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INEQUALITY OF OPPORTUNITY IN HEALTH IN INDONESIA

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Abstract:

Whereas health equity issues are undoubtedly more relevant in developing countries, research on health inequalities and, more specifically, on inequality of opportunity in the health dimension, remains scarce in this context. This paper explores the degree of inequality of opportunity in health in a developing country, using the 2007 Indonesian Family Life Survey, a large-scale survey with extremely rich information about individual health outcomes (biomarkers and self-reports) and individual circumstances.

We compute a continuous synthetic index of global health status based on a comprehensive set of health indicators and subsequently implement non-parametric and parametric methods in order to quantify the level of inequality of opportunity in the health dimension. Our results show large inequality of opportunities in health in Indonesia, compared to European countries. Concerning transmission mechanisms, parental (particularly maternal) vital status appears as the main channel. Compared to what has been observed in more developed countries, the effect of parental education on health is relatively smaller, and mainly indirect (passing through descendants' socioeconomic, marital and migration statuses), while the existence of long-term differences in health related to religion, language spoken and particularly province of location suggest a relatively higher relevance of community belonging variables for health equity in the context of a developing country as Indonesia.

Key words: Equality of opportunity; health; Indonesia; stochastic dominance; continuous health index;

Résumé

Les pays en développement sont particulièrement concernés par la question des inégalités de santé et notamment celle de l'inégalité des chances. Néanmoins, très peu de travaux sont proposés dans le cadre des économies en développement. Cet article étudie l'ampleur des inégalités des chances en matière de santé en Indonésie à partir de données recueillies par l'enquête IFLS (*Indonesian Family Life Survey*) de 2007 qui propose une information individuelle détaillée sur l'état de santé (bio-marqueurs et auto-évaluation) mais aussi sur l'environnement socio-économique.

Un indicateur synthétique continu de l'état de santé global calculé à partir d'un ensemble complet d'informations sur la santé est dans un premier temps proposé. Des méthodes paramétriques et non paramétriques sont ensuite mobilisées pour mesurer le niveau de l'inégalité des chances dans le domaine de la santé. Les résultats mettent en évidence une importante inégalité des chances relative à l'état de santé en Indonésie par rapport au niveau d'inégalité observée dans les pays européens. Le principal vecteur de transmission de l'inégalité est le statut de santé des parents (statut vital) et en particulier celui de la mère. L'impact du niveau d'éducation des parents est indirect (agissant sur l'environnement socio-économique, le statut marital et la migration des descendants) et est beaucoup plus faible que celui généralement observé dans des économies plus développées. Les disparités à long terme de l'état de santé liées à la religion, à la langue pratiquée et plus encore à la région d'habitation suggèrent que les variables d'appartenance communautaire sont prépondérantes pour analyser la question de l'équité en santé dans un pays en développement comme l'Indonésie.

Mots Clés : Egalité des chances ; santé ; Indonésie ; dominance stochastique ; indicateur continu de santé

JEL Code: D63; I14; O15

1. Introduction

Promoting population health and health equity is one of the main targets of the World Health Organisation (Marmot et al., 2008). Improving equity in health implies reducing not only differences in health status that exist between developing and developed countries, but also health inequalities between groups within countries. A growing literature exists evaluating health inequalities within developed countries. The reduction of inequalities in health is indeed one of the main objectives of public health policies in European countries. Surprisingly, the measurement of inequalities in health status has been less explored within developing countries, in part due to the lack of appropriate data (Braveman and Tarimo, 2002; Rannan-Eliya and Somanathan, 2006; Gwatkin, 2009).[1]

Yet health equity appears to be a more relevant issue in developing and intermediate countries since the absolute situation of the poorest is indubitably of particular concern in countries with lower health outcomes on average. In addition, examining health inequalities is crucial to monitor population health in a development context, since health inequalities seem to raise with rising per capita incomes (Wagstaff, 2002). More generally, as argued in the World Bank's 2006 World Development Report, "Equity and Development", inequalities in health reflect and reinforce inequalities in other domains, and these inequalities together act as a brake on economic growth and development (World Bank, 2006).

The current philosophical literature regarding social justice identifies some types of inequality as more objectionable than others (Dworkin, 1981; Arneson, 1989; Cohen, 1989; Roemer; 1998; Fleurbaey, 2008). In particular, inequalities related to "circumstances", that is, to determinants which are beyond individual responsibility, are considered as the most unacceptable and are recognized as inequalities of opportunities, whereas inequalities related to determinants that are freely chosen (often called "efforts") may be considered as legitimate inequalities. The concept of inequality of opportunity is a subject of recently growing interest in the health economics literature as a normative basement for policies aiming at reducing health inequalities (see among others, key contributions by Sen, 2002a; Fleurbaey, 2006; Rosa-Dias and Jones, 2007; Fleurbaey and Schokkaert, 2012; Li Donni et al., 2014).

Recent studies have proposed to empirically assess the level of inequality of opportunity in health, under several normative assumptions, and to explore its construction channels, but to our knowledge this has solely been implemented in European countries (see Rosa-Dias [2009], Tubeuf et al. [2012] and Li Donni et al. [2014] for UK; Garcia Gomez et al. [2012] for the Netherlands; Jusot et al. [2013] for France; Bricard et al. [2013] for a comparison of various European countries). To the best of our knowledge, inequality of opportunity in health status among the adult population has never been investigated in a developing country, whereas large inequalities of opportunities have already been shown for various other welfare outcomes (income, education, wealth,...) in both developed and developing (see Brunori et al. 2013 for a recent review and international comparison)[2].

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[1] Most of the research litterature on health equity in developing countries has focused on access to basic health services, and papers dealing with the measurement of inequality of opportunity in the developing world essentially look at income, consumption or education outcomes or eventually the influence of family background on child health.

[2] Note that some recent studies already provide evidence on the influence of social and family background on child health in developing countries (see, for example, Strauss and Thomas, 2008; Paxon and Schady, 2007), but no follow up until adulthood is examined.

The aim of our paper is to fill this gap by exploring the degree of inequality of opportunity in adults' health status in Indonesia, an emerging country which has experienced one of the strongest gains in life expectancy in the past 20 years though is still well below developed countries' mean levels[3]. The choice of Indonesia is not without reason. First, if such improvements in life expectancy in Indonesia are to be praised, they may lead to additional and distinct health problems such as increasing need for care related to aging as well as rising non communicable diseases. Second, Indonesia's health budget, albeit increasing, is comparatively below those observed in neighbouring countries such as Vietnam, the Philippines, Malaysia, and well below more developed countries[4]. In this context, the measurement of health inequities and inequalities in Indonesia is of particular and rising concern (see Pitriyan and Siregar, 2013). Finally, Indonesia benefits from high quality health data that allow us to contribute to the crucial issue, for the analysis of inequalities in health, of the choice of a health indicator.

All studies on inequalities of opportunities in health, except Garcia Gomez et alii. (2012), rely on the use of a self-assessed health indicator. One first reason is its availability in most health surveys. Self-reports of general health have also proved to be a good predictor of mortality and health expenditures and one may argue that this indicator proposes a more comprehensive picture of global health status than more specific indictors, such as the report of some diseases (Idler and Benyamini, 1997). However, numerous debates exist on the validity of this indicator for interpersonal comparisons (for instance, Moessgaard et al., 2002; Sen, 2002b; van Doorslaer and Gerdtham, 2003), since this measurement being subjective, it also integrates personal expectations of good health, which are influenced by social and cultural environments. Hence, it is compelling to take into account the various dimensions of the concept of health by considering both health perception and other health indicators known to be more objective. In this study, the use of the 2007 Indonesian Family Life Survey, which is a large-scale survey with extremely rich information about individual health status, including both objective and subjective health measures, allows the construction of a continuous synthetic global health index that integrates various health dimensions.

Based on this continuous global health index, this study proposes to analyse inequalities of opportunities in health related to social and family background, location and community environment in Indonesia. Using an ex-ante approach to the measurement of inequality of opportunity in health (described in section below), we intend to be exhaustive and apply both non-parametric and parametric techniques. Health inequalities across circumstances are firstly identified using tests of stochastic dominance at first order. Multivariate regressions are then used to investigate the channels of construction of inequalities of opportunities in health. Finally we propose to assess the relative contribution of various types of determinants to inequalities in health based on the decomposition of the variance.

Our findings show large inequalities of opportunities in health in Indonesia. Health in adulthood appears to be directly affected by parents' vital status. By contrast, the effect on the descendant's health from parents' education is mainly indirect going through the descendant's socioeconomic, marital and migration statuses. Father's educational level status has nevertheless a non-negligible direct effect on adult health. The existence of long term difference in health related to religion, language spoken and province of location finally suggest that communities also constitute a relevant circumstance in the Indonesian context, in addition to social and family background.

[3] Indonesia's life expectancy at birth has passed from 58 years in 1980 to 70 years in 2011, according to the World Development Indicators 2013 release (World Bank, 2013).
[4] In 2011 total health expenditure (in % of GDP) is of 2.7 in Indonesia; 4.1 in Philippines; 3.6 in Malaysia; 6.8 in Vietnam; and above 12% in OECD member countries (Word Bank, 2013).

The remainder of the paper is as follows. Section 2 presents our approach to the measurement of inequality of opportunity in health. Section 3 describes the Indonesian IFLS sample and variables used and reports the associated descriptive statistics. Section 4 presents the estimating methods and section 5 reports results. A discussion and concluding remarks form the final section.

2. An ex-ante approach of inequality in opportunity in health

Theoretically, achieving equality of opportunity implies to respect two basic principles: the compensation principle, which demands that inequalities due to circumstances be eliminated and the reward principle, which requires rewarding any efforts done by individuals. Despite this general agreement, the measurement of equality of opportunity entails many theoretical, methodological and empirical questions.

