

## **Inequality of Opportunities in Health and Health Care**

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### **Summary:**

Recent developments in the analysis of inequalities in health and health care have turned their interest into an explicit normative understanding of the sources of inequalities calling upon the concept of equality of opportunity. According to this concept, some sources of inequality are more objectionable than others and could represent priorities for policies aiming at reducing inequalities in health care use, access or health status.

Equality of opportunity draws a distinction between “legitimate” and “illegitimate” sources of inequality. While legitimate sources of differences can be attributed to consequences of individual effort (i.e. determinants within people’s control), illegitimate sources of differences are related to circumstances (i.e. determinants beyond people’s responsibility).

The study of inequalities of opportunity is rooted in social justice research and the last decade has seen empirical research using this literature at the core of their approach rapidly growing both in developed and developing countries. Empirical research on inequalities of opportunity in health and health care is mainly driven by data availability. Most studies in adult population are based on data from European countries, especially from the UK while studies analysing inequalities of opportunity among children are based in low or middle-income countries and focus on children less than 5 years old. Regarding the choice of circumstances, most studies considered social background as an illegitimate source of inequalities in health and health care. Geographical dimensions were also considered but to a lesser extent and more widely in studies in children or in countries outside Europe. Regarding effort variables or legitimate sources of health inequality, there is a wide use of smoking-related variables.

Regardless of the population, health outcome and circumstances considered, scholars provided evidence of illegitimate inequalities in health and health care. Studies on inequalities of opportunity in health care are mainly found in children population; this emphasizes the necessity to tackle inequalities as early as possible.

### **Keywords (5-10 words):**

Circumstances; effort; equality of opportunity; inequality; health

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## **Introduction**

Following on the call for health equity by the World Health Organisation (Commission on Social Determinants of Health 2008), the reduction of health inequalities is the main objective of public health policies worldwide. The health economics literature in that context has provided conceptual foundations of measuring inequality and inequity in health and health care, which were initiated in Wagstaff and Van Doorslaer (2000) and then extensively summarised in Fleurbaey and Schokkaert (2011). This measurement framework has helped to assess the existence and to evaluate the magnitude of inequalities in health as well as in health care delivery, access, and financing. Beyond the measurement of inequalities, it has also provided a methodology to decompose inequalities within determining factors (Wagstaff and Van Doorslaer 2000, Mackenbach, Stirbu et al. 2008). While horizontal equity (i.e. those with the same health care needs get the same care/access/health) and to a lesser extent vertical equity (i.e. those with unequal needs receive unequal care/access/health) were at the core of this literature, the normative viewpoint was implicit inasmuch as it considered that socioeconomic differences in health or health care outcomes were particularly unjust. Recent developments in the analysis of health inequalities have turned their interest into an explicit normative understanding of those inequalities and their health determinants calling upon the philosophical literature regarding social justice and especially the concept of equality of opportunity (Dworkin 1981, Arneson 1989, Cohen 1989, Roemer 1998, Barry 2005, Fleurbaey 2008). According to this concept, some sources of inequality are more objectionable than others and could represent priorities for policies aiming at reducing inequalities in health care use, access or health status. Equality of opportunity draws a distinction between “legitimate” and “illegitimate” sources of inequality. While legitimate sources of differences can be attributed to consequences of individual effort (i.e. determinants within people’s control), illegitimate sources of differences are related to circumstances (i.e. determinants beyond people’s control). In the specific context of health care, the concept of equality of opportunity consists in a moral right to health care according to which

health care is a concern of justice and it is the responsibility of the public health sector to tackle health inequities and provide care according to needs (Daniels, 1985). Therefore the crucial question for EOP in health care is to investigate whether the factors explaining the differences in health care use or access are ethically justified (Fleurbaey and Schokkaert, 2011). Typically, differences in health care use that reflect differences in health status are likely to be justified, so health needs lead to legitimate sources of inequality. On the other hand, differences in health care use of access that are due to factors that are unrelated to health care needs (e.g. socioeconomic status) are considered as illegitimate sources of inequality, and so inequalities of opportunities in health care.

Following the World Bank Development Report (2006), which brought at the forefront the question of inequality of opportunity (Rosa Dias and Jones 2007), the last decade has seen empirical research using this concept at the core of their approach rapidly growing both in developed and developing countries.

This chapter aims at giving the first comprehensive survey of the empirical work on equality of opportunities in health and health care published so far. Reviews of empirical work on equality of opportunity in other outcomes are already available (see Brunori, Ferreira et al. 2013, Roemer and Trannoy 2014, Ferreira and Peragine 2016, Ramos and Van De Gaer 2016). Our aim is to provide a state of the art critical survey of the extensive literature recently produced in inequalities of opportunities in health and health-related outcomes. The most relevant literature databases<sup>1</sup> were searched in February 2018 from their inception dates to present. Searches were designed to identify studies by combining the search term ‘inequality’ or ‘inequalities’ with the terms ‘health’ and ‘opportunity’ or ‘opportunities’. Full details of the search strategy are presented in Appendix A. In addition, grey literature was sought by citations searching via Google scholars of the first published papers on the concept of inequalities of opportunities in health (Rosa Dias 2009, Trannoy, Tubeuf et al. 2010). To be eligible for inclusion papers had to use the concept of equality of opportunity as a framework for the study. Studies that only touched

up upon the concept of opportunities in health and in health care in their conclusion and did not offer an interpretation of the results within the equality of opportunity perspective were excluded. A wide literature has looked into the importance of early life conditions for health over the life course and the influence of the social background on health status through various mechanisms (see for instance Barker 1996, Wadsworth 1999, Case, Lubotsky et al. 2002, Currie and Stabile 2003, Case, Fertig et al. 2005, Blane, Netuveli et al. 2007, Kuh, Shah et al. 2009, Lindeboom, Llena-Nozal et al. 2009, Tubeuf and Jusot 2011, Tubeuf, Jusot et al. 2012, Agahi, Shaw et al. 2014, Burkhauser, Hahn et al. 2015, Shippee, Rowan et al. 2015). This literature could be considered as empirical research on the importance of circumstances that individuals did not choose prior to the use of the concept of equality of opportunity in health to label them. Similarly, research on the correlation between health statuses across generations (Ahlburg 1998, Strauss and Duncan 2008) and the intergenerational transmission of health-related outcomes such as obesity (Zhang, Zheng et al. 2011, Classen and Thompson 2016, Dolton and Xiao 2017), health conditions (Thompson 2014, Thompson 2017) or physical activity (Kantomaa, Tammelin et al. 2007) would also provide primary research on inequalities of opportunity whilst the concept is not named. The wide literature that has been mainly published in public health and social epidemiology was only touched upon when the concept of inequalities of opportunities in health was clearly used as a framework for the analysis.

The chapter is presented as follows. Section 2 presents the framework of equality of opportunity in health, especially for empirical research. In section 3, the published and unpublished literature currently available on the assessment of inequalities of opportunities in health and health care is presented and summarised. Two distinct dimensions appear to divide the included studies: whether they were about children and younger population or not, and whether the methodological perspective used was *ex-ante* or *ex-post*. We have therefore divided the review within three main contexts of assessment of inequalities of opportunity: (i) *ex-ante* perspective, (ii) *ex-post* perspective, and (iii) child health. In each of the perspectives the population of interest, the health

and health care outcomes, and the methods are described. A critical discussion of the methods and results of this literature concludes and identifies apparent gaps and expected avenues for future research.

## **The Framework of Equality of Opportunity**

### ***From Inequality to Inequality of Opportunity***

The first empirical contributions on inequalities in health and health care provided insight into the determinants of those inequalities, especially the relationship between income and other socioeconomic determinants with health and health care use or access. The pioneering work of the ECuity<sup>3</sup> and the Eurothine<sup>4</sup> collaboration projects dominated empirical research on the magnitude of inequalities and their determining factors. While the ECuity project initiated the use of the concentration index and its decomposition, which was then followed with numerous empirical work measuring inequalities in health and health care access and health care delivery developed and developing countries, the Eurothine project aimed at evaluating the effectiveness of interventions and policies implemented to reduce inequalities in health and health care in various European countries. Following the lead of economics research that had demonstrated the importance of social determinism, empirical research in health economics later evolved towards the understanding of potential mechanisms explaining the construction of social health inequalities over the life span. Scholars especially turned their interest to the role played by childhood conditions on the health of children and adults. At the same time, the issue of responsibility became more and more predominant in the literature in social choice and political philosophy, through the concept of luck egalitarianism. From the objective of equalising health outcomes across socioeconomic groups in these positive approaches or ensuring an equal access to care for people with equal needs, research moved toward normative discussions on the sources of inequalities in health and health care with a focus on the importance of fairness. The outcome to equalise when analysing inequalities thus became ‘opportunities’.

### *A Definition of Inequality of Opportunity*

Based on the philosophical literature on inequality of opportunity (Dworkin 1981, Arneson 1989, Cohen 1989, Roemer 1998, Rawls 1999, Roemer 2002, Fleurbaey 2008), there is a global agreement in the economic literature on the necessity to take into account the determinants of any outcome in order to judge the legitimacy of differences in this outcome between members of a given society. The concept of equality of opportunities initiated by Roemer (1998) relies on the distinction between sources of inequalities. The share of inequality related to health determinants that are beyond individual responsibility called circumstances are considered as the most unacceptable and recognised as inequalities of opportunities. On the other hand, the share of inequality related to determinants that are freely chosen by individuals according to their preferences, namely effort, may be considered as legitimate inequalities. It is worthwhile underlining that the partition between effort and circumstances is sometimes labelled as legitimate versus illegitimate sources of inequality, or ethically acceptable versus ethically unacceptable, or even equitable or fair versus inequitable or unfair. Disagreement as to which sources are considered as legitimate/effort and illegitimate/circumstances is common. Most studies on inequality of opportunity in health and health care consider that social and family background constitutes relevant circumstances since individuals cannot be held responsible for their birth lottery. In particular, they cannot be held responsible for their parents' educational level, occupation or living conditions during their childhood or parental health-related characteristics, such as genetic inheritance, lifestyles, or health care habits. On the contrary, effort is difficult to observe and measure; nevertheless there is a consensus in the health field that individuals' lifestyles, such as not smoking, having a balanced diet, not drinking too much, or using preventative health care can be considered as examples of individual effort for health and health care. Lifestyles and health care habits represent individual choice and effort to invest in health capital. It appears relevant here to underline the importance of referring to an "age of consent" that acts as a threshold below which people cannot be held responsible for their effort

(Arneson 1989). Individuals can only be held responsible for the lifestyles they have consciously and fully chosen, which is likely to be the case when lifestyles are initiated after a certain age (e.g. 15 years old). Brunori (2017) suggests that a good benchmark for such a discussion is the legal literature on criminal responsibility. In the EOP literature, obesity or health care utilisation during childhood are most often viewed as children's health outcomes or childhood circumstances than as legitimate sources of inequality within a children population.

