# Mortality and living arrangement: living alone, with family or in institution

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## Introduction

Mortality risks differ by types living arrangement, like living with others, living alone and living in institutionalized households. The latter classification is based on a widely used household concept that distinguishes people in private and non-private households, among the first group we find those living alone in a single-person household and those living with other people. The living arrangement as considered in this presentation describes the way how individuals are arranging their daily life in relation to co-resident persons with whom a close relationship exists. We will consider two complementary ways to describe this living arrangement. The first one is based on dichotomic variables and aims identifying the direct effect of living or not living with a spouse or partner, living alone, and living in institution to the risk of dying. The second one is based on the distribution of the population through a detailed household typology with additional information on marital status. As example, that typology will allow distinguishing persons who are single, widowed or divorced/separated among those living alone. All investigations are controlled by sex, age and level of education as these covariates are proved to have the strongest impact on the probability to die.

## Background

The links between marital status and mortality have been investigated by a large number of researchers and demonstrated the protective role of marriage (Manzoli et al: 2007, Rendall et al. 2011).

Comparing persons living alone, in married couple with or without children, in cohabitating non-married couples or with other persons in private living

arrangements is rather common (Davis et al. 1997, Koskinen et al. 2007). Several studies have investigated the mortality risks in nursing homes but without comparing the mortality levels in institutions with those observed in private households (Breuer et al. 1998; Cohen-Mansfield et al. 1999; Dale et al. 2001; Kiely & Flacker 2002; Raines & Wight 2002; Flacker & Kiely 2003; Hjaltadattir et al. 2011). Some recent researches go further in details of private living arrangements, considering not only marital status but also de fact partnership, considering that marital status does not reflect social reality any more (Drefahl 2010). However, very little is known about the mortality of persons in this group as it is mostly younger age groups involved in such living arrangements. The partnership unlike marriage seems to provide less protective support (Koskinen et al. 2007).

Socio-economic factors are considered as responsible on differences within the groups of persons with the same marital status or living arrangements. The studies confirm that socio-economic status has impact of mortality, particularly in case of non-married living arrangements (Drefahl 2010). Among these the level of education may play role in different ways, through attitude on healthy life style, marital status patterns etc. but also as a proxy indicator on wealth or poverty (Koskinen et al. 2007). Thus controlling by education would be an appropriate way to eliminate the selectivity within living arrangements groups and to consider the impact of the socio-economic status to mortality.

The main aim of this contribution is to analyse the variation of survival of elderly in various living arrangements that are either private households or collective households.

## Data and methods

Exhaustive Belgian data will be used for analyzing survival and mortality risk by living arrangements. By considering more than one million persons we will be able to consider a larger number of different living arrangements without being limited due to the too small numbers.

Based on the continuous population registration system we consider 1,743,784 persons aged 65 years and older that were alive on the 1st January 2002.

Information on these individuals was derived from the population registration system (age, sex and detailed living arrangement) on 1st January 2002 and the living arrangement is supposed to be invariant during 2002, the year of observation. Information on the education level is obtained from the census organized on 1st October 2001 and classified in two groups: the low educated for whom the age of end of scholarship was up to 14 included and the high educated that finish attending school at 15 years or later. Finally the deaths occurring during the year 2002 were recorded in the continuous population registration system. According to these data a total of 85,231 persons died in 2002.

Changes in living arrangement occurring during the year 2002 and mostly those related to widowhood, were considered but found to be not significant as impact on survival during the year 2002.

As far as the detailed typology of living arrangements is concerned we use the following one:

1. Persons living alone among which we consider four different groups according their marital status:
   - Persons living alone never married
   - Persons living alone that are widowed since more than 5 years (before 1997). The date of last widowhood was obtained from the population registration system.
   - Persons living alone that were recently widowed (during the last 5 years, since 1997)
   - Persons living alone that are either divorced or married but separated from their spouse.
2. Persons living in private household with other persons; among these persons we consider separately five different groups:
   - Persons living with their older spouse
   - Persons living with their younger spouse
   - Person living with a partner
   - Person living in one-parent family only with one or more child(ren)
   - Person living in another type of private household.
3. Persons living in collective or institutional household among the following categories:
   - Persons living in residential homes for elderly (without medical care)
   - Persons living in nursing homes for elderly (with medical care),
   - Persons living in convents and monasteries
   - Persons living in another institutional household (mainly psychiatric institutions and prisons).

