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Towards a Broader Framework for Assessing Country Development in Health: A Practical Approach Based on Theory and Evidence

Final Report

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Executive summary

The aim of this study is to explore alternative approaches to identify health needs and constraints in countries, based on indicators that are broader than national income and more relevant to assess the stage of national development in health. We propose a conceptual framework that examines the notions of health needs and system performance jointly under the overarching concept of “health coverage”. The theoretical framework implies that an operational health development index the index requires a count of people with adequate access to necessary services in a country, with the associated health benefits obtained. It also requires an assessment of the countries’ performance on financial risk protection in health, i.e. the level of protection achieved against financial hardship caused by securing access to necessary care.

Our study then suggests alternative methodologies for operationalising the conceptual framework, constructing measures of national development in health based on relevant indicators that are of comparable definition and measurement across countries; measured in an acceptably reliable way; not easily manipulated; and available for most countries. Limitations in terms of cross-country data availability restrict the choice of indicators for the computation of indices. We use the proportion of births attended by skilled health staff and the total number of DALYs lost for all causes (communicable diseases, non-communicable diseases and injuries) as indicators of access to care and associated health benefits. As a proxy for the degree of financial risk protection in health, we construct a measure of pooled prepaid health spending as a share of total spending. In extensions of the basic analyses, we supplement the information on access to care by including other indicators related to coverage (unmet need for contraception), equity (skilled birth attendance ratio between the poorest and richest wealth quintiles) and care quality (treatment success rate of new tuberculosis cases) aspects.

As recognition that information on other country factors beyond health needs, access and financial protection may be seen as relevant for welfare assessments in the health domain and for health resource allocation decisions, our study also constructs indices measuring perceived constraints for financing development in health. We explore alternatives to account for national capacity to domestically finance health, primarily by considering indicators based on Gross National Income (GNI) per capita and tax revenue as a proportion of GDP. In further extensions of the work we look more closely at fiscal space, incorporating indicators of general government expenditure on health as a share of total government expenditure and total debt service as a share of GNI.

The approach we have chosen to operationalise our indices of health development is similar to the mechanics behind the construction of the Human Development Index. We construct normalised sub-indices of performance in the dimensions of access, financial protection and

financial constraints, and use those sub-indices to construct two overall measures of national health development: a “strict” index incorporating the information on access to care and financial protection, and an “extended” index that adds to the latter the information on financial constraints. These indices are then expanded in subsequent analyses using the additional coverage, equity and care quality indicators mentioned above. As a further demonstration of the flexibility of our framework and operational methodology, we collect sub-national level data on care access and financial protection for India, computing “strict” indices and corresponding sub-indices to assess and compare health development levels for Indian states.

In general, country rankings in the health development scale vary substantially when the conditions of access to care and financial protection in health are explicitly considered through our “strict” index, compared to GNI rankings. Beyond a simple re-ranking of countries, the decomposition of changes in ranking between a GNI criterion and our health development indices sheds light on some important aspects for health policy. As an example, for the majority of countries whose health development ranking worsens substantially when our proposed indices are used instead of GNI only, such deterioration is driven mostly by accounting for their situation regarding access to care and financial risk protection in health (reflected in the “strict” index version). Accounting for financial constraints (the “extended” index version) tends to improve the ranking of these countries, suggesting that the relatively adequate domestic capacity to finance healthcare is not being channelled adequately through pooled prepaid sources and effectively expanding access to needed health services. In these cases, the decomposition of the “strict” index into its access and financial protection components is able to provide leads on where the major bottlenecks for health development lie. Moreover, our analyses can identify those country cases where there is a need for external support to fill in gaps in domestic ability to maintain and expand current health coverage levels, offering preliminary insights into specific support modalities (financial or non-financial) that may be more efficient to promote health development in a particular setting. As such, the conceptual framework and health development measures proposed in this study could form the basis for discussions on new policies of national governments and international organisations to improve the health of populations.

Section 1 Statement of the Problem

1.1 Income and development in health

Historically, national income has been chosen in practice as the key (or only) indicator of a country's development achievements by multilateral organisations and countries that provide development assistance. This choice responds mainly to pragmatic reasons. Average income levels – measured usually through Gross National Income (GNI) or Gross Domestic Product (GDP) per capita – are considered to be reasonably good indicators of a country's economic welfare. Measures such as GNI per capita are simple, well understood and widely available for almost every country in the world.

Yet the simplicity of GNI or GDP per capita indicators means that many aspects of a country's development that may be deemed relevant for assessments of population welfare are not satisfactorily captured in the measurements. One clear example is the issue of income distribution: countries may make progress in average income levels (even to the point where they become ineligible as aid recipients judged by a simple GNI per capita threshold) through income gains concentrated among those citizens who were already better-off to begin with, while a large share of the population remains on relatively low income levels. This issue is made worse by the fact that GNI per capita may provide a very different picture of economic welfare compared to estimates of household income derived from national surveys, for instance in resource-rich nations.

Measures of income per capita also become less relevant if the goal is to provide a broader picture of a country's development in specific sectors. In the health area, countries that make progress in terms of average income may do so with a persistent and very significant overall burden of disease, and this has been the situation in most low and middle-income countries – including many of the countries that transitioned to the “middle-income” status in recent years and suffered a consequent reduction in aid flows to their health sectors. Despite the rise in average incomes, some of these countries may still need a strong international contribution to remedy the lack of health system capacity to cope with a large and changing burden of disease.

1.2 Health coverage and development in health

The Global Fund, WHO, the World Bank and others have been urging countries to take concrete steps towards the achievement of universal health coverage, which in its simplest formulation means providing all people with access to needed health services of sufficient quality to be effective, without their use imposing financial hardship (World Health Organization 2010a). In the current global health debate, effective access to the health system accompanied (and enabled) by higher reliance on prepaid health spending and risk pooling mechanisms are regarded as key conditions for actual progress in terms of population health coverage, and expansions in coverage have become a fundamental

development objective in the health sector (Backman et al. 2008; Garrett et al. 2009). Countries where the average income has been increasing may still experience major challenges to meet the fundamental development goal of expanding health coverage, facing growing and changing population health needs in situations, for example, where a very limited tax and contributory base acts as a major constraint to reduce large shares of private out-of-pocket spending in the total financing of the health system.

Ideally then, the information included in assessing a country's development in health should reflect the national situation concerning the key strategic objective of health coverage. Sustaining and increasing the pool of funds available for health is crucial to promote equity of access to and quality of health services, ultimately improving population health.

1.3 Our study

The aim of our study is to explore alternative approaches to identify health needs and constraints in countries, based on indicators that are broader than national income and more relevant to assess the stage of national development in health. We propose a conceptual framework that examines the notions of health needs and system performance jointly from a conventional micro-economic perspective, under the overarching concept of "health coverage". The study then suggests alternative methodologies for operationalising the conceptual framework constructing measures of national development in health based on relevant indicators that are of comparable definition and measurement across countries; measured in an acceptably reliable way; not easily manipulated; and available for most countries (in particular low- and middle-income countries). We believe the conceptual framework and health development measures proposed in this study could form the basis for discussions on new policies of international organisations to improve the health of populations.

Section 2 A theoretical framework to assess development in health

This section sets out a simple theoretical framework for discussing the issues underlying system coverage and health development assessments. It draws heavily on material treated more comprehensively in Moreno-Serra and Smith (2012a).

2.1 The definition and measurement of health coverage

There is no generally accepted theoretical framework within which the international policy debate on health coverage has taken place. Commentators have tended to adopt two distinct perspectives on the issue. The first, dominant in the public health literature, examines the observed utilisation of health services in relation to some norm of utilisation that might be expected if there were no financial or other constraints to access (Oliver and Mossialos 2004; World Health Organization 2010b). A common approach to defining and measuring health coverage levels in this literature has been to focus on particular health services, aimed at specific target groups (e.g., vaccination of children) (UNICEF 2009). It is assumed that the chosen services are needed by anyone in the specified groups (defined by age or gender, for example), and coverage is then made synonymous with the proportion of the relevant population receiving the intervention. Frequently, researchers analyse a few services in isolation, with no explicit theoretical framework being adopted to guide the choice of health coverage metrics.

The second perspective, more commonly found in the economics literature, examines the extent to which citizens suffer financial hardship or bankruptcy as a result of using specified health services, and the potential welfare effects of interventions such as public insurance (see e.g., Wagstaff and Yu 2007; Gross and Notowidigdo 2011; Einav et al. 2010). Much of this theoretical research has focused on the social welfare consequences of alternative government policies to expand insurance coverage. The focus is often on the conventionally defined adverse selection and moral hazard costs of higher utilisation resulting from extended insurance coverage. Extended coverage in this context refers to the extra numbers of individuals who take up health insurance, or benefit from reduced cost-sharing for certain medical services. No specific attention is usually paid in such models to the value of improvements in health status, for example, generated by increased use of services by people who were previously deterred from accessing needed medical care due to financial barriers.

There have been a few attempts to develop multidimensional coverage indices useful to track health system performance over time and for international comparisons. However, the proposed health coverage metrics invariably lack a clear theoretical grounding. This includes an early study by Tanahashi (1978) that proposes five dimensions to be considered when assessing health service coverage (availability, accessibility, acceptability, contact and effectiveness), with no basis on any theoretical framework that could be used to guide the construction of operational metrics of coverage. Another model of “effective coverage” was

proposed by Shengelia et al. (2005) but again there is insufficient formal conceptualisation of key elements, such as the precise nature of individual preferences governing care seeking in the model and the role of service prices. Furthermore, there is no direct link between a social welfare function and their suggested measure of effective coverage.

The notion of health coverage has evolved in recent years to embrace financial risk protection – the idea that access to necessary health services should not cause financial hardship to users through excessive health payments (World Health Organization 2010a). Economic theory has long acknowledged the value attributed by individuals to protection mechanisms against substantial financial losses, yet the issue of financial protection has been largely neglected within the theoretical literature on health coverage discussed above. Instead, the topic has been addressed chiefly in an extensive empirical literature, where the extent of financial protection is usually measured by the relative participation of out-of-pocket payments in the total financing of the health system or, alternatively, the incidence of catastrophic healthcare payments in a population (e.g., Wagstaff and van Doorslaer 2003; Xu et al. 2003).

Although not explicitly informed by micro-economic theory, such studies usually (explicitly or implicitly) invoke certain economic assumptions. One such assumption is that healthcare spending affects individual welfare by imposing an opportunity cost in terms of foregone consumption of other goods and services. This opportunity cost – and any associated utility loss – will tend to increase according to the complexity of the demanded health services and may become “unacceptably” high. This reflects a fundamental concern about the potentially high cost of healthcare, both in absolute and relative terms, as even low-cost health services may lead to major utility losses for poorer individuals. The latter provides the economic rationale for defining a given amount of healthcare payments as “catastrophic” and indicative of inadequate financial protection. In this context, the utility losses associated with the cost of necessary health treatments, relative to an individual’s budget constraint, represent an essential aspect that a more comprehensive theoretical framework for the analysis of health coverage and development in health should seek to capture.

2.2 A model of health coverage based on economic theory

The alternative traditions described in the previous section require different analytic conventions, employ different (and sometimes ad-hoc) metrics, and often give rise to conflicting and incomplete perspectives on the ultimate policy concern of evaluating development in health. In what follows we outline the basic elements of an economic model that reconciles various concepts of health coverage found in the literature, and can serve as a basis to develop an operational index of coverage – as a fundamental measure of national development in health – that reflects concerns with both unmet health needs and financial risk protection in health.

2.2.1 An individual utility model

We start with a simple individual utility function (based on wealth and health) and examine the utility losses that arise as the result of illness. We take as a starting point universal free access to all health treatments. We then examine the changes in utility associated with the introduction of a user charge – i.e. non-pooled financing – for a given treatment. Such changes in utility for any individual can take one of two forms: a wealth-related loss caused by the need to pay for treatment, or a health-related loss caused by the denial of access to treatment that would otherwise have been secured without the user charge.

We assume there is a set of n healthcare problems, and for each problem there is a treatment i available at a known constant cost x_i . The treatments are assumed to be the most cost-effective interventions for each condition. We further assume that the treatments are additively separable, i.e. there are no interactions between diseases or treatments; that the need for treatment i in wealth group y occurs with probability $\pi_i(y)$; and that the health benefits of treatment i are equal for all groups.

The impact of user charges on utilisation can be illustrated by means of a model of individual utility. Without treatment, an illness requiring treatment i reduces health from h to $h - b_i$, where b_i is the health gain associated with the treatment. The user charge is p_i , the magnitude of which is a policy choice that depends on the level of public subsidy (from pooled public funds) provided towards the treatment. The charge is some proportion (less than or equal to one) of the cost of treatment x_i .

For those who secure treatment at the price p_i , the wealth-related utility loss, relative to having free access to the treatment, is:

$$\Delta u_y(h, y) = u(h, y) - u(h, y - p_i) \quad (1)$$

If someone foregoes treatment because of the charge p_i , the equivalent utility loss (relative to free access to the treatment) is:

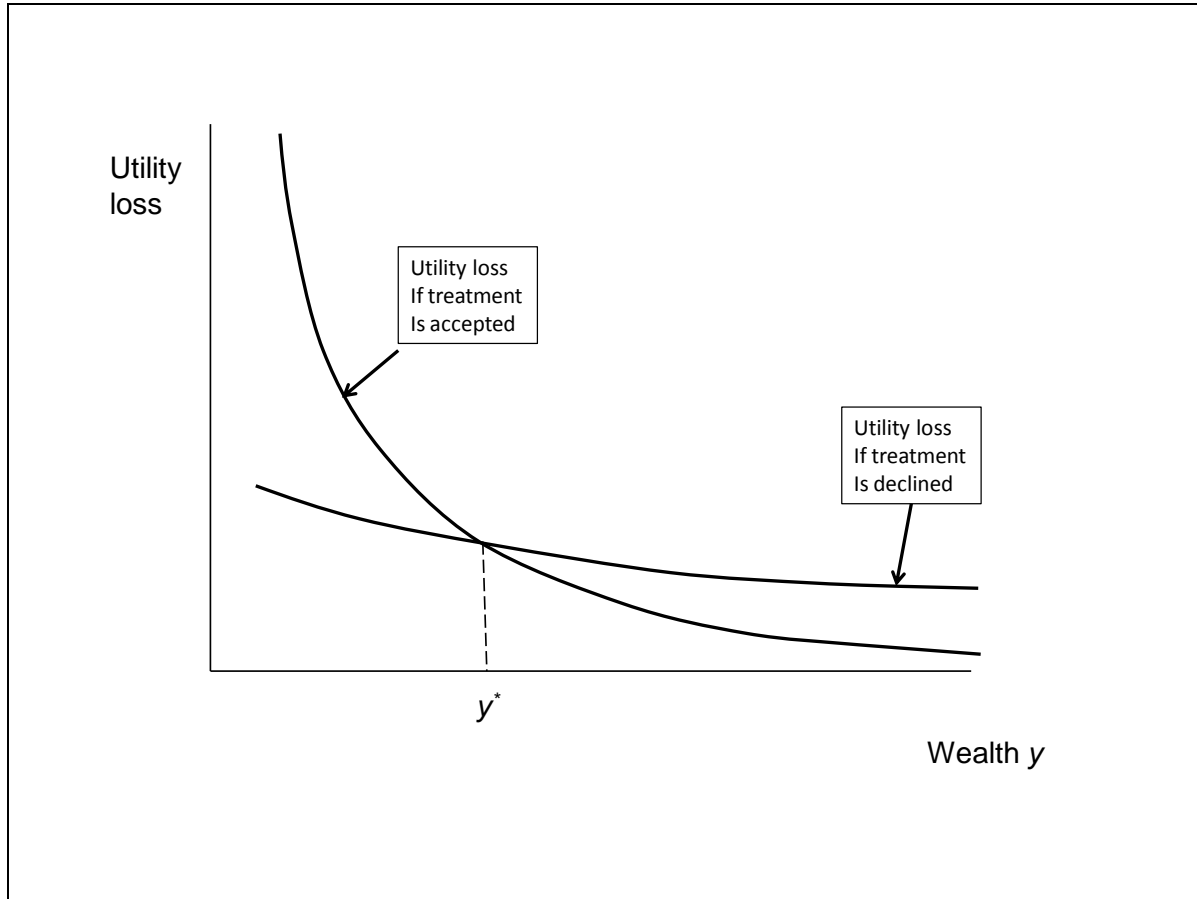
$$\Delta_N u(h, y) = u(h, y) - u(h - b_i, y) \quad (2)$$

This expression reflects a loss of health b_i , the magnitude of which increases as the benefits of treatment i increase. Under conventional assumptions, it can be shown that there will be a critical wealth level for treatment i for which the two utility levels (with and without treatment at price p_i) are equal, such that for values of y in excess of y_i^* the individual will opt to seek treatment, whilst for lower levels of y the individual will forego treatment.

This is illustrated in Figure 1, which shows the utility losses at different levels of wealth relative to free access to treatment. Below wealth y^* , the utility loss is lower if treatment is foregone, because the price involved leads to an unacceptable sacrifice of other goods and services (possibly including basic food and shelter for the very poorest). The treatment will

be perceived as unaffordable. At higher levels of wealth the utility loss is lower if treatment is purchased.

Figure 1: Comparison of utility loss (relative to free access to treatment) if treatment is purchased or foregone at subsidised price p_i



Source: Moreno-Serra and Smith (2012a).

It is important to note that, for simplicity, the model does not consider heterogeneity in initial health status h and capacity to benefit b . Another feature that could be incorporated in more refined extensions of this model is uncertainty, both in health outcome and in price, which in practice may lead to substantial variations in individual choices and *ex post* utility levels.

2.2.2 Social welfare and health coverage

The utility losses from deficient health coverage illustrated above can be assessed from a societal perspective, by integrating these individual losses into a social welfare function, incorporating a set of weights $w(y)$ based on wealth levels. A general formulation is:

$$\begin{aligned}
WL_i(p_i) = & \int_0^{\infty} w(y)u(h, y)\pi_i(y)\gamma(y)dy - \int_0^{y_i^*(p_i)} w(y)u(h - b_i, y)\pi_i(y)\gamma(y)dy \\
& - \int_{y_i^*(p_i)}^{\infty} w(y)u(h, y - p_i)\pi_i(y)\gamma(y)dy
\end{aligned} \tag{3}$$

The first expression gives the level of utility with full access and no user charges. The second expression gives the expected aggregate utility for those who do not receive treatment at price level p_i , whilst the final expression gives the expected aggregate utility for those who pay for treatment at that price level.

Expression (3) can be thought of as the “expected welfare costs” associated with user charge p_i for treatment i . Summed across all treatments, it is in principle this welfare loss in health that any metrics of health coverage should be seeking to capture.

2.2.3 A theory-based metric of health development based on coverage

In approximate terms and under conventional utility assumptions, expression (3) can underpin an operational index of health coverage. Ignoring equity weights and assuming a general vector of treatment prices \mathbf{p}_i , the expected utility loss for treatment i relative to free access is:

$$WL_i(\mathbf{p}_i) = \sum_{j \in N_i} \pi_{ij} b_i + \sum_{j \in Y_i} \pi_{ij} [v(y) - v(y - p_{ij})] \tag{4}$$

The first expression gives the expected health-related loss suffered by those who would decline treatment i due to user charges (foregone health benefits b_i). The second expression is the expected wealth-related loss suffered by those who receive treatment and pay the required price. Equity weights can be readily applied to this model to reflect societal preferences, for example by weighing more heavily deficiencies in access to necessary care by those in lower incomes.

A comprehensive metric of health development based on coverage should in principle consider all relevant treatments and seek to aggregate their coverage according to some concept of importance to the entire population under scrutiny. Therefore, from (4), an operational index of health development could be computed by adding up, for all treatments and citizens: (a) the number of people estimated to forego treatment due to price barriers, weighted by the expected loss of health (measured, for instance, in terms of burden of disease or disability-adjusted life years – DALYs); and (b) the number of people who secure access to treatment by paying a charge, weighted by the expected wealth-related utility loss. Note that the utility losses above are defined in terms of DALY loss or its wealth-related equivalent. They therefore automatically reflect the different effectiveness of different treatments, as expressed in potential health gains.