While the key idea of responsibility underlying the measurement of inequalities of opportunity is easier to conceptualise when the outcome of interest is health status and effort is proxied with lifestyles, the transposition to health care is not direct. Equality of opportunity theory distinguishes between illegitimate inequalities, which are due to non-responsibility characteristics and legitimate inequalities due to responsibility characteristics (Trannoy, 2016). The issue is how to define variables that one can be held responsible for in the context of health care access or use. Health care use is determined by health care needs and availability, which both represent circumstances that individuals cannot be held responsible. However health care use is also likely to express individuals' health care habits and preferences. In the social justice theory, two competing views debate on how preferences should be treated. Some philosophers following Ronald Dworkin (1981a and 1981b) consider that preferences should be fully respected so that individuals are considered responsible for their preferences, while others like Gerard Cohen (1989) see individuals as only responsible of what they can control. This debate especially matters for equality of opportunity in health care outcomes where the crucial question is to investigate whether the factors explaining the differences in health care use or access are ethically justified (Fleurbaey and Schokkaert, 2011).

Theoretically, achieving equality of opportunity implies to respect two basic principles (Fleurbaey 2008): the *compensation principle*, which demands that inequalities due to circumstances be eliminated or compensated and the *liberal reward principle*, which requires rewarding any efforts done by individuals and respecting them when designing the redistribution

policies. Despite this general agreement, the measurement of equality of opportunity still entails many theoretical, methodological and empirical questions (Fleurbaey and Schokkaert 2011, Brunori, Ferreira et al. 2013, Roemer and Trannoy 2014, Ramos and Van De Gaer 2016).

### ***Two Approaches for Measuring of Inequality of Opportunity***

Following the typology proposed by Fleurbaey and Peragine (2013) and used by Ramos and Van de Gaer (2016), Li Donni, Peragine et al. (2014) and Roemer and Trannoy (2014), two different approaches have been proposed to the formulation of the compensation principle: the *ex-ante* and the *ex-post* approaches. The *ex-post* approach consists in looking at differences in the actual outcome between individuals having the same responsibility (effort) characteristics 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.

The *ex-post* approach requires observing the efforts that should be rewarded or to impose very restrictive assumptions on the relationship between responsibility characteristics and outcomes. Conversely, the *ex-ante* approach only requires observing circumstances since inequality of opportunity is identified comparing outcome distributions between types of circumstances. This second approach is less data hungry since it allows considering only a limited set of relevant factors independent from individual responsibility. Fleurbaey and Peragine (2013) have shown the incompatibility of the *ex-post* and the *ex-ante* approaches of the compensation principle. While *ex-post* compensation and liberal reward are often found to be inconsistent in relation with the timing of the choice of the effort by the individual, *ex-ante* compensation and liberal reward are consistent. The choice between the *ex-ante* and the *ex-post* approaches is driven either by data availability or ethical viewpoint. Efforts could be considered by nature as unobservable hence when measurements of efforts are used, the choice of those variables must be well justified and requires demonstrating that individuals are fully responsible of those efforts.



### ***The Correlation Between Effort and Circumstances***

An issue in this context was highlighted in Jusot, Tubeuf et al. (2013) bringing to the forefront the open debate in the literature on the relationship between effort and circumstances, which cannot be assumed to be independent. The key matter in this context is the precise definition of effort, which should be rewarded and the definition of circumstances, which should be compensated. The original debate on the correlation between efforts and circumstances was between John Roemer and Brian Barry in the field of education (Roemer 1998 p.22; Barry 2005). Debating about the case of Asian students who *“generally work hard in school and thereby do well because parents press them to do so. The familial pressure is clearly an aspect of their environment outside their control”*, Roemer argued that an equal-opportunity policy must respect the individual effort in an approach where *“we could somehow disembody individuals from their circumstances”* (Roemer 1998, page 15). As a consequence, the extra effort of the Asian student must not be rewarded because it is determined by a characteristic outside his control. Conversely, Barry argued that nevertheless, *“the fact that their generally high levels of effort were due to familial pressure does not make their having expended high levels of effort less admirable and less deserving than it would have been absent such pressure”*. From this point of view, which is the mainstream view in the literature on incentives (Yellen 1984), the extra effort of the Asian student should be entirely rewarded and the lack of familial pressure of other types of students should not be compensated. When transposing this debate in the field of health, lifestyles – such as having a balanced diet, doing exercise, not smoking or not drinking too much – are often considered as relevant efforts as they constitute causal determinants of health status. The fact that lifestyles are freely chosen individual behaviours is debatable, especially because they are likely to be influenced by the family and social environment during childhood as well as genetic characteristics and preferences. The Barry/Roemer debate in health would then ask about the legitimacy of, for instance, holding sons of smokers less responsible than sons of non-smokers to smoke. While for Barry this distinction is irrelevant, Roemer considers that the share of smoking,

which can be attributed to the family and social background, is a circumstance and not an effort. This distinction is typically meaningful for *ex-post* approaches however *ex-ante* approach where only circumstances are observed must adopt a Roemerian approach.

### ***The EOP Principles Across Generations***

Another challenge in defining effort is identifying “whose” effort it is; as Roemer and Barry respectively observe “*Asian children (...) do well because parents press them to do so*” and “their generally high levels of effort were due to familial pressure”. The transmission of values through parental effort results in what is seen as effort exerted by the next generation and if one considers that pressure from family to educate children is a parental effort; the definition of circumstances to be compensated is less obvious. Jusot, Tubeuf et al. (2013) underline the impossibility to respect the principles of compensation and natural reward for all generations. If one gives precedence to the young generation in the application of the two equality-of-opportunity principles of compensation and liberal reward, then one should consider that the whole initial background represents circumstances including parental effort independently of the link with children’s effort. On the other hand, if one gives precedence to the past generation in the application of the two equality-of-opportunity principles, then one should consider that parental effort must be respected whatever its consequences to the next generation. This latter position corresponds to Swift (2005), who argued “*To the extent that the reproduction of inequality across generations occurs through the transmission of cultural traits, it does so substantially (though not exclusively) through intimate familial interactions that we have reason to value and protect. Preventing those interactions would violate the autonomy of the family in a way that stopping parents doing spending their money on, or bequeathing money to their kids would not.*” (Swift 2005, Sørensen 2006). From Swift’s point of view, family is an association and following on Rawls’ justice theory, the ‘basic liberties’, including among them freedom of association, have lexical priority over fair equality of opportunity and the principle of difference (Rawls 1999). Transposed to the field of health and health care, it is easy to see that the way parents used health

care, especially health checks and preventive care when one was a child makes one more likely to use health care in a similar way as an adult; this might also be the case with diet, physical activity or smoking and drinking behaviors.

### ***Empirical Approaches***

Empirical literature in equality of opportunity in health calls upon two types of methodologies: non-parametric and parametric, which are sometimes coupled in studies. The non-parametric approach follows from the methodology proposed by Lefranc, Pistolesi et al. (2009) to identify inequality of opportunity in income. It relies upon the use of dominance criteria and bilateral tests and compares cumulative distribution functions of outcomes conditional to categories of circumstances (types) of individuals and groups with the same effort (tranches). On the other hand, the parametric approach relies on econometric modelling and is used to identify inequalities of opportunities investigating the association between circumstances and the outcome. Parametric studies adopting an *ex-ante* approach simply estimate a reduced form model in order to identify differences in health opportunities related to circumstances, independently from the influence of any unobserved efforts, as suggested by Ferreira and Gignoux (2011) and Trannoy, Tubeuf et al. (2010). On the other hand, methodologies used in the *ex-post* approach vary according to the normative position adopted regarding the correlation between efforts and circumstances or legitimate and illegitimate sources of inequality. Health outcomes can simply be regressed on observed circumstances and observed efforts or auxiliary equations focusing on the efforts on their own or more complex structural modeling can also be considered. In the *ex-ante* approach where effort is by definition not observed, the literature avoids the problem of lacking effort indicators by combining an *ex-post* approach to inequality of opportunity with a concept of relative effort whereby two people belonging to different types are deemed to have exerted the same effort if and only if they are in the same percentiles of their respective (and different) conditional distributions.

If empirical studies in EOP in health initially tested the existence of inequality of opportunities in health, recent studies go beyond assessment and propose a quantification of the inequality of opportunities in health. Two broad types of measures are used, the direct ones and the indirect ones, as underlined in the literature (Fleurbaey and Schokkaert 2011, Brunori, Ferreira et al. 2013, Ramos and Van De Gaer 2016). On one hand, direct measures assess how large is the inequality when only the share of inequality due to circumstances remains. Empirically, it consists in estimating the inequality using a counterfactual outcome distribution in which all inequalities due to differences in effort have been eliminated. The direct unfairness proposed by Fleurbaey and Schokkaert (2009) is a typical direct measure of inequality of opportunities, which is consistent with the *ex-ante* approach of compensation. Direct unfairness evaluates the level of inequality that would exist if all individuals chose to exert the same reference level of effort. On the other hand, indirect measures assess how much inequality remains after opportunities are equalized. Empirically, this indirect approach often 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. The use of this measurement method is however debatable (Schokkaert, 2018), since different distributions could lead to the same measure of inequalities of opportunities. The fairness gap (Fleurbaey and Schokkaert, 2009) is a preferable indirect measure of inequality of opportunities and quantifies the inequality in the distribution as the distance between the observed outcome and the outcome that would exist if all individuals had the same reference set of circumstances. The fairness gap corresponds to the *ex-post* compensation principle.

### **A Review of the EOP in Health and Health Care Empirical Literature**

The literature search yielded 415 potentially relevant studies and 228 studies were identified as citing the two seminal papers published on the empirical study of inequality of opportunity in health (Rosa Dias 2009, Trannoy, Tubeuf et al. 2010). After removal of duplicates<sup>5</sup>, 401

references were identified for screening. Titles and abstracts were screened including studies where equality of opportunity appeared to be used as the analysis framework and Endnote software was used to manage references. After screening, 242 studies were excluded and 63 possibly relevant studies were retrieved for full-text assessment. After full-text review, 44 studies were included in the analysis and 19 studies were excluded. Studies were excluded for the following reasons. Thirteen studies only focused on intergenerational transmission of health, lifestyles or health-related outcomes and did not use equality of opportunity in the analysis or as an interpretation framework, four references were older versions of a published version already included, and two studies did not use a health outcome. A PRISMA chart describing the inclusion and exclusion process can be found in Figure 1.

