

Socioeconomic Inequity in Health Care Use Among Elderly Europeans*

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1 Introduction

A principal challenge of health care policy is to ensure equity in the distribution of help which is provided. Two kinds of deviations from a profile which is 'fair' are coined vertical and horizontal inequity. To illustrate the vertical type a relevant policy problem is about how much to allocate of a given amount of fund to the treatment of devastating deceases, say cancer and Aids. It is difficult to tell objectively that one of the problems is more or less important from the other. An answer is to be found from the inherent architecture of norms and values that a specific society possesses. The second type of situation is, when there are two individuals who have the same health problem (say Aids), but are not treated equally, for example because one of them is wealthy and has the necessary funds to access expensive health recourses (e.g. specialist treatment), from which the more indigent parts of society are excluded. These kind of problems involve horizontal inequity, which comprises that individuals who have the same needs, receive equal treatment. For example, a wealthy and a poor individual should receive the same amount of help, if they suffer from the same health problem. In the exiting article, we focus on the extent of horizontal inequity among elderly Europeans.

One of the most striking developments in modern societies is the ever-increasing ageing of the population. For a large part this can be explained away

This paper uses data from SHARE Waves 1, 2, 3 (SHARELIFE), 4 and 5 (DOIs: 10.6103/SHARE.w1.260, 10.6103/SHARE.w2.260, 10.6103/SHARE.w3.100, 10.6103/SHARE.w4.111, 10.6103/SHARE.w5.100), see Brsch-Supan et al. (2013) for methodological details. The SHARE data collection has been primarily funded by the European Commission through FP5 (QLK6-CT-2001-00360), FP6 (SHARE-I3: RII-CT-2006-062193, COMPARE: CIT5-CT-2005-028857, SHARELIFE: CIT4-CT-2006-028812) and FP7 (SHARE-PREP: N211909, SHARE-LEAP: N227822, SHARE M4: N261982). Additional funding from the German Ministry of Education and Research, the U.S. National Institute on Aging (U01_AG09740-13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553-01, IAG_BSR06-11, OGHA_04-064) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

with the advancements in healthcare and medicine, which are both important factors that contribute to the increase in average life expectancy.

The other side of the coin is that for these extra years in life expectancy, the expenditures for healthcare increase disproportional. However, the increase in healthcare cost is not the focal research question in this report. Instead, we want to use the previous observation to motivate that healthcare for the elderly should be centric in the analysis of healthcare distribution, as perhaps this subgroup of the population is the most susceptible to (in)equity of use of healthcare.

Let us elaborate a little further on this statement: One of the major challenges in society is handling the diseases that come with a population that ages. In this case, we specifically refer to diseases such as dementia and Alzheimer (from hereon collectively referred to as dementia). It is well-known that dementia has a disproportional large effect on an individuals live, and as the individual progresses into later stages of dementia the general tendency is that the individual becomes less independent, and more and more dependent on others, such as personal care by their children or professional care in nursing homes.

This reveals a specific form of potential inequity in healthcare use: if an individual is no longer able to independently ask, seek, and obtain the healthcare that they need, this will inevitably lead to inequity in healthcare use. For example, if an individual is diagnosed with dementia but lives in a nursing home, or is surrounded by children that can provide support, it is more likely that this person will get the healthcare that she needs. On the other hand, if someone that is diagnosed with dementia lives alone, secluded from society, it is likely that they 'miss out on the healthcare they need as they are no longer to arrange such healthcare for themselves. If a society strives for equity in healthcare use this is a large societal challenge that has to be addressed.

In previous research inequity in healthcare use has been explained away by income. In this report, we hypothesise that another driving factor of inequity in healthcare use is the social network of an elderly individual, proxied by the number of children of the individual. This leads to our general research question: The goal of this research is to assess the socioeconomic inequities in healthcare use among elderly Europeans. We assess this potential inequity in two ways: First, we look at income, as this is customary in the existing literature. Second, we examine the effect of an individuals social network, as this might provide a novel (potential) insight in the mechanics behind inequity in healthcare use of the elderly.

In addition to the above research question we want to study in more detail whether this effect differs from country to country within Europe. More specifically, we hypothesise that we will find different patterns of inequity between southern European countries and northern European countries. We believe that for both groups of countries the social network of an elderly individual will make sure that the individual gets the healthcare that they need, but that the way that this healthcare is delivered differs.