It is of course straightforward to define the above health development index as a positive function of coverage, i.e. a higher value of the index denoting broader health coverage, increasing in the levels achieved of access to services and financial risk protection in the health system. For this we can simply consider the complement of equation (4) and sum, across all treatments and citizens, the estimates of total utility gains arising from the elimination or reduction of user fees for some treatments, departing from an initial situation where the cost of all treatments must be paid in full by users through fees charged at the point of use. From an individual perspective, these utility gains arise from enhanced access to necessary services (which were previously unaffordable) and improved protection against the financial consequences of illness (due to a lower burden of out-of-pocket healthcare payments as a share of a person's income), for a given level of health need.

Section 3 Preliminary operationalisation of the theoretical framework

3.1 Data requirements and sources

As it is clear from the discussion in the previous section, data limitations may restrict the richness of information incorporated for operationalising the index of health development based on coverage. This study has started by assessing the trade-offs between data availability for most countries (particularly low and middle-income), quality and fitness for purpose for the information contained in major international, publicly available sources. These include the World Bank *World Development Indicators* (WDI), the WHO *Global Health Observatory* repository, UNICEF *Childinfo* and Global Burden of Disease estimates from IHME (University of Washington).

The indicators used for this preliminary operationalisation of the index are described below and their sources are given in Table A1 in the Appendix. The time period for which we have been able to collect the relevant country information is 1995-2013. We consider the case of a health development index that is a positive function of coverage.

3.1.1 Measuring access to care and health needs

The construction of the index requires a count of people with adequate access to necessary services in a country. It is worth noting that the index should, in principle, refer specifically to the set of “needed” services. This is not straightforward since the definition of what a needed service means is open to debate and may vary across societies (Culyer and Wagstaff 1993).

For our purposes, rates of utilisation of services that should be provided to entire population groups (e.g., pregnant women, children) can be used in principle as proxies for the conditions of access to needed services in a health system. Here we use the **proportion of births attended by skilled health staff** (% of total births in the most recent year). Skilled birth attendance represents a good proxy for the conditions of access to the broader basket of services provided in a health system, better than other indicators such as immunisation rates (World Health Organization 2008). It refers to a service that should be provided in clinical facilities to all pregnant women, thus shortages from the 100% rate tend to indicate general deficiencies in access to the health system. In this context, the concept of “need” is implicitly incorporated in our framework as “capacity to benefit”.

A rough estimate of the health benefits lost because of foregone treatments can be obtained in terms of disability-adjusted life years (DALYs). DALYs are a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death. In our application we use the **total number of DALYs lost for all causes** (communicable diseases, non-communicable diseases and injuries) in the country in 2013.

Since in this application we will be constructing an index that is intended to be a positive function of health development – i.e. the higher the index, the higher the level of development – we use in the computations below the *inverse* of the total number of DALYs lost in a country.

3.1.2 Measuring financial protection in health

The theory-driven index formula requires an assessment of the countries' performance on financial risk protection in health, i.e. the level of protection achieved against financial hardship caused by securing access to necessary care, preferably with those on lowest incomes weighted most highly. Ideally, the index would include measures of the numbers suffering catastrophic (or impoverishing) healthcare spending in each country, in particular “gap” indicators that measure by how much a given catastrophic threshold is exceeded on average across income groups (Moreno-Serra et al. 2013). Although a few studies have compiled the available information on catastrophic and impoverishing health spending for a good number of countries (e.g., 89 countries spanning the period 1990-2003 in the study by Xu et al. 2007), these data are now relatively old and more recent data have been produced sporadically for a reduced number of countries.

Given the above data constraints, simpler proxies for financial barriers and risk protection in health must be used in this application. We have collected data on out-of-pocket (OOP) health spending as a share of total, which has been found to be highly and positively correlated with indicators of catastrophic health spending (Xu et al. 2007). This high correlation is reassuring in that the included OOP spending indicator seems able to capture adequately the financial burden caused by private payments for necessary care. We then construct a measure of **pooled prepaid health spending as a share of total spending**, by subtracting the share of OOP health spending from the total. Thus, pooled prepaid spending refers to funds paid by individuals before the need for medical care through channels such as general taxation, social insurance contributions, and private voluntary insurance payments. In practice, the vast majority of such pooled financing across countries takes the form of government spending on health, particularly in the developing world.

There is accumulating evidence about the benefits of additional pooled prepaid spending for broader and more equitable access to health services, in addition to improved protection against catastrophic and impoverishing health payments (Moreno-Serra and Smith 2012b; Escobar et al. 2010). As a consequence, higher reliance on pooled sources of health financing (as opposed to OOP funding) has been found to greatly enhance the positive population impacts brought about by additional resources pumped into the health system (Moreno-Serra and Smith 2014). Therefore, the inclusion of the pooled spending measure in the computation of the health development index can also provide valuable information for policy on, for example, how effective additional domestic and donor funds are likely to be to spur health improvements in a given country.

3.1.3 An “extended” approach: including information on financial constraints

The operationalisation of the theoretical framework described in the previous section can be flexible enough to incorporate information on other country factors beyond – but associated with – health needs, access and financial protection, that may be seen as relevant for welfare assessments in the health domain. These factors include perceived constraints for development in health. The importance of the latter aspect for global health policy debates is reflected, among others, by its inclusion (in various capacities) within the funding allocation formulas adopted by many international agencies, including the World Bank International Development Association (IDA), the Global Fund and the Global Partnership for Education.

We thus begin to explore the merits of accounting for national capacity to domestically finance health, a topic that we discuss further in Section 4. We focus here on two related indicators to obtain a broad picture of such financing capacity. The first one is the traditionally used indicator of income per person, **Gross National Income (GNI) per capita**, measured in purchasing-power parity adjusted (international) dollars. The second indicator is **tax revenue as a proportion of GDP**. The latter provides good information about the available tax base to support expansions in pooled health financing and – particularly in low and middle-income countries – the extension of the informal economy as an associated constraint for raising health revenues internally (Johnson et al. 1997).

3.2 Computation of the health development indices

3.2.1 Some options from the international application of development indices

Many of the instances where health-related indices have been developed and applied for comparison across countries come from international organisations and governments who have implemented quantitative resource allocation formulas. A key difference in the formulas applied by international organisations as opposed to governments lies in the explicit inclusion of past performance and governance among the indicators considered. In contrast national health systems using funding formulas have largely been driven by allocations based on need. Health-related indices have also been developed by multilateral organisations seeking to compare the performance of member countries on specific aspects of the health system, and within broader assessments of national development levels, not necessarily linked to resource allocation mechanisms. We discuss a few selected examples below.

World Bank International Development Association (IDA)

The World Bank’s IDA provides assistance to more than 81 countries on concessional lending terms. In order to allocate its resources amongst the eligible countries, the IDA uses a quantitative funding allocation formula that includes performance indices for three aspects. The first aspect is a country’s performance rating (CPR) in implementing policies

that promote economic growth and poverty reduction, measured through the Country Policy and Institutional Assessment (CPIA) index and an effectiveness measure (Portfolio Performance Rating) capturing percentage of “problem” projects in each country. The other aspects included are need and domestic ability to pay, measured by population size and GNI per capita respectively.

The main determinant of a country’s ranking and score for the IDA funding formula is the country performance rating. Need is positively associated with the allocation score whereas ability to pay enters negatively in the score function, with weights for each component defined as follows:

$$\text{IDA country score} = f(\text{Country Performance Rating}^5, \text{Population}, \text{GNI per capita}^{-0.125})$$

Global Partnership for Education

The Global Partnership for Education uses a Needs and Performance Framework to compare country proposals for funding (Global Partnership for Education 2012). The framework comprises a Needs Index (NI) and a Performance Index (PI) that can be ultimately employed to rank countries according to their situation in those two dimensions. The NI includes 6 factors – country fragility (FRAG), gender parity in school completion (GPIC), primary completion rate (PCR), number of school age children (CSA), per capita income (PCI) and volume of current external financing for education (EXT). The PI includes the World Bank’s CPIA indicator (PII), government educational expenditure as a share of GDP (ED/GDP) and a progress indicator towards the primary education completion target (PPI). The two indices are calculated as follows:

$$\text{Needs Index} = (1 - \text{PCR})^{0.15} \times \text{CSA}^{0.9} \times \text{PCI}^{-0.125} \times \text{EXT}^{-0.1} \times \text{GPIC}^{-0.35} \times \text{FRAG}^{-0.15}$$

$$\text{Performance Index} = \text{PII} \times \text{PPI}^{0.3} \times (\text{ED/GDP})^{0.3}$$

For the purposes of funding allocation, the Needs and Performance Framework in general gives equal weight to performance, needs in addition to the inclusion of population size.

WHO’s fairness of financial contribution index

The framework proposed in our study is not, of course, the first to pay attention to issues pertaining to health financing within assessments of country performance in health. As one previous attempt, the World Health Report 2000 developed the notion of fairness of financial contribution, based on the premise that a fair health system ensures households make health care payments according to their ability to pay rather than risk of illness, hence being protected against the risk of falling into poverty—or being deterred from seeking care—due to healthcare costs (World Health Organization 2000). Starting from this concept, a measure of a household’s contribution to the financing of the health system was defined as the ratio of total household spending on health to its capacity to pay (or, more specifically, to its effective income net of subsistence). The latter is measured as non-food

expenditures or a food-based poverty line to enhance cross-country comparability. The numerator of the ratio, total household spending on health, is defined in a broad manner and includes all sources of health system financing: income taxes, value-added tax, excise tax, social security contributions, private voluntary insurance and out-of-pocket payments.

An index of fairness of financial contribution—a refinement after an original version of the indicator used in the World Health Report 2000—was then proposed to summarise the distribution of health financing contributions across households (see e.g., Murray et al. 2003):

$$\text{Fairness of financial contribution} = 1 - \sqrt[3]{\frac{\sum_{h=1}^n w_h |HFC_h - HFC_0|^3}{\sum_{h=1}^n w_h}},$$

where

$$HFC_0 = \frac{\sum_{h=1}^n w_h HFC_h}{\sum_{h=1}^n w_h CTP_h}$$

and HFC_h is the household's financial contribution to funding the health system, CTP_h is the household's capacity to pay, h represents households, n is the total number of households and w_h are household weights. The WHO index has some desirable properties. It was designed so as to take the value of one when there is complete equality of household contributions—defined as all households paying the same proportion of their capacity to pay to fund the health system—and values lower than one when there is any inequality in household contributions. It also gives explicit considerations to the degree to which households spend their non-subsistence income on health payments.

Although in principle the WHO index can provide valuable information about the degree of inequality in households' health care payments, which may be linked to how exposed households in a country are to the risk of impoverishment from high levels of health expenditure, the relatively rich information required means that data availability hampers the calculation of the index for most countries. To illustrate this issue, a ranking of countries according to the fairness of financial contribution index presented in Murray et al. (2003) was based on data from household surveys conducted between 1991 and 2000 for just 59 countries. From the specific perspective of country assessments of financial protection in health, indicators based mainly on households' direct health expenses from national account information – such as the shares of OOP and pooled health expenses included in our study – are available for most countries, and (as argued above) tend to capture reasonably how households' health expenses affect citizens' living standards.

The Human Development Index

The Human Development Index (HDI) is a summary measure of key dimensions of human development. It measures the average achievements in a country in three basic dimensions of human development: a long and healthy life, access to knowledge and a decent standard of living (UNDP 2015). Specifically for the health component of the index, life expectancy at birth is used as the sole indicator. Mean observed and expected years of schooling are the two indicators used to measure access to knowledge, whereas GNI per capita is the single proxy for living standards.

The composite HDI is calculated as the geometric mean of normalised indices from each of the three dimensions mentioned above, with minimum and maximum values for each indicator set in order to transform the indicators into indices between zero (lowest achievement) and one (highest achievement). In other words, the HDI is computed as:

$$\text{Human Development Index} = \sqrt[3]{\text{Health index} \times \text{Education index} \times \text{Income index}},$$

where each dimension index (health, education and income) is calculated as:

$$\text{Dimension index} = \frac{\text{actual value} - \text{minimum value}}{\text{maximum value} - \text{minimum value}}.$$

Based on the dimension indices an overall HDI can be calculated for each country, varying from zero to one, with a higher HDI reflecting a higher level of human development.

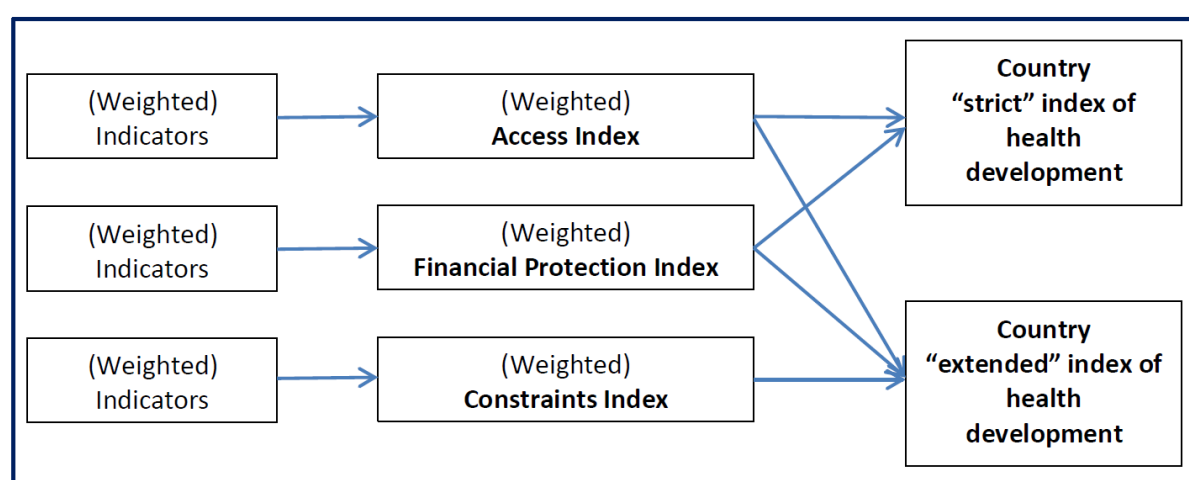
3.2.2 Our approach to computing the health development indices

The general approach we choose for operationalising the proposed health development indices is close in spirit to the mechanics behind the Human Development Index explained above. The specific aspects of the computations are described in what follows. It is worth noting that, in spite of the particular choice of computation approach made here, the theoretical framework developed in section 2.2 is flexible enough so as to be operationalised in alternative ways (e.g., within an IDA-type formula with subjective weights applied to each health development dimension). The fundamental issue is that the selected indicators can provide a picture as accurate as feasible of a country's situation concerning the key domains of access to care and financial risk protection, relative to – or weighted by – their health needs.

Following from the theoretical derivations, we seek to construct indices of health development that are comparable across countries, for each of the three dimensions: **(a) access to care** measured through total and unmet health needs; **(b) financial protection** measured by reliance on pooled prepaid health financing; and **(c) constraints** to expansions in health system coverage, measured by income per person and the available tax base.

After computation of these dimension-specific indices, we proceed to construct composite measures of health development combining all components (a), (b) and (c). Since dimensions (a) and (b) correspond more closely to the notion of health development based on coverage as derived from our theoretical framework, we first compute a **“strict” health development index** encompassing only the dimension-specific indices of access to care and financial protection, under equal weights for each of the components as a starting point. Finally, in a separate computation, we construct an **“extended” health development index** for each country, which is an overall measure combining country performance in all three dimension-specific indices for components (a), (b) and (c). Figure 2 illustrates our approach.

Figure 2: An overview of our approach to constructing health development indices



Access to care index

As illustrated in Table 1, the access to care index is constructed as the geometric mean of two normalised sub-indices reflecting performance in unmet health needs (the skilled birth attendance rate) and total health needs (total DALYs lost). For the normalisation of the sub-indices, a minimum value of zero and a maximum of 100 are set for skilled birth attendance, since it is reasonably well accepted that this intervention should be provided to the entire target group of pregnant women (World Health Organization 2008, 2010a). This of course means that the unmet needs sub-index is given by the observed ratio of skilled birth attendance itself. For health needs, on the other hand, we use the inverse of the number of DALYs lost (as explained above), and the corresponding minimum and maximum values are those observed in the entire sample of countries for the available period 1995-2013.

Having calculated the normalised unmet needs and total health needs sub-indices, the geometric mean of these sub-indices is computed. The final access to care index for a given country is then computed as the normalised value of its sub-indices’ geometric mean, using the minimum value of zero and, as maximum value, the highest geometric mean of the sub-indices for all countries and years under consideration. As for all other indices computed in this application, the normalisation employed ensures the access index lies between zero and

one, with higher values of the index indicating better conditions of access to care given health needs in a country.

Financial protection index

The financial protection index is constructed based on the share of pooled health spending in the total health financing (Table 1). It is computed as the normalised value of a country's pooled spending share, where the minimum and maximum values used in the normalisation procedure correspond, respectively, to the lowest and highest values of the pooled spending share observed for the entire sample of countries and years under consideration. Higher values of the index indicate higher degrees of protection against financial risk due to healthcare payments.

Constraints index

The constraints index is computed as the geometric mean of normalised sub-indices for GNI per capita and tax revenue as a share of GDP (Table 1). The normalisation of these two sub-indices is based on the corresponding minimum and maximum values for each indicator observed in the entire sample of countries for the available period 1995-2013. Having computed the normalised GNI and tax revenue sub-indices, the geometric mean of these sub-indices is computed. The final constraints index for a given country is then given by the normalised value of the GNI and tax revenue sub-indices' geometric mean, where the minimum value used for the normalisation is zero and the highest geometric mean of the sub-indices for all countries and years under consideration is used as the maximum value. A higher value of the constraints index suggests a higher domestic capacity to finance health and improve coverage.

Table 1: Detailed methodology for computation of health development indices

Dimension	Aspect	Indicator	Relationship of indicator with health development	Minimum value (full = full sample, all countries, 1995-2013)	Maximum value (full = full sample, all countries, 1995-2013)	From indicator to sub-index (t = 2013 = latest year) (full = full sample, all countries, 1995-2013)	Dimension-specific index (geo mean = geometric mean) (t = 2013 = latest year) (full = full sample, all countries, 1995-2013)	Health development index strict	Health development index extended
Access to care	Unmet health needs	Skilled birth attendance (%)	+	0	100	(1) $\frac{actual\ value(t) - \min\ value\ (full)}{\max\ value\ (full) - \min\ value\ (full)}$	(a) $\frac{geo\ mean(1,2)(t)}{\max\ value\ (geo\ mean\ (1,2))\ (full)}$ = $\frac{\sqrt{index(1)(t) \times index(2)(t)}}{\max\ value\ (geo\ mean(1,2))(full)}$	$\sqrt{a \times b}$	$\sqrt[3]{a \times b \times c}$
	Total health needs	Total DALYs lost (inverse of)	+	$\frac{1}{\max\ value\ (full)}$	$\frac{1}{\min\ value\ (full)}$	(2) $\frac{\frac{1}{actual\ value\ (t)} - \frac{1}{\max\ value\ (full)}}{\frac{1}{\min\ value\ (full)} - \frac{1}{\max\ value\ (full)}}$			
Financial protection	Protection against financial hardship caused by out-of-pocket health payments	Pooled health expenditure (% total health expenditure)	+	Observed min value (full)	Observed max value (full)	(3) $\frac{actual\ value(t) - \min\ value\ (full)}{\max\ value\ (full) - \min\ value\ (full)}$	(b) Same as (3)		
Constraints	Domestic capacity to finance health and expand coverage	GNI per capita (USD PPP)	+	Observed min value (full)	Observed max value (full)	(4) $\frac{actual\ value(t) - \min\ value\ (full)}{\max\ value\ (full) - \min\ value\ (full)}$	(c) $\frac{geo\ mean(4,5)(t)}{\max\ value\ (geo\ mean(4,5))\ (full)}$ = $\frac{\sqrt{index(4)(t) \times index(5)(t)}}{\max\ value\ (geo\ mean(4,5))(full)}$		
		Tax revenue (% GDP)	+	Observed min value (full)	Observed max value (full)	(5) $\frac{actual\ value(t) - \min\ value\ (full)}{\max\ value\ (full) - \min\ value\ (full)}$			

3.3 Main results for index computations

The full results for the computations of the health development indices as described in the previous section are shown in Table A2 in the Appendix. All indices refer to year 2013, the most recent year available. The first part of the table shows the GNI per capita and a corresponding “GNI index” calculated as described in the previous section for the financial protection index; that is, normalised using the minimum and maximum values of GNI per capita observed in the entire sample between 1995 and 2013. Countries are ordered in a ranking (position) ranging from the lowest GNI per capita in 2013 to the highest GNI per capita in the same year. The second part of Table A2 presents the results for the computations of all our proposed health development indices and sub-indices for countries, as well as the corresponding ranking (position) of each country according to the “strict” and “extended” versions of the overall health development index.

