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personal health**

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Does income inequality make us sick? Whether, and (if so) how, income inequality affects personal health

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ABSTRACT

It is an established fact that the level of one's income affects one's health. More divisive, however, is the question whether people's health is also affected by inequalities in income. The latter would imply that not only how much income we have matters for health, but also how much more or less we have of it compared to others. If this is the case, one of the far-reaching consequences would be that the benefits that we believe economic growth is to bring about (among others, better health for everyone) become uncertain if we do not also focus on redistribution. In recent years, the question whether income inequality affects health has received a growing scholarly interest and has been repeatedly scrutinized empirically. Unfortunately, however, consensus has not been reached. Far from it, in fact: in the lively debate, time and again an affirmative analysis is set against a negative one, and vice versa. In this review, I expound upon the arguments of both positions and conclude with some indications, which suggest that health might indeed be affected by income inequality.

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1. Introduction

The idea that income inequality affects people's personal health [hereafter, negative inequality effect] is a controversial issue. Whereas few find it hard to believe that someone's income level affects health, many are much more skeptical about the idea that inequality affects people's health. The skepticism is supported by a series of empirical analyses which find no inequality effect on health. In contrast, another series of empirical analyses affirms the negative effect of inequality on health. In reviewing this discussion, I focus on the two aspects that scholars of both sides discern: facts and figures, and underlying explanations. As I show in this review, consensus has not been reached with regards to the former, whereas the discussion of the latter does suggest the existence of a negative inequality effect.

2. Facts and figures

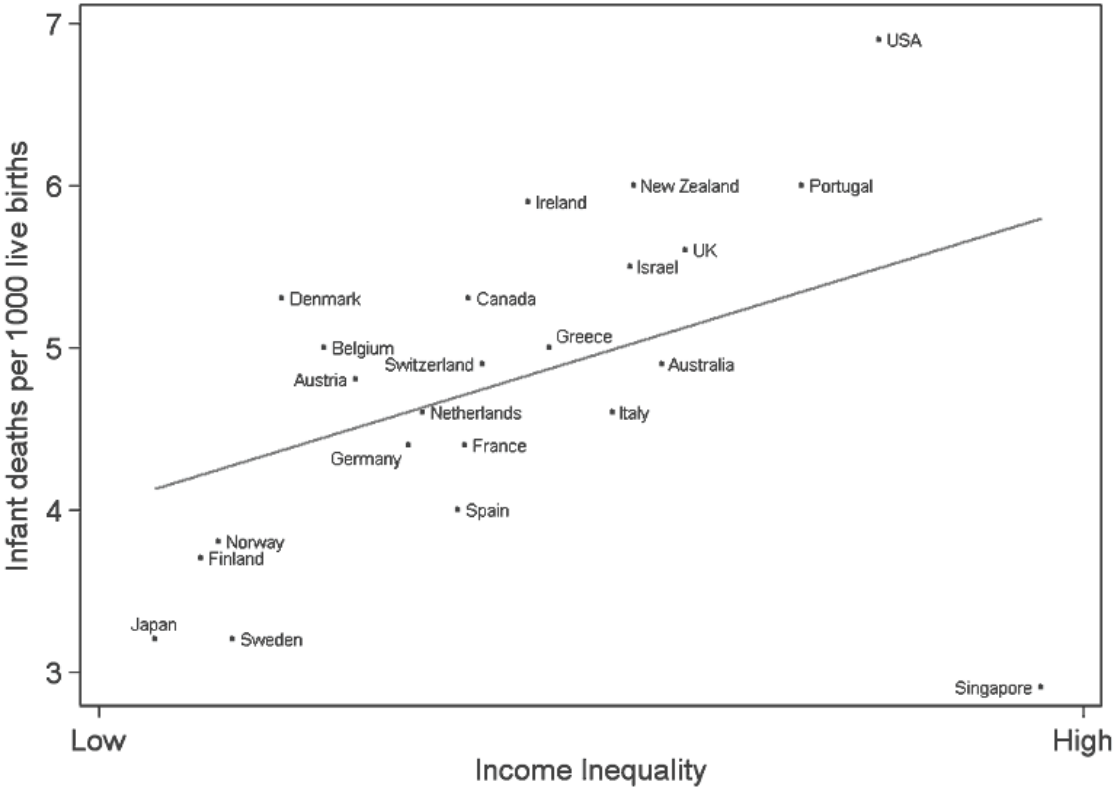
2.1. *Salient bivariate statistics*

Agreement exists on the fact that in bivariate statistics, income inequality strongly correlates with different health-indicators, such as life expectancy, infant mortality, several causes of death, and obesity (see figure 1). Some scholars, among which epidemiologists Picket and Wilkinson are the most well-known, use these correlations as a confirmation for the negative inequality effect (among others, Wilkinson, 1992; 1995; 2005; Wilkinson and Picket, 2006; 2007; 2009a; 2009b). Time and again, the conclusion is clear: higher inequality strongly correlates with poorer health.¹

Furthermore, the relationship not only holds when comparing wealthy democratic nations, but also when other geographical regions, in particular the individual states in the US, are compared to each other (Kaplan et al., 1996; Kennedy et al., 1996; Wilkinson and Picket, 2009b: 82-83).

¹ Some disagreement exists on whether the choice of inequality indicator affects these outcomes. Several studies confirm that the choice of inequality measure shows to be irrelevant (Kawachi and Kennedy, 1997; also see Wilkinson and Picket, 2009b, who use both the Gini indicator and quintile ratios). The irrelevance of the inequality indicator should not come as a great surprise, because inequality indicators highly correlate per country (OECD, 2008: 25-26). Because of this high correlation, in their meta-analysis, Kondo et al. (Kondo et al., 2009) transform the inequality measures used in other studies into a Gini-index and corroborate the inequality-health effect. Nevertheless, in some studies the choice of inequality indicator does matter (cf. Daly et al., 1998; Weich et al., 2002).

Figure 1 Inequality and infant mortality.