We believe that in southern European countries there is a tendency to provide the healthcare to the individual 'within the family. This implies that there

would be an inequity gap, in the direction that elderly with a large social network will receive less professional (i.e. measured) healthcare. On the other hand, for northern Europe we hypothesise that it is more customary to seek professional care if an elderly becomes less independent. That is, the tendency exists of not directly providing healthcare for parents but instead seeking professional care, for example in the form of a nursing home. We want to test these hypothesis using horizontal inequity (HI) indices for healthcare usage.

2 Literature Review of Models

Variables which quantify the extent of health care which an individual consumes includes visits to a doctor in a given amount of time (year), visits to a specialist, etc. Typically, these variables are observed as counts, and therefore econometric models involving counting data provide a good starting points. The simplest such model assumes a Poisson Process for doctor visits, hence in a given amount of time the distribution of visits y_i is given by

$$\mathbb{P}[y_i = y, x_i] = e^{-\lambda} \frac{\lambda^y}{y!}. \quad (1)$$

In such a model the conditional variance of visits is equal to the conditional mean. However, empiric data tend to show *over-dispersion*, e.g. the conditional variance exceeds the mean. Count models based on the negative binomial distribution provide more flexibility and have been used frequently in previous research. This approach results if λ is assumed to be Gamma distributed, while given λ , (1) holds. For example Cameron and Trivedi (year) consider a model of this type, with:

$$\begin{aligned} \lambda &\sim \Gamma(\phi_i, \nu_i), \\ \phi_i &= \exp(x_i' \beta), \\ \nu_i &= \exp(x_i' \beta) / \sigma^2 \end{aligned} \quad (2)$$

where $\nu, \sigma^2 > 0$ are parameters to be estimated. This model incorporates the possibility of over-dispersion as the conditional expectation and variance are $\mathbb{E}[y_i|x_i] = \exp(x_i' \beta)$ and $Var[y_i|x_i] = (1 + \sigma^2)\mathbb{E}[y_i|x_i]$.

A salient feature of health use data is that zero observations proliferate. Indeed, visits to a doctor have an occasional nature, and in a typical cross-section the share of non-visits dominates. In a seminal article Pohlmeier and Ulrich (1995) solve this challenge, by considering the decision to visit a doctor, and the subsequent process of consuming health care once a doctor is visited as a two part decision making process. As they explain a principal agency relation plays a prominent role as a cause for this dichotomy: when considering whether to visit a doctor, an individual seeking treatment is in the main decision making role, however, once he is treated, it is the mainly the doctor who determines which

treatment is suitable and to which extent it is provided (in this decision he will take into account his personal interests). Based on these considerations, the authors propose a hurdle model providing room to describe the two decision phases separately. Moreover, after comparing their Hurdle Model to a simple model of the Negative Binomial type, they find that the first considerably improves estimation results, and that failing to treat the phases separately, leads to serious misspecification problems. The hurdle model consists of the components:

$$\begin{aligned} \mathbb{P}[y_i = 0|x_i] &= F(x_i'\beta_1, \sigma_1^2) \\ y_i|y_i > 0 &\sim N_i|N_i > 1, \end{aligned} \tag{3}$$

where the functional form of F can be for example of a logit, probit type, and N_i is a negative binomially distributed random variable:

$$N_i \sim \text{NegBin}(\exp(x_i'\beta_2), \sigma_2^2). \tag{4}$$

Importantly, the parameters (β_1, σ_1^2) describing the contact probability and the parameters (β_2, σ_2^2) describing the health usage conditional on contact are allowed to be different. By dis-tangling the decision phases involving the contact and the subsequent treatment, the model proves successful in describing the large fraction of zero observations, while accounting for the nonzero values simultaneously.

3 Data

3.1 Dependent Variable Selection

In order to assess inequity in health-care use, a measure for an individuals use of health-care as well as the individuals need of health care is needed. Given both measures we are able to quantify the extent of inequity and the socioeconomic factors relating to this inequity. However, measuring health-care use is not trivial as most respondents are probably not able to (monetarily) quantify their health-care use. Some costs are directly visible to the individual, such as costs for medicine, but other costs may be more obfuscated, e.g. the cost of a doctors visit, especially if this is covered by health insurance and the respondent does not have to pay the bill.