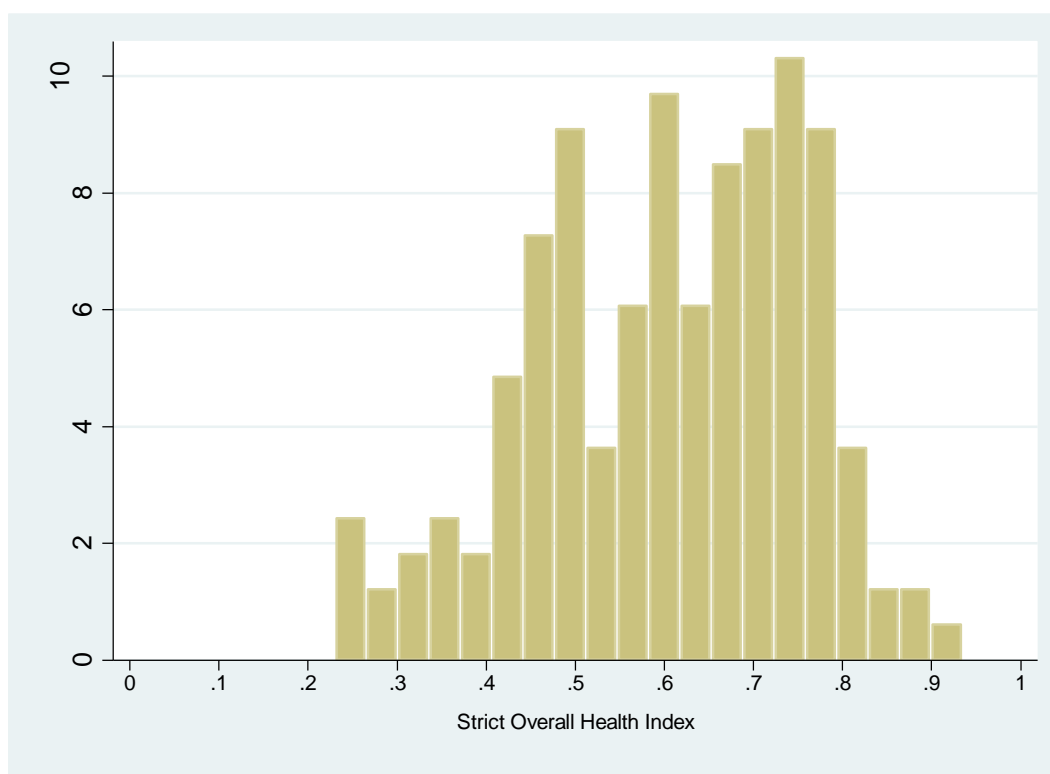
Table A2 and all subsequent analyses in this report refer to the results for the 165 countries with data on GNI per capita and for which at least the “strict” health development index could be calculated given data availability. The additional information required to account for the *constraints* dimension as currently defined means that the “extended” index could be calculated for a smaller number of countries (141).

3.3.1 Overview

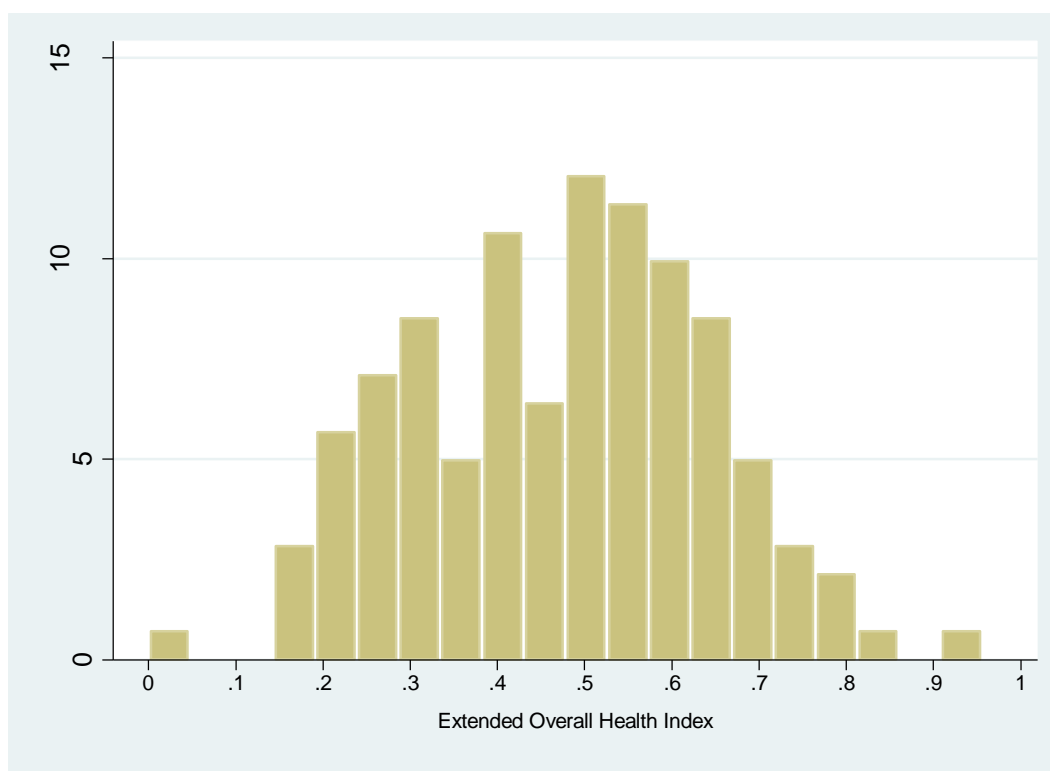
We start by comparing the distribution of values for the “strict” and “extended” health development indices. Figure 3 shows that the values of the “strict” index are distributed between just above 0.2 and 0.9, with mean and median around 0.6 (Panel A). A comparison with the distribution of the “extended” index reveals that taking into account the development constraints faced by countries tends to shift the whole index distribution to the left, i.e. de facto reducing measured levels of health development for most countries by 20% (Panel B). The mean and median of the “extended” index lie around 0.5 with the bulk of the distribution between just above 0.15 and 0.8. Thus accounting for domestic constraints to finance health and expand coverage means that measured levels of health development are generally farther away from the hypothetical situation of maximum health development achievement.

Figure 3: Distribution of values for the health development indices

Panel A: "Strict" index



Panel B: "Extended" index



We now examine the distribution of the “strict” and “extended” health development indices according to income groups (defined as per the World Bank classification of countries). Figure 4 shows the composition of each quartile of the “strict” index (1 = first quartile, countries with the 25% lowest values of the “strict” index”; going up to 4 = fourth quartile, countries with the 25% highest values of the “strict” index) by income group. Half of the first quartile is made of low-income countries (21), followed in composition by 39% of lower-middle-income nations. All remaining low-income countries and most of the remaining lower-middle income countries belong to the second quartile of the “strict” index distribution. Interestingly, many upper-middle-income countries (16) – and even some non-OECD countries classified as high income – rank in the bottom 50% of health development levels measured by the “strict” index.

Figure 4: Composition of the four quartiles of the “strict” index of health development, by income groups

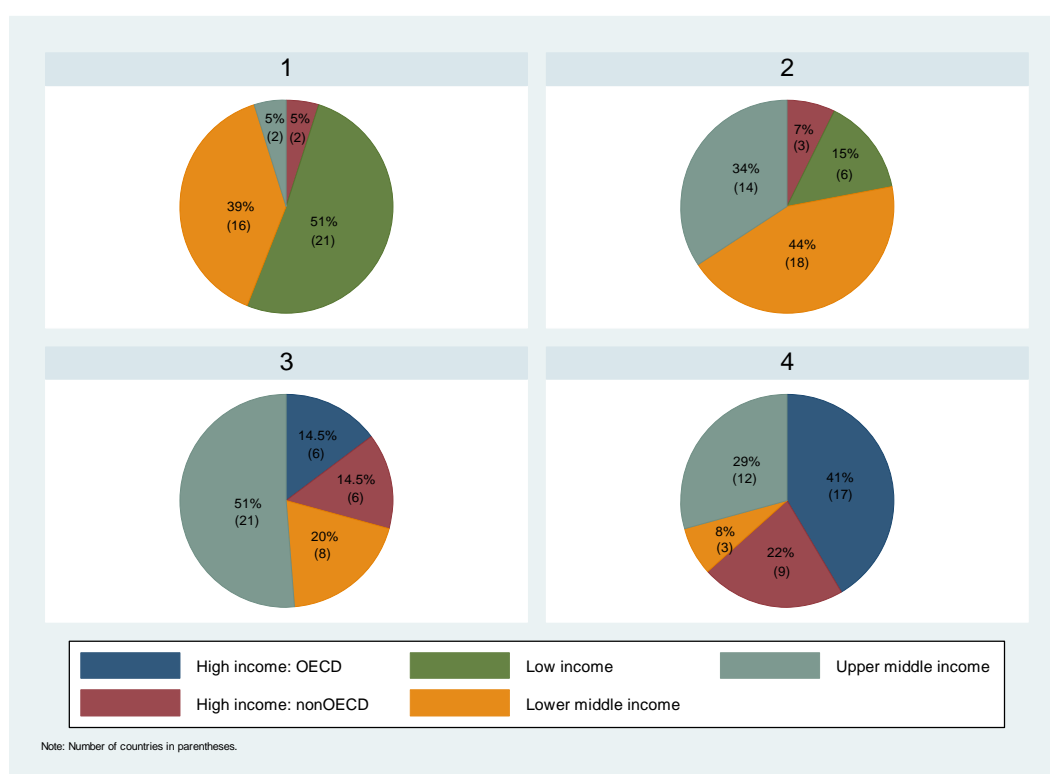


Figure 5 shows the same analysis above but for the composition of our “extended” index of health development. A clear message that arises is that all low-income countries for which the “extended” index could be calculated (21 countries) belong to the first quartile; in other words, all low-income countries present poor health development performance if domestic constraints to finance health and coverage expansions are taken into account. Similarly, all lower-middle-income countries fall in the lowest two quartiles of health development when financial constraints are considered, accompanied by 8 upper-middle-income countries. Since the “extended” index includes the GNI per capita indicator, it is not that surprising to see the composition of quartiles and ranking of countries according to the “extended” index

to be closer to the simple GNI per capita ranking, in contrast to what was observed for the “strict” health development index.

Figure 5: Composition of the four quartiles of the “extended” index of health development, by income groups

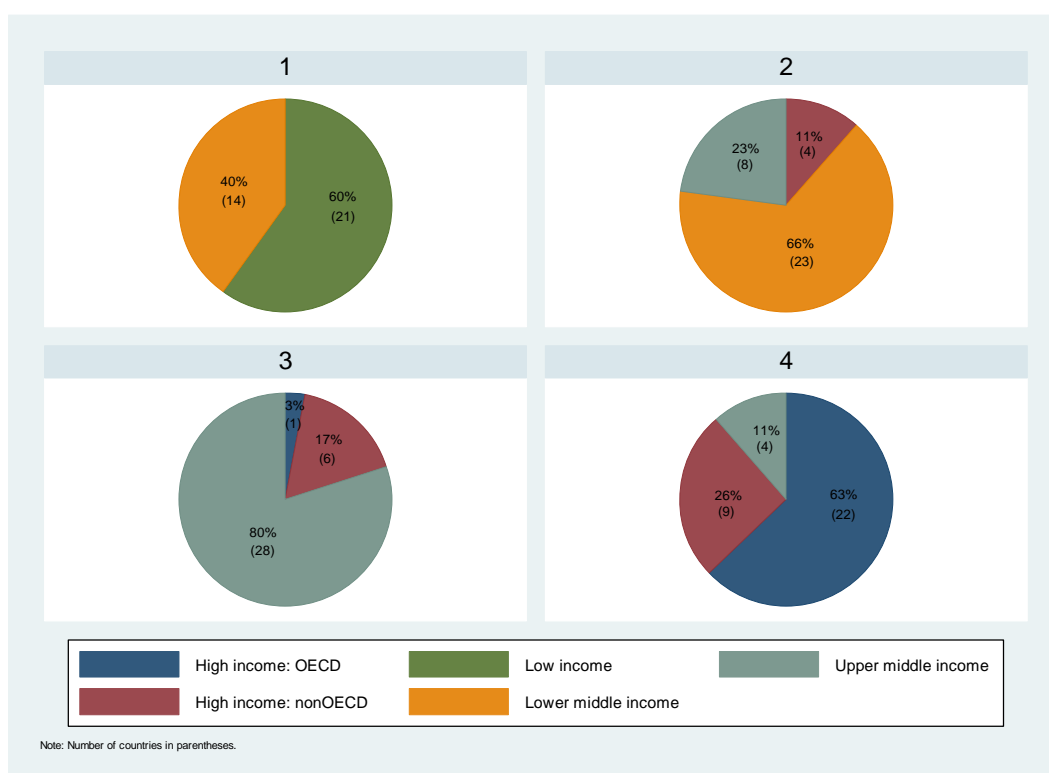
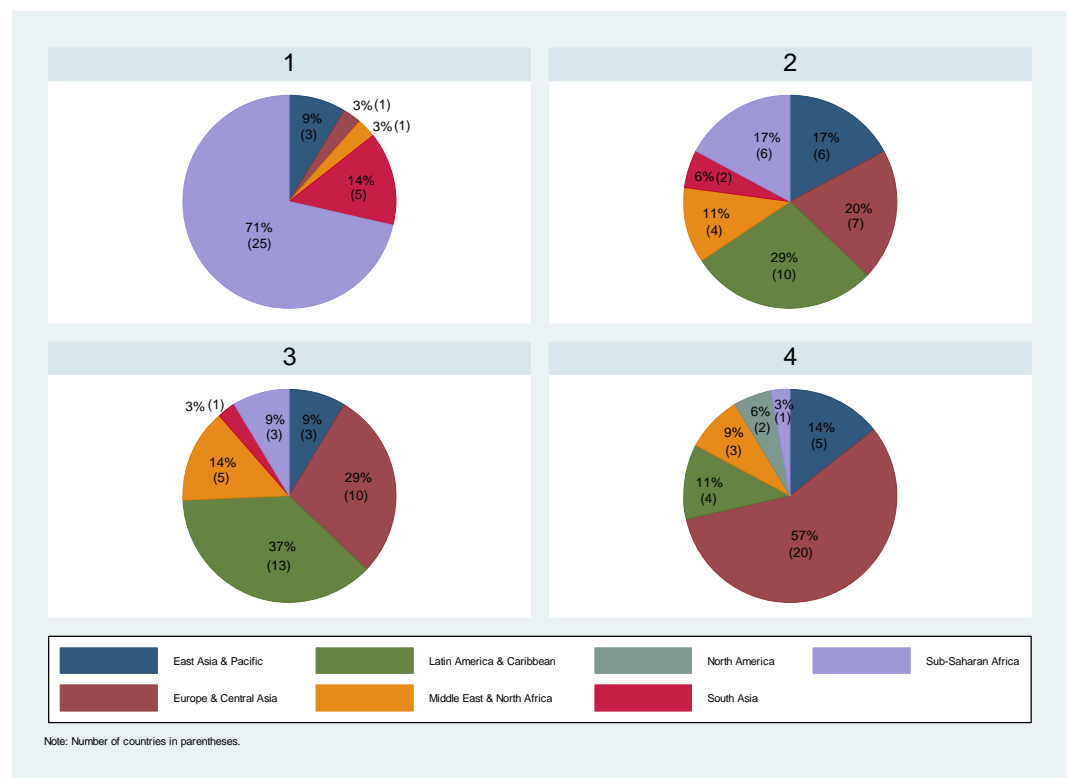


Figure 6 and Figure 7 present similar analyses to the above but focusing on world regions. Two-thirds of the group of countries with the lowest “strict” health development indices (quartile 1) are located in Sub-Saharan Africa. These countries also make up roughly one-third of the group in the second quartile of the “strict” index. Sub-Saharan African countries tend to concentrate in the bottom quartiles when the “extended” index is examined as well. Likewise, South Asian countries tend to belong to the first quartile both in the “strict” and “extended” versions of health development indices. Latin American and Caribbean countries, on the other hand, generally exhibit higher levels of health development than their Sub-Saharan African and South Asian counterparts, being concentrated in the top two quartiles of the “strict” index. Accounting for financial constraints through the “extended” index has the effect of increasing the participation of Latin-American and Caribbean countries in the second quartile of health development.

Figure 6: Composition of the four quartiles of the “strict” index of health development, by world regions



Figure 7: Composition of the four quartiles of the “extended” index of health development, by world regions

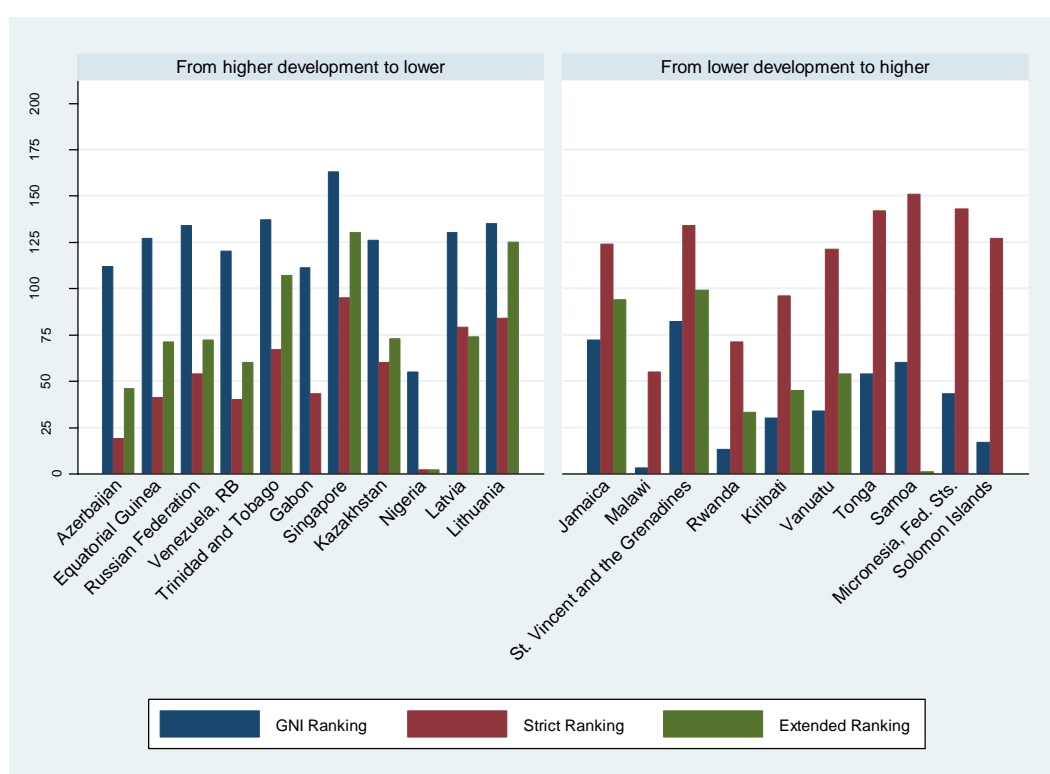


3.3.2 A closer look: comparisons of health development indices and GNI classification for selected countries

We now turn to a closer examination of how the levels and rankings of specific countries change in the health development scale when the latter is evaluated by the proposed “strict” and “extended” indices, compared to the commonly used GNI per capita indicator.

Figure 8 shows country rankings according to GNI per capita and the resulting rankings when health development is measured using the “strict” and “extended” indices. We select for this analysis the 10 countries (or 11 countries in case of a tie) whose rankings change the most moving “from higher development to lower” (i.e. those with the largest negative changes in ranking when moving from the GNI indicator to the “strict” index, reflecting a deterioration in measured health development from the former to the latter), as well as the 10 countries whose rankings change the most “from lower development to higher” (i.e. those with the largest positive changes in ranking between the GNI indicator and the “strict” index”, reflecting an improvement in measured health development from the former to the latter).

Figure 8: Changes in health development rankings using different indices, selected countries



Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance.