In this sense, two different approaches have been proposed for evaluating the respect of the compensation principle (see Fleurbaey and Peragine (2013); Ramos and Van de Gaer (2012); Li Donni et al. (2014)): the ex-ante and the ex-post approaches to compensation. The ex-post approach consists on regarding differences in actual outcomes between individuals having the same responsibility characteristics or efforts and there is equality of opportunity if all those who exert the same effort obtain the same outcome. The ex-ante approach, instead, suggests that there is equality of opportunity if all individuals face the same set of opportunities, regardless of their circumstances. Fleurbaey and Peragine (2013) have indeed shown the incompatibility of the ex-post and the ex-ante approaches of compensation. It is therefore necessary to choose one approach or the other in order to evaluate inequality of opportunities.

The distinction between direct and indirect measures of inequality of opportunity has been also underlined (Fleurbaey and Schokkaert, 2012; Ramos and Van de Gaer, 2012; Brunoni et al., 2013). On one hand, direct measures assess how much inequality remains when only inequality due to circumstances is left. Empirically, it consists in estimating the inequality in a counterfactual outcome distribution in which all inequalities due to differences in effort have been eliminated. On the other hand, indirect measures assess how much inequality remains after opportunities are equalized. Empirically, it consists in estimating the level of inequality of opportunity by comparing inequality in the actual outcome distribution to inequality in a counterfactual outcome distribution where all individuals were to face the same circumstances Finally, non parametric and parametric methodologies have been proposed for assessing inequality of opportunity, with both direct and indirect measures, and in both ex-post or ex-ante approaches.

There is no systematic association between the approach retained, the type of measure and methodology chosen in the empirical literature on inequality of opportunities. These methodological choices are in fact often driven by data availability or empirical difficulty to define efforts to be rewarded and circumstances to compensate. The ex-post approach needs to observe responsibility variables, or to impose very restrictive assumptions on the relationship between responsibility characteristics and outcomes. The ex-ante approach does not require the observation of efforts since inequality of opportunity is identified by comparing outcome distributions between types of circumstances. It allows considering only a limited set of relevant factors independent from individual responsibility.

In the field of health, lifestyles -such as having a balanced diet, doing exercise, not smoking or not drinking too much, not being obese- are often considered as relevant efforts in relation to health

(Rosa-Dias, 2009, 2010; Jusot et al., 2013; Garcia Gomez et al., 2012; Bricard et al., 2013). However, even if those factors constitute causal determinants of health status, the fact they are freely chosen behaviours could be debatable, considering the influence of the family and social environment as well as genetic characteristics and preferences. Conversely, social and family background are undoubtedly good candidates for defining circumstances since they are clearly beyond individuals' responsibility and have been shown to be strongly associated with heath status in adulthood (for instance Barker 1996; Blane 1999; Wadsworth, 1999; Case et al., 2002; Currie and Stabile 2003; Kuh et al., 2004; Case 2005; Rosa-Dias 2009, 2010; Lindeboom et al. 2009; Trannoy et al., 2010; Tubeuf et al., 2012; Jusot et al., 2013).

In this paper, we follow the theoretical framework proposed by Roemer (1998) and used by Trannoy et al. (2010), in which effort is treated as unobserved. We choose to adopt an ex-ante approach using both non parametric and parametric analyses. Following Lefranc et al. (2008, 2009), Trannoy et al. (2010) and Rosa-Dias (2009), we use first-order stochastical dominance analysis as a weak test of ex-ante equality of opportunity. As suggested by Ferreira and Gignoux (2011), and Trannoy et al. (2010), a reduced form model is estimated in order to identify differences in health opportunities related to circumstances, independently from the influence of any unobserved efforts. Finally, we propose to consider a direct measure of inequality of opportunity in health, as suggested by Rosa-Dias (2009), but using the natural decomposition of the variance as proposed by Jusot et al. (2013) and Bricard et al. (2013).

3. Data

Sample

The data used in this study come from the Indonesia Family Life Survey (IFLS), a large-scale on-going longitudinal survey conducted by the RAND corporation[5] and publicly available. The first wave was conducted in 1993 (IFLS1), and full follow-ups took place in 1997 (IFLS2), 2000 (IFLS3), and 2007 (IFLS4). A total of 7,224 households were interviewed in IFLS1, representing about 83% of the Indonesian population living in 13 of the nation's 26 provinces. Subsequent waves attempted to reinterview these households and households to which previous household members had moved. Because substantial effort has been done to track the movers, attrition rates in IFLS surveys are remarkably low. Overall, 87.6% of households that participated in IFLS1 are interviewed in each of the subsequent three waves.

In all four waves of the survey a wide list of self-reported measures of health condition are available, that includes self-assessed general health status, symptoms, pain, diagnosed chronic conditions and functional limitations. Anthropometric measures (height and weight) are also included in all rounds. IFLS2 and IFLS3 introduced a set of biomarker measurements conducted by a nurse, and questions capturing mental health. The IFLS4 wave overhauled the health questionnaire in order to make the IFLS survey more comparable with international surveys (such as HRS, ELSA, SHARE), but loosing internal panel consistency in many health measurements. In particular, modules on physical functioning, chronic health conditions, pain or mental health were heavily revamped, and new biomarker measurements added.

[5] Several institutions have also collaborated in the project, such as Lembaga Demografi, University of Indonesia, UCLA, the Population Research center, University of Gadjah Mada, the Center for Population and Policy Studies (CPPS) of the University of Gadjah Mada and Survey METRE.

In this paper we therefore restrict the analysis to the data of the 2007 wave, in order to maximize the range of health self-reported and physically assessed indicators at our disposal. Previous waves have nevertheless been used in order to recover eventually missing information on relevant socioeconomic variables. At the same time, since various physical measurements of health are only recorded for household members aged 40 and over, the analytic sample is restricted to this age spectrum.

Health outcomes

Health status is difficult to measure, partly because the concept of health is multidimensional (Blaxter, 1985), and no agreement exists as to what measures are good indicators of health (Moessgaard et al., 2002; Sen, 2002b; Shmueli, 2003; van Doorslaer and Gerdtham, 2003; Baker et al., 2004; Lindeboom and Van Doorslaer, 2004; Etilé and Milcent, 2006; Mackenbach et al., 1996; Perronnin et al., 2006; Jürges, 2007; Tubeuf et al., 2008; Bago d'Uva et al., 2011). For this reason, health can only be fully assessed by various health indicators, examined simultaneously (Shmueli, 2003; Perronnin et al., 2006; Tubeuf et al., 2008).

One of the most commonly used indicators of overall health status in household surveys is the simple question "In general, how is your health?". The IFLS survey includes this question allowing for four response categories: "very healthy", "somewhat healthy", "somewhat unhealthy" and "very unhealthy". In principle true health is a continuous latent variable. When respondents answer such a survey question about their general health, they evaluate their true health and project this value onto the scale provided. Though this categorical variable has been shown to be a very good predictor variable of other outcomes such as morbidity and mortality (Idler and Benyamini, 1997), it has various limitations. One major concern with this subjective measure is the well-known reporting bias problem which may appear if sub-groups of the population use systematically different threshold levels for self-assessed health, despite having the same level of 'true' health. A second major concern for our purposes is the ordinal scale problem, which implies that this indicator does not provide a cardinal and continuous health scale that can be used for the measurement of inequalities in health. Though continuous measures of health exist in the survey (e.g., biomarkers), they usually capture specific health dimensions and do not provide an overall picture of general health status.

In this paper we choose to compute a continuous health indicator using a generalised ordered logit regression explaining self-assessed health as a function of several objective and quasi-objective health variables (distinction inspired by Jürges, 2007), that we specify here below. The estimation method is described in next section.

In IFLS4 two health workers (typically nurses) visited each household to record various measures of physical health for each household member. The objective measures of health state included in this paper come from such biomarker measurements. These include measures of Body Mass Index (classified in undernourished, normal, overweight and obese), waist circumference, presence of anemia (through hemoglobin levels below WHO thresholds), hypertension (through blood pressure measurements, both systolic and diastolic), grip strength and lung capacity.[6]

[6] Total and HDL cholesterol blood tests were also included in the IFLS survey, but are excluded from the set of objective variables here considered. Unfortunately they present high levels of missing values, which lead to a substantial loss of the original sample.

Self-reported information on factual conditions is here considered as quasi-objective health measurements.[7] Our quasi-objective health variables include functional limitations, smoking behaviour, mental health, acute morbidity symptoms and body pain symptoms. Functional limitations of individuals are here measured by: (i) the number of Activities of Daily Living (ADL) that individuals do with difficulty or are unable to do (i.e., ability to carry heavy load, to draw a pail of water from a well, to walk five kilometers, to bow squat or kneel, to dress or go to the bathroom without help and to stand up from sitting); and (ii) the number of Instrumental Activities of Daily Living (IADL), that is, activities not necessary for fundamental functioning but required to be able to live independently (i.e., ability to shop for personal needs, prepare a meal, take medicine, visit acquaintances in village or take a trip out of town). Smoking behaviour of respondents captures whether they currently smoke or not, and if they had smoked in the past but ended up quitting. Mental health is diagnosed by a depression scale corresponding to a short version of the questionnaire developed by the Center for Epidemiologic Studies Depression Scale (CES-D). A three-category variable has been constructed from scores ranges: no depression, mild to moderate depression and possibility of major depression. Acute morbidity symptoms during the past 4 weeks are included for left side chest pain, morning headaches, and troublesome urinary symptoms. Questions about pain in specific parts of the body (head, arm, back, knee,…) have been used to construct indicator variables capturing whether if individuals suffer from body pain on a daily/weekly basis, from severe body pain, or from body pain limiting their daily activities.