**[insert Jusot\_Tubeuf- Figure 1 here]**

Of the 44 studies included in the review, fifteen studies used data from a European country (UK n=7, France n=3, and one each in Luxemburg, Italy, the Netherlands, Norway, Spain, and England), eleven studies used data from Africa or Middle-East (Tunisia n=2, Togo n=2, Egypt n=2, and one each in Morocco, Ethiopia, Israel, and South Africa), four studies used data from Asia (China n=2, Indonesia n=1, India n=1), six used data from Central or South America (Chile n=2, Columbia n=2, Brazil n=1, Mexico n=1), three considered the United States and/or Canada, and five studies considered multiple countries. Included studies for this review were spanning 9 years (2009-2018) and the majority of the studies were published since 2013.

An evident way of grouping the included studies emerged considering the population of interest and the empirical methods. Among the 44 included studies, two thirds focused on adult populations where approximately one half used an *ex-post* approach, 38% consider an *ex-ante* approach and four studies (14%) combined *ex-ante* and *ex-post* perspectives. The last third of the 44 studied focused on children's health-related outcomes. The distinction between the *ex-ante* and *ex-post* approaches makes less sense among this population of interest since they are below the age of consent and thus they could not be considered as responsible of their behaviours. The

review is divided into three sub-sections. First, it summarises and discusses studies using an *ex-ante* perspective for the analysis of inequality of opportunity, then it focuses on studies adopting an *ex-post* perspective, finally empirical work on inequality of opportunities in children's health and health care is presented.

### ***Ex-Ante Inequality of Opportunities in Health and Health Care***

The fifteen studies that measured inequality of opportunities in health and health care using an *ex-ante* perspective are described in Table 1.

**[insert Jusot\_Tubeuf- Table 1 here]**

More than half of the studies focused on European countries: two from the UK (Jones, Rice et al. 2012, Li Donni, Peragine et al. 2014), two from France (Trannoy, Tubeuf et al. 2010, Bricard 2013), one in Italy (Gigliarano and D'Ambrosio 2013), Spain (Pinilla, Lopez-Valcarcel et al. 2017), and Norway (Ovrum and Rickertsen 2015), and one study used data from 14 European countries participating to the Survey on Health, Ageing and Retirement in Europe (SHARE) and the English Longitudinal Study of Ageing (ELSA) (Pasqualini, Lanari et al. 2017). Outside Europe, one study focused on data from the USA (Chen 2015), one on Israel (Lazar 2013). Finally, only five studies focused on low or middle-income countries: four in South America, two on Columbia (Fajardo-Gonzalez 2016, Rivera 2017), one in Brazil (Barbosa 2016), one in Chile (Gallardo, Varas et al. 2017), and one in Indonesia (Jusot, Mage et al. 2014).

Most studies considered health status as the outcome of interest (87%) while only two papers used health care outcomes such as health care habits, physician visits and preventive care. Studies of inequalities in opportunity in health mainly used self-assessed health (SAH) (73%) while four studies considered various scores as health outcomes. The Columbian study considered the EQ-5D health-related quality of life score (Rivera 2017), the US study used both the physical and mental summary scales of the SF-12 health questionnaire (Chen 2015), one of the British studies used mental and chronic diseases and disability (Jones, Rice et al. 2012), and the Indonesian study used a synthetic health score built on the basis of several self-reported and objective health

measures (Jusot, Mage et al. 2014). Regarding the type of circumstances considered, most studies considered parental social background proxied by various characteristics; this included parental education (53%), parental social class (33%), family financial situation or income (33%), and more rarely the number of books in the household at age 10 (Pasqualini, Lanari et al. 2017), living conditions (Chen 2015), or assets ownerships (Fajardo-Gonzalez 2016). Some other sociodemographic characteristics were also considered such as ethnicity (27%), religion and language spoken (Jusot, Mage et al. 2014), or family structure (Rivera 2017). While individual education level is sometimes viewed as an effort variable in the *ex-post* approaches, Barbosa (2016) considered education as a source of illegitimate inequality in health care insofar as a child has limited responsibility for parental decisions about which school to attend and Jones, Rice et al. (2012) used cognitive and non-cognitive abilities and happiness measured while at school as childhood circumstances.

Geographical characteristics were also used as circumstances; this included the country or region of residence at birth or during childhood (33%), the country or region of residence as an adult (27%), the rural/urban status of the location (20%), parents' country of birth in one study (7%), or socioeconomic characteristics of the country of residence (7%).

Beyond socioeconomic background, numerous studies considered health-related circumstances, such as parents' health or vital status (40%) and one study used both the parents' health habits and childhood physician density (Bricard 2013). Finally, one study considered childhood health status as a circumstance (Jones, Rice et al. 2012) and the US study considered accidents, health shocks, disability related to health limitations (Chen 2015) as circumstances to determine the level of SAH.

Empirically, most of the *ex-ante* studies directly used circumstances in their models while two studies: one in France (Trannoy, Tubeuf et al. 2010), the other in Spain (Pinilla, Lopez-Valcarcel et al. 2017), proposed a pathway analysis to distinguish the direct impact of circumstances on

health outcomes from their indirect impact through their role on the determination of individual socioeconomic status.

Four studies focused on the impact of circumstances on lifestyles; two studies looked into the impact of circumstances on health care use (one in Brazil (Barbosa 2016), one in France (Bricard 2013)), and two focused on the impact on various unhealthy behaviours such as smoking, alcohol consumption, diet, obesity, physical activity, teenage pregnancy (one in the UK (Jones, Rice et al. 2012) and one in Norway (Ovrum and Rickertsen 2015)). These studies did not measure the consequences of those lifestyles on health nor discuss their potential impact in terms of natural reward principle. This is the reason why those studies could be more easily attached to the *ex-ante* approach since they considered, implicitly or explicitly, that intergenerational transmission of lifestyles is one of the pathways explaining inequalities on opportunity in health.

Regarding the methodology used, 11 studies used a parametric modelling (73%), one study used the Fleurbaey and Schokkaert framework (Barbosa 2016), whereas ten studies relied on a non-parametric approach (67%): six used first or second order stochastic dominance tests (40%) in order to compare health outcome distribution by group of circumstances and three propose an analysis of EOP by types (20%) or rank analysis (7%).

When measuring inequalities, several indices and methods are used for quantifying IOP, this includes the direct unfairness and fairness gap (Barbosa 2016), the Shapley measure (Fajardo-Gonzalez 2016), variance decomposition (Jusot, Mage et al. 2014) or R-squared decomposition (Pasqualini, Lanari et al. 2017), indices decompositions including the Gini index (Trannoy, Tubeuf et al. 2010, Ovrum and Rickertsen 2015, Fajardo-Gonzalez 2016, Rivera 2017), the Erreygers index (Trannoy, Tubeuf et al. 2010) or the Atkinson index (Li Donni, Peragine et al. 2014) and the concentration index (Ovrum and Rickertsen 2015, Barbosa 2016).



### ***Ex-Post Inequality of Opportunities in Health and Health Care***

The eighteen studies that measured inequality of opportunities in health using an *ex-post* perspective are described in Table 2, none of them considered a health care outcome.

**[insert Jusot\_Tubeuf- Table 2 here]**

Around half of studies focused on the UK or England, using either the data from the 1958 National Child Development Study (Rosa Dias 2009, Rosa Dias 2010, Jones, Roemer et al. 2014), the British Household Panel Survey (Li Donni, Peragine et al. 2009, Li Donni, Peragine et al. 2014), the Health And Life Survey (Balía and Jones 2011), or the Health Survey of England (Carrieri and Jones 2018). Five other studies focused on single European countries (France (Jusot, Tubeuf et al. 2013), Luxembourg (Deutsch, Alperin et al. 2017), the Netherlands (Garcia-Gomez, Schokkaert et al. 2015)) or cross-country comparisons (13 different countries (Bricard, Jusot et al. 2013) or 14 countries (Pasqualini, Lanari et al. 2017)). Outside Europe, studies with an *ex-post* approach included two in the USA (Asada, Hurley et al. 2015, Chen 2015), one in Canada (Asada, Hurley et al. 2014), one in Israel (Lazar 2013), one in Chile (Carranza and Hojman 2015), and one in China (Sun, Ma et al. 2013).

A large majority of studies focused on inequalities in opportunity in health, using self-assessed health as the main health outcomes of interest (67%). Four studies considered various scores as health outcomes: the two North American studies considered the Health Utility Index (HUI), which is a quality of life score (Asada, Hurley et al. 2014, Asada, Hurley et al. 2015), two studies used mental health scores (Rosa Dias 2010, Chen 2011), one used a physical score from the SF12 questionnaire (Chen 2015). Other health-related outcomes were also considered; it includes health events (Garcia-Gomez, Schokkaert et al. 2015), chronic diseases or disability in two studies (Rosa Dias 2010, Pasqualini, Lanari et al. 2017), various biomarkers (Carrieri and Jones 2018) and mortality in two studies (Balía and Jones 2011, Garcia-Gomez, Schokkaert et al. 2015). One study used body mass index (Pasqualini, Lanari et al. 2017) despite such health-related lifestyles are often considered as effort variables to reward in other studies. Another study focused on

health care use used as a proxy of health status (Sun, Ma et al. 2013). There were no studies where inequalities of opportunities in health care use *per se* were measured; this is probably related to the fact that *ex-post* studies require an actual measurement of effort, which is conceptually always difficult to have, especially in the case of health care.

Regarding the type of circumstances or illegitimate factors considered, most of studies considered parental social background proxied with various characteristics including parental education (39%), parental social class or employment (44%), family financial situation and adverse life events (28%), grandfather's education (11%), and in few studies the number of books in the household at age 10 (11%), parental literacy (6%), or living conditions (6%). Some other sociodemographic characteristics considered included ethnicity (11%) and family structure (11%). Finally, whereas own education level could be viewed as an effort variable as under one's responsibility, several studies considered some circumstances related to educational achievement such as achieved education (28%), cognitive abilities, happiness at school as well as parental support to stay at school (6%), math test score at 11 years old (6%), or social development at 11 years old (6%). Two other studies considered marital status or socioeconomic status as illegitimate sources of inequalities in health as well (17%).

Geographical dimensions were also often used as circumstances; this included the country of birth and year of immigration (11%), parents' country of birth (6%), socioeconomic characteristics of the country or region of residence (11%), and in one study health-related regional averages (6%).

Beyond socioeconomic background, numerous studies considered health-related circumstances, such as parents' health or vital status or longevity (22%), parental smoking (22%) or mother's smoking during pregnancy and breastfed (6%), diabetes, epilepsy or heart diseases in the family (11%), accident (6%), parents' alcohol consumption (11%), and dental visits for children (6%). Finally, some study considered respondents' own health status in childhood or birth weight as a circumstance (17%) as well as current disability related to health limitations (11%).

Regarding efforts variables, most studies (94%) considered that lack of smoking represented an effort to be rewarded. The next most used variables for effort were body mass index (39%), physical activity (39%), diet (17%), and alcohol consumption (17%). Few studies also considered socioeconomic characteristics (income, education, employment, home ownership, religion, area of residence or marital status) as effort variables (28%), especially in order to test different ethical positions on the partition between effort and circumstances. Finally only two studies considered medication taking (Carrieri and Jones 2018) or treatment preferences (Sun, Ma et al. 2013) as a measure of individual effort.

