Progress Toward the Health MDGs

Are the Poor Being Left Behind?

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Abstract

This paper looks at differential progress on the health Millennium Development Goals between the poor and better-off within countries. The findings are based on original analysis of 235 Demographic and Health Surveys and Multiple Indicator Cluster Surveys, spanning 64 developing countries over the period 1990–2011. Five health status indicators and seven intervention indicators are tracked for all the health Millennium Development Goals. In most countries, the poorest 40 percent have made faster progress than the richest 60 percent. On average, relative inequality in the Millennium Development Goal indicators has been falling. However, the opposite is true in a sizable minority

of countries, especially on child health status indicators (40–50 percent in the cases of child malnutrition and mortality), and on some intervention indicators (almost 40 percent in the case of immunizations). Absolute inequality has been rising in a larger fraction of countries and in around one-quarter of countries, the poorest 40 percent have been slipping backward in absolute terms. Despite reductions in most countries, relative inequalities in the Millennium Development Goal health indicators are still appreciable, with the poor facing higher risks of malnutrition and death in childhood and lower odds of receiving key health interventions.

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Introduction

With barely more than 500 days to go until the December, 31 2015 target date for the attainment of the Millennium Development Goals (MDGs), global and country-specific progress toward the health-related MDGs is being fervently discussed – by ministries of health, development partners, civil society organizations, and health advocates. Recent estimates (Go and Quijada 2012; United Nations 2012; World Bank 2013) show that while progress toward most non-health MDG targets is largely on-track, progress toward the health MDG targets is not.

Largely absent from the discussion on the health MDGs has been the question raised by Gwatkin (2005) nearly 10 years ago, namely whether progress within countries has been pro-poor (i.e. faster among the poor and hence inequality-reducing) or pro-rich.¹ Only three studies have shed light on this question; as we show below, these studies reached different conclusions. As a result, it is unclear right now whether progress to date on the health MDGs has been pro-poor or pro-rich – for both interventions (e.g. immunization) and outcomes (e.g. under-five mortality). In this paper we re-analyze this unresolved question, using a larger number of MDG indicators, more countries, more survey years, more recent data, and more measures of inequality than previous studies.

What did previous studies find about whether progress towards the health MDGs has been pro-poor?

Table 1 indicates, for each of the main four health-related MDGs, the goal, the targets, the official indicators, and the additional core intermediate indicators recommended by a technical consultation between the UN technical agencies and the World Bank in 2001.

¹ Throughout this paper we mean by “pro-poor” whether changes in MDG health indicators are such that there is a reduction in inequality (in the indicator) between the poor and better off. This is in the spirit of the definition of pro-poor growth proposed by Kakwani and Pernia (2000) (growth that reduces income inequality) and the definition of pro-poorness used in the context of the redistributive effects of taxes and transfers (taxes and transfers that reduce income inequality) (Lambert 2001).

Table 2 summarizes the three previous studies that shed light on the issue of whether progress toward the health MDGs has been pro-poor at the country level. The studies vary in the time period under analysis, and in the number of countries studied. Two use only the Demographic and Health Survey (DHS), while one uses both the DHS and the Multiple Indicator Cluster Survey (MICS). One study focuses on just one MDG and one official indicator, another looks at two MDG and one official indicator of each, and a third looks at three MDGs and six official indicators.

In the absence of consumption data (the preferred measure of household living standards in developing countries (Deaton 1997)), all three studies distinguish between poor and better-off households using the ‘wealth index’ developed by Filmer and Pritchett (2001) and included in each public release DHS and MICS dataset.² Two of the previous three studies address the inequality issue by looking at changes in the ratio of the outcome among the poorest quintile to the outcome among the richest quintile. The other uses the concentration index (Kakwani, Wagstaff and van Doorslaer 1997), analogous to the Gini coefficient except that when looking at inequality in, say, underweight, individuals are ranked by their household’s score on the wealth index, rather than by underweight. Both approaches speak to the issue of relative – rather than absolute – inequality, and shed light on whether progress has been pro-poor in a relative sense (in which case relative inequality is said to have fallen).

The findings of the three previous studies are mixed. Looking at under-five mortality (U5MR) between 1990 and 2001, Moser et al. (2005) find no clear trend, while Suzuki et al.

² This uses principal components analysis to construct a weighted average of a variety of indicators capturing the ownership of assets (e.g. car and television), and the characteristics of the family’s home (e.g. type of floor and roof). Subsequent to the work of Gwatkin et al. (2000; 2007), who published tabulations by ‘wealth quintile’ of a large battery of health, nutrition and population indicators for all DHS surveys, the organization responsible for the DHS (then Macro International) decided to include the Filmer-Pritchett wealth index in each public-release DHS dataset; UNICEF, which is responsible for the MICS, subsequently decided to do the same with the MICS.

(2012) find that progress between 1995 and 2007 on MDGs 1, 4 and 5 outcomes was generally pro-rich. On interventions, both Suzuki et al. (2012) and Victora et al. (2012) mostly find pro-poor progress, except on skilled birth attendance (SBA) where Suzuki et al. (2012) find progress has been pro-rich.