Among the countries whose health development deteriorates when measured by our proposed indices, the majority are economies largely driven by oil production revenues. Countries such as Azerbaijan, Equatorial Guinea and Nigeria experience quite dramatic

departures from their higher levels of health development measured solely by GNI, moving to the group of countries with the lowest health development rankings measured by the “strict” and “extended” indices. Beyond a simple reclassification of countries, the decomposition of changes in ranking between a GNI criterion and our health development indices also sheds light on some potentially important aspects for health policy. For example, for the majority of countries whose health development ranking worsens the most when our proposed indices are used instead of GNI only, such deterioration is driven mostly by accounting for their situation regarding access to care and financial risk protection in health (reflected in the “strict” index version). Accounting for financial constraints (the “extended” index version) tends to improve the ranking of these countries. Thus, policy measures aimed at advancing health development in these countries could do well by ensuring that the relatively adequate domestic capacity to finance healthcare is channelled through pooled prepaid sources and effectively expands access to needed health services. Of course, the major bottlenecks for health development in a specific country may lie on financial/non-financial barriers to access and/or financial hardship caused by healthcare payments. To shed light on this, the changes from GNI ranking to the “strict” health development index ranking can be further decomposed by “access to care” and “financial protection” dimensions as well. We perform such analyses in the next sub-section.

Figure 8 also shows information for the 10 countries whose health development ranking improves the most when measured by our proposed indices (“from lower development to higher”). Once again the main drivers behind ranking changes are access to care and financial protection in health, whereas accounting for financial constraints through the “extended” index brings country rankings closer to their GNI-only rankings. The “strict” index rightly seems to reflect health development progress achieved by countries known to have implemented wide-ranging health system reforms geared towards coverage expansions. As an example, Rwanda achieved great progress in terms of population coverage by formal health insurance arrangements in the last decade, based on increased reliance on pooled sources of health financing through a combination of enhanced government budget support and community-based health insurance schemes. This progress has been followed by measured improvements in access to services by disadvantaged populations and reductions in the incidence of catastrophic health expenditures (Saksena et al. 2010), which are reflected in our “strict” health development index.

Comparisons for selected income groups

We now perform an examination of changes in country rankings from GNI to “strict” and “extended” indices by income groups. We look at four country income groups: low-income, lower-middle-income, upper-middle-income and high-income (non-OECD). For each of these groups we select the three countries whose rankings change the most moving “from higher development to lower” as well as the three countries whose rankings change the most

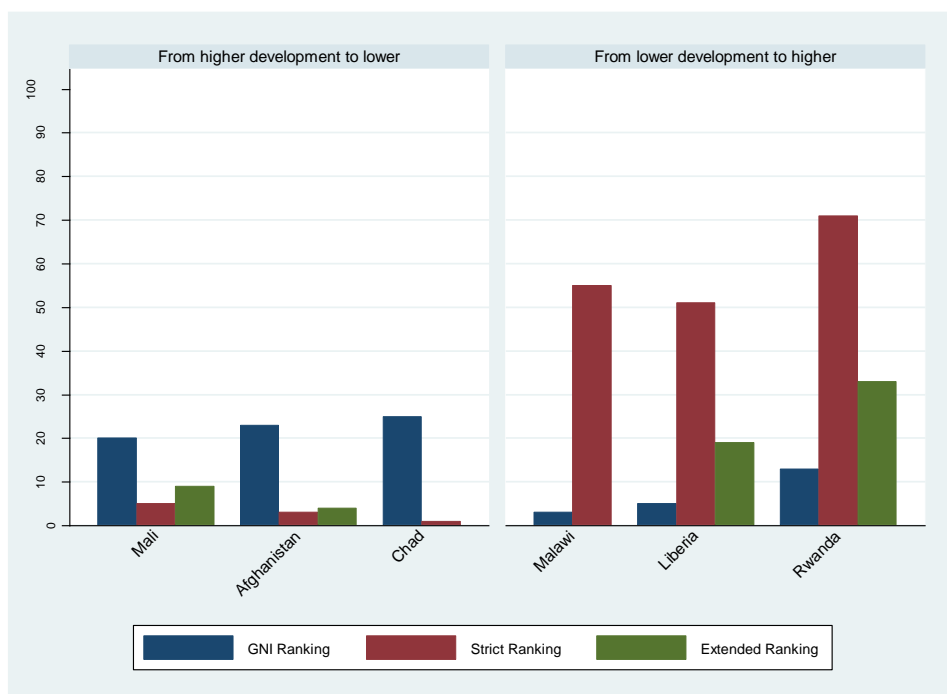
“from lower development to higher” (based on the “strict” index, as defined in the previous sub-section).

Figure 9 shows two separate patterns. For the low-income and lower-middle-income groups (panels A and B), the countries whose measured health development deteriorates the most using our indices (compared to the GNI measure) reach a similar ranking regardless of whether the “strict” or “extended” index versions are used. In other words, accounting for financial constraints does not change their health development performance measured by access to care and financial protection conditions. For these same income groups, the countries whose health development levels improve the most if we move beyond GNI per capita do so based primarily on their good “strict” index performance, whereas consideration of domestic financial constraints tends to push those countries down in the health development scale (Samoa is an extreme example of the latter).

The second pattern in Figure 9 refers to ranking changes for the selected countries in the upper-middle-income and high-income (non-OECD) groups (panels C and D). These countries tend to see their position in the health development ranking fall mainly when the focus is on the access and financial protection dimensions; their relatively better situation regarding domestic financial constraints for health has the general effect of pushing measured development up. On the other hand, the countries in these groups that improve their levels of development when our indices are used do so based on particularly good performance in access to care and financial protection.

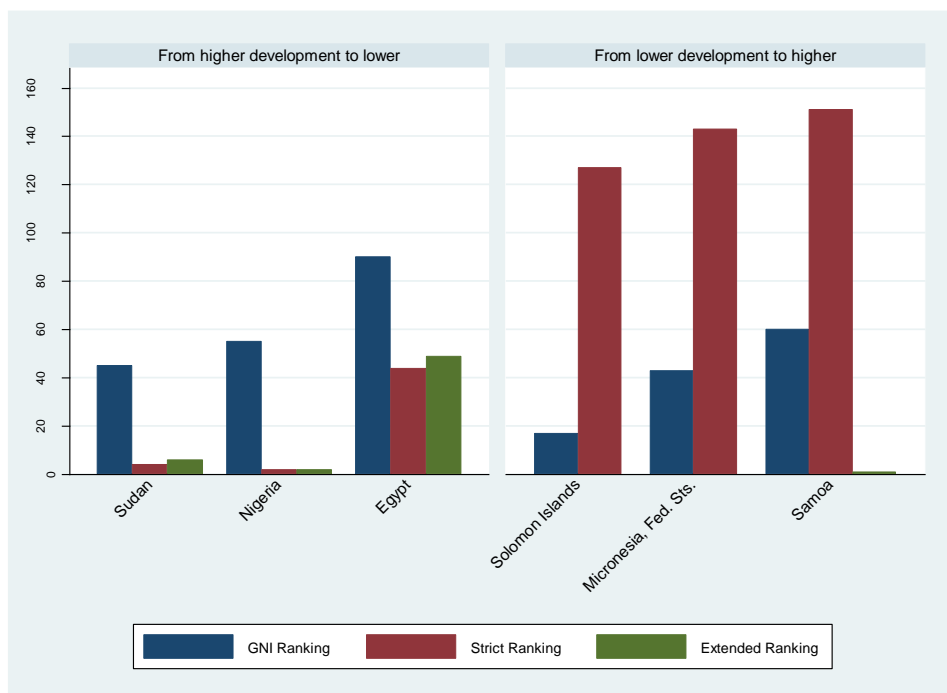
Figure 9: Changes in health development rankings using different indices, selected income groups and countries

Panel A: Low-income countries



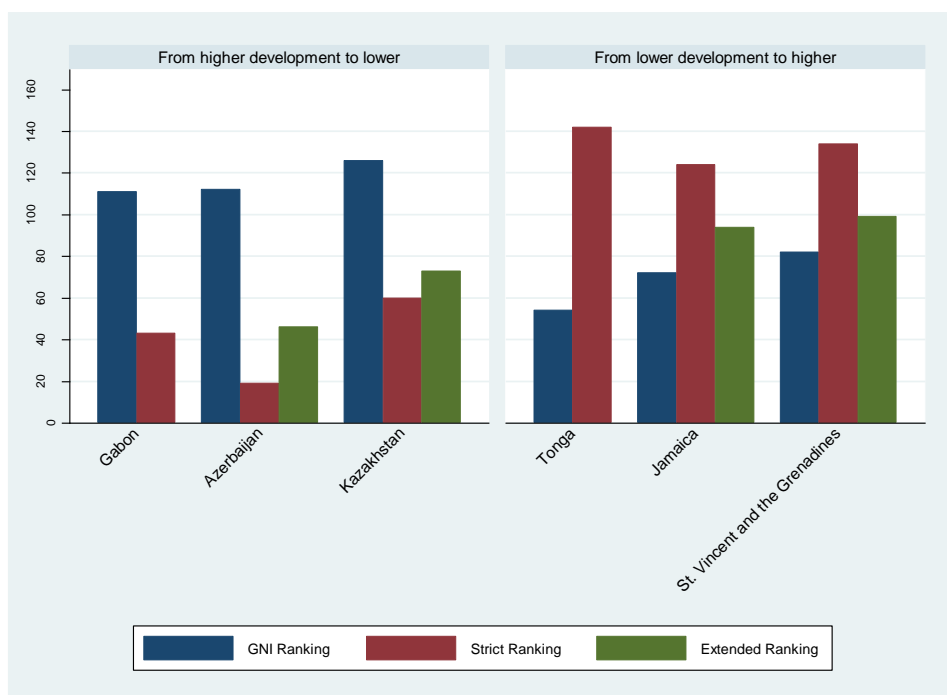
Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance.

Panel B: Lower-middle-income countries



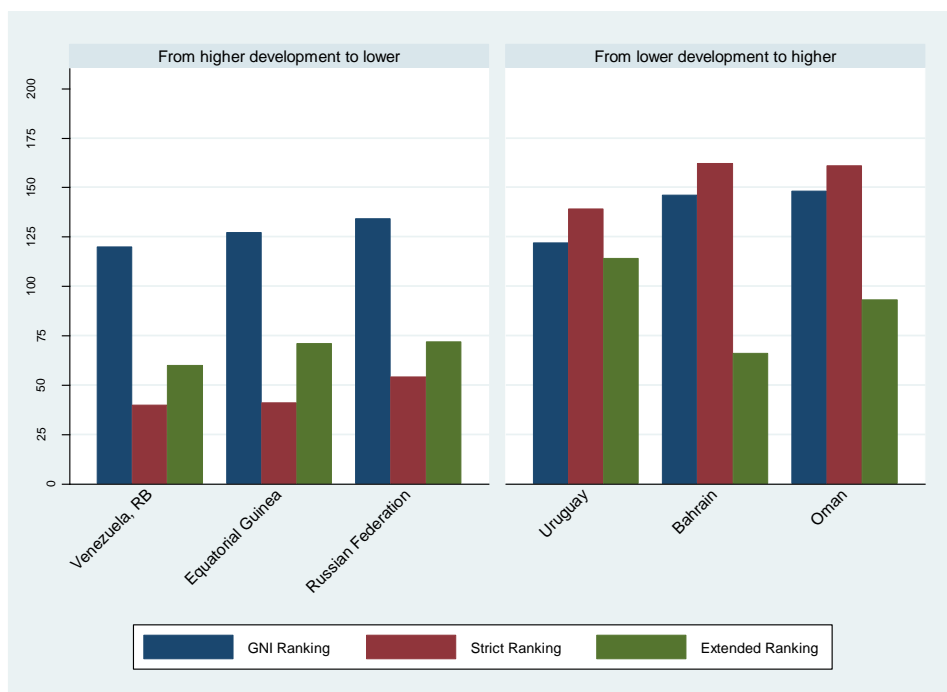
Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance.

Panel C: Upper-middle-income countries



Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance.

Panel D: High-income countries (non-OECD)



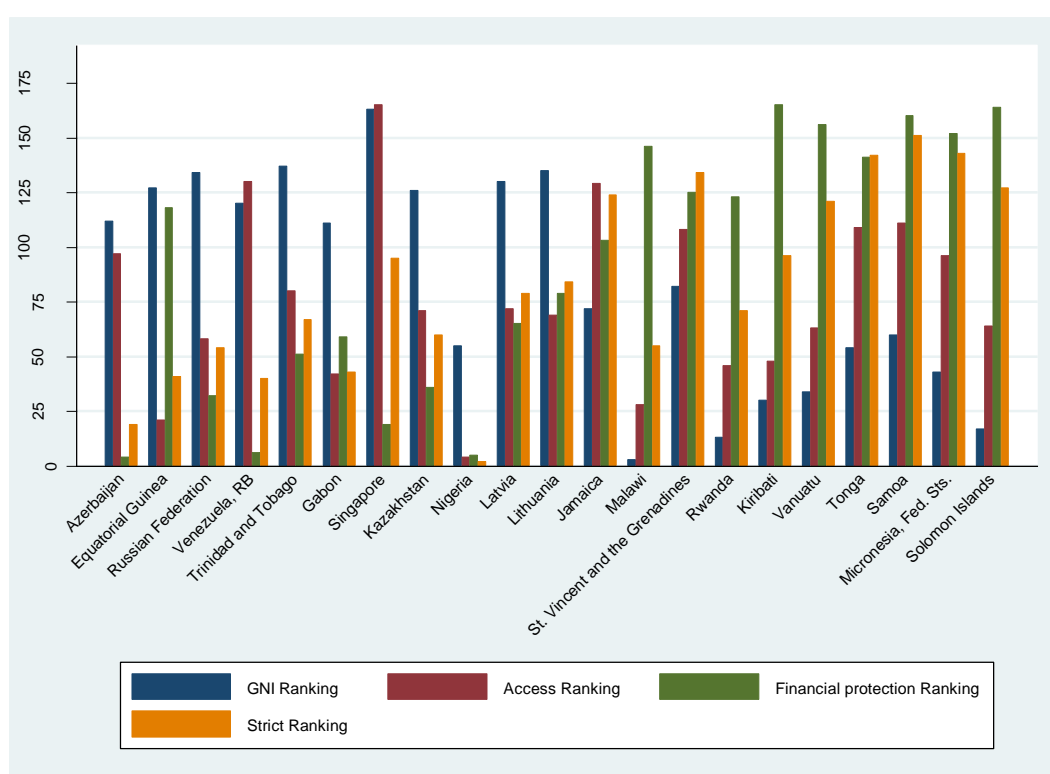
Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance.

3.3.3 Relative importance of access to care and financial protection for measured levels of health development

From a policy perspective it seems relevant to disentangle the particular impact of each of the components of the “strict” and “extended” health development indices for the resulting country rankings. In what follows we present analyses for the components of the “strict” index. Refinements and extensions to these analyses are presented in Section 4 below.

Figure 10 shows the variation in country rankings when we measure health development solely by GNI, then separately by each dimension of the “strict” index – access to care and financial protection – and finally by the resulting overall “strict” index. The selected countries are the 10 countries with the largest negative changes in ranking from GNI-only to “strict” indices, and also the 10 countries with the corresponding largest positive changes in ranking, as defined in section 3.3.2.

Figure 10: Changes in health development rankings using different sub-indices, selected countries



Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance.

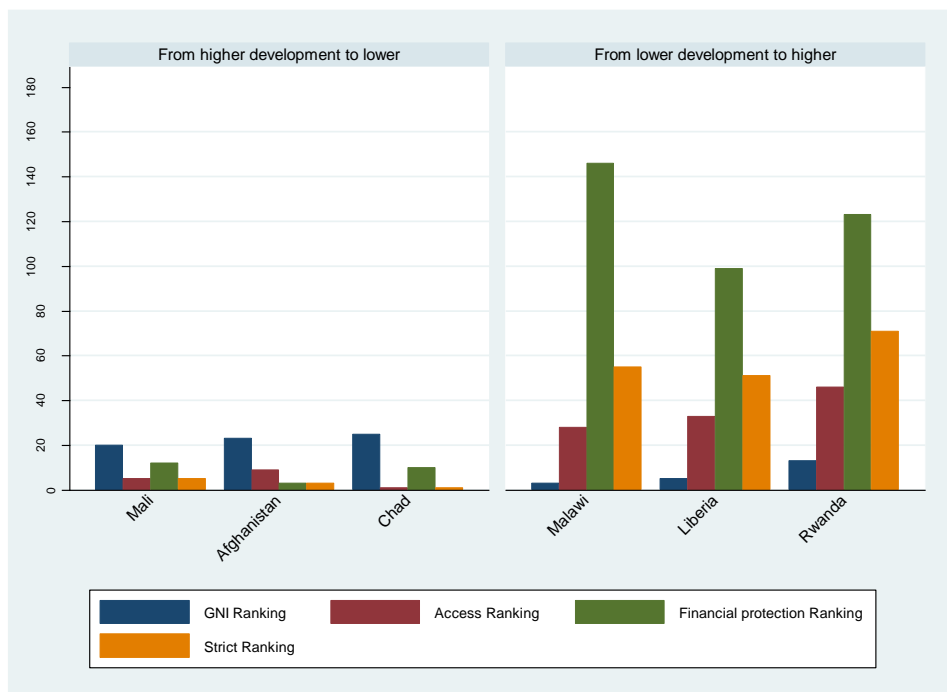
The examination of components of the “strict” index produces different insights into the main bottlenecks for health development – and consequently potential policy responses – across the selected group of countries. As an illustration, Azerbaijan’s substantial fall in the health development ranking when the latter is measured by the “strict” index instead of GNI per capita is led primarily by low performance in the financial protection dimension. This

may suggest a situation where improvements in the utilisation of needed health services by its population have been achieved at the cost of relatively high private out-of-pocket payments associated with access to those services, potentially exposing large population groups to financially catastrophic health payments. The panorama looks somewhat different in Equatorial Guinea, another country with a significant drop in the health development ranking as measured by the “strict” index. The major driver behind this drop in Equatorial Guinea’s health development ranking is in fact poor performance in the access to care dimension, which suggests a situation where access to services is inadequate given the burden of disease in the population, possibly due to barriers to access beyond a lack of reliance in pooled health financing (such as physical availability of services, for instance). Of course, more detailed analyses specific to each country should be conducted to validate the conjectures above and define policy responses, but the examination of our simple indices provides useful insights on where the main hurdles for health development may lie.

In Figure 11 we replicate the analysis above by income groups, using the four income groups and same country selection criteria as in section 3.3.2. In all income groups there are cases in which the significant fall in health development rankings from GNI-only to the “strict” index is driven mainly by particularly poor performance in the financial protection dimension. Examples are Afghanistan (panel A), Egypt (panel B), Azerbaijan (panel C) and Venezuela (panel D). In fewer instances does the access to care dimension clearly become the major determinant of the change in ranking, such as in Chad and Mali (panel A) and Equatorial Guinea (panel D). Finally, relatively good performance in the financial protection dimension constitutes, in general, the primary driver of the observed improvement in health development rankings according to the “strict” index for the selected countries in the low-income, lower-income and upper-middle-income groups.

