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Comparing the relationship between stature and later life health in six low and middle income countries ☆

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ABSTRACT

This paper examines the relationship between stature and later life health in 6 emerging economies, each of which are expected to experience significant increases in the mean age of their populations over the coming decades. Using data from the WHO Study on Global Ageing and Adult Health (SAGE) and pilot data from the Longitudinal Ageing Study in India (LASI), I show that various measures of health are associated with height, a commonly used proxy for childhood environment. In the pooled sample, a 10 cm increase in height is associated with between a 2 and 3 percentage point increase in the probability of being in very good or good self-reported health, a 3 percentage point increase in the probability of reporting no difficulties with activities of daily living or instrumental activities of daily living, and between a fifth and a quarter of a standard deviation increase in grip strength and lung function. Adopting a methodology previously used in the research on inequality, I also summarise the height-grip strength gradient for each country using the concentration index, and provide a decomposition analysis.

1. Introduction

Comparison of cross country health differences provides an opportunity to evaluate the efficacy of different policies and institutions adopted in these locations (Kapteyn, 2010). The recent emergence of harmonised micro level datasets has the potential to contribute to this discussion by permitting the comparison of survey respondents on the basis of their own individual characteristics, and not just aggregate indicators such as life expectancy. This is particularly true in the field of ageing research, where a number of studies now collect standardised information on a wide range of characteristics (Banks and Smith, 2012). These include the Health and Retirement Study (HRS) in the US, the English Longitudinal Study of Ageing (ELSA) in the UK, and the Survey of Health, Ageing and Retirement in Europe (SHARE). A welcome development is the introduction of similar initiatives in lower and middle income countries. These include the WHO study on Global Ageing and Adult Health - SAGE (Kowal et al., 2012), the Longitudinal Ageing Study in India - LASI (Arokiasamy et al., 2012), and the China Health and Retirement Longitudinal Study - CHARLS (Zhao et al., 2012).

An understanding of the consequences of population ageing is likely to be of particular interest to lower and middle income countries due to the fact that the older portion of their populations is expected to grow rapidly over the coming decades. For example, by 2050 more than 750 million individuals over the age of 60 will live in India and China, constituting over a third of the world's total population in that demographic (Chatterji et al., 2008). Increases in morbidity are likely to accompany this (Bloom et al., 2011), and therefore international comparisons using micro level data will be useful in assessing the extent to which changes in morbidity are likely to occur, potential variation in the consequences of population ageing across countries, and whether it is possible to identify the factors which predict healthy ageing. The existing literature on international comparisons typically evaluates differences in means or regression coefficients across higher income countries, as described in the review by Banks and Smith (2012). For example, Banks et al. (2006) discuss health disparities between England and the US using ELSA and the HRS. Examples of papers

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which take advantage of newer data include Chatterji et al. (2008), who conduct a similar analysis for India and China. Naidoo et al. (2010) and Basu and Millett (2013) evaluate cross national differences in health using data from the SAGE study.

One aspect of ageing where there is particular scope for interesting comparisons across countries relates to the role of the life cycle, and the extent to which initial health affects adult outcomes. An established literature links early life conditions to later life wellbeing, including both health and economic outcomes (Almond and Currie, 2011a,b). However, as with other aspects of ageing, most of the existing research in this field has also focused on higher income nations. The inclusion of retrospective life history modules in studies such as ELSA, SHARE, and the HRS is partly a reflection of the attention the lasting implications of childhood circumstance have been receiving (Smith, 2009). For example, Banks et al. (2011) find that the transmission of poor early life health into adverse adult outcomes is greater in the US than the UK.

A number of recent papers have also provided evidence on this topic for low and middle income countries, see Currie and Vogl (2013) and McEniry (2013) for an overview. For example, Beltran-Sanchez et al. (2011) examine the long term correlates of education in Mexico, while DeGraff and Wong (2014) investigate the influence of broader childhood environment in the same country. McEniry and Palloni (2010) examine the long-run impact of disease and nutrition in childhood using data from Puerto Rico. The newly developed ageing studies, such as the LASI or SAGE data used in this paper, also provide a useful original source of information. For example, Smith et al. (2012) use data from CHARLS and find a significant association between childhood environment and the outcomes of Chinese respondents, which is consistent with the evidence from Mexico and Puerto Rico.

