



Avoiding blindness to health status in health achievement and health inequality measurement



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ABSTRACT

The concentration index, being focused on the socioeconomic dimension of health inequality and overlooking aversion to pure health inequality, can produce ethically contestable rankings of health distributions. A health transfer from a sicker but richer individual to healthier but poorer individual will decrease the concentration index. This paper presents a new class of health inequality indices that avoid this limitation by trading off socioeconomic-related health inequality against pure health inequality.

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1. Introduction

A large body of the health inequality measurement literature is based on the accumulated knowledge in income inequality measurement. Early contributions to health inequality measurement by [Le Grand \(1989\)](#) and [Le Grand and Rabin \(1986\)](#) proposed the well known Gini coefficient as measure of *pure* health inequality (e.g., inequality in mortality). However, as the decision maker may often be interested in the socioeconomic dimension of health inequalities (rather than pure health inequalities), the use of the concentration index is considered more appropriate (see [Wagstaff et al., 1989](#); and [Wagstaff et al., 1991](#)). As a result, a large body of the literature is using the concentration index and it is now a widely accepted measure of socioeconomic health inequality. While the theoretical welfare foundations of income inequality measurement has led to many contributions in the social choice literature (for a survey, see [Dutta, 2002](#)), exploration of the welfare foundations of health inequality measurement is still scarce. [Stecklov and Bommier \(2002\)](#), [Fleurbaey \(2006\)](#) and [Bleichrodt and van Doorslaer \(2006\)](#) are notable exceptions.

In the context of income inequality measurement, [Atkinson \(1970\)](#) argues that the “examination of the social welfare functions implicit in these (income inequality) measures shows that in a number of cases they have properties which are unlikely to be acceptable, and in general there are no grounds for believing that they would accord with social values” (p. 262). Based on this idea, [Bleichrodt and van Doorslaer \(2006\)](#) derived social welfare functions that are implicit in the health Gini (pure health inequality) and the health concentration (socioeconomic health inequality) indices. As [Atkinson \(1970\)](#), they argue that concern with (health) inequality implies an underlying social judgment that reduction in these inequalities should increase social welfare. In their theoretical investigation the authors identify formally two health transfer principles: the *principle of health transfers* and the *principle of income-related health transfers*.

The *principle of health transfers* is imbedded in the health Gini measure. It holds if a transfer of health from someone who is healthier to someone who is less healthy does not decrease social welfare as long as the ranks of the two individuals remains unchanged.¹ One may object that these transfers are desirable when

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¹ It is important to note that although a unit health *per se* is not transferable, health policies can influence individuals' health levels. As such, they act as if they were transferring a unit of health from one individual to another.

the healthier person is poor and the less healthy person is rich. This is why Wagstaff et al. (1989) highlight the importance of turning the attention towards socioeconomic health inequality rather than pure health inequality.

Socioeconomic health inequality measures (e.g., the health concentration indices) are based on the *principle of income-related health transfers*. This ethical principle holds if transferring health from a rich person to a poorer person does not decrease social welfare. However, as pointed by Bleichrodt and van Doorslaer (2006), whether this principle is ethically appealing is contestable. It is possible that transferring health from a person with higher income to a person with a lower income is not desirable if the rich person is in poor health and the difference in income is small. Using an experimental approach, Bleichrodt et al. (2012) investigated the plausibility of the *principle of income-related health transfers* and find that it is systematically violated. Unfortunately, by construction, concentration indices react favorably when a health transfer is made from an individual at a lower rank in the health distribution to a person at a higher rank (regardless of the magnitude of the difference in their health status), provided that the former has a slightly higher income. It follows that this class of socioeconomic health inequality indices, given its mathematical linear rank dependent structure (i.e., obeys the *principle of income-related health transfer*), overlooks individual heterogeneity in the income-health relation (i.e. non-monotonicity in the income-health gradient when there is more than one individual) and thus exhibits *blindness to health status*.² To our knowledge, to this date, no practical measurement solution has been offered to circumvent this problem.³ We believe that it is important to understand the source of this measurement issue and address it, as overlooking it may lead to health policy recommendations that do not concord with the values of many, and even a majority, in society (i.e., a health transfer from a less healthy individual to a healthier individual should not be evaluated as an improvement in the distribution of health).

