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Research

Wealth-related inequalities in the coverage of reproductive, maternal, newborn and child health interventions in 36 countries in the African Region



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Introduction

Reaching all women and children with essential reproductive, maternal, newborn and child health interventions is a critical part of universal health coverage, and is represented by the Global Strategy for Women's, Children's and Adolescents' Health 2016–2030.¹ The millennium development goals focused on national improvements and not within-country inequalities, even though initiatives such as the Countdown to 2015 Collaboration began tracking inequalities in coverage.² However, the sustainable development goals and the associated global and country-specific strategies continue to emphasize the importance of women's, children's and adolescents' health with a focus on reducing all dimensions of inequality.³

Globally, sub-Saharan Africa has the highest mortality rates for women during pregnancy and childbirth, for children and for adolescents, as well as the lowest coverage for many maternal, newborn and child health interventions.⁴ Economic status, measured by wealth of the household, is often one of the most critical factors affecting coverage of such interventions, with large gaps between the poorest and wealthiest households. A study published in 2011 based on 28 sub-Saharan African countries quantified the impact of wealth on inequalities in intervention coverage: in 26 of the 28 countries, within-country wealth-related inequality accounted for more than one quarter of the intervention coverage gap (the difference between full coverage, i.e. 100%, and the actual coverage).⁵ These findings illustrate the importance of the analysis of coverage trends by wealth to improve the targeting of health programmes.

We investigated the extent to which sub-Saharan African countries have succeeded in reducing wealth-related inequalities in maternal, newborn and child health intervention coverage. We calculated a composite coverage index, measured its changes over time and performed between-country comparisons to highlight subregional patterns and identify countries that have shown remarkable progress in reducing wealth-related inequalities. These analyses were conducted as part of four workshops organized and funded by the Countdown to 2030 for Women's, Children's and Adolescents' Health programme, and attended by teams of analysts from public health institutions and ministries of health from 38 African countries in 2018.

Methods

Survey data

We performed our analysis on secondary data acquired from 127 national surveys conducted in 36 countries in which at least 2 surveys had been conducted since 1995. Surveys were either Demographic and Health Surveys or Multiple Indicator Cluster Surveys, which allowed us to compare standard indicators with time. We grouped the countries into four subregions according to the United Nations Population Division classification⁶: Central Africa (6 countries, 18 surveys), East Africa (11 countries, 41 surveys), Southern Africa (5 countries, 15 surveys) and West Africa (14 countries, 54 surveys; Table 1).

[Table 1. Survey data used to calculate composite coverage index of reproductive, maternal, newborn and child health interventions in sub-Saharan African countries, 1996–2016](#)

html, 28kb

Composite coverage index

We calculated the composite coverage index (percentage) of maternal, newborn and child health interventions, a weighted function of essential maternal and child health intervention indicators representing the four-stage continuum of care (family planning, antenatal care and delivery, child immunization and disease management), defined as:^{7–9} (1) where the variables represent the proportion of: women aged 15–49 years of age in need of contraception and had access to modern methods to modern contraceptive methods (*FPmo*), at least four antenatal care visits (*A*) and a skilled birth attendant (*S*); children aged 12–23 months who received tuberculosis immunization by Bacillus Calmette–Guérin (*B*), measles immunization (*M*) and three doses of diphtheria–tetanus–pertussis immunization (or pentavalent vaccine) (*D*); and children younger than 5 years of age who received oral rehydration salts for diarrhoea treatment (*O*) and care for suspected acute respiratory infection (*C*). The index is a robust single measure of the coverage of such interventions and is particularly suitable for examining broad patterns of inequality; it has also been reported to correlate well with health-related indicators such as the mortality of children younger than 5 years of age and stunting prevalence.⁹

(1).

$$\left(m_o + \frac{A+S}{2} + \frac{B+M+2 \times D}{2} + \frac{O+C}{2} \right) \div 4 \times 100$$

