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Social heterogeneity in self-reported health status and the measurement of inequalities in health

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1. Introduction

The reduction of health inequalities is one of the main targets of the National Health Strategy announced in 2013 by the French Ministry of Health. Indeed, many studies have shown very large social inequalities in health in comparison to other European countries (Leclerc, Fassin, Grandjean, Kaminski & Lang, 2000; Mackenbach, Stirbu, Roskam, Shaap, Menvielle, Leinsalu et al. 2008; Van Doorslaer & Koolman, 2004). Beyond the analysis of the determinants of these inequalities and the evaluation of policies aimed at their reduction, health inequality measurement remains an issue for the monitoring of health inequalities (CSDH, 2008; Haut Conseil de la Santé Publique, 2013).

In this context, questions remain regarding the measurement of socioeconomic inequalities in health. In particular, we wonder to what extent measurement tools and input variables influence the magnitude of socioeconomic inequalities in health. For example, France is the European country with the highest level of health inequality when measured by the relative risk of premature mortality of blue collar workers compared to white collar workers (Kunst, Groenhof, Mackenbach & EU Working Group on Socio-economic Inequalities in Health, 2000; Mackenbach et al., 2008). Nevertheless, France's level of health inequality is average when inequalities are measured by a concentration index of self-assessed health (Van Doorslaer & Koolman, 2004). The measurement of health, the measurement of the social dimension and the measurement tool used influence the magnitude of the socioeconomic inequalities in health (Couffinhal, Dourgnon & Tubeuf, 2004; Dourgnon & Lardjane, 2007; Girard, Cohidon & Briançon, 2000). This article aims to study the influence of measurements of health on the extent of socioeconomic inequalities in health.

Health status can be measured by many indicators such as mortality, morbidity, and functional limitations. We shall limit ourselves to health indicators, which are distinct from mortality indicators because they measure both quality of life and vital status. The health

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indicators we chose refer to one of the three dimensions composing an individual health status: subjective, medical or functional health (Blaxter, 1985; Sermet & Cambois, 2002). The subjective model gathers self-assessed health, symptoms and quality of life indicators. According to the medical or biological model, health can be evaluated by diagnosed or reported diseases and information from clinical, physiological or psychiatric examination. Lastly, according to the functional and social model, health is evaluated by functional limitations or an inability to perform normal tasks. Thus, these indicators represent different dimensions of health status. Finally, in addition to differences due to the dimension of health itself, differences in the nature of the indicator, such as reported or diagnosed information, induce different measurements of health.

Nevertheless, all indicators do not similarly describe inequalities in health. For instance, data from the latest Health and Health Insurance Survey show that inequalities in health between education and income groups are more important when health is measured by self-assessed health or functional limitations compared to frequence of chronic diseases (Table 1). One interpretation of these differences recently proposed in the literature was to consider that each indicator is prone to a socioeconomic reporting heterogeneity, i.e., differences in reporting rates according to socioeconomic status at a same "given health status".

(Table 1 about here)

Some recent studies thus focused on reporting biases related to self-assessed health, which is the most regularly collected measurement of health in household surveys. Even if this indicator is a good predictor of mortality (Idler & Benyamini, 1997) and health care utilisation (DeSalvo, Fan, McDonell & Fihn, 2005), it is also the result of a complex aggregation process of several elements that an individual knows about their own health status. Initially, self-assessed health integrates morbidity, which depends not only on diseases and on functional limitations but also on diagnosed health problems, and thus, on interactions with health professionals. This measurement is subjective, and it therefore integrates personal expectations of good health, which are influenced by social and cultural environments. Several studies have highlighted discordance between health perception and other health indicators considered to be more objective. The literature underlines four sets of factors that can affect individual health judgement and therefore self-assessed health. The first group is related to the nature of diseases an individual suffers from. For example, Van Doorslaer and Gerdtham (Van Doorslaer & Gerdtham, 2003) observe that men with hypertension report better health than women for a given death risk. Age and gender also influence reports: women report a poorer health status than men for similar levels of incapacity. Moesgaard et al. (Moessgaard Iburg, Salomon, Tandon & Murray, 2002) suggest that women would have higher expectations of good health. In addition, Baron-Epel and Kaplan (Baron-Epel & Kaplan, 2001) show that older people more favourably judge their health status than younger

people. Reporting heterogeneity related to socioeconomic status has also been found. In France, self-assessed health is affected by optimism biases for both rich people and the poorest people for a given clinical health (Etile & Milcent, 2006). Lastly, health perception seems to depend on cultural characteristics: an Australian study showed that the indigenous population declared being in better health than the general population, despite higher incidence rates of serious illnesses (Mathers & Douglas, 1998).