This paper contributes to the literature on the measurement of socioeconomic health inequalities by proposing a class of health inequality indices that address the issue of *blindness to health status*. We first show that any index that belongs to Wagstaff's class of health achievement indices or extended concentration indices may exhibit *blindness to health status*. To highlight the principle of health transfer, we construct a class of uni-dimensional indices of health inequality by borrowing the mathematical structure of Atkinson (1970) indices. We show that these Atkinsonian indices exhibit blindness to socioeconomic inequality but are sensitive to pure health inequality. We also compare both types of index. Finally, building on the well known rank dependent expected utility framework (Quiggin, 1982), we combine Wagstaff's class of health achievement (and extended health concentration) indices with our Atkinsonian health inequality indices and propose a general class of indices that overcomes *blindness to health status* and obeys the *principle of income-related health transfers*. Using Quiggin's (1982) allows us to preserve the well established properties of socioeconomic health inequality indices (rank dependence) and exploit the analogy between risk aversion in the expected utility framework and pure health inequality aversion (i.e. obeying the *principle of health transfers*) to introduce an arbitrage between health status

and socioeconomic status.⁴ We finally present an empirical illustration to provide evidence that this arbitrage may matter in practice and is not only a theoretical issue.

The remainder of the paper unfolds as follows. The next section presents the measurement framework on which our contribution will be based. In Section 3, we will introduce a new class of health achievement and inequality indices: the Atkinson-Wagstaff class of health achievement and health inequality indices. Section 4 presents a brief empirical illustration using the Joint Canada/United States Surveys of Health 2004 and the Canadian Community Health Survey 2007–2008. The last section summarizes our results.

2. Review of available measures

The main aim of this paper is to provide a measurement framework that overcomes *blindness to health status* by capturing pure and socioeconomic health inequalities simultaneously. To achieve this objective, we build on Quiggin (1982) and introduce an arbitrage between health status and socioeconomic status by combining two classes of indices: (a) Wagstaff health achievement and extended concentration indices and (b) Atkinson indices.

In what follows, we provide a description of the measurement framework of each of these indices. We first introduce Wagstaff's health achievement indices and extended concentration indices and discuss the possible issues that may result from the use of these indices by providing a numerical example. We then turn our attention to pure health inequality indices (i.e. Atkinsonian indices) as they are a necessary ingredient in the solution that we propose. We also discuss the well known problems associated with pure health inequality indices.

2.1. Wagstaff's health achievement indices and health concentration indices

The concentration index measures socioeconomic health inequality by ranking individuals according to their socioeconomic status (from lowest to highest) and then looking at the health distribution given this ranking. Let r_i , $i = 1$ to N , be the rank of individual i in a population of N individuals and h_i be the health status of individual i , then Wagstaff's achievement indices (Wagstaff, 2002) can be written as follows:

$$A(\nu) = \sum_{i=1}^N \theta(r_i; \nu) h_i, \quad (1)$$

where

$$\theta(r_i; \nu) = \frac{(N - r_i + 1)^\nu - (N - r_i)^\nu}{N^\nu}, \quad \nu \geq 1. \quad (2)$$

For simplicity, it is assumed that health status h_i is a ratio-scale variable but one could use categorical variables by applying the count transformation proposed in Makdissi and Yazbeck (2014). Following Yitzhaki (1983), ν in equation (2) can be interpreted as a parameter of aversion to socioeconomic health inequality.⁵ If $\nu = 1$, there is no aversion to socioeconomic health inequality and $A(1)$ is simply the average health status, $\mu_h = \frac{1}{N} \sum_{i=1}^N h_i$. If $\nu > 1$, then the

² By *blindness to health status* we mean that these socioeconomic health inequality indices ignore the fact that, in some circumstances, a health transfer from a poorer person to a richer person (provided that the former is in much better health) increases social welfare.

³ Erreygers et al. (2012) point to it again 6 years after Bleichrodt and van Doorslaer (2006) without providing a solution.

⁴ Note that Erreygers (2013) dual Atkinson measure of socioeconomic inequality of health does not overcome this problem. Erreygers (2013) uses Atkinson's equally distributed equivalent health framework but does not use, as we do, the mathematical form of Atkinson's inequality indices. As noted by Erreygers (2013), given the bi-linear nature of his measure, the marginal impact of a change in health is the same regardless of the initial health status.

⁵ Note that Yitzhaki (1983) considers the context of income inequality.

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