Table 1 presents descriptive statistics on health outcomes for the total sample used, as well as separately for two age groups. As expected, there are substantial differences by age, no matter which health indicator we look at. If we focus on self-reported health, we see that above 70 percent of the population self declares as being "somewhat healthy", no matter the age group. Over time, individuals tend to declare themselves less often as "very healthy" (9% among the '40-60' age group versus 4% among the 'more than 60' group and more often as somewhat unhealthy (15% versus 24% respectively). The share of individuals in the sample declaring themselves as unhealthy is low at all ages (0.39% and 0.64% respectively) in Indonesia. This proportion is very similar to the proportion of people reporting a very poor health status in European countries, whereas health status of the population is certainly better in Europe than in Indonesia. This suggests that self-reported health indicator suffers from cultural and social reporting biases, which compromise its use for international comparisons between countries with different level of development but also for interpersonal comparisons between individuals with different socioeconomic characteristics. Therefore it confirms the interested of considering objective and quasi-objective health indicators in addition to self-reported health. In general though, and as expected, health status declines with age, whether if we consider biomarkers (higher undernourishment, anemia and hypertension levels, lower grip strength or lung capacity) or quasi-objective measures (higher number on ADL and IADL done with difficulty, as well as higher levels of different suffering from body pain).

Circumstances and current socioeconomic status

Our aim is to explore the relative contribution of circumstance variables, that is, those which can be regarded as exogenous to the individual, to overall health inequality, after adjusting for demographic

[7] Contrary to what is usually considered in developed countries (see Jürges, 2007), we decided to exclude information on doctor diagnosed chronic illnesses and conditions, since they will highly depend on the degree of respondents' access to health services, and both the literature on health services in Indonesia, and exploratory data analysis with censuses of village infrastructure all suggest that the distribution of health services in Indonesia is certainly not random (Frankenberg, 1995).

characteristics (sex and age cohort). The set of circumstance variables considered in this paper includes[8]: parental education (captured by the level of education of the father and school attendance of the mother); parental health status (proxied by parents' vital status); community belonging (through language spoken in daily life at home and religion declared)[9]. Location controls (urban/rural area and province) are also included.

In a second step, we introduce in the model a list of current individual characteristics found to be associated to health status in Indonesia (Miller et al, 2006; Lu, 2010a ; Lu, 2010b), in order to investigate the channels of construction of inequalities of opportunity in health: individual's own education, occupational and marital status as measured in 2007 and the fact of having been migrant / stayer during the period 1993-2007. The information on migration was obtained from two different sources in the survey: the tracking modules with information on the household's location in 1993, 1997, 1998, 2000 and 2007, and the specific (adult) individuals' migration modules with information on residence at birth, at age 12, and all moves after age 12.

Descriptive statistics for both circumstance variables and current individuals' characteristics are reported respectively in tables 2 and 3. As expected in an emerging country, levels of parental health and education have greatly increased over time though are still rather low (among the 40 to 60 age group, 37% of fathers and 54% of mothers and 13% of individuals never attended school and only 23% of fathers and 47% of mothers are still alive). Concerning community belonging variables, an increase in the number of adults speaking Indonesian at home is observed four younger adults (24% at 40-60 years old versus 13% at more than 60). The share of population by religion group holds rather stable over time (muslim percentages passing from 87 to 89 across age groups). In terms of location, about half of our sample lives in rural areas, and Java (60%) and Sumatra (18%) are the most populated provinces (migration status touches 50% of total population). Finally, as opposed to what is observed in more developed countries, married rates are clearly overwhelming (81%), and only a negligible share of adults remains single (1%) or divorces/separates (3.5%). Working rates, though diminishing with age, are impressively high after 60 years old (57%), when compared to more developed country standards.

4. Methods

Computing a continuous health index

In the line of the methodology suggested by Perronnin et al. (2006) and Jürges (2007), the first step of our analysis consists in constructing a continuous health index measuring a "synthetic global health status" and allowing comparisons between individuals as well as statistical computations of inequality measures in health. For this purpose we choose to estimate a generalized ordered logit (gologit) model

[8] Several studies have already suggested that health in adulthood is influenced by social and family background through various mechanisms (see for instance Barker 1996; Blane 1999; Case et al., 2002; Lindeboom et al. 2009; Strauss and Thomas, 2008). According to the latency model, social and family living conditions during childhood may have a direct influence on health in adulthood following a latency period. The pathway model relies on social background having an indirect influence on health status in adulthood through a transmission of socioeconomic status over different generations. Furthermore scholars have confirmed the existing correlation between health statuses across generations.

[9] The variable ethnicity group was also available in the survey. To capture community belonging, we nevertheless have preferred to use language spoken and religion declared, since there are 29 different ethnic groups in IFLS4 and interpretation becomes rather cumbersome. In any case, robustness of results to the choice of community variable has been tested and similar results are obtained.

of self-reported health (SRH) on the set of objective and quasi-objective health variables (X) described above.[10] The gologit model thus writes:

$$\mathrm{P}(\mathrm{SRH_i} > \mathrm{j}) = \mathrm{f}(\mathrm{X_i}\beta_\mathrm{j}) = \frac{\exp(\alpha_\mathrm{j} + \mathrm{X_i}\beta_\mathrm{j})}{1 + [\exp(\alpha_\mathrm{j} + \mathrm{X_i}\beta_\mathrm{j})]} \qquad \text{j=1, 2, …M-1}$$

where M is the total number of categories of the ordinal dependent variable. From this model we can determine the probabilities that SRH will take on each of the values 1,…, M, conditional on the explanatory variables:

$$P(SRH_i = 1) = 1 - f(X_i\beta_1)$$

$$P(SRH_i = j) = f(X_i\beta_{j-1}) - f(X_i\beta_j) \quad \text{j=2,…M-1}$$

$$P(SRH_i = M) = f(X_i\beta_{M-1})$$

The gologit model is a general specification, which nests more restrictive models such as the simple logistic regression model (when M=2), the parallel-lines ordinal logistic model, that assumes that the β's (not the α's) are the same for all values of j, or the partial proportional odds model, less restrictive than the previous one since it only assumes parallel slopes (equal β's) for a subset of covariates. To determine whether the coefficients for some independent variables are identical across the binary equations while the coefficients for other independent variables differ, a Wald test developed by Brant (1990) is usually applied. In our case, preliminary analysis using this Brant test has showed an overall violation of the parallel-line assumption on a number of covariates. Our preferred regression is therefore the partial proportional odds model[11].

From this econometric specification, we use the predicted probability of reporting a very good health status, $\mathrm{P}(\mathrm{SRH_i} = 1)$, as a continuous outcome in order to explore inequality in opportunities in health. Since the partial proportional odds model allows the parameters to differ across values of j, the contribution of the various objective and quasi-objective health variables may differ according to the cut-point considered for computing on the predicted health status. We therefore consider the predicted probability of reporting a very good health status or a somewhat healthy health status , $\mathrm{P}(\mathrm{SRH_i} = 1{,}2)$, as the second outcome variable in a first robustness check, leaving main conclusions unchanged (see appendix A1). Note also that we are aware that self-assessed conditions, even if here taken from factual matters, may contain some amount of measurement error, usually in the form of non-neutral under-reporting (Mackenbach et al., 1996; Baker et al., 2004). Therefore, an array of robustness test concerning their inclusion or exclusion in the computation of the continuous health index has been performed (appendix A2), leaving one more time the conclusion unchanged in terms of inequalities of opportunities in health (A3).

Non-parametric analysis of inequality of opportunity in health

Following Lefranc et al. (2008, 2009), Trannoy et al. (2010) and Rosa-Dias (2009), we firstly rely on the comparison of cumulative distribution functions (CDF) of the outcome conditioned on each type of circumstances in order to (weakly) test the existence of inequality of opportunity. Lefranc et al. (2008,

[10] For a detailed description on the method used, see Williams (2006). Richard Williams' gologit2 Stata module is used to estimate the model.
[11] Results imposing the parallel lines assumption available from the authors upon request.

2009) have shown that equality of distributions conditional on circumstances is a necessary condition for equality of opportunity, according to the definition proposed Roemer (1998), even if circumstances are not fully described. Thus, stochastic dominance at first order tests can be used to test if any circumstance endows an advantage at any percentile of the distribution of health statuses (and not only in average).

> *Stochastic dominance at first order is defined as follows: Given any two health distributions A and B, corresponding to two types, with respective cumulative distribution functions FA(x) and FB(x), A dominates at first order B if and only if $FA(x_j) \leq FB(x_j)$, for any health status $x_j=\{x_1,x_2,\ldots, x_k\}$.*

In this case, the set of opportunities is better for individuals with type A than for individuals with type B, since at each point of the distribution of health status, the cumulative probability to be in the poorest health statuses is lower for individuals with types A than for individuals with type B. Graphically, the CDF of health statuses of individuals with type A is always below that of individuals with B at any point of the distribution of health status, and unilateral Kolmogorov-Smirnov (KS) tests of equality of distribution can be used for inference analysis.

Using the predicted probability of reporting a very good health status $\widehat{\mathrm{P}}(\mathrm{SRH_i} = 1)$ as a continuous health indicator, we perform the non parametric test by comparing the CDF conditional on each type of circumstance (parents' education, parents' longevity, location and community variables) in order to test the violation of the condition of equality of opportunity in health. To complete the analysis, we propose also to compare the CDF conditional on current socioeconomic status descriptors (education, occupation, migration and marital status) using the same test. This allows identifying systematic inequalities related to those variables, even if the interpretation of those health inequalities in the equality of opportunity framework is not straightforward since the current situation of individuals is jointly explained by their circumstances, their efforts at school and on labour market and unobserved characteristics.