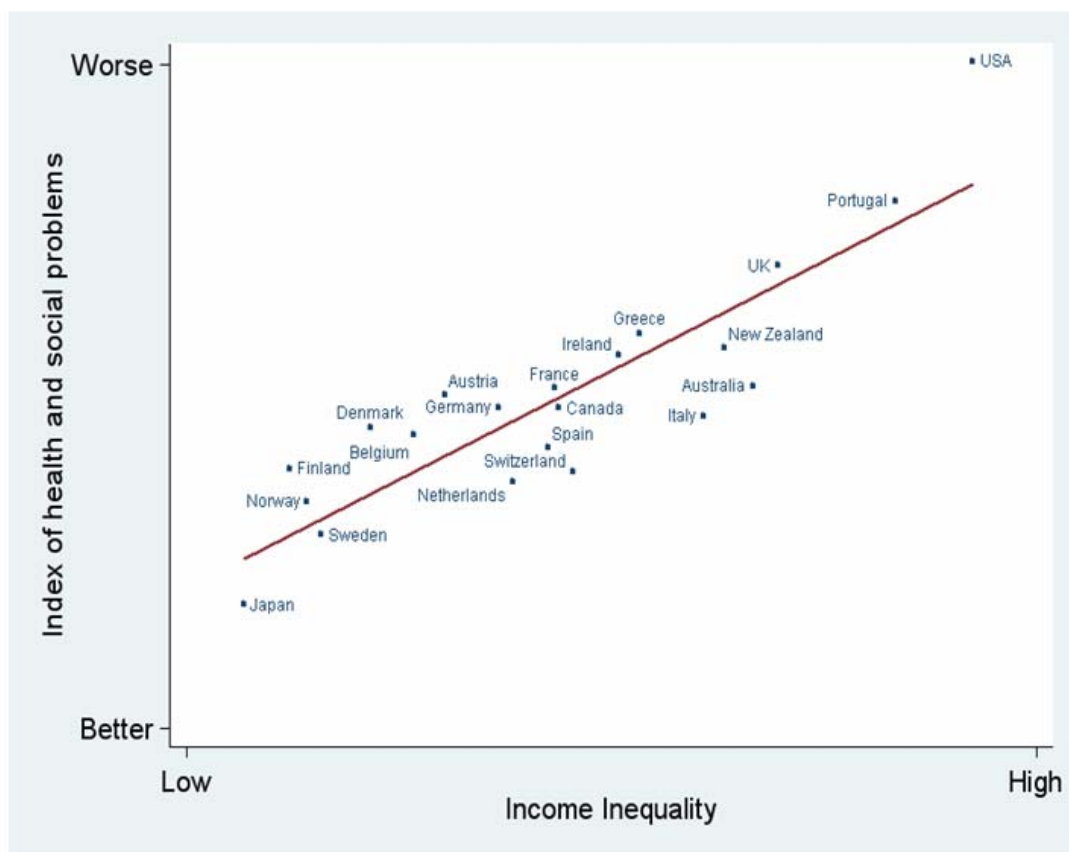


Source: Wilkinson and Pickett (2009b: 82) (Pearson’s $r = 0.42$; $P = 0.04$) Income inequality is measured by the S80/S20 ratio (this figure and notes on the statistical sources is available at www.equalitytrust.org.uk).

In addition, income inequality not only strongly correlates with health, but also with other societal phenomena. Kaplan *et al.* (1996) find that a society’s prevalence of smoking, the number of prisoners, homicides and violent crimes are also negatively related to income inequality. In their more recent work, Wilkinson and Pickett (among others, Wilkinson, 2005; Pickett and Wilkinson, 2007; Wilkinson and Pickett, 2009b) corroborate these findings and even expand the bundle of social phenomena: it is shown that also mental health, teenage births, educational performance (both attainment levels and dropout rates), and social mobility negatively correlate with income inequality.

Using an index of ten social factors (life expectancy, math and literacy scores, infant mortality, homicides, imprisonment, teenage births, trust, obesity, mental illness, and social mobility) Wilkinson and Pickett (2009b: 19) bring these figures together. The correlation between this index and income inequality is stunning (Pearson’s $r = 0.87$; $p < 0.01$) (see figure 2), and is largely confirmed when controlling their results with an index of child well-being in wealthy countries developed by UNICEF (Pickett and Wilkinson, 2007).

Figure 2 Inequality and the index of health and social problems.



Source: Wilkinson and Pickett (2009b: 20), available at: www.equalitytrust.org.uk. (Pearson's $r = 0.87$; $p < 0.01$)

Though scholars do not contest the correctness of these figures (among others, Ben-Shlomo et al., 1996; Davey Smith and Egger, 1996; Van Doorslaer et al., 1997; Yngwe et al., 2005; Subramanian and Kawachi, 2006; Kondo et al., 2008; Leigh et al., 2009; Van Ourti et al., 2009; Karlsson et al., 2010), after all, they result from plain bivariate statistics, yet many discredit the usage of these correlations as a proof for income inequality having an *effect* on health. Establishing that X and Y occur together, does not yet confirm that X or Y causes the other. This dispute serves as a good segue for introducing the statistical debate upon the negative inequality effect.

2.2. The statistical debate upon the negative inequality effect

2.2.1. Miscellaneous data issues

The first criticisms on analyses that affirmed the negative inequality effect mainly addressed data-related issues (Judge, 1995; among others, Davey Smith, 1996; for a summary, read Lynch and Kaplan, 1997; more recent, Fritzell, 2006; Leigh et al., 2009). It was shown that the earlier analyses suffered from poor data quality and inadequate data management, such

as not using household equivalence scales when computing income, and the lack of a theoretical justification for the chosen inequality indicator. Since then, however, better data has been made available, and data processing standards have crystallized. Consequently, in recent analyses, these data issues are tackled as well as they can be (cf. among others, Kondo et al., 2008; Subramanyam et al., 2009).

2.2.2. Multivariate statistics

A second and more profound point of criticism is the fact that the bivariate statistics presented above do not control for other possible influences (such as absolute household income). As a consequence, from the abovementioned associations we cannot know whether the correlation between inequality and health is genuine or spurious (when more equality and better health are both caused by a phenomenon not included in the analysis).

To settle this issue, scholars increasingly turn to multivariate statistics. Unfortunately, however, these analyses do not offer consistent results. Several analyses affirm that income inequality has an independent, robust and strong negative effect on personal health (among others, Subramanian and Kawachi, 2006; Kondo et al., 2008; Subramanyam et al., 2009). In contrast, other multivariate analyses refute these results by detecting no significant association between income inequality and personal health (among others, Mellor and Milyo, 2002; Lorgelly and Lindley, 2008). Is there a way to bridge this inconclusiveness?

