Living arrangements, health status and mortality risk among the aged in Belgium, 2002

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Mortality in the institutionalized aged population is generally recognized as being considerably higher than among those living in private household; whereas among the latter population, there is a greater risk of mortality among those living alone than among those living with other adults (generally with spouse and / or children). However, given that the institutionalized population is generally in poorer health compared to the independent-living population, it is unclear whether the higher mortality risk among the institutionalized population results from their poorer health, or from other causes associated with institutionalization. The Belgian Census of 2001, coupled with a near-complete follow-up of deaths over the subsequent year (2002), enables us to compute a reasonable measure of health at the time of the census and thus separate out the effects of health status and living conditions on mortality. Taken across the entire Belgian population (Belgian nationals only) aged 65 and above at the time of the census (N = 1.64 million cases with full data), and controlling for background characteristics including education, we find that:

1. Men have higher mortality than women
2. The logit of the mortality risk increases linearly with age
3. The mortality risk declines as health status improves
4. The mortality risk decreases as the level of education increases
5. Those living in institution have a higher risk of mortality than those living in private housing, *irrespective of health status*

This last conclusion is prominent: even if much of the apparently higher mortality of the institutionalized aged population may be attributable to the generally poorer health of those living in institution, there is nonetheless a higher mortality risk in institution. In the discussion, we suggest the existence of a *salutogenic* effect of living independently in private housing, whatever the individual's health status.

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1. Introduction

Mortality of the institutionalized elderly population is generally recognized as being considerably higher than that living in private household; among the latter group, there is a greater risk of mortality among those living alone than among those living with other adults (generally with spouse and / or children). Given that the institutionalized population is liable to be in poorer health than the independent-living population, it is still unclear whether the higher mortality risk among the institutionalized population results from their poorer health, or from other causes associated with institutionalization. This contribution will address this question by analyzing the way mortality risks vary by age, sex and living arrangement and controlling the impact of the health status.

2. Living arrangement, health and mortality risks

A large number of studies have investigated the links between marital status and mortality and enhanced *inter alias* the protective role of marriage (MANZOLI et al: 2007, RENDALL et al. 2011). Mortality risk differs also by living arrangement when comparing persons living alone, in married couple with or without children, in cohabitating non-married couples or with other persons (DAVIS et al. 1997, KOSKINEN et al. 2007). Nevertheless most mortality studies differentiating the impact of types of private living arrangement on mortality do not include in their approach the living arrangement in collective household or institution. In parallels several studies investigate the mortality risk in nursing homes with the date of entry as starting point but without comparing the mortality levels with the ones observed in private households (BREUER et al. 1998, COHEN-MANSFIELD et al. 1999, DALE et al. 2001, KIELY et al. 2002, RAINES et al. 2002, FLACKER et al: 2003, HJALTADATTIR et al. 2011). The only attempt comparing the two main types of living arrangement, private or collective household, is proposed by GRUNDY (2010) who studies the survival during 5 years for persons extracted from the Office for National Statistics Longitudinal Study that were enumerated in 1981, 1991 and 2001 as being in institution. Her findings show an incidence risk ratio for residents in institution in 2001 of 2.85 for women and 2.80 for men and a deterioration of that situation between 1991 and 2001.

Obviously the role of health as intermediate variable is important (LILLARD et al. 1996, RAPP 2011). The mortality risk is correlated with the health status, the latter being approached most often through the self-rated health index (SRH) (IDLER et al. 1997). Among others, ZUNZUNEGUI (2001) showed that the SRH varies between different types of private living arrangements while MURPHY (1993) investigated

the link between those private living arrangements and health. But none of these authors considered the collective household or institution. On a different aspect, several authors demonstrated that health is an important determinant for the choice of living arrangement (BÖRSCH-SUPAN et al. 1996).

As the deterioration of the health status is the main reason for entering in institution (KLEIN 1996, NIHTILA et al. 2008), the health status is found to be largely worse for those living in institution compared to those living in private household.

Accordingly the question that emerges is whether the difference in health status observed by age and sex between different living arrangements could explain the differences in mortality risk between the same groups. In other words, what could be the remaining impact of the living arrangement on mortality if controlled by health status? That question is of particular importance when considering the need to support policies in the field.

3. Data

The Belgian data gives the opportunity to investigate more closely the impact of health on the difference of mortality risk by living arrangement. All residents of Belgium enumerated at the Census on the 1st October, 2001 who were still alive at midnight of the 31st December, 2001 according the continuous population registration system. 1,64 million persons aged 65 and above are considered. Information on these individuals was derived from two sources:

a. personal status information was derived directly from the population register: sex, date of birth and household characteristics to identify the living arrangement as on 1st January 2002.

b. other social and personal information was as reported by the individual in the 2001 census forms and will be used to assess the individual health status and the level of education. Nevertheless of these individuals, 30,659 (less than 2%) did not submit a census form and only population registration data is available. However, as we shall see, it will be possible to impute a value for the proposed health indicator for those who did not fill the census form. For the level of education in addition to those who did not fill the census form, 248,801 persons did not answer. Fortunately for a large part of these we were able to find a similar information from the 1991 census.

The outcome variable, the probability to die during the year 2002, is also observed with the continuous population registration system; the survival during the whole year 2002 is checked: a total of 85,223 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 far as mortality is concerned. Unfortunately changes occurring in the health status were impossible to observe and accordingly we considered that health status is constant meaning that we assume that changes of health status occurring in 2002 could be neglected and do not affect our results.

For living arrangement we will limit our investigations to three main groups: those living with others, those living alone and those living in collective household. The latter category includes nursing homes with or without medical care but also convent, psychiatric institutions and prisons. Fortunately, above 60, the majority of those living in collective household are in nursing homes and the limited number of persons living in convent could be assimilated to those living in nursing home. Nevertheless those who had a short stay in institution because they die quickly after institutionalisation suffer from under-coverage that could result in under-estimating the mortality risk in institution.

Health status is collected through four census questions, the self-rated health status (SRH), the disability status (disable or not) and, for disable only, the impact on daily activities and the intensity of bedridden. For the purpose of the analysis we will use in the first round the SRH as indicator of the subjective health status. In the second round a combined single health indicator will be computed based on all four census questions in order to assess the health status based on both subjective and objective information.

The census questions are the following:

1. SRH (on a five point scale from 'Very Good' to 'Very Poor'). Not all respondents answered this question and, as noted above, a further group of persons, for whom we have information from the population register, did not return a census form. Obviously this last group has no response on any of the health questions.

2. Does the respondent suffer from any chronic disease or disability? – 'Yes' or 'No'. This was a filter question and those that answered yes were asked:

a. to what extent they were limited in their daily activities, on a three point scale from 'Little' to 'Severely'. Nevertheless one third of respondents who answered 'Yes' to question 2 did not answer to this question 2a.

b. to what extent were they bedridden, again on a three point scale from 'Little' to 'Severely'. As for daily activities, about one third of the

respondents who answered 'Yes' to the filter question, did not answer this one.