Parametric analysis of inequality of opportunity in health

In a second step, we propose to examine the role of social and family background on the value of $\widehat{\mathrm{P}}(\mathrm{SRH_i} = 1)$ using OLS regression analysis. This parametrical approach proposes to test the equality of opportunity hypothesis in terms of conditional expectation after control for age and sex, which constitute two important biological determinants of health status. This second approach permits also to explore the channels through which the intergenerational transmission goes, even if this methodology only provides statistical correlations which cannot be interpreted as in terms of causality.

Health in adulthood, measured by the predicted probability of reporting a very good health status $\widehat{\mathrm{P}}(\mathrm{SRH_i} = 1)$ is assumed to be a function of biological determinants (age and sex) D_i, a set of social, family and community circumstances C_i, individual's current socioeconomic status SES_i, and an error term u_i, which is assumed to be normally distributed, and corresponds to unobserved circumstances, unobserved individuals efforts and pure luck:

$$\hat{P}(SRH_i = 1) = \alpha + D_i\beta + C_i\gamma + SES_i\delta + u_i$$

We firstly estimate a reduced form model, called model 1, where health status is only explained by circumstances and demographics variables:

$$\hat{P}(SRH_i = 1) = \alpha_1 + D_i\beta_1 + C_i\gamma_1 + u_{1i} \quad (1)$$

This initial specification, called model 1, allows testing the significance of the association between circumstances and the probability of reporting a very good health status after adjustment for age groups and sex, and therefore the existence of differences in opportunity in health related to circumstances, independently from the influence if any unobserved efforts (Ferreira and Gignoux, 2011; Trannoy et al., 2010). Note that this ex-ante approach of inequality of opportunity in health is consistent with Roemer's view of inequalities of opportunity if the efforts are correlated to circumstances, as the parameter γ_1 corresponds to the sum of the direct influence of circumstances on health and their indirect influence through the determination of efforts (Bourguignon et al., 2007; Trannoy et al., 2010; Jusot et al., 2013).

In a second step we add individual's current socioeconomic status to our previous equation and obtain model 2:

$$\hat{P}(SRH_i = 1) = \alpha_2 + Di\beta_2 + Ci\gamma_2 + SES_i\delta_2 + u_{2i} \quad (2)$$

This two-step analysis permits understanding the underlying mechanisms influencing circumstances on adult health: the parameter γ_2 gives a measure of the direct long term effect of circumstances on health status, whereas the decrease in the value of the parameter γ_2 with comparison to the value of the parameter γ_1 corresponds to the indirect effect of circumstances going through the influence of social, family and community background on current socioeconomic status.

Inequality of opportunity measurement

The purpose of the final step of the analysis is to quantify and decompose the magnitude of health inequality in order to provide a direct measure of inequality of opportunity in health. Based on the methodology proposed by Jusot et al. (2013) and Bricard and al. (2013), we propose to use our continuous health indicator $\hat{P}$ as a linearly decomposable measure of health status and to measure inequalities in overall health status by the variance of $\hat{P}$. The variance allows a straightforward decomposition of components and presents good properties of consistency, symmetry, translation invariance and independence of the level of disaggregation (Shorrocks, 1982).[12]

[12] In the income literature, the mean log deviation has been pointed out as a particularly appropriate measure of inequality of opportunity (see Ferreira and Gignoux, 2011). However, working with a health indicator coming from a probabilistic framework (thus having values between zero and one and leading to negative values on the logarithm scale) make us prefer the variance as a measure of inequality. The variance is also considered a prefered indicator when looking at the wealth distribution, usually with zero means, or at net income, where negative values may appear in the distribution (Ferreira et al., 2011).

Using the results of the estimate of model 1, we can distinguish three additive broad sources of health inequalities: the circumstances, the demographic characteristics and residual terms. The decomposition of the variance of health status $\sigma^2(\hat{P}_i)$ is therefore given by:

$$\sigma^2(\hat{P}_i) = \mathrm{cov}(C_i\hat{\gamma}_1, \hat{P}_i) + \mathrm{cov}(D_i\hat{\beta}_1, \hat{P}_i) + \mathrm{cov}(\hat{u}_{1i}, \hat{P}_i)$$

As the contribution of a source in the natural decomposition of variance is simply given by the covariance between each source of health and the outcome, the component of health inequality related to illegitimate determinants $\mathrm{cov}(C_i\hat{\gamma}_1, \hat{P}_i)$ gives us a direct absolute measure of inequality of opportunity in health, and the ratio between this covariance and the variance of health status $\mathrm{cov}(C_i\hat{\gamma}_1, \hat{P}_i) \big/ \sigma^2(\hat{P}_i)$, a relative measure of inequality of opportunity in health. Using the same methodology, we also decompose of the variance of health status $\sigma^2(\hat{P}_i)$ according to the precise sources of health inequality in order to quantify the respective contribution of parental education, parental health status, community belonging and location to health inequalities. Note that in the presence of omitted circumstance variables that are correlated with the observed ones, our measure of overall inequality of opportunity is to be considered a lower-bound and the analysis and interpretation of these partial effects must be done with care. In this sense, coefficients should not be interpreted causally (which would require the orthogonality assumption between observed and non-observed variables), but only as partial correlations between individual circumstance variables and the global health index. Nevertheless, this accounting exercise is reasonably informative about the pathways through which observed circumstances (directly) and unobserved circumstances (indirectly) jointly affect health status.

Finally, we decompose the variance of health status $\sigma^2(\hat{P}_i)$ based on the estimate of model 2 as follows:

$$\sigma^2(\hat{P}_i) = \mathrm{cov}(SES_i\hat{\delta}_2, \hat{P}_i) + \mathrm{cov}(C_i\hat{\gamma}_2, \hat{P}_i) + \mathrm{cov}(D_i\hat{\beta}_2, \hat{P}_i) + \mathrm{cov}(\hat{u}_{1i}, \hat{P}_i)$$

This allows measuring the component of health inequality related to current socioeconomic status $\mathrm{cov}(SES_i\hat{\delta}_2, \hat{P}_i)$, which corresponds to the concept of social health inequalities which is widely used in the epidemiological and economic literature on inequalities in health. Note that the component of health inequality related to illegitimate determinants, $\mathrm{cov}(C_i\hat{\gamma}_2, \hat{P}_i)$, as measured in model 2, corresponds only to the share of inequalities of opportunities in health attributable to the direct effect on circumstances on health status. Thus for comparing the magnitude of inequality of opportunity in health to the magnitude of social health inequalities, we must compare our measure of social health inequality with our measure of inequalities in opportunities in health as measured in model 1.

5. Results

Continuous health index

To compute our continuous health indicator we estimate a generalized ordered logit regression explaining self-assessed health as a function of the objective and quasi-objective health variables described above. Since less the 0.5% of the sample declares herself unhealthy we opted for grouping answers to self-reported health into three categories: (1) very healthy; (2) somewhat healthy; (3) somewhat unhealthy and unhealthy. Table 3 presents our estimates the preferred partial proportional odds specification. Note that positive coefficients indicate that higher values on the explanatory variable make it more likely that the respondent will be in a higher category of the dependent variable (thus worse self-reported health level); meanwhile, negative coefficients indicate that higher values on the explanatory variable increase the likelihood of being in the current or a lower category (denoting better self-reported health).

Among our objective measures and evaluations of health status, only hypertension, grip strength and lung capacity continuously showed a significant effect on SRH status. This effect worked in the direction of individuals declaring themselves in worse health as levels of hypertension were detected and as their grip strength and lung capacity diminished. Age, which does not meet the parallel-lines assumption, appears as significant only for the category "very healthy". Individuals with higher age tend to report themselves less often as being very healthy, but reporting differences are insignificant between the "somewhat healthy" and "somewhat unhealthy/unhealthy" categories. Our rest of biomarkers, that is, body mass index, waist circumference and anemia appear here as insignificant.

When we turn to our quasi-objective health measures, we see that the number of ADL (and instrumental ADL) achieved with difficulty, together with ever feeling chest pains on left side and more generally, suffering from severe body pain, are all continuously and significantly linked with lower reported levels of health, no matter the cutpoint chosen. On the contrary, suffering from depression (whether moderate or major), morning headaches, or more generally from body pain every week/day or such that daily activities are limited, do not play a significant role in determining a self-declared "very healthy" status, but only appear as significant when comparing higher health categories versus the last "somewhat unhealthy/unhealthy" group. Concerning individuals' smoking behaviour, we observe a non-symmetric pattern. A person who has smoked but quit is more likely to report bad health while being a current smoker appears not significant. This result is not surprising. Most of people who have decided to stop smoking have experienced different health problems, in particular pulmonary problems, and tend to declare being unhealthy. At the same time, being a current smoker only has a significant negative effect on the probability of declaring oneself "very healthy" with respect to lower health levels.

From this econometric specification, we have determined the predicted probability of reporting a very good health status, $P(SRH_i = 1)$, which gives us a continuous measure of health status. The aim is to examine the role of social and family background on the value of this continuous health index. Note that we are aware that self-assessed conditions, even if here taken from factual matters, may contain some amount of measurement error, usually in the form of non-neutral under-reporting (Mackenbach et al., 1996; Baker et al., 2004). Therefore, an array of robustness test concerning their inclusion or exclusion in the computation of the continuous health index has been performed. Table A1 in the appendix presents two of the tested alternative specifications for our gologit regressions: (i) including only biomarkers, and (ii) adding a subset of quasi-objective variables. In general, we observe that conclusions remain unchanged and if anything, our preferred specification adds variation to the predicted probability of reporting a very good health status, and therefore is the most conservative in terms of quantifying inequality of opportunity in health status.