Ideally, claims of causality are analyzed using panel-data. However, due to high data restrictions of that technique, only few such studies have been carried out thus far. And, unfortunately, the results are inconclusive again: whereas Cantarero *et al.* (2005) and Hildebrand and Van Kerm (2009) find confirmation for the negative income effect, Fiscella and Franks (1997), Lorgelly & Lindley (2008), and Leigh *et al.* (2009) do not.

Scrutinizing all these analyses methodologically is a well-nigh impossible exercise "due to the differences between the countries studied, [...] differences in the choice of methods, dependent variables (subjective or objective health) and interpretation of covariates as confounders or mediators" (Karlsson et al., 2010: 876). Furthermore, a quick look at such meta-analyses, which weigh up affirmative against negative analyses, shows that these do not take away the inconclusiveness.

Wagstaff and Van Doorslaer (2000), mainly reject the association between income inequality and personal health. Four years later, Subramanian and Kawachi (2004: 89) conclude that "the evidence is still far from complete." In contrast, in the most comprehensive review thus far, Wilkinson and Pickett (2006) are more conclusive in favor of the inequality hypothesis. Unfortunately, they do not indicate which proportion of their

155 included peer-reviewed articles used multi-level statistics, whereas Wagstaff and Van Doorslaer (2000) convincingly argue that in order to discriminate between the negative inequality effect and other possible effects such as the absolute income hypothesis (which is further discussed below), multi-level analyses (which include, in addition to inequality at the society's level, individual level income and health data). Recently, Kondo et al. (2009) pursued a meta-analysis of all multi-level studies carried out since 1995. Their results suggest "a modest adverse effect of income inequality on health," which "has potentially important policy implications for population health as income inequality is an exposure that applies to society as a whole" (p. 1178). Nevertheless, these authors also remain cautious, and conclude that "further investigations are needed" (p. 1181), because, among other reasons, the heterogeneity among the studies they included in their meta-analysis.

It is thus fair to say that the empirical literature on the inequality – health association, remains inconclusive. Even though Subramanian and Kawachi (2004) and Wilkinson and Pickett (2006) provide arguments for why most unsupportive analyses are possibly false negatives (e.g. geographical scale of assessing inequality and sample size), it nevertheless seems that one can always find contrasting pairs of studies which meet the same statistical standards.

3. Alternative hypotheses

Instead of further scrutinizing statistical analyses, the remainder of this paper focuses on the alternative hypotheses which have been formulated to explain away the bivariate negative correlation overwhelmingly found between income inequality and personal health. If these correlations are not the result of an effect of income inequality on health, then which factors do cause this multitude of negative correlations? As it is shown, these alternative explanations are not immune to critique.

3.1. The absolute income argument

The most important alternative hypothesis is the absolute income argument: what matters for personal health is not someone's relative income position, but someone's absolute income. People living in poor circumstances have poor health, whereas people living in comfort live longer, and in better health. It has been found repeatedly that this relationship between absolute income and health is "a 'gradient' that extends beyond poverty levels of income and runs from top to bottom of the socioeconomic range" (Subramanyam et al., 2009: 327). Within each country, people less well-off tend to have a shorter life expectancy, and they run a far higher risk to develop different diseases, such as several cancers, chronic lung disease, gastrointestinal diseases, and depression. In contrast, people more well-off live longer and have smaller risks of

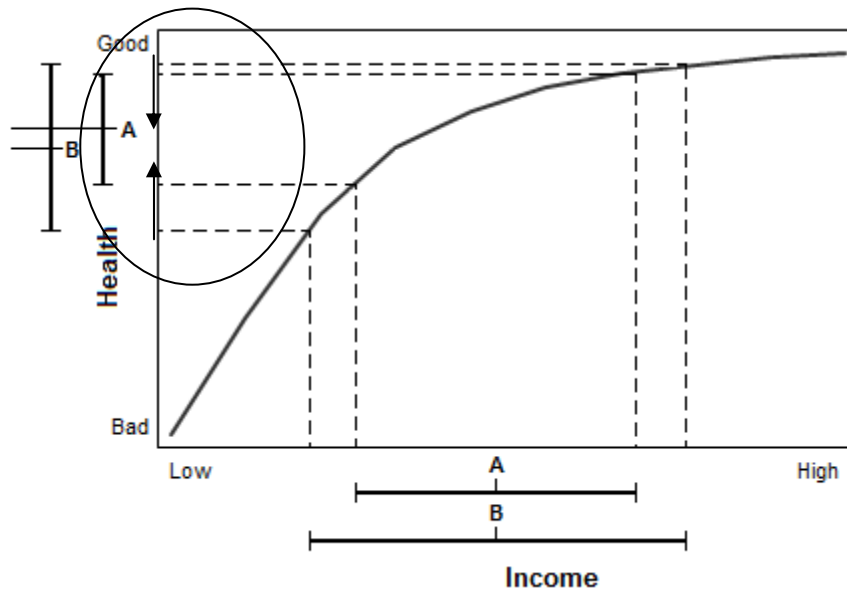
developing these diseases. Thus, health inequalities “favor the better-off” (Van Doorslaer et al., 1997: 109). In Britain, this social gradient in health came to the surface in the famous Whitehall I (1967) and Whitehall II (1985) studies (Marmot and Davey Smith, 1997). Also outside the UK, the social gradient in health outcomes is well-established (among others, for the Scandinavian countries: Backlund et al., 1996; for Belgium: De Graeve and Duchesne, 1997; Van Doorslaer et al., 1997; Deleeck, 2003; for a comparison of several industrialized countries: Kunst et al., 2005; Lecluyse, 2007; for Japan: Kondo et al., 2008; for the US: Subramanyam et al., 2009)

Referring to this strong relationship between someone’s absolute income and personal health, some scholars maintain that this association explains away the association between a society’s inequality and people’s health position. They underpin this idea with a mathematical argumentation, often called the Absolute Income Hypothesis (AIH) (put forward by, among others, Backlund et al., 1996; Lynch and Kaplan, 1997: 305-306). This mathematical argument runs as follows:

Characteristic for the social gradient in health, is its concave course: the health improvements by becoming richer diminish the richer one becomes (which is empirically confirmed by, among others, Van Ourti et al., 2009). From this, it follows mathematically that for two countries with the same average absolute income level but with a different income distribution, the country with the lowest income inequality has, on average, healthier citizens.

