Progress on impoverishing health spending in 122 countries: a retrospective observational study

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Summary

Background The goal of universal health coverage (UHC) requires that families who get needed health care do not suffer financial hardship as a result. This can be measured by instances of impoverishment, when a household's consumption including out-of-pocket spending on health is more than the poverty line but its consumption, excluding out-of-pocket spending, is less than the poverty line. This links UHC directly to the policy goal of reducing poverty.

Methods We measure the incidence and depth of impoverishment as the difference in the poverty head count and poverty gap with and without out-of-pocket spending included in household total consumption. We use three poverty lines: the US$1·90 per day and $3·10 per day international poverty lines and a relative poverty line of 50% of median consumption per capita. We estimate impoverishment in 122 countries using 516 surveys between 1984 and 2015. We estimate the global incidence of impoverishment due to out-of-pocket payments by aggregating up from each country, using a survey for the year in question when available, and interpolation and model-based estimates otherwise. We do not derive global estimates to measure the depth of impoverishment but focus on the median depth for the 122 countries in our sample, accounting for 90% of the world's population.

Findings We find impoverishment due to out-of-pocket spending even in countries where the entire population is officially covered by a health insurance scheme or by national or subnational health services. Incidence is negatively correlated with the share of total health spending channelled through social security funds and other government agencies. Across countries, the population-weighted median annual rate of change of impoverishment is negative at the $1·90 per day poverty line but positive at the $3·10 per day and relative poverty lines. We estimate that at the $1·90 per day poverty line, the worldwide incidence of impoverishment decreased between 2000 and 2010, from 131 million people (2·1% of the world's population) to 97 million people (1·4%). The population-weighted median of the poverty gap increase attributable to out-of-pocket health expenditures among the 122 countries in our sample are ¢1·22 per capita at the $1·90 per day poverty line and ¢3·74 per capita at the $3·10 per day poverty line. In all countries, out-of-pocket spending can be both catastrophic and impoverishing at all income levels, but this partly depends on the choice of the poverty line.

Interpretation Out-of-pocket spending on health can add to the poverty head count and the depth of poverty by diverting household spending from non-health budget items. The scale of such impoverishment varies between countries and depends on the poverty line but might in some low-income countries account for as much as four percentage points of the poverty head count. Increasing the share of total health expenditure that is prepaid, especially through taxes and mandatory contributions, can help reduce impoverishment.

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See Comment page e124

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Introduction

Although the share of health spending financed out of pocket has been decreasing worldwide, out-of-pocket spending as a share of household consumption has been increasing.[1] This poses a challenge to attaining both aspects of universal health coverage (UHC): that everyone, poor and rich alike, should receive needed health care, and that families who do get needed care do not suffer undue financial hardship as a result.[2] This second dimension of UHC, referred to as financial protection, can be captured through two indicators.[2,3] In a companion paper,[4] we present global estimates for one of them, namely so-called catastrophic out-of-pocket expenditures, defined as expenditures that are especially large relative to a family's total income or consumption; this is the official UHC financial protection monitoring indicator for the Sustainable Development Goal (SDG) 3.8.2. Here we present results for the second widely used indicator of financial protection, namely impoverishment due to out-of-pocket health spending.[3,5–10] This is not an official

Research in context

Evidence before this study

The most recent global study on impoverishing out-of-pocket expenditures was based on 116 surveys covering 89 countries with a median survey year of 1997. That study classified a household as poor if its consumption fell short of an allowance for food expenditures. The latter was set equal to average food spending among households whose food spending share (as a percentage of total consumption) was in the 45th to 55th percentile range, the assumption being that, at least in low-income and middle-income countries, the food intake of this group averages 2000 kcal. 100 million people worldwide and annually (an additional 1·7% of the population) were estimated to have fallen into poverty because of out-of-pocket health spending, with 90% of those people living in low-income countries. The study did not explore the relationship between impoverishing spending and macroeconomic and health-system characteristics, and it did not measure the extent to which out-of-pocket expenditures exacerbate the depth of poverty.

A regional study of 11 low-income and middle-income Asian countries estimated the impoverishing effects of out-of-pocket payments and the extent to which they increase the depth of poverty using the prevailing US$1 per day and $2 per day international poverty lines. An additional 2·7% of the population under study (78 million people) was estimated to have fallen below the $1 per day poverty line through out-of-pocket health payments (57 million people at the $2 per day poverty line), and out-of-pocket spending was estimated to have increased the poverty gap by 18% at the $1 per day poverty line (7% at the $2 per day poverty line). Positive partial correlations were found between impoverishment and national reliance on out-of-pocket health financing (p=0·18) and the prepayment poverty rate (p=0·07). After controlling for the share of health finance from out-of-pocket payments and the poverty rate, neither national income per head nor the distribution of health payments in relation to total household consumption were significant.

Added value of this study

We use the international extreme poverty line (one of the poverty lines used to monitor Sustainable Development Goal 1) and poverty lines capturing moderate absolute poverty and relative poverty. We measure the incidence of impoverishing health spending and its depth to capture the effect of out-of-pocket payments on the living standards of both poor and non-poor people. We use more recent data than the previous two studies, extend the country coverage from 89 countries to 122 countries, report data on trends for 84 countries, and estimate impoverishment worldwide for 3 years (2000, 2005, and 2010). Like the previous regional study, we analyse country-level correlates of impoverishment, but do so using 516 datapoints rather than 11 datapoints, and we explore how impoverishing health payments vary with the share of total health spending channelled through different types of publicly and privately financed prepayment arrangements. For a selection of countries, we also explore the degree to which impoverishment is associated with the fraction of the population covered by a health insurance scheme or by a national or subnational health service, an indicator proposed by some but rejected by others as a possible measure of universal health coverage. We also explore the relation between catastrophic and impoverishing out-of-pocket spending at the country and global levels and show that it partly depends on the choice of the poverty line.