Non –parametric analysis of inequality of opportunities

In order to test the existence of inequalities in health, we firstly compared cumulative distributions of continuous measure of health status conditional to demographics characteristics (Figure 1), various types of circumstances (Figures 2 to 5) and current socioeconomic status (Figure 6). Graphically, first order dominance relationship can be identified when the CDF corresponding to one particular characteristic is always below that of one other type at any point of the distribution of health status. In addition, two-sample Kolmogorov-Smirnov (KS) first-order stochastic dominance tests have been implemented for every pair of categories within variables.

The comparison of CDF conditional to demographic characteristics firstly shows that men dominate women and younger adults dominate older ones in terms of health status, with KS tests significant at 1% confidence level. Concerning circumstances, figures 2 to 5 shows the existence of inequalities of opportunities in health according to all studied dimensions. The higher the level of parental education the better health opportunities are: KS tests are always significant for any pair of categories (at 1% level between no education/no attendance and some education/attendance, and between junior high versus senior high education; at 10% between elementary and junior high or between senior high and university). The distribution of predicted health status of individuals whose either father or mother is still alive dominates the distribution of health of individuals whose parents are deceased and differences are highly significant. Speaking Indonesian at home is also significantly associated with better health opportunities. Individuals declaring themselves Muslims show CDF's significantly beneath non-Muslims (whether Christian or other, at 5%), but no statistically significant difference is found among non-Muslims. In terms of location, individuals living in Sulawesi presented the poorest health opportunities, followed by Sumatra. No significant first order stochastic dominance is found among the rest of provinces.

Figure 6 represents the CDFs of health status conditional on their current socioeconomic status. The findings reveal significant social inequalities in health. The distribution of health status of migrants significantly dominates the distribution of health of stayers. The higher the level of individual education, the better health opportunities are, and the health distribution of employed individuals significantly dominates the distribution of individuals with others occupational statuses. Finally, the comparison of distributions of health related to marital health status shows CDFs disfavouring widowed individuals.

Parametric analysis of inequality of opportunities

Table 5 reports on the OLS estimation results of our synthetic measure of global health status $\widehat{\mathrm{P}}(\mathrm{SRH_i} = 1)$ on our set of circumstance variables (model 1) as well as adding controls for current socioeconomic status (model 2).

Circumstance variables have the expected effect on health status. The coefficient of the age group dummy variables is negative, significant and increasing with age. Gender has a significant effect on health (women still experiencing lower levels of health in a multivariate setting). The estimated effect of parental education on health in adulthood is positive, increasing with education levels and significant, though once we introduce own education as a covariate only father's senior high level of education remains significant. Parental health, though, remains positive and highly significant in both models 1 and 2. The estimated effect of being Christian (which groups Catholicism and Protestantism religious groups) or Other (which groups Hinduism, Buddhism and Confucianism) is always negative with Muslisms as the reference category, though the group Others seems worse off in terms of health status since coefficients in this category are higher and always significant while significance is lost in model 1 for Christians. Not speaking Indonesian in daily life at home also has a significant negative effect on health status (a third of the effect vanishes in model 2 though). Provincial differences appear as important in Indonesia: with Sumatra as our reference category, living in Java or more so in the Lesser Sunda Islands has a strong and always highly significant positive effect. The effect of the Sulawesi province is on the contrary negative and highly significant. The province of Kalimatan shows up as insignificant. Surprisingly, no significant difference in health is observed across urban and rural areas in both specifications.

Turning now to the vector of current socioeconomic variables, we observed that migration is statistically insignificant while own education, being currently occupied and marital status all play a significant role. Own education has the usual positive and significant effect on health at all categories (though non monotonically increasing, since the magnitude of the senior high category coefficient is slightly higher than the university level one). Being currently occupied has a positive effect in health (though double causality in this case may probably be at play). Finally, marital status also has the expected effect: with married status as reference, being divorced/separated, single or widow/widower (in order of increasing coefficient magnitude) all have significant negative effects on health.

Inequalities of opportunities measurement

The aim of the last step of the analysis is to provide a measure of inequalities of opportunities in health and to quantify the relative contribution of each type of circumstance.

For this purpose, inequalities in overall health status are measured by the variance of $\widehat{P}$ (equal to 12,356). Using the results of the estimate of model 1, we can easily compute the covariance between our continuous health index and each source of inequalities - respectively $\text{cov}(C_i\hat{\gamma}_1, \hat{P}_i)$, $\text{cov}(D_i\hat{\beta}_1, \hat{P}_i)$ and $\text{cov}(\hat{u}_{1i}, \hat{P}_i)$ - which gives us the absolute contribution to health inequalities of respectively, circumstances, demographics and unobserved factors. The ratios between those covariances and the variance of health status are finally computed in order to give the relative contribution of each source to overall inequalities and presented in Table 6.

Unsurprinsigly, most of health inequalities are attributable to unobserved factors, which are a mix of luck factors, unobserved circumstances and efforts. However, the contribution of residuals terms, equal to 63%, seems to be weaker than that fund in France (Jusot et al. ,2013) and in Europe (Bricard et al., 2013), even if the comparison of results of those previous studies is not obvious due to different methodological choices. Findings also highlight the important role of demographic variables in inequalities in health in Indonesia, with comparison to other observed factors. With a contribution of 27%, demographic variables constitutes a larger source of inequalities than solely circumstances (model 1), or both circumstances and current socioeconomic status (model 2). The contribution of demographics seems to be more important than in European countries, where their contribution is comparable to the contribution of circumstances (Jusot et al., 2013 ; Bricard et al., 2013).

Nevertheless, inequalities of opportunities in health, as measured by a direct measure, count for 10% of total inequalities in health (in model 1), and are of comparable extent of inequalities in health attributable to current socioeconomic status (which counts for 9% in model 2). Inequality in opportunity in health appears to be very large in Indonesia when compared to more developed countries. With very larger set of circumstances, Jusot et al. (2013) have found that inequalities of opportunities in health count for less than 9% of the variance of health status in general population in France, whereas Bricard et al. (2013), have found that inequalities in opportunities among adults aged 50 and over ranged from 2.5% to 6.5% in Europe, excepted in Austria where they reach 10% (according to our own calculation).

Among circumstances, parents' health is found to have the highest impact to the level of equality of opportunity in health (with a contribution of 57%), and in particular mother's health (which counts for 41%). By contrast, social background counts for less than 20% of inequalities of opportunities in health , whereas is was found to be the most important source of inequalities in opportunities in health in France (Trannoy et al., 2010 ; Jusot et al., 2013). Even if inequalities of opportunities related to religion and language spoken are of second order, the large extend of inequalities in opportunities related to province of location finally suggest that communities also constitutes a relevant circumstance, in addition to social and family background.

6. Conclusion

The aim of this paper was to explore to role of social and family background on health status in adulthood in order to measure inequalities of opportunities in health in an ex-ante approach in Indonesia. The use of the 2007 Indonesian Family Life Survey, a large-scale survey with extremely rich information about individual health outcomes, which includes both biomarkers and self-reports, allowed the construction of a continuous global health index for analysing inequalities of opportunities in global health status. Several types of circumstances appropriated to context of a developing country were considered: social and family background, location and community environment. Inequalities of opportunity in health were firstly identified using tests of stochastic dominance at first order. Multivariate regressions were then used to investigate the channels of construction of inequalities of opportunity in health. Decomposition analysis was finally performed in order to quantify inequalities of opportunity in health.

Consistently with previous studies on inequalities in opportunity in health in developed countries (Rosa-Dias, 2009; Rosa-Dias, 2010; Garcia Gomez et al., 2012; Tubeuf et al., 2012; Jusot et al., 2013; Bricard et al., 2013, Li Donni, 2014), findings of the non parametric analysis show significant inequalities of opportunities in health related to social background, parents' vital status, community of origin and location, as well as inequalities in health related to current socioeconomic status in Indonesia. The parametrical analysis provides in addition interesting results on the pathways for intergenerational transmission of inequalities in health even if our results cannot be interpreted in terms of causality. Health in adulthood appears to be directly affected by gender and parents vital status. By contrast, the effect on the descendant's health from parents' education is mainly indirect going through the descendant's socioeconomic, marital and migration statuses. However, father's educational level status has also a direct effect on adult health. The results finally show long term differences in health related to religion, language spoken and province of location.

Regarding the decomposition of inequalities, most of differences in health status were still remain unexplained or attributable to age and gender, which constitute the primary determinant of health.

However, inequalities of opportunities in health, as measured by a direct measure, count for 10% of total inequalities in health, and appear to be large in Indonesia when compared to more developed countries. Indeed, they are of comparable extent of inequalities in health attributable to current socioeconomic status. Among circumstances, parents' health is found to have the highest impact on the level of equality of opportunity in health, and in particular mother's health. By contrast, social background was found to be the most important source of inequalities in opportunity in health in France (Trannoy et al., 2010). The existence of long-term differences in health related to religion, language spoken and, more importantly, province of location finally suggest that the importance of location in Indonesia, compared to more developed countries is compelling for health equity and that community belonging also constitutes a relevant circumstance, in addition to social and family background.

As social, family and community background represent factors beyond individual responsibility, they are socially or morally unacceptable sources of inequality in health. These results advocate the need to neutralise the effect of these circumstances on health in order the archive the goal of equity in health underlined by World Health Organization's Commission, in addition to usual policies aiming at reducing current socioeconomic inequality.