Other reported health indicators also suffer from cultural and social reporting heterogeneity. A traditional example is that of the Kerala region in India, where reported morbidity is higher than anywhere else in India, while at the same time, this region has the lowest mortality rate and the highest literacy rate (Murray & Chen, 1992). Several analyses highlight an under-report of diseases in less educated people, in lower income levels and in lower social groups (Elstad, 1996; Mackenbach et al., 2008; Murray & Chen, 1992). In the same way, using Israeli data, Shmueli (Shmueli, 2002; Shmueli, 2003) showed heterogeneity in reporting health related to age, gender, education, ethnic origin and religious faith for the following health indicator: analogical visual scale (HR-QOL), quality of life (SF-36), self-assessed health and chronic diseases.

These reporting heterogeneity related to socioeconomic, demographic, pathological or cultural characteristics is recognised an important obstacles for inter-individual comparisons of reported health levels (Bound J., 1990) and for the analysis of socioeconomic inequalities in health (Elstad, 1996; Etile & Milcent, 2006; Jusot, Rochaix & Tubeuf S., 2005; Mackenbach, Looman & van der Meer, 1996). In France, few studies have examined this question; only reporting heterogeneity in self-assessed health related to income has been studied (Etile & Milcent, 2006). Therefore, reporting biases affecting other health indicators need to be studied, especially because recent articles stress their importance in national contexts (Bago d'Uva, O'Donnell & Van Doorslaer, 2008a; Bago d'Uva, Van Doorslaer, Lindeboom & O'Donnell, 2008; Dourgnon & Lardjane, 2007; Etile & Milcent, 2006; Jurges, 2007). To study reporting biases, the most widespread approach consists of assuming that some indicators are more objective than others and trying to measure "true health". Reporting biases correspond then to the difference between health as measured by the indicator considered to be "subjective" and health as measured by the more "objective" indicator (Delpierre, Datta, Kelly-Irving, Lauwers-Cances, Berkman & Lang, 2012; Delpierre, Kelly-Irving, Munch-Petersen, Lauwers-Cances, Datta, Lepage et al. 2012; Delpierre, Lauwers-Cances, Datta, Berkman & Lang, 2009; Elstad, 1996; Etile & Milcent, 2006; Mackenbach et al., 1996; Malmusi, Artazcoz, Benach & Borrell, 2012; Schneider, Pfarr, Schneider & Ulrich, 2012; Tubeuf & Perronnin, 2008; Van Doorslaer & Gerdtham, 2003). As this approach requires assuming one or several indicators to be more objective, it fails in taking into account

the multidimensional concept of health. An alternative approach[1] suggested by some authors (Jurges, 2007; Shmueli, 2002; Shmueli, 2003; Tubeuf, 2009; Tubeuf & Perronnin, 2008) consists of building a health score based on several indicators, ignoring their relative objectivity, and then analysing reporting biases as discordance between that score and each health indicator on which it relies. Shmueli (Shmueli, 2003) underlines the need to reproduce this analysis with other health indicators to test the sensitivity of the results.

Following this second approach, this article proposes to analyse reporting heterogeneity related to socioeconomic and demographic characteristics affecting several health indicators in France. This study emphasises differences in inequalities in health according to the latent health indicator. In addition, it suggests the existence of reporting heterogeneity biases. For a given latent health status, health reports will depend on household composition, demographic and socioeconomic characteristics. Our study shows that the four health indicators suffer from reporting heterogeneity biases but that the report of chronic diseases is the indicator that biases the measurement of socioeconomic inequalities in health the most.

The analysis relies on the 2002-2003 INSEE National Health Survey, which is described in the next section. Section 3 presents our methodology. The results are described in section 4, and a comprehensive discussion ends this study.