We thus have three separate health questions: Self Rated Health (SRH); Limitations to daily activities (L) and being Bedridden (B). The filter question on chronic diseases is included in the last two questions, as all those who reported having no chronic disease were automatically put in the null category on the last two questions.

In order to consider the relation between the three health questions we performed a Multiple Correspondence Analysis (MCA) (Venables & Ripley, 2002; Greenwood & Blasius, 2006; Dray & Dufour, 2007). MCA is an extension of the two-way Correspondence Analysis (CA) that seeks to represent graphically the conditional distributions within each category of the different variables. Each variable is divided into categories, and in each category there is a distribution of the categories of all the other variables. The categories that have similar distributions of the other variables will be proximately located in the plot and those that have dissimilar distributions will be further apart. Respondents who did not return a census form naturally had the same response on all variables, and they were excluded at this point from the analysis. However, as we may consider that majority of these non-respondents to have serious health limitations, we shall reintroduce them afterwards at the poor health end of the scale we are creating.

Figure 1 presents the MCA plot for this analysis. The three variables present three overlapping scales running from left to right on the first dimension, with poorer health on the left and better health on the right. The three categories of non-response are located in the middle of this scale, but are placed off the scale on the second dimension. Nonetheless, this location does suggest that, *on the average*, the non-responses should be regarded as being of average condition, and cannot be supposed to be people in particularly bad health. MCA also locates the cells of the cross-tabulation of the three variables on the same set of axes as the category labels, thus enabling us to locate each cell in relation to the scale generated by the location of the category labels. We treat the first dimension of the MCA plot as the value of this scale, ordinally locating the category labels, and therefore the cells, in relation to each other, and we may thus assign a scale value to each cell. Of the 150 possible combinations (6 categories of SRH * 5 categories each of Disability and Bedridden) there were 102 actual cells, and these were assigned raw scores ranging from -1.72 (extremely poor health) to 1.06 (no reported health problems). The 36,777 persons who did not return a census form were assigned a score of -1.7, reflecting their assumed very poor health, which prevented their returning the census form.

For each cell, composed of 6 to 608,300 individuals, we computed the probability of dying during the year 2002. Figure 2 plots these probabilities against the scale value, with points sized relative to the square root of the number of people in the cell. The relationship between the two is clearly monotonic, but curvilinear. The line gives the binomial regression of the proportion dying against the log of the scale (adding 2 to avoid negative numbers). There is, as can be seen, a remarkably good fit (pseudo-R^2 = 0.841) between the value of the health index and the proportion dying, thus giving *prime facie* validity to this index. Finally, for ease of interpretation, we rescaled log(index + 2) to have a value from 0 (poorest health) to 100 (best health). It is to be noted that this index was defined *without* reference to the proportion dying by level of the scale, and these proportions were used only for validation and for a monotonic, and hence order maintaining, transformation of the scale.

That combined health indicator will be considered as a continuous variable ranking from 0 meaning no disability to 10 for those who perceived themselves in very bad health, are strongly hampered in their daily life and stay permanently in bed. A special attention will be devoted to missing data for the health status either because the census form was not filled or some answers to the health questions were missing.

Of the total recorded population, 85,223 died during the calendar year 2002. In the following pages we seek to ascertain the main variables predicting death and hence identifying the major groups at risk with a special emphasis on the role of the living arrangement after controlling the difference in health status.

4. Results

(Ongoing investigation including the level of education will be added)

This data set was linked to the outcome variable: persons who died during the calendar year 2002 and our analysis focuses on the probability of dying during that year. We commence by considering how sex, age and the living arrangement observed on 1st January 2002 influence the probability to die during the year 2002, and then we will consider multivariate models predicting the probability of dying during the year including the health indicator.

Age, sex and living arrangement

The probability to die increases from less than 1 percent per year at age 60 to over 40 percent at ages over 100 and the logit probability of dying follows a linear increase. At all ages men maintained mortality rate considerably higher than that of the women (Figure 3). The overwhelming majority of the population (69.4 percent)

were living with others in private households. A quarter (25.6 percent) of the population was living alone, and the remaining five percent was classified in the population register as living in collective, non-private households. As shown in Figure 3 the mortality risk was lower among those living with others than among those living alone and was considerably higher among those living in collective households and the later observation is valid for all age groups and sex.

Inter-correlations

Considering the above estimates of the mortality risks there must certainly be close correlations between the various independent variables. Women survive longer than men, and the over-representation of women increases with age. Similarly, those living in institutions will have been selected on the basis of health, amongst other considerations, so that any attempt to identify the effect of one of these variables must take into account, and control for, the effects of other variables. To see the inter-correlations between these variables, Figure 4 presents a violin plot (Hintze and Nelson, 1998) of the health index by sex and living arrangements. This is an extension of the standard boxplot (Tukey, 1977), with the width of the "violin" reflecting the relative frequency of cases at the different levels of the dependent variable in each group. Unfortunately, these plots do not reflect the relative sizes of the groups. The distribution of the health measure is similar in the two independent living arrangements, with a heavy concentration at the high end and very few people at the very poor end of the spectrum. Men living with others have, on the average, the highest median level of health, while those living alone have a lower median level of health, on a par with that of men and women living alone. Those living in institution present a very different pattern. The median level of health is intermediate, reflecting the presence of many in good health, as well as a relatively large numbers of people in poor health. However, although those in institutions are, on the average, of lower health, the main difference between those in independent and institutional living arrangements is in the spread of the health conditions. The institutionalised population shows a far more symmetric spread to include all health conditions, whereas for those living alone or with others the modal condition is one of good health, and it is rare for them to be in very poor health.

Modelling Mortality

Table 1 presents the main effects binomial regression model of the probability of dying during 2002, as a function of age, sex, health and living arrangements. As we have a clear directional hypothesis concerning the effect of each variable, we present one-tailed confidence intervals for the exponentiated coefficients, all of which are significant at $p < 0.001$. The underlying risk, for men aged 60, in poor

health and living with others, is 0.00021 (21 / 100,000). The probability is about a half this value for women, is about ten percent higher for those living alone, and about double for those living in institutions. Judging by the probability (z) values, however, the main effects are undoubtedly those of age and health. Mortality increases by about ten percent for each year of age, and decreases by about two and one half per cent for each unit increase in the health index. Our first conclusion, then, is that institutionalisation and ill-health operate independently to increase the probability of dying, with institutionalisation doubling the mortality risk, and ill health (0 on the health index) increasing the risk by a factor of almost 12 (0.976^{-101}) relative to best health (100 on the health index).