Data and indicators

Data

Like Suzuki et al. (2012), we take our data from both the DHS and the MICS surveys. These global household survey programs are the only regular source of comparable household-level data on the health MDG monitoring indicators. We analyzed the raw data from 164 DHS surveys and 71 MICS surveys, covering a total of 91 countries between 1990 and 2011. After eliminating countries with only one period of data, and one dataset with some implausible values, we were left with 64 countries with at least two periods of data. Depending on the MDG indicator (see below for selection criteria and definitions), we have data for between 9 and 63 countries, with an average of 40 countries per indicator (see Table 3). There are some indicators with up to six surveys per country, but the average is 2.7.

We thus cover more countries than previous studies (64 compared to the 22 analyzed by Moser et al. (2005), the 40 analyzed by Suzuki et al. (2012), and the 35 analyzed by Victora et al. (2012)), and unlike previous studies whose trends have been estimated from just two surveys per country per indicator, ours are estimated from several surveys per country per indicator, for an average of 2.7.

Indicators

Table 4 shows the MDG indicators and their definitions used in the present study. Our list includes five health status indicators (stunting, underweight, infant mortality, under-five mortality, and HIV prevalence); the rest are intervention indicators. Our aim was to include as many of the official indicators as possible for each MDG.³ We have included in our analysis five additional indicators that are almost always used in MDG monitoring exercises, drawn from the additional core intermediate indicators listed in Table 1.

Specifically, we include the prevalence of stunted children (MDG1), the percentage of children aged one who have been fully immunized (MDG4)⁴, the percentage of children in malaria-endemic countries sleep under an insecticide-treated bednet (MDG4 and MDG6), antenatal visit coverage (MDG5), and whether or not a condom was used during sexual intercourse with a high-risk partner (MDG6).

Our study thus extends the range of indicators studied compared to previous studies.

Unlike Moser et al. (2005) who focused on MDG outcomes (actually just one outcome: under-five mortality) and Victora et al. (2012) who focused on MDG interventions, but like Suzuki et al. (2012) we analyze data on both MDG outcomes and MDG interventions. While Suzuki et al. (2012) analyze more indicators than we do, we analyze more MDG indicators.⁵

³ Some official indicators – such as the number of tuberculosis (TB) cases detected and treated under DOTS – are not covered by the DHS or MICS, or in any other global household survey exercise. Deaths from malaria and TB are also not captured by regular household surveys like the DHS and MICS, partly because of sample size issues, but also because of the difficulty of ascertaining after the fact the cause of death. Maternal mortality is often computed using variables from the DHS, but maternal deaths are so rare that quintile-level analysis would be challenging.

⁴ The official indicator captures only measles immunization.

⁵ We include two additional MDG6 indicators – condom use and HIV prevalence.

Stratification by ‘wealth’

As in previous studies, we stratify households by the Filmer-Pritchett wealth index. Where available, we use the wealth index variable in the DHS or MICS dataset. For a handful of MICS surveys, we had to construct the wealth index ourselves. In each case, when using wealth quintiles, we sorted *households* into quintiles; individuals then acquire the quintile of their household, so that in an analysis of, say, child mortality, the ‘poorest quintile’ may account for more than 20 percent of births.

Results

We ask first how well countries *as a whole* are progressing on the MDG indicators, and display our results in such a way as to show the full variation across countries and across indicators in rates of progress. We then examine progress among the poorer wealth quintiles (we focus on the poorest two⁶), both in absolute terms and relative to the rest of the population. Finally, we explore more systematically how wealth-related inequalities in the MDG indicators have changed over time, presenting results for both relative and absolute inequality. Table 5 pulls together the key summary statistics that emerge from our analysis. Figures 1-8 give much more detail, and highlight the heterogeneity across developing countries.

⁶ The poorest 40 percent is the target group in the World Bank’s new goal of “promoting shared prosperity”, see e.g. <http://www.worldbank.org/content/dam/Worldbank/document/WB-goals2013.pdf>, where the Bank says: “we will monitor progress in shared prosperity using the income growth of the bottom 40 percent of a nation’s population. This implies a direct focus on the income of the less well-off, as opposed to the common practice of focusing only on growth of GDP per capita and implicitly relying on the “trickle down” impact of growth on the bottom of the distribution. The measure captures the two elements central to the notion of shared prosperity: a growing economy and a fundamental concern for equity.”

How fast is the developing world progressing toward the health MDGs?

Figure 1a shows the average annual growth rates for all countries (ranked in ascending order of their growth rate) on each of our MDG indicators; see also columns 1 and 2 of Table 5.⁷ The growth curves in Figure 1a also allow us to see at a glance the median annual growth rate for each indicator, *and* the fraction of countries experiencing negative and positive growth. For the health status (intervention) indicators, progress entails a country having a negative (positive) value of average annual growth in Table 5 and being below (above) the zero line on the y-axis in Figure 1a.

On all indicators except contraception, the majority of countries have made progress. For example, reading across the zero line on the y-axis in the stunting chart, we see that around 65 percent of countries have reduced the prevalence of stunting; for underweight, the figure is 80 percent. All but 22 per cent of countries have seen increases in ANC coverage. Reading up the median line on the x-axis in the IMR chart, we see that the median annual rate of reduction of IMR is around 0.03 or three percent; the median rate annual rate of increase of measles immunization is around two percent.

