Mind the gap: equity and trends in coverage of maternal, newborn, and child health services in 54 Countdown countries

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Summary

Background Increasing the coverage of key maternal, newborn, and child health interventions is essential if Millennium Development Goals (MDG) 4 and 5 are to be reached. We have assessed equity and trends in coverage rates of a key set of interventions through a summary index, to provide overall insight into past performance and progress perspectives.

Methods Data from household surveys from 54 countries in the Countdown to 2015 for Maternal, Newborn and Child Survival initiative during 1990–2006 were used to compute an aggregate coverage index based on four intervention areas: family planning, maternal and newborn care, immunisation, and treatment of sick children. The four areas were given equal weight in the computation of the index. Standard measures were applied to assess current levels and trends in the coverage gap measure by wealth quintile.

Findings The overall size of the coverage gap ranged from less than 20% in Tajikistan and Peru to over 70% in Ethiopia and Chad, with a mean of 43% for the most recent surveys in the 54 countries. Large intracountry differences were noted, with a country mean coverage gap of 54% for the poorest quintiles of the population and 29% for the wealthiest. Differences between the poorest and the wealthiest were largest for the maternal and newborn health intervention area and smallest for immunisation. In 40 countries with more than one survey, the coverage gap had decreased by an average of 0.9 percentage points per year since the early 1990s. Declines greater than 2 percentage points per year were seen in only three countries after 1995: Cambodia, Mozambique, and Nepal. Country inequity patterns were remarkably persistant over time, with only gradual changes from top inequity (disproportionately smaller gap for the wealthiest) in countries with coverage gaps exceeding 40%, to linear patterns and bottom inequity (disproportionately greater gap for the poorest) in surveys with gaps below 40%.

Interpretation Despite most Countdown countries having made gradual progress since 1990, coverage gaps for key interventions remain wide and, in most such countries, the pace of decline needs to be more than doubled to reach levels of coverage of these and other interventions needed in the context of MDG 4 and 5. In general, in-country patterns of inequality are consistant and change only gradually if at all, which has implications for the targeting of interventions.

Funding None.

Introduction

Coverage, defined as the percentage of people receiving a specific intervention in those who need it,[1] is an important output of health services and should be an essential part of any strategy to monitor progress in programme implementation. Coverage includes two interactive components—service provision and service use—indicating the need for effective public health actions to address both supply and demand. The ability to reach and maintain high rates of coverage for priority interventions among the general and disadvantaged populations in a country is an indication of the strength of the health system.[2]

The Countdown to 2015 for Maternal, Newborn and Child Survival[3] initiative consists of individuals and institutions who share the aim of stimulating country action by tracking coverage for interventions that are essential for the attainment of major health Millennium Development Goals (MDG). The Countdown strategy is to establish a process through which national and international policy makers, programme implementers, development and media partners, and researchers can work together to compile and disseminate the most recent

information about individual countries' progress in achieving high, sustained, and equitable coverage—with health interventions effective in reducing mortality in women, newborn babies, and children under 5 years of age. Country-specific data are presented for the 68 countries that represent an estimated 97% of yearly maternal and child deaths worldwide.[4] Coverage levels are presented in the Countdown report in a two-page country profile that combines estimates and trends for coverage with other information needed to interpret them.[3] This profile includes country-specific data for nutrition and mortality, the uptake of relevant policies, the status of selected measures of health system strength, and equity.

Previous work has shown the usefulness of an index that summarises coverage across a range of interventions.[5] Victora and colleagues[5] used data from Demographic and Health Surveys (DHS) to construct a so-called co-coverage score including eight public health interventions with proven benefit in reducing child mortality: vaccinations for BCG, diphtheria, pertussis, and tetanus (DPT), and measles; tetanus toxoid vaccination for the mother; vitamin A supplementation; antenatal care; skilled birth

	Definition
Indicators for family planning	
Need for family planning satisfied	Percentage of currently married women who say that they do not want any more children or that they want to wait 2 or more years before having another child, and are using contraception
Contraceptive prevalence rate	Percentage of women aged 15–49 years currently married or in union who are using (or whose partner is using) a modern contraceptive method
Indicators for maternal and newborn care	
Skilled birth attendance	Percentage of livebirths in the 3 years before the survey attended by skilled health personnel (doctor, nurse, midwife, or auxiliary midwife)
Antenatal care	Percentage of women attended at least once during pregnancy by skilled health personnel for reasons related to the pregnancy in the 3 years before the survey
Indicators for immunisation	
Measles vaccination	Percentage of children aged 12–23 months who are immunised against measles
Diphtheria, pertussis, and tetanus vaccination	Percentage of children aged 12–23 months who received three doses of diphtheria, pertussis, and tetanus vaccine
BCG vaccination	Percentage of children aged 12–23 months currently vaccinated against BCG
Indicators for treatment of sick children	
Oral rehydration therapy	Percentage of children under-5 with diarrhoea in the past 2 weeks who received oral rehydration therapy (packets of oral rehydration salts, recommended home solution, or increased fluids) and continued feeding
Treatment of acute respiratory infection	Percentage of children aged 0–59 months with suspected pneumonia (cough and dyspnoea) who sought care from a health provider

Table 1: Definition of indicators by intervention area used for the coverage gap index

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attendance; and safe water supply. The resulting score was used as an outcome measure to describe within-country inequalities in coverage by socioeconomic status, and served as the indicator of equity in the 2005 cycle of Countdown.[2] The co-coverage score was calculated for each child within the survey sample, and was therefore limited to the subset of interventions that all children and their mothers should receive—ie, the measure was limited to preventive interventions. A similar measure was recently used to describe inequities in coverage of four neonatal survival interventions in eight countries.[6]

A wider range of interventions was used to develop a composite measure of health system coverage to compare health system performance between states in Mexico.[7] This measure was based on 14 interventions for child and adult health for which state-level estimates of coverage were available. This method allowed the inclusion of curative as well as preventive interventions.