Model 2 presents a model with interactions, nesting age and health within sex and living arrangements. The coefficients are identical to those obtained from six separate regressions, one for each combination of sex and living arrangements, but enabling statistical comparison between the columns. Intercepts refer to men or women, living with others, alone or in institutions, at age 60 and at the worst level of health.

i. For men, the confidence intervals for those living with others and in institutions clearly overlap, while those living alone have a higher mortality risk, in particular higher than those living with others. For women, those living with others and alone have lower mortality, comparable to that for men living with others, while those in institutions have significantly higher mortality, comparable to that for men living alone.
ii. The effects of age (at health index = 0) are indistinguishable for women in the three forms of living arrangements, and for men living with others. The effect of age, however, is lower for men living alone and higher for those living in institutions.
iii. The effects of health follow a classic ANOVA pattern: as health improves the mortality risk decreases, and the decrease is greater for women than it is for men. This decline is also clearly ranked by type of living arrangement, with the mortality risk declining most among those living with others, less among those living alone and least among those living in institutions.
iv. The age-by-health interaction looks at the way the effects of health change with age. In general, as people grow older, there is a slight reduction in the beneficial effects of good health, or, otherwise put, the better health is, the greater the effects of age on the mortality risk. If we reinterpret this result, it says that at older ages there is a lesser contrast in the mortality risk between good and poor health than there is at younger

ages. This effect is weaker for men than it is for women; it is lower for those in institutions than for those living at home (with others or alone), and amongst women is slightly greater for those living with others than for those living alone. This interaction thus works to slightly offset the advantages previously noted for women over men, for health and for the different living arrangements.

Graphical representation

To see more clearly the implications of these results, Figures 5 and 6 present predicted mortality rates for men and women in the different living arrangement, by health and age respectively. Figure 5 presents (log) mortality rates by health, at ages 60, 70, 80 and 90; and Figure 6 presents (log) mortality rates by age, at health index values of 0, 33.3, 66.7 and 100. At all ages, mortality declines as health increases, men's mortality rates are higher than those for women, and there is a clear ordering of the risk, with those living with others having a lower mortality rate than those living alone, who in turn have a lower rate than those living in institutions. Men's mortality rates in institutions exactly correspond to women's rates when living alone. Furthermore, at all ages, the rate of decline is greater for living alone than for institutions and for living with others than for living alone, so that as health improves, the differences between the different living arrangements increase. Age operates in a similar fashion, but in the opposite direction: men's rates are greater than women's rates; institutions > living alone > living with others, and the rates converge as age increase, though not as noticeably as for health.

Partition Tree Analysis

The regression analysis above explores the contribution of each of the included variables to explaining the outcome variable (mortality) by positing a particular form of this relationship (linear logistic), estimating the strength of this relationship (the coefficient) and testing for the statistical significance of each variable's contribution. An alternative approach, proposed by Breiman et al. (1984) and implemented by Therneau and Atkinson (2011), is to partition the data into subsets so as to maximize the differences between the subsets, in terms of the mortality risk, and minimize differences within each subset. At each stage the data are divided according to the best breakpoint of the variable that best partitions the data, that is, the one that maximally reduces the unexplained variation in the dependent variable. Each subset is in turn partitioned, and so on until an optimal division of the cases is reached. However, while the purpose of these partitions is variable reduction, this procedure is a data-mining procedure based on the evaluation of all possible partitions, and thus is not amenable to statistical induction.

Figure 7 presents the partition tree of the probability of dying, by age, health, living arrangements and sex. The heights of the branches are proportional to the variance reduction entailed. The partition rule is indicated at each node, cases which match the rule (True) are in branches to the left of the node (lower mortality), those which do not (False) are to the right (higher mortality). The first node partitions by age (< 83.5 or ≥ 83.5) and the second by health. Note that at younger ages the critical health value is far higher than at older ages, indicating that at older ages only the most disabled are penalised in the sense that they have a higher mortality risk. The third level of partitions is also in terms of age and health, except for older people in medium to good health, for whom the partition is in terms of living arrangements (independent – low – versus institutionalised – high). Level 4 again partitions by age and health (for those ≤ 75.5 years) and level 5 partitions one branch by sex (women < men) and one by health. There is one level 6 division, by sex. The overall pattern is thus very clear, and matches well that presented in the regression analysis: the major factors affecting the mortality risk are age and health, followed by living arrangements, with independent living being better than institutionalisation, in particular at poorer levels of health.

5. Discussion

(the discussion on ongoing investigation on education will be added)

In the population under study, for people aged 65 years and over, the two most important explanatory variables are age and health status with equal contribution to the fitness of the general model. These two variables are strongly correlated even though a certain mortality risk does exist, also, for those who are still relatively young and in apparently good health. Women experience half risk to die compared to men (0.498). This level is obtained by controlling for age, health status and living arrangement.

Our aim in this analysis was to consider the effects of living arrangement on this risk: to what extent the probability of dying, controlling for the effects of sex, age and health varies by living arrangement? Even when controlling these variables, living arrangement keep some explanatory power showing a slightly higher risk to die for those living alone (1,086) compared to those living with others, and a strongly higher risk for those living in collective household (1.916).

These first results indicate clearly there is a definite disadvantage to living in an institution, and that previously reported enhanced mortality risks for those living in

institution cannot be explained only in compositional terms, that is, because the institutionalised population is older or in worse health.

The problem of missing values for the health status due to non-answer or not filling the census form and the decision to impute a fixed value for the health indicator close to 100 -that means in very bad health- could bias our analysis. However when running the same model after exclusion of missing cases the results presented here above are still valid. Without considering these cases the odd ratio for 'living in collective household' drops down to 1.355 compared to 1.916 but stays largely significant.