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Table 1: Descriptive statistics on health outcomes

	Total population		Age: 40 to 60		Age: more than 60	
Self-reported health						
very healthy (%)	7.84		9.04		4.06	
somewhat healthy (%)	74.13		75.33		70.35	
somewhat unhealthy (%)	17.58		15.23		24.95	
unhealthy (%)	0.45		0.39		0.64	
Biomarkers' measures						
Body Mass Index						
undernourished (%)	13.45		9.50		25.80	
normal (%)	56.54		56.45		56.84	
overweight (%)	22.52		25.16		14.26	
obese (%)	7.49		8.89		3.10	
Waist circumference	81.54	(11.69)	82.21	(11.43)	79.42	(12.24)
Anemia: Hb below WHO's thresholds (%)	24.99		20.66		38.57	
Hypertension (%)	43.12		37.62		60.36	
Grip strength	26.64	(10.96)	28.57	(10.71)	20.62	(9.45)
Lung capacity	294.34	(109.09)	317.30	(104.07)	222.44	(91.85)
Quasi-objective health measures						
Number of IADL with difficulty	0.35	(0.79)	0.18	(0.51)	0.88	(1.18)
Number of ADL with difficulty	0.70	(1.23)	0.44	(0.89)	1.48	(1.71)
Smoking behaviour						
Never smoked (%)	60.05		61.50		55.50	
Smoked but quit (%)	4.38		3.28		7.85	
Still smokes (%)	35.57		35.23		36.65	
Mental health (CES-D scores)						
No depression (%)	91.36		91.64		90.49	
Mild to moderate depression (%)	5.26		4.93		6.30	
Possibility of major depression (%)	3.37		3.43		3.21	
Ever feel chest pains on left side? (%)	13.60		13.43		14.16	
Headache when get up in the morning? (%)	20.92		19.75		24.57	
Do you often get up to urinate at night? (%)	51.09		48.93		57.85	
Suffers body pain every week/day (%)	25.46		23.56		31.41	
Suffers severe body pain (%)	6.49		6.52		6.41	
Suffers body pain limiting daily activities (%)	23.21		21.10		29.81	
Number of observations	7734		5862		1872	

Note: Numbers show means and percentages of variables used (standard deviations for continuous variables in parentheses).

Table 2: Descriptive statistics on circumstances

	Total population	Age: 40 to 60	Age: more than 60
Demographic characteristics			
Sex			
Male %	48.20	48.45	47.44
Female %	51.80	51.55	52.56
Age			
From 40 to 60 %	73.70	97.24	0.00
From 60 to 80 %	24.72	2.76	93.48
More than 80 %	1.58	0.00	6.52
Parental education			
Father's educational attainment			
No education %	45.01	37.48	68.59
Elementary %	44.54	50.32	26.44
Junior high %	5.15	5.85	2.94
Senior high %	4.32	5.10	1.87
University %	0.98	1.25	0.16
Mother ever attended school %	39.53	45.91	19.55
Parental health			
Father still alive %	17.84	23.08	1.44
Mother still alive %	37.66	47.70	6.25
Community variables			
Religion			
Islam %	88.36	88.91	86.65
Christian %	5.82	5.54	6.68
Other %	5.82	5.54	6.68
Language spoken in household			
Indonesian %	21.98	24.58	13.84
Not indonesian %	78.02	75.42	86.16
Location variables			
Urban area %	51.22	52.73	46.47
Provinces			
Sumatra %	18.04	18.70	15.97
Java %	59.96	60.05	59.67
Lesser Sunda Islands %	12.94	12.18	15.33
Kalimatan %	3.80	4.03	3.10
Sulawesi %	5.26	5.05	5.93

Table 3: Descriptive statistics on current socioeconomic variables

	Total population	Age: 40 to 60	Age: more than 60
Migrant status %	50.44	52.25	44.76
Own education			
No education %	19.50	13.22	39.16
Elementary %	46.68	47.87	42.95
Junior high %	11.13	12.33	7.37
Senior high %	14.62	16.91	7.48
University %	8.07	9.67	3.04
Marital status			
single %	1.46	1.77	0.48
married %	81.41	87.12	63.51
divorced/separated %	3.53	3.58	3.37
Widow/widower %	13.60	7.52	32.64
Currently occupied %	77.08	83.52	56.89

Table 4. Partial proportional odds model on self-reported health

	Unhealthy (3) or somewhat healthy (2) versus very healthy (1)		Unhealthy(3) versus very healthy (1) or somewhat healthy (2)	
Independent variables	**Coeff.**	**Std. Err.**	**Coeff.**	**Std. Err.**
Biomarkers' measures				
Age	0.016***	(0.005)	-0.005	(0.004)
Body Mass Index (category excluded: normal)				
undernourrished	0.092	(0.090)	0.092	(0.090)
overweight	0.063	(0.079)	0.063	(0.079)
obese	-0.116	(0.124)	-0.116	(0.124)
Waist circumference	-0.002	(0.003)	-0.002	(0.003)
Anemia: Hb below WHO's thresholds	-0.148	(0.102)	0.094	(0.075)
Hypertension	0.134**	(0.059)	0.134**	(0.059)
Grip strength	-0.006*	(0.003)	-0.006*	(0.003)
Lung capacity	-0.001*	(0.000)	-0.001*	(0.000)
Quasi-objective health measures				
Number of Instrumental ADL with difficulty	0.089*	(0.047)	0.089*	(0.047)
Number of ADL with difficulty	0.324***	(0.031)	0.324***	(0.031)
Smoking behaviour (category excluded: never smoked)				
Smoked but quit	0.022	(0.217)	0.520***	(0.147)
Still smokes	0.302***	(0.098)	0.063	(0.079)
Mental health (CES-D scores)				
Mild to moderate depression	0.025	(0.210)	0.873***	(0.119)
Possibility of major depression	-0.039	(0.276)	1.170***	(0.146)
Ever feel chest pains on left side?	0.522***	(0.080)	0.522***	(0.080)
Headache when get up in the morning?	0.006	(0.119)	0.501***	(0.075)
Do you often get up to urinate at night?	0.023	(0.057)	0.023	(0.057)
Suffers body pain every week/day	0.043	(0.118)	0.550***	(0.075)
Suffers severe body pain	0.276**	(0.109)	0.276**	(0.109)
Suffers body pain limiting daily activities	0.057	(0.125)	0.483***	(0.078)
Constant	1.747***	(0.376)	-1.893***	(0.331)
Number of observations		7 734		
Adjusted R2		0.113		

note: *** p<0.01, ** p<0.05, * p<0.1

Figure 1.

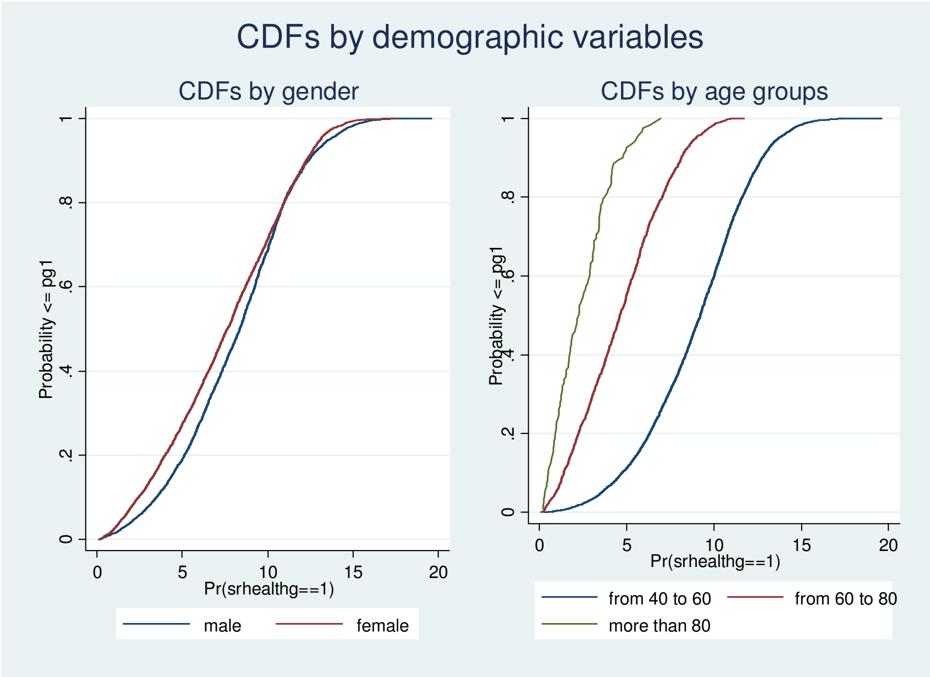

Figure 2.