Several results shown in Figure 1a are worth noting. First, despite progress for the developing world as a whole, not all countries have made progress toward the MDGs; and, for some MDGs, the fraction not making progress is very high. Over half of countries have seen no progress in contraceptive prevalence, one quarter of countries have not recorded increases in immunization coverage, and one fifth of countries have not made progress in

⁷ Growth rates are computed using information from all available survey years. We assume a compound growth process, and estimate the average annual percentage change by regressing – for each country and each indicator, separately for the population and the poorest 40 percent – the natural logarithm of the indicator on the date of the survey. The average annual rate of growth is equal to the exponential of the (regression) coefficient on the year variable minus one (see e.g. <http://data.worldbank.org/about/data-overview/methodologies>).

reducing underweight, with the figure for stunting as high as one third. Moreover, it is not just a question of some countries not making progress; there are countries that are actually going backwards. In some cases, such as contraception, the countries going backwards are doing so fairly slowly; in others, such as infant- and under-five mortality, immunization and malaria nets, the rates of negative progress are quite high.

A second noteworthy feature of Figure 1a is the variation *across indicators* in the amount of progress made. The conclusion we draw on this depends somewhat on whether we look at median rates of growth or the fraction of countries making progress. For example, the median country recorded roughly similar rates of reduction for underweight, IMR and U5MR; but 93 percent of countries saw progress on IMR while only 80 percent did on underweight. Overall, though, progress has been more on child mortality (Goal 4) than on malnutrition (Goal 1) and maternal health (Goal 5).

A final feature of Figure 1a worth noting is how the indicators vary in how evenly progress is spread *across countries*. This is clearer in Fig 1b which imposes the same range on the y-axis on each chart. The measles immunization growth is very flat: very few countries record an exceptionally high growth rate, and none achieved a growth rate of more than 20 percent. The SBA curve is also fairly flat, but has a steeper and more extended right tail: around five percent of countries averaged growth in excess of 10 percent, some recording growth rates substantially higher than 10 percent. The malaria net growth curve shows much more variation in the spread of growth rates across countries.

How fast are the poor progressing toward the health MDGs?

Figure 2 shows the growth curves for the poorest 40 percent and the richest 60 percent within each country; see also columns 3 and 4 of Table 5. The first conclusion is that for all

MDG indicators, except contraception, the poorest 40 percent have made progress, whether we measure this in terms of the median growth rate or the fraction of countries where progress among the poorest 40 percent has occurred. We also see similar broad patterns in the data of the poorest 40% to those for the population as a whole: negative progress among some countries, variations across indicators in the speed of progress, and small pockets of rapid progress on some indicators.

While the poorest 40 percent have, broadly-speaking, shared in the progress toward the health MDGs of the population as a whole, Figure 2 does reveal some differences in the speed of progress between the poorest 40 percent and richest 60 percent. The degree to which progress has been pro-poor or pro-rich is also shown in Figure 3 (and column 5 of Table 5) which shows how countries vary in excess growth among the poorest 40 percent, i.e. the excess of the growth rate among the poorest 40 percent over the growth rate among the richest 60 percent. For an intervention indicator, such as immunization, positive excess growth among the poorest 40 percent means faster progress among the poor, i.e. pro-poor progress. For health status indicators, such as underweight and mortality, the opposite is the case: positive excess growth among the poorest 40 percent means pro-rich progress.

On the MDG outcomes, the picture varies somewhat by indicator. On HIV prevalence, progress has been markedly pro-rich. The median rate of reduction for the richest 60 percent was around three percentage points higher than that for the poorest 40 percent. And while 90 percent of countries saw a reduction in HIV prevalence among the richest 60 percent, only around 55 percent of countries saw a reduction in HIV prevalence among the poorest 40 percent. Figure 3 shows that in the case of HIV prevalence, excess (negative) growth among the poorest 40 percent was recorded in only roughly 35 percent of countries.

By contrast, no striking differences in progress between the poor and better off emerge for malnutrition and child mortality. The growth curves for the poorest 40 percent and richest 60 percent are close to one another, and actually intersect several times; and the excess growth curves in Figure 3 all intersect the median line on the x-axis around zero on the y-axis. For both malnutrition indicators, the median rate of reduction among the richest 60 percent is very slightly larger than that among the poorest 40 percent, and the fraction of countries where the richest 60 percent saw reductions in malnutrition is very slightly higher than the fraction of countries where the poorest 40 percent saw reductions. In Figure 3 it emerges that for malnutrition the fraction of countries seeing negative excess growth among the poorest 40 percent is only slightly less than 50 percent, and the median excess growth rate is almost zero. On the excess growth measure, progress on child mortality emerges as neither pro-poor nor pro-rich.

On MDG intervention indicators, a distinctly pro-poor picture emerges. In Figure 2, for all indicators except contraception, the growth curve for the poorest 40 percent lies above that for the richest 60 percent, so that whether one looks at the difference in median growth rates or at the differences in the fraction of countries recording progress, we get a pro-poor result. We get the same pro-poor picture for MDG intervention indicators in Figure 3, where all curves except that for contraception intersect the zero line on the y-axis to the left of the median line on the x-axis. Thus, whether we look at the median rate of excess growth among the poorest 40 percent, or at the fraction of countries where there is positive excess growth among the poorest 40 percent, we see the same pro-poor picture. Using the latter indicator of pro-pooriness, Figure 3 suggests progress has been especially pro-poor for antenatal care and condom use, while progress on use of contraception has been neither pro-poor nor pro-rich.