2. Data

The data come from the French National Health Survey carried out by INSEE in 2002-2003. The survey is representative of the community-dwelling French population. For the purpose of this study, the sample was restricted to the 20 145 adults aged 18 to 85 years and having answered all of the health-related questions.

Measurement of health status

To measure the health status, we selected four health indicators able to cover the different health dimensions suggested by Blaxter (Blaxter, 1985): the three health questions of the Mini European Health Module (MEHM) (EHEMU, 2010) concerning self-assessed health, chronic diseases and functional limitations plus the SF-36 mental health indicator (McCabe, Thomas, Brazier & Coleman, 1996).

The self-assessed health indicator of the MEHM corresponds to the question: “How is your health in general?” and the possible answers are: “very good”, “good”, “fair”, “bad” and,

[1] Rather than comparing self-assessed health to more or less objective indicators, another methodology consists of examining variation in the evaluation of given health states represented by hypothetical case vignettes, called anchoring vignettes. However, this approach does not apply to self-rated health (Bago d'Uva, O'Donnell & Van Doorslaer, 2008b; Bago d'Uva et al., 2008) (King 2004).

"very bad" This indicator is dichotomised by grouping people who rate their health as very poor, poor or average health status versus good or very good. 22.3% of the sample report having a very poor, poor or average health status..

The indicator of chronic diseases comes from the second question of the MEHM: "Do you have any longstanding illness or longstanding health problem?" A total of 39.8% of the sample gave a positive response to this question.

Functional health was measured using the third indicator of the MEHM. It corresponds to the question: "For at least the past six months, to what extent have you been limited because of a health problem in activities people usually do?" A total of 11.4% of the individuals reported limitations.

The indicator of mental health is generated from the SF-36 score of mental health (MH). Individuals had an average score of 66.7 out of 100. Individuals scoring lower than 56 (first quartile) are considered to have poor mental health.

Measurement of socioeconomic status

In addition to age and gender, we considered 5 socioeconomic status indicators in our analysis: household composition, education level, household income, social occupation, and activity status. Ages are grouped into six classes: 18-24 years, 25-39 years, 40-49 years, 50-59 years, 60-74 years, and 75-85 years. Education level is measured by the highest diploma obtained and is separated into four categories: people without a diploma, people having a diploma lower than general or technical A-level, people having a diploma equivalent to the general or technical A-level and people having a higher education diploma. Equivalised household income corresponds to the total household income (resulting from an exact report or an imputed amount from income categories) divided by the number of consumption units in the household. The equivalence scale used is the OECD scale, which gives a weight of 1 to the first member of the household, a weight of 0.5 for any other adult and a weight of 0.3 for any child under 14 years of age. Equivalised household income is categorised into four income quartiles.

Social occupation is measured by either the current occupation or the last occupation. Six social classes are distinguished: farmers, self-employed workers, managers, clerks, employees, workers and unknown occupation. Activity status is derived as a six-group variable as follows: employed, unemployed, student, retired, homemaker, and inactive.

Table 2 shows some descriptive statistics of the sample.

(Table 2 about here)

3. Methodology

We used an MIMIC model (Multiple Indicators Multiple Index Causes), which is a structural equation model, as suggested by Shmueli in order to explore social heterogeneity affecting various health indicators (Shmueli, 2002; Shmueli, 2003). If we assume the existence of a latent 'true health' status that explains individual responses to health indicators, we can build a synthetic health score based on a set of selected health indicators that provides an estimate of the 'true health'. Therefore, socio-demographic variation in each health indicator can be separated into variation in the true health and measure-specific variation, holding true health constant. The latter variation is referred to as 'reporting heterogeneity'. The variation in the estimated latent health status represents the true social health inequalities.

3.1 Construction of a synthetic health score

The construction of this model initially requires a factor data analysis in order to generate a continuous health score using the four selected health indicators as described in section 2. The factor analysis empirically determines the number of relevant factors summarising the information of these four health indicators, i.e., the number of subjacent latent variables that influence responses to health indicators. The eigenvalue minimum criteria (i.e. the factor must have an eigenvalue equal at least to 1 to be selected) is used to identify the number of factors to be selected..