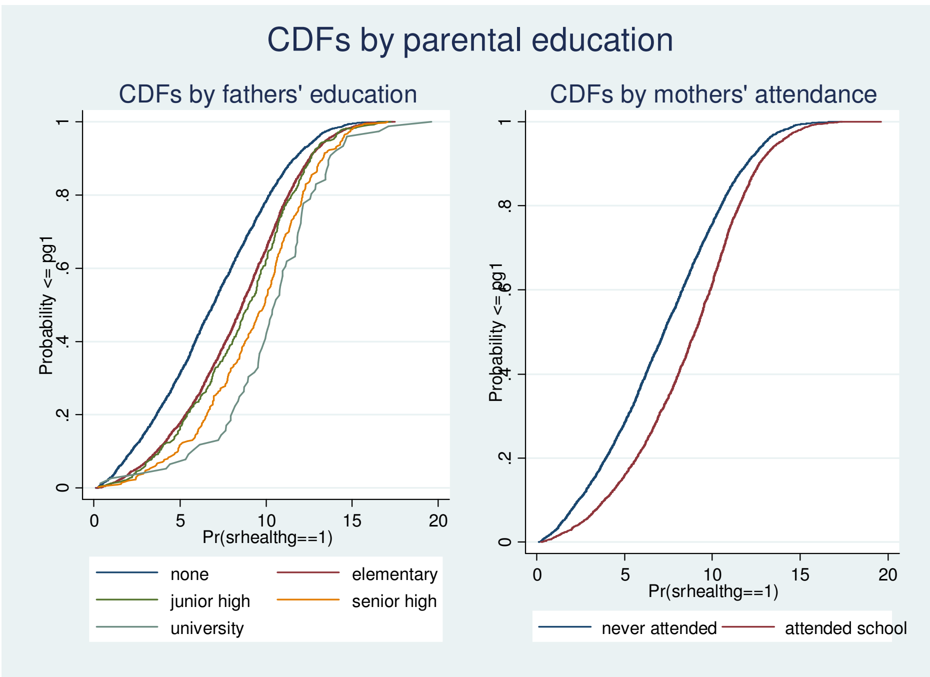

Figure 3.

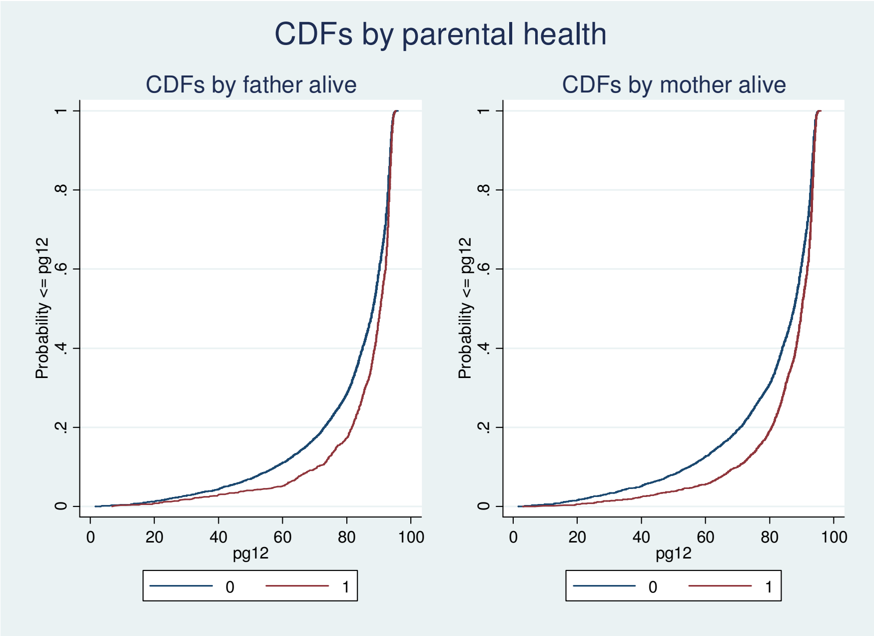

Figure 4.

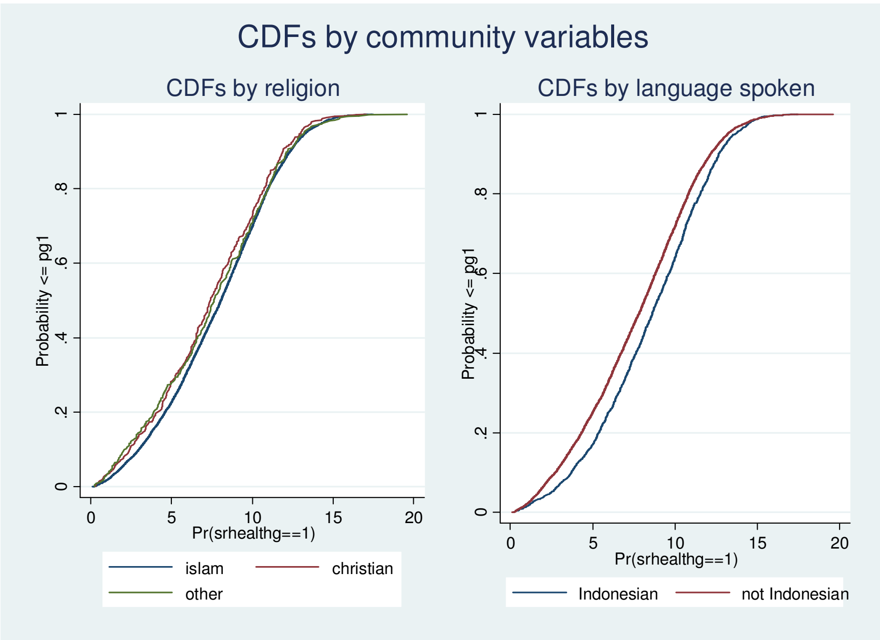

Figure 5.

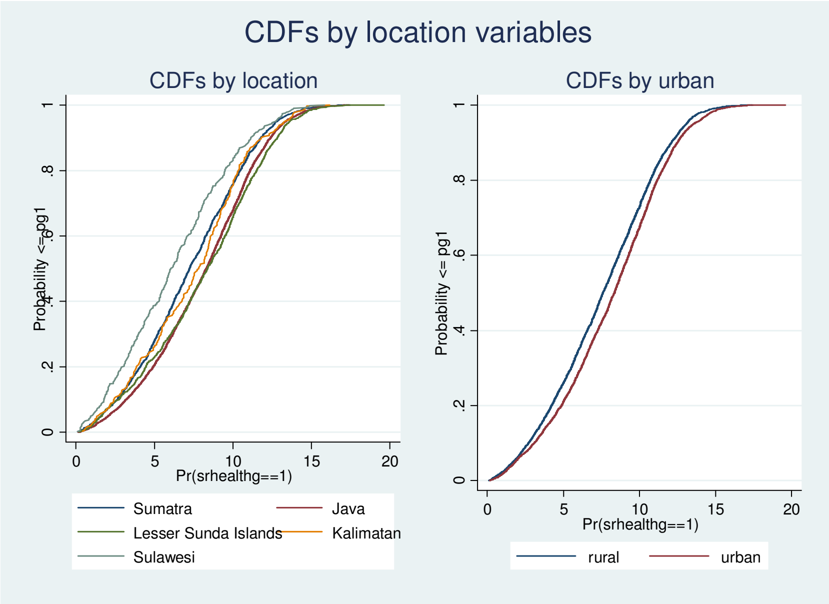

Figure 6.

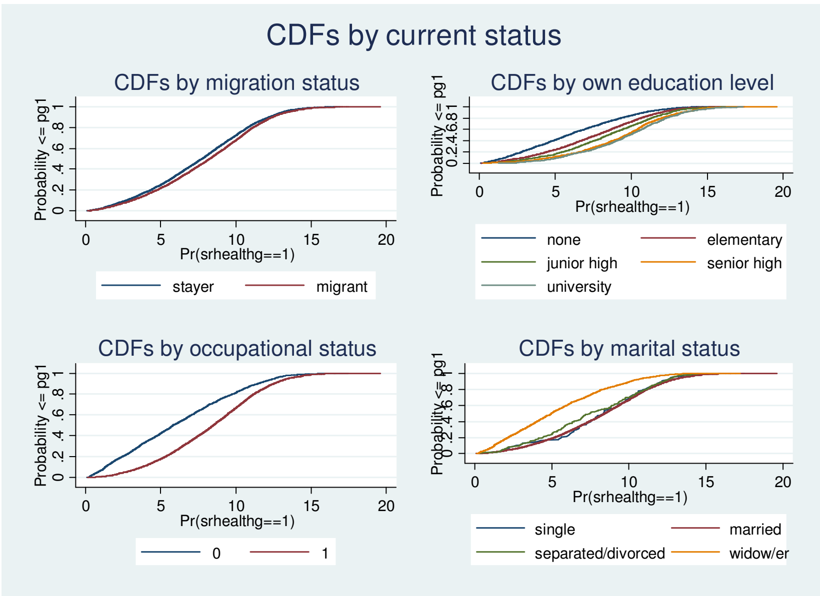

Table 5: OLS Regressions on Predicted probability of SRH: very healthy (1)

Variables	Only circumstances		Adding current socioeconomic status	
Circumstance variables				
Demographic characteristics				
Age (category excluded: from 40 to 60)				
From 60 to 80	-3.619***	(0.08)	-3.192***	(0.09)
More than 80	-5.830***	(0.26)	-4.928***	(0.26)
Female	-0.559***	(0.06)	-0.045	(0.07)
Parental education				
Father's education (cat. excluded: no education)				
Elementary	0.189**	(0.09)	-0.022	(0.09)
Junior high	0.354**	(0.17)	-0.164	(0.17)
Senior high	0.846***	(0.18)	0.240	(0.18)
University	1.323***	(0.34)	0.635*	(0.34)
Mother ever attended school	0.225**	(0.09)	0.064	(0.09)
Parental health				
Father still alive	0.603***	(0.09)	0.555***	(0.09)
Mother still alive	0.857***	(0.07)	0.752***	(0.07)
Community variables				
Religion (cat. excluded: islam)				
Christian	-0.038	(0.14)	-0.291**	(0.14)
Other	-0.613***	(0.16)	-0.712***	(0.16)
Language spoken in household				
Not indonesian	-0.235***	(0.08)	-0.166**	(0.08)
Location variables				
Urban area	0.071	(0.07)	-0.017	(0.07)
Provinces (cat. excluded: Sumatra)				
Java	0.939***	(0.09)	0.938***	(0.09)
Lesser Sunda Islands	1.613***	(0.14)	1.580***	(0.13)
Kalimatan	0.115	(0.18)	0.127	(0.18)
Sulawesi	-0.446***	(0.16)	-0.409***	(0.16)
Current socioeconomic variables				
Migrant status			-0.052	(0.06)
Own education (cat. excluded: no education)				
Elementary			0.252***	(0.09)
Junior high			0.836***	(0.13)
Senior high			1.450***	(0.13)
University			1.432***	(0.15)
Currently occupied			0.830***	(0.08)
Marital status (cat. excluded: married)				
single			-0.533**	(0.26)
divorced/separated			-0.340**	(0.17)
Widow/widower			-0.719***	(0.10)
Adjusted R2	0.366		0.394	

note: *** p<0.01, ** p<0.05, * p<0.1. Standard errors in parentheses.