Figure 3 points to large differences across countries in the degree to which progress toward the health MDGs has been pro-poor. For example, while on average progress has been broadly similar for the poorest 40 percent and the richest 60 percent for malnutrition and child mortality, there are some countries (to the left of Figure 3) where progress has been dramatically pro-poor (growth rates have been more negative for the poorest 40 percent than for the richest 60 percent), but also some countries (to the right of Figure 3) where progress has been markedly pro-rich (growth rates have been less negative for the poorest 40 percent). Likewise, while, on average, progress on intervention indicators has been pro-poor, Figure 3 shows that in plenty of countries, progress has been slower for the poorest 40 percent than for the richest 60 percent.

The maps in Figure 4 show, for a subset of indicators, where progress has been most pro-poor. For most indicators, most continents have a mix picture – some countries have achieved pro-poor progress, but not all. This is less true of Asia and the Americas: on antenatal care and skilled birth attendance, almost all countries in these regions have achieved pro-poor progress; by contrast, in almost all countries in Asia, progress on underweight has been pro-rich.

To what extent is overall pro-poor progress attributable to some countries improving systematically across all MDG indicators? Treating each country-indicator combination as an observation, and defining the outcome as whether the country recorded excess growth among the poorest 40 percent for that indicator, we performed a two-way analysis of variance; the 12 indicator and 64 country codes were entered as independent variables. We found that two thirds of the explained variance is attributable to variation across countries, holding indicators constant. In other words, two thirds of the explained variation is

explained by some countries systematically doing better than others in achieving pro-poor progress *across all indicators*.

How have wealth-related inequalities in the health MDGs been changing?

Faster growth among the poorer wealth groups implies a reduction in wealth-related inequalities in the MDG health indicators. Figures 2 and 3 are thus *suggestive* of inequality reduction for the intervention indicators, and of little change in inequality for the outcome indicators. But the charts do not give us a definitive answer on inequality trends; it could be argued that splitting the population into two at the 40 percent mark is a somewhat arbitrary way of tracking inequality. Moreover, they do not give us a sense of *by how much* inequality has been reduced, or of the amount of inequality left at the time of the latest survey. Finally, pro-poor progress – in the sense of faster growth among the poor – implies a reduction in *relative* inequality, but not necessarily in *absolute* inequality. Equal increases in, say, income for everyone implies less relative inequality, but no change in absolute inequality. The choice between the two concepts is entirely a value judgment; given this, it seems worth presenting evidence on both.

A simple – and very incomplete – relative inequality measure is the ratio of the poorest quintile's value to that of the richest quintile. Figure 5 shows this measure for the earliest survey in each country and the latest survey. A more complete measure of wealth-related health status and health intervention inequality is the concentration index (Kakwani, Wagstaff and van Doorslaer 1997). A positive value indicates that the better off, on average, have higher values of the outcome variable (good in the case of an intervention, bad in the case of an indicator like malnutrition), while a negative value indicates they have, on average lower values (bad in the case of an intervention, good in the case of an indicator

like malnutrition). With a binary outcome, like the variables being used in the present paper, the bounds of the concentration index are $\mu-1$ and $1-\mu$, where μ is the mean of the outcome variable (Wagstaff 2005); thus as the mean increases, the range of possible values shrinks, tending to zero as the mean goes to one. Figure 6 shows the population mean and the concentration index for the earliest and latest surveys for all countries for all MDG indicators; see also column 6 of Table 5.⁸

Four points are worth noting in Figures 5 and 6. First, reinforcing earlier studies, we find in both charts inequalities on all but one indicator to the disadvantage of the poor: the poor, on average, have higher rates than the better off on all the MDG health status indicators except HIV, and lower rates on the MDG intervention indicators. Second, for the intervention indicators, we see the ratios in Figure 5 getting closer to one and the concentration indices in Figure 6 approaching zero as the population average gets closer to one. All the charts in Figure 6 have something of a half-arrowhead appearance, reflecting the fact that the bounds shrink as the population mean rises towards one, and that inequality is almost everywhere pro-rich (so we see only the left or right of the arrowhead). Third, in the case of the intervention indicators the markers in both charts seem to be rising over time (population averages are improving), and closing in on the vertical line on the x-axis (inequalities are falling). For the malnutrition and child mortality indicators, we see the markers falling over time, but no clear pattern in terms of inequality. We come back to this in a moment. Fourth, inequalities favoring the better off are still very much in evidence even in the latest round of surveys.

⁸ Concentration indices were computed from the individual-level data not the quintile data using the convenient covariance method (see e.g. Jenkins 1988), except in the case of the mortality variables whose concentration indices were computed from quintile data (see e.g. Kakwani, Wagstaff and van Doorslaer 1997).