The exploratory factor analysis shows the existence of a unique latent factor behind the four health indicators, representing 62% of the total inertia. The confirmatory factor analysis confirms the good adequacy of the data with one latent factor model as the Root Mean Square Error of Approximation[2] (RMSEA) criterion equals 0.031. The estimated latent variable, also called true latent health corresponds to a continuous synthetic indicator measuring poor health.

3.2 Analysis of report heterogeneity

In the second step of the study, we estimated a simultaneous equations model. The first equation (1) estimates the effects of socioeconomic characteristics on the estimated latent health summarised by the health score. The other equation (2) explains reports to the health indicators according to the latent health. The health score is thus used both as a dependent variable explained by various determinants of health in (1) and as an explanatory variable of reports to the health indicators in (2). Testing the existence of the social reporting

[2] See the RMSEA definition in the following section 3.2

heterogeneity of health is therefore equivalent to testing the existence of an effect of socioeconomic variables on individual reports to indicators, independent of their effect on the latent health variable. Direct effects on the health indicators are called "reporting bias", as it is usually done in this literature.

More formally, the MIMIC model with only one latent factor can be formalised as follows:

$$(1)\ \eta = \Gamma' Z + \zeta$$

$$(2)\ Y = \Lambda\eta + \beta' Z + \varepsilon$$

The synthetic health score (η) is a continuous variable. The vector ($Y' = (Y_1, Y_2, Y_3, Y_4)$) is composed of four dichotomous health indicators: Y1 is an indicator of poor self-assessed health, Y2 is an indicator of reported chronic diseases, Y3 is an indicator of reported activity limitations and Y4 is an indicator of poor mental health. Socioeconomic characteristics are represented by ($Z = (Z_1, Z_2 \ldots)$). The vector ($\Lambda' = (\lambda_1, \lambda_2 \ldots)$) corresponds to contributions of the synthetic health indicator (η) to reports of health indicators (Y_i). The vector (Γ) represents the effects of socioeconomic variables (Z) on latent health (η), which can be interpreted as determinants of "true" health. The vector (β) corresponds to direct effects of socioeconomic variables (Z) on health indicators (Y), which are apparent to social reporting biases. Finally we assume that the two error terms (ζ) and (ε) are uncorrelated, but measurement errors ($\varepsilon = (\varepsilon_1, \varepsilon_2 \ldots)$) are such that ($\varepsilon_i$) and ($\varepsilon_j$) with ($i, j = 1, 2 \ldots$ and $i \neq j$) can be correlated. The potential correlation of the measurement errors (ε_i) and (ε_j) permits incorporating reporting biases that could be common to some indicators and independent from socioeconomic characteristics.

This modelling strategy can be schematically represented as follows:

(Figure 1: MIMIC model about here)

Equations (1) and (2) are simultaneously estimated using M-Plus software. The estimated parameters in Eq. (1) are linear regression coefficients, the health score being a continuous variable, and the coefficients of Eq. (2) are coefficients from a probit model because Yi are categorical variables. The adjustment of the model to the data is evaluated using the RMSEA criterion in which the satisfaction threshold is below 0.05.

4. Results

The MIMIC model is estimated and leads to a satisfactory adjustment with a RMSEA criterion equal to 0.007. Two series of results are shown; the first is related to the

determinants of latent health, and the second concerns reporting heterogeneity affecting reports of the four health indicators.

The column "poor latent health" in Table 3 presents the linear regression estimates of the latent health variable as explained by several individual socioeconomic characteristics. The four other columns present the Probit estimates associated with the four health indicators while adjusting for latent health. In this table, a negative coefficient shows a positive impact on good health. Gender, age, household composition, education level, income and social status significantly influence latent health. Poor health increases with age, and men are in better health than women. People living alone are in poorer health than couples without children, but couples without children are in poorer health than those with children. Poor health decreases with higher education level, with higher income level and higher social position. Lastly, unemployed people, retired people, inactive people and homemakers are in poorer health than employed people.

(Table 3 about here)

The second series of results is related to the determinants of the four health indicators (columns 3 through 10 of Table 3). Only statistically significant coefficients have been reported in Table 3. Coefficient associated to the "latent health" show that latent health significantly contributes to the way health indicators are reported. True latent health contributes more to self-assessed health (coef=1 by construction) compared to the other three indicators (chronic diseases reports (coef = 0.609), activity limitations reports (coef = 0.756) and mental health (coef = 0.54).