Implications of the available evidence

Out-of-pocket health expenditures divert household spending from non-medical budget items such as food and shelter and can make the difference between a household's (non-medical) consumption being above the poverty line and being below it; this impoverishment adds to the poverty head count. We estimate that in 2010, 97 million people were impoverished by out-of-pocket spending on health care at the $1·90 per day poverty line, equivalent to 1·4% of the world's population. This represents a decrease from 2000, when 131 million people (2·1% of the world's population) were impoverished from out-of-pocket spending on health care. By contrast, at the $3·10 per day and relative poverty lines, the number of people impoverished by health spending increased between 2000 and 2010, from 105 million people (1·7% of the population) to 122 million people (1·8%) in the case of the $3·10 per day poverty line, and from 79 million people (1·3%) to 103 million people (1·5%) in the case of the relative poverty line. The incidence of impoverishment varies between countries that legally and automatically cover their populations through national or subnational health services or through a national health insurance programme. However, we find that the incidence of impoverishment decreases with both the share of health spending that is channelled through social security funds and the share channelled through other government agencies. Catastrophic spending and impoverishment are different aspects of financial protection. In all countries, out-of-pocket spending can be both catastrophic and impoverishing, and this partly depends on the choice of the poverty line: in high-income countries, out-of-pocket spending is very rarely impoverishing if the extreme poverty line is used. But in both poor and rich countries, out-of-pocket spending can be both impoverishing and catastrophic if a relative poverty line is used.

SDG indicator but supplements the catastrophic payment indicator by estimating how much poverty is increased by households having to pay out of pocket for health care and thereby diverting resources from other goods and services that are also considered necessary to sustaining living standards and life itself.[11,12] This indicator therefore links UHC directly to the first SDG goal, namely to end poverty in all its forms everywhere.

Our study data provide an update and extension of datasets from two previous studies of impoverishment due to out-of-pocket health spending: a global 2007 study[13] of 89 countries that used a food-based poverty line; and a 2006 regional study[5] of 11 Asian countries that used the then US$1 per day and $2 per day international poverty lines. We use the new $1·90 per day and $3·10 per day international poverty lines (at 2011 purchasing power parity [PPP] factors) and a relative poverty line equal to 50% of median consumption—an approach that is commonly used[14] to construct poverty lines in countries within the Organisation for Economic Co-operation and Development (OECD). We extend country coverage to 122 countries (median year 2005), estimate annual average changes for 93 countries, and report global and regional estimates for 2000, 2005, and 2010. We also search through a broader set of macroeconomic and health-system variables that might be associated with the incidence of impoverishment at the national level. We go beyond reporting the incidence of impoverishment by looking at its depth. This allows us to capture the poverty effect of out-of-pocket spending among the poor, which is not captured by the incidence of impoverishment.

Methods

Impoverishing payments as a measure of financial hardship

We say a household is impoverished by out-of-pocket spending on health when its consumption, excluding its out-of-pocket spending (which we think of as the amount it had to spend on non-health budget items given the occurrence of the health event that necessitated the out-of-pocket spending), is less than the poverty line but its consumption, including its out-of-pocket spending (which we think of as the amount it would have had to spend on non-health budget items in the absence of the health event), is more than the poverty line. The idea is that such a household was forced by the adverse health event to divert spending away from non-health budget items to such an extent that its spending on these items went from being above the poverty line to being below the poverty line.

From a policy perspective, a concern about impoverishment is closely linked to a concern about poverty. By contrast, catastrophic spending, which involves households spending above a prespecified share of their total consumption or income on out-of-pocket spending, reflects a concern about a sharp drop in living standards irrespective of whether it is impoverishing or not. Impoverishment need not imply catastrophic spending, and vice versa: a household could spend a relatively large fraction of its income or consumption on out-of-pocket payments and yet be sufficiently far from the poverty line not to be impoverished; conversely, a household could be sufficiently close to the poverty line to be impoverished without spending a large fraction of its income or consumption on out-of-pocket payments.

We measure impoverishment incidence as the change in poverty head count with and without out-of-pocket spending included in consumption (or income).[3] This head count measure does not tell us how far such households are pushed below the poverty line. Nor does it capture the fact that some households that are already poor might be pushed even further into poverty by their out-of-pocket health spending. These two facets of impoverishment can be captured by the change in the poverty gap attributable to out-of-pocket spending, which captures the addition to the depth of poverty due to out-of-pocket spending. In the case of a household impoverished by out-of-pocket spending, the change in the gap is the amount by which out-of-pocket spending pushes the household below the poverty line. In the case of a household that is already poor, the change in the poverty gap is equal to the full amount of the household's out-of-pocket spending. These amounts are then averaged across all households to get the overall average change in the poverty gap due to out-of-pocket health spending. If multiplied by the poverty line, it can be thought of as the average per-capita amount by which out-of-pocket spending pushes or further pushes households below the poverty line. We do not report changes in poverty gap using relative poverty lines because we have expressed poverty gap additions due to out-of-pocket payments in US$ terms; this is possible with an absolute poverty line in US$ terms, but with relative poverty lines, the amounts would depend on the sample of countries used and would have no absolute meaning.

We use three different poverty lines. The first is the international $1·90 per day poverty line, which is often referred to as the extreme poverty line. It is an updating of the old $1·25 per day poverty line and underlies SDG target 1.1.[15] The second poverty line is the $3·10 per day international poverty line, which is an updating of the old $2·00 per day poverty line commonly used for middle-income countries.[15] The third poverty line is a relative poverty line, defined as 50% of median consumption (or income where consumption is unavailable). This is the line that comes closest to the one used by the OECD-14 countries and one of the poverty lines used by the influential Luxembourg Income Study (the others being 40% and 60%), and it is close to the poverty line used by Eurostat (60%).

Household consumption or income, out-of-pocket expenditures on health, and poverty lines are all measured by their daily value per capita. International poverty lines are converted to local currency units (LCUs) using 2011 PPP exchange rates and consumer price indices (CPIs). In other words, if a country's PPP for private consumption in 2011 is 2·5 (2·5 LCUs to $1), then the $1·90 per day poverty line is equivalent to 4·75 LCUs per day in 2011. Suppose that the household survey data at hand is for 2015, and the CPI for that year is 95 (with 2011=100 or a 5% reduction in consumer prices for private consumption), then the $1·90 per day

poverty line in LCUs for 2011 is equivalent to (1·9×2·5=4·75)×0·95=4·51 LCUs per day for 2015. Similarly, the $3·10 per day poverty line would be equivalent to (3·1×2·5×0·95)=7·4 LCUs per day for 2015. PPP data are downloadable from the World Bank's World Development Indicators website. Data on CPIs are downloadable from the World Development Indicators website and from the World Bank's PovcalNet.