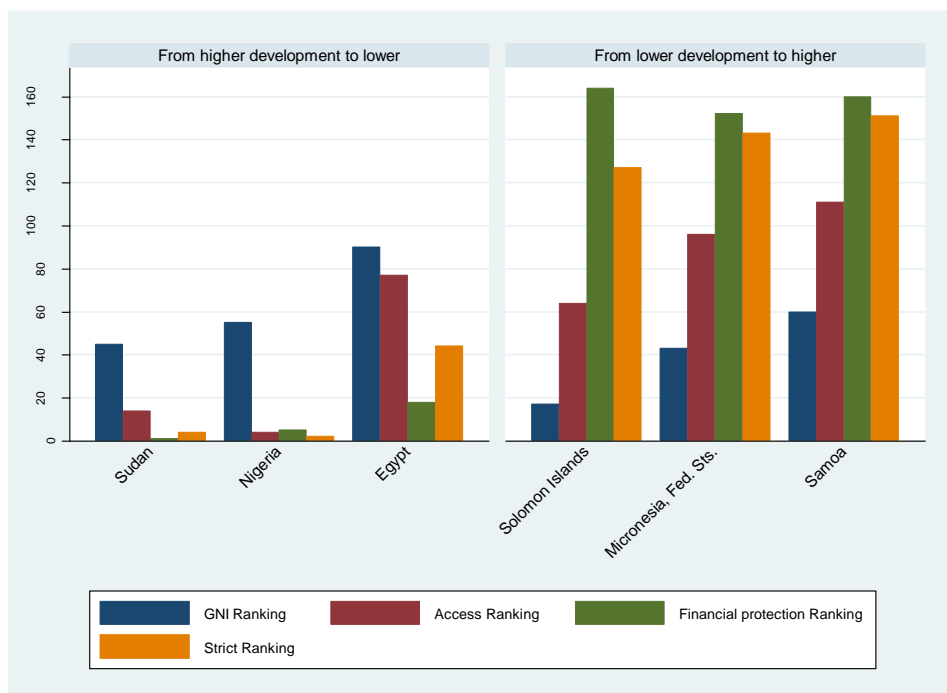
Figure 11: Changes in health development rankings using different sub-indices, selected income groups and countries

Panel A: Low-income countries



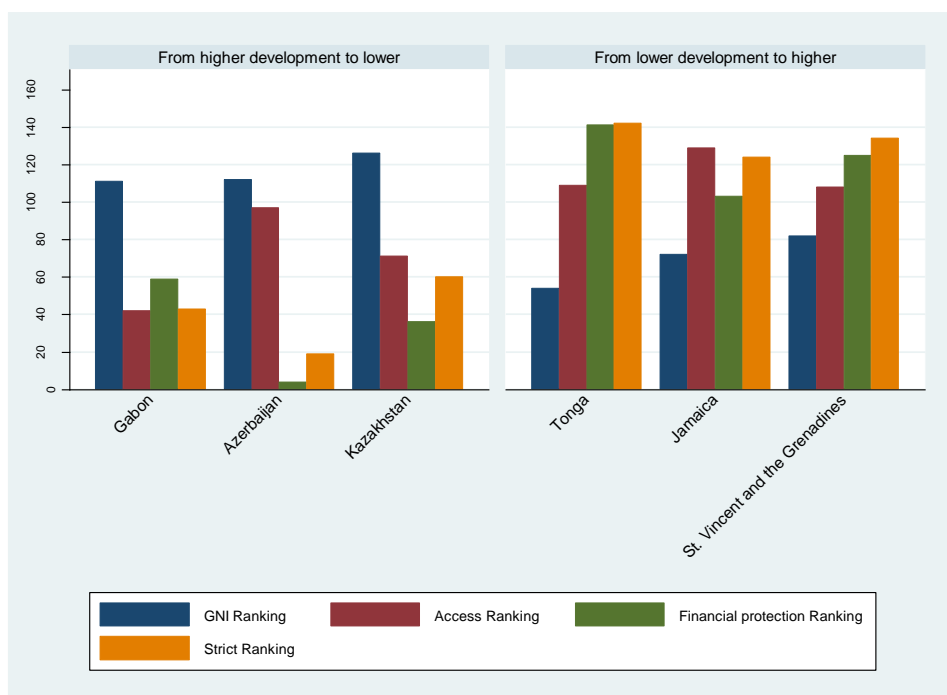
Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance.

Panel B: Lower-middle-income countries



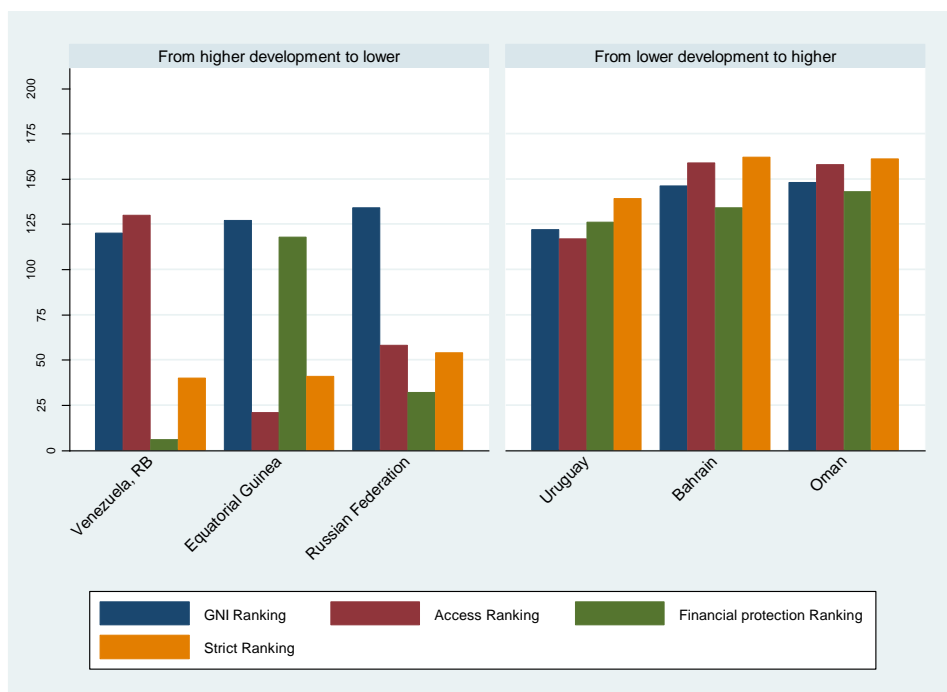
Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance.

Panel C: Upper-middle-income countries



Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance.

Panel D: High-income countries (non-OECD)



Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance.

Section 4 Extensions

4.1.1 Fiscal space aspects

The “extended” version of our health development index focuses on limited information about domestic constraints for financing expansions in health coverage. This information includes GNI per capita, whose important caveats for measuring even capacity to pay for health have been noted previously. International agencies may, therefore, consider other factors as more relevant for welfare assessments and – particularly – support allocation decisions in the health area. One such example is fiscal space. Its importance for global health policy debates is highlighted by its inclusion (in various capacities) within the funding allocation formulas adopted by agencies such as the World Bank International Development Association (IDA) and the Global Partnership for Education.

Although there is no consensus around a definition of the term “fiscal space”, the latter is commonly understood as how much room there is in a government’s budget to allow the allocation of public resources to a given goal (say healthcare provision) without risking the financial sustainability of the government or the economy. In this section we extend our analysis to examine the implications of accounting for fiscal space proxies for the resulting country rankings in the health development scale. As before, the choice of fiscal space indicators is constrained by the availability of data for countries of different income levels. Despite this constraint, and following suggestions from co-conveners, we have been able to supplement information already used (**tax revenue as a share of GDP**) with data on two other indicators that provide broad and relevant information on national room to allocate public spending to health in a sustainable manner over time. The first indicator is **general government expenditure on health as a share of total government expenditure**. The second indicator is **total debt service as a share of GNI**.

Information provided by broader indicators such as the World Bank’s CPIA debt policy rating could have been useful as well, but such data were available for a more limited number of countries than the total debt service variable. Since adding the government expenditure on health and total debt service indicators to those used in the baseline “strict” and “extended” indices means that we end up restricted to a sample of 97 countries, using the CPIA indicator would further reduce our ability to generalise the conclusions. We believe nonetheless that the total debt service indicator offers relevant information on country budgetary risks and long-term public spending sustainability.

Indicator definitions and sources are provided in Appendix Table A1. Similarly to the constraints index, we construct a fiscal space index given by the geometric mean of normalised sub-indices for tax revenue as a share of GDP, government expenditure on health as a share of total government expenditure, and the *inverse* of total debt service (so higher values of the latter sub-index denote more fiscal space; see Appendix Table A3). As

before, the normalisation of these three sub-indices is based on the corresponding minimum and maximum values for each indicator observed in the entire sample of countries for the available period 1995-2013.

Having constructed the normalised tax revenue, government health spending and debt sub-indices, the geometric mean of these sub-indices is calculated. The final fiscal space index for a given country is then given by the normalised value of the three sub-indices' geometric mean, where the minimum value used for the normalisation is zero and the highest geometric mean of the sub-indices for all countries and years under consideration is used as the maximum value. By construction, a higher value of the fiscal space index suggests more fiscal space. Finally, we construct a "strict + fiscal" index for each country, which is an overall measure combining country performance in all three dimension-specific indices: access, financial protection and fiscal space (Annex Table A3). The full results for the computation of the indices described in this section, for all countries with available data, are given in Appendix Table A4.

The information conveyed by our original indices ("strict" and "extended") and the new information provided by the fiscal space indicators can be summarised through maps showing the comparative performance of each country according to performance bands (quartiles). Figure 12, Figure 13 and Figure 14 show world maps displaying country rankings according to the "strict" index, "extended" index and "strict + fiscal" indices (respectively). As explained before, lower rankings (closer to 1) represent: lower health development (according to the "strict" index); lower health development and higher financial constraints (using limited financial information; "extended" index); and lower health development and less fiscal space (judged by broader financial indicators; "strict + fiscal" index).

As seen in the previous section, although most bad performers according to the "strict" index are in Sub-Saharan Africa and South Asia, some upper-middle income countries and even high-income countries such as Russia and Venezuela also belong to the two bottom groups in terms of health development performance (Figure 12). If in addition to health development *per se* we also take into consideration domestic financial constraints measured by the "extended" index, the map in Figure 13 shows the low-income countries in Africa and South Asia still among the lowest ranked nations, reflecting prevalent domestic financial constraints. Other countries such as South Africa, Russia and Venezuela climb in the rankings due to their relatively high capacity to finance health coverage expansions domestically. Arguably, for the latter group of countries there is at least some degree of mismatch between their relatively high ability to pay for health coverage improvements and their relatively poor observed performance in ensuring adequate access and financial protection for their populations.

Figure 12: Country rankings according to the “strict” index (165 countries)

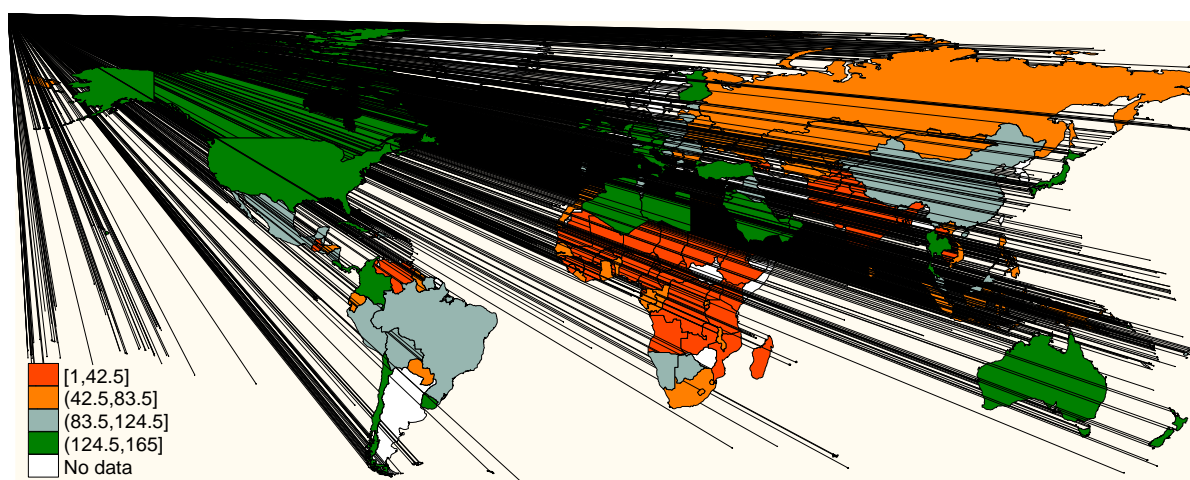


Figure 13: Country rankings according to the “extended” index (141 countries)

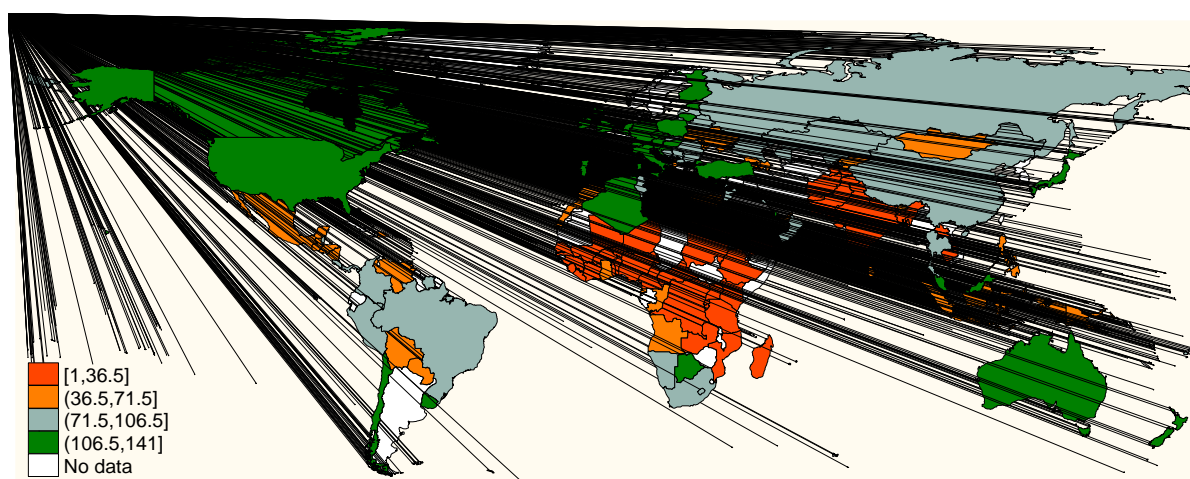
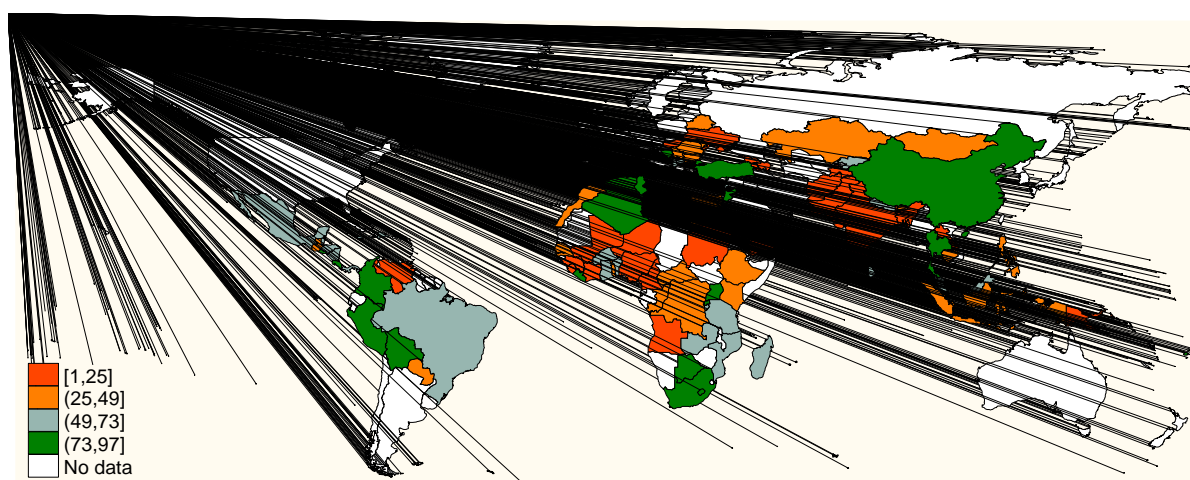


Figure 14: Country rankings according to the “strict + fiscal” index (97 countries)



The “strict + fiscal” index provides useful information additional to the above concerning governmental room to improve health financing whilst ensuring public spending

sustainability. Thus, as with the “extended” index, movements in country rankings from the “strict” to the “strict + fiscal” index may be of interest for international agencies seeking to promote health development through financial and non-financial support mechanisms – including decisions about the type(s) of assistance that are likely to be more effective in a particular context.

Figure 14 shows that African and South Asian countries in general tend to remain in the bottom half of the rankings. However, compared to the “strict” index, the analysis of the “strict + fiscal” index results in greater differentiation among African countries with similar health needs, based on their capacity to sustainably increase domestic resource allocation to the health system. This differentiation becomes evident when we compare, for instance, the situations of Sudan, whose case for external support targeted to the health sector remains strong in light of relatively low domestic fiscal space for health coverage expansions, and Madagascar, whose relatively good fiscal space may weaken the case for external financial support. For Madagascar, international policy responses may be more effective in stimulating health development if geared towards non-financial support (e.g. technical assistance on health service delivery issues and advocacy initiatives around public spending decisions) rather than financial aid *per se*. Once again, it must be emphasised that the precise policy implications and actions for each specific country must be informed by detailed case studies beyond the scope of our analysis.

An important limitation of the analyses above using the “strict + fiscal” index must be highlighted. International agencies may consider important to assess countries’ past and current efforts associated with health development when making decisions about support allocation. Effort factors commonly mentioned in the global health debate include national policies to promote effectiveness and transparency in public spending (e.g., quality of governance indicators) but also the level of priority given to health, measured by the share of public spending channelled to the health sector. Similarly, the tax share in a country can also be interpreted at least in part as a choice variable, whose magnitude is influenced by societal preferences regarding financing of public services including healthcare.

Therefore, the inclusion of the government spending on health and tax revenue shares in our empirical exercise can be seen as capturing some of the “effort” aspects mentioned above in addition to domestic financial constraints *per se*. This suggests that country rankings according to the “strict + fiscal” index should be treated with caution, particularly if the goal is to inform support allocation decisions by donors. All else equal, countries with lower debt servicing and/or higher shares of government spending going to health will have more fiscal space and hence a higher “strict + fiscal” index. As a result, in some cases lower values of the “strict + fiscal” index may not be driven mainly by deficiencies in access to care or financial protection, but rather by less national “effort” as arguably suggested by higher debt or a lower share of public resources devoted to health. Thus we cannot emphasise

enough the need to investigate further the specific drivers behind each country index ranking prior to drawing firm conclusions on support allocation aspects.

4.1.2 Broadening the definition and measurement of access: equity and care quality aspects

So far in this report we have constructed measures of health development based on aspects broader than income per person, including health coverage and financial constraints, assessed by indicators widely acknowledged as relevant to assess national progress on health and for policy discussions in the area. Although we believe there are strong merits in relying on a parsimonious number of indicators that are reliable, valid, relevant, and can be easily understood and collected for most countries, a single framework will never capture all aspects of relevance for health development. Composite indices aggregating a few underlying indicators, such as the ‘strict’ and ‘extended’ indices discussed here, can be helpful to communicate broad results and draw attention to trends in health development performance.

It is straightforward, however, to expand the sort of information included in the indices to offer a more complete picture of health development, provided the necessary country-level data are available. A very relevant case is the multi-dimensional nature of the access to care dimension. The current global health debate – around, for instance, the idea of universal health coverage as a key objective for health systems (World Health Organization 2010a) – makes frequent reference to *equitable* access to services, going beyond simple national averages. It also emphasises the notion of access to services that are clinically effective, therefore making *quality of care* a crucial element within assessments of country development in health. Our theoretical framework is very flexible in that the evaluation of utility levels from health coverage can take into account concerns about equity in access by incorporating a set of weights based, for instance, on wealth levels. Quality deficiencies can be accommodated in our framework as an adverse impact on measured coverage and therefore health development.

In this section we illustrate how our baseline analyses can be expanded to measure and compare levels of health development accounting for how equitable access to necessary health services is in the countries, as well as the quality of care provided. To do so, we proxy equity in health service access by the **skilled birth attendance ratio between the poorest and richest population quintiles of the wealth distribution**. The assumption is that higher poor-rich skilled birth attendance ratios suggest more equitable access to necessary services in general in the country. The corresponding data source is the UNICEF *Childinfo* database (UNICEF 2015).

We are severely restricted by data availability for our choice of care quality indicator; our exploratory work of potential data series has been unable to identify more general indicators of care quality commonly used in country case studies – such as hospital

readmission and avoidable mortality rates, or patient satisfaction measures – available for a reasonable number of developing and developed countries. We have obtained, however, data on the **treatment success rate of new tuberculosis cases**. These data are available for most countries from the *Global Health Observatory* (World Health Organization 2015) and arguably offer a good approximation of quality standards at least in primary care.