The analogue of the concentration index for absolute inequality measurement is the absolute concentration index, equal to the mean multiplied by the standard concentration index.⁹ A positive value indicates higher values, on average, among the better off, and a negative value indicates higher values, on average, among the less well off. In the case of a binary outcome, the bounds of the absolute concentration index start at zero when the population mean is zero, grow as the mean rises above zero reaching a maximum and minimum widen, increase as the population average rises above zero, reaching minimum and maximum values of -0.25 and +0.25 as the mean reaches one half; as the population mean rises further, the bounds shrink, reaching zero again as the mean reaches one.¹⁰

Figure 7 is the analogue of Figure 6 but for the absolute concentration index; see also column 10 of Table 5. Five features of Figure 7 are worth highlighting. First, we see that absolute inequality also favors the better off. Second, we see that as the population average rises, absolute inequality does not always decrease; instead, there is a sign – especially visible for the ANC and SBA indicators – of inequalities growing as the population average increases, before diminishing. This is consistent with the bounds of the absolute concentration index having a rotated ellipse shape with minima and maxima of -0.25 and +0.25. Third, the smaller bounds of the absolute concentration index explain why the values for the absolute concentration index are smaller than those for the regular concentration index. Fourth, as with relative inequality, it appears that the upward drift in the intervention markers over time has been associated with less absolute inequality, while for the malnutrition and mortality indicators, the pattern is less clear. Fifth, as with relative inequality, we still see evidence of inequalities even in the latest data.

⁹ The absolute concentration index is the same as the generalized concentration index, the former being derived from the absolute concentration curve, the latter from the generalized concentration curve. On absolute inequality, see Jenkins and Jäntti (2005 p.14), Moyes (1987 p.205) and Lambert (2001 p.56). In the health context, see Wagstaff et al. (1991) and Wagstaff (2009).

¹⁰ This follows from the fact that the absolute concentration index is equal to the mean times the standard concentration index.

Figure 8 shows the global distribution, for each indicator, of annual average changes in the regular and absolute concentration indices; see also columns 7, 8, 9, 11, 12 and 13 of Table 5. Two points are worth highlighting. First, reductions in relative inequality are more evident for the intervention indicators than for the health status indicators. For IMR, roughly half of countries saw relative inequality increase; half saw it fall. For the other four health status indicators, only a slight majority of countries saw a reduction in relative inequality, and the (absolute) percentage change per year in relative inequality was small (typically less than one percent). The health status indicator that bucks this trend is HIV prevalence, where 67 percent of countries saw relative inequality fall, and the regular concentration index fell by 2.3 percent per year. Keep in mind, though, that in the initial round of surveys, HIV was more prevalent among the better off, not the poor; so while a reduction in inequality occurred, it was not a pro-poor change. On the intervention indicators, reductions in inequality are more pronounced. On average, nearly three quarters of countries record reductions in relative inequality on the intervention indicators, and the annual reduction in the concentration index averages around four percent.

Second, we see fewer countries reducing absolute inequality than relative inequality, and smaller median reductions in absolute inequality. On the malnutrition and child mortality indicators, we actually see *increases* in absolute inequality in the majority of countries, with changes in the absolute concentration index for these indicators averaging three percent. On the intervention indicators we see reductions in absolute inequality, but the percentage reductions in absolute inequality are, on average, half as large as the percentage reductions in relative inequality. The different behaviors of the relative and absolute inequality measures reflects the fact that an improvement to someone in the richest half of the population will cause absolute inequality to rise, but it need not cause relative inequality to

rise; depending on the initial concentration index value, improvements to people well above the mid-point of the wealth distribution could still be compatible with a reduction in relative inequality.¹¹

Discussion

The developing world as a whole is making progress toward all MDG indicators.

Unsurprisingly perhaps, given the different starting points, progress has been slower on some indicators (for example, immunization, which had higher initial rates of coverage) than on others (for example, antenatal care coverage, which had lower initial rates). More surprising is the fact that for every indicator there are several countries that have gone backwards. For some indicators, the fraction of such countries is quite high: one quarter for immunization; and a fifth and a third for underweight and stunting.

The main focus of the paper, however, has been on differential progress between the poor and better off. There are three key messages of this paper. First, in a majority of countries the poorest 40 percent are making faster progress than the richest 60 percent, and on average relative inequality in the MDG indicators has been falling. Second, in an appreciable fraction of countries, the poorest 40 percent have not been progressing in absolute terms. Moreover, in a sizable fraction of countries the poorest 40 percent have progressed less quickly than the richest 60 percent, and relative inequality has been growing. This is especially true of the child health status indicators (for child malnutrition and mortality, the fraction in this latter category is 40-50 percent), but it is also true of some intervention indicators (for immunization, the figure is almost 40 percent). Third,

¹¹ Wagstaff (2009) proves both results. An increase in individual i 's outcome (holding everyone else's constant) will raise absolute inequality if person i is in the upper half of the wealth distribution. The same increase will raise relative inequality only if the person's rank in the wealth distribution exceeds $\frac{1}{2}(CI+1)$ where CI is the value of the (initial) concentration index. So if CI is 0.25, person i 's rank in the wealth distribution would have to be above 0.625 for relative inequality to increase.

while on average relative inequality has been falling, appreciable inequalities remain. In the latest round of surveys used in this study (of which all but two are from the 2000s), the richest 60 percent of children in the developing world are, compared to the poorest 40 percent and based on a comparison of odds ratios, 1.2 times as likely to sleep under a bednet, 1.5 times as likely to be immunized, and 3.7 times as likely to have been delivered by a skilled birth attendant.

