small proportion of the
differences. Excessive alcohol use seems to be one major cause of the mortality differences. Longitudinal settings including follow-ups of both living arrangements and mortality are needed to more accurately assess the relative contribution of selective and causal mechanisms leading to mortality differences by living arrangement.

KEY MESSAGES
- In the Finnish working aged population, mortality among cohabiters, persons living with someone other than a partner and persons living alone is 66–224% higher than among married people. In the older population, mortality in the other groups is 15–40% higher than among married persons.
- Having no children is associated with excess mortality in working aged women and men in each living arrangement group.
- Adjusting for education, social class and employment status attenuates the mortality differences by 7–31%. Excessive alcohol use seems to be one major cause of the mortality differences.

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