Regarding the methodology, most studies (94%) used a parametric modelling except one that used a semi-parametric approach (Balía and Jones 2011). Four of them studies specifically referred to the Fleurbaey and Schokkaert structural framework (28%). Only two studies relied on non-parametric approaches including stochastic dominance tests (Rosa Dias 2009, Chen 2015), EOP analysis by types (Jones, Roemer et al. 2014, Chen 2015, Carrieri and Jones 2018) or by tranches (Li Donni, Peragine et al. 2009, Lazar 2013, Li Donni, Peragine et al. 2014). If most of studies implicitly adopted a Barry viewpoint (Barry, 2005) on the measurement of efforts to reward, four studies used a Roemerian approach to assess the full impact of circumstances on health outcomes, including their indirect effect on effort variables (Bricard, Jusot et al. 2013, Jusot, Tubeuf et al. 2013, Carranza and Hojman 2015, Deutsch, Alperin et al. 2017).

Several indices and methods were used for the quantification of inequalities of opportunity: direct unfairness and fairness gap (17%), variance decomposition (22%), Gini index (28%), Atkinson decomposition (17%), counterfactual decomposition (11%), and more rarely, a decomposition of Rho-squared (Pasqualini, Lanari et al. 2017), Theil index (Carranza and Hojman 2015), Sen welfare index (Balía and Jones 2011), and Dissimilarity index (Jones, Roemer et al. 2014) as well as a generalised Lorenz curve (Balía and Jones 2011) or a Shapley decomposition (Deutsch, Alperin et al. 2017).

### *Inequality of Opportunities in Child Health and Health Care*

The fifteen studies that measured inequality of opportunities in child health and health care are described in Table 3.

**[insert Jusot\_Tubeuf- Table 3 here]**

All studies focused on one or several countries that are considered as low or middle-income countries according to the World Bank. More than half of the included used data from the Demographic and Health Surveys programme, which provides nationally representative household data for a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition. The three papers that undertook a comparison of inequality of opportunities in child health used DHS data (Hoyos and Narayan 2011, Assaad, Krafft et al. 2012, Andersen, Griffin et al. 2017). Most studies focused on health and health care outcomes before the age of 5 except four empirical studies, which used longitudinal survey data: under 18 in China (Eriksson, Pan et al. 2014), under 8 in Ethiopia (Hussien and Ayele 2016), between 2 and 6 years old in Mexico (Van De Gaer, Vandenbossche et al. 2013), and between 10 and 14 years old in South Africa (Zoch 2015). Six studies in children considered health outcomes, four studies focused on health care specific outcomes, and five considered both of them. Health outcomes included the World Health Organisation (WHO) indicators on child growth and malnutrition such as height, weight and a combination of both or either with age via z-scores. Two studies considered slightly different health outcomes. One study in Morocco (El-Kogali, Krafft et al. 2016) considered a set of early child development outcomes including cognitive, emotional and social development outcomes. One study in Mexico (Van De Gaer, Vandenbossche et al. 2013) looked into the incidence of anemia, stunting, standardized body mass index, and the number of sick days. When the outcomes were related to access to services they included access to basic health care, pre- and post-natal care, basic nutrition, immunization and vaccination as well as access to clean water and adequate sanitation.

The vector of circumstances variables varied between studies probably because of data availability. The family social background was used as a circumstance in each study. All studies except one (Hoyos and Narayan 2011) considered parental education level (the mother only or both parents); household wealth or a proxy of wealth such as household amenities was used in 87% of the studies and three studies additionally considered parental occupation (the father only or both parents) and one study used the mother's social class. Another very frequent circumstance was geographical characteristics (80%) such as the region of residence, the urban/rural status, and the distance to nearest health facility. Two studies also considered variables at regional level: smoking prevalence at community level (Eriksson, Pan et al. 2014) and regional averages of sociodemographic variables (Singh 2011) while one study used access to public services such as sanitation and clean water as a circumstance (Hussien and Ayele 2016). Other variables considered as part of the vector of circumstances included further parental characteristics (e.g. age, gender of the head of household, height, height-for-age, weight-for-age, presence in the household, religion, indigenous background, and caste), characteristics about the child (e.g. age, sex, birth order, number of siblings, and child of a multiple birth), and characteristics about the household (e.g. size, number of children, and number of adults).

In the presence of a set of circumstances potentially quite large, measuring inequality of opportunities non-parametrically is difficult as the circumstances-types become too large to have enough observation in each type. In this case, inequality of opportunities is measured parametrically. Twelve studies (80%) used a parametric approach to measure inequalities of opportunities; two studies used both a non-parametric and a parametric approach while one study only used a non-parametric approach. Most parametric studies (75%) assessed the existence of inequality of opportunities in health or in health care of children population using the Human Opportunity Index. The Human Opportunity Index (HOI) has been developed by the World Bank and is an index measuring the access of children to basic services and goods, which can be considered prerequisites needed for childhood development (Paes de Barros, Ferreira et al. 2009).

The key services that are included in the HOI vary but generally include access to clean water, immunization, sanitation, basic health care, or basic nutrition. The use of a HOI leads to measure an equality of opportunity-sensitive coverage rate, which can rely on various circumstances, outcomes, opportunities, and population groups. Most of the studies using a HOI approach additionally used a dissimilarity index derived by comparing group means for different combinations of circumstances to the population average to quantify how outcomes differ by circumstances. The dissimilarity index was then completed with a Shapley decomposition to estimate the marginal contribution of each considered circumstance to the inequality of opportunity. One of the parametric studies (Assaad, Krafft et al. 2012) decomposed the inequality using the Theil-T index while another one undertook an Oaxaca-Blinder decomposition of the inequality between urban and rural areas. The three studies that considered a non-parametric approach to assess inequality of opportunities used an approach by types (Hussien and Ayele 2016, Sanoussi 2018) however only one of the studies (Van De Gaer, Vandebossche et al. 2013) compared types with first- or second-order stochastic dominance.

### **Critical Discussion**

In the last two decades economists have provided different analytical tools and empirical assessments aimed at facilitating the measurement and the reduction of inequality of opportunity in education, earnings and other socioeconomic outcomes. More recently, it is in the area of health and health care that studies have investigated and measured inequalities of opportunity.

Interestingly, empirical research on the measurement of IOP in health and health care in adults has mainly been based on data from European countries, especially from the UK. This is particularly noticeable for the studies using an *ex-post* approach for the measurement of IOP. This research is probably driven by data availability, since an *ex-post* approach requires to observe both circumstances and efforts variables. The scarcity of empirical studies focusing on IOP in the

US is particularly unforeseen in the context of a large adherence of the US society to the philosophy of responsibility (Rawls 1999).

By contrast, most studies analysing IOP in health and health care among children are based in low or middle-income countries and focused on children less than 5 years old.

A crucial issue for the analysis of inequalities in health is the choice of a health indicator. Most studies on an adult population relied on self-assessed health status in spite of the debates on the relevance of this subjective indicator for interpersonal comparisons (Kerkhofs and Lindeboom 1995, Doiron, Fiebig et al. 2015, Jusot, Tubeuf et al. 2017). The use of other types of health outcomes has increased in recent studies. This includes quality of life measures such as the Health Utility Index, as well as physical and mental health scores, physical impairments, chronic diseases, biomarkers and mortality. On the other hand, the studies conducted among children and younger populations focused on anthropometrical measures (height-for-age, weight-for-age, weight-for-height) and lack of access to goods and services which may be detrimental for health status such as access to care, immunization, access to sanitation, access to basic services or nutrition (anaemia, stunting). While many of the children and younger population studies used health care variables as the outcomes of interest, only two studies used an *ex-ante* perspective on the measurement of health inequalities. The absence of *ex-post* empirical applications using health care as the outcome of interest might be explained by the lack of data on efforts, such as preferences in the context of health care being much harder to come by. More generally, the limited studies of inequalities of opportunity in health care access or delivery may be explained according to Fleurbaey and Schokkaert (2011) “*health care itself can be viewed as a transfer of resources, but it would make little sense to advocate that everyone should receive the same amount of health care within a group of circumstances*”.

Regarding the main objectives of the studies, some of them only aim to test for the existence of inequalities of opportunity in health and health care while some others provide measurements of the magnitude of those inequalities and others went a step further exploring their construction

channels. Beyond the clear divide between parametric and non-parametric approaches, methodologies used for identifying IOP in health are quite homogeneous even if they often use different normative assumptions. However measurement tools when quantifying IOP are very heterogeneous, and this heterogeneity could partly explain the inconsistency that is found in results.

Regarding the choice of circumstances, most studies considered social background as an illegitimate source of inequalities in health and health care. Geographical dimensions were also considered but to a lesser extent and more widely in studies in children or in countries outside Europe. Interestingly, a relatively small number of studies included parental health related characteristics such as parents' longevity, chronic diseases or lifestyles despite their contribution to the explanation of IOP is expected by the limited availability of such data in surveys explains the challenges to measure it.

Regarding effort variables or legitimate sources of health inequality, all *ex-post* studies but one used a smoking-related variable. This statement is probably data driven since smoking is collected in most health surveys but also related to the agreement that smoking represents a chosen risky behaviour. This is consistent with lab experiments showing that individuals widely agree that smoking is an individual choice for which they can be held responsible (Le Clainche and Wittwer 2015). On the other hand, a smaller number of studies considered BMI as an effort variable despite height and weight are likely to be frequently collected in surveys but there is a debate on whether obesity represents a lack of health effort or is a combination ageing, socioeconomic status, and health problems.

What was learnt from this literature review on inequalities of opportunities in health and health care? Regardless of the population, health outcome and circumstances considered, scholars provided evidence of illegitimate inequalities in health. Given the important contribution of health to both well-being and productivity, this emerging literature contributes to highlighting unfair inequalities in welfare, in addition to already substantial literature showing inequalities of



opportunity in income or education. Most studies also concluded that there is an impact of circumstances on effort variables. Independently of the methodology used, whether it is an *ex-ante* or an *ex-post* approach, and the normative viewpoint chosen on how to treat the correlation between circumstances and efforts, the diagnosis on the existence of inequalities of opportunities is the same. The results on the magnitude of these inequalities of health opportunities are less consistent and this is mainly related to the types and the number of circumstances and efforts that are mobilized in the empirical studies. In any case, this literature provides evidence of unfair inequalities in health and the need for related public policies to tackle them. It appears important however to mention the debate on the additional knowledge provided from the analysis of inequalities of opportunities in health for policy makers when compared to the literature on income-related health inequalities (Kanbur and Wagstaff 2015, Schokkaert 2015, Wagstaff and Kanbur 2015).