The outcome variable will be a dichotomic variable considering the survival or not on 31 December 2002. We use binary logistic regression for predicting odds of dying during the year 2002 by 13 categories of living arrangements controlling by the basic demographic variables (age and sex) and the educational level as dichotomic variable representing high or low education. Age is considered as continuous variable (age 65 = 0). The reference groups are systematically chosen as those experiencing the lower level of mortality.

## Results

The distribution of the studied population by living arrangements on 1st January 2002 is shown in Table 1. From total observed population 64.2% are living with other persons, 30.4% are living alone and 5.4% in institutional residences.

***Table 1. Distribution of the population aged 65 years and over by types of living arrangements on 1st January 2002 according the population register***

| | Men | Women | All | % of total |
|---|---|---|---|---|
| Living with older spouse | 100040 | 289504 | 389544 | 22,3 |
| Living with younger spouse | 394741 | 117522 | 512263 | 29,4 |
| Living with partner | 17759 | 17018 | 34777 | 2,0 |
| Living with child only | 12723 | 56827 | 69550 | 4,0 |
| Living with other person(s) | 41517 | 72212 | 113729 | 6,5 |
| Alone never -married | 25787 | 32726 | 58513 | 3,4 |
| Alone widowed long time ago | 45461 | 250782 | 296243 | 17,0 |
| Alone widowed recently | 27617 | 77112 | 104729 | 6,0 |
| Alone other (divorced, separated) | 30085 | 40532 | 70617 | 4,0 |
| In residential home | 10114 | 40637 | 50751 | 2,9 |
| In nursing home | 5645 | 22375 | 28020 | 1,6 |
| In religious institution | 1862 | 7874 | 9736 | 0,6 |
| In other institutional residence | 1779 | 3533 | 5312 | 0,3 |
| All living arrangements | 715130 | 1028654 | 1743784 | 100,0 |

As presented in Table 2, mortality risks by age, sex and living arrangements show considerable differences over the groups based on these characteristics. Women have less risk to die in all cases compared to men. For the observed population the risk to die increases from less than 1 percent per year at age 65 up to 38 percent at ages over 90. The *logit* probability of dying follows a linear increase, what allows using the logistic regression for analysis.

The first analysis considers separately in different models the following dichotomic variables:

- Living with spouse or not
- Living with partner or not
- Living with child(ren) or not
- Living alone or with others
- Living in private household or in institutional household.

We run separate models for men and women and for each model we include age as continuous variable (age 65 = 0) and education (reference = high educated). The estimated odds ratios are presented in Table 3.

***Table 2. Mortality risks the population aged 65 years and over by types of living arrangements on 1st January 2002 (proportion of those who died during the year 2002) according to the continuous population registration system.***

| Men | 65 | 70 | 75 | 80 | 85 | 90 |
|---|---|---|---|---|---|---|
| Living with older spouse | 0,89 | 1,54 | 2,70 | 5,11 | 9,60 | 16,99 |
| Living with younger spouse | 0,94 | 1,54 | 2,91 | 5,34 | 11,25 | 18,30 |
| Living with partner | 1,29 | 2,03 | 2,95 | 6,18 | 12,34 | 21,96 |
| Living with child olny | 1,40 | 2,10 | 3,62 | 5,91 | 11,58 | 20,97 |
| Living with other person(s) | 1,48 | 2,04 | 4,22 | 7,48 | 14,17 | 22,91 |
| Alone never -married | 1,28 | 1,81 | 3,03 | 5,39 | 9,44 | 16,08 |
| Alone widowed long time ago | 1,20 | 1,81 | 3,02 | 4,99 | 9,20 | 17,73 |
| Alone widowed recently | 1,13 | 1,80 | 2,96 | 5,09 | 8,71 | 15,88 |
| Alone other (divorced, separated) | 1,35 | 1,87 | 3,17 | 5,92 | 9,73 | 17,26 |
| In residential home | 8,27 | 10,22 | 12,73 | 15,99 | 20,77 | 28,72 |
| In nursing home | 7,64 | 10,45 | 13,89 | 18,47 | 21,79 | 29,10 |
| In religious institution | 0,63 | 1,41 | 2,44 | 4,94 | 9,74 | 18,77 |
| In other institutional residence | 3,13 | 3,27 | 6,06 | 10,16 | 15,56 | 22,44 |
| Women | 65 | 70 | 75 | 80 | 85 | 90 |
| Living with older spouse | 2,14 | 3,41 | 5,97 | 8,47 | 15,76 | 20,75 |
| Living with younger spouse | 1,92 | 3,19 | 5,44 | 8,94 | 14,53 | 23,23 |
| Living with partner | 2,52 | 3,95 | 5,80 | 9,83 | 15,18 | 16,00 |
| Living with child olny | 3,09 | 4,35 | 6,58 | 10,75 | 15,94 | 26,85 |
| Living with other person(s) | 2,54 | 4,17 | 6,78 | 10,75 | 19,64 | 27,53 |
| Alone never -married | 3,10 | 4,58 | 7,18 | 9,94 | 14,89 | 20,79 |
| Alone widowed long time ago | 3,43 | 4,46 | 6,65 | 9,70 | 14,31 | 22,80 |
| Alone widowed recently | 3,40 | 5,07 | 7,31 | 9,77 | 14,70 | 23,37 |
| Alone other (divorced, separated) | 3,41 | 4,54 | 7,88 | 9,98 | 17,35 | 21,72 |
| In residential home | 11,80 | 16,27 | 22,07 | 23,60 | 28,77 | 38,22 |
| In nursing home | 12,50 | 16,89 | 24,73 | 25,25 | 32,29 | 38,64 |
| In religious institution | 0,94 | 2,07 | 3,96 | 7,39 | 17,37 | 32,26 |
| In other institutional residence | 5,03 | 8,96 | 10,78 | 16,39 | 24,43 | 34,78 |