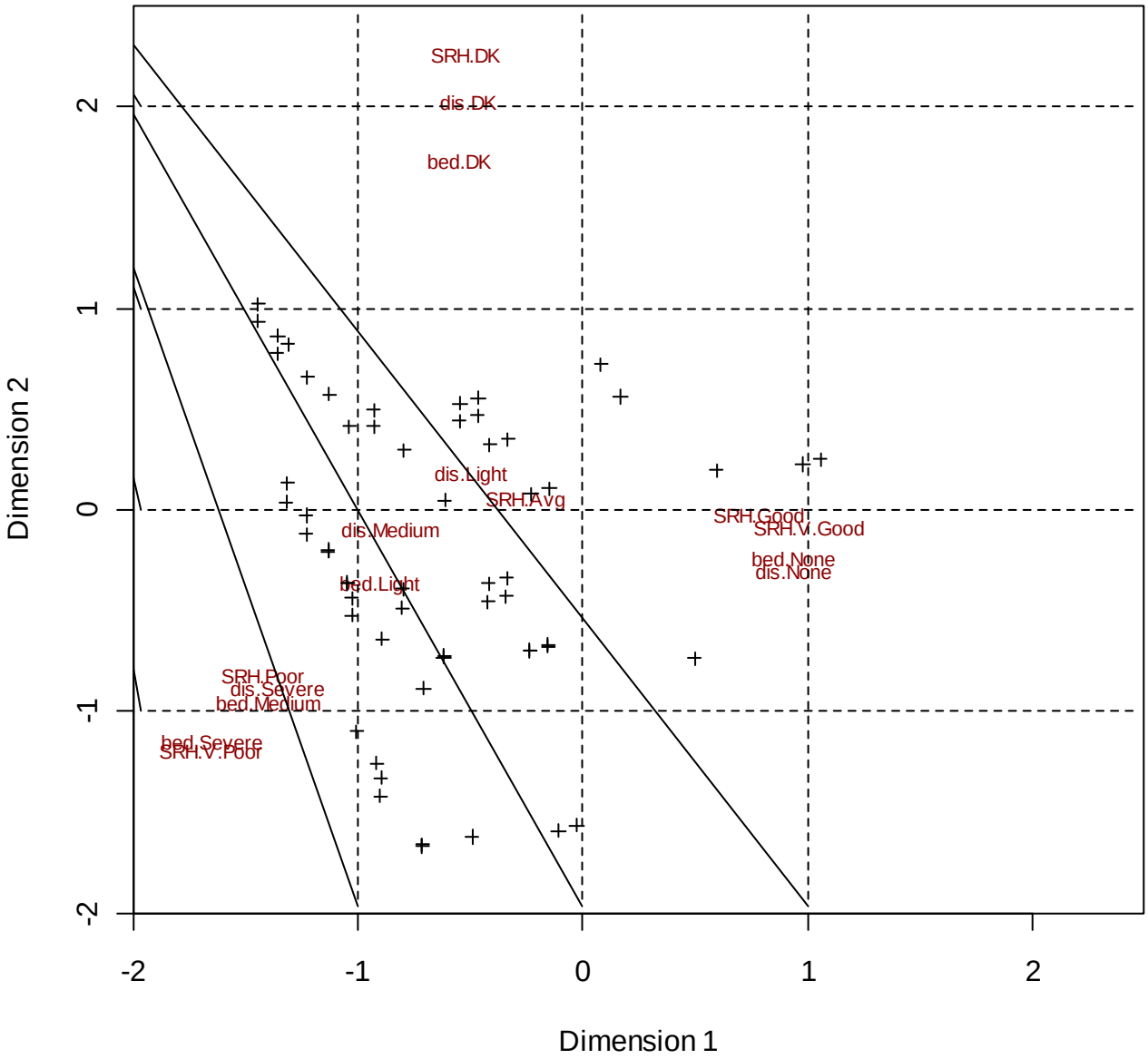
Further analysis should include the marital status of those living alone (never married or ever married) and the distinction between married couples and those living with others (including with children). Moreover, as the size of the population under study is very large, it is possible to run models for both sex and 5 years age groups separately that will allow identifying variations of the impact of health and living arrangement by age and sex.

Collecting information on the health status only at census time introduces a limitation linked to the availability of data as a deterioration of health could appear in the following months and results in institutionalisation and/or death. Living arrangement is considered as constant as observed at the beginning of the year what is also a limitation in our investigation. However the loss of spouse, that is the major event that changes living arrangement and has an impact on health and mortality, has been controlled and found having a limited immediate impact on entry in institution and mortality in the population under study. Another limitation is the non-consideration of socio-economic variables. Somewhat higher mortality risk in institution could result from the fact that the low-educated part of the population experiences a higher probability to be institutionalised as well as a higher mortality risk. On a different perspective, we should consider that the variable 'living arrangement' is collected through the administrative population register that considers collective households and not institutions. This data source underestimates the number of persons institutionalised for short duration because they died shortly after entry and were not registered. Accordingly the mortality risk in institution could be underestimated. Definitively further investigations will be needed to complement these preliminary results.

Nevertheless these first results have important implications for the direction of policy for the elderly. Our results indicate very clearly that for the elderly it is preferable to remain at home – either living with others or living alone – where a

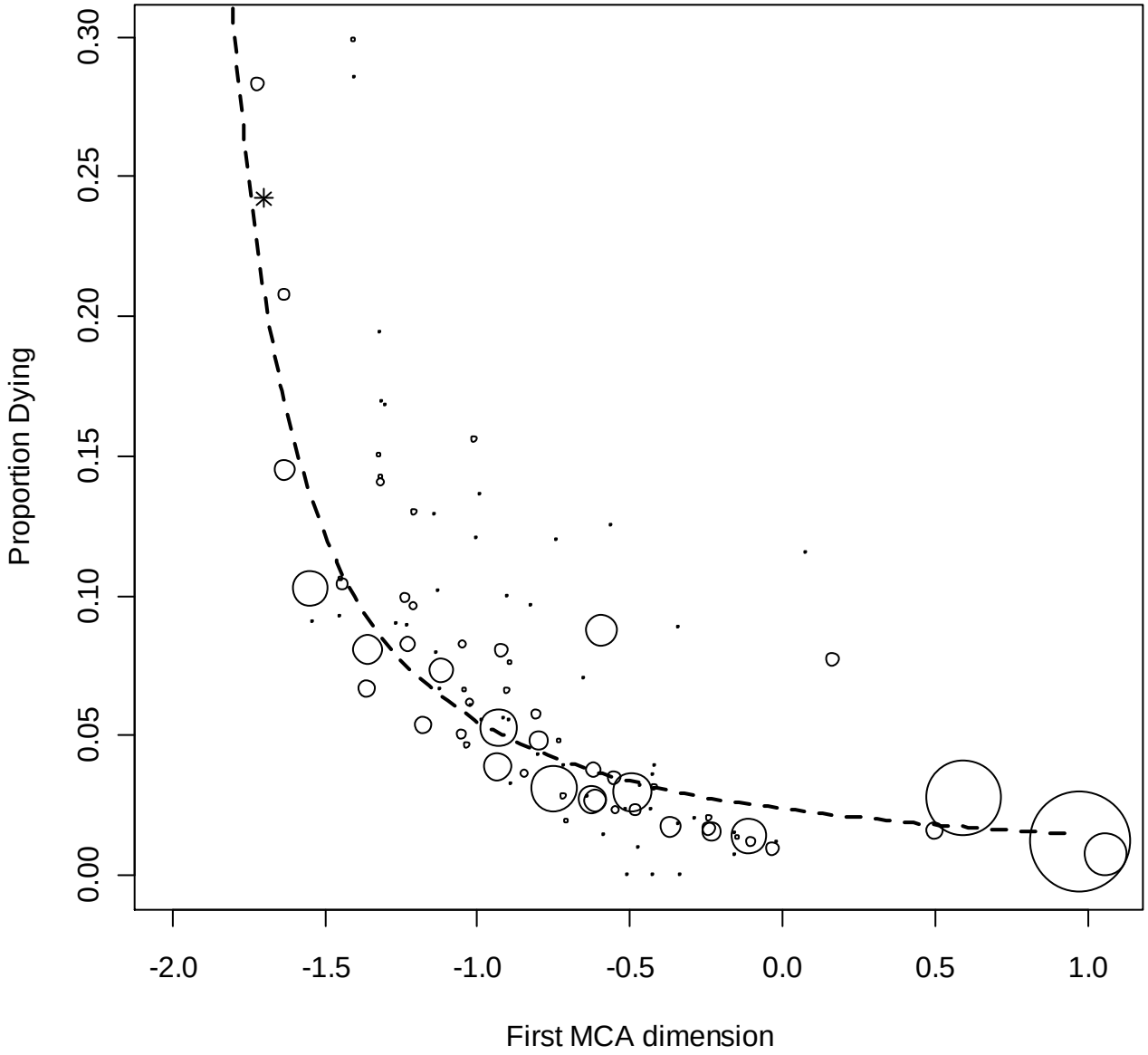
network of support services could enable them to maintain as normal a life as possible in their natural surroundings. These support services would include the provision of hot meals, home cleaning and personal help, an emergency help line and nursing and physician services for cases in need. We note (Figure 7) that in conditions of worst health (index = 0) the lowest mortality risk is for women living alone, women who we may assume, given their state of health, should be taking advantage precisely of such services. We further note that the mortality risk is highest for those living in institutions even in the worst state of health, and that is, even under conditions where the institutions may be expected to offer the greatest advantage for survival, the mortality risk is still lower when living independently.