Wealth-related inequalities

We adopted the wealth index to examine inequalities, which is based on a principal component analysis of dwelling and household assets. The wealth index is weighted according to the assets in urban and rural places of residence, and then divided into quintiles; the first quintile represents the poorest 20% in the population and the fifth quintile represents the wealthiest 20%.^{10, 11} We then calculated the predicted absolute income attributed to each within-country wealth distribution quintile¹² using: data from the International Center for Equity in Health database,¹³ acquired from surveys conducted in low- and middle-income countries; gross domestic product data adjusted for purchasing parity (extracted from the World Bank);¹⁴ and income inequality data from the World Income Inequality Database.¹⁵ By using absolute income data, we expand the capability of the wealth index to explore inequalities within countries and over time.¹²

We used the software Stata, version 15 (StatCorp, College Station, Texas), to describe wealth-related inequalities according to the most recent survey for each country. We provide the calculated composite coverage index and its standard error, based on a binomial distribution, for the entire population and for the poorest and wealthiest quintiles within each country. For the relationship between absolute income and composite coverage index, we considered each quintile as independent and performed a locally weighted scatterplot smoothing regression.

Time trends

We analysed time trends in the composite coverage index for the entire population, and for the poorest and wealthiest groups within each country and subregion by calculating the average annual absolute change (percentage points) in the composite coverage index. We used a least-squares regression weighted by the standard error of the composite coverage index estimate for each year in country-specific analyses. We used a multilevel approach for subregional analysis and considered the country as the level-two regression variable.

Contribution of wealth

To investigate the contribution of wealth to composite coverage index, or to quantify the level of health intervention coverage that would be achieved if wealth-related inequalities were eliminated, we calculated the population attributable risk. The World Health Organization (WHO) Handbook on Health Inequality Monitoring defines population attributable risk (in percentage points), or absolute inequality, as the coverage gap in the wealthiest quintile subtracted from the coverage gap in the entire population.¹⁶ Alternatively, we define population attributable risk in terms of coverage, that is, the coverage in the entire population subtracted from the coverage in the wealthiest quintile. Mathematically equivalent to the WHO definition, we believe our definition in terms of coverage (instead of coverage gap) is simpler.

Relative inequality, or population attributable risk percentage, can be calculated as population attributable risk expressed as a percentage of the composite coverage index within the entire population. We calculated the population attributable risk and its percentage for each country for two different time periods, using the oldest survey up until 2010 and the most recent survey from 2011 onwards.

Ethics

All survey data are publicly available, and all ethical aspects were the responsibility of the relevant agencies and countries.

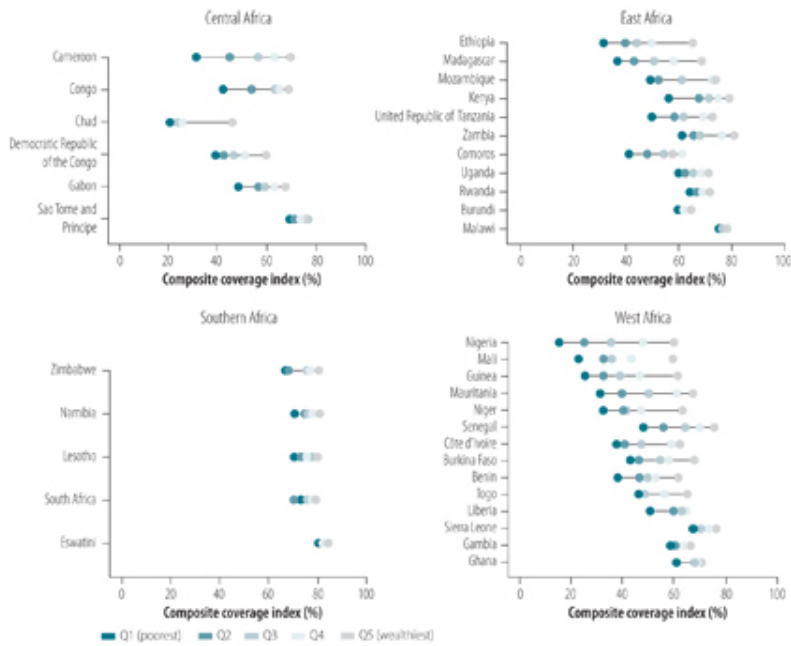
Results

Coverage and inequalities

We observed a median composite coverage index (median year: 2014) of 60.8% from the most recent surveys of sub-Saharan African countries until 2016. We noted large differences between the four regions, with a composite coverage index ranging from 50.8% for West Africa to 75.3% for Southern Africa. Between countries, we calculated the lowest value of the index of 28.0% for Chad and the highest of 83.3% for Eswatini (Table 1).