Here we extend these earlier efforts by developing and applying an aggregate coverage gap measure based on a broad set of interventions in maternal, newborn, and child health programme areas. The immediate objective was to develop a summary measure of coverage that could be used to assess and report on equity in the 2008 Countdown cycle, with special attention to time trends.

Methods
Data
Estimates for intervention coverage were obtained from large-scale nationally-representative surveys implemented under the Demographic and Health Surveys (DHS) programme[8] or UNICEF's Multiple Indicator Cluster Surveys (MICS) programme[9] between 1990 and 2006. Coverage data were obtained in these surveys through standardised interviews with women aged 15–49 years. We included all low-income and lower middle-income countries identified as priority countries in the 2008 Countdown cycle.[4] Data from a total of 175 surveys were assessed, including 121 DHS and 54 MICS (webtable 1). 114 of 175 surveys in 54 Countdown countries included data for all variables in the coverage gap and sufficient data to compute a wealth index, and 40 countries had at least two surveys for trend analysis.

Development of the coverage gap index
Our aim in selecting the interventions for the index was to address a range of intervention areas that draw on different health system delivery strategies, thereby increasing the validity of the index as a measure of overall coverage and health system strength. We reviewed a total of six potential intervention areas, and applied the criteria of data availability, accuracy and consistency of measurement, relevance to health system strength, and potential health gain from achieving high levels of coverage, to establish the subset of coverage indicators for inclusion in the index. Webtable 2 provides a summary of definitions and our findings against these criteria for each potential indicator.

Table 1 shows the final set of four intervention areas, which are presented along the continuum of care,[10] a major theme of the 2008 Countdown: family planning, maternal and newborn care, immunisation, and treatment of sick children. In each intervention area, one to three indicators are selected. These coverage indicators are consistent with those used in the 2008 Countdown, except that BCG has been added within the immunisation area, and an indicator of "need satisfied" was used in the coverage gap measure, whereas contraceptive prevalence and unmet need for family planning are reported in the Countdown assessment.

Unlike most other coverage indicators, the target for use of contraceptives for married women of reproductive ages is less than 100% because of variations in the wanted level of fertility and other factors. An alternative measure that can support a target of 100% is the proportion of need for family planning that is satisfied.[11] Measurement of this indicator needs multiple survey questions, all of which are present in the current DHS protocol. A regression analysis of results from DHS surveys showed a high level of correlation between use of modern contraceptives (surgical, hormonal, and barrier methods) and the proportion of need satisfied ($r=0.93$; need satisfied=$1.07\times$contraceptive prevalence rate+27). This finding suggests that in surveys without data for the need for family planning, the indicator can be roughly estimated from the more widely available data for contraceptive prevalence rate. For high contraceptive prevalence rates (exceeding 68%) the estimated need satisfied was kept at 100%. We used this measure as the family planning indicator to compute the coverage gap index.

All data were abstracted from DHS and MICS reports and databases. For missing data, values were extrapolated

for values that fell in the periods between two surveys; if the most recent value was missing for one indicator of the index, it was replaced with the same value as in the preceding survey. Some surveys did not include data for whether a child with diarrhoea had continued to be fed during the episode, precluding calculation of the diarrhoea treatment indicator. If a country had several surveys, but only one with the full information for all components of the oral rehydration therapy indicator, we imputed a coverage score assuming that the continued feeding practices during diarrhoea were unchanged between the two surveys.

Cronbach's α reliability coefficients were calculated to ascertain the internal consistency of the items (the four intervention areas) in relation to the underlying construct. Cronbach's α reliability coefficient has a theoretical value of between 0 and 1, and values exceeding 0·7 for the coefficient are regarded as acceptable.[12] Item analysis aims to further improve the reliability of the index by identifying items that are poorly correlated with other items.[13] Cronbach's α reliability coefficient was 0·885 for the full set of eight coverage indicators. No item was removed.

Epidemiological, subjective, and statistical approaches can be used to assign weights within and between intervention areas. The epidemiological approach, which applies health gains attributable to specific interventions as weights in calculating the index, was not used because it adds another layer of assumptions that might hamper widespread use of the index. We gave equal weight to all four intervention areas and within each intervention area. The only exception was DPT3 coverage which was given a weight of 2, since it involves multiple contacts with the health services and correlates highly with other vaccinations such as those for poliomyelitis and *Haemophilus influenzae B*. The effect of different weights (eg, 1 or 3 for DPT3) on the summary measure was small. The formula to calculate the coverage gap index is:

$$100\% - \frac{\left(\dfrac{ORT+ARI}{2}+FP+\dfrac{SBA+ANC}{2}+\dfrac{MSL+2DPT3+BCG}{4}\right)}{4}$$

where ORT=oral rehydration therapy; ARI=acute respiratory infection; FP=family planning; SBA=skilled birth attendance; ANC=antenatal care; MSL=measles vaccination; and DPT3=three doses of diphtheria, pertussis, and tetanus vaccine.