On the subset of issues that we address and previous authors have addressed, we see some similarities in results, but also some differences. Our results are broadly consistent with those of Victora et al. (2012) and Suzuki et al. (2012) who found pro-poor progress on most of the MDG intervention indicators that were also examined here; the exception is SBA which Suzuki et al. (2012) concluded had been pro-rich. On inequalities in health status indicators, our results on under-five mortality are consistent with those of Moser et al. (2005) who found that progress had been neither pro-poor nor pro-rich on balance, but our results on underweight are less encouraging than those of Suzuki et al. (2014) who found pro-poor progress in over 60 percent of countries. Differences in findings may be due to variations in the methodological approaches adopted, such as differences in the number of countries included, time period examined the definition of poor and non-poor and the measure of inequality.

Our first finding – that in most countries the poor have not been left behind by the health MDGs – will be reassuring to donors, international development and technical agencies, national governments, NGOs, program implementers, and health care professionals. But our other two findings – that relative inequalities have grown in a sizable minority of countries especially on health status indicators, and that, despite reductions in most countries, inequalities are still appreciable – will be a cause for concern. Governments,

donors and NGOs ought, after all, to be able to exert a fairly direct influence over the coverage of immunization, skilled birth attendants, bednets, etc. Our findings suggest that Gwatkin (2005) was right to warn that programs that improve population averages may not necessarily disproportionately benefit the poor. Our findings also suggest that it is indeed important to monitor progress not only on population averages but also on inequalities – a point made by the UN’s 2013 high-level panel report on the post-2015 development agenda (United Nations 2013). Our results ought also to prompt yet further discussion of appropriate policies to reduce inequalities in intervention coverage and health status. For example, are universalist policies the answer, or is there a greater need for targeting of efforts toward the poor? Do ‘new’ initiatives such as conditional cash transfers and pay-for-performance stand a better chance of reducing inequalities than ‘traditional’ approaches like pure input-financing?

Our finding that progress on interventions has been considerably more pro-poor than progress on health status is a puzzle that merits further research. One hypothesis is that the quality of health care is worse for lower socioeconomic groups, so that even though they may have experienced a larger percentage increase in, say, antenatal visits, babies in the poorest 40 percent of the population have not had the same improvement in their survival prospects. If true, this would point to the need for a monitoring framework that captures not only the quantity of care (as is currently the case) but also its quality. Another hypothesis is that while inequalities in the official monitoring indicators have been narrowing, inequalities in at least some of the interventions not monitored may have been widening. Examples include health interventions delivered by caregivers, like breastfeeding, hand-washing, and antibiotics for a child suffering from dysentery or pneumonia – indicators that a UN technical consultation suggested be tracked but which

never obtained official indicator status; as a result, the interventions in question may have been under-promoted. If true, this would point to the need for a broadening of the monitoring framework to capture interventions delivered by caregivers, as well perhaps as a policy shift in the health sector toward preventive and curative interventions delivered in the home and in the community.

Table 1: MDG health goals, targets, and indicators

MDG goal	Targets	Official indicators	Additional core intermediate monitoring indicators[§]
Goal 1: Eradicate extreme poverty and hunger	Halve, between 1990 and 2015, the proportion of people who suffer from hunger.	Prevalence of underweight children under five years of age Proportion of population below minimum level of dietary energy consumption	Percentage of children 6 to 59 months who received one dose of vitamin A in the past six months, proportion of infants under six months who are exclusively breastfed.
Goal 4: Reduce child mortality	Reduce by two thirds, between 1990 and 2015, the under-five mortality rate	Under-five mortality rate Infant mortality rate Measles immunization among children under one	Proportion of infants under six months who are exclusively breastfed, proportion of surviving infants who have received a dose of measles vaccine by their first birthday, proportion of children with fast or difficult breathing in the past two weeks who received an appropriate antibiotic, proportion of children with diarrhea in the past two weeks who received oral rehydration therapy (ORT), proportion of children under five who slept under an insecticide-treated net the previous night (in malarious areas), proportion of children with fever in the past two weeks who received an appropriate anti-malarial (in malarious areas)
Goal 5: Improve maternal health	Reduce by three quarters, between 1990 and 2015, the maternal mortality ratio	Maternal mortality ratio Proportion of births attended by skilled health personnel	Contraceptive prevalence rate, percentage of women with any antenatal care, provision of emergency obstetric care, syphilis in pregnant women, and proportion that are properly treated, percentage of women receiving antenatal care who receive at least two to three intermittent preventive malaria treatments during pregnancy (in malarious areas)
Goal 6: Combat HIV/AIDS, malaria and other diseases	Have halted by 2015 and begun to reverse the spread of HIV/AIDS	HIV prevalence among 15-24-year old pregnant women Condom use rate of the contraceptive prevalence rate Number of children orphaned by HIV/AIDS	Percentage of persons using a condom at last higher-risk sex, percentage of sexually transmitted infection clients who are appropriately diagnosed and treated according to guidelines, percentage of HIV-positive women receiving anti-retroviral treatment during pregnancy to prevent mother-to-child transmission of HIV
	Have halted by 2015 and begun to reverse the incidence of malaria and other major diseases	Prevalence of and death rate associated with malaria Proportion of population in malaria risk areas using effective malaria prevention and treatment measures	Percentage of patients with uncomplicated malaria who received treatment within 24 hours of onset of symptoms, percentage of children under five sleeping under insecticide-treated nets, percentage of pregnant women sleeping under insecticide-treated nets, percentage of pregnant women who have taken chemoprophylaxis or drug treatment for malaria
		Prevalence of and death rates associated with tuberculosis Proportion of tuberculosis cases detected and cured under directly observed treatment, short-course (DOTS)	Percentage of estimated new smear-positive tuberculosis cases that were registered under the DOTS approach