Figure 1: Multiple Correspondence Analysis of Health Variables



SRH (Self Rated Health): V. Good; Good; Average; Poor; V. Poor; DK (no response)
dis (Disability): Severe; Moderate; Light; None; DK (no response)
bed (Bedridden): Severe; Moderate; Light; None; DK (no response)
Note: bed.None and dis.None overlap. Displaced in plot for readability

Figure 2: Proportion died by First MCA Dimension



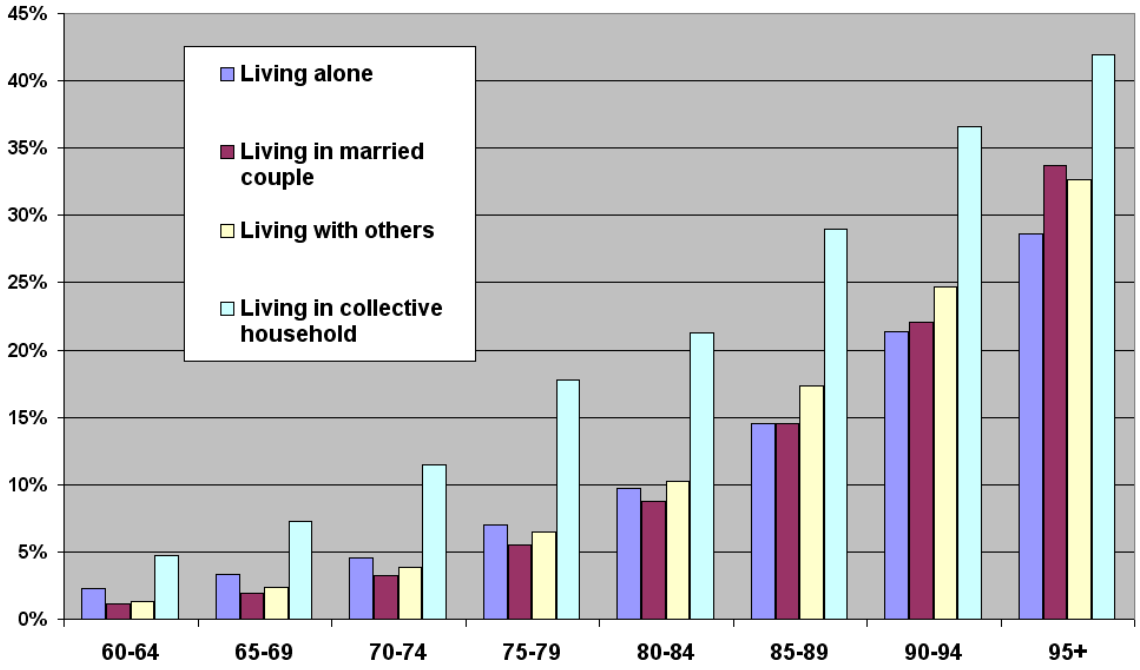
Notes: Point sizes relative to square root of group size

* = non respondents (did not submit census form)

--- = Binomial regression fit, proportion dying by log(index + 2)

Figure 3. Mortality risk during the year 2002 by sex, age groups and living arrangement (Belgium, data source: see text)