We present the results as a measure of the gap between maximum and actual coverage for several reasons. First, monitoring progress towards reduction of the coverage gap becomes a more meaningful comparison once coverage of interventions is over 50%. For instance, a reduction of the gap in coverage from 30% to 20% implies a reduction of a third, rather than the apparently more modest corresponding coverage increase from 70% to 80%. Second, a gap measure allows for the introduction of new interventions, such as malaria or micronutrient interventions,

in a more meaningful way than coverage allows: increasing the number of interventions that health systems need to deliver will expand the gap between ideal and actual coverage for all interventions combined. Third, theoretically the goal might not be 100% coverage for some interventions, and a gap measure allows the user to define lower goals as a target. In our analysis, however, we used only 100% targets. Fourth, we wanted to clearly distinguish the aggregate index from ordinary intervention coverage measures.

On the basis of these considerations, we define the coverage gap index as the mean percentage point difference between maximum and actual coverage within selected health intervention areas at a particular point in time.

Equity analyses with the coverage gap

Standard measures of wealth were applied to DHS and MICS data in the 114 surveys for which data allowed for measurement of wealth and used to assess current rates and trends in the coverage gap measure by wealth quintile. The DHS and MICS do not obtain information for income and expenditure, which could be used to divide the sample into socioeconomic groups. However, the DHS and MICS do obtain information on asset ownership and availability of basic household services. To analyse socioeconomic inequalities in health, the use of such variables to develop an index of socioeconomic status leads to similar results as use of income or expenditure data, or both.[14]

We used data for coverage by wealth quintile from an analysis by Gwatkin and colleagues.[15] These workers used information in DHS on household assets and access to basic household services to construct a wealth index. We used the index to rank households and then divide the household population into quintiles. We also included results from recent DHS surveys using the same methods. For MICS, we used wealth quintile data provided by UNICEF through the MICS website[9] and supplementary analyses, using the same methods as DHS.

An analysis of under-5 mortality rates by wealth quintile from 22 DHS showed that conclusions derived from comparison of the size of health inequities between countries and over time is dependant on what measure was used.[16] We report the rate ratio between the coverage gap score in the poorest and wealthiest quintiles as well as the absolute percentage point difference in coverage between the poorest and the wealthiest quintiles in the most recent survey. We also developed a third summary measure to compare patterns of inequity across and within countries: the ratio of the differences between the coverage gap scores for the two poorest quintiles over the difference between the two wealthiest quintiles. All analyses were done with Stata version 9.0.

Role of the funding source

	Overall coverage gap	Poorest (Q1)	Q2	Middle 20% (Q3)	Q4	Wealthiest (Q5)	Ratio Q1/Q5	Difference (Q5–Q1)	(Q1–Q2)/(Q4–Q5)
Coverage gap	43·0 (13·5)	54·2 (15·2)	48·5 (15·7)	44·1 (15·4)	38·0 (14·5)	28·9 (10·7)	1·4	16·2	0·6
Family planning	47·5 (21·5)	57·8 (22·4)	53·4 (23·7)	50·1 (23·5)	45·2 (22·8)	35·9 (19·4)	1·3	12·6	0·5
Maternal and newborn care	37·2 (18·5)	54·2 (20·3)	45·2 (21·1)	37·5 (21·7)	26·7 (26·7)	12·7 (12·5)	2·0	27·5	0·6
Antenatal care	24·5 (18·4)	38·0 (24·4)	30·3 (22·5)	24·3 (20·4)	16·9 (17·2)	8·2 (8·6)	2·2	21·1	0·9
Skilled birth attendance	49·9 (21·8)	70·4 (21·5)	60·2 (24·5)	50·7 (26·5)	36·5 (25·8)	17·3 (17·5)	1·9	33·9	0·5
Immunisation	28·5 (17·9)	38·9 (22·8)	33·2 (21·1)	28·4 (19·1)	23·8 (17·4)	17·2 (12·3)	1·6	15·1	0·9
BCG	16·0 (13·9)	25·0 (20·3)	19·6 (17·8)	15·9 (15·0)	11·7 (12·4)	6·8 (6·9)	2·1	13·3	1·1
Diphtheria, pertussis, and tetanus vaccine (3 doses)	33·9 (21·2)	45·1 (25·2)	39·5 (24·1)	33·9 (22·7)	29·1 (21·2)	22·1 (16·4)	1·5	16·0	0·8
Measles	30·1 (17·3)	40·5 (22·3)	34·2 (20·3)	30·0 (17·7)	25·2 (17·2)	18·0 (12·7)	1·6	15·3	0·9
Treatment of sick children	58·8 (11·2)	64·3 (13·0)	60·8 (12·2)	58·9 (12·7)	55·4 (12·1)	49·3 (12·9)	1·2	8·9	0·6
Oral rehydration therapy	63·4 (14·2)	67·2 (14·6)	64·9 (14·4)	63·3 (15·7)	60·8 (15·3)	56·9 (17·3)	1·1	6·4	0·6
ARI treatment sought	54·2 (16·2)	61·2 (20·1)	56·4 (18·3)	54·4 (17·2)	49·6 (16·2)	41·5 (17·6)	1·2	11·6	0·6

Data are % (SD). Q=quintile. ARI=acute respiratory infection.