There are a number of reasons why a comparison of the association between early life conditions and later outcomes in lower and middle income countries is specifically of interest. Firstly, their ageing populations are likely to impact relatively more significantly on these societies, given the comparatively more limited resources available to their governments. Secondly, given that the initial environment experienced by children in these countries is likely to have been more adverse than that experienced by children in higher income countries, the impact of early life conditions on this cohort of adults may be expected to be even greater (Currie and Vogl, 2013). For example, stunting (growth restriction as defined by being 2 standard deviations below the expected height for age) is rare in high income countries, but affects 40% of children in Africa (Black et al., 2008). Even if initial endowments were similar across countries, differences in the association between childhood circumstance and later outcomes could have the potential to add to our understanding of the factors underlying variation in aggregate outcomes (Banks et al., 2011). Finally, a cross country comparison could provide a useful first indication as to the extent to which the role of early life conditions can be mitigated by macro level factors.

In addition to this primary motivation of investigating the extent of variation in the correlates of initial environment, an additional contribution of this paper is that I introduce an alternative approach for measuring the association between early life conditions and later health. Comparisons based on regression coefficients from the typical analyses in these studies represent the average association in the population, and do not necessarily describe whether inequality is concentrated among the least well off, or evenly spread across the distribution of socioeconomic status. Therefore, I also adopt a more flexible methodology for establishing the extent to which the relationship between childhood environment and adult health varies across countries. The inequality literature in economics typically uses the concentration curve and the concentration index as a summary measure for describing gradients in health and socioeconomic variables (Wagstaff et al., 1991). Specifically, the concentration curve defines the share of the outcome of interest which is accounted for by the cumulative proportion of individuals in the population ranked from the least well off to the most well off (O'Donnell et al., 2008). This approach has been previously used in a variety of applications, including to determine the extent of inequality in health (van Doorslaer and Koolman, 2004), malnutrition (Wagstaff et al., 2003), birth weight (Madden, 2013a), health care use (Layte and Nolan, 2014), BMI (Madden, 2013b; Walsh and Cullinan, 2014), health behaviours (Hudson et al., 2014), and vaccination (Doherty et al., 2014).

This existing literature generally examines income related inequality, however, measures of household income in childhood are rarely available outside of cohort studies. Therefore, height is often used as the measure of initial environment in studies on the lasting impact of childhood circumstance (Akachi and Canning, 2010; Case and Paxson, 2008, 2010; Lee and Smith, 2014; Smith et al., 2012). When compared to using self-reported health in childhood derived from retrospective questionnaires, results using height are generally comparable (e.g. Banks et al., 2011), even though these two measures are not always highly correlated (Smith et al., 2012). The use of height as a proxy for early life conditions is also supported by studies which examine the determinants of stature, for example height is related to initial disease environment (Bozzoli et al., 2009), nutritional intake (Walker et al., 2007), and birth weight (McGovern, 2014). Historical improvements in height in western countries since the 18th century are believed to be at least partly caused by advances in nutritional status (Fogel, 2004), and the link between average height and economic development is also believed to be driven by the relationship between nutritional intake and early environment (Strauss and Thomas, 1998). Improvements in adult life expectancy and declining mortality among the young have been associated with increases in height among the same cohorts (Crimmins and Finch, 2006). The use of anthropometric data in this context is documented in the overviews by Steckel (2008, 2009).

It is important to acknowledge that there are limitations to using height as a proxy for early life conditions, an issue which I discuss in more detail in Section 2. These include the fact that stature may be a noisy measure of initial environment (especially at the individual level), there are many possible determinants of height which are difficult to isolate, including nutritional status, disease environment and genetics, and finally, there are diverse pathways through which height could affect later outcomes, including potentially direct advantages due to size itself (rather than latent effects of early life conditions). Therefore, results from studies which rely on height should be interpreted with these limitations in mind. In this paper, I do not make any claims about the results being interpretable as causal effects, as that is not possible with the available data. Instead, the associational analysis presented here can be viewed as being part of the initial steps into investigating the relationship between early life conditions and later outcomes in lower and middle income countries.

Using data on 6 countries from SAGE (China, Ghana, India, Mexico, Russia and South Africa) and pilot data from LASI, I examine the association between stature and four health measures (self-rated health, difficulties with activities of daily living (ADL) and instrumental activities of daily living (IADL), grip strength and lung function). Along with height, the latter three outcomes have the advantage of being objectively measured, are easily comparable across countries, and are commonly collected in many surveys. In addition, grip strength and lung function have been shown to be important measures of frailty in later life (Cook et al., 1995; Mannino et al., 2003; Rantanen et al., 1999; Sharp et al., 1997). I begin with a regression analysis comparing the association of height with each of the health outcomes by country. Then, I illustrate the