MEN



WOMEN

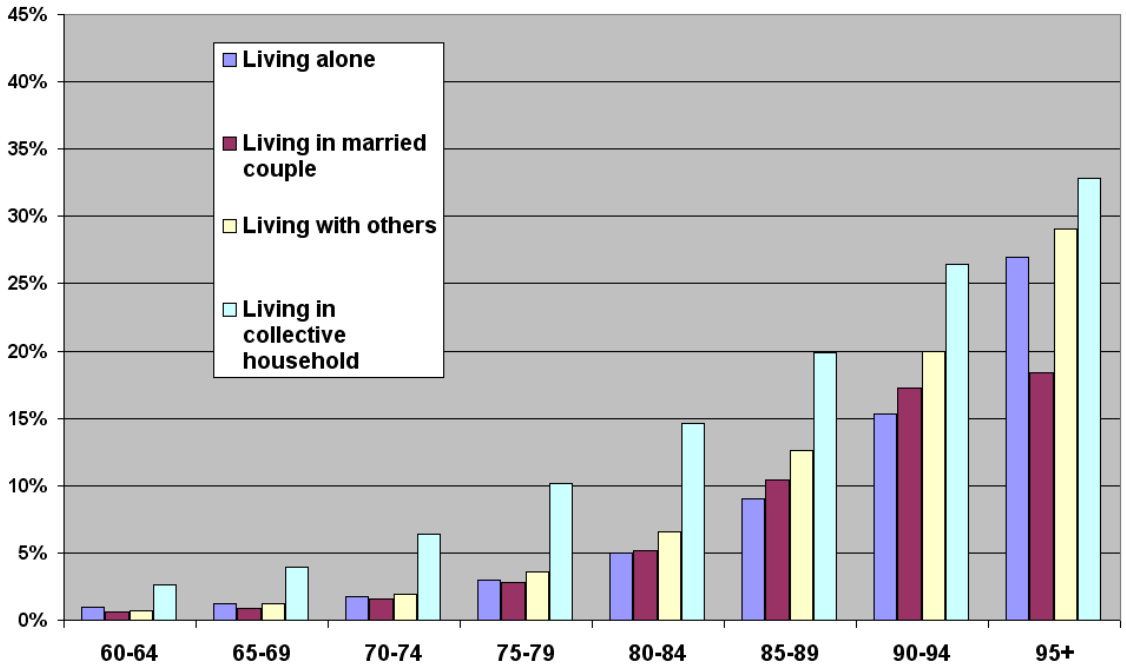
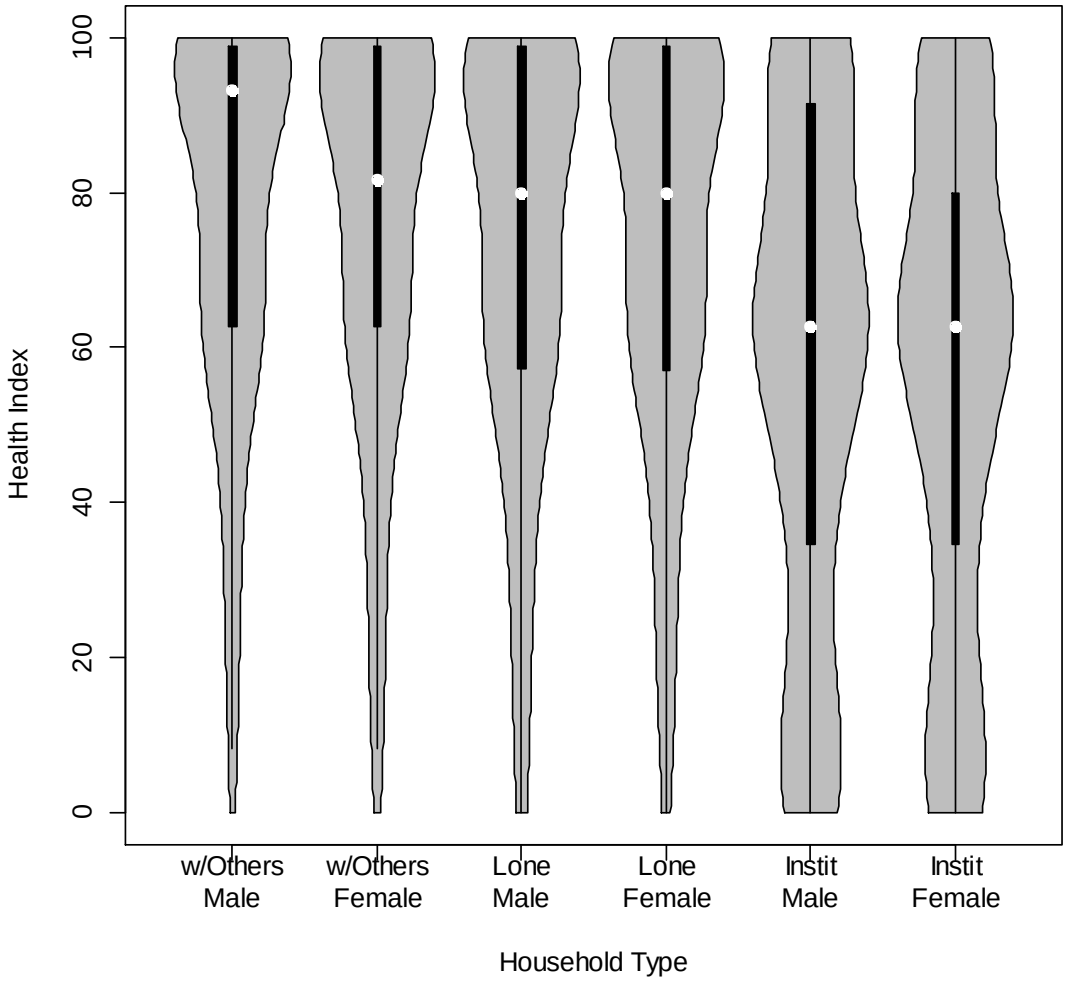


Figure 4: Violin Plot of Health Index by Sex and Living Arrangements



Note: Width of each plot represents the relative frequency of values of the dependent variable (health index). Black rectangles are standard boxplots with the white dots representing the group-specific median. The horizontal lines approximately divide the distribution into "high", "medium" and "low" levels of health.

Table 1: Direct effects of Sex, Living Arrangements, Age and Health on Mortality:

Binomial (logistic) regression for probability of dying during 2002

Variable	e^b (Relative Risk)	z - value	CI (99.9%, one tailed)
Intercept	0.000210	-236	< 0.000235
Sex (Male)	1		
Sex (Female)	0.498	-90.4	< 0.510
Living with others	1		
Living alone	1.086	9.44	> 1.057
Institutionalised	1.913	58.4	> 1.848
Age (60 = base)	1.099	208	> 1.098
Health	0.976	-201	< 0.977
Null Deviance = 162392	Null df = 17049		
Model Deviance = 26173	Model df = 17044		
Pseudo - R^2 = 0.839			

Note: Base Age = 60

For intercept, reported value is inverse logit of coefficient

Table 2: Age and Health nested within Sex and Living Arrangements:

Binomial (logistic) regression for probability of dying during 2002

Variable	Men			Women		
	Living w/others	Living Alone	Institutionalised	Living w/others	Living Alone	Institutionalised
Intercept	0.00141 (0.000920 - 0.00216)	0.00271 (0.000564 - 0.00140)	0.00151 (0.000624- 0.00360)	0.000889 (0.000564 – 0.00140)	0.000734 (0.000401- 0.00134)	0.00268 (0.00144 - 0.00496)
Age	1.0736 (1.0676 - 1.0797)	1.0618 (1.0523 - 1.0715)	1.0798 (1.0682 – 1.0917)	1.0711 (1.0650 - 1.0773)	1.0717 (1.0639 - 1.0797)	1.0654 (1.0578 – 1.0731)
Health	0.944 (0.938 - 0.950)	0.956 (0.946 - 0.966)	0.978 (0.962 - 0.994)	0.920 (0.913 - 0.927)	0.935 (0.926 - 0.944)	0.0.956 (0.945 - 0.967)
Age * Health	1.000413 (1.000325 – 1.000500)	1.000334 (1.000198 – 1.000470)	1.00000785 (1.000 – 1.000204)	1.000741 (1.000644 – 1.000838)	1.000572 (1.000455 – 1.000688)	1.000272 (1.000134 – 1.000411)
Deviance	23687	Df	17026			
Gain	2486	Df	18			

Notes: Values are exponentiated coefficients (inverse logit in Intercept row)

(Values in parentheses are 99.9 per cent confidence intervals)

Figure 5: Fitted mortality probabilities, by Health Index, sex and Living Conditions, at Various Ages. For fitted model, see Table 2