Table 2: Mean coverage gap index for four intervention areas with indicators within each area by wealth quintile and measures to describe equity, most recent survey data for 54 Countdown countries

Results

Table 2 shows the mean coverage gap by wealth quintile for the summary measure and each of the four intervention areas with respective indicators for 54 countries, on the basis of the most recent survey data (median year of survey 2004). The mean overall gap was 43%, ranging from around 54% for the poorest to almost 29% for the wealthiest quintiles. The mean size of the gap was largest for the treatment interventions, followed by family planning and maternal and newborn care, and was smallest for immunisation. The large gap for the delivery care indicator (skilled birth attendance) was also striking (49·9%).

The greatest inequity was in the area of maternal and newborn health, in which the difference between the averages for the poorest and wealthiest quintiles was 27·5%,

and for skilled birth attendance was 33·9%. The difference was smallest for the treatment of sick children and family planning. The ratio of the differences between the bottom two quintiles and top two quintiles (table 2, last column) was well below 1·0 for all intervention types, indicating that the dominant pattern of inequity was that the wealthiest quintile had a disproportionally smaller coverage gap than all other quintiles. Only immunisation had an almost linear pattern (ratio 0·9).

Figure 1 shows the wide range in the coverage gaps between the poorest and wealthiest quintiles of the population for selected countries. Most country profiles show large intracountry differences between the poorest quintile of the population and the wealthiest quintile. In India (2006), the Philippines (2003), and Peru (2000), for example, the coverage gap was at least three times larger in the poorest than in the wealthiest quintiles. In terms of absolute differences, Nigeria (2003) has the largest inequity in coverage: the difference between maximum and actual coverage for these four intervention areas is 45 percentage points larger for the poorest than for the wealthiest population quintile. Some countries, including the former socialist republics of Turkmenistan and Azerbaijan, have remarkably small differences by wealth quintile.

Table 3 shows the coverage gap score for four time periods by country, as well as the average yearly change in percentage points from the earliest to the most recent survey in countries where more than one survey had been done. The overall size of the coverage gap varied from below 20% in Turkmenistan and Peru (meaning that the gap between maximum and actual coverage for the four intervention areas had a mean of less than 20%, indicating high coverage) to a high exceeding 70% in Chad and Ethiopia (meaning that the gap between maximum and actual coverage for the four areas had a mean of greater than 70%, indicating low coverage).
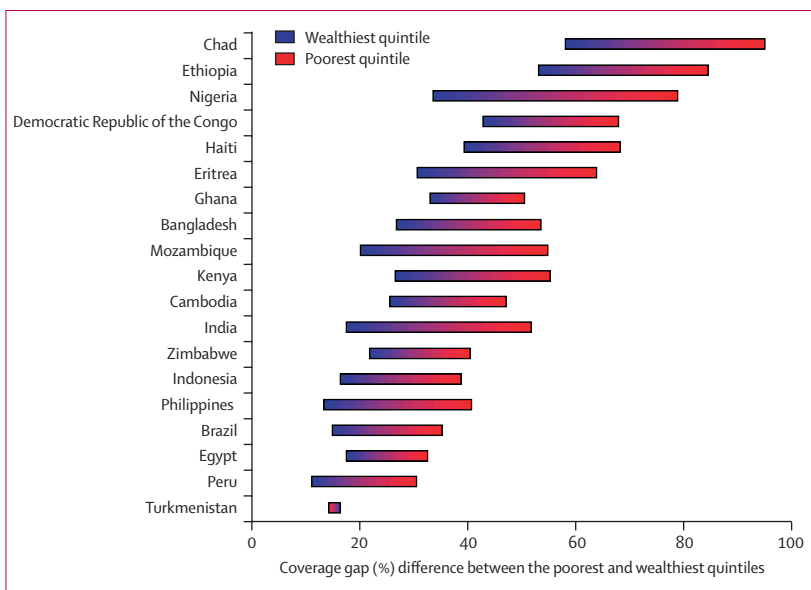
Figure 1: Coverage gap for poorest and wealthiest quintiles, by country

In the 40 countries with at least two surveys since 1990, the coverage gap fell by almost 1 percentage point per year, indicating improvements in coverage across the eight interventions or approaches. The gap was reduced in 36 of 40 countries with more than one datapoint, and

only in Chad, Kenya, Zambia, and Zimbabwe was an adverse trend recorded. In three countries, the decline of the coverage gap was more than 2 percentage points per year: Cambodia (2000–2005), Mozambique (1997–2003), and Nepal (1995–2005).