***Table 2. Estimated odds ratios for dying during the year 2002 for different models considering separately a different covariate in addition to age and education.***

| | Men | Women |
|---|---|---|
| Living without spouse (ref with spouse) | 1,424 | 1,335 |
| Living without partner (ref with partner) | 1,018 | 1,013 |
| Living without child(ren) (ref with child(ren)) | 0,989 | 1,011 |
| Living not alone (ref alone) | 0,937 | 1,453 |
| Living in institutional household (ref private household) | 2,703 | 2,398 |

For men as for women, living with spouse is largely beneficial for surviving while living with partner shows a not significant positive effect. However the latter result can be explained by the fact that the larger part of those not living with partner are living with spouse. Living with child(ren) or not has not significant effect that could be opposed if men and women are compared. Living alone shows a clear opposition between men and women as this situation increases the mortality risk for men and decreases it for women compared to the situation 'living with others'. Living in private household is largely favourable compared to living in institutional household with odds ratios higher than 2 for both women and men. This preliminary analysis demonstrates that living in private household is better for both men and women while within those living in private household living alone is better for women while living with spouse favour the survival of men. The multivariate analysis will help to clarify this first result.

Thereafter we apply the binary logistic regression to the same outcome variable (dying in 2002 or not) and consider all explanatory covariates together including the multi-categorical variable describing living arrangement in detail. We use also the interaction between sex and living arrangement in order to obtain odds ratios for each living arrangement according the sex. Table 4 presents the estimated odds ratios and the relative gender gap computed by comparing these odds ratios for men and women.

***Table 4. Odds ratios to die during the year 2002 and relative gender gap (all are significant with a p < 0.001).***

| | Odds ratio | | |
|---|---|---|---|
| Age (65+) | 1,11 | | |
| Education level (high versus low) | 1,20 | | |
| | Women | Men | Relative gender gap |
| Living with older spouse (reference for women) | 1,00 | 2,20 | 2,20 |
| Living with younger spouse | 1,11 | 2,06 | 1,85 |
| Living with partner | 1,32 | 2,34 | 1,78 |
| Living with child only | 1,45 | 2,58 | 1,78 |
| Living with other person(s) | 1,71 | 2,63 | 1,53 |
| Alone never -married | 1,24 | 2,70 | 2,17 |
| Alone widowed long time ago | 1,20 | 2,34 | 1,95 |
| Alone widowed recently | 1,13 | 2,54 | 2,24 |
| Alone other (divorced, separated) | 1,29 | 3,00 | 2,33 |
| In residential home | 3,26 | 6,31 | 1,94 |
| In nursing home | 3,45 | 6,75 | 1,95 |
| In convent | 1,27 | 2,02 | 1,59 |
| In other institutional residence | 2,24 | 4,59 | 2,04 |

Firstly, we observe that the effect of educational level is important, for the persons with the lower level of education odds of dying is 20% higher.