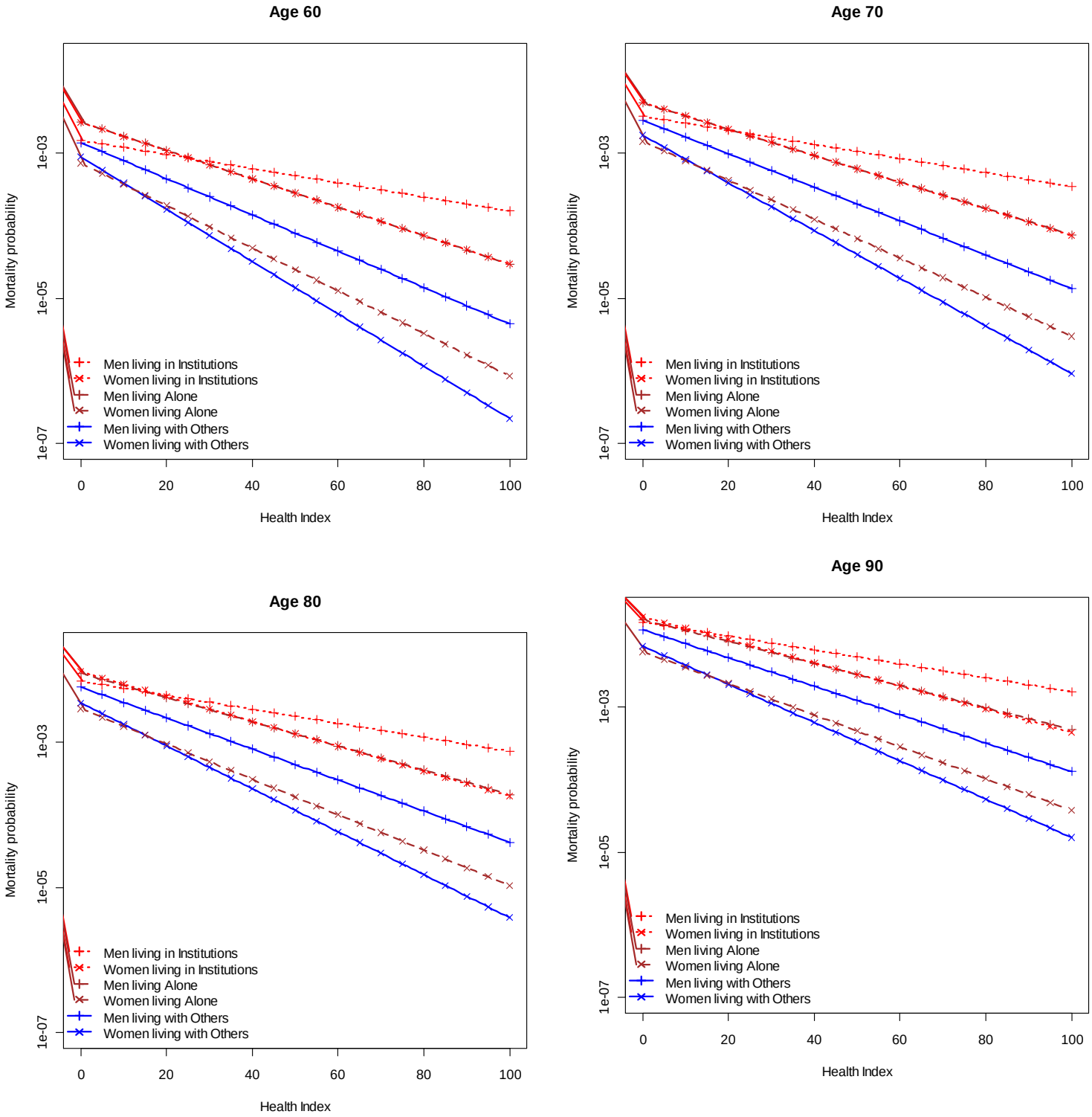


Figure 5: Fitted mortality probabilities, by Age, Sex and Living Conditions, at Various Levels of the Health Index. For fitted model, see Table 2.