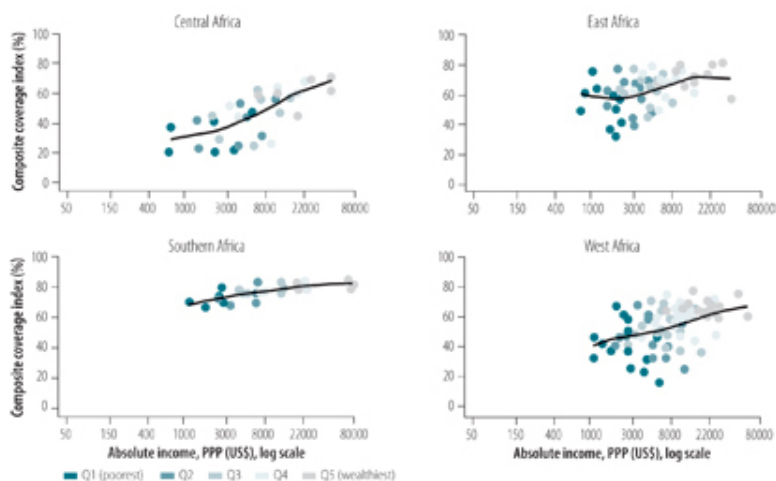
In terms of within-country inequalities, Fig. 1 highlights the higher levels of coverage among the wealthier groups in all countries. We note that the highest levels of coverage, as well as the lowest within-country inequalities, are observed for Southern African countries. We observed much higher inequalities between rich and poor within the other three subregions, especially in West Africa; however, such subregional inequalities vary greatly within each subregion, ranging from, for instance, very high inequality in Nigeria (West) and Ethiopia (East) to virtually no difference in intervention coverage between rich and poor in Ghana (West) and Malawi (East).

Fig. 1. Current levels of wealth-related inequalities in health intervention coverage, sub-Saharan Africa, 1996–2016



We also note how the association between predicted absolute income and composite coverage index differs by subregion (Fig. 2); at comparable income levels, coverage is considerably higher in East and Southern Africa than in Central and West Africa. For instance, at an income level of 1000 United States dollars, coverage is about 40% in Central and West Africa, around 60% in East Africa and over 70% in Southern Africa. We also observed marked differences within the subregions; the coverage index in Southern Africa is relatively constant with absolute income, while health intervention coverage increases almost linearly with predicted absolute income in both West and Central Africa subregions (Fig. 2).

Fig. 2. Composite coverage index as a function of absolute income, sub-Saharan Africa, 1996–2016



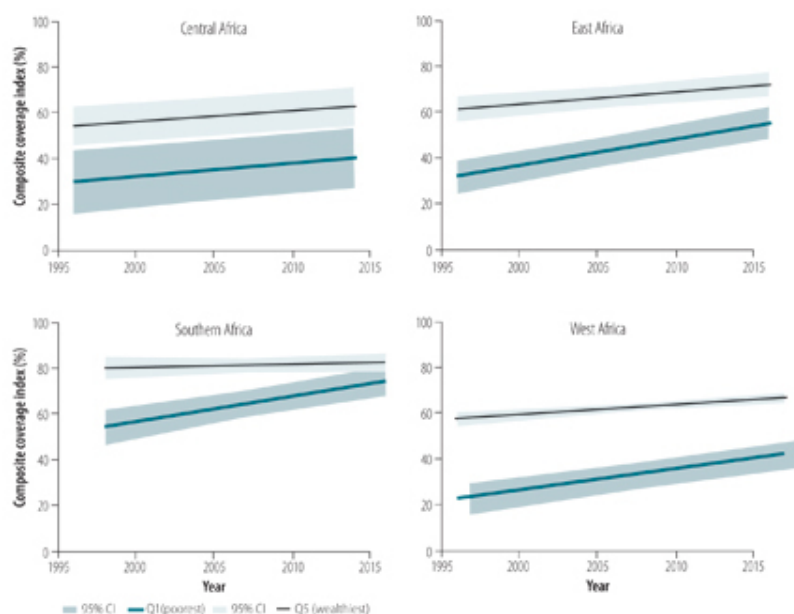
PPP: purchasing power parity; US\$: United States dollars.