Our results also shed light on the existence of various reporting biases affecting health indicators. On the one hand, the negative and significant correlation of the measurement errors attached to mental health and chronic disease suggests a specific reporting bias related to these two health indicators independent of socio-demographic characteristics. On the other hand, the direct effects of some characteristics on health indicators for a given latent health suggest the existence of reporting biases related to demographic, economic and social characteristics. Hence, for a given latent health, women report more chronic diseases and more mental health problems than men. Older people report more chronic diseases and better mental health. People living alone or in single-parent families report more mental health problems compared to couples; they also self-assess a poorer health status. Conversely, non-nuclear families report fewer chronic diseases than couples. Education and income levels significantly influence health variables for a given latent health. Having A-level or less than A-level education is significantly related to better self-assessed health. In parallel, individuals with a diploma higher than A-level report more chronic diseases and activity limitations. Income level has a direct and positive effect on the chronic disease indicator: the higher the

income, the more likely chronic diseases are reported. As for social activity, clerks or managers report more chronic diseases and activity limitations than others for a given latent health. Lastly, students report less general health problems than employed people, whereas retired and inactive people report more activity limitations.

5. Discussion

The objective of this study was to analyse social heterogeneity affecting health report and potentially affecting the measurement of social inequalities in health. All our results confirm social differences in latent health. Moreover, our results show reporting heterogeneity for a given latent health. Women and older people more often report chronic diseases than other for a comparable latent health status. Mental health problems are over-reported by women and single people and are under-reported by the older people. Inactive people, retired people and clerks more frequently report activity limitations. Lastly, the most educated people, people with higher incomes, clerks and managers more frequently report chronic diseases, while less educated people under-report poor self-assessed health, for a comparable latent health status.

The approach suggested by Shmueli (Shmueli, 2002; Shmueli, 2003) has allowed us to generate a synthetic latent health indicator using four health indicators and to disentangle the association between socio-demographic characteristics and health indicators into (i) the contribution of these characteristics to the latent true health and (ii) their direct contribution to reports of each health indicator considered as reporting bias. However, the methodology and the way to interpret results have some limitations that can be discussed in four points.

First, this method relies on the assumption of the existence of a single latent health variable explaining individual reports of various health indicators. The exploratory factor analysis on the four health indicators shows a unique latent factor summarising health and thus confirms that health could satisfactorily be represented by a unique variable. However, this factor represents only 62% of total inertia. Therefore, the latent variable generated by this method does not permit having a complete representation of health, which is largely multidimensional concept.

Second, this first assumption implies to interpret the direct effects of socio-demographic characteristics on health indicators as health reporting biases. However, these effects can represent either reporting biases or effects of individual characteristics on some specific health dimensions, and thus determinants of health. For example, the particular effect of gender on the SF-36 mental health score can be due to over-reporting of mental health problems by women, but it can also result from a strong association between gender and this dimension of health with regard to the other dimensions. Indeed, there is a strong difference in the prevalence of depression between women and men (Grigoriadis & Robinson, 2007).

Similarly, inactive people have certainly specific risks for functional limitations but not necessarily higher risks of chronic disease. Thus, as various health indicators do not refer to the same dimension of health, they could lead to a different measurement of social health inequalities even in absence of social reporting heterogeneity if socioeconomic differences in health do change according to the considered dimension of health.

Third, this method allows us to identify specific biases affecting each indicator, but does not allow us to identify common biases affecting the full set of health indicators. Therefore, an optimistic or pessimistic bias affecting reports of the four indicators and correlated to a particular socio-demographic characteristic will not be identified as a bias, but will be mistaken for the effect of this characteristic on latent health. However, a potential correlation in measurement errors of two indicators was found between mental health and chronic disease, suggesting a common reporting error.