Odds ratios are estimated considering women living with older husband as the reference. The results support the idea that the survival for both members in a couple is improved if the men are older than the women, what is often observed. For the opposite situation where men are younger than their spouse and women older, the odds ratios are 11% higher for women and 7% for men (2.20 compared to 2.06). As a result the relative gender gap between spouses in married couples is less important (2.20/1.11 = 1.99) when the men is younger compared to the situation when he is older (2.06/1 = 2.06).

According to our analysis living with partner outside of marriage is clearly less favorable in older ages than living with married partner. The odds ratio of dying is respectively 1.32 for women and 2.34 for me showing a lower relative gender gap (1.78). Nevertheless for both men and women this living arrangement is less favorable than living with spouse: 20-30 % higher mortality risk for women and only 10% higher for men. Accordingly living with partner is less unfavorable for men compared to women.

Where spouse or partner was not available, we were able to estimate the impact of living with child(ren) or not. The odds ratio to die for women with child(ren) only is 1.45 that is 45% compared to living with older husband while for men the odd ratio is 2.58 is only 25% higher than for those living with younger wife.

For women the worse situation in private living arrangement is for women living with other persons, a situation that includes women living in the family of their child as well as with persons with whom they do not have close relationship. The odds ratio of dying is 1.71 for them. For men the situation is also unfavorable for survival but the relative gender gap is the lowest for that living arrangement showing that such living arrangement is relatively more favorable for men compared to women.

According to literature living alone generally associates to lower risk to die for women. In our results, for persons living alone whatever their marital status in this living arrangement the odds to die that are higher compared to those living with spouse. Among persons living alone being widow or widower is associated with lower odds to die. The higher chance to survive concerns recent widows with odds ratio just a little higher than that for women living with a younger spouse. At the opposite, for widowers the odds ratios to die are higher for those recently widowed. Those living alone and never married show intermediate values for odds ratios between widowed and those who are divorced or separated for whom the highest odds are observed.

As observed by other researchers, living in institution is associated with largely higher odds to die; the increase compared to the reference group (younger women living with spouse) is more than 3 times in both types of collective households for elderly. Therewith, odds ratio for women in nursing homes with medical care is higher than that for women in residential homes. The odds to die for women in

convent is largely lower than in other institutional living arrangements. Moreover, these odds are comparable to those in category 'alone' for women and even better compared to those living with wife for men. That proves our suggestion of heterogeneous composition of people having been classified under institutional living arrangements.

## Conclusions and discussion

Our aim in this analysis was to consider the effects of living arrangement on the risk to die: to what extent the probability of dying, controlling for the effects of sex, age and education varies by living arrangement?

The effect of educational level is important, for the persons with the higher level of education the odds of dying considerably lower. Even when controlling these variables, living arrangement keep explanatory power. However, effect of living arrangements to mortality differs between men and women and due to that the gender gap varies as well. With the exception of living in religious institution, the lowest odds to die for men associate to living with wife. The survival for both is improved if the man is older than the woman. Nevertheless the relative gender gap between spouses in married couples is smaller when the men is younger compared to the situation when he is older.

Living with partner outside of marriage is clearly less favorable in older ages than living with married partner but it is less unfavorable for men compared to women.

Women living alone have a slightly higher risk to die compared to those living with older husband (reference group), while for men to live alone is more unfavorable compared to living with spouse. This situation is also reflected by the highest gender gap in all types of living alone except that of between men and women who are widowed for long time.

For women the highest risk to die when having private living arrangements is to live with other persons. Even if for men this situation is also unfavorable for survival, the relative gender gap is the lowest showing that such living arrangement is relatively good for men compared to women. The same seems to be valid also when living with child only.

We observe strongly higher risk for both men and women living in institutional residencies compared to other living arrangements but with exception those living in religious institutions. The odds ratio to die for women in convent is close to those living alone while for men in monasteries the odds are lowest compared to any other living arrangements. Nevertheless, the gender gap of those in residential and nursing homes is considerably lower compared to most situations of living alone suggesting that elderly men in the institutional living arrangement are going somewhat better than women while women are better alone.

With inclusion of the marital status of those living alone, considering never married distinctly from widowed and divorced or separated the background of relatively low risks of dying for persons living alone can enlighten. We observe considerable differences in odds of dying for men with the stronger effect to those never-married and divorced or separated. The gender gap is highest for these two categories as well.

Further details can be added on living arrangements as the impact of living with child is only partly covered in this study. Moreover, as the size of the population under study is very large, it is possible to run models for men and women separately as well for 5 years age groups that will allow identifying variations of the impact living arrangement by age-groups and sex.

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