More importantly, the literature on inequalities of opportunities in health has also contributed to the literature on equality of opportunities in general because of three key specificities.

First, the literature on IOP in health has contributed to the development of the *ex-post* approach for measuring inequality of opportunity. As individual efforts are certainly easier to define and observe in the field of health than in other fields, given the broad consensus on the fact that health related behaviors such as lack of smoking, of obesity or prudent alcohol drinking that are measured in most of health interview surveys should be rewarded.

Second, there is a specific challenge with age and genetic inheritance, and to a lesser extent sex, in the study of IOP in health and health care: should they be compensated or not? While the way to treat age has not been at the forefront in studies of inequalities of opportunities in income, the ageing process and biological determinants in general explain a share of health outcomes. Similarly the large number of studies focusing on inequalities of opportunity in access to health care emphasize the necessity to tackle inequalities as early as possible as they can have long-term

consequences over one's life. This opens new avenues of research on the normative status of genes, age and sex.

Third, the debate on the role played by preferences as being formed under the control of the past generation or being under the full responsibility of individuals could easily be further developed when studying EOP in health care since discrete choice experiments are increasingly used to measure individual preferences regarding health and health care (Clark, Domino et al. 2012).

The last specificity of IOP in health relate to that part of health inequality that can be explained by a parametric regression model. Most models of health outcomes only explain about 20% of the variance and a large residual part remains whatever the number of circumstances and efforts variables considered in the analysis. This raises the issue of the importance of unobserved variables and the normative status of "luck". Theoretical EOP has discussed the type of luck that can be pushed towards circumstances or effort (Dworkin 1981, Fleurbaey 2008, Roemer and Trannoy 2014, Schokkaert 2015) however the translation of this debate to empirical studies presents challenges for future research.

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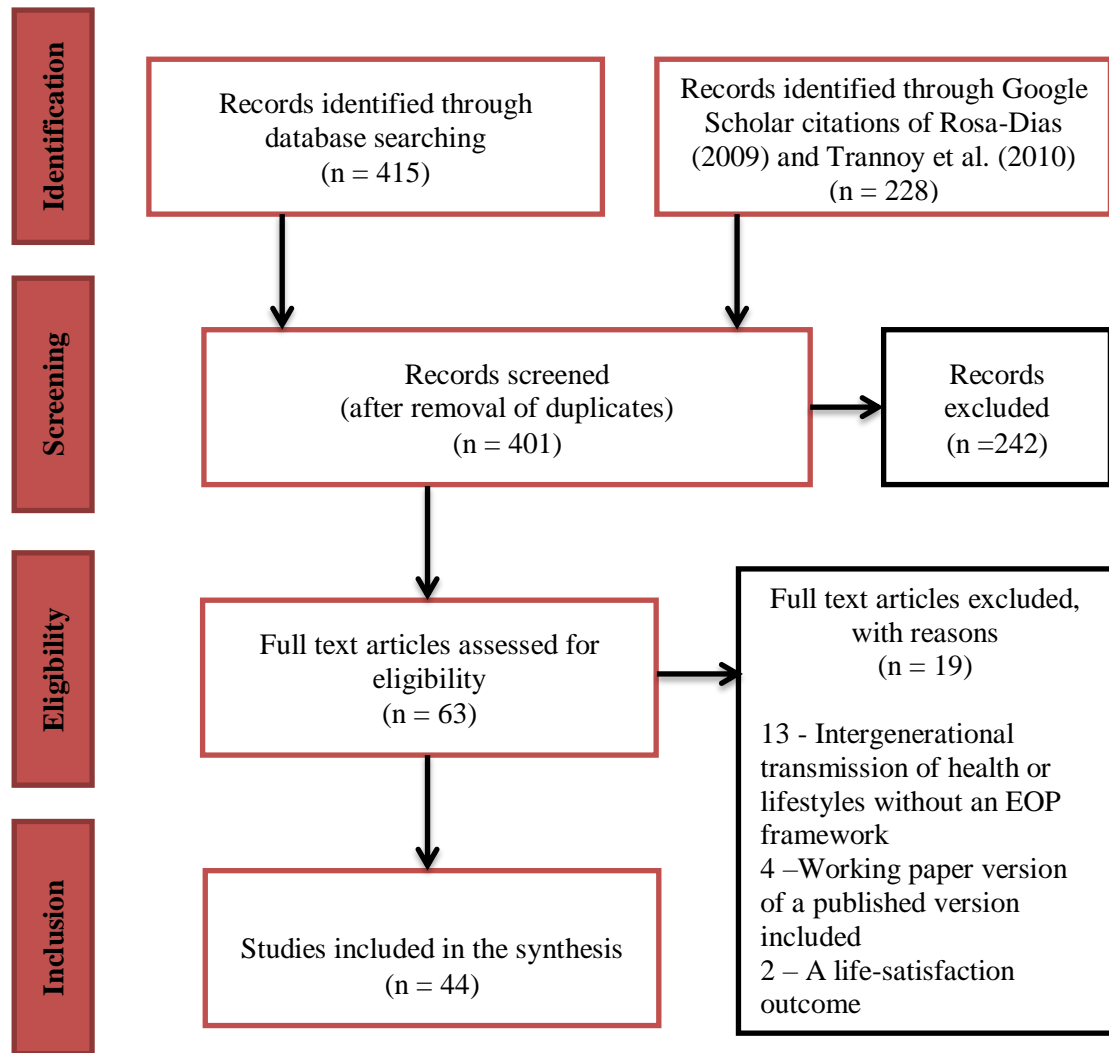
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## Figures

Figure 1: Flow diagram of excluded and included studies





## Tables

**Table 1: EOP in child health**

<i>Study reference</i>	<i>Country</i>	<i>Type, year of data</i>	<i>Study population</i>	<i>Sample size</i>	<i>Health outcome</i>	<i>Circumstances variables</i>	<i>Methods</i>
Amara & Jemmali, 2017	Tunisia	MICS <sup>1</sup> 2011-12	Under 5	N=10,514	Access to basic health care Access to basic nutrition services	Mother and father's education Household wealth quintile Urban/rural residence Age, gender of the household head	Parametric approach Human Opportunity Index Dissimilarity Index Shapley decomposition
Andersen et al. 2017	60 LMI <sup>2</sup> countries	166 cross-sectional surveys DHS <sup>3</sup> between 1990 & 2015	Under 5	N=919,343 children (average per country N=5,538)	Height-for-age z-score	Mother's education Wealth quintiles Mother's age and height Birth order, sex of the child Child of a multiple birth	Parametric approach Fields' decomposition Nutritional Mobility Index for country i at time t
Assaad et al. 2012	Egypt Jordan Morocco Turkey	18 cross-sectional surveys DHS <sup>3</sup> between 1988 & 2008	Under 5	Not provided	Height Weight-for-height z-score	Mother and father's education Father's occupation Household wealth quintile Urban/rural residence Mother's age Birth order, sex of the child Child of a multiple birth	Parametric approach Theil-T index
El-Kogali et al. 2016	Morocco	DHS <sup>3</sup> 2003/04 MICS <sup>1</sup> 2006/07 ENPSF <sup>4</sup> 2011 ONDH <sup>5</sup> (2012) Cross-sectional surveys	Under 5	Not provided	ECD <sup>5</sup> outcomes: Prenatal care, skilled delivery, infant mortality immunisation, nutrition, Cognitive, emotional, and social development outcomes	Mother and father's education Household wealth Urban/rural residence Region of residence Sex of the child	Parametric approach Dissimilarity Index Shapley decomposition
Eriksson et al. 2014	China	CHNS <sup>7</sup> 1991-2009 longitudinal survey	Under 18	12,749	Height-for-age z-score Weight-for-age z-score	Mother and father's education Mother and father's occupation Household amenities Mother and father's health Mother and father's height-for-age Mother and father's weight-for-age Region of residence Distance to nearest health	Parametric approach IV regression model Urban/rural Blinder-Oaxaca decomposition

						facility Age, sex, birth order of child Number of siblings Community smoking prevalence	
Ersado & Aran, 2014	Egypt	DHS <sup>3</sup> 2000 & 2008 HIECS <sup>8</sup> 2000 & 2008 cross-sectional surveys	Under 5	Not provided	Access to health care Access to basic services Height-for-age z-score Weight-for-height Weight-for-age z-score	Mother and father's education Household wealth quintile Imputed household consumption Region of residence Age, sex of child Number of siblings	Parametric approach Human Opportunity Index and changes over time Dissimilarity Index Shapley decomposition
Hoyos & Narayan, 2011	47 LMP <sup>2</sup> countries	DHS <sup>3</sup> between 2003 & 2010	Under 15	Not provided	Immunization against polio Immunization against measles	Household wealth Region of residence Gender of the child	Parametric approach Human Opportunity Index Dissimilarity Index Shapley decomposition
Hussien, & Ayele, 2016	Ethiopia	YLS <sup>9</sup> 2002, 2006 Longitudinal survey	Under 8	Not provided	Standardized height-for-age Weight-for-height z-score	Mother and father's education Household wealth index Mother's religion Rural/urban residence Region of residence Public services (toilet facility, drinking water)	General entropy measures Non-parametric type approach Parametric approach
Saidi, & Hamdaoui, 2017	Tunisia	MICS <sup>1</sup> 2011-12	Under 5	2,938	Weight-for-age Length-for-age Weight-for-height Access to health services	Household head's education Household wealth index Region of residence sociodemographic variables Age, gender, sex of household head Household size, number of children	Parametric approach Human Opportunity Index Dissimilarity Index Shapley decomposition
Sanoussi, 2017	Togo	DHS <sup>3</sup> 1998 & 2013 cross-sectional surveys	Under 5	28,457	Access to prenatal care Access to postnatal care Access to any vaccination	Mother and father's education Household wealth index Mother and father's occupation Rural/urban residence Region of residence Sex of the household head Sex of the child Number of children in the household	Parametric approach Human Opportunity Index Dissimilarity Index Shapley decomposition
Sanoussi, 2018	Togo	DHS <sup>3</sup> 1998 & 2013 cross-sectional surveys	Under 5	44,998	Standardized height	Mother's educational level Mother's social class Rural/urban residence Region of residence	Non-parametric type approach from circumstances