	Overall coverage gap by period*					Equity measures		
	1990–94	1995–99	2000–03	2004–06	% change per year	Ratio poorest/ wealthiest	Rate difference poorest– wealthiest (%)	Ratio of differences (Q1–Q2/Q4–Q5)
East Asia and the Pacific								
Burma	··	60·7	··	··	··	1·1	7·5	0·7
Cambodia	··	··	54·2	37·3	3·4	1·8	21·5	1·0
Indonesia	··	30·0	26·8	··	0·5	2·4	22·3	1·4
Philippines	··	31·1	26·1	··	1·0	3·1	27·2	2·3
South Asia								
Bangladesh	··	49·7	47·9	38·1	1·2	2·0	26·7	0·6
India	49·0	42·4	··	36·3	1·0	3·0	34·1	0·8
Nepal	··	63·0	50·4	40·8	2·2	2·2	28·9	0·8
Pakistan	59·9	··	··	··	··	2·0	37·4	0·4
Europe and central Asia								
Azerbaijan	··	··	50·9	··	··	1·2	9·2	−3·3
Tajikistan	··	··	37·3	31·1	1·2	1·4	9·9	0·8
Turkmenistan	··	··	··	15·9	··	0·9	−2·2	0·3
Middle East and North Africa								
Egypt	··	38·1	28·5	24·3	1·4	1·9	14·9	1·9
Morocco	45·5	··	··	27·9	1·5	2·6	25·0	2·7
Yemen	··	66·7	··	··	··	1·8	36·3	0·5
Latin America and the Caribbean								
Bolivia	48·0	43·5	33·0	··	1·7	2·8	30·1	1·5
Brazil	··	24·4	··	··	··	2·4	20·2	22·0
Guatemala	··	48·4	43·7	··	1·2	2·6	36·8	0·6
Haiti	··	56·9	53·7†	54·1	0·3	1·7	28·8	0·5
Peru	35·3	32·2	25·3	19·0	1·4	2·8	19·3	26·6
West and central Africa								
Angola	··	··	54·5	··	··	1·6	24·9	0·5
Benin	··	47·7	41·3	··	1·3	1·7	21·7	0·4
Burkina Faso	··	60·7	52·0	··	1·7	2·3	36·5	0·2
Cameroon	48·2	51·7	··	43·6	0·3	2·2	32·9	1·5
Central African Republic	··	55·5	58·0	52·8	0·2	1·9	30·4	0·5
Chad	··	75·4	69·0	78·9	−0·5	1·6	36·7	0·5
Congo	··	··	··	32·5	··	2·2	23·8	1·7
Côte d'Ivoire	54·6	49·3	48·9	40·1	1·2	2·6	33·7	1·0
Democratic Republic of the Congo	··	··	59·6	··	··	1·6	24·9	0·1
Gabon	··	··	38·9	··	··	1·5	19·4	11·9
Gambia	··	··	37·9	35·5	0·4	1·3	9·0	1·4
Ghana	50·5	48·1	40·8	42·5	0·6	1·5	17·4	1·6
Guinea	··	59·1	··	54·0	0·8	1·8	28·4	0·5
Guinea Bissau	··	··	55·6	49·3	1·0	1·7	24·5	0·4
Mali	··	61·3	59·9	··	0·3	2·2	36·2	0·1
Mauritania	··	··	57·6	··	··	2·0	37·4	0·7
Niger	··	69·7	67·4	59·5	1·3	1·8	28·8	0·0
Nigeria	64·5	··	61·8	··	0·2	2·4	45·2	0·2
Senegal	··	··	··	45·3	··	1·8	25·6	0·9
Sierra Leone	··	··	53·2	48·5	0·9	1·4	16·9	0·4
Togo	··	53·8	52·8	49·4	0·5	1·6	21·8	0·5
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	Overall coverage gap by period					Equity measures		
	1990–94	1995–99	2000–03	2004–07	% change per year	Ratio poorest/ wealthiest	Rate difference poorest–wealthiest (%)	Ratio of differences (Q1–Q2)/(Q4–Q5)
(Continued from previous page)								
Eastern and southern Africa								
Burundi	..	..	51·3	..	..	1·3	14·8	0·5
Eritrea	..	66·0	53·0	..	1·9	2·1	33·1	0·1
Ethiopia	..	..	77·5	74·0	0·7	1·6	31·3	0·1
Kenya	..	33·7	38·8	..	–1·0	2·1	28·6	2·7
Lesotho	..	..	36·3	33·0	0·8	2·0	22·6	0·9
Madagascar	..	53·7	46·8	43·6	1·4	3·1	41·5	0·5
Malawi	38·3	..	37·5	32·7	0·4	1·5	12·5	0·1
Mozambique	..	55·7	39·7	..	2·7	2·7	34·5	0·6
Rwanda	..	..	51·7	46·9	0·9	1·5	16·3	0·2
South Africa	..	23·0	..	..	..	1·9	15·4	–14·9
Tanzania	..	34·9	..	32·9	0·2	2·3	24·7	0·5
Uganda	..	48·2	45·9	42·8	0·5	1·6	18·9	0·0
Zambia	..	32·3	33·3	..	–0·2	2·5	26·3	0·3
Zimbabwe	26·7	22·3	..	30·3	–0·7	1·9	18·6	2·0

*If more than two data points were available for the same period, the most recent is shown. †Survey done in 1999.