Fourth, the latent health variable has been generated from information common to the four health indicators and may thus vary with changes in these indicators. To test the stability of our results, we have changed each of the four indicators by another indicator available in the survey, which refers to the same dimension of health: self-assessed health of the MEHM has been replaced by self-assessed health of the SF-36, chronic diseases of the by a list of reported chronic diseases, activity limitations of the MEHM by reports of incapacities and deficiencies and finally SF-36 mental health score by the CES-D score, which is a validated depression scale (Radloff, 1977). Results were found to be stable since most of biases highlighted in our model remained unchanged (results not shown, available in (Tubeuf, Jusot, Devaux & Sermet, 2008). In particular, the sensitivity analysis has confirmed under-reporting of poor self-assessed health by students and over-reporting by single-parent families, higher reporting of chronic diseases by older people, the more educated people and the richer, higher reporting of functional problems by retired people, inactive people and more educated people, and finally, over-reporting of mental health problems by women, single or single-parent families and under-reporting by older people.

Nevertheless, this analysis provide consistent results with the literature. . First, in line with many previous studies, social inequalities in health are found showing a deterioration of health with social status, education level and income when health is measured by the latent health indicator (Mackenbach et al., 2008; Van Doorslaer & Masseria, 2004). We also found evidence of reporting biases affecting health reports according to four indicators: chronic diseases, activity limitations, self-assessed health and the SF-36 mental health score A large number of direct effects affects the chronic diseases indicator suggesting that this indicator provides a particularly biased health measurement according to individual socio-demographic characteristics. In line with Moesgaard et al. (Moessgaard Iburg et al., 2002), we show that women over-report chronic diseases. Gender differences in diseases report may come from a

more frequent use of health care for the same health status, a greater attention paid to health problems and a better knowledge of health problems that can be partly explained by the poorer latent health in women compared to men. Our results on over-report by the elderly support previous findings by Shmueli (Shmueli, 2003), Social differences by education level, income, and occupation are also confirmed by Mackenbach et al. (Mackenbach et al., 1996) and Elstad (Elstad, 1996). Again these findings can be explained by better medical information related to more frequent health care utilisation or by greater attention paid to health by higher social groups. Besides, one can wonder whether the concept of chronic diseases is well-understood in any social group.

The activity limitations indicator also reveals reporting heterogeneity related to education level and activity status. Individuals having a diploma higher than A-level, clerks and managers report more activity limitations than those in the working classes, even though they have a better latent health. This over-reporting may be explained by a lower tolerance towards functional limitations and activity restrictions for these social groups. Moreover, we observe over-reporting of activity limitations by retired and inactive people. This result may correspond to the justification bias as proposed by Bound (Bound J., 1990), according to which people would justify their exit from the labour market because of their poor health. However, one can also argue that inactive or early-retired people experience a specific risk of suffering from activity limitations, which mainly explains their anticipated exit (Barnay & Debrand, 2006). The results related to the SF-36 mental health score suggest over-reporting of this type of health problem by women, in accordance with the results of the analysis carried out in Israel by Shmueli (Shmueli, 2003). However, this finding can be due to a specific gender effect on this dimension of health, the risk of depression or anxiety being more widespread among women (Grigoriadis & Robinson, 2007). We also confirm the under-reporting bias of mental health problems by older people shown by Shmueli (Shmueli, 2003). This effect may be explained by lower expectations in terms of the mental health of old people because of the numerous health problems related to aging. Nevertheless, this effect may also not be related to reporting bias, but rather to a less marked age effect on mental health than on other dimensions of health. Lastly, we show over-reporting of mental health problems by single or single-parent families wich is undoubtedly partly due to the specific influence of isolation on this dimension of health (Wang, 2004).

The few direct effects affecting self-assessed health suggest that this indicator is less biased than the other health indicators. In opposition to Etilé and Milcent (Etile & Milcent, 2006), no evidence of biases related to income or occupation was found. Nevertheless, people having an intermediate education level less frequently report poor health compared to people without a diploma and to the most educated people for a given latent health status. This optimism bias compared to the most educated individuals could be explained by higher expectations for

health when people are more educated as suggested by Mackenbach et al.(Mackenbach et al., 1996) , Elstad (Elstad, 1996) or Delpierre (Delpierre et al., 2012; Delpierre et al., 2012; Delpierre et al., 2009). However, students report better self-assessed health, whereas they have a poorer latent health than employed people possibly due to allergies, depression and anxiety. Perhaps this optimism bias suggests that they do not take into account chronic health problems or mental health in their appreciation of their general health status. Lastly, single-parent people more frequently report a poor self-assessed health for a given latent health status. This over-reporting may reflect health complaints or express a social difficulty through health problem report. Similarly, the higher probability of reporting a poor health status for people without a diploma for a given health status in comparison to the individuals having an intermediate education level may be interpreted as a pessimistic bias, but could also reflect specific health problems, distress, pain or burden of pathologies that are not fully taken into account by the other health indicators.