For **World Development Indicators** see https://data.worldbank.org/data-catalog/world-development-indicators

For **PovcalNet** see http://iresearch.worldbank.org/PovcalNet/povOnDemand.aspx

Estimating impoverishing spending aggregates

Our household surveys are nationally representative, so our analysis of a household survey leads directly to a national estimate of the incidence of impoverishing spending for that country in that year. We also estimated the regional and global incidence of impoverishing spending, using UN regions and three reference years (2000, 2005, and 2010). The process is described in a previous paper[4] and in the appendix. Briefly, building on the World Bank's approach to estimating global poverty,[16,17] these estimates are produced by lining up datapoints to a reference year by using a combination of survey-based values, interpolation and extrapolation based on econometric modelling, and imputation using regional medians. We do not report uncertainty intervals for the regional estimates because, as far as we know, no agreed methodology exists for computing such intervals, given the variation in the way the point estimates underlying the regional estimates are constructed. These estimates, and the aggregate correlates below, were obtained using STATA version 14.

See Online for appendix

Aggregate correlates of impoverishing spending

To explore the partial relation between a country's incidence of impoverishing out-of-pocket health expenditures and various macroeconomic indicators and health-system characteristics, we used multiple linear regression. We included the same variables as previously described,[4] which are essentially those used in the aforementioned regional and global studies,[5,13] namely per-capita gross domestic product (GDP), the Gini index of income inequality, total health expenditure as a percentage of GDP, social security (health) expenditure as a percentage of total health expenditure, other government (health) expenditure (eg, Ministry of Health, subnational governments) as a percentage of total health expenditure, private (health) insurance as a percentage of total health expenditure, and non-profit (health) expenditure (ie, non-profit institutions serving households such as non-governmental organisations) as a percentage of total health expenditure. Additionally, we included national poverty rates at the $1·90, $3·10, and relative poverty lines. We also interacted GDP per capita with itself (ie, GDP per capita squared) and with each of the other variables.

Household datasets

To measure a country's incidence of impoverishment due to out-of-pocket health expenditures, we require micro (ie, unit-record) data from nationally representative household surveys containing information on out-of-pocket health spending and total household consumption (or, when unavailable, income). We use essentially the same dataset as in our previous report,[4] which provides details of the database assembly and a map showing coverage of the surveys used by country and decade (breakdowns of surveys by type of survey and survey coverage by decade and UN region are provided in the appendix). The difference between the two datasets is that we imposed additional quality checks in the analysis of impoverishment requiring that our poverty estimates be close to those reported in the World Bank's poverty database PovcalNet.

Household living standards

Income is difficult to measure in low-income countries, in part because many families produce and consume some of their food on a family plot and this does not appear as income.[12] Consumption is therefore more widely used, except in a few middle-income and high-income countries where we have used income in the absence of data on consumption. Ideally, a consumption aggregate should capture consumption across a broad range of categories. It should also capture the use value of durables.[12] Housing should also be included, measured by the value of the flow of services that the household receives from occupying its dwelling.[18] We have not attempted to reconstruct a consumption aggregate for our datapoints but rather rely on datasets for which an aggregate already exists.

Out-of-pocket spending

Out-of-pocket spending includes payments made by the user at the point of use and includes cost-sharing and informal payments, both in kind and in cash, but excludes payments by a third party payer.[19] We have previously discussed the definitions and challenges associated with measuring out-of-pocket spending in household surveys.[4] All out-of-pocket spending data have been annualised.

Data on the macroeconomic and health-system indicators

Data sources for the macroeconomic and health-system correlates are the same as used previously,[4] but the poverty rates were computed as part of the impoverishment calculations in this study.

Data sharing

The data are downloadable from https://data.worldbank.org/universal-health-coverage or http://apps.who.int/gho/cabinet/uhc.jsp.

Role of the funding source

The funding sources did not have any role in the design, conduct, analysis, or writing up of the study. The