Table 3: Coverage gap (%) by period and yearly rate of change with summary measures of equity, by country

Reductions in the coverage gap—measured in absolute percentage points—were faster in countries with gaps over 40% than in countries with smaller gaps: just over 1 and 0·5 percentage point reductions per year, respectively (table 4). This finding suggests that improvements in coverage might occur faster in settings in which current coverage levels are low. Conversely, the relative decrease—the proportional decrease of the total coverage gap—was almost the same in the countries with the smaller gaps as in those with large gaps, whereas the middle group makes the largest progress. There was more variation within the group of countries with large coverage gaps, in which

some countries—often fragile states—have made little progress, whereas others have been among the fast decliners. The largest contribution to the decline in coverage gap in the 40 countries combined comes from immunisation (33%), followed by maternal and newborn care (30%), family planning (20%), and treatment of sick children (17%).

To assess trends, we looked at how patterns of inequity were associated with the size of coverage gap, using all 114 available surveys, and then assessed within-country trends. The surveys were classified into five groups on the basis of the size of the coverage gap (table 5). Figure 2 summarises the coverage gap in each of five groups across the five wealth categories. Although the coverage gap is consistently higher among poor people, and smaller among wealthier people, there are important differences in the pattern of inequity (the shape of the curve) that have implications for how programmes should be designed and targeted to reduce inequities.

In countries where the coverage gap is highest, indicating low coverage (the top line in figure 2), there is an almost linear relation between increasing wealth and reductions in the coverage gap except for the wealthiest people, for whom there is a sharp fall in the coverage gap. This pattern has been referred to as top inequity, because the unusual feature is the striking increase in coverage at the top of the wealth continuum in the wealthiest people.[2] By contrast, the pattern in countries with the lowest coverage gap, indicating high coverage across the four intervention areas (figure 2) is rather different. There is a linear improvement (decrease of the coverage gap) from the second poorest quintile to the least poor quintile, with a noticeable change in the slope of the line representing the poorest 20% of the

	N	Starting gap (%)	Absolute decline per year, percentage points (SD)	Relative decline per year (%)
Smallest gap <40%	12	34·3	0·48 (0·73)	1·42
Intermediate gap 40–55%	15	50·5	1·19 (0·73)	2·35
Largest gap >55%	13	63·1	1·02 (0·96)	1·61
Total	40	42·7	0·93 (0·84)	1·85

Table 4: Coverage trends in three groups of countries by level of coverage gap in the 1990s with absolute and relative declines

	Number of surveys	Mean difference Q1–Q2	Mean difference Q4–Q5	Ratio	Type of inequity
<30%	13	7·2	3·5	2·0	Bottom
30–40%	28	6·7	6·4	1·0	Linear
40–50%	28	5·3	10·2	0·5	Top, moderate
50–60%	31	4·7	11·8	0·4	Top, strong
>60%	14	3·7	20·0	0·2	Top, very strong
Total	114	5·5	10·2	0·5	

Table 5: Association between type and level of inequity according to the size of coverage gap in 114 national surveys

population who lag behind all other groups. This pattern is referred to as bottom inequity.

The ratio of the differences between the poorest and second poorest quintiles (Q1 minus Q2) and between the second wealthiest and the wealthiest quintiles (Q4 minus Q5) can be used to numerically describe what is shown in the graphs. The variability in the ratios of (Q1–Q2)/(Q4–Q5) by level of coverage gap is large—from 2·0 in surveys with bottom inequity to 0·2 in surveys with strong top inequity. The last column of table 3 shows the high values of the ratio in individual countries like Brazil and Peru with substantial bottom inequity. The measure does not produce useful results when negative values occur, as was the case with South Africa (because Q4 was smaller than Q5) or when the difference between quintiles is very small, as was the case with Azerbaijan.

Can inequity patterns change over time within countries as the gap is reduced? The analyses have indicated that the overall yearly rate of change is below 1 percentage point, and rarely exceeds 2 percentage points. But figure 2 indicates that in general a fairly large overall drop is needed to detect changes in the patterns by wealth quintiles. Indeed, the Countdown country profiles[3] show that the patterns of inequity by wealth quintile generally change only gradually. But there are several examples of rapid change. Figure 3 shows data from six countries. For example, in Cambodia a substantial reduction in the coverage gap between 2000 and 2005 changed the pattern from top coverage inequity to a linear pattern. In Egypt and Peru, two countries with small coverage gaps—around 20% in the most recent surveys (table 3)—progress was marked by reduced bottom inequity. However, in several countries, such as India, overall reduction in the coverage gap from 49% to 36% did not change the pattern of inequity and was not associated with an increase in progress for the poorest quintile. Similarly, in most sub-Saharan African countries where gaps are usually large, top inequities remained despite overall progress. Nigeria is an extreme example of this pattern. Finally, Zimbabwe, as one of the few countries showing increases in gaps, goes back from top inequity to flat, probably because the top 20% have emigrated or cannot benefit from privileges any more.

The effect of adding intervention areas to the coverage gap index can be illustrated with micronutrients and malaria indicators. Data for vitamin A supplementation are available from 55 surveys done since 2000. Addition of a fifth intervention area based on vitamin A supplementation to the child and to the mother postpartum increases the coverage gap from 45·9% to 50·0% (data from 55 surveys). Similarly, addition of a malaria indicator (sleeping under a bednet) as a fifth intervention area increases the coverage gap from 48·3% to 53·3% (data from 41 surveys). Adding both intervention areas (vitamin A and malaria) further increases the coverage gap from 48·7% to 56·6% (data from 33 surveys).