This analysis thus underlines the existence of reporting heterogeneity related to socio-demographic characteristics affecting the set of considered health indicators. Among these indicators, chronic disease reporting suffers from many biases and particularly from a pessimism bias related to education, social status and income. Consequently, this indicator cannot be regarded as a good measurement tool for social inequalities in health, as it would underestimate their magnitude. In contrast, self-assessed health, activity limitations and mental health seem to be the more relevant indicators. These indicators represent various dimensions of health; they can thus advantageously be used according to the objectives of the analysis. Aiming for an overall monitoring of social inequalities in health, self-assessed health finally seems to be a good health measurement tool.

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7. Appendix

Figure 1: MIMIC Model

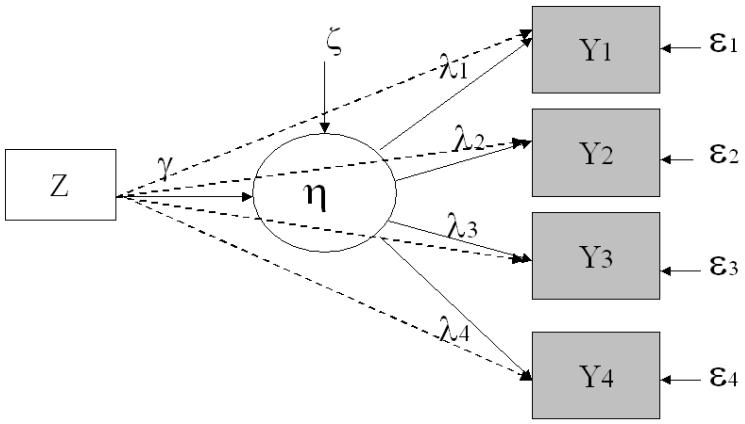

Table 1: Differences in the magnitude of health inequalities according to the health measures

	Fair and Poor perceived health		Chronic diseases		Activity limitations	
	%	Age-gender standardised index	%	Age-gender standardised index	%	Age-gender standardised index
Monthly Income per consumption unit						
1st quintile [0 - 926 €[	43.7	1.34	42.3	1.15	36.8	1.39
2nd quintile [926 - 1 264 €[	38.3	1.09	41.2	1.05	30.3	1.06
3rd quintile [1 264 - 1 600 €[	36.4	1.06	39.2	1.02	28.0	1.01
4th quintile [1 600 - 2 120 €[	30.4	0.92	36.6	0.97	23.9	0.91
5th quintile [2 120 € - Max]	22.4	0.68	34.9	0.92	19.2	0.74
non response	35.9	0.95	37.7	0.90	28.7	0.93
Highest degree obtained						
No diploma	54.2	1.27	50.3	1.09	44.3	1.24
Certificate of primary education	60.5	1.13	59.5	1.06	50.7	1.11
Certificate of general Education (lower high school degree)	36.8	1.05	39.7	0.99	28.7	1.03
Baccalaureate (high school graduation)	29.9	0.98	34.6	0.99	21.6	0.90
Higher education degree	19.0	0.68	31.1	0.94	16.2	0.75
Ongoing schooling	7.9	0.54	15.0	0.78	7.2	0.66