This is illustrated in figure 3. The income distributions of the hypothetical countries A and B are represented by the bars below the X-axis: though both countries are equally well-off on average (equal mean income), income in country A is more equally distributed than in country B. The Y-axis represents personal health, and shows that the more equal country A has a better average health than the less equal country B. However, it is not the income inequality that explains the difference in average health, but the fact that in country B the gains in health by having more wealthy citizens is outweighed by the firmer losses in health by having more poor people. This thus suggests that a society’s health position has nothing to do with its level of inequality per se. According to the proponents of the AIH, the best way to enhance people’s health is not more equality, but more growth, especially at the bottom of the income distribution.

Figure 3 The curvilinear relation between income and personal health



This figure illustrates how two hypothetical countries A and B, which are equally well-off but have differing income distributions (X-axis), have different average health statuses (Y-axis) because of the curvilinear relation between people's absolute income and health positions. The illustration assumes income to be equally distributed around the average. A similar illustration, though for a within country comparison through time, can be found in Wagstaff and Van Doorslaer (2000: 546).

Nevertheless, several strong points have been made against the AIH. First, Kawachi and his colleagues (1997) arrive at a remarkable finding. Because they use community-level data, they cannot rule out that their initially found negative inequality effect is not explained by the AIH. However, the authors hypothesize that the effect of income inequality on health runs via social capital, that is, they assume that more equal societies provide more social capital, of which they assume it positively affects personal health. When controlling their initial negative inequality effect for social capital, as expected, the initial effect attenuates substantially. Important here, is that the effect of social capital rules out the AIH: even Wagstaff and Van Doorslaer (2000: 556), who are skeptical about the negative inequality effect, conclude that, if the AIH would be "generating the effect of income inequality at the community level, then controlling for community-level social capital levels should not remove this effect."

A further challenge to the AIH is that the negative inequality effect is not observed when inequality is measured at a local level (e.g. counties, neighborhoods, parishes). This means that a more equal income distribution within a neighborhood does not, in general, correlate with average health in that neighborhood. Nevertheless, also within neighborhoods rich people tend to have better health than less rich people. Why, then, does the absolute income – health effect does not cause the negative inequality effect at this neighborhood level? Proponents of the negative inequality effect argue that the absence of the AIH at the local level is a clear indication of not being a valid explanation for the negative inequality effect in general. What in fact happens is that

the income inequality which affects one's health, is not the inequality within the locality, but the inequality between the locality and the rest of the country (among others, Subramanian and Kawachi, 2004: 81; Wilkinson and Pickett, 2009a: 502-503). For instance, people in deprived areas do not feel deprived because they see how their neighbors are living, but because they see how people are living elsewhere in society.

A third point, which is made against the AIH, challenges its over-all explaining power. Is it reasonable that very well-off people still have poorer health than those even more well-off (as empirically observed (Kaplan et al., 1996: 999; Sapolsky, 2004: 409)), just because the most well-off have even more income than the already well-off? Several scholars (among others, Marmot, 2005; Wilkinson, 2005: 69) question whether the health differences between the already very rich can be explained by differences in their income.

The fourth and final point which is made against the AIH concerns "over-controlling". People's absolute income is a two-sided coin: on the one hand, it reveals people's purchasing power; on the other hand, it also shows their position within the income distribution. Statistically disentangling both effects is a complicated task. As it follows, including absolute income as a control variable in an analysis of inequality might be a case of over-controlling and hence erroneous.

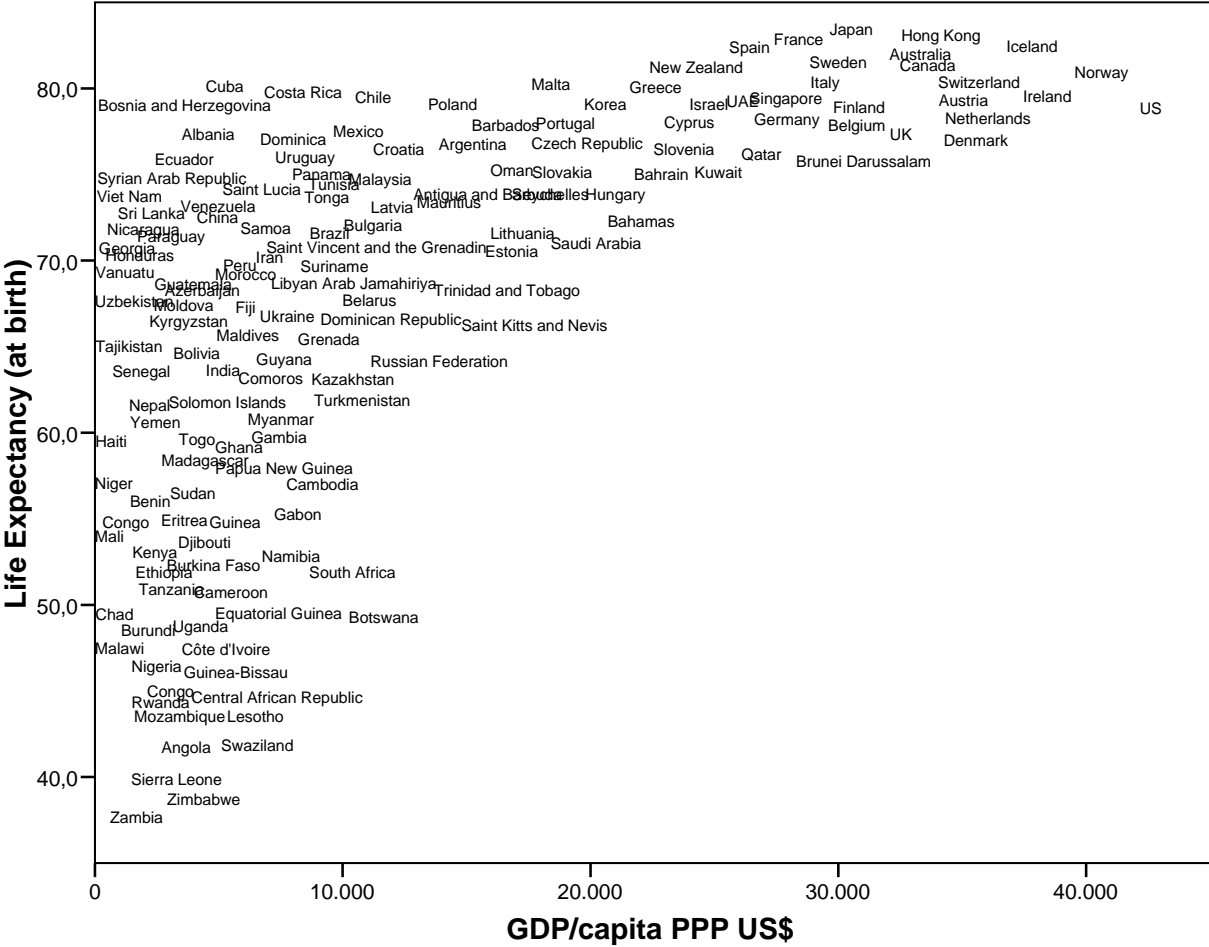
An ingenious way out for this issue is offered by Yngwe and her colleagues (2005). They pool together data of individuals of three, highly comparable countries: Finland, Norway, and Sweden. This unified dataset contains people with the same level of absolute purchasing power though nevertheless have a different relative position within their respective country. This allows the authors to disentangle the absolute and the relative effects of personal income. Their analysis brings them to the conclusion that there is "an effect of position over and above the effect of consumption ability" (Yngwe et al., 2005: 634).