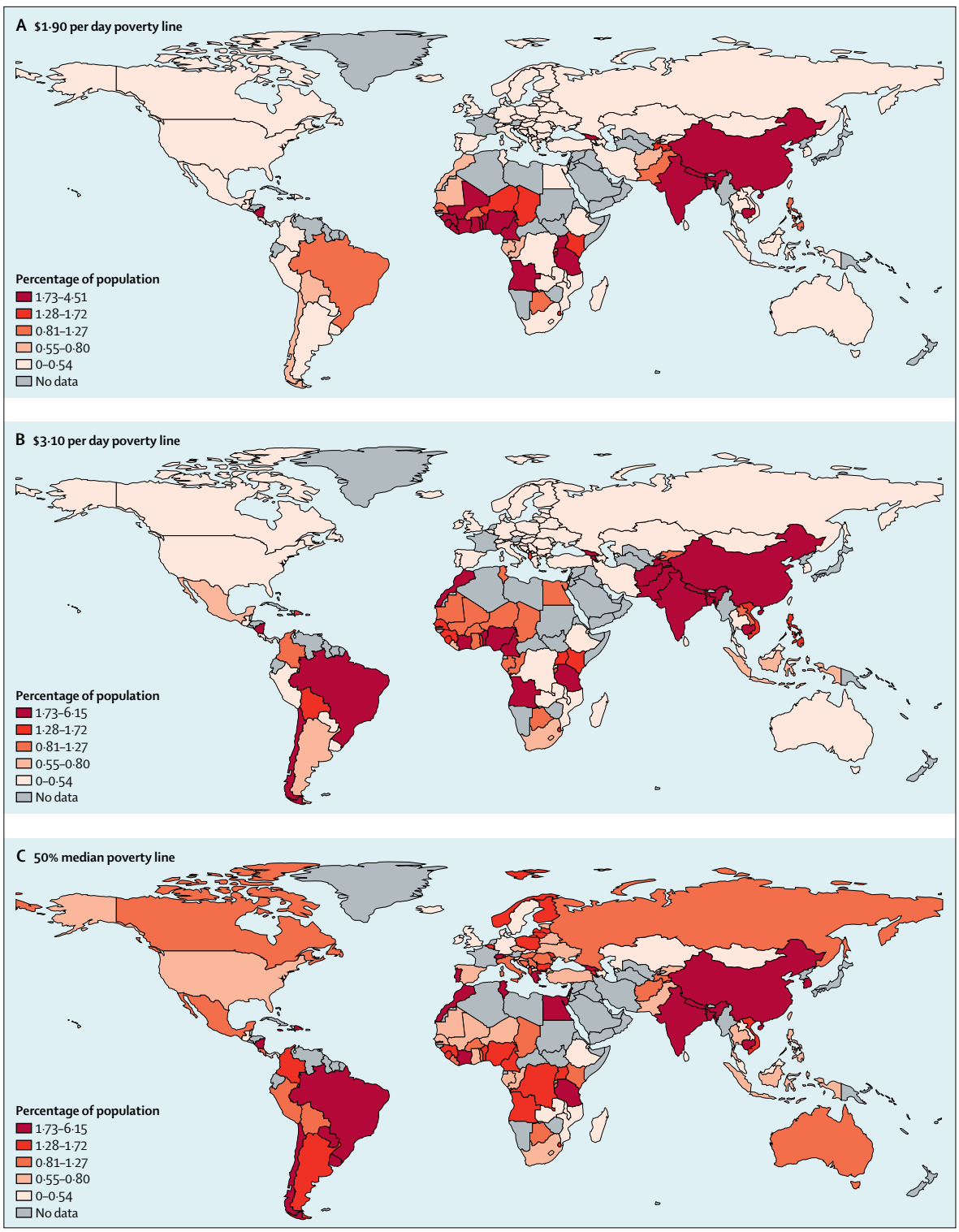

Figure 1: **Incidence of impoverishing health spending at the US$1·90 per day (A), $3·10 per day(B), and 50% median (C) poverty lines, latest year**
Numbers are population percentages and refer to most recent survey. The surveys range from 1992 to 2015, with a median of 2005 (IQR 2001–2009). Cutpoints for all charts are selected such that countries are divided into five equal-sized groups at the relative poverty line.

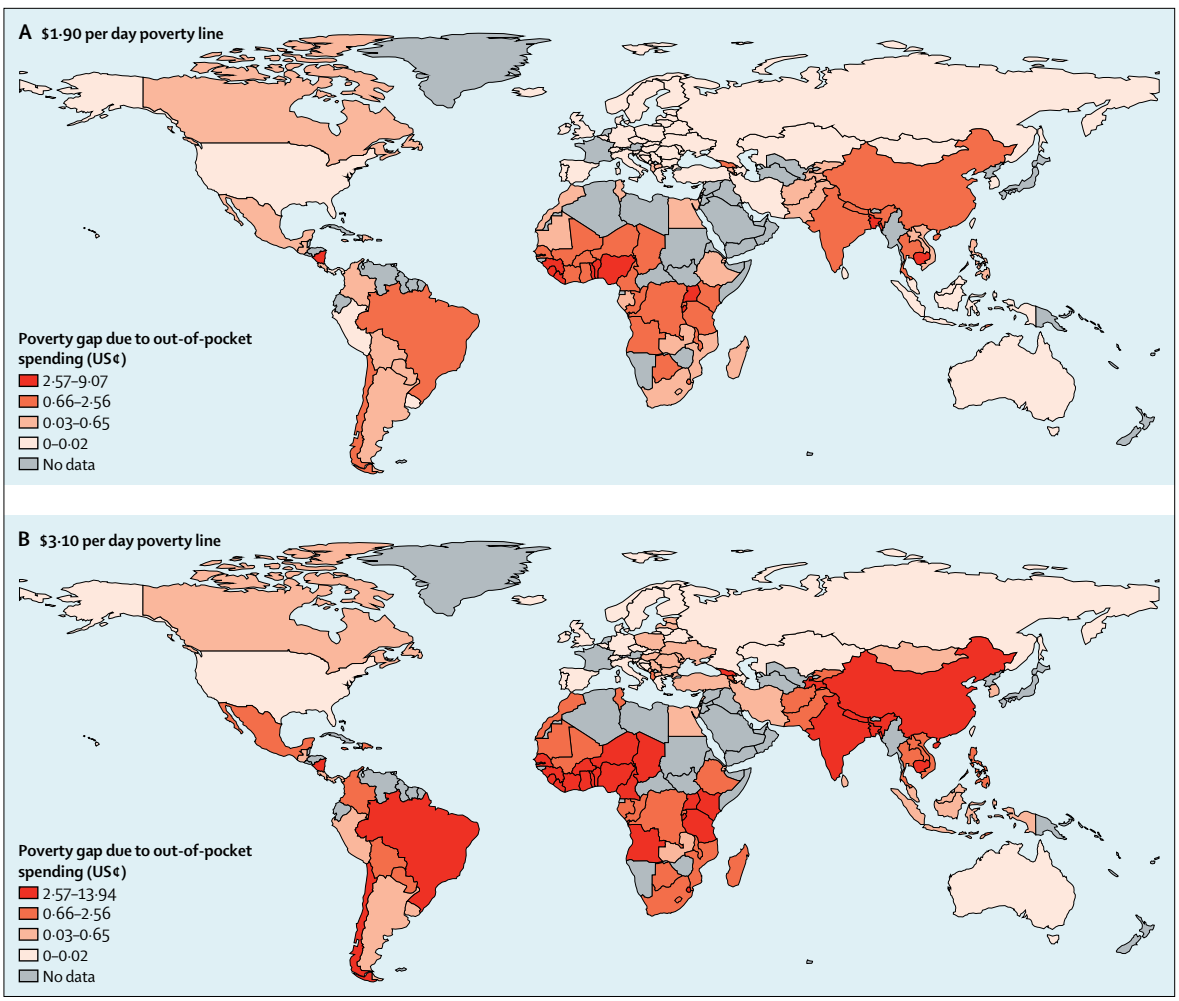

Figure 2: **Poverty gap due to out-of-pocket spending at the US$1·90 per day (A) and $3·10 per day (B) poverty lines**
Numbers are population percentages and refer to most recent survey. The surveys range from 1992 to 2015, with a median of 2005 (IQR 2001–2009). Cutpoints for both charts are selected such that countries are divided into four equal-sized groups at the $3·10-a-day poverty line.

corresponding author had full access to all the study data and had final responsibility for the decision to submit for publication.

Results

The incidence of impoverishing out-of-pocket payments at the $1·90 per day poverty line in our most recent surveys varies markedly between countries (figure 1), from no impoverishment in most high-income countries (and some middle-income countries) to more than 4% in Bangladesh and India. The population-weighted median incidence of impoverishment is 1·86% at the $1·90 per day line, 2·44% at the $3·10 per day line, and 1·83% at the relative poverty line.