Source: Health and Health Insurance Survey, IRDES, 2012

Table 2: Sample description

Variables	Freq.	Prop.
Gender		
Female	10662	52.9%
Male	9483	47.1%
Age classes		
18-24	2326	11.5%
25-39	5879	29.2%
40-49	4261	21.2%
50-59	3586	17.8%
60-74	3153	15.7%
75-85	940	4.7%
Household composition		
Single	2725	13.5%
Couple without children	6144	30.5%
Couple with children	9407	46.7%
Single-parent family	1097	5.4%
Non-nuclear family	772	3.8%
Education level		
No diploma	2709	13.4%
Diploma lower than A-level	8677	43.1%
A-level	3445	17.1%
Diploma higher than A-level	5314	26.4%
Household income		
1st income quartile	4224	21.0%
2nd income quartile	4983	24.7%
3rd income quartile	5286	26.2%
4th income quartile	5652	28.1%
Social occupation		
Farmer	667	3.3%
Self-employed	1047	5.2%
Manager	2853	14.2%
Clerk	4410	21.9%
Employee	5355	26.6%
Worker	4207	20.9%
Unknown occupation	1606	8.0%
Activity status		
Employed	11898	59.1%
Unemployed	1246	6.2%
Student	1253	6.2%
Retired	3879	19.3%
Homemaker	1417	7.0%
Inactive	452	2.2%
Self-assessed health		
Reported poor self-assessed health (MEHM)	4486	22.30%
Poor general health status (SF36 General Health score)	5143	25%
Reported morbidity		
Reported chronic disease problem (MEHM)	8022	39.80%
At least one reported chronic disease	12551	62.3%
Functional health		
Reported functional limitations (MEHM)	2292	11.40%
At least one reported activity limitation	4979	24.20%
Mental health		
Poor mental health (SF36 Mental Health score)	5143	25%
Having a depression risk (CES-D score)	5143	25%

Source: National Health Survey, INSEE, 2002-2003, Data analysis by Irdes

Table 3: Determinants of poor latent health and the probability of reporting a poor health status with regard to each indicator

Individual characteristics	Poor latent health		Poor self-assessed health		Chronic disease		Activity limitation		Poor mental health	
	Estim.	**T-test**	**Estim.**	**T-test**	**Estim.**	**T-test**	**Estim.**	**T-test**	**Estim.**	**T-test**
Gender										
Male	Ref.	Ref.			Ref.	Ref.			Ref.	Ref.
Female	0.087	3.734			0.05	2.293			0.296	13,371
Age classes										
18-24	-0.262	-5.697								
25-39	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
40-49	0.284	9.911							-0.07	-2,429
50-59	0.503	15.227			0.113	3.666			-0.174	-5,289
60-74	0.53	9.51			0.335	6.22			-0.31	-5,426
75-85	0.88	13.32			0.301	4.427			-0.273	-3,979
Household composition										
Single	0.071	2.336							0.204	6,662
Couple without children	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Couple with children	-0.054	-2.157								
Single-parent family	-0.088	-1.466	0.149	2.401					0.243	4,748
Non-nuclear family	0.024	0.456			-0.145	-2.804				
Education level										
No diploma	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Diploma lower than A-level	-0.1	-2.993	-0.119	-3.682						
A-level	-0.237	-5.469	-0.108	-2.498						
Diploma higher than A-level	-0.468	-11.477			0.185	4.691	0.18	3.48		
Household income										
1st income quartile	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
2nd income quartile	-0.074	-2.563			0.068	2.443				
3rd income quartile	-0.194	-6.452			0.124	4.226				
4th income quartile	-0.23	-6.981			0.156	4.839				
Social occupation										
Farmer	-0.1	-1.918								
Self-employed	-0.149	-3.332								
Manager	-0.298	-6.754			0.163	3.946	0.112	2.093		
Clerk	-0.171	-4.995			0.124	3.802	0.112	2.786		
Employee	-0.077	-2.723								
Worker	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Unknown occupation	-0.199	-3.046								
Activity status										
Employed	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.	Ref.
Unemployed	0.314	7.849								
Student	0.251	2.769	-0.357	-3.521						
Retired	0.246	5.155					0.198	3.605		
Homemaker	0.173	4.214								
Inactive	0.942	14.875					0.547	8.898		
Threshold/ Intercept			0.709	14.816	0.567	13.122	1.367	24.345	0.592	13.252
Latent health			1	0	0.609	36.355	0.756	39.859	0.54	33.692
R^2	0.246		0.888		0.402		0.568		0.314	
Chi 2 (WLSMV)	73.244									
P-value	0.0005									
RMSEA	0.007									
Correlation between chronic disease and mental health	-0.051	-4.012								

Source: National Health Survey, INSEE, 2002-2003, Data analysis by Irdes