More empirical evidence on the limitations of the AIH is found in the paradox of cross-country comparisons. Taken the fact that richer people tend to live longer (and healthier), one would assume that a richer country (i.e. a country with more well-off people) would have a higher life expectancy than a poorer country (i.e. a country with less well-off people). However, as Figure 4 shows, above a certain point of financial well-being this is not the case: it hardly makes a difference for a population's life expectancy to be better-off than others. Amartya Sen (1993: 24) points sharply at a related point by comparing the life expectancy of African Americans in the United States with the life expectancy of less well-off groups throughout the world: "African-Americans are poor in comparison with U.S. whites, but they are immensely richer than Chinese and Keralan citizens. On the other hand, in terms of life and death, African-Americans are less likely to survive to a ripe old age than are people in some of the poorest Third World

countries.” Noteworthy is the fact that Sen puts the AIH into perspective without being a proponent of the negative inequality effect. Sen follows a neo-materialist approach (see below), considering structural public investments, mainly in schooling, health care and social peace, as the major health factor (Sen, 1993; 1999: 160-188, 204-226).

To sum up, whereas the AIH is often presented as a counter-hypothesis, to explain away the bivariate correlations between inequality and health, this AIH is far from being unproblematic itself. The AIH, nevertheless, is not the only alternative hypothesis.

Figure 4 Life expectancy and economic development.



Data source: (United Nations, 2007)

3.2. Underlying societal structures

A second alternative hypothesis holds that the negative inequality effect is caused by underlying, country specific structures. Neo-materialism, Anglophone culture, country size, or the density of ethnic minorities; these factors are all suggested to affect both income inequality and personal health, without there being a causal link between the latter two.

The theory of neo-materialism is the most important of these mechanisms and holds that institutional characteristics, especially welfare state institutions, cause the initially observed negative inequality effect. It is assumed that welfare states with better (health care) services and benefit systems boost health and simultaneously decrease economic inequality (among others, Davey Smith, 1996; Kaplan et al., 1996). A further argument for this approach is that health seems to be more affected by inequality measured at a geographical level which coincides with a political jurisdiction (e.g. at state-level in the US).

Four counterarguments can be put forward against the neo-materialism hypothesis. First, as with the AIH, doubt on the neo-materialism hypothesis is cast by the fact that the social gradient in health runs all the way through the income distribution (Wilkinson, 2005: 69; Wilkinson and Pickett, 2009a). However, within one society, above a certain income threshold, the access and quality of societal institutions scarcely differs. Yet, health still differs according to income. Second, the negative inequality effect is also confirmed in analyses, which are based on reference groups that share the same institutional setting (such as age groups) (Karlsson et al., 2010). A similar conclusion is found in the abovementioned study by Yngwe and her colleagues (2005): in their analysis of three Scandinavian welfare states, which differ little in institutional design (cf. Esping-Andersen, 1990; Goodin et al., 1999; Lähteenmäki-Smith, 2005), they nevertheless observe the negative inequality effect. A third point against the neo-materialism hypothesis focuses on health care access: Sapolsky (2004: 409) points to the fact that income inequality is also associated with “diseases whose incidences are unchanged by access to preventative health care (e.g., juvenile diabetes or rheumatoid arthritis).” Finally, Pham-Kanter (2009) corroborates the negative inequality effect even after controlling for state fixed effects. In sum, though (welfare state) institutions are important for both average health and the income distribution, nevertheless, these institutions do not fully explain away the association between income inequality and personal health.

Let me briefly assess the other societal factors, which are put forward to explain away the inequality – health association: a country’s culture; country size; and presence of ethnic divisions. It is sometimes suggested that the negative inequality effect is particularly strong in Anglo-Saxon countries, and in large countries. Against this claim, several case studies are put forward. Take Portugal, for instance: this country has inequality and health levels which are comparable to those of the United States, but obviously has a different culture, and is much smaller (Wilkinson and Pickett, 2009b: 176). Another remarkable comparison illustrating that a specific culture is not crucial for the inequality – health association is that of Japan and Britain made by Marmot and Davey Smith (1989). Today, life expectancy in Japan clearly exceeds that of Britain (82.9 against 79 years at birth (United Nations, 2007)). Nevertheless, only 40 years ago, when Japan and Britain were culturally as different as today (if not more) they

had comparable levels of income inequality, and similar life expectancies. In other words, to explain the current differences in life expectancies, there are better arguments needed than cultural differences.

In addition, the presence of ethnic minorities is also sometimes used to explain away the negative inequality effect. State comparisons within the United States of America show that those states with more inequality and poorer health are also these states with the largest African-American population. The reasoning which is then sometimes followed is that, since African Americans in general have poorer health and lower absolute income (reminiscent of the absolute income argument), states with a higher share of African Americans also have larger economic inequality and a poorer average health position. However, if taken separately, it turns out that the association between income inequality and personal health is as strong for white people as for black people (for coronary heart disease even stronger) (Kaplan et al., 1996; Kennedy et al., 1996).