The poverty gap increase attributable to out-of-pocket health expenditures (ie, the average per-capita amount by which out-of-pocket spending pushes or further pushes households below the poverty line) in our most recent surveys also varies markedly between countries (figure 2), varying in the case of the $3·10 per day poverty line from ¢0 per capita (in 2011 PPP US$) in most high-income countries (and some middle-income countries) to more than ¢8 per capita in Cambodia and Guinea. In interpreting these rather small numbers, it needs to be kept in mind that the poverty gap increases are averaged across the entire population of a given country, whereas only a small fraction of households both spend on health and are pushed into or further into poverty by out-of-pocket spending, and that if households are poor or near poor, they might be spending on health care but might not actually be spending much in US$ terms because they have not got many dollars to start with. The population-weighted median of the poverty gap increase attributable to out-of-pocket health expenditures is ¢1·22 per capita at the $1·90 per day line and ¢3·74 per capita at the $3·10 per day line.

The relation at the country level between impoverishing and catastrophic out-of-pocket spending is shown in the

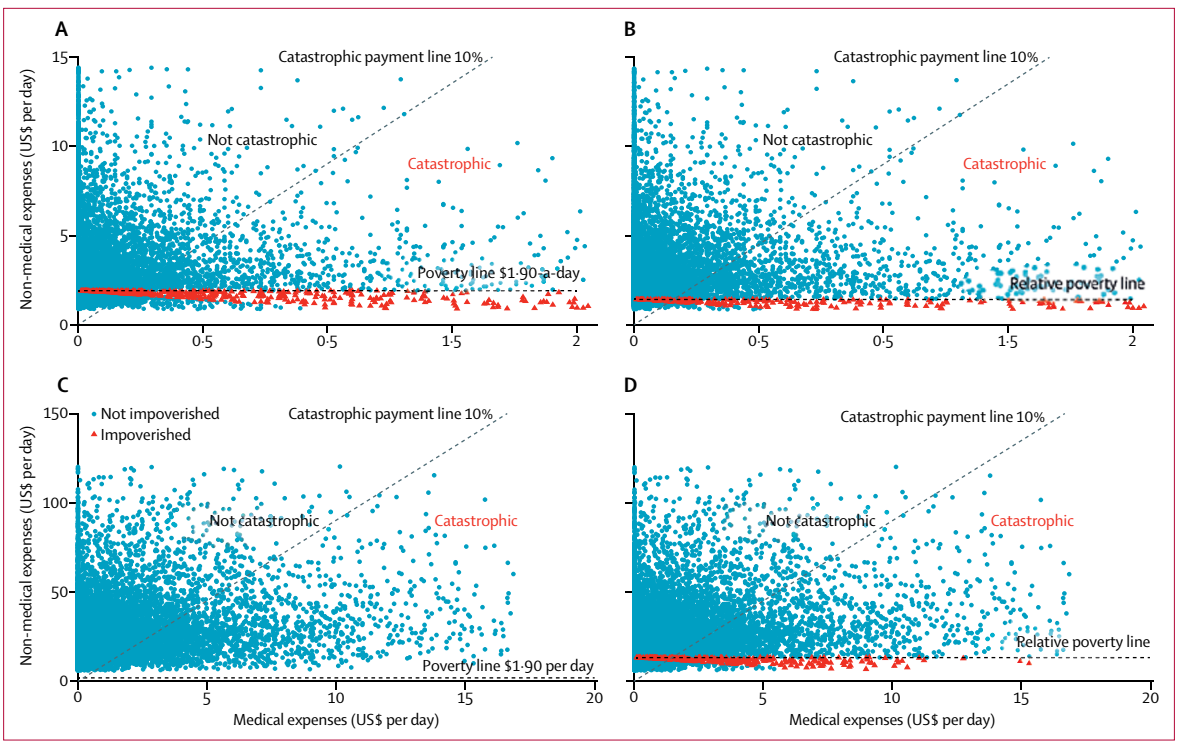

***Figure 3*: Impoverishing versus catastrophic spending in a selected lower-middle-income country and a selected high-income country, US$1·90 per day versus relative poverty lines, 2010**

(A) Lower-middle-income country, absolute extreme ($1·90 per day) poverty line: not catastrophic or impoverishing: 85·7% of households; impoverishing only: 0·8%; catastrophic only 10·4%; catastrophic and impoverishing: 3·1%. (B) Lower-middle-income country, relative (50% of median consumption) poverty line: not catastrophic or impoverishing: 86·1% of households; impoverishing only: 0·4%; catastrophic only: 11·3%; catastrophic and impoverishing: 2·2%. (C) High-income country, absolute extreme ($1·90 per day) poverty line: not catastrophic or impoverishing: 76·0%; impoverishing only: 0%; catastrophic only: 24·0%; catastrophic and impoverishing: 0%. (D) High-income country, relative (50% of median consumption) poverty line: not catastrophic or impoverishing 75·4%; impoverishing only: 0·6%; catastrophic only: 21·7%; catastrophic and impoverishing: 2·3%.

scatter plots for two specific but unnamed countries—one a lower-middle-income country, the other a high-income country (figure 3); the scatter plots show both the $1·90 per day poverty line and the relative poverty line. The catastrophic payment threshold is set at 10%, which means that non-medical consumption is less than nine times out-of-pocket spending. Points below the catastrophic payment line in the graphs identify such cases of catastrophic out-of-pocket spending. Any instance of impoverishment must be below the poverty line, but below the poverty line there are also already poor households whose out-of-pocket spending has pushed them even further below the poverty line. In the case of the lower-middle-income country at the $1·90 per day poverty line (figure 3A), 85·7% of households are neither impoverished nor incur catastrophic spending. A further 10·4% of households incur catastrophic spending without being impoverished, although some of these are already poor and are driven further into poverty by their out-of-pocket spending. A further 0·8% of households are impoverished but do not incur catastrophic spending, and the final 3·1% of households are impoverished and incur catastrophic spending. For the high-income country (figure 3C), at the $1·90 per day poverty line, the picture is very different: there is no impoverishment, and 24·0% of the population incurs catastrophic spending. This result is to be expected because the World Bank recently estimated[20] that the relevant absolute poverty line for high-income countries is almost ten times the extreme line of poverty, namely $21·70 per day at 2011 PPP. The two countries look more similar when we use a relative poverty line (figure 3B, D), with similar proportions (about 2%) of the population incurring both catastrophic and impoverishing payments and similar percentages incurring only impoverishing payments; the difference is in the proportion of households that incur catastrophic but not impoverishing payments (11·3% in the lower-middle-income country *vs* 21·7% in the high-income country).