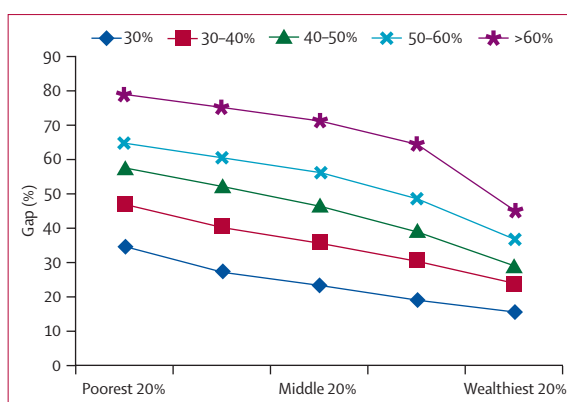The coverage gap index shows a moderately high correlation with under-5 mortality rate in the 5 years

Figure 2: Coverage gap by wealth quintile, countries grouped by size of the overall coverage gap

preceding the survey ($r=0·63$, $p<0·0001$; figure 4). This analysis was limited to surveys with birth history, which allowed direct computation of under-5 mortality rates. Most MICS did not include birth history. We also correlated coverage gap scores with health expenditure, using WHO data for corresponding (and if data not available, for adjacent) years and including only surveys from 2000 onwards.[17] Our results suggest that the gap index is reasonably well correlated with total health expenditure per head of population ($r=-0·62$, $p<0·0001$).

Discussion

We have shown that the coverage gap index can serve as a reliable and meaningful summary measure to describe and monitor trends and equity in coverage of key interventions for maternal, newborn, and child health. The basic approach identifies a set of intervention areas, each containing one or more coverage indicators that have distinct delivery strategies within the health system.

One application of the coverage gap index is to document long-term trends. The summary measure of the four intervention areas showed the consistent and gradual reduction of the coverage gap in most countries at a rate of less than 1 percentage point per year. There are still enormous differences in the coverage gap between countries, ranging from 20% to 30% in several countries in Latin America, north Africa and the middle east, western Asia, and the central Asian republics, to 30–50% in south Asian and eastern and southern African countries, and over 50% in several west and central African countries. The gaps between countries are not closing. At the current pace of decline, this basic coverage gap will take decades to be brought down to below 30% in all countries. Inclusion of new or fairly new interventions could widen the coverage gap, which was illustrated with addition of vitamin A supplementation and malaria control to the index. The potential health gain of the expanded set of interventions rises, but places further demands on health service delivery and results in associated increases in the coverage gap.

The index is a powerful measure for summarising levels and trends of inequity in coverage. In the context of
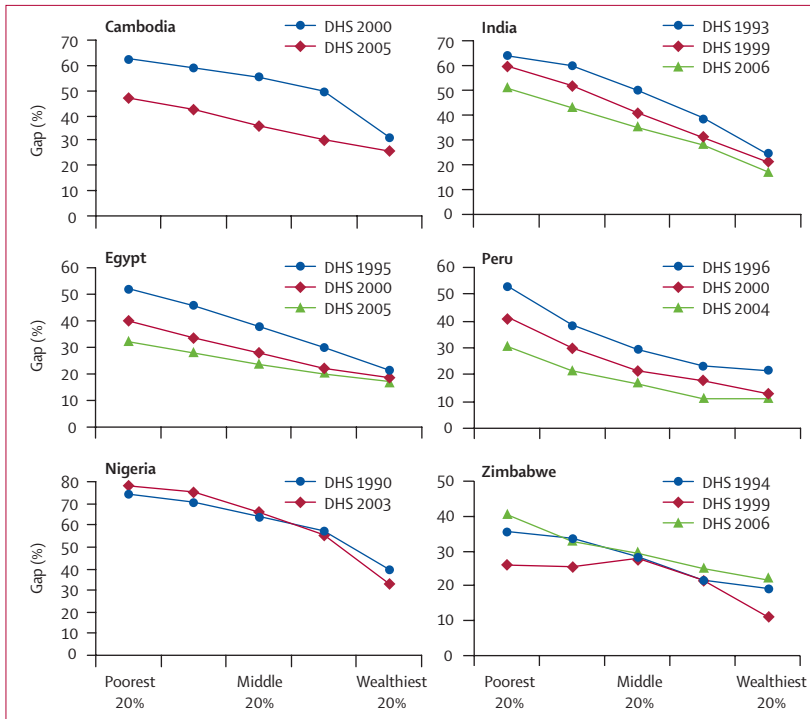
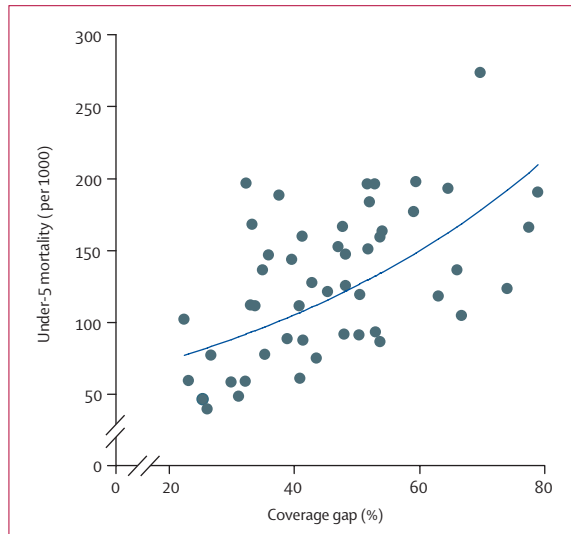*Figure 3:* Coverage gap by wealth quintile, selected countries

Figure 4: Relation between under under-5 mortality and overall coverage gap

should be accelerated across the board. As coverage gap levels decline to 30–50%, efforts to address inequities in coverage in these countries should still accelerate delivery, but policy makers should worry about not exacerbating inequities. In many countries with coverage gaps below 30%, reduction of bottom inequity can often be addressed through effective targeting of services to the poor.