Of course, societal factors such as (welfare state) institutions, specific culture and ethnic minorities do influence both a country's level of economic inequality and its citizen's health position. Nevertheless, these factors turn out to be insufficient to explain away the observed association between income inequality and personal health as a spurious correlation.

3.3. Underlying personal characteristics

A final group of variables, which are said to underlie and explain away the negative inequality effect, focuses on personal characteristics. Poor health behavior is one of the central arguments in this reasoning. An often-established fact is that poor people are more prone to smoking, alcohol intake, fat-rich diets, and other adverse health-affecting habits. To explain the differences in health behavior between less well-off and better-off people, scholars often refer to specific lifestyles and lack of knowledge about good health behavior. These personal characteristics are then said to explain the social gradient in health, but also to explain away the association between inequality and health. Of course, lifestyles do have important health effects. However, to explain away the inequality – health correlation, the lifestyles and knowledge argument makes use of the AIH, of which the above discussion showed its shortcomings. As it follows, the lifestyles/knowledge argument also does not suffice to explain away the negative inequality effect (for a further discussion of lifestyle effects, see Marmot, 2005: 37-61).

For other personal characteristics, such as age, gender, ethnicity, and education, the literature is unanimous in that they have a too limited effect to explain away the relationship between inequality and health.

3.4. Recapitulation

To sum up, a lively debate has been going on between supporters and opponents of the negative inequality effect. The discussion above made clear that this relationship has not been settled yet empirically as one would have hoped. This should not come as a surprise, however, since the issue connects several closely intertwined theories, which are hard to separate analytically. As Leigh *et al.* (2009: 399) conclude: "This is a field with too many theories for the number of available data points." When then scrutinizing the arguments underlying the alternative hypotheses, it follows that these are insufficient to fully explain away the negative inequality effect.

4. If there is an effect

Following the analysis above, one should assume that there is a genuine correlation between income inequality and personal health. However, this does not yet imply that the hypothesis of the negative inequality effect is correct. The question remains open whether it is inequality that affects personal health. From a theoretical viewpoint, the opposite is just as well possible. Nevertheless, as the following review of the discussion shows, the negative inequality effect seems warranted. However, I first briefly discuss the position that personal health might affect a society's income distribution.

4.1. Health selection

The idea that personal health affects a society's income distribution is based on the health selection hypothesis, which assumes that people's health status determines their position in the income distribution. Especially poor health is said to negatively affect someone's earning potential. Furthermore, it is assumed that having more unhealthy people, or people who are more unhealthy, entails more income inequality.

This hypothesis, however, has met with clear objections. First, it is theoretically possible that health selection leads to more equality, instead of more inequality. For instance, when in a society many people already have poor health (and, according to the hypothesis, low income), additional people getting unhealthy leads to more equality. The income distribution would narrow down to the bottom. Second, and this empirical objection is most important, though some people's health clearly affects their income potential, on average, however, someone's health status is only a minor factor in determining that person's economic position (Marmot and Davey Smith, 1997). Consequently, "most experts now agree that the arrow of causation runs predominantly from low income to poor health, rather than the reverse" (Kawachi and Kennedy, 2002: 61).

4.2. Social comparison and relative deprivation

This then brings us to the negative inequality effect and the processes behind it. The idea that a society's income inequality affects the health status of its citizens (and other social phenomena) is not to be taken lightly. It implies that it is inequality that increases physical and mental illness. The mechanism, which is said to tie the societal to the individual, is the psychological effect inequality has on individuals: "the brain is the crucial organ in generating the social gradient in health" (Marmot, 2005: 20). Through social comparisons individuals develop a sense of relative standing, which, mostly unwittingly, causes stress and feelings of relative deprivation (also suggested by, among others, Lynch and Kaplan, 1997). These effects are said to increase with higher levels of inequality.

The idea that social inequalities strongly influence physical health is well documented in neurobiology. Biologically, individual health is based on "homeostasis," which means "maintaining physiological balance" (Sapolsky, 2004: 393). A simple example is found in a person who has just started jogging around in the park. That person's homeostasis is disturbed by the increased physical activity. By displaying several stress-responses, such as increasing heart rate and breathing, the body re-establishes a balance given the higher level of physical activity.

Initially, stress-responses are conducive to a person's health: they increase alertness, energy-capacity, as well as the body's healing capacity. In contrast, when stress-responses become chronic, they become detrimental for physical health. By way of example, "if energy is constantly mobilized, it is never stored, which produces muscle atrophy, fatigue, and an increased risk of insulin-resistant (adult-onset) diabetes" (Sapolsky, 2004: 395). In addition, cardiovascular malfunctions are linked to chronic stress.

This brief biological account of health points at the importance of stressors. The fact that social inequality is such a stressor has been demonstrated repeatedly. A first part of the evidence comes from experiments with primate and non-primate animals. "Overwhelmingly, the distinctive physiological correlates of a particular rank emerge *after* the rank is achieved, suggesting that behavior drives physiology more than physiology drives behavior" (Sapolsky, 2004: 398, *my italics*). Furthermore, these experiments demonstrate that the nature of the inequality (e.g. stable – unstable, cooperative – non-cooperative, easy to avoid – difficult to avoid) importantly influences who in the hierarchy experience stress (Sapolsky, 2005; with respect to humans, Zink et al., 2008: 278): subordinate animals in stable and violently enforced inequalities; dominant animals when inequalities are unstable.

The fact that social inequalities induce stress is also corroborated in humans. First, it is found that levels of glucocorticoids, which are crucial stress-hormones, have a clear social gradient. It is therefore not

surprising that epidemiological research finds that diseases with the greatest sensitivity to stress, such as heart disease and diabetes also have a clear social gradient. The subsequent hypothesis, namely that these social differences in health are attributable, at least in part, to income inequality, is endorsed by Pham-Kanter (2009). He finds that cardiovascular morbidity and hypertension is clearly linked with someone's relative economic position. Another clear indication is that social status turns out to be one of the main sources of chronic stress (Wilkinson, 2005: 257). All this brings Sapolsky (2004: 410) to the conclusion that a person's "poor health is not so much the outcome of being poor, but of feeling poor, that is, feeling poorer than others."