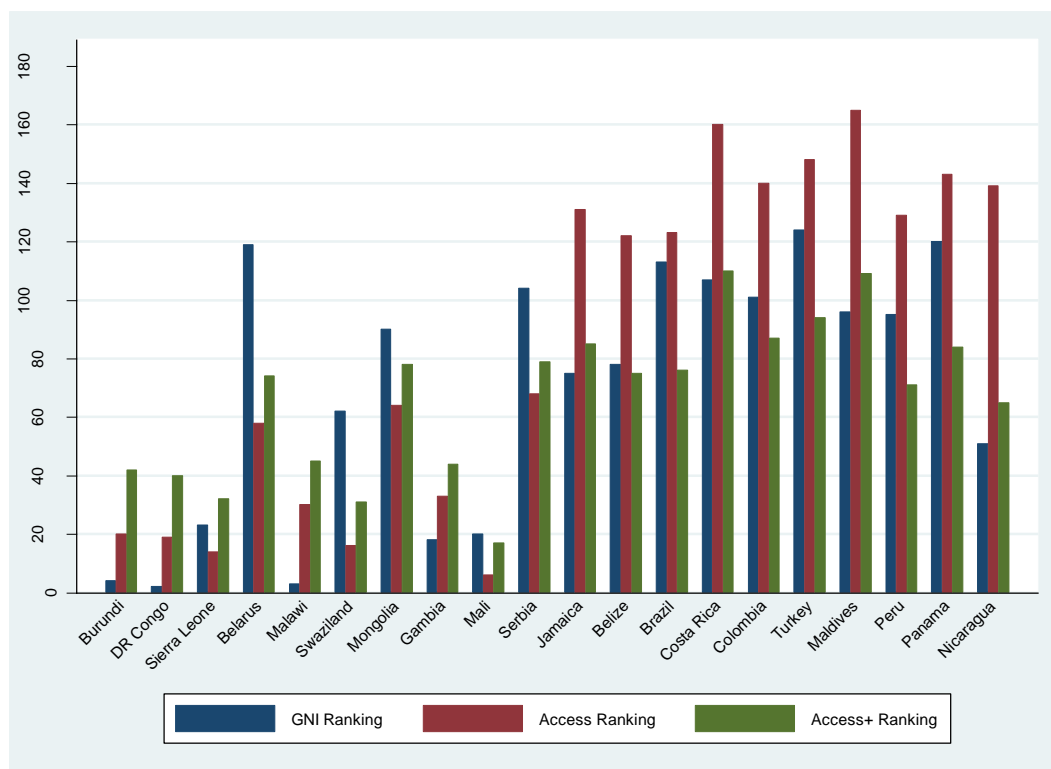
A pragmatic way to incorporate the equity and quality information into our health development indices is to include the corresponding indicators directly within the access to care index. Following the same methodology described in Table 1, we simply construct normalised sub-indices for the two extra dimensions, and the now expanded access to care index (“access+”) is given by the normalised value of the geometric mean of sub-indices for skilled birth attendance (level), DALYs lost, skilled birth attendance poor-rich ratio, and the tuberculosis treatment success rate. We are able to calculate the “access+” index for 110 countries given the available data.

The main message from the new simulations is that using the “access+” index does not lead to wholesale changes in country rankings, compared to the ranking obtained using our original access index. Even though the distribution of the “access+” index shifts to the right relative to the original index, and its average value rises from 0.482 to 0.661, the average *change* in rankings is a deterioration of nine positions in a country’s ranking, with a median decline of just three positions.

There are specific cases, of course, where changes are more significant. Figure 15 displays the results for the calculations of the original “access” and “access+” indices for the 10 countries with the largest positive (improvement) and negative (deterioration) changes in ranking. Among the 10 countries on the left-hand side of the Figure, Burundi and the Democratic Republic of Congo stand out as those whose rankings improve the most when the expanded definition of access is used, despite a still relatively poor performance on access to care (both countries are among the worse 40% performers).

Some interesting results are found among the countries on the right-hand side of Figure 15, those with the largest decrements in their rankings. Latin-American and Caribbean countries predominate among countries where the inclusion of the equity and care quality dimensions leads to large falls in access to care performance. These deficiencies in access to needed health services are not well captured by a simple GNI per capita indicator: the latter usually leads to different conclusions about measured health development and country rankings, particularly noticeable in the cases of countries such as Brazil, Peru and Panama.

Figure 15: Changes in country rankings after adding equity and care quality indicators to the original definition of the access index, selected countries



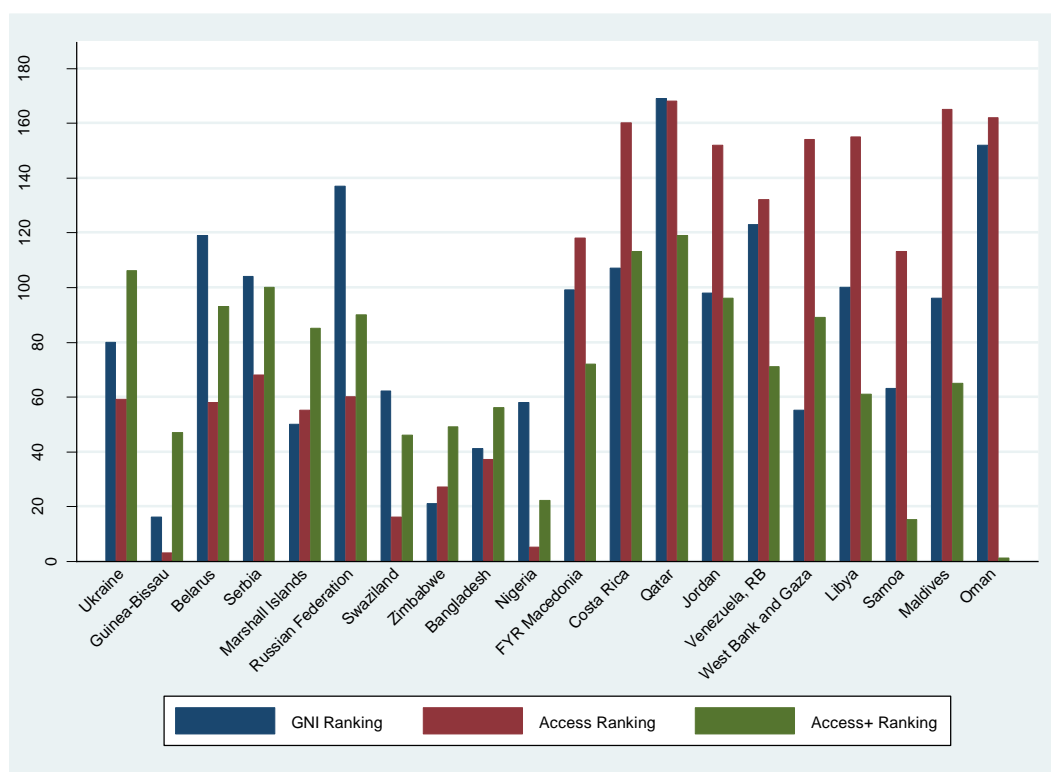
Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance. The “access” index includes the skilled birth attendance rate and DALYs lost as indicators. The “access+” index includes the latter two indicators, plus the poor-rich skilled birth attendance ratio and the treatment success rate of new tuberculosis cases.

As a final note on the access to care dimension, we have also explored the alternative of complementing the skilled birth attendance rate with information on **unmet need for contraception**, as a way of broadening the assessment of service coverage offered by the skilled birth attendance rate. We use data on unmet need for contraception available from the World Bank *World Development Indicators*; the indicator is defined as the percentage of fertile, married women of reproductive age who do not want to become pregnant and are not using contraception (World Bank 2015). The broader access to care index (“access+”) is now given by the normalised value of the geometric mean of sub-indices for DALYs lost, the skilled birth attendance rate and the unmet need for contraception (as with DALYs lost, the contraception indicator enters the index computation as its inverse so that higher values denote better access).

We are able to calculate this new “access+” index for 120 countries given the available data. As before, Figure 16 shows results for the calculations of the original “access” and new “access+” indices for the 10 countries with the largest positive (left-hand side) and negative (right-hand side) changes in ranking. Once again some African countries (e.g. Guinea-Bissau, Swaziland and Nigeria) are among those with largest ranking improvements, despite a still low performance on access to care overall. Similarly to the previous analyses in this section,

using the new “access+” index for health development assessments generally leads to different conclusions from using solely a GNI per capita criterion. This is evident among Middle-Eastern and North-African countries, many of which belong to the high-income or upper-middle-income categories but whose development performance tends to be much lower when the broader access to care index is examined (e.g. Oman, Libya and Qatar).

Figure 16: Changes in country rankings after adding the unmet need for contraception indicator to the definition of the access index, selected countries



Note: The vertical axis denotes the country ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance. The “access” index includes the skilled birth attendance rate and DALYs lost as indicators. The “access+” index includes the latter two indicators, plus the unmet need for contraception indicator.

4.1.3 Computation of health development indices using sub-national data: India

In this section we present exploratory work on the computation of our health development indices using data at the sub-national level. This exercise is useful to showcase the flexibility of the suggested methodological framework to provide policy insights at a higher granularity level.

Beyond a simple demonstration of the flexibility of our approach, there are important practical reasons why the calculation of health development indices with sub-national data is relevant from a policy standpoint. National governments may be interested in using the information on health needs, access to care and financial risk protection available across jurisdictions to inform their decisions about transfers from the central health budget to sub-

national levels of government. Such information could be incorporated, for instance, as further risk-adjusters – in addition to more traditional measures such as population size – into the capitated funding allocation models used by some national governments (e.g. in Europe and Latin America). From a different perspective, an international donor agency may wish to focus their efforts on the particular geographic areas that exhibit the lowest levels of health development within a given country, as opposed to supporting activities for the whole country population. This may arise from pressures around the need to distribute a limited amount of development assistance among many countries of very different population sizes. Since for individual agencies a decision to support the entire population of a large, low-health development country is likely to be financially unfeasible, having information on the specific levels of health development across jurisdictions may be critical to allow optimal targeting of resources within the country, while ensuring the availability of resources to support equally “deprived” populations in other countries. This would hence contribute to the achievement of maximum value-for-money for a given pot of resources according to the agency’s particular objectives.

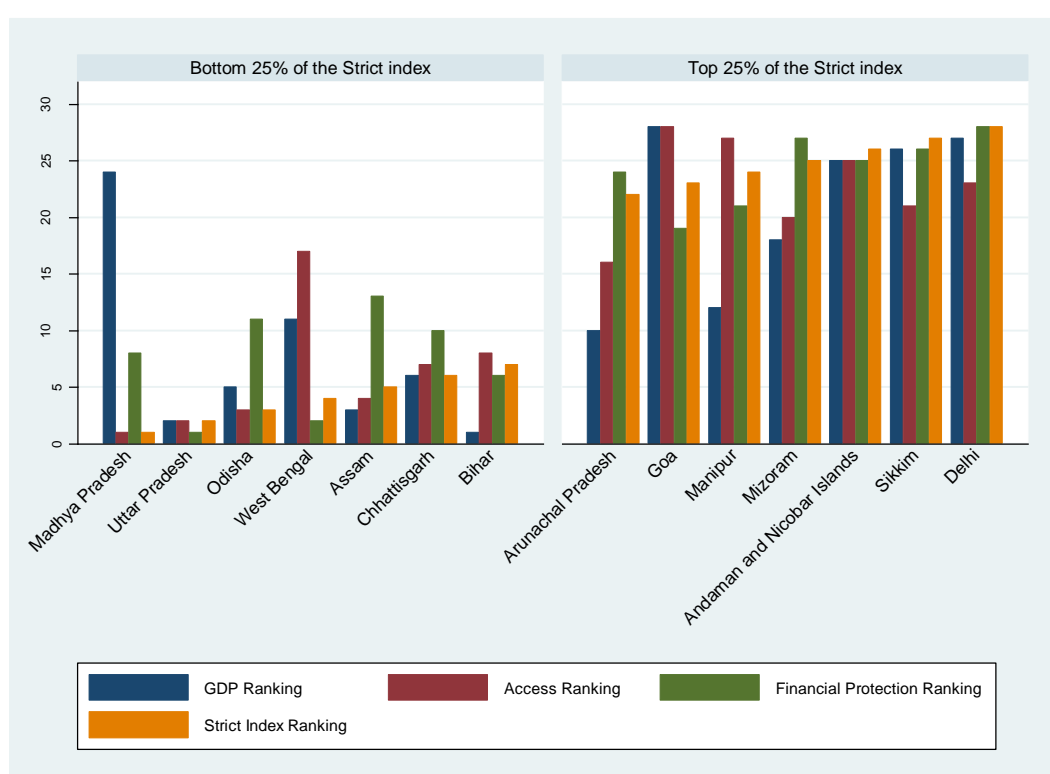
We choose India, one of the most populated countries in the world, as a case study to illustrate the issues above. India’s population is estimated to be over 1.2 billion people, distributed across 29 states and seven union territories (Census of India 2015). More than one-half of Indian states have a population of at least 30 million people, reaching around 100 million in Bihar, Maharashtra and West Bengal, and almost 200 million in Uttar Pradesh. Although India belongs to the middle-income World Bank category classification as indicated by its GNI per capita (US\$ 5,180 in 2013), the country’s ranking in the health development scale drops substantially if our “strict” index is used instead of GNI per capita. India becomes the 18th least developed country in the world with a measured “strict” index of just 0.409 (Table A2), driven by relatively similar poor performance on both the access to care given health needs and financial protection dimensions. In what follows we use our proposed methodology to examine whether and how such health development performance varies across Indian states.

The sub-national-level indicators used for this exercise are similar to the ones used for the cross-country analyses and are described in Table A5 in the Appendix. The conditions of access to necessary health services across Indian states are measured by the proportion of births attended by skilled health staff (% of total births in the most recent year). As for health needs, unfortunately data on DALYs lost are currently unavailable for Indian states. We predict the total number of DALYs lost for all causes in a given state based on a linear regression model estimated for all *countries* in the sample, with countries’ infant mortality rates as the single explanatory variable (the regression has good explanatory power, with an R^2 value of 0.731). DALYs for Indian states have then been predicted using the estimated coefficients from the regression model and the observed state infant mortality rates for year 2011. Finally, the financial protection indicator is constructed as public expenditure on health as a share of total health expenditure. The corresponding sub-indices and the “strict”

health development index for each state are then constructed using the same methodology as in the cross-country case (see Table 1). Given data availability we are able to compute the indices for 28 states; the full results are shown in Appendix Table A6.

Figure 17 illustrates how health development rankings for Indian states change from when we use GDP per capita as the single criterion, moving to assessing health development separately by access to care and financial risk protection, and by the overall “strict” index. For the sake of comparison we select the seven states in the bottom and top quartiles of the “strict” index.

Figure 17: Changes in health development rankings using different sub-indices, Indian states



Note: The vertical axis denotes the state ranking according to the corresponding index. Lower ranking (closer to 1) = worse health development performance.

This exercise demonstrates how the flexible nature of the “strict” index may be used to generate insights into the major obstacles for health development, beyond what can be provided by a simple examination of income levels, and this time with more disaggregated data. For example, among the 25% worse performers according to the “strict” index there are cases of relatively wealthy states such as Madhya Pradesh and West Bengal, alongside very poor states such as Bihar and Uttar Pradesh. The low levels of health development found in the latter two states are compounded by the relative scarcity of local resources to pay for health services, a situation that may be regarded as deserving particular attention by central government policies and international donor agencies, involving both financial and non-financial support mechanisms.

By contrast, the relatively higher ability to pay for healthcare in Madhya Pradesh and West Bengal may call for more nuanced approaches for development support. Madhya Pradesh's poor health development performance is driven primarily by deficient conditions of access to care given health needs, whereas in West Bengal the major development bottleneck refers to insufficient protection of residents against the financial consequences of healthcare payments. Central government policies may then be designed and targeted to the most pressing issue in each state, and donors may wish to adopt support mechanisms focused on non-financial aspects (e.g. technical assistance geared towards more equitable access to available health services by the poorest residents).

Some of these policies and support mechanisms could be designed based on success stories from other Indian states. Arunachal Pradesh, for instance, is among the top 25% states in terms of health development, with good performance both on the access and financial protection dimensions, despite an income level similar to West Bengal and much lower than Madhya Pradesh. Although Arunachal Pradesh may still require extra financial support from donors so as to maintain and expand health coverage for its residents, closer scrutiny of specific health policies managed locally may offer valuable lessons for other states on how to translate more effectively available resources for health into broader coverage. Analyses like these, complemented by more detailed field studies, may help international agencies allocate their scarce resources more efficiently by targeting support to specific bottlenecks in selected states.

Section 5 Concluding remarks: limitations and policy implications

5.1.1 Study limitations

The primary aim of the work for this report is to suggest an approach and operational methodology to measure health needs and constraints across countries, based on information broader than national income and relevant to assess levels of national development in health. Such an endeavour will always require the analyst to make simplifying assumptions about relationships among the variables examined, and the analyses will always be subject to methodological and practical limitations. In addition to other limitations mentioned throughout the report, we highlight below some important assumptions and caveats that need to be factored in when interpreting our results and drawing policy conclusions.

The basic assumption of our conceptual framework is that individuals care about both health and wealth for their welfare. We take as a starting point universal free access to all health treatments at the point of use; we then look at the welfare losses arising from the introduction of a user charge – i.e. non-pooled financing – for a given treatment. Thus our framework embodies the belief, echoed in the current global health debate, that the incorporation of welfare losses caused by deficiencies and inequities in timely access to necessary health services and financial risk protection should be key to any framework to assess the stage of development in health in countries. The usefulness of our approach to inform policy discussions will of course be diminished for a national or international agency that adopts alternative normative criteria and does not regard the notion of health coverage as the central basis for health development assessments.

As made clear throughout this report, data availability issues restrict the richness of usable information to operationalise our indices of health development based on coverage. For example, the construction of the access to care element of our theoretical index of health development requires a count of unmet needs in the whole system. Data limitations preclude, however, the use of some indicators that could have offered a better picture of that dimension. In practice we assume, based on the results from the literature, that the skilled birth attendance rate (supplemented, in an extension of the analysis, by an indicator of unmet contraception need) is a good proxy for the general conditions of access to the entire basket of services in a health system. We also assume that cross-country variations in deficiencies in access to necessary services will be translated to some extent into differences in the number of total DALYs lost. Some studies, on the other hand, have attempted to measure unmet need using survey data, based on the amount of healthcare that an individual, on average, would have received had they been treated as other individuals with the same age, gender and morbidity characteristics were treated (Wagstaff and van Doorslaer 2000). Such methodology could improve upon simpler indicators like skilled birth attendance rates to provide an estimate of the number of people foregoing access to

necessary care. Unfortunately the necessary survey data are simply not available for many countries at this point.

In principle, our coverage-based indices should refer specifically to the set of actually “needed” services. This is not straightforward to operationalise since the definition of what a needed service means is open to debate and may vary across societies (Culyer and Wagstaff 1993). We attempt to circumvent this problem in our access index by focusing on coverage information for services targeted at specific population groups, where everyone in the group is assumed to need the intervention (birth attended by skilled health professional for pregnant women, and contraceptive services for women who wish to avoid pregnancy).

The financial risk protection dimension of our suggested approach requires an estimate of the financial hardship caused by securing access to necessary care, with those on lowest incomes weighted most highly. We have already discussed in Section 3.1.2 the difficulties associated with finding comparable cross-country data on some catastrophic and impoverishing health spending indicators suggested in the literature. We therefore use the share of pooled prepaid health spending over total as a valid proxy (according to existing studies) for the degree of protection against the risk of falling into poverty because of health payments.

Yet it must be acknowledged that comparisons of the share of pooled health spending across countries may not necessarily reflect money well spent or the degree of protection against inefficient health spending. This is an intrinsic limitation not only of our chosen financial protection variable but also of more refined catastrophic health spending indicators. However, to the extent that the degree of efficiency in health spending can be captured by comparing national health expenditures and the corresponding benefits obtained in terms of population health, the joint examination of our measures of access to care (which include population health status proxied by DALYs lost) and financial protection (through shares of pooled health financing) through the “strict” health development index should incorporate some relevant information on efficiency, or how efficient a country is in translating pooled health financing into better outcomes.