Singh, 2011	India	NFHS <sup>11</sup> 1992-93 and 2005-06 cross-sectional surveys	Under 5	Not provided	Full immunization at age 1+ Underweight child	Average parental education Household wealth quintiles Region of residence Caste of the household head Religion, sex of the child Number of siblings	Parametric approach Human Opportunity Index Dissimilarity Index
Valez et al. 2012	Egypt	DHS <sup>3</sup> 2000 & 2009	Under 17	Not provided	Access to clean water Access to adequate sanitation Weight-for-height under age 4 Height-for-age age 2-7 Weight-for-age age 10-17	Mother and father's education Household income per capita Rural/urban residence Region of residence Presence of father and mother in the household Gender of the child Number of children under 5, 6-17 in the household Number of people 70+ or	Parametric approach Human Opportunity Index and changes over time Dissimilarity Index Shapley decomposition
Van de Gaer et al. 2013	Mexico	Oportunidades program 1997-2003	2-6 years old	2,984	Anaemia Stunting Standardised BMI Number of sick days in past four week	At least one parent completed primary education Parents' indigenous background	Non-parametric type approach First or second-order stochastic dominance and test Parametric regression with propensity score matching
Zoch, 2015	South Africa	KIDS <sup>12</sup> 1993-2004 NIDS <sup>13</sup> 2008 Longitudinal surveys	10-14 years old	3,305	Access to adequate sanitation Access to clean water	Mother and father's education At least one parent completed high school or achieved a higher education. Household income per capita Rural/urban residence At least one biological parent in the household Ethnic background Number of children	Parametric decomposition Human Opportunity Index Dissimilarity Index

<sup>1</sup> MICS: Multiple Indicator Cluster Survey

<sup>2</sup> LMIC: Low and Middle Income

<sup>3</sup> DHS Demographic and Health Survey

<sup>4</sup> ENPSF: National Population and Family Health Survey

<sup>5</sup> ONDH: National Human Development Observatory

<sup>6</sup> ECD: Early Childhood Development

<sup>7</sup> CHNS: China Health and Nutrition Survey

<sup>8</sup> HIECS: Household Income, Expenditure and Consumption Survey

<sup>9</sup> YLS: Young Lives Survey

<sup>10</sup> ILCS: Income and Living Conditions Survey

<sup>11</sup> NFHS: National Family Health Survey

<sup>12</sup> KIDS: KwaZulu-Natal Income Dynamics Study

<sup>13</sup> NIDS: National Income Dynamics Survey

**Table 2: Ex-ante analyses of equality of opportunity (EOP) in health and health care**

<i>Study reference</i>	<i>Country</i>	<i>Type, year of data</i>	<i>Study population</i>	<i>Sample size</i>	<i>Health or health care outcome</i>	<i>Circumstances variables</i>	<i>Other current variables</i>	<i>Methods</i>
Barbosa, 2016	Brazil	PNAD <sup>1</sup> 2008	(1) General population (2) Women 15+	391,868 individuals 110,280 women	Physician visits Women's preventive care: mammography, cervical screening	Education Ethnicity Region of residence	Household income Age and sex SAH Rural/urban residence Employment status Family type Health insurance coverage Preferences related to medical care	Parametric regression Fleurbaey and Schokkaert framework Direct unfairness and fairness gap Concentration and horizontal indices Health care advantage rank
Bricard, 2013	France	2010 ESPS <sup>2</sup>	16+	4,608	Health care habits during adulthood	Mother and father's education Mother and father's social class Family financial situation Mother and father's health Region of birth Parental health care habits Childhood physician density	Age and sex SAH Functional limitations Chronic conditions Education Social status Income Marital status Region of residence Physician density	Parametric regression Two steps: long-term effect of parental habits during childhood and on health care use of their descendants
Chen, 2015 <sup>5</sup>	USA	NLSY79 <sup>3</sup> longitudinal survey	40+	3,505	SAH (1-poor to 5-excellent) Physical component score Mental component score	Mother and father's education Race Household characteristics Incidence of health shocks Disability and health	Age and sex Education Income Smoking initiation, duration, current and past	Non-parametric approach Stochastic dominance Kolmogorov-Smirnov test EOP by type

						limitations	Number of daily cigarette	
Fajardo-Gonzalez, 2016	Columbia	2010 LSSM <sup>4</sup> survey	Head of household 25-65	2,253	SAH (poor, fair, good, excellent)	Parental educational level Household socioeconomic assets ownership at age 10 Parental vital status Rural/urban residence Region of birth	Ethnicity Years of education	First or second-order stochastic dominance and test Parametric regression Shapley decomposition Gini-Opportunity Index
Gallardo et al. 2017	Chile	2010 Chilean National Health Survey	General population 20+	4,404	SAH (poor, fair, good, very good, excellent)	Mothers' education Family income Rural/urban residence Region of birth		Non-parametric approach Second-order stochastic dominance and test
Gigliarano & D'Ambrosio, 2013	Italy	2009 IT-SILC <sup>5</sup>	General population 16+	43,636	SAH (very good, good, fair, bad, very bad)	Region of residence	Education level Income	Non-parametric Kolmogorov-Smirnov tests
Jones et al., 2012	UK	1958 NCDS <sup>6</sup> birth cohort	From birth to age 46	17,000 (original sample)	SAH at age 46 (excellent, good, fair, poor, very poor) Mental illness at age 42 Chronic illness/disability at age 46 Smoking at age 42 Alcohol consumption at age 33 Fried food at age 33 Teenage pregnancy	Type of primary and secondary schools Childhood health (morbidity, height, weight) Parents' SES Parents' education Incidence of household financial difficulties Neighbourhood during childhood and adolescence Cognitive and non-cognitive abilities Happiness at school	Educational attainment Health-related lifestyles (smoking, alcohol, food consumption,	Non-parametric approach First order stochastic dominance and test Applied testable conditions for stochastic dominance
Jusot et al., 2014	Indonesia	IFLS <sup>7</sup> 2007 wave	40+	7,224	A continuous health indicator using a regression explaining SAH as a function of several objective and quasi-objective health variables (biomarkers, ADL <sup>8</sup> and IADL <sup>9</sup> , CES-D <sup>10</sup> )	Mother and father's education Parental health status Religion Language spoken Rural/urban residence Region of birth	Age and sex Educational level, Marital status, Immigration status Occupational status	Non-parametric approach First order stochastic dominance and test Parametric regression Variance decomposition
Lazar, 2013 <sup>5</sup>	Israel	2003 Israeli	20+	3,011	SAH (not good at all,	Father's education	Age and	<u>Ex-ante approach</u> : Type approach



		Social Survey			not so good, good, very good)	Father's country of birth (Israel, Europe, America)	gender Religion	classifying population by circumstances Parametric regression Decomposition of overall inequality
Li Donni et al., 2014 <sup>s</sup>	UK	BHPS <sup>11</sup> 2000-2005 longitudinal survey	55+	Between 2,519-2,631	SAH (very poor, poor, fair, good, excellent) considered with very poor/poor	Father's SES Father's vital status Ethnicity Country of birth Any accident	Smoking Education level Age and gender	Type approach classifying population by circumstances Parametric regression Decomposition of overall inequality using the Atkinson equality index
Ovrum & Rickertsen, 2015	Norway	Norwegian Monitor Survey 2005-2011	25-74	10,591	SAH (very bad, bad, fair, good, very good health) Eating fruits and vegetables Physical activity Fish consumption Smoking Obesity	Parents' educational level Family economic situation when 10-15 years old	Age and sex Marital status Educational level Social occupation Psychological traits	Parametric regression Decomposing overall and socioeconomic inequality in health and lifestyles Gini indices, education- and income-related concentration indices
Pasqualini et al., 2017 <sup>s</sup>	14 European countries	SHARE <sup>12</sup> and ELSA <sup>13</sup> 2005, 2007 and 2008	49+	32,165 SHARE <sup>12</sup> and 10,281 ELSA <sup>13</sup>	SAH (Excellent, very good, good, fair, poor) Body Mass Index More than 3 chronic conditions	Number of books in the household at age 10 Financial hardship Average level of income in the country of residence Income inequality within the country of residence	Age and sex Marital status Employment status, Educational level	Parametric regression Decomposition of the adjusted R-squared of the models
Pinilla et al., 2017	Spain	EFF <sup>14</sup> 2002, 2005, 2008, and 2011 longitudinal survey considered pooled	28-86	Approximately 15,000 people	SAH (very good, good, acceptable, poor, very poor) [also education and occupation as outcome with generalised residuals]	Mother and father's occupation Family's SES"	Age and sex Educational level Occupational status Household income Age cohort	Parametric regression Sequential models Pathway models
Rivera, 2017	Columbia	2010 ELCA <sup>15</sup>	17+	10,164	EQ-5D VAS <sup>16</sup> Medical characteristics adjusted EQ-5D VAS <sup>16</sup>	Race Birthplace Region of residence Household structure Mother and father's	Occupation Education Household wealth Age and sex	Parametric regression Ex-ante measure of inequality of opportunities in health in Barry and Roemer approaches Gini coefficient

					EQ-5D score	education Mother and father's chronic illness Mother and father's vital status		Fields' decomposition of total unjust inequalities
Trannoy et al., 2010	France	2004 French SHARE <sup>12</sup>	49+	2,666	SAH (very poor, poor, fair, good, v. good)	Mother and father's vital status, relative longevity Mother and father's job	Education Professional status Age and sex	Non-parametric approach First order stochastic dominance and test Parametric regression Sequential models Pathway models Gini and Erreygers indices
<sup>5</sup> : References including both ex-ante and ex-post approaches  <sup>1</sup> PNAD: Pesquisa Nacional por Amostra de Domicílios <sup>2</sup> ESPS: Enquête Santé et Protection Sociale <sup>3</sup> NLSY79: National Longitudinal Survey of Young 1979 <sup>4</sup> LSSM: Living Standards and Social Mobility <sup>5</sup> IT-SILC: Italian data of the European Survey of Income and Living Conditions <sup>6</sup> NCDS: National Child Development Study <sup>7</sup> IFLS: Indonesian Family Life Survey <sup>8</sup> ADL: Activities of Daily Living						<sup>9</sup> IADL: Instrumental Activities of Daily Living <sup>10</sup> CES-D: Center for Epidemiologic Studies Depression Scale <sup>11</sup> BHPS: British Household Panel Survey <sup>12</sup> SHARE: Survey on Health, Ageing and Retirement in Europe <sup>13</sup> ELSA: English Longitudinal Survey of Ageing <sup>14</sup> EFF: Encuesta Financiera de las Familias <sup>15</sup> ELCA: Encuesta Longitudinal de Colombia <sup>16</sup> EQ-5D VAS: EuroQoL 5 Dimensions Visual Analogue Scale with values between 1 and 100, where 1 represents the worst health status and 100 represents the best.		