Table 6. Contribution to health inequality

	Only circumstances (model 1)			Adding current SES (model 2)		
Demographics	27.19%			23.28%		
Residual	63.22%			60.41%		
Circumstances	9.60%			7.35%		
Parental education		19.10%			4.55%	
among which father's education			12.73%			2.18%
among which mother's attendance			6.37%			2.37%
Parental health		56.89%			66.10%	
among which father's vital status			15.93%			19.17%
among which mother's vital status			40.96%			46.93%
Community variables		3.49%			4.36%	
Location variables		20.53%			24.99%	
Current socioeconomic status				8.96%		
Migration					-0.50%	
Own education					50.56%	
Currently occupied					28.43%	
Marital status					21.51%	

Note: Variance and covariance calculations from OLS regressions.

Table A1. Partial proportional odds model on self-reported health. Alternative specifications.

	Self-reported health: very healthy (1)		Self-reported health: somewhat healthy (2)		Self-reported health: very healthy (1)		Self-reported health: somewhat healthy (2)	
Biomarkers' measures								
Age	0.013**	(0.005)	-0.007**	(0.004)	0.028***	(0.005)	0.012***	(0.003)
Body Mass Index (category excluded: normal)								
undernourrished	0.063	(0.089)	0.063	(0.089)	0.124	(0.084)	0.124	(0.084)
overweight	0.045	(0.078)	0.045	(0.078)	0.034	(0.075)	0.034	(0.075)
obese	-0.142	(0.122)	-0.142	(0.122)	-0.116	(0.118)	-0.116	(0.118)
Waist circumference	-0.001	(0.003)	-0.001	(0.003)	0.002	(0.003)	0.002	(0.003)
Anemia: Hb below WHO's thresholds	0.014	(0.064)	0.014	(0.064)	-0.153	(0.102)	0.072	(0.069)
Hypertension	0.129**	(0.057)	0.129**	(0.057)	0.043	(0.090)	0.255***	(0.063)
Grip strength	-0.008**	(0.003)	-0.008**	(0.003)	-0.002	(0.004)	-0.016***	(0.003)
Lung capacity	-0.001*	(0.000)	-0.001*	(0.000)	-0.001***	(0.000)	-0.001***	(0.000)
Quasi-objective health measures								
Number of Instrumental ADL with difficulty	0.122***	(0.046)	0.122***	(0.046)				
Number of ADL with difficulty	0.393***	(0.030)	0.393***	(0.030)				
Smoking behaviour (category excluded: never smoked)								
Smoked but quit	0.374***	(0.133)	0.374***	(0.133)				
Still smokes	0.363***	(0.097)	0.055	(0.076)				
Mental health (CES-D scores)								
Mild to moderate depression								
Possibility of major depression								
Ever feel chest pains on left side?	0.309**	(0.152)	0.762***	(0.082)				
Headache when get up in the morning?	0.096	(0.120)	0.700***	(0.072)				
Do you often get up to urinate at night?	-0.090	(0.088)	0.139**	(0.066)				
Suffers body pain every week/day								
Suffers severe body pain								
Suffers body pain limiting daily activities								
Adjusted R2			0.085				0.023	

Table A2: OLS Regressions on Predicted probability of SRH : very healthy (1). Using only biomarkers as covariates.

Variables	**Only circumstances (model 1)**		**Adding current SES (model 2)**	
Circumstance variables				
Demographic characteristics				
Age (category excluded: from 40 to 60)				
From 60 to 80	-3.533***	(0.047)	-3.329***	(0.049)
More than 80	-5.479***	(0.148)	-5.068***	(0.149)
Female	-1.257***	(0.036)	-0.999***	(0.040)
Parental education				
Father's education (cat. excluded: no education)				
Elementary	0.231***	(0.050)	0.091*	(0.050)
Junior high	0.533***	(0.094)	0.209**	(0.095)
Senior high	0.642***	(0.102)	0.272***	(0.104)
University	1.221***	(0.192)	0.805***	(0.191)
Mother ever attended school	0.337***	(0.051)	0.234***	(0.050)
Parental health				
Father still alive	0.712***	(0.050)	0.681***	(0.049)
Mother still alive	0.771***	(0.041)	0.715***	(0.041)
Community variables				
Religion (cat. excluded: islam)				
Christian	-0.145*	(0.079)	-0.279***	(0.078)
Other	0.091	(0.092)	0.053	(0.091)
Language spoken in household				
Not indonesian	-0.149***	(0.046)	-0.091**	(0.046)
Location variables				
Urban area	-0.068*	(0.039)	-0.152***	(0.040)
Provinces (cat. excluded: Sumatra)				
Java	0.055	(0.050)	0.055	(0.049)
Lesser Sunda Islands	0.421***	(0.077)	0.398***	(0.076)
Kalimatan	0.039	(0.103)	0.018	(0.101)
Sulawesi	-0.279***	(0.091)	-0.250***	(0.090)
Current socioeconomic variables				
Migrant status			0.143***	(0.036)
Own education (cat. excluded: no education)				
Elementary			0.220***	(0.053)
Junior high			0.486***	(0.075)
Senior high			0.937***	(0.075)
University			0.817***	(0.088)
Currently occupied			0.301***	(0.047)
Marital status (cat. excluded: married)				
single			-0.142	(0.149)
divorced/separated			-0.206**	(0.098)
Widow/widower			-0.346***	(0.058)
Adjusted R2	0.641		0.654	

Table A3: OLS Regressions on Predicted probability of SRH : very healthy (1). Using biomarkers and a subset of quasi-objective variables as covariates.

Variables	**Only circumstances (model 1)**		**Adding current SES (model 2)**	
Circumstance variables				
Demographic characteristics				
Age (category excluded: from 40 to 60)				
From 60 to 80	-3.687***	(0.082)	-3.255***	(0.086)
More than 80	-5.899***	(0.258)	-4.989***	(0.261)
Female	-0.558***	(0.063)	-0.054	(0.069)
Parental education				
Father's education (cat. excluded: no education)				
Elementary	0.191**	(0.087)	-0.011	(0.088)
Junior high	0.358**	(0.165)	-0.100	(0.166)
Senior high	0.746***	(0.178)	0.228	(0.182)
University	1.242***	(0.335)	0.651*	(0.335)
Mother ever attended school	0.215**	(0.089)	0.068	(0.088)
Parental health				
Father still alive	0.563***	(0.088)	0.514***	(0.086)
Mother still alive	0.823***	(0.072)	0.723***	(0.071)
Community variables				
Religion (cat. excluded: islam)				
Christian	-0.050	(0.138)	-0.273**	(0.136)
Other	-0.442***	(0.161)	-0.525***	(0.158)
Language spoken in household				
Not indonesian	-0.281***	(0.081)	-0.222***	(0.080)
Location variables				
Urban area	0.082	(0.068)	0.015	(0.069)
Provinces (cat. excluded: Sumatra)				
Java	0.889***	(0.087)	0.895***	(0.086)
Lesser Sunda Islands	1.441***	(0.134)	1.423***	(0.133)
Kalimatan	-0.018	(0.180)	-0.016	(0.177)
Sulawesi	-0.350**	(0.159)	-0.286*	(0.157)
Current socioeconomic variables				
Migrant status			-0.006	(0.063)
Own education (cat. excluded: no education)				
Elementary			0.342***	(0.092)
Junior high			0.808***	(0.131)
Senior high			1.351***	(0.131)
University			1.293***	(0.154)
Currently occupied			0.801***	(0.082)
Marital status (cat. excluded: married)				
single			-0.651**	(0.261)
divorced/separated			-0.256	(0.171)
Widow/widower			-0.764***	(0.101)
Adjusted R2	0.370		0.394	

Table A4. Contribution to health inequality with alternative predicted health models.

	Health prediction using only biomarkers		Health prediction using biomarkers and subset of quasi-objective health variables	
	Only circumstances (model 1)	**Adding current SES (model 2)**	**Only circumstances (model 1)**	**Adding current SES (model 2)**
Demographics	50.45%	25.40%	28.17%	23.73%
Residual	35.86%	16.59%	62.84%	55.42%
Circumstances	13.69%	6.52%	8.99%	7.07%
Parental education	29.23%	18.32%	19.28%	5.45%
among which father's education	16.07%	8.58%	12.73%	2.83%
among which mother's attendance	13.16%	9.74%	6.55%	2.62%
Parental health	67.86%	76.76%	57.77%	65.36%
among which father's vital status	23.89%	26.48%	15.76%	18.44%
among which mother's vital status	43.97%	50.29%	42.01%	46.92%
Community variables	0.48%	2.21%	4.24%	5.00%
Location variables	2.43%	2.70%	18.71%	24.18%
Current socioeconomic status		4.70%		8.59%
Migration		2.61%		-0.07%
Own education		57.87%		47.70%
Currently occupied		19.63%		28.61%
Marital status		19.89%		23.75%

Note: Variance and covariance calculations from OLS regressions.