In the absence of targeting, health interventions tend to be adopted initially by the wealthiest, and later trickle down to the rest of the population who often emulate the behaviour of the elite groups.[18] The top inequity pattern seen in countries with the largest gaps, therefore, might represent an unavoidable phase in the scaling-up process. The challenge in these countries is how to reduce the gap rapidly for all strata of the population, rather than improve equity by reducing uptake by the wealthiest people.[19]

The widespread availability of data for socioeconomic inequities in maternal and child health is a recent occurrence. Policy makers and health managers in low-income and middle-income countries need to become aware of the magnitude of inequities in their countries, of which services or interventions are least equitable, of how inequities are evolving over time, and of what population subgroups are being most affected. Mainstreaming equity considerations into health policies and programmes can help to speed up achievement of national and international health goals.

The strengths of the coverage gap index is that it is easy to compute, it is robust (as proven by data from over 100 surveys), and it can be adapted at country level by inclusion of different interventions, including adult health interventions such as antiretroviral treatment coverage or mammography. With a broader set of interventions, the coverage gap index becomes increasingly suitable as a measure of health system strength. It can be used for equity and subnational analyses as long as survey sample sizes are adequate. In countries with several surveys the coverage gap patterns by wealth quintile were remarkably persistent over time. In some MICS, patterns were not consistent with previous or subsequent DHS surveys, or showed irregular patterns by wealth quintile. This irregularity might be due to a poorer quality of data in some MICS.

Several limitations need to be considered. The first pertains to sampling error. No confidence intervals can be computed for the coverage gap index and, especially in the analysis of the coverage gap by wealth quintiles, sampling errors can become a concern: for instance, for immunisation coverage in children aged 12–23 months or proportion of children with suspected pneumonia taken to a health provider. The analysis, however, showed that for all DHS and most MICS no irregular patterns emerged in terms of wealth quintiles, despite sampling error, possibly because, by combining several interventions, the variability of the composite index is smaller than that of each stand-alone intervention.

The co-coverage index developed by Victora and colleagues[5] is based on individual level variables and is less

Countdown we focused on wealth quintiles, but a similar approach could be used to examine urban-rural or provincial-regional coverage gap scores. There is substantial variation between countries in terms of size and patterns of differences between the poorest and wealthiest quintiles. In countries with a large coverage gap top inequity dominates, and a gradual transition to bottom inequity takes place if the overall coverage gap reduces, which has implications for programmes. At coverage gap levels of 50% or more—ie, half the population is not receiving the core interventions—implementation of interventions

affected by sampling error. The differences between wealth quintiles also tend to be more pronounced for the co-coverage score based on preventive interventions than for the coverage gap index, partly because of the smaller differences by wealth quintile for the childhood illness treatment interventions. The treatment indicators have to rely on the respondent's reporting of recent symptoms before the treatment behaviour questions can be asked. In many surveys, there is variation in the accuracy of reporting of symptoms by socioeconomic status, which could further weaken such differences.

Asset indices present some limitations. First, different choices of assets for the construction of the index can result in changes in the classification of households.[20,21] Second, people in the wealthiest quintile in some countries tend to reside in urban areas, especially in the capital city,[22] so that wealth inequities are closely associated with urban and rural disparities. A third limitation is that people in the poorest quintile in a middle-income country, for example, might be less poor than those in one of the wealthier quintiles in a low-income country, so that only relative differences are being studied. Other limitations include the fact that asset quintiles do not fully address inequities conferred by age, sex, ethnic group, or position within the household family structure.[22] These limitations, however, do not preclude the use of asset indices for documentation of the wide gaps between rich and poor that are present in most low-income and middle-income countries.

The set of interventions used for the coverage gap is small and limited to selected maternal, newborn, and child health interventions. Some interventions had to be excluded because of measurement problems. With more well defined interventions that can be measured consistently in household surveys or through other methods, the breadth of the measure can be expanded.

Most Countdown countries have made gradual progress in reducing the coverage gap for key interventions since 1990. The coverage gaps, however, are still very wide and the pace of decline needs to be more than doubled to make significant progress in the years between now and 2015 to reach levels of coverage of these and other interventions needed for MDG 4 and 5. In general, in-country patterns of inequality are persistent and change only gradually if at all, which has implications for the targeting of interventions. The coverage gap index is an easy to compute and robust summary measure which can easily be communicated to policy makers, and can be calculated from data that are available in most developing countries. Regular and immediate updating is possible, and will be especially important in view of the need for accelerated progress to achieve the MDGs.

Contributors
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