Given the above-mentioned, it seems more reasonable to look at a proxy for health-care use. In the literature, the number of visits to the general practitioner or medical specialist is often used as such a proxy [REFS]. The SHARE dataset, however, contains many other potential proxies, for example: whether an individual visited the hospital in the last 12 months, or the number of chronic diseases an individual has. Both variables most likely influence the use of health-care. However, it might be difficult to combine them in a sensible way to quantify the (monetary) use of health care. Is the chronic disease expensive to treat, or not? Was the hospitalization for a minor health issue, or for an extensive

surgery?

That is, combining these measures into a single factor such that this factor acts as a valid proxy for the need of health care is a challenge that we have to leave for further research. As such, we stick to what is frequently done in the existing literature and take the number of doctor visits as a proxy for use of health care.

3.2 Explanatory and Control Variable Selection

When selecting the explanatory variables, we distinguish between several types of variables. As we intend to measure the need for health-care by means of a statistical model, variables that may influence the need for health-care are included. A logical choice for this type of variables is then health and health behaviour related variables. We select as many of these variables, such as self-perceived health, number of chronic diseases, smoking/drinking behaviour, from the SHARE dataset as possible. We also account for activities/sports, as these could be related to health-care issues such as injuries. Furthermore, we include variables related to functional limitations; these are likely to be correlated with the health of individuals. Not all health related variables are used. Variables with a large percentage missing values are excluded from the analysis to preserve a large number of total observations.

Next to these variables, we select non-need related variables to account for differences in socio-economic status of the individuals. Moreover, we control for income level as previous research shows that this variable explains the inequity in health-care use. Braveman et al. (2005) argue that, even though income and education are likely to be correlated, they are not interchangeable in health related models; the correlation is not strong enough to proxy on another. As the education level of an individual may have an effect on the choices one makes, this variable is included as well.

The SHARE dataset contains information pertaining to family circumstances as well, which can be of interest in the analysis due to the fact that the research considers elderly only. Even though having relatives cannot influence the need for health, it is possible that it influences the usage of health-care if family members take care of each other. This information is exploited by including the number of children, the number of grandchildren and marital status in the model.

Lastly, as health-care need is likely to differ over age and gender, we control for these variables.

3.3 Transformation of Variables

Based on the variable selection criteria mentioned in the previous subsection, many variables are selected to be included in the model. The manner in which

the data is measured, where individuals are asked questions regarding many aspects of health, enforces this issue even more. Including many variables in the model is likely to result in multicollinearity and a loss of efficiency. Furthermore, the interpretation of the explanatory variables becomes very difficult when, for example, 8 activity related variables are included in the model. For these reasons, we decide to make use of data reduction to create a parsimonious model.

In the literature, datasets are reduced mainly based on Principal Component Analysis (PCA). However, as our dataset predominantly contains ordinal and nominal variables, PCA is not the appropriate technique to use (Linting, Meulman, Groenen, & van der Koojj, 2007). Therefore we choose to combine closely related variables that are measured in the same fashion, by including their individual specific average in the model, instead of each variable separately. This way, the variables ActivityDifficulty (measures how much difficulty the respondent experiences in daily activities), Activity (measures to what extent the respondent partakes in various activities), Recall (proxies the memory-related capabilities of a respondent) and Muscle (proxies the motoric skills of a respondent).

4 Calculating the health inequity

We are interested in the socioeconomic equity of medical use. We can use concentration curves to investigate the inequality and calculate the health inequity from this. The concentration curve is a plot of the rank of a socioeconomic rank, for example based on income or number of children, against the medical use rank, for example based on the number of doctor visits in the last year. In an equal world, the concentration curve would be a straight line from the bottom left to the top right corner at a 45 degree angle. Any deviations illustrate an inequality in favor of high values of the socioeconomic status if the line is above the 45 degree line and in favor of small values if it is below the 45 degree line. The concentration index measures this and is then defined as the area between the concentration curve and the 45 degree line.

However, this is not necessarily inequity. For that, we follow Wagstaff and Van Doorslaer (2002) and calculate both the concentration index using the observed medical use and the medical need. The need is the fitted value from our model where the non need variables are set to reference values. If we define our model as $f(x_{it}, z_{it})$ with x_{it} the need variables and z_{it} the non-need variables. If we then also define y_{it} as the medical use, and $C(y)$ as the function yielding the concentration index, the health inequity is then given by the following equation.

$$HI = C(y_{it}) - C(f(x_{it}, \tilde{z})), \quad (5)$$

where \tilde{z} are the reference values for the non need variables. If the health inequity is positive, this indicates inequity in favor of larger values of the socioeconomic variable. For example, if the socioeconomic

For more information, see for example O'Donnell et al. (2008).