The difference between catastrophic and impoverishing spending worldwide is shown in figure 4. Catastrophic spending is a challenge for countries at all levels of development. Impoverishment is sensitive to the choice of the poverty line. When the international (extreme) poverty line of $1·90 per day is used, impoverishment is not a challenge for the high-income countries and only marginally so for the upper-middle-income countries, which is to be expected given that this poverty line is too

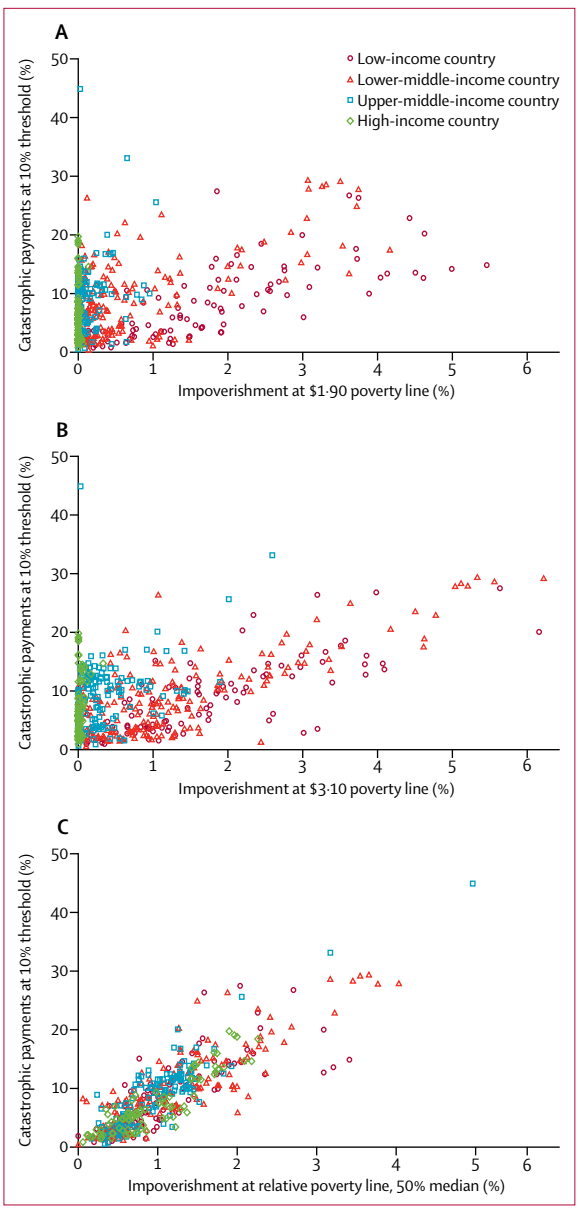

Figure 4: **Impoverishing versus catastrophic spending—the global picture**

low for these countries; it is, however, a challenge for the low-income and lower-middle-income countries. By contrast, when a relative poverty line is used, impoverishment becomes a challenge in upper-middle-income and high-income countries.

Aggregating across countries using the combination of interpolation and extrapolations, available estimates for reference years and econometric modelling (details on the number of datapoints in each category are provided in table 1), we estimate that in 2010, 97 million people were impoverished by out-of-pocket spending on health at the $1·90 per day poverty line, equivalent to 1·4% of the world's population (table 2). At the $3·10 per day and relative (50% of median consumption) poverty lines, 122 million people (1·8% of the world's population) and 103 million people (1·5%) were impoverished by out-of-pocket spending on health. Our estimates for 2010 vary across UN regions, with Asia and Africa having the highest incidence of impoverishment at the $1·90 per day poverty line (2·4% and 1·4%, respectively). These two regions account for 94% of the world's population impoverished by out-of-pocket health spending.

We estimated the average annual change in the incidence of impoverishing out-of-pocket payments at the $1·90 per day, $3·10 per day, and relative poverty lines across all available surveys for the 84 countries for which surveys are available for 2 years or more (figure 5). At the $1·90 per day poverty line, the average annual change ranges from –0·6 percentage points in Tajikistan (2003–07) to 0·2 percentage points in Nigeria (2003–09). In 17 (20%) of the countries for which we have data for 2 years or more, the incidence of impoverishing out-of-pocket spending using the $1·90 poverty line increased over time. The data for the $3·10 and relative poverty lines are 29% and 52%, respectively. The population-weighted median annual changes in the incidence of impoverishing out-of-pocket health spending are –0·02 percentage points at the $1·90 per day poverty line, 0·11 percentage points at the $3·10 per day poverty line, and 0·07 percentage points at the relative poverty line. The population-weighted median annual changes in the poverty gap increase attributable to out-of-pocket health expenditures are ¢–0·12 at the $1·90 per day poverty line and ¢–0·03 at the $3·10 per day line. Thus at the $1·90 per day poverty line, the incidence and depth of impoverishment have both been decreasing; by contrast, at the $3·10 per day poverty line, the incidence of impoverishment has been increasing, but the depth has been decreasing (albeit only marginally).

At the $1·90 per day poverty line, the absolute number and percentage of people worldwide who became impoverished decreased between 2000 and 2010, from 131 million people (2·1%) to 97 million people (1·4%; table 2). By contrast, at both the $3·10 per day and relative poverty lines, the absolute number and percentage of people impoverished increased, from 105 million people (1·7%) to 122 million people (1·8%) in the case of the $3·10 per day poverty line, and from 79 million people (1·3%) to 103 million people (1·5%) in the case of the relative poverty line. The incidence of impoverishment has evolved differently across UN regions. Africa and Asia have both seen reductions in impoverishment at the $1·90 per day poverty line, reflecting rising living standards pushing up the proportion of people living some distance above the extreme poverty line. Asia, by contrast, has seen an increase in impoverishment at the $3·10 per day poverty line, reflecting the fact that rising living standards have pushed Asian populations higher, many being lifted above the $3·10 per day poverty line, and

therefore, unlike Africans who are further behind, are vulnerable to impoverishment through out-of-pocket spending at the $3·10 per day poverty line. In other regions, the very small incidence at both absolute international poverty lines is because such poverty lines are too low in most countries in Latin America and the Caribbean and in Oceania.