Source: Wagstaff and Claeson (2004). [§] Additional core intermediate monitoring indicators are those recommended by a technical consultation between the World Bank and UN technical agencies, and are as reported in Table 2.1 of Wagstaff and Claeson (2004). That table also lists optional indicators.

Table 2: Previous studies of differential progress by wealth toward the health MDGs

	Moser, Leon and Gwatkin (2005)	Suzuki, Sharan and Bos (2012)	Victora et al. (2012)
Time period	1990-2001	1995-2007	1990-2007
No. countries	22	40	35
Data source	Demographic and Health Survey (DHS)	Demographic and Health Survey (DHS), Multiple Indicator Cluster Survey (MICS)	Demographic and Health Survey (DHS)
No. surveys per country	2	2	2
Official indicators	Under-five mortality	Prevalence of underweight children under five years of age Under-five mortality rate Infant mortality rate Measles immunization among children under one Proportion of births attended by skilled health personnel	Skilled birth attendant Measles immunization
Additional core intermediate monitoring indicators	None	Use of insecticide-treated bednets by under-five children Proportion of infants under six months who are exclusively breastfed Proportion of children with diarrhea in the past two weeks who received oral rehydration therapy (ORT) Proportion of children with fever in the past two weeks who received an appropriate anti-malarial (in malarious areas) Contraceptive prevalence rate	Use of insecticide-treated bednets by under-five children
Stratifying variable	Wealth index	Wealth index	Wealth index
Summary statistic	Changes in ratio of the richest 20 percent to the poorest 20 percent	Changes in ratio of the richest 20 percent to the poorest 20 percent	Changes in concentration index
Findings	An approximately equal number of countries with widening and narrowing inequalities	Pro-poor progress on underweight Pro-rich progress on under-five mortality Pro-poor progress on most intervention indicators except skilled birth attendance	Inequalities have been falling over time

Source: Authors' compilation based on listed studies.

Table 3: Details of datasets used in the current study

MDG	Indicator	No. countries	No. surveys	Surveys per country		
				Average	Minimum	Maximum
1	Stunting	53	156	2.9	2	5
1	Underweight	54	158	2.9	2	5
4	IMR	41	126	3.1	2	5
4	U5MR	41	125	3.0	2	5
4	Full immunization	60	178	3.0	2	6
4	Measles immunization	63	188	3.0	2	6
5	ANC4+	41	127	3.1	2	5
5	SBA	41	127	3.1	2	5
5	Contraceptive prevalence	38	87	2.3	2	4
6	Condom use in risky intercourse	15	32	2.1	2	3
6	HIV prevalence	9	18	2.0	2	2
6	Malaria nets (children)	23	54	2.3	2	3
Average		40	115	2.7	2	4.5

Source: Authors' calculations from original DHS and MICS datasets.

Table 4: MDG indicators used in current study

MDG goal	Indicator	Definition
Goal 1: Eradicate extreme poverty and hunger	Underweight	Percentage of children with a weight-for-age z-score <-2 standard deviations from the reference median [§]
	Stunting	Percentage of children with a height-for-age z-score <-2 standard deviations from the reference median [§]
Goal 4: Reduce child mortality	Infant mortality rate (IMR)	Number of deaths among children under 12 months of age per 1,000 live births [§]
	Under-five mortality rate (U5MR)	Number of deaths among children under 5 years of age per 1,000 live births [§]
	Measles immunization	Percentage of children aged 12-23 months who received measles either verified by card or by recall of respondent
	Full immunization	Percentage of children aged 12-23 months who received BCG, measles, and three doses of polio and DPT, either verified by card or by recall of respondent
	Malaria nets (children)	Percentage of children under 5 sleeping under an (ever) insecticide-treated bednet the previous night
Goal 5: Improve maternal health	Skilled birth attendant (SBA)	Percentage of births of births to mothers aged 15-49 that were attended by skilled health attendant (SBA)
	Antenatal care visits – 4 or more (ANC4+)	Percentage of mothers aged 15 to 49 who received at least four antenatal care (ANC4+) visits from any skilled personnel (as defined in the country's DHS or MICS)
	Contraceptive prevalence	Percentage of women aged 15 to 49 who currently use a modern method of contraception
Goal 6: Combat HIV/AIDS, malaria and other diseases	HIV prevalence	Percentage of adults aged 15 to 49 testing positive for HIV 1 or 2
	Condom use in risky intercourse	Percentage of women aged 15 to 49 who had more than one partner in the past year and used a condom during last sexual intercourse
	Malaria nets (children)	Percentage of children under 5 sleeping under an (ever) insecticide-treated bednet the previous night