However, the neurological reactions towards social inequality cannot fully explain the negative inequality effect; a psychological interpretation of the inequality situation is needed. By way of example, Zink *et al.* (2008) find that, when playing a non-competitive computer game, knowing whether the co-player is human or a computer, makes the difference between being neurologically affected by unequal achievements or not. In other words, neurons are not the full picture; our psychological interpretation of inequality is also a crucial determinant for the negative inequality effect. The psychological phenomena most linked to the negative inequality effect are social comparison and relative deprivation (among others, Marmot and Davey Smith, 1997; Wilkinson, 2005; Yngwe *et al.*, 2005; Subramanian and Kawachi, 2006; Kondo *et al.*, 2008; Pham-Kanter, 2009; Wilkinson and Pickett, 2009b).

5. Conclusion

The idea that income inequality would negatively affect personal health is a controversial issue. Some find it really troublesome that income inequality, and not (only) levels of absolute income, would affect someone's health. For example, it casts doubt on the benefits that economic growth is often said to bring if this growth leads to more inequality (as has been the case for many OECD countries (OECD, 2008)). Consequently, growing attention is given to the construction of statistical models to prove or refute this negative inequality hypothesis. Unfortunately, until today, consensus has not been reached. One can always find contrasting pairs of studies which meet the same statistical standards. Subsequently, in this review analysis, I have taken an alternative approach. Instead of further statistically scrutinizing these models, I focused on the hypotheses that underlie the negative inequality effect and the hypotheses, which are used to explain away the observed bivariate correlation between income inequality and health. The analysis of these hypotheses revealed that the negative inequality effect cannot be explained away by the alternative hypotheses which have been used. Of course, phenomena other than inequality, such as someone's absolute income, access to (health care) services, and personal lifestyles, affect someone's health. Nevertheless, important indications are found which

assert that also income inequality within society negatively affects personal health. This negative inequality effect is said to run via the individual's psychological perception and interpretation of inequality by making social comparisons. Nevertheless, the significance of the negative inequality effect is to remain a much debated topic, and consensus is a long way off.

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References

- Backlund, E., Sorlie, P. D. and Johnson, N. J. (1996), 'The shape of the relationship between income and mortality in the United States; Evidence from the national longitudinal mortality study' in *Annals of Epidemiology*, 6(1): 12-20
- Ben-Shlomo, Y., White, I. R. and Marmot, M. G. (1996), 'Does the variation in the socioeconomic characteristics of an area affect mortality?' in *British Medical Journal*, 312(7037): 1013-1014
- Cantarero, D., Pascual, M. and Sarabia, J. M. (2005), 'Effects of income inequality on population health: new evidence from the European Community Household Panel' in *Applied Economics*, 37(1): 87-91
- Daly, M., Duncan, G., Kaplan, G. A. and Lynch, J. (1998), 'Macro-to-micro links in the relation between income inequality and mortality' in *The Milbank Quarterly*, 76(3): 315-339
- Davey Smith, G. (1996), 'Editorial: Income inequality and mortality: why are they related?' in *British Medical Journal*, 312(7037): 987-988
- Davey Smith, G. and Egger, M. (1996), 'Commentary: understanding it all - health, meta-theories, and mortality trends' in *British Medical Journal*, 313(6959): 1584-1585
- De Graeve, D. and Duchesne, I. (1997), 'Socioeconomic health inequalities in Belgium in an international perspective' in *Archives of Public Health*, 55(3-4): 119-138
- Deleeck, H. (2003), 'Dood en verdeling, over sociale ongelijkheid in ziekte, zorg en dood' in *Streven*, 70(1): 20-32
- Esping-Andersen, G. (1990), *The Three Worlds of Welfare Capitalism*, Princeton: Princeton University Press, 248p.
- Fiscella, K. and Franks, P. (1997), 'Poverty or income inequality as predictor of mortality: longitudinal cohort study' in *British Medical Journal*, 314(7096): 1724-1727
- Fritzell, J. (2006). Does inequality kill? On the relation between income inequality and health. 4th Annual ESPAnet Conference. Bremen.

- Goodin, R. E., Headey, B., Muffels, R. and Dirven, H.-J. (1999), *The Real Worlds of Welfare Capitalism*, Cambridge: Cambridge University Press, 358p.
- Hildebrand, V. and Van Kerm, P. (2009), 'Income inequality and self-rated health status: evidence from the European Community Household Panel' in *Demography*, 46(4): 805-825
- Judge, K. (1995), 'Income distribution and life expectancy: a critical appraisal' in *British Medical Journal*, 311(7015): 1282-1285
- Kaplan, G. A., Pamuk, E. R., Lynch, J. W., Cohen, R. D. and Balfour, J. L. (1996), 'Inequality in income and mortality in the United States: analysis of mortality and potential pathways' in *British Medical Journal*, 312(7037): 999-1003
- Karlsson, M., Lyttkens, C. H., Nilson, T. and Leeson, G. (2010), 'Income inequality and health: Importance of a cross-country perspective' in *Social Science & Medicine*, 70(6): 875-885
- Kawachi, I. and Kennedy, B. P. (1997), 'The relationship of income inequality to mortality: does the choice of indicator matter?' in *Social Science & Medicine*, 45(7): 1121-1127
- Kawachi, I. and Kennedy, B. P. (2002), *The Health of Nations: Why Inequality is Harmful to Your Health*, New York: The New Press, 232p.
- Kawachi, I., Kennedy, B. P., Lochner, K. and Prothrow-Stith, D. (1997), 'Social capital, income inequality and mortality' in *American Journal of Public Health*, 87(9): 1491-1498
- Kennedy, B. P., Kawachi, I. and Prothrow-Stith, D. (1996), 'Income distribution and mortality: cross sectional ecological study of the Robin Hood index in the United States' in *British Medical Journal*, 312(7037): 1004-1007
- Kondo, N., Kawachi, I., Subramanian, S. V., Takeda, Y. and Yamagata, Z. (2008), 'Do social comparisons explain the association between income inequality and health?: Relative deprivation and perceived health among male and female Japanese individuals' in *Social Science & Medicine*, 67(6): 982-987
- Kondo, N., Sembajwe, G., Kawachi, I., van Dam, R. M., Subramanian, S. V. and Yamagata, Z. (2009), 'Income inequality, mortality, and self rated health: meta-analysis of multilevel studies' in *British Medical Journal*, 339(b4471): 1178-1188
- Kunst, A. E., Bos, V., Lahelma, E., Bartley, M., Lissau, I., Regidor, E., Mielck, A., Cardano, M., Dalstra, J. A., Geurts, J. J. M., Helmert, U., Lennartson, C., Ramm, J., Spadea, T., Stronegger, W. J. and Mackenbach, J. P. (2005), 'Trends in socioeconomic inequalities in self-assessed health in 10 European countries' in *International Journal of Epidemiology*, 34(2): 295-305
- Lähteenmäki-Smith, K. (2005) 'Changing political contexts in the Nordic welfare states: The central-local relationship in the 1990s and beyond', in McEwen, N. and Moreno, L. (eds.), *The territorial politics of welfare*, London: Routledge, pp. 168-188