The approach we have chosen to operationalise our indices of health development is similar to the mechanics behind the construction of the Human Development Index. We construct normalised sub-indices of performance in the dimensions of access, financial protection and financial constraints. Importantly, each of these sub-indices – as well as the indicators included in each of them – is given equal weight in the construction of the health development indices presented here. In other words, we avoid giving priority to any of these dimensions for country comparisons of health development. Some agencies may have different objectives within the health sector, with different priorities regarding health policy actions and population groups. These can be accommodated by varying the weighting scheme applied to the proxy indicators included and the relevant sub-indices.

5.1.2 Implications for policy

This report develops a framework for health development assessments based on a sound conceptual model and that can be easily operationalised and understood. The policy insights offered by our proposed health development indices is limited, as discussed above, by actual cross-country data availability, particularly on aspects related to coverage of necessary health services (at all levels of care) and degree of financial protection from healthcare payments. Thus, perhaps the first lesson from our analytical work is the urgent need for new data collection procedures specifically designed to address these issues using standardised instruments to allow cross-country comparison. Time series data are critical for health policy monitoring and evaluation, requiring data collection to be repeated using the same instrument such as standardised health facility and household surveys (for example, Living Standards Measurement Study surveys are the main time series data source for more detailed financial protection analyses in low-income countries). Since cost is a major determinant of the interval between national surveys, it seems important for international agencies to intensify current efforts to support regular data collection in low-income countries.

Subject to the data limitations above, our simulations offer potentially useful policy insights that are discussed in the previous sections. We now highlight some of the broad policy conclusions arising from the analyses. Once again, we stress that the precise policy implications and actions for each specific country must be informed by detailed case studies beyond the scope of our report.

Our approach does better than simple measures of GNI per capita to assess and compare national health development levels. In general, country rankings in the health development scale vary substantially when the conditions of access to care and financial protection in health are explicitly considered through our “strict” index, compared to GNI rankings. Several upper-middle-income and lower-middle income countries fall many positions in the rankings due to poor performance on access and financial protection, ranking in the bottom half of the development scale implied by our “strict” index. The indices also reflect adequately known progress made by some countries in system coverage given health needs.

Beyond a simple re-ranking of countries, the decomposition of changes in ranking between a GNI criterion and our health development indices sheds light on other important aspects for health policy. As an example, for the majority of countries whose health development ranking worsens substantially when our proposed indices are used instead of GNI only, such deterioration is driven mostly by accounting for their situation regarding access to care and financial risk protection in health (reflected in the “strict” index version). Accounting for financial constraints (the “extended” index version) tends to improve the ranking of these countries, suggesting that the relatively adequate domestic capacity to finance healthcare is not being channelled adequately through pooled prepaid sources and effectively expanding

access to needed health services. In these cases, the decomposition of the “strict” index into its access and financial protection components is able to provide leads on where the major bottlenecks for health development lie.

Moreover, our analyses can identify those country cases where there is a need for external support to fill in gaps in domestic ability to maintain and expand current health coverage levels, offering preliminary insights into specific support modalities (financial or non-financial) that may be more efficient to promote health development in a particular setting. Accounting for fiscal space aspects leads, for example, to noteworthy differentiation between African countries with similar health needs, based on their domestic capacity to ensure adequate health system funding. In instances where countries enjoy relatively good fiscal space, the case for external financial support may be weakened, pointing instead to support responses geared towards e.g. technical assistance and advocacy, rather than financial aid *per se*. Our indices are also able to flag cases where low ability to pay for health is a major hurdle for ameliorating low levels of health development. Finally, given data availability, similar analyses to the above can be conducted to help policy decision-making at the sub-national level, as demonstrated in this report for the Indian context.

We believe, therefore, that our methodological proposals can be helpful for policy-making in at least three broad informational categories: (i) to inform discussions around health resource allocation at the national and international levels; (ii) to inform programmatic choices and policy responses; and (iii) to inform priority-setting by international donor agencies.

With regard to category (iii) above, we note that the primary aim of this work from the outset has been to contribute to the measurement of health needs and constraints across countries, based on information broader than national income and relevant to assess levels of national development in health. Issues around how our proposed framework and health development measures could be used to inform funding allocation decisions by donors, in particular possibilities to incorporate our indices into donor resource allocation formulas, have only been discussed in the report for illustration purposes, in order to highlight the flexibility of our suggested approach.

We nonetheless acknowledge that the issue of development assistance is a fundamental one and often linked to country classification mechanisms. As a first approach to the issue, we envisage that our health indices could potentially be used as inputs within simple IDA-type allocation formulas, with alternative weights according to institutional preferences, or within more refined support allocation mechanisms such as capitation funding across and even within countries, for example with our “strict” index entered as a population risk-adjuster. This type of use for our proposed health development measures carries its own challenges of course. Some of these challenges are widely acknowledged in policy discussions, such as the potential for perverse incentives around indicator manipulation as countries seek to attract continued development support. Although any approach based on

measuring and country classification for aid entitlement is likely to be subject to perverse incentives to some extent, we believe that our guiding principle of selecting indicators mostly collected by international agencies through accepted mechanisms would help mitigate concerns about data manipulation. As such, the conceptual framework and health development measures proposed in this study could form the basis for discussions on new policies of national governments and international organisations to improve the health of populations.

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Appendix

Table A1: Indicator definitions and sources

Indicator	Description	Source
Skilled birth attendance	Births attended by skilled health staff (% of total)	World Bank; WHO; UNICEF
DALYs lost	Total number of DALYs lost for all causes, all ages (per 100,000)	Institute for Health Metrics and Evaluation
Pooled prepaid health expenditure	Pooled prepaid health expenditure (= total minus out-of-pocket) as share of total health expenditure (%)	WHO
GNI per capita	GNI per capita, PPP (international dollars)	World Bank
Tax revenue	Tax revenue (% of GDP)	World Bank
Government expenditure on health	General government expenditure on health (% total government expenditure)	WHO
Debt	Total debt service (% of GNI)	World Bank

Table A2: Full results of index computations

Country	GNI			Health Development						
	Position	GNI pc	GNI Index	Sub-indices			Strict Index		Extended Index	
				Access	Fin. Protection	Constraints	Position	Index	Position	Index
Central African Republic	1	586	0.002	0.216	0.549	0.033	12	0.344	3	0.158
Democratic Republic of the Congo	2	662	0.002	0.291	0.672	0.038	25	0.442	7	0.194
Malawi	3	726	0.003	0.330	0.883		55	0.540		
Burundi	4	747	0.003	0.296	0.797	0.053	39	0.486	13	0.232
Liberia	5	760	0.003	0.352	0.739	0.067	51	0.510	19	0.259
Niger	6	876	0.004	0.183	0.467	0.056	6	0.292	5	0.169
Mozambique	7	1072	0.006	0.259	0.936	0.090	42	0.492	22	0.279
Togo	8	1083	0.006	0.324	0.594	0.080	24	0.439	15	0.249
Eritrea	9	1129	0.006	0.284	0.452		13	0.359		
Guinea	10	1131	0.006	0.261	0.434	0.068	10	0.337	8	0.198
Madagascar	11	1326	0.008	0.337	0.698	0.073	38	0.485	18	0.258
Ethiopia	12	1333	0.008	0.224	0.645	0.070	15	0.380	11	0.216
Rwanda	13	1400	0.008	0.422	0.815	0.087	71	0.587	33	0.311
Burkina Faso	14	1444	0.009	0.328	0.667	0.096	34	0.468	21	0.276
Comoros	15	1447	0.009	0.475	0.548		50	0.510		
Guinea-Bissau	16	1456	0.009	0.179	0.566		8	0.318		
Solomon Islands	17	1498	0.009	0.549	0.966		127	0.728		
Gambia	18	1559	0.010	0.339	0.789	0.100	53	0.518	28	0.299
Uganda	19	1577	0.010	0.310	0.615	0.086	22	0.436	16	0.254
Mali	20	1587	0.010	0.213	0.397	0.102	5	0.291	9	0.205
Haiti	21	1653	0.010	0.302	0.702		30	0.461		
Sierra Leone	22	1697	0.011	0.267	0.385	0.089	9	0.320	10	0.209
Afghanistan	23	1703	0.011	0.242	0.260	0.074	3	0.251	4	0.167
Benin	24	1722	0.011	0.445	0.590	0.108	52	0.512	30	0.305
Chad	25	1847	0.012	0.136	0.388		1	0.230		
Senegal	26	2158	0.015	0.413	0.630	0.138	49	0.510	34	0.330
Papua New Guinea	27	2183	0.015	0.344	0.890	0.145	59	0.553	39	0.354
Nepal	28	2190	0.015	0.391	0.537	0.124	28	0.458	26	0.297
United Republic of Tanzania	29	2300	0.016	0.297	0.667	0.112	26	0.445	23	0.281
Kiribati	30	2337	0.016	0.444	0.999	0.132	96	0.666	45	0.389
Tajikistan	31	2417	0.017	0.584	0.397	0.106	37	0.482	25	0.290
Cameroon	32	2682	0.019	0.301	0.383	0.120	11	0.340	14	0.240
Kenya	33	2692	0.019	0.338	0.553	0.143	20	0.432	27	0.299
Vanuatu	34	2770	0.020	0.543	0.928	0.146	121	0.710	54	0.419
Sao Tome and Principe	35	2796	0.020	0.539	0.399	0.137	32	0.464	32	0.309
Cambodia	36	2812	0.020	0.478	0.401	0.125	23	0.438	24	0.289
Kyrgyzstan	37	2975	0.021	0.624	0.635	0.162	87	0.629	47	0.400
Côte d'Ivoire	38	2980	0.021	0.286	0.486	0.144	14	0.373	20	0.271
Bangladesh	39	3082	0.022	0.365	0.396	0.114	16	0.380	17	0.255
Mauritania	40	3255	0.023	0.392	0.536		29	0.458		
Lesotho	41	3278	0.024	0.222	0.856	0.308	21	0.436	44	0.388
Yemen	42	3491	0.025	0.383	0.257	0.126	7	0.314	12	0.232
Micronesia, Fed. Sts.	43	3537	0.026	0.647	0.905		143	0.765		
Zambia	44	3640	0.027	0.301	0.721	0.170	33	0.466	35	0.333
Sudan	45	3754	0.028	0.273	0.240	0.109	4	0.256	6	0.193
Ghana	46	3774	0.028	0.402	0.637	0.168	48	0.506	38	0.350
Honduras	47	3864	0.028	0.626	0.548	0.169	70	0.586	43	0.387
Marshall Islands	48	4278	0.032	0.476	0.876		92	0.646		
Nicaragua	49	4307	0.032	0.713	0.599	0.182	94	0.654	55	0.427
Lao People's Democratic Republic	50	4402	0.033	0.356	0.599	0.182	31	0.462	36	0.339
Pakistan	51	4680	0.035	0.370	0.449	0.163	17	0.408	29	0.300
Viet Nam	52	4906	0.037	0.706	0.505		75	0.597		
Republic of Moldova	53	5034	0.038	0.572	0.553	0.220	62	0.562	51	0.411
Tonga	54	5131	0.039	0.664	0.876		142	0.763		
Nigeria	55	5166	0.039	0.197	0.305	0.064	2	0.245	2	0.157
India	56	5180	0.039	0.403	0.416	0.170	18	0.409	31	0.305
Uzbekistan	57	5300	0.040	0.656	0.538		74	0.594		
Congo	58	5309	0.040	0.426	0.782	0.128	66	0.577	37	0.349
Swaziland	59	5407	0.041	0.274	0.894		45	0.495		
Samoa	60	5472	0.041	0.665	0.934	0.000	151	0.788	1	0.000
Bolivia (Plurinational State of)	61	5555	0.042	0.604	0.801	0.221	111	0.696	65	0.475
Guyana	62	5787	0.044	0.538	0.686		80	0.607		
Cabo Verde	63	5962	0.045	0.637	0.768	0.235	114	0.699	69	0.486
Bhutan	64	6705	0.052	0.537	0.745	0.180	88	0.633	52	0.416
Morocco	65	6776	0.052	0.597	0.414	0.295	47	0.497	53	0.418
Georgia	66	6799	0.052	0.580	0.379	0.293	35	0.469	48	0.401
Angola	67	6869	0.053	0.265	0.755	0.261	27	0.448	41	0.374
Guatemala	68	6895	0.053	0.468	0.480	0.198	36	0.474	40	0.354
Fiji	69	7002	0.054	0.562	0.790	0.292	97	0.666	78	0.506
El Salvador	70	7255	0.056	0.665	0.715	0.236	108	0.690	68	0.482
Timor-Leste	71	7357	0.057	0.370	0.918		68	0.583		
Jamaica	72	7377	0.057	0.699	0.749	0.325	124	0.724	94	0.554
Paraguay	73	7383	0.057	0.708	0.432	0.223	58	0.553	50	0.409
Philippines	74	7598	0.059	0.569	0.431	0.227	46	0.495	42	0.382
Belize	75	7614	0.059	0.675	0.737	0.302	118	0.706	86	0.532

Table A2: Full results of index computations (*continued*)

Country	GNI			Health Development						
	Position	GNI pc	GNI Index	Sub-indices			Strict Index		Extended Index	
				Access	Fin. Protection	Constraints	Position	Index	Position	Index
Armenia	76	7891	0.061	0.649	0.451	0.279	56	0.541	58	0.434
Ukraine	77	8199	0.064	0.515	0.571	0.282	57	0.542	59	0.436
Sri Lanka	78	9177	0.072	0.703	0.534	0.242	82	0.612	61	0.449
Namibia	79	9212	0.072	0.445	0.929	0.337	91	0.643	80	0.518
Indonesia	80	9446	0.074	0.605	0.541	0.240	64	0.572	56	0.428
Bosnia and Herzegovina	81	9508	0.074	0.661	0.709	0.325	105	0.685	88	0.534
St. Vincent and the Grenadines	82	9695	0.076	0.662	0.826	0.345	134	0.740	99	0.574
Tunisia	83	9719	0.076	0.760	0.646	0.330	115	0.700	91	0.545
Albania	84	10004	0.078	0.642	0.483	0.304	61	0.557	62	0.455
Turkmenistan	85	10055	0.079	0.582	0.654		83	0.617		
Dominica	86	10117	0.079	0.689	0.730	0.343	120	0.709	95	0.557
Mongolia	87	10223	0.080	0.540	0.629	0.289	69	0.583	63	0.462
St. Lucia	88	10373	0.081	0.678	0.575	0.358	85	0.624	81	0.519
Ecuador	89	10385	0.081	0.658	0.549		77	0.601		
Egypt	90	10439	0.082	0.583	0.418	0.271	44	0.494	49	0.404
Grenada	91	10765	0.085	0.656	0.493	0.328	63	0.569	64	0.474
Peru	92	10819	0.085	0.695	0.650	0.310	100	0.672	82	0.519
Maldives	93	11103	0.087	0.880	0.624	0.285	136	0.741	90	0.539
Dominican Republic	94	11252	0.089	0.670	0.609	0.272	89	0.639	67	0.481
Jordan	95	11290	0.089	0.757	0.764	0.304	140	0.760	96	0.560
The former Yugoslav republic of Macedonia	96	11365	0.089	0.671	0.688	0.317	101	0.679	84	0.527
Libya	97	11377	0.090	0.768	0.702		130	0.734		
Colombia	98	11615	0.091	0.719	0.861	0.288	149	0.787	98	0.563
China	99	11747	0.093	0.735	0.660	0.256	112	0.696	75	0.499
South Africa	100	12134	0.096	0.397	0.929	0.408	81	0.607	87	0.532
Serbia	101	12353	0.097	0.560	0.620	0.362	73	0.589	76	0.501
Algeria	102	12486	0.099	0.732	0.748	0.501	135	0.740	119	0.650
Thailand	103	13050	0.103	0.668	0.887	0.341	146	0.770	104	0.587
Costa Rica	104	13134	0.104	0.813	0.766	0.311	152	0.790	101	0.579
Iraq	105	13234	0.105	0.645	0.634		90	0.640		
Montenegro	106	14453	0.115	0.639	0.572		78	0.604		
Suriname	107	14672	0.116	0.581	0.856	0.393	116	0.705	102	0.580
Barbados	108	14927	0.118	0.661	0.680	0.451	99	0.670	105	0.587
Bulgaria	109	15017	0.119	0.551	0.603	0.393	65	0.576	79	0.507
Brazil	110	15288	0.121	0.676	0.700	0.345	107	0.688	92	0.547
Gabon	111	15657	0.124	0.400	0.610		43	0.494		
Azerbaijan	112	15861	0.126	0.648	0.287	0.334	19	0.431	46	0.396
Mexico	113	15863	0.126	0.708	0.558	0.292	86	0.628	70	0.487
Botswana	114	16035	0.127	0.489	0.946	0.482	102	0.680	111	0.606
Mauritius	115	16221	0.129	0.673	0.534	0.409	76	0.599	85	0.528
Belarus	116	16284	0.129	0.509	0.680	0.366	72	0.589	77	0.502
Panama	117	16330	0.130	0.725	0.750	0.286	131	0.738	89	0.538
Lebanon	118	16491	0.131	0.725	0.656	0.372	109	0.690	97	0.562
Romania	119	17068	0.136	0.587	0.802	0.418	106	0.687	103	0.582
Venezuela, RB	120	17079	0.136	0.702	0.340	0.379	40	0.488	60	0.449
Turkey	121	18378	0.146	0.731	0.850	0.451	150	0.788	120	0.654
Uruguay	122	18697	0.149	0.671	0.829	0.437	139	0.746	114	0.624
Cuba	123	18712	0.149	0.686	0.930		156	0.799		
Antigua and Barbuda	124	19290	0.154	0.719	0.732	0.442	125	0.726	113	0.615
Croatia	125	19621	0.157	0.614	0.875	0.457	129	0.733	116	0.626
Kazakhstan	126	20305	0.162	0.577	0.536	0.392	60	0.556	73	0.495
Equatorial Guinea	127	20918	0.167	0.299	0.807	0.484	41	0.491	71	0.489
Chile	128	20959	0.167	0.774	0.682	0.468	126	0.727	117	0.627
Poland	129	21611	0.173	0.626	0.771	0.434	110	0.695	108	0.594
Latvia	130	21630	0.173	0.578	0.634	0.337	79	0.605	74	0.498
Bahamas	131	21656	0.173	0.639	0.697	0.428	98	0.668	100	0.576
Malaysia	132	21812	0.174	0.788	0.638	0.438	119	0.709	109	0.604
Hungary	133	22042	0.176	0.580	0.724	0.525	93	0.648	110	0.604
Russian Federation	134	22610	0.181	0.523	0.519	0.431	54	0.521	72	0.489
Lithuania	135	23912	0.192	0.569	0.673	0.773	84	0.619	125	0.666
Estonia	136	24635	0.197	0.602	0.810	0.468	113	0.698	112	0.611
Trinidad and Tobago	137	24990	0.200	0.588	0.574	0.622	67	0.581	107	0.594
Slovakia	138	25261	0.202	0.649	0.778	0.410	122	0.711	106	0.592
Portugal	139	25420	0.204	0.634	0.733	0.534	103	0.682	118	0.628
Czech Republic	140	26131	0.210	0.659	0.843	0.439	138	0.745	115	0.624
Malta	141	26757	0.215	0.728	0.684	0.629	117	0.706	128	0.679
Slovenia	142	27167	0.218	0.675	0.879	0.511	147	0.770	126	0.672
Cyprus	143	29165	0.234	0.874	0.535	0.610	104	0.684	122	0.658
New Zealand	144	31955	0.257	0.710	0.893	0.711	155	0.796	138	0.767
Italy	145	33757	0.272	0.667	0.819	0.647	133	0.739	132	0.707
Bahrain	146	35762	0.288	0.866	0.854	0.146	162	0.860	66	0.476
United Kingdom	147	36576	0.295	0.693	0.907	0.713	154	0.793	137	0.765
Oman	148	36741	0.296	0.838	0.877	0.229	161	0.857	93	0.552
Japan	149	36906	0.297	0.729	0.856	0.452	153	0.790	121	0.656
Ireland	150	37877	0.305	0.785	0.831	0.677	157	0.808	136	0.762

Table A2: Full results of index computations (*continued*)

Country	GNI			Health Development						
	Position	GNI pc	GNI Index	Sub-indices			Strict Index		Extended Index	
				Access	Fin. Protection	Constraints	Position	Index	Position	Index
Finland	151	38914	0.314	0.651	0.814	0.653	128	0.728	131	0.702
Belgium	152	40222	0.324	0.657	0.830	0.742	132	0.739	134	0.740
Canada	153	41607	0.335	0.720	0.849	0.512	148	0.782	127	0.679
Australia	154	41796	0.337	0.727	0.808	0.701	144	0.766	135	0.744
Germany	155	43994	0.355	0.635	0.871	0.528	137	0.744	124	0.664
Austria	156	44022	0.355	0.689	0.842	0.665	141	0.762	133	0.728
Netherlands	157	45117	0.364	0.698	0.946	0.700	159	0.813	139	0.773
Saudi Arabia	158	52008	0.420	0.828	0.801		160	0.815		
United States of America	159	52097	0.421	0.671	0.882	0.551	145	0.769	129	0.688
Switzerland	160	55649	0.450	0.707	0.740	0.547	123	0.724	123	0.659
United Arab Emirates	161	59124	0.478	0.931	0.811	0.105	163	0.869	57	0.430
Luxembourg	162	60011	0.485	0.736	0.892	0.920	158	0.810	140	0.845
Singapore	163	75400	0.610	1.000	0.430	0.759	95	0.656	130	0.689
Kuwait	164	85119	0.690	0.932	0.843	0.181	164	0.886	83	0.522
Qatar	165	123282	1.000	0.954	0.916	1.000	165	0.935	141	0.956

Notes: Countries in ascending order according to GNI per capita. Position 1 = lowest ranked country (worst performance) according to the specific index. Lower positions (closer to 1) indicate worse performance, i.e. lower health development (according to the “strict” index) or lower health development and higher financial constraints (according to the “extended” index). See text and Table A1 for definition of indicators and indices.