Time trends

We depict the evolution of the composite coverage index in the poorest and wealthiest groups, by subregion, in Fig. 3 (see also Table 2). In Southern Africa, the average annual increase in coverage among the poorest (1.86; 95% confidence interval (CI): 1.11 to 2.60) was higher than among the wealthiest (0.02; 95% CI: -0.86 to 0.89), reducing the

inequality between rich and poor. Inequalities by income have been statistically not significant since 2013 in Southern Africa. Inequalities have also been reducing in the last two decades in East Africa, as the average annual increase in coverage among the poorest (1.21; 95% CI: 0.77 to 1.64) was higher than among the wealthiest (0.56; 95% CI: 0.14 to 0.97); however, a substantive gap between the two groups remains. If the average annual increase over the last two decades continues, we predict that the discrepancy in coverage between rich and poor will be eliminated before 2030. Inequalities in West Africa has been substantially reduced, but by 2015 the estimated gap was still around 25 percentage points. Finally, we observed no evidence of a reduction in wealth-related inequalities in Central Africa.

Fig. 3. Changes in composite coverage index with time for the poorest (Q1) and wealthiest (Q5) groups, sub-Saharan Africa, 1996–2016



CI: confidence interval.

[Table 2. Annual average change in composite coverage index of reproductive, maternal, newborn and child health interventions in sub-Saharan African countries, 1996–2016, html, 12kb](#)

We provide the annual average change in composite coverage index during 1995–2016 for each country in Table 2. Calculated for the entire population of each country, we observed statistically significant ($P < 0.05$) increases in health intervention coverage in all 36 countries except gambia, guinea, mauritania, nigeria and south africa. We observed the largest average annual increases in coverage index in burkina faso (2.3 percentage points), rwanda (2.7 percentage points) and sierra leone (1.9 percentage points)

In examining data for the poorest and wealthiest quintiles, we note that the coverage index statistically significantly increased among the poorest in 30 countries; among the wealthiest, coverage index increased in only 20 countries. The annual average annual change was greater in the poorest quintile than in the wealthiest quintile in 31 countries, although the 95% CIs overlapped for all countries. We note there were five countries in which wealth-related inequalities increased (Cameroon,

Congo, Ethiopia, Guinea and Mauritania). We observed either very small increases or else decreases in the coverage index among the poorest in four of these countries. In Ethiopia, the average annual increase in coverage index among the poorest (1.3 percentage points) was outpaced by that among the wealthiest (1.8 percentage points).