As with catastrophic spending, the incidence of impoverishment can vary across countries with similar types of health systems. Denmark, Ireland, Italy, Portugal, and the UK all officially cover 100% of their populations automatically with national or regional health services,[21,22] yet the incidence of impoverishment is higher in Italy and Portugal (1·0% and 2·4%, respectively, at the relative poverty line) than in Denmark, Ireland, and the UK (0·3%, 0·4%, and 0·2%, respectively, at the same poverty line). The incidence of impoverishment (at the relative poverty line) also varies between Hungary (1·1%), South Korea (1·9%), Montenegro (0·2%), and Romania (0·8%) despite the fact that in these four countries, 100% of the population is officially covered by a national health insurance scheme.[21,22] The USA is, as with catastrophic payments, a counterexample: insurance coverage rates stayed largely unchanged over the period 1995–2013,[23] yet the incidence of impoverishment decreased, at both the $3·10 per day and relative poverty lines. As with catastrophic payments, in countries where additional groups have acquired coverage in formal insurance schemes, the incidence of impoverishment has not always changed in the expected direction (figure 5). In Thailand and Vietnam, the incidence of impoverishment has decreased with time for all three poverty lines, but in China, Indonesia, and Mexico, reductions are seen only for some poverty lines, whereas impoverishment in the Philippines has increased for all three poverty lines. Thus, as with catastrophic expenditures, the incidence of impoverishment cannot be inferred from the proportion of the population covered by health insurance schemes or public health services.

The incidence of impoverishment is positively but not significantly associated with per-capita GDP. Marginal effects evaluated at the median per-capita income of our sample of countries are shown in table 3. Nor is income inequality significantly associated with impoverishment. Both these results contrast with our results for catastrophic spending.[4] Poverty is, however, associated with impoverishment: for example, impoverishment incidence at the $3·10 per day poverty line is negatively associated with the poverty head count at the $1·90 per day poverty line, reflecting the fact that more people living below the $1·90 per day poverty line means fewer people exposed to the risk of falling from above the $3·10 per day poverty line to below it. The share of GDP spent on health is positively associated with the incidence of impoverishment, but not significantly so at the $1·90 per day poverty line. We find a negative partial association between impoverishment and the share of total health expenditure channelled through social security funds and other government agencies, with no significant difference in effects between the two types of agency. These results mirror our previous results[4] on catastrophic spending, suggesting that health spending channelled through private voluntary insurance and non-profits provide no financial protection.

	1995–2005 (reference year 2000)		2000–10 (reference year 2005)		2005–15 (reference year 2010)	
	Number of countries	Proportion of global population (%)	Number of countries	Proportion of global population (%)	Number of countries	Proportion of global population (%)
Reference year point	25	38·2%	34	19·2%	54	31·4%
Two points within band	13	5·2%	23	52·5%	13	21·8%
One point within band	42	34·2%	43	13·5%	27	29·4%
Fitted	10	4·7%	2	0·1%	12	3·1%
Regional median	103	17·1%	92	14·5%	88	14·1%

Table 1: **Categories of datapoints used for aggregation**

	2000		2005		2010	
	Proportion of population (%)	Number of people (millions)	Proportion of population (%)	Number of people (millions)	Proportion of population (%)	Number of people (millions)
US$1·90 per day poverty line						
Global	2·1%	130·6	1·8%	115·5	1·4%	96·8
Africa	2·0%	16·6	1·4%	12·7	1·4%	14·9
Asia	3·0%	109·8	2·5%	98·4	1·9%	79
Europe	0·1%	0·9	0%	0·3	0%	0·1
Latin America and the Caribbean	0·6%	3·3	0·7%	4·1	0·5%	2·8
North America	..	0	..	0	..	0
Oceania	..	0	..	0	..	0
US$3·10 per day poverty line						
Global	1·7%	105·4	1·8%	115·2	1·8%	122·1
Africa	2·0%	16·0	1·4%	12·4	1·4%	14·6
Asia	2·1%	78·0	2·4%	92·8	2·4%	100·8
Europe	0·5%	3·4	0·2%	1·1	0·1%	0·5
Latin America and the Caribbean	1·5%	8·0	1·6%	8·8	1·0%	6·3
North America	..	0	..	0	..	0
Oceania	..	0	..	0	..	0
Relative poverty line (50% median consumption per capita)						
Global	1·3%	78·9	1·5%	95·4	1·5%	103·4
Africa	1·0%	8·4	1·1%	10·5	1·2%	12·7
Asia	1·5%	54·1	1·7%	66·0	1·7%	72·0
Europe	0·9%	6·3	0·9%	6·7	1·0%	7·7
Latin America and the Caribbean	1·4%	7·3	1·7%	9·3	1·4%	8·6
North America	0·8%	2·5	0·8%	2·5	0·6%	2·2
Oceania	0·8%	0·3	0·8%	0·3	0·9%	0·3

Table 2: **Global estimates of impoverishing out-of-pocket health spending**

Figure 5: **Annual percentage point change in incidence of impoverishing health spending**
Numbers are average annual percentage point changes, computed using all surveys available for the country in question by regressing impoverishing expenditure rate on year of survey; number shown is coefficient from this regression. The surveys span the period 1992–2015, with a median year of 2005, and an interquartile range of 2001–09.

Discussion

In most countries, the incidence of impoverishment has been decreasing if an absolute poverty line is used: impoverishment increased in only 20% of countries at the $1·90 per day poverty line and in only 30% of countries at the $3·10 per day poverty line. By

	US$1·90 per day	US$3·10 per day	Relative poverty line (50% median consumption)
GDP per capita, 2011 (intl$)	0·040 (p=0·17)	0·053 (p=0·24)	0·044* (0·091)
Gini index of income inequality	0·002 (p=0·75)	0·005 (p=0·32)	0·005 (p=0·33)
Poverty at $1·90 line	0·032 (p=0·22)	–0·061* (p=0·055)	0·015 (p=0·39)
Poverty at $3·10 line	0·026* (p=0·019)	0·074† (p=0·00098)	–0·001 (p=0·90)
Poverty at relative line	–1·045* (p=0·051)	–0·541 (p=0·42)	1·259‡ (p=0·028)
THE (% of GDP)	0·038 (p=0·22)	0·095* (p=0·08)	0·091‡ (p=0·0032)
Social security (% of THE)	–0·008‡ (p=0·014)	–0·020† (p=0·00023)	–0·019† (p=0·00015)
Other government expenditure (% of THE)	–0·011‡ (p=0·014)	–0·016‡ (p=0·0029)	–0·021† (p=0·00000012)
Private insurance (% of THE)	0·017 (p=0·38)	0·007 (p=0·79)	0·006 (p=0·80)
Non-profit institutions (% of THE)	–0·014 (p=0·23)	–0·005 (p=0·70)	–0·025‡ (p=0·018)
Number of observations	467	467	467
Social security=other government agencies (probability)	0·423	0·274	0·530

Marginal effects are evaluated at 50th percentile of per-capita income distribution. Last row of the table tests the hypothesis that coefficients on two variables (social security and other government agencies) are equal. Full regression results are available in the appendix. GDP=gross domestic product. THE=total health expenditure. *p<0·10. †p<0·001. ‡p<0·05.