[§] WHO 2006 child growth standards used to calculate z-score

[§] Mortality rate calculated using the true cohort life table approach. The DHS reports use the synthetic cohort life table approach

Table 5: Key summary statistics on differential progress by wealth toward the health MDGs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
	Annual growth					Relative inequality				Absolute inequality			
		% countries	Median growth rate	% countries where mean for poorest 40% improved	Median excess growth of poorest 40%			Median change in CI [§] p.a.	as % of median initial CI [§] (absolute value)		% countries with fall in absolute CI [§]	Median change in absolute CI [§] p.a.	as % of median initial absolute CI [§] (absolute value)
Indicator	Median growth rate pop	where pop improved	poorest 40%			Median initial CI [§]	with fall in CI [§]			Median initial absolute CI [§]	absolute CI [§]		
Stunting	-0.0084	64	-0.0087	64	0.0023	-0.1035	58	-0.0009	0.8	-0.0406	45	0.0001	0.3
Underweight	-0.0269	80	-0.0239	74	0.0064	-0.1345	56	-0.0012	0.9	-0.0246	43	0.0004	1.8
IMR	-0.0281	93	-0.0283	93	-0.0004	-0.1039	49	0.0010	0.9	-0.0080	34	0.0003	3.4
U5MR	-0.0307	88	-0.0328	90	0.0019	-0.1209	61	-0.0009	0.7	-0.0143	34	0.0003	2.1
Full immunization	0.0242	73	0.0295	72	0.0105	0.0934	68	-0.0040	4.2	0.0419	58	-0.0008	1.9
Measles	0.0169	78	0.0217	78	0.0091	0.0655	75	-0.0025	3.8	0.0386	73	-0.0012	3.1
ANC4+	0.0310	78	0.0445	78	0.0164	0.2001	78	-0.0049	2.4	0.0571	44	0.0003	0.6
SBA	0.0183	83	0.0277	80	0.0130	0.2807	73	-0.0043	1.5	0.1080	49	0.0004	0.3
Contraception	-0.0143	41	0.0065	50	-0.0009	0.0691	53	-0.0015	2.2	0.0097	53	-0.0005	5.6
HIV-prevalence	-0.0101	67	-0.0026	56	0.0198	0.1526	67	-0.0035	2.3	0.0066	89	-0.0004	5.4
HIV-condom	0.0740	93	0.1095	100	0.0412	0.2446	93	-0.0113	4.6	0.0625	57	-0.0002	0.4
Malaria-net children	0.1691	78	0.3353	74	0.0480	0.2950	65	-0.0304	10.3	0.0171	52	-0.0001	0.8
Av. health status	-0.0208	78	-0.0193	75	0.0060	-0.0620	58	-0.0011	1.1	-0.0162	49	0.0002	2.6
Av. interventions	0.0456	75	0.0821	76	0.0196	0.1783	72	-0.0084	4.2	0.0478	55	-0.0003	1.8

Source: Authors' calculations from original DHS and MICS datasets. § CI is concentration index – see text for definition.

Figure 1a: Progress toward the health MDGs for the entire population

Source: Authors' calculations from original DHS and MICS datasets. The annual growth is as a fraction, so e.g. 0.02 means 2% annual growth.

Figure 1b: Progress toward the health MDGs for the entire population – common growth rate scales

Source: Authors' calculations from original DHS and MICS datasets. The annual growth is as a fraction, so e.g. 0.02 means 2% annual growth.

Figure 2: Progress toward the health MDGs among the poorest 40 percent and richest 60 percent

Source: Authors' calculations from original DHS and MICS datasets. The annual growth is as a fraction, so e.g. 0.02 means 2% annual growth.

Figure 3: Incidence of excess growth among the poorest 40 percent on health MDG indicators

Source: Authors' calculations from original DHS and MICS datasets. The annual growth is as a fraction, so e.g. 0.02 means 2% annual growth.

Figure 4: Map of excess growth among the poorest 40 percent on health MDG indicators

Source: Authors' calculations from original DHS and MICS datasets. The annual growth is already as a percentage, so e.g. 2 means 2% annual growth.

Figure 5: Trends in ratio of poorest quintile's MDG indicator value to richest quintile's value

Source: Authors' calculations from original DHS and MICS datasets. The population rate is as a fraction, so e.g. 0.2 means a population average of 20%. This is true also for IMR and U5MR which are typically expressed per 1,000.

Figure 6: Trends in the concentration index of MDG indicators

Source: Authors' calculations from original DHS and MICS datasets. . The population rate is as a fraction, so e.g. 0.2 means a population average of 20%. This is true also for IMR and U5MR which are typically expressed per 1,000.

Figure 7: Trends in the absolute concentration index of MDG indicators

Source: Authors' calculations from original DHS and MICS datasets. . The population rate is as a fraction, so e.g. 0.2 means a population average of 20%. This is true also for IMR and U5MR which are typically expressed per 1,000.

Figure 8: Variations across countries in trends in relative and absolute wealth-related inequality in MDG indicators

Source: Authors' calculations from original DHS and MICS datasets. The vertical axis measures the annual average change in the index, not the percentage change.

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