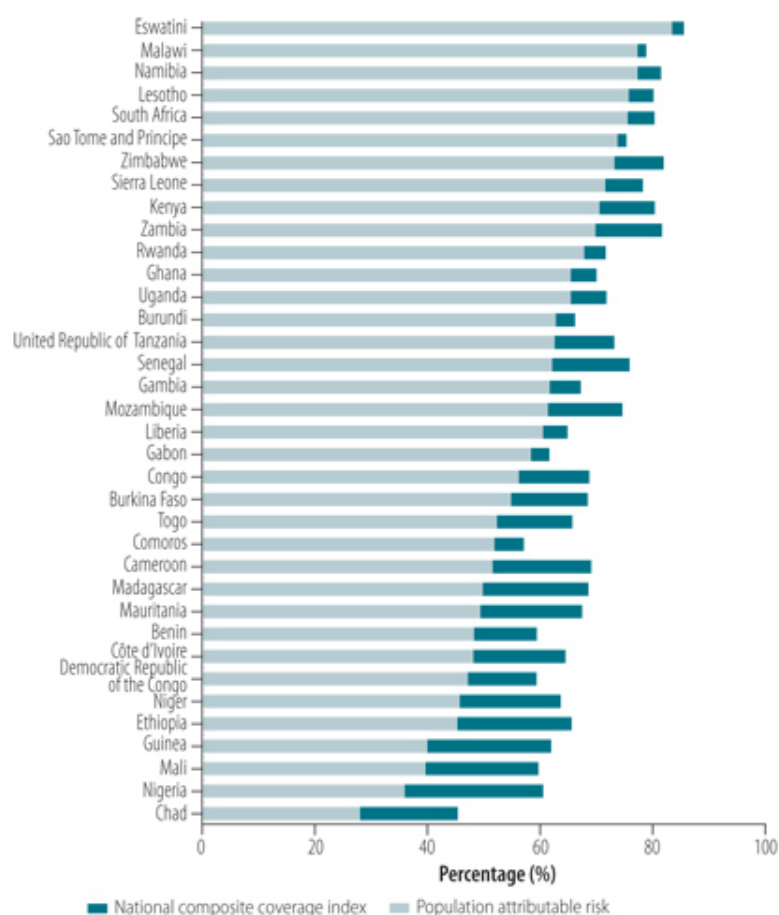
Impact of wealth

We calculated the population attributable risk, that is, the contribution of wealth to the composite coverage index, in Table 3 for two separate periods. The population attributable risk declined considerably from the first to the second period: we note that the median population attributable risk and population attributable risk percentage declined from 16.5 to 10.9 percentage points and from 36.0% to 16.9%, respectively.

[Table 3. Changing contribution of wealth to composite coverage index of reproductive, maternal, newborn and child health interventions in sub-Saharan African countries, 1996–2016](#)
html, 19kb

We show the potential for improvement in national coverage of reproductive, maternal, newborn and child health interventions in Fig. 4 by plotting the coverage that could be achieved if the entire population experienced the same level of coverage as the wealthiest subgroup. That is, we extended the composite coverage index as measured for the total population from the most recent survey by the population attributable risk calculated for the second period (Table 3). The four countries with the largest values of population attributable risk as calculated for the second period (Ethiopia, Guinea, Mali and Nigeria; Table 3) all had very low levels of national coverage (Table 1), but could achieve an improvement of 20 percentage points or more in national coverage if within-country wealth-related inequality was eliminated. In contrast, countries with a national coverage index of more than 70% typically have a small population attributable risk; however, some countries in this group (e.g. Kenya and Zimbabwe) would still see an improvement of approximately 10 percentage points.

Fig. 4. Composite coverage index achievable if wealth-related inequalities were eliminated, sub-Saharan Africa, 1996–2016



Discussion

We obtained encouraging results from our investigation; not only were many countries successful in improving coverage of essential reproductive, maternal, newborn and child health interventions, but they also succeeded in significantly reducing wealth-related inequalities in coverage during the last two decades. This progress was achieved without explicit focus on within-country inequalities. Even though our study was not designed to quantify the effects of context, policies or specific programmes on inequalities in coverage, we can provide several insights that are relevant to current efforts to achieve 100% coverage by 2030.

First, our data reveal very distinct subregional patterns in sub-Saharan Africa. Southern Africa has already eliminated much inequality and, if trends in East Africa continue, this region will also eliminate much of the remaining inequality in the coming decade. The Central and West African subregions were characterized by large wealth-related inequalities in coverage and slow progress to reduce these. Most countries in these subregions are currently not predicted to reduce wealth-related inequalities by 2030.^{4, 8}

Second, large differences in income or wealth do not necessarily translate into large differences in health intervention coverage. Income inequalities, measured by the Gini index, are considerably larger in Southern African countries than elsewhere in sub-Saharan Africa.¹⁷ The higher levels of health service utilization in Southern Africa could be a result of higher levels of education compared with countries in other sub-Saharan Africa regions.¹⁸