5 Results

Figure 1 shows the estimated HI indices per country for income and number of children. From the figure, we can see that HI for the number of children varies (HI_{child}) between -0.17 and 0.07. This implies that there is indication of inequity in health-care related to the number of children. Here, a negative value of HI_{child} indicates that people with more children tend to make less use of health-care than people with more children. The relative differences in HI_{child} between countries form a pattern: the results show positive HI_{child} indices for North-European countries, while the index tends to be lower for South- and East-European countries. This result is very intuitive as the analysed countries differ substantially in culture which causes differences in the manner in which the elderly are taken care of by their relatives. In particular, in South- and East-European countries, it is common that children take care of their parents for a long time. This is related to the fact that, while in North-European countries children move out when they come off age, this is not the case for East- and South-European countries. This discrepancy between countries contributes to the fact that, in East- and South-European countries, the elderly tend to make less use of health-care when they have more children. For North-European countries, the opposite applies.

Moreover, the Figure 2 shows the HI indices per country for income (HI_{income}). As compared to the HI_{child} indices, this index is larger for all countries except Austria. In fact, with the exception of Austria, the index is positive for all countries. This indicates that there is inequity in health-care due to income differences, which is pro-rich. These results are significantly different from the results found by Van Doorslaer, Koolman & Jones (2004). In that paper, far less indication of inequity was found; the estimated HI_{income} indices are much less for GP visits, but also for medical specialist visits compared to our results. Of course, this difference could be caused by various methodological factors. However, the aspects that could cause the difference in results may be the fact that our analysis focuses on elderly, the fact that Van Doorslaer et al. makes a distinction between GP and specialist visits and that we make use of more recent data. This implies that, for instance, the difference in results may imply that the inequity is larger for elderly or has become larger over time.

6 Conclusion

In this report we have assessed the extent of socioeconomic inequities in health care use among elderly Europeans. We have assessed this inequity on the basis of two factors: income of an elderly individual and the size of the social network of an individual. In addition, we have examined these effects per country to assess whether there are geographical differences in healthcare use inequity across Europe.

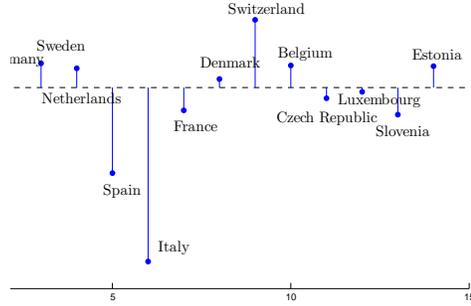


Figure 1: HI for number of children, per country

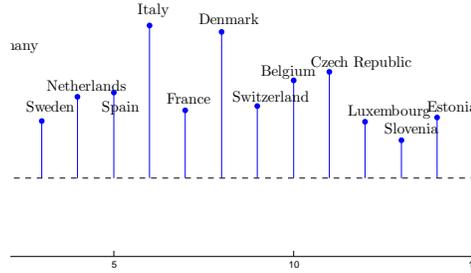


Figure 2: HI for income, per country

Table 1: Table HI

	HI Child	HI Income
Austria	-0.00472115	0.04114461
Slovenia	0.0472954	-0.02694226
Luxembourg	0.07162048	-0.00395248
Sweden	0.07185175	0.02421527
Estonia	0.07693716	0.02140878
France	0.08620079	-0.02232337
Switzerland	0.09155401	0.06779489
Netherlands	0.10281142	0.01915964
Spain	0.10862163	-0.08530023
Belgium	0.12369126	0.02230767
Czech Republic	0.13473144	-0.01034697
Germany	0.15435353	0.01236574
Denmark	0.18569724	0.0084503
Italy	0.19454007	-0.17368408

Our initial results are as follows: First of all we find strong evidence for inequity of health care usage among the elderly, based on income. That is, in general we find a positive HI indices per country for income. In other words, this implies that the higher the income of an individual, the more healthcare she uses, standardised for the other explanatory variables in our model. This is in line with the outcomes of other research on inequity in relation to income.

Secondly, we examine the inequity of healthcare use explained away by the size of the social network of an individual. The results that we find are that southern European countries, together with eastern European countries, have a negative HI indices for size of social network. For northern European countries, however, we find the opposite that they have positive HI indices for size of social network. One potential explanation for this finding could be the difference in culture

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