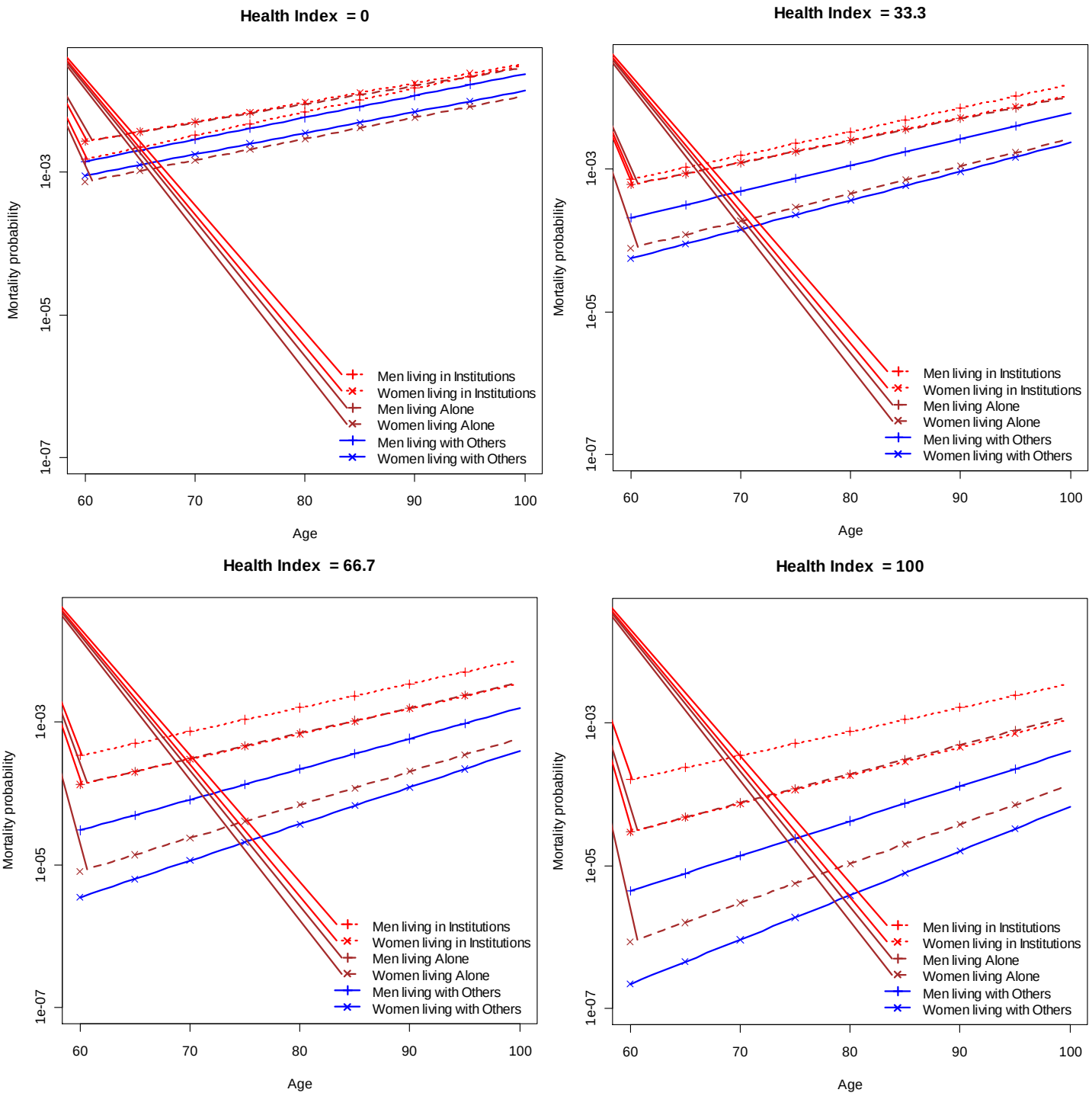
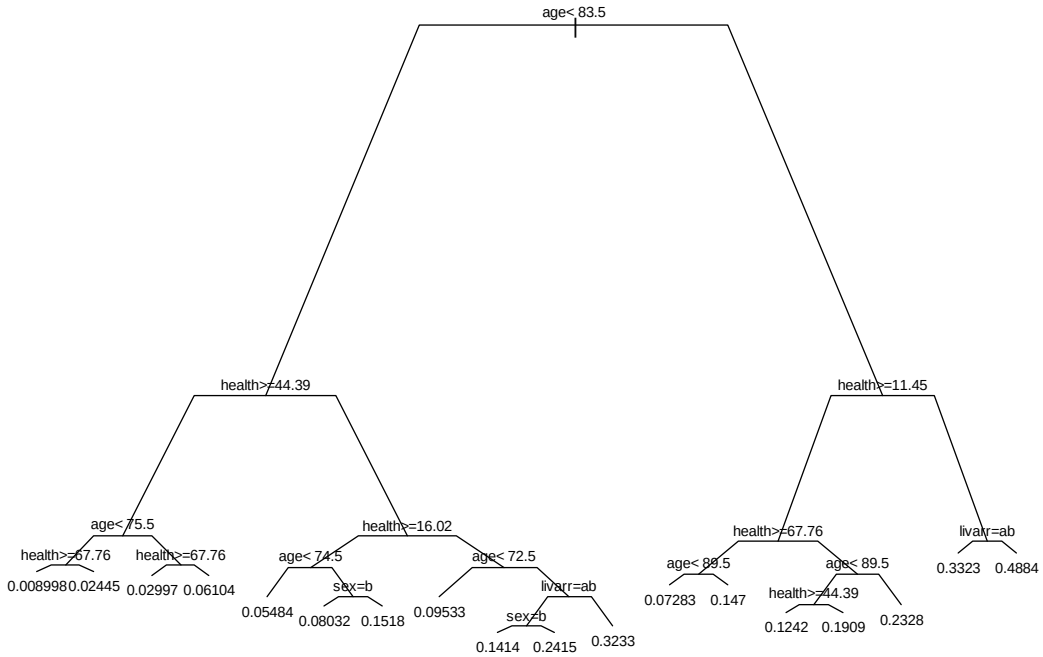


Figure 6: Partition model of mortality probabilities, by Age, Health Index, Living Conditions and Sex

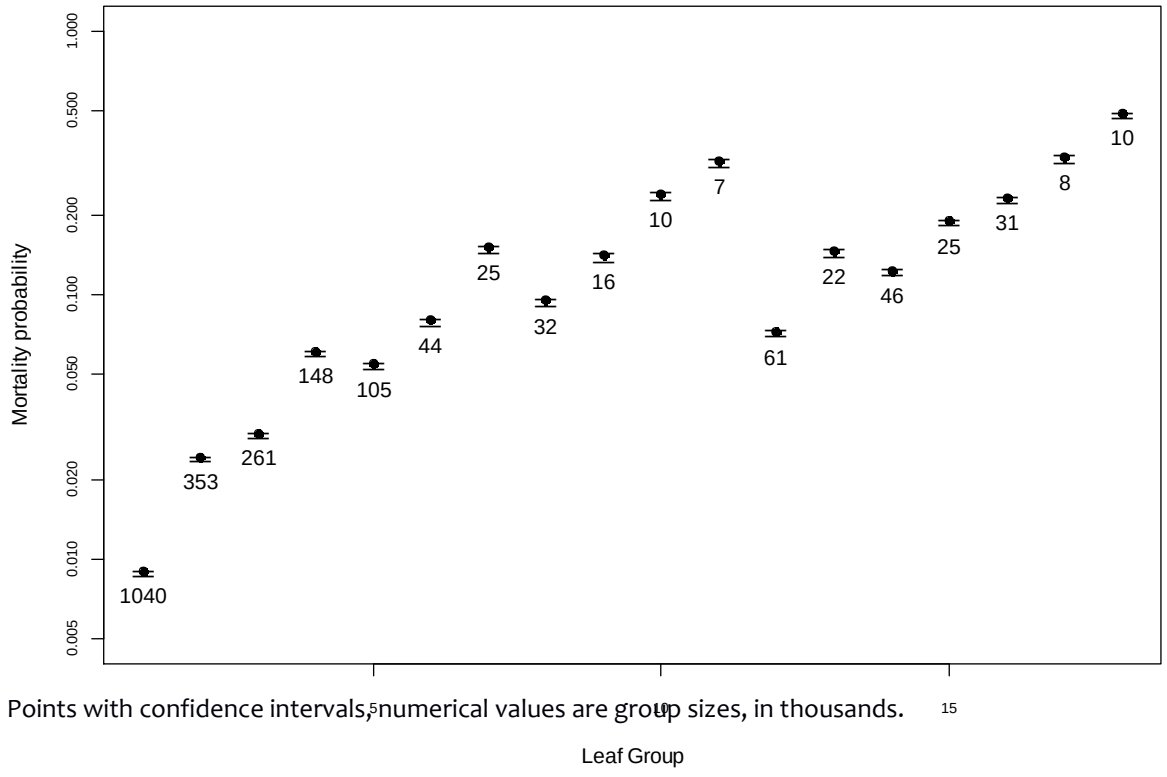
A: Partition tree



Notes: Nodes indicate partition rule, cases matching rule on the left (lower mortality), those not matching rule on the right (higher mortality). Values under leaves are mortality probabilities

For Living Arrangements (livarr): a = with others, b = Alone. For Sex: a = Male, b = Female

b. Mortality probabilities of partition groups



Notes: Points with confidence intervals, numerical values are group sizes, in thousands.

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