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# Modelling health, income and income inequality: the impact of income inequality on health and health inequality

John Wildman\*

*Economics, The Ridley Building, University of Newcastle, Newcastle Upon Tyne NE1 7RU, Newcastle, UK*

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## Abstract

A framework is developed to analyse the impact of the distribution of income on individual health and health inequality, with individual health modelled as a function of income and the distribution of income. It is demonstrated that the impact of income inequality can generate non-concave health production functions resulting in a non-concave health production possibility frontier. In this context, the impact of different health policies are considered and it is argued that if the distribution of income affects individual health, any policy aimed at equalising health, which does not account for income inequality, will lead to unequal distributions of health. This is an important development given current UK government attention to reducing health inequality.

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## 1. Introduction

The existence of income related inequalities in health is widely acknowledged (Kakwani et al., 1997; van Doorslaer et al., 1997; Humphries and van Doorslaer, 2000) and suggest that individual health is a function of individual income—the *absolute income hypothesis*. Outside the economics literature there is increasing support for the *relative income hypothesis*, which states that in developed countries income inequality has a larger impact on individual health than absolute income (Wilkinson, 1996). Although recent studies may

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\* Tel.: +44-191-222-8645; fax: +44-191-222-6551.

*E-mail address:* [j.r.wildman@ncl.ac.uk](mailto:j.r.wildman@ncl.ac.uk) (J. Wildman).

have been inconclusive in finding evidence of the relative income hypothesis this may be the result of imprecise proxies used in data studies. The theory linking relative concerns to health needs to be developed further, which is one of the aims of this paper.

Proponents of the relative income hypothesis have provided empirical evidence from a number of aggregate cross-section studies to support their case (Rodgers, 1979; Kennedy et al, 1996; Chiang, 1999). Gravelle (1998), Gravelle et al. (2002), Wagstaff and van Doorslaer (2000) have shown that aggregate level studies are doubtful sources of evidence because of the potential problems of aggregating non-linear functions, and that research should focus on individual level relationships.

Recently, more studies investigating the relationship between income inequality and health at the individual level have appeared in the literature. Fiscella and Franks (1997) using US data, find that after controlling for individual income, income inequality has no impact on health. Daly et al. (1998) also using US data, find some evidence for the relative income hypothesis on sub-groups in their sample but not in the sample as a whole. Kennedy et al. (1998) undertake a multi-level study for 50 US states using individual level data and find that higher Gini coefficients significantly reduce health. Soobader and LeClere (1999) also use individual level US data to investigate whether different levels of aggregation impact on an empirical test of the relative income hypothesis. They find that at higher levels of aggregation the impact of income inequality is stronger than in smaller geographical areas and that including individual income does not remove this significance at higher aggregation levels. Using British data, Wildman (2002) has found some evidence of the relative income hypothesis. These papers have produced mixed results, stressing the need to further understand the pathways through which income inequality may affect individual health.

Any debate over the impact of absolute income and income inequality has been hampered by the dearth of theoretical models which demonstrate the impact of both absolute income and income inequality (Wildman and Jones, 2001). This paper models individual health as a function of individual income and income inequality. It is shown that the impact of income inequality can have potentially far reaching implications for modelling individual and societal health. These developments are important as current government policy is aimed at reducing inequalities in health.

The 'Independent Inquiry into Inequalities in Health' (DoH, 1999) acknowledges a possible link between health and income inequality, and the Green Paper, 'Our Healthier Nation' (DoH, 1998), states that the objectives of UK Government policy are to increase health and reduce health inequalities. The National Health Service has also undertaken to reduce avoidable health inequalities. If the impact of income inequality is unaccounted for, policies aimed at equalising health may generate health inequalities and lower average health.

## **2. The basic framework**

Culyer and Wagstaff (1993) used four quadrant diagrams to present the results of applying commonly cited equity of health objectives to medical care expenditure. The four quadrant diagram is a convenient way to model the solution to a system of non-linear simultaneous equations. It is assumed that society consists of two identical individuals, the only varying

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