**Table 3: Ex-post analyses of equality of opportunity (EOP) in health and health care**

<i>Study reference</i>	<i>Country</i>	<i>Type, year of data</i>	<i>Study population</i>	<i>Sample size</i>	<i>Health or health care outcome</i>	<i>Circumstances variables /illegitimate factors</i>	<i>Effort variables</i>	<i>Other current variables</i>	<i>Methods</i>
Asada et al. 2014	Canada	2002-03 JCUSH <sup>1</sup> cross-sectional survey	18+	3,057	HUI3 <sup>2</sup>	Sex Marital status Race Country of birth Education Household income Health care use Health insurance	Age Smoking Body Mass Index Physical activity		Parametric regression Fleurbaey and Schokkaert framework Gini index decomposition
Asada et al. 2015	USA	2002-03 JCUSH <sup>1</sup> cross-sectional survey	18+	4,328	HUI3 <sup>2</sup>	Sex Marital status Race Country of birth Education Household income Health care use Health insurance	Age Smoking Body Mass Index Physical activity		Parametric regression Fleurbaey and Schokkaert framework Gini index decomposition Direct and indirect fairness standardisation
Balia and Jones, 2011	UK	HALS <sup>3</sup> 1984-1985 and mortality data in 2005	40+ in 1984-84	4,572	Mortality Smoking-related mortality	Mother and father's smoking Any regular smoker in the household	Smoking initiation Smoking quitting	Social status Education Marital status Rural/urban residence Household size Age and sex Birth cohort Smoking start date	Semi-parametric approach (Duration model with latent factor) Gini coefficient Sen welfare index Generalised Lorenz curve
Carranza and Hojman, 2015	Chile	SPS <sup>4</sup> 2002, 2004, 2006, 2009 longitudinal study	30+	10,934	SAH (very poor, poor, fair, good, very good) considered as binary	Mother and father's education Mother and father's literacy Mother and father's employment Household composition	Smoking Sports activity Body Mass Index	Age and sex Numeracy score	Parametric regression Ex-post roemerian approach with relative effort from auxiliary equation Variance, Gini, Theil, and Atkinson decomposition

						Mother and father's vital status			
Carrieri and Jones, 2016	England	HSE <sup>5</sup> 2003-2012 cross-sectional survey	16+	2,336 to 10,910	Biomarkers (Cholesterol, glycated haemoglobin, fibrinogen, and mean arterial pressure)	Cohort of birth Sex Educational level	Saliva cotinine Diet Physical activity Drinking Body Mass Index Medication taking Household income		Non parametric approach EOP by type Parametric regression Decomposition of Gini index
Chen, 2015 <sup>s</sup>	USA	NLSY79 <sup>6</sup> longitudinal survey	40+	3,505	SAH (1-poor to 5-excellent) Physical component score Mental component score	Mother and father's education Race Household characteristics Incidence of health shocks Disability and health limitations	Smoking initiation, duration, current and past Number of daily cigarette	Age and sex Education Income	Non-parametric approach Stochastic dominance Kolmogorov-Smirnov test EOP by type with education attainment and income-lifestyle pair Parametric regression Counterfactual decomposition
Deutsch et al., 2016	Luxembourg	PSELL-3 <sup>7</sup> 2005, 2007, 2008 longitudinal survey	25-65	2,332	SAH (very poor, poor, fair, good, very good) considered as binary	Mother and father's education Mother and father's country of birth Family financial situation Years of immigration Country of birth	Smoking Physical activity Education	Age Sex	Parametric regression Ex-post roemerian approach with relative effort from auxiliary equations Shapley decomposition
Garcia-Gomez et al., 2015	Netherlands	HSLC 1998-2007 cross-sectional survey	40+	12,484	Mortality Health events (cancer, circulatory, stroke, respiratory, digestive, genitourinary)	Age Education Gender	Non smoker Exercise Not overweight Marital status Religion Rural/urban residence Region of residence Home ownership		Parametric regression Fleurbay and Schokkaert framework Direct and indirect fairness standardisation
Jones et al., 2014	UK	1958 NCDS <sup>8</sup> birth	From birth to age 46	17,000 (original	SAH at 46 (excellent, good,	Parental SES Parents' support to	Cigarette smoking at age	Social status Education	Non-parametric regression EOP by type under two policy

		cohort		sample)	fair, poor, very poor) LSI <sup>9</sup> or disability at age 46 Mental health score	stay in school Cognitive ability at 7 Childhood health at 7 Diabetes in the family Happiness at school at 7 SES in local area Political party in local area pre-reform	46		regimes EOP by type with educational, non-educational, and residual path Parametric regression Dissimilarity index Counterfactual decomposition
Jusot et al., 2013	France	2006 ESPS <sup>9</sup>	16+	6,074	SAH (very good, good, fair, bad, very bad) considered as binary	Mother and father's education Mother and father's social status Mother and father's longevity Mother and father's smoking Father's alcohol Adverse life experiences Financial situation	Non-smoker Vegetable consumption Non obese	Age and gender	Parametric regression Ex-post roemerian approach with relative effort from auxiliary equation Variance decomposition
Lazar, 2013 <sup>5</sup>	Israel	2003 Israeli Social Survey	20+	3,011	SAH (not good at all, not so good, good, very good)	Father's education Father's country of birth (Israel, Europe, America)	Smoking Education level, Occupation	Age and gender Religion	Non parametric approach Tranches approach classifying by levels of effort Parametric regression Decomposition of overall inequality
Li Donni et al., 2009	UK	BHPS <sup>11</sup> 1996-2005	16+	16,204	SAH (very poor/poor, fair, good, excellent) considered as binary	Father's social class when individual was aged 14	Smoking Number of cigarettes smoked	Age and sex Education Occupation status Household income Region of residence Ethnic group Year dummies	Non-parametric regression Type approach Tranches approach classifying by levels of effort Parametric regression Decomposition of overall inequality using the Atkinson equality index
Li Donni et al., 2014 <sup>5</sup>	UK	BHPS <sup>11</sup> 2000-2005 longitudinal survey	55+	Between 2,519-2,631	SAH (very poor/poor, fair, good, excellent)	Father's SES Father's vital status Ethnicity Country of birth Any accident	Smoking	Education level Age and gender	Non parametric approach Tranches approach classifying by levels of effort Parametric regression Decomposition of overall

									inequality using the Atkinson equality index
Pasqualini et al., 2017 <sup>8</sup>	14 European countries	SHARE <sup>12</sup> and ELSA <sup>13</sup> 2005, 2007 and 2008	49+	32,165 SHARE <sup>1</sup> and 10,281 ELSA <sup>12</sup>	SAH (Excellent, very good, good, fair, poor) Body Mass Index Chronic conditions	Number of books in the household at age 10 Financial hardship Average level of income in the country of residence Income inequality within the country of residence	Age and sex Marital status Employment status, Educational level	Migration from the country of birth	Parametric regression Decomposition of the adjusted R-squared of the models
Rosa-Dias, 2009	UK	1958 NCDS <sup>8</sup> birth cohort	From birth to age 46	4,408	SAH at age 46 (excellent, good, fair, poor, very poor)	Parental SES Both grand-father's SES Mother and father's education Mother and father's smoker Maternal smoking after 4 month pregnancy Breastfed, birth weight Physical/mental impairment, obesity at 16 Diabetes, epilepsy, health condition in family Math test score at 11 Arguments with parents about risks of smoking	Smoker at age 33 Avoidance of fried food Vegetables consumption Sweets consumption	Education Social status	Non parametric approach First order stochastic dominance and test Gini-opportunity index Health pseudo-Gini Parametric regression Separate equations for each of the efforts
Sun et al., 2013	China	CHNS <sup>14</sup> 1997, 2000, 2004, 2006 cross-sectional data	18-75	4,168	Health care expenditure in the past 4 weeks	Education Family income Medical insurance Regional health care statistics (medicine availability and travel time) Urban/rural residence Year dummies	Treatment preferences Smoking Drinking	Age and sex Marital status Health needs (SAH, chronic diseases, illness, inpatient)	Parametric regression Fleurbaey and Schokkaert framework Fairness gap decomposition

Bricard et al., 2013	13 European countries	SHARE <sup>12</sup> 2004 and 2007/2007 SHARELIFE in 2008/2009	50-80	20,946	SAH (Excellent, very good, good, fair, poor) considered as binary	Main breadwinner occupation Number of books at home Number of rooms per household member Number of facilities Financial difficulties Mother and father's longevity Parents' smoking Parents' alcohol Dental visits for children	Smoking Obesity Sedentary behaviour	Age and sex Country dummies	Parametric regression Ex-post roemerian approach with relative effort from auxiliary equation Variance decomposition
Rosa-Dias, 2010	UK	1958 NCDS <sup>8</sup> birth cohort	From birth to age 46	4,408	SAH at age 46 (excellent, good, fair, poor, very poor) LSI <sup>9</sup> or disability at age 46 Mental health score at age 42	Parental SES Both grand-father's SES Mother and father's education Mother's smoker Financial hardships Physical/mental impairment, obesity at 16 Diabetes, epilepsy, heart condition in family Cognitive ability at 11 Social development at 11	Smoker at 33 Avoidance of fried food at 33 Alcohol at 33	Sex Education	Parametric regression Fleurbay and Schokkaert framework Separate equations for each of the efforts

<sup>8</sup> References including both ex-ante and ex-post approaches

<sup>7</sup> PSELL-3: Panel Socio-Economic Liewen zu Lëtzebuerg

<sup>1</sup> JCUSH: Joint Canada/United States Survey of Health

<sup>2</sup> HUI: Health Utilities Index Mark 3

<sup>3</sup> HALS: British Health and Lifestyle Survey

<sup>4</sup> SPS: Social Protection Survey

<sup>5</sup> HSE: Health Survey for England

<sup>6</sup> NLSY79: National Longitudinal Survey of Young 1979

<sup>8</sup> NCDS: National Child Development Study

<sup>9</sup> ESPS: Enquête Santé et Protection Sociale

<sup>10</sup> LSI Long-standing illness

<sup>11</sup> BHPS: British Household Panel Survey

<sup>12</sup> SHARE

<sup>13</sup> ELSA

<sup>14</sup> CHNS: China Health and Nutrition Survey

## Appendix A

### Search Strategies

Project Name: Inequalities of Opportunities in Health – Book Chapter

Date: 19/03/2018

Database: Medline; Medline In-Process & Other Non-Indexed Citations; Medline Epub Ahead of Print; Embase; Econlit; The Cochrane library

### Ovid MEDLINE(R) <1946 to January Week 4 2018>

Search Strategy:

- 
- 1 ((Inequalit\* or equal\* or equit\* or inequit\*) adj "of opportunit\*").ab. (474)
  - 2 ((Inequalit\* or equal\* or equit\* or inequit\*) adj2 opportunit\*).ti,kf. (320)
  - 3 1 or 2 (764)
  - 4 health\*.tw,kf. (1976096)
  - 5 3 and 4 (305)
  - 6 Economics/ (26852)
  - 7 exp Economics, Dental/ (4032)
  - 8 exp Economics, Nursing/ (3978)
  - 9 exp Economics, Medical/ (13992)
  - 10 exp Economics, pharmaceutical/ (2723)
  - 11 exp Economics, Hospital/ (22604)
  - 12 exp "Costs and Cost Analysis"/ (211426)
  - 13 exp "Fees and Charges"/ (29059)
  - 14 exp budgets/ (13192)
  - 15 exp "Value of Life"/ec [Economics] (240)
  - 16 budget\*.tw. (20676)
  - 17 cost\*.ti. (91261)
  - 18 (cost\* adj2 (effective\* or utilit\* or benefit\* or minimi\* or evaluat\* or analy\* or study or studies or consequenc\* or compar\* or efficienc\* or variable or unit or estimate\* or variable\* or unit)).ab. (123712)
  - 19 (economic\* or pharmaco-economic\* or pharmaco-economic\*).tw. (182428)
  - 20 (price or prices or pricing).tw. (27302)
  - 21 (financ\* adj2 (cost\* or data or "health care")).tw. (6510)
  - 22 (fee or fees).tw. (13725)
  - 23 (value adj1 (money or monetary)).tw. (430)
  - 24 quality-adjusted life years/ (9743)
  - 25 (eq-5d\* or eq5d\* or euroquol\* or euroqol\* or euroqual\* or euro-quol\* or euro-qol\* or euro-qual\*).tw. (6344)
  - 26 exp models, economic/ (12938)
  - 27 markov chains/ (12389)
  - 28 quality adjusted life.tw. (8408)
  - 29 (qaly or qalys or qald or qale or qtime).tw. (6830)
  - 30 disability adjusted life.tw. (1947)
  - 31 (daly or dalys).tw. (1787)
  - 32 "Global Burden of Disease"/ [new 2017] (105)
  - 33 health\* year\* equivalent\*.tw. (38)
  - 34 (hye or hyes).tw. (57)
  - 35 (hui1 or hui2 or hui3).tw. (310)
  - 36 disutil\*.tw. (300)
  - 37 standard gamble\*.tw. (718)



- 38 (time trade off or time tradeoff).tw. (1104)
- 39 (hqol or h qol or hrqol or hr qol).tw. (10941)
- 40 (pqol or qls).tw. (286)
- 41 (sf6d or sf 6d or short form 6d or shortform 6d or sf sixd or sf six d).tw. (599)
- 42 exp animals/ not (exp animals/ and exp humans/) (4417696)
- 43 exp Veterinary Medicine/ (23906)
- 44 exp Animal Experimentation/ (8565)
- 45 ((energy or oxygen\* or metaboli\*) adj3 (expenditure\* or cost\*)).tw. (25772)
- 46 or/42-45 (4454796)
- 47 or/6-41 (567374)
- 48 47 not 46 (528603)
- 49 5 and 48 (71)

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**Ovid MEDLINE(R) In-Process & Other Non-Indexed Citations <February 01, 2018>, Ovid MEDLINE(R) Epub Ahead of Print <February 01, 2018>**

Search Strategy:

- 
- 1 ((Inequalit\* or equal\* or equit\* or inequit\*) adj "of opportunit\*").ab. (81)
  - 2 ((Inequalit\* or equal\* or equit\* or inequit\*) adj2 opportunit\*).ti,kf. (39)
  - 3 1 or 2 (120)
  - 4 health\*.tw,kf. (305961)
  - 5 3 and 4 (49)
  - 6 Economics/ (2)
  - 7 exp Economics, Dental/ (1)
  - 8 exp Economics, Nursing/ (0)
  - 9 exp Economics, Medical/ (0)
  - 10 exp Economics, pharmaceutical/ (6)
  - 11 exp Economics, Hospital/ (0)
  - 12 exp "Costs and Cost Analysis"/ (16)
  - 13 exp "Fees and Charges"/ (1)
  - 14 exp budgets/ (1)
  - 15 exp "Value of Life"/ec [Economics] (0)
  - 16 budget\*.tw. (4317)
  - 17 cost\*.ti. (13614)
  - 18 (cost\* adj2 (effective\* or utilit\* or benefit\* or minimi\* or evaluat\* or analy\* or study or studies or consequenc\* or compar\* or efficienc\* or variable or unit or estimate\* or variable\* or unit)).ab. (23504)
  - 19 (economic\* or pharmacoeconomic\* or pharmaco-economic\*).tw. (34221)
  - 20 (price or prices or pricing).tw. (4922)
  - 21 (financ\* adj2 (cost\* or data or "health care")).tw. (710)
  - 22 (fee or fees).tw. (1714)
  - 23 (value adj1 (money or monetary)).tw. (79)
  - 24 quality-adjusted life years/ (0)
  - 25 (eq-5d\* or eq5d\* or euroquol\* or euroqol\* or euroqual\* or euro-quol\* or euro-qol\* or euro-qual\*).tw. (1525)
  - 26 exp models, economic/ (0)
  - 27 markov chains/ (1)
  - 28 quality adjusted life.tw. (1450)
  - 29 (qaly or qalys or qald or qale or qtime).tw. (1235)
  - 30 disability adjusted life.tw. (428)

- 31 (daly or dalys).tw. (366)
- 32 "Global Burden of Disease"/ [new 2017] (0)
- 33 health\* year\* equivalent\*.tw. (2)
- 34 (hye or hyes).tw. (4)
- 35 (hui1 or hui2 or hui3).tw. (23)
- 36 disutil\*.tw. (57)
- 37 standard gamble\*.tw. (61)
- 38 (time trade off or time tradeoff).tw. (120)
- 39 (hqol or h qol or hrqol or hr qol).tw. (2049)
- 40 (pqol or qls).tw. (57)
- 41 (sf6d or sf 6d or short form 6d or shortform 6d or sf sixd or sf six d).tw. (67)
- 42 exp animals/ not (exp animals/ and exp humans/) (228)
- 43 exp Veterinary Medicine/ (59)
- 44 exp Animal Experimentation/ (1)
- 45 ((energy or oxygen\* or metaboli\*) adj3 (expenditure\* or cost\*)).tw. (4012)
- 46 or/42-45 (4251)
- 47 or/6-41 (73992)
- 48 47 not 46 (73408)
- 49 5 and 48 (9)

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### **Embase Classic+Embase <1947 to 2018 February 01>**

Search Strategy:

- 
- 1 ((Inequalit\* or equal\* or equit\* or inequit\*) adj "of opportunit\*").ab. (682)
  - 2 ((Inequalit\* or equal\* or equit\* or inequit\*) adj2 opportunit\*).ti,kw. (387)
  - 3 1 or 2 (1024)
  - 4 health\*.tw,kw. (3025080)
  - 5 3 and 4 (391)
  - 6 health economics/ (35528)
  - 7 exp economic evaluation/ (268224)
  - 8 exp health care cost/ (257726)
  - 9 pharmacoconomics/ or "drug cost"/ or drug utilization/ or "utilization review"/ (156867)
  - 10 socioeconomics/ and economics/ (15284)
  - 11 \*socioeconomics/ (20197)
  - 12 Economic model/ (1024)
  - 13 \*fee/ (6567)
  - 14 \*"cost"/ (13768)
  - 15 cost\*.ti. (137666)
  - 16 (cost\* adj2 (effective\* or utilit\* or benefit\* or minimi\* or evaluat\* or analy\* or study or studies or consequenc\* or compar\* or efficienc\* or variable or unit or estimate\* or variable\* or unit)).ab. (205380)
  - 17 (price or prices or pricing).tw. (46578)
  - 18 (economic\* or pharmaco-economic\* or pharmaco-economic\*).tw. (288148)
  - 19 budget\*.tw. (32786)
  - 20 (value adj1 (money or monetary)).tw. (663)
  - 21 (financ\* adj2 (cost\* or data or "health care")).tw. (9433)
  - 22 financ\*.tw. and economics/ (13933)
  - 23 (expenditure\* not energy).tw. (34035)
  - 24 quality adjusted life year/ (20346)

- 25 (eq-5d\* or eq5d\* or euroquol\* or euroqol\* or euroqual\* or euro-quol\* or euro-qol\* or euro-qual\*).tw. (14581)
- 26 quality adjusted life.tw. (14901)
- 27 (qaly or qalys or qald or qale or qtime).tw. (15268)
- 28 disability adjusted life.tw. (2882)
- 29 (daly or dalys).tw. (2840)
- 30 (SF6D or sf 6d or short form 6d or shortform6d).tw. (1196)
- 31 health\* year\* equivalent\*.tw. (40)
- 32 (hye or hyes).tw. (115)
- 33 health utilit\*.tw. (2607)
- 34 (hui1 or hui2 or hui3).tw. (465)
- 35 disutil\*.tw. (689)
- 36 standard gamble\*.tw. (987)
- 37 (time trade off or time tradeoff).tw. (1678)
- 38 (hqol or h qol or hr qol or hrqol).tw. (20716)
- 39 (pqol or qls).tw. (541)
- 40 or/6-39 (1011709)
- 41 exp animals/ not (exp animals/ and exp humans/) (4961162)
- 42 exp nonhuman/ not (exp nonhuman/ and exp human/) (4064264)
- 43 exp experimental animal/ (589993)
- 44 exp veterinary medicine/ (36589)
- 45 animal experiment/ (2157220)
- 46 ((energy or oxygen\* or metaboli\*) adj3 (expenditure\* or cost\*)).tw. (37032)
- 47 or/41-46 (7005151)
- 48 40 not 47 (940128)
- 49 5 and 48 (91)

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**The Cochrane Library (Wiley)**

#1 ((Inequalit\* or equal\* or equit\* or inequit\*) near/2 opportunit\*):ti,ab,kw (Word variations have been searched) 11

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**EconLit (EBSCO) 1886 - present**

- S5 (TX health\*) AND (S3 AND S4) (224)
- S4 TX health\* 98,589
- S3 S1 OR S2 (1,519)
- S2 TI ( ((Inequalit\* or equal\* or equit\* or inequit\*) N2 opportunit\* ) OR SU ( ((Inequalit\* or equal\* or equit\* or inequit\*) N2 opportunit\* ) ) (593)
- S1 AB ((Inequalit\* or equal\* or equit\* or inequit\*) N1 "of opportunit\*") (1,205)

## Notes

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<sup>1</sup> This included Ovid Embase; Ovid Medline; Ovid Medline In-Process & Other Non-Indexed Citations; Ovid MEDLINE(R) Epub Ahead of Print; Cochrane Database of Systematic Reviews (Cochrane Library, Wiley) ; NHSEED (Cochrane Library, Wiley); RePEc Ideas; and Econlit.

<sup>3</sup> See: <http://impact.ref.ac.uk/CaseStudies/CaseStudy.aspx?Id=43455>

<sup>4</sup> See: [http://ec.europa.eu/chafea/projects/database/fileref/SANCO/2003/2003125\\_1\\_en.pdf](http://ec.europa.eu/chafea/projects/database/fileref/SANCO/2003/2003125_1_en.pdf)

<sup>5</sup> Duplicates included the same papers, which were available with the same titles and sometimes available in several working paper versions and published version.