Table 3: **Marginal effects of macroeconomic and health systems characteristics on the incidence of impoverishment at different per-capita income levels**

contrast, using the relative poverty line (50% of median consumption), impoverishment increased in just over half of countries. Not all countries are equally large, of course, and population-weighted median annual changes and global estimates tell a somewhat different story. At the $1·90 per day poverty line, the population-weighted median annual change was negative, and the estimated number of people impoverished by out-of-pocket spending on health decreased between 2000 and 2010, from 131 million people (2·1% of the world's population) to 97 million people (1·4%). By contrast, at the $3·10 per day and relative poverty lines, annual average changes in impoverishment incidence were positive, and the number of people impoverished by health spending increased between 2000 and 2010, from 105 million people (1·7%) to 122 million people (1·8%) in the case of the $3·10 per day poverty line, and from 79 million people (1·3%) to 103 million people (1·5%) in the case of the relative poverty line. These poverty head count data do not tell us how far impoverished families fell below the poverty line due to their out-of-pocket spending or how far already poor families are pushed still further into poverty. The poverty gap increase attributable to out-of-pocket payments provides this information: this has been decreasing at both the $1·90 per day and $3·10 per day poverty lines, albeit only marginally in the latter case.

The scale of impoverishment depends to some degree on the poverty line. At the $1·90 per day poverty line, the incidence of impoverishment ranges from 0% in mostly high-income countries to more than 3% in several low-income and lower-middle-income countries (IQR 3·63). By contrast, at our relative poverty line (50% of median consumption), impoverishment varies less between countries (IQR 1·86), with impoverishment occurring even in high-income countries.

As with catastrophic spending, the incidence of impoverishment varies between countries, and impoverishment is evident even in countries that cover all their populations automatically through national or subnational health services or through a national health insurance programme. We find that the incidence of impoverishment decreases with both the share of health spending that is channelled through social security funds and the share channelled through other government agencies. However, we also find that the positive partial relation between impoverishing expenditures and the share of GDP spent on health might reflect, as previously hypothesised,[13] greater service availability, more use of expensive technology, and higher prices, all of which are likely to be positively associated with out-of-pocket expenditures. This relationship, like the positive association found in the case of catastrophic spending, suggests that simply spending more on health is not sufficient to provide financial protection. We also find that catastrophic spending and impoverishment are indeed different aspects of financial protection. In all countries, out-of-pocket spending can be catastrophic without being impoverishing: indeed, in the high-income countries, out-of-pocket spending is very rarely impoverishing if the extreme poverty line is used. In the poorer countries (and in the richer countries if a relative poverty line is used), out-of-pocket spending can be both impoverishing and catastrophic, or just catastrophic or just impoverishing.

This study shares several limitations with the companion paper on catastrophic health spending.[4] First, our data on out-of-pocket spending come from surveys with widely varying survey instruments. Second, because of data gaps (some countries do not have a usable survey, some have only one, and some are quite old), when deriving our global estimates, we had to use a combination

of survey-based datapoints, interpolated and extrapolated datapoints based on econometric modelling, and imputation using regional medians. Third, our data are cross-sectional and do not provide information on out-of-pocket expenditures across multiple periods within the same household. Finally, we capture only one dimension of UHC. Additionally, and specific to this study, we are estimating impoverishment by comparing a household's consumption with and without out-of-pocket spending included in the consumption aggregate. For households incurring out-of-pocket spending, we know how much they had available for non-health budget items, but we cannot be certain how much they would have spent the money on other items that year in the absence of the health event that necessitated the out-of-pocket spending—they might have borrowed less or saved more, in which case their counterfactual consumption would not have been higher by as much as the amount spent out of pocket. If so, we will end up overestimating impoverishment.[24] We assess the extent to which out-of-pocket expenditures are both catastrophic and impoverishing but find that the correlation is sensitive to the choice of the poverty line. However, catastrophic expenditures can be defined in different ways, with definitions varying in the extent to which adjustments are made to take into account spending on necessities when comparing how much people pay out of pocket relative to their household's resources. The correlation of catastrophic and impoverishing expenditures would probably increase when these other measures of catastrophic expenditures are used. Finally, the results of our analysis of associations between impoverishment and macroeconomic and health-system variables do not necessarily indicate a causal effect of, for example, prepayment mechanisms on impoverishment incidence, although they are consistent with such an effect.

Out-of-pocket health spending pushed an estimated 97 million people (1·4% of the world's population) below the $1·90 per day extreme poverty line in 2010. This is less than in 2000, when 131 million people (2·1%) were pushed below the extreme poverty line. The trend at the higher $3·10 per day poverty line, by contrast, has been upwards: global impoverishment increased from 105 million people (1·7%) in 2000 to 122 million people (1·8%) in 2010. The trend has also been upwards when a relative poverty line (50% of per capita consumption) is used: from 79 million people (1·3%) in 2000, to 103 million people (1·5%) in 2010. As with catastrophic spending, impoverishment exists even in countries that cover all their populations automatically through national or subnational health services or through a national health insurance programme. However, we find that the incidence of impoverishment decreases with the share of health spending that is channelled through social security funds and the share channelled through other government agencies, with similarly sized effects. As with catastrophic spending, reducing impoverishment from out-of-pocket health spending requires not just covering more people but covering a larger share of total health spending through government financing arrangements.

Contributors

All authors contributed to the assembly of the dataset. The screening of datapoints was undertaken by AW, GF, and PE. The dataset was analysed by AW, GF, and PE. The first draft of the manuscript was written by AW, GF, and PE. All authors contributed to the writing of the manuscript.

Declaration of interests

We declare no competing interests.

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