- Lecluyse, A. (2007), 'Income-related health inequality in Belgium: a longitudinal perspective' in *The European Journal of Health Economics*, 8(3): 237-243
- Leigh, A., Jencks, C. and Smeeding, T. M. (2009) 'Health and economic inequality', in Salverda, W., Nolan, B. and Smeeding, T. M. (eds.), *The Oxford Handbook of Economic Inequality*, Oxford: Oxford University Press, pp. 384-405
- Lorgelly, P. K. and Lindley, J. (2008), 'What is the relationship between income inequality and health? Evidence from the BHPS' in *Health Economics*, 17(2): 249-265
- Lynch, J. W. and Kaplan, G. A. (1997), 'Understanding how inequality in the distribution of income affects health' in *Journal of Health Psychology*, 2(3): 297-314
- Marmot, M. G. (2005), *Status Syndrome: How your social standing directly affects your health*, London: Bloomsbury, 311p.
- Marmot, M. G. and Davey Smith, G. (1989), 'Why are the Japanese living longer?' in *British Medical Journal*, 299(6715): 1547-1551
- Marmot, M. G. and Davey Smith, G. (1997), 'Socio-economic Differentials in Health' in *Journal of Health Psychology*, 2(3): 283-296
- Mellor, J. M. and Milyo, J. (2002), 'Income inequality and health status in the United states; Evidence from the Current Population Survey' in *The Journal of Human Resources*, 37(3): 510-539
- OECD (2008), *Growing Unequal*, Paris: OECD Publisher.
- Pham-Kanter, G. (2009), 'Social comparisons and health: can having richer friends and neighbors make you sick?' in *Social Science & Medicine*, 69(3): 335-344
- Pickett, K. E. and Wilkinson, R. G. (2007), 'Child wellbeing and income inequality in rich societies: ecological cross sectional study' in *British Medical Journal*, 335(7629): 1080-1086
- Sapolsky, R. M. (2004), 'Social status and health in humans and other animals' in *Annual Review of Anthropology*, 33: 393-418
- Sapolsky, R. M. (2005), 'The influence of social hierarchy on primate health' in *Science*, 308: 648-652
- Sen, A. (1993), 'The economics of life and death' in *Scientific American*, 268(5): 18-25
- Sen, A. (1999), *Development as Freedom*, Oxford: Oxford University Press, 366p.
- Subramanian, S. V. and Kawachi, I. (2004), 'Income inequality and health: what have we learned so far?' in *Epidemiological Reviews*, 26(1): 78-91
- Subramanian, S. V. and Kawachi, I. (2006), 'Whose health is affected by income inequality? A multilevel interaction analysis of contemporaneous and lagged effects of state income inequality on individual self-rated health in the United States' in *Health & Place*, 12(2): 141-156
- Subramanyam, M., Kawachi, I., Berkman, L. and Subramanian, S. V. (2009), 'Relative deprivation in income and self-rated health in the United States' in *Social Science & Medicine*, 69(3): 327-334

- United Nations (2007), *Human Development Report 2007/2008*, New York, United Nations, 384p.
- Van Doorslaer, E., Wagstaff, A., Bleichrodt, H., Calonge, S., Gerdtham, U.-G., Gerfin, M., Geurts, J., Gross, L., Häkkinen, U., Leu, R. E., O'Donnell, O., Propper, C., Puffer, F., Rodríguez, M., Sundberg, G. and Winkelhake, O. (1997), 'Income-related inequalities in health: some international comparisons' in *Journal of Health Economics*, 16(1): 93-112
- Van Ourti, T., Van Doorslaer, E. and Koolman, X. (2009), 'The effect of income growth and inequality on health inequality: theory and empirical evidence from the European Panel' in *Journal of Health Economics*, 28(3): 525-539
- Wagstaff, A. and Van Doorslaer, E. (2000), 'Income inequality and health: what does the literature tell us?' in *Annual Review of Public Health*, 21: 543-567
- Weich, S., Lewis, G. and Jenkins, S. P. (2002), 'Income inequality and self related health in Britain' in *Journal of Epidemiology and community Health*, 56(6): 436-441
- Wilkinson, R. G. (1992), 'Income distribution and life expectancy' in *British Medical Journal*, 304: 165-168
- Wilkinson, R. G. (1995), 'A reply to Ken Judge: mistaken criticisms ignore overwhelming evidence' in *British Medical Journal*, 311(7015): 1285-1287
- Wilkinson, R. G. (2005), *The Impact of Inequality; How to Make Sick Societies Healthier*, London & New York: Routledge, 355p.
- Wilkinson, R. G. and Pickett, K. E. (2006), 'Income inequality and population health: a review and explanation of the evidence' in *Social Science & Medicine*, 62(7): 1768-1784
- Wilkinson, R. G. and Pickett, K. E. (2007), 'The problems of relative deprivation: Why some societies do better than others' in *Social Science & Medicine*, 65(9): 1965-1978
- Wilkinson, R. G. and Pickett, K. E. (2009a), 'Income inequality and social dysfunction' in *Annual Review of Sociology*, 35: 493-511
- Wilkinson, R. G. and Pickett, K. E. (2009b), *The Spirit Level; Why More Equal Societies Almost Always Do Better*, London: Allan Lane.
- Yngwe, M. Å., Fritzell, J., Burström, B. and Lundberg, O. (2005), 'Comparison or consumption? Distinguishing between different effects of income on health in Nordic welfare states' in *Social Science & Medicine*, 61: 627-635
- Zink, C. F., Tong, Y., Chen, Q., Bassett, D. S., Stein, J. L. and Meyer-Lindenberg, A. (2008), 'Know your place: neural processing of social hierarchy in humans' in *Neuron*, 58(2): 273-283