Table A3: Detailed methodology for computation of “strict”, “fiscal space” and “strict + fiscal” indices

Dimension	Aspect	Indicator	Minimum value (full = full sample, all countries, 1995-2013)	Maximum value (full = full sample, all countries, 1995-2013)	From indicator to sub-index (t = 2013 = latest year) (full = full sample, all countries, 1995-2013)	Dimension-specific index (geo mean = geometric mean) (t = 2013 = latest year) (full = full sample, all countries, 1995-2013)	Strict index	Strict + fiscal index
Access to care	Unmet health needs	Skilled birth attendance (%)	0	100	(1) $\frac{actual\ value(t) - \min\ value\ (full)}{\max\ value\ (full) - \min\ value\ (full)}$	(a) $\frac{geo\ mean(1,2)(t)}{\max\ value\ (geo\ mean\ (1,2))\ (full)}$ = $\frac{\sqrt{index(1)(t) \times index(2)(t)}}{\max\ value\ (geo\ mean(1,2))(full)}$	$\sqrt{a \times b}$	$\sqrt[3]{a \times b \times c}$
	Total health needs	Total DALYs lost (inverse of)	$\frac{1}{\max\ value\ (full)}$	$\frac{1}{\min\ value\ (full)}$	(2) $\frac{\frac{1}{actual\ value\ (t)} - \frac{1}{\max\ value\ (full)}}{\frac{1}{\min\ value\ (full)} - \frac{1}{\max\ value\ (full)}}$			
Financial protection	Protection against financial hardship caused by out-of-pocket health payments	Pooled health expenditure (% total health expenditure)	Observed min value (full)	Observed max value (full)	(3) $\frac{actual\ value(t) - \min\ value\ (full)}{\max\ value\ (full) - \min\ value\ (full)}$	(b) Same as (3)		
Fiscal space	Domestic capacity to finance health and expand coverage	Tax revenue (% GDP)	Observed min value (full)	Observed max value (full)	(4) $\frac{actual\ value(t) - \min\ value\ (full)}{\max\ value\ (full) - \min\ value\ (full)}$	(c) $\frac{geo\ mean(4,5,6)(t)}{\max\ value\ (geo\ mean(4,5,6))\ (full)}$		
		Government expenditure on health (% total government expenditure)	Observed min value (full)	Observed max value (full)	(5) $\frac{actual\ value(t) - \min\ value\ (full)}{\max\ value\ (full) - \min\ value\ (full)}$			
		Total debt service (% GNI) (inverse of)	$\frac{1}{\max\ value\ (full)}$	$\frac{1}{\min\ value\ (full)}$	(6) $\frac{\frac{1}{actual\ value\ (t)} - \frac{1}{\max\ value\ (full)}}{\frac{1}{\min\ value\ (full)} - \frac{1}{\max\ value\ (full)}}$			

Table A4: Full results of index computations: “strict”, “fiscal space” and “strict + fiscal”

Country	GNI			Strict Index		Fiscal Space Index		Strict + Fiscal Index	
	Position	GNI pc	GNI Index	Position	Index	Position	Index	Position	Index
Central African Republic	1	586	0.002	12	0.344	91	0.649	35	0.425
Democratic Republic of the Congo	2	662	0.002	25	0.442	68	0.425	39	0.437
Malawi	3	726	0.003	55	0.540				
Burundi	4	747	0.003	39	0.486	74	0.491	56	0.488
Liberia	5	760	0.003	51	0.510	95	0.867	90	0.609
Niger	6	876	0.004	6	0.292	80	0.511	13	0.352
Mozambique	7	1072	0.006	42	0.492	83	0.524	64	0.502
Togo	8	1083	0.006	24	0.439	82	0.515	49	0.463
Eritrea	9	1129	0.006	13	0.359				
Guinea	10	1131	0.006	10	0.337	54	0.363	10	0.345
Madagascar	11	1326	0.008	38	0.485	81	0.513	60	0.494
Ethiopia	12	1333	0.008	15	0.380	69	0.442	27	0.399
Rwanda	13	1400	0.008	71	0.587	93	0.756	94	0.638
Burkina Faso	14	1444	0.009	34	0.468	89	0.647	69	0.521
Comoros	15	1447	0.009	50	0.510				
Guinea-Bissau	16	1456	0.009	8	0.318				
Solomon Islands	17	1498	0.009	127	0.728				
Gambia	18	1559	0.010	53	0.518	55	0.364	45	0.460
Uganda	19	1577	0.010	22	0.436	96	0.869	76	0.549
Mali	20	1587	0.010	5	0.291	84	0.538	15	0.357
Haiti	21	1653	0.010	30	0.461				
Sierra Leone	22	1697	0.011	9	0.320	85	0.538	24	0.381
Afghanistan	23	1703	0.011	3	0.251	92	0.662	11	0.347
Benin	24	1722	0.011	52	0.512	71	0.451	58	0.491
Chad	25	1847	0.012	1	0.230				
Senegal	26	2158	0.015	49	0.510	45	0.330	41	0.441
Papua New Guinea	27	2183	0.015	59	0.553	5	0.168	19	0.372
Nepal	28	2190	0.015	28	0.458	76	0.499	54	0.471
United Republic of Tanzania	29	2300	0.016	26	0.445	90	0.647	65	0.504
Kiribati	30	2337	0.016	96	0.666				
Tajikistan	31	2417	0.017	37	0.482	17	0.210	18	0.365
Cameroon	32	2682	0.019	11	0.340	70	0.450	20	0.373
Kenya	33	2692	0.019	20	0.432	57	0.373	31	0.411
Vanuatu	34	2770	0.020	121	0.710	86	0.571	95	0.660
Sao Tome and Principe	35	2796	0.020	32	0.464				
Cambodia	36	2812	0.020	23	0.438	60	0.386	34	0.420
Kyrgyzstan	37	2975	0.021	87	0.629	41	0.317	63	0.500
Côte d'Ivoire	38	2980	0.021	14	0.373	28	0.271	8	0.335
Bangladesh	39	3082	0.022	16	0.380	51	0.359	21	0.373
Mauritania	40	3255	0.023	29	0.458				
Lesotho	41	3278	0.024	21	0.436	94	0.781	71	0.530
Yemen	42	3491	0.025	7	0.314	33	0.281	3	0.303
Micronesia, Fed. Sts.	43	3537	0.026	143	0.765				
Zambia	44	3640	0.027	33	0.466	78	0.504	55	0.479
Sudan	45	3754	0.028	4	0.256	75	0.493	4	0.318
Ghana	46	3774	0.028	48	0.506	61	0.389	50	0.463
Honduras	47	3864	0.028	70	0.586	38	0.291	51	0.464
Marshall Islands	48	4278	0.032	92	0.646				
Nicaragua	49	4307	0.032	94	0.654	48	0.349	72	0.530
Lao People's Democratic Republic	50	4402	0.033	31	0.462	10	0.198	12	0.348
Pakistan	51	4680	0.035	17	0.408	14	0.205	6	0.324
Viet Nam	52	4906	0.037	75	0.597				
Republic of Moldova	53	5034	0.038	62	0.562	37	0.288	44	0.450
Tonga	54	5131	0.039	142	0.763				
Nigeria	55	5166	0.039	2	0.245	87	0.615	7	0.333
India	56	5180	0.039	18	0.409	20	0.227	9	0.336
Uzbekistan	57	5300	0.040	74	0.594				
Congo	58	5309	0.040	66	0.577	21	0.237	37	0.429
Swaziland	59	5407	0.041	45	0.495				
Samoa	60	5472	0.041	151	0.788	1	0.000	1	0.000
Bolivia (Plurinational State of)	61	5555	0.042	111	0.696	66	0.396	84	0.577
Guyana	62	5787	0.044	80	0.607				
Cabo Verde	63	5962	0.045	114	0.699	62	0.391	83	0.576
Bhutan	64	6705	0.052	88	0.633	13	0.204	38	0.434
Morocco	65	6776	0.052	47	0.497	26	0.261	28	0.401
Georgia	66	6799	0.052	35	0.469	12	0.204	14	0.355
Angola	67	6869	0.053	27	0.448	34	0.281	25	0.384
Guatemala	68	6895	0.053	36	0.474	63	0.393	43	0.445
Fiji	69	7002	0.054	97	0.666	77	0.503	88	0.607
El Salvador	70	7255	0.056	108	0.690	50	0.352	77	0.551
Timor-Leste	71	7357	0.057	68	0.583				
Jamaica	72	7377	0.057	124	0.724	30	0.272	70	0.523
Paraguay	73	7383	0.057	58	0.553	18	0.213	29	0.402
Philippines	74	7598	0.059	46	0.495	49	0.350	42	0.441
Belize	75	7614	0.059	118	0.706	31	0.276	68	0.516

Table A4: Full results of index computations: “strict”, “fiscal space” and “strict + fiscal”
(continued)

Country	GNI			Strict Index		Fiscal Space Index		Strict + Fiscal Index	
	Position	GNI pc	GNI Index	Position	Index	Position	Index	Position	Index
Armenia	76	7891	0.061	56	0.541	4	0.166	17	0.365
Ukraine	77	8199	0.064	57	0.542	8	0.187	23	0.380
Sri Lanka	78	9177	0.072	82	0.612	32	0.278	52	0.471
Namibia	79	9212	0.072	91	0.643				
Indonesia	80	9446	0.074	64	0.572	19	0.215	32	0.413
Bosnia and Herzegovina	81	9508	0.074	105	0.685	47	0.346	75	0.545
St. Vincent and the Grenadines	82	9695	0.076	134	0.740	67	0.401	87	0.603
Tunisia	83	9719	0.076	115	0.700	44	0.327	74	0.543
Albania	84	10004	0.078	61	0.557	46	0.337	53	0.471
Turkmenistan	85	10055	0.079	83	0.617				
Dominica	86	10117	0.079	120	0.709	56	0.369	82	0.570
Mongolia	87	10223	0.080	69	0.583	11	0.199	30	0.407
St. Lucia	88	10373	0.081	85	0.624	72	0.455	81	0.562
Ecuador	89	10385	0.081	77	0.601				
Egypt	90	10439	0.082	44	0.494	42	0.323	36	0.429
Grenada	91	10765	0.085	63	0.569	40	0.306	48	0.463
Peru	92	10819	0.085	100	0.672	59	0.375	79	0.553
Maldives	93	11103	0.087	136	0.741	53	0.361	85	0.583
Dominican Republic	94	11252	0.089	89	0.639	39	0.299	62	0.496
Jordan	95	11290	0.089	140	0.760	58	0.374	86	0.600
The former Yugoslav republic of Macedonia	96	11365	0.089	101	0.679	24	0.257	59	0.491
Libya	97	11377	0.090	130	0.734				
Colombia	98	11615	0.091	149	0.787	64	0.394	93	0.625
China	99	11747	0.093	112	0.696	88	0.623	96	0.671
South Africa	100	12134	0.096	81	0.607	73	0.467	80	0.557
Serbia	101	12353	0.097	73	0.589	16	0.209	33	0.417
Algeria	102	12486	0.099	135	0.740	97	1.000	97	0.818
Thailand	103	13050	0.103	146	0.770	65	0.395	91	0.616
Costa Rica	104	13134	0.104	152	0.790	52	0.361	89	0.608
Iraq	105	13234	0.105	90	0.640				
Montenegro	106	14453	0.115	78	0.604				
Suriname	107	14672	0.116	116	0.705				
Barbados	108	14927	0.118	99	0.670				
Bulgaria	109	15017	0.119	65	0.576	23	0.254	40	0.438
Brazil	110	15288	0.121	107	0.688	25	0.257	61	0.495
Gabon	111	15657	0.124	43	0.494				
Azerbaijan	112	15861	0.126	19	0.431	6	0.175	5	0.319
Mexico	113	15863	0.126	86	0.628	43	0.325	66	0.505
Botswana	114	16035	0.127	102	0.680	79	0.510	92	0.618
Mauritius	115	16221	0.129	76	0.599	3	0.149	22	0.377
Belarus	116	16284	0.129	72	0.589	35	0.282	46	0.460
Panama	117	16330	0.130	131	0.738	36	0.283	73	0.536
Lebanon	118	16491	0.131	109	0.690	22	0.246	57	0.489
Romania	119	17068	0.136	106	0.687	15	0.208	47	0.461
Venezuela, RB	120	17079	0.136	40	0.488	9	0.194	16	0.359
Turkey	121	18378	0.146	150	0.788	29	0.272	78	0.553
Uruguay	122	18697	0.149	139	0.746				
Cuba	123	18712	0.149	156	0.799				
Antigua and Barbuda	124	19290	0.154	125	0.726				
Croatia	125	19621	0.157	129	0.733				
Kazakhstan	126	20305	0.162	60	0.556	7	0.187	26	0.387
Equatorial Guinea	127	20918	0.167	41	0.491				
Chile	128	20959	0.167	126	0.727				
Poland	129	21611	0.173	110	0.695				
Latvia	130	21630	0.173	79	0.605				
Bahamas	131	21656	0.173	98	0.668				
Malaysia	132	21812	0.174	119	0.709	27	0.264	67	0.510
Hungary	133	22042	0.176	93	0.648	1	0.000	1	0.000
Russian Federation	134	22610	0.181	54	0.521				
Lithuania	135	23912	0.192	84	0.619				
Estonia	136	24635	0.197	113	0.698				
Trinidad and Tobago	137	24990	0.200	67	0.581				
Slovakia	138	25261	0.202	122	0.711				
Portugal	139	25420	0.204	103	0.682				
Czech Republic	140	26131	0.210	138	0.745				
Malta	141	26757	0.215	117	0.706				
Slovenia	142	27167	0.218	147	0.770				
Cyprus	143	29165	0.234	104	0.684				
New Zealand	144	31955	0.257	155	0.796				
Italy	145	33757	0.272	133	0.739				
Bahrain	146	35762	0.288	162	0.860				
United Kingdom	147	36576	0.295	154	0.793				
Oman	148	36741	0.296	161	0.857				
Japan	149	36906	0.297	153	0.790				
Ireland	150	37877	0.305	157	0.808				

Table A4: Full results of index computations: “strict”, “fiscal space” and “strict + fiscal”
(continued)

Country	GNI			Strict Index		Fiscal Space Index		Strict + Fiscal Index	
	Position	GNI pc	GNI Index	Position	Index	Position	Index	Position	Index
Finland	151	38914	0.314	128	0.728				
Belgium	152	40222	0.324	132	0.739				
Canada	153	41607	0.335	148	0.782				
Australia	154	41796	0.337	144	0.766				
Germany	155	43994	0.355	137	0.744				
Austria	156	44022	0.355	141	0.762				
Netherlands	157	45117	0.364	159	0.813				
Saudi Arabia	158	52008	0.420	160	0.815				
United States of America	159	52097	0.421	145	0.769				
Switzerland	160	55649	0.450	123	0.724				
United Arab Emirates	161	59124	0.478	163	0.869				
Luxembourg	162	60011	0.485	158	0.810				
Singapore	163	75400	0.610	95	0.656				
Kuwait	164	85119	0.690	164	0.886				
Qatar	165	123282	1.000	165	0.935				

Notes: Countries in ascending order according to GNI per capita. Position 1 = lowest ranked country according to the specific index. Lower positions (closer to 1) indicate: lower health development (according to the “strict” index); narrower fiscal space (according to the “fiscal space” index); and lower health development and narrower fiscal space combined (according to the “strict + fiscal” index). See text and Tables 1, A1 and A3 for definition of indicators and indices.

Table A5: Indicator definitions and sources – Indian sub-national data

Indicator	Description	Source
Skilled birth attendance	Births attended by skilled health staff (% of total)	Coverage Evaluation Survey 2009. India Ministry of Health and Family Welfare
DALYs lost	Total number of DALYs lost for all causes, all ages (per 100,000)	Authors' own calculations. Predicted values based on a linear regression model estimated for all countries in the sample, with countries' infant mortality rates as explanatory variable. DALYs for Indian states have then been predicted using the results from the regression model and the states' infant mortality rates for year 2011 (Open Government Data Platform India, 2015)
Pooled prepaid health expenditure	Public expenditure on health as share of total health expenditure (%)	National Health Accounts India 2004-05. India Ministry of Health and Family Welfare
GDP per capita	Per capita net state domestic product at constant (2004-05) prices, Rupees, 2013-14	Open Government Data Platform India 2015 (https://data.gov.in/)

Table A6: Full results of index computations: Indian states

State	GDP			Health Development			
				Sub-indices		Strict Index	
	Position	GDP pc	GDP Index	Access	Fin. Protection	Position	Index
Bihar	1	15506	0.000	0.314	0.085	7	0.163
Uttar Pradesh	2	19233	0.031	0.117	0.021	2	0.050
Assam	3	23392	0.065	0.169	0.119	5	0.142
Maharashtra	4	24042	0.070	0.685	0.068	12	0.216
Odisha	5	24929	0.077	0.130	0.112	3	0.120
Chhattisgarh	6	28373	0.106	0.270	0.095	6	0.160
Jharkhand	7	28882	0.110	0.353	0.247	16	0.296
Jammu and Kashmir	8	31054	0.128	0.438	0.502	21	0.469
Rajasthan	9	31836	0.134	0.244	0.164	10	0.200
Arunachal Pradesh	10	36019	0.168	0.531	0.586	22	0.558
West Bengal	11	36293	0.171	0.533	0.029	4	0.124
Manipur	12	37154	0.178	0.910	0.408	24	0.609
Meghalaya	13	41094	0.210	0.227	0.463	17	0.324
Andhra Pradesh	14	42170	0.219	0.438	0.083	9	0.190
Karnataka	15	45024	0.242	0.543	0.210	18	0.338
Tripura	16	47261	0.261	0.615	0.134	15	0.287
Punjab	17	49411	0.278	0.538	0.085	11	0.214
Mizoram	18	49963	0.283	0.548	0.822	25	0.671
Himachal Pradesh	19	54494	0.320	0.388	0.382	20	0.385
Uttarakhand	20	59161	0.358	0.430	0.287	19	0.352
Tamil Nadu	21	62361	0.384	0.787	0.079	14	0.250
Gujarat	22	63168	0.391	0.444	0.118	13	0.229
Haryana	23	67260	0.425	0.359	0.093	8	0.183
Madhya Pradesh	24	69584	0.444	0.000	0.088	1	0.000
Andaman and Nicobar Islands	25	72716	0.469	0.738	0.623	26	0.678
Sikkim	26	83527	0.558	0.606	0.762	27	0.679
Delhi	27	127667	0.920	0.636	0.824	28	0.724
Goa	28	137401	1.000	1.000	0.329	23	0.573

Notes: States in ascending order according to GDP per capita (in Rupees). Position 1 = lowest ranked state (worst performance) according to the specific index. Lower positions (closer to 1) according to the “strict” index indicate worse performance, i.e. lower health development. See text and Table A5 for definition of indicators and indices.