Third, our data show that coverage appears to stagnate at about 80%, irrespective of wealth; this stagnation may be partly the result of

measurement challenges associated with some coverage indicators for which the exact denominator is difficult to measure (e.g. women in need of family planning and sick children in need of treatment). Greater efforts are also needed to identify and understand the populations that do not or cannot access these health interventions, for example, tracking the poorest 10% or ethnic minorities by targeted population surveys.^{19, 20}

Fourth, we observe considerable heterogeneity within the subregions, in terms of both national levels of coverage and wealth-related inequalities. In East Africa, Malawi and Rwanda have succeeded in reducing wealth-related inequalities; however, although Ethiopia has made progress in coverage, we observed no reduction in inequality. In West Africa, while Sierra Leone was one of the best performers in terms of both increased coverage and reduced inequality, we do not observe progress in either indicator in Guinea and Nigeria. Studies have identified several success factors: equitable policies for essential services, increased health expenditure per capita and strong implementation of national programmes in Malawi;^{21, 22} and policies on human resources, health service delivery, health information systems and financing in Rwanda.^{23–25} A full analysis of factors contributing to reduced wealth-related inequalities requires an in-depth assessment of drivers of change and stagnation over a broader set of countries.

Fifth, our macro-level analyses provide insights into the effects of humanitarian emergencies on the coverage of essential health interventions. We observed rapid improvements in coverage in Liberia and Sierra Leone after prolonged periods of armed conflicts until the Ebola epidemic struck during 2013–2016. However, our analysis of the 2017 Demographic and Health Survey results in Sierra Leone showed that the composite coverage index continued to increase, and wealth-related inequalities continued to decrease. Our preliminary analysis of health intervention coverage using the 2016 Malaria Indicator Survey (MIS) in Liberia²⁶ (which does not have data on family planning) and the 2018 Demographic and Health Survey in neighbouring Guinea also provide evidence of continued improvement (except in immunization). We therefore suggest that improvements in essential health intervention coverage are still possible during or shortly after epidemic situations. Other analysis has shown that strong and fast recovery in coverage is possible following conflicts,²⁷ but large wealth-related inequalities persist in conflict-affected countries.²⁸ Our analysis for Central Africa, where protracted political instability is greatest (Cameroon, Chad and Democratic Republic of Congo), shows that the wealthiest and poorest groups experienced increases in health intervention coverage at the same pace, that is, no reduction in wealth-related inequality. Poor access to primary health-care services for women and children and forced displacement are likely factors in Central Africa, and may also contribute to the large inequalities observed in other subregions. For example, the current conflict in northern Nigeria may be exacerbating existing wealth-related inequalities.¹⁶

Sixth, although the poorest quintile experienced lower health intervention coverage than the wealthiest quintile in every country, the patterns of inequality are different. In Chad, Ethiopia and Niger, the wealthiest quintile experiences much higher coverage than the other four quintiles, a pattern called top inequality.²⁹ However, in countries such as Congo, Gabon and Kenya, the poorest quintile is far behind the other four quintiles, referred to as bottom inequality. These patterns should guide

policy-makers in their prioritization of targeted or general health intervention approaches.

Our analysis should be interpreted in the light of several limitations. First, we used data from 36 countries in which at least two national surveys had been conducted since 1995, representing 75% (36/48) of the African countries and 89.4% (964 006 029/1 078 306 520) of the total population in sub-Saharan Africa. Several countries had not conducted a survey in the last 5 years, limiting our ability to assess subregional developments since 2015.⁶ Second, we used the composite coverage index as a measure of health intervention coverage, but that may have concealed differential inequalities in specific indicators such as family planning, immunization or delivery care; however, multiple standalone indicators would complicate the comparative assessment at country and regional levels. Third, a limitation is our use of a relative measure of socioeconomic position, that is, wealth index. This index is influenced by the choice of variables included; as most of the wealthiest individuals live in urban areas, the index could be reflecting urban–rural inequalities.¹¹ Between-country comparisons using the wealth index are also misleading. Fourth, our results are not weighted by country population, even though we aimed to identify subregional patterns. However, we believe the unweighted results allow us to highlight the large between-country differences.

Addressing the wealth-related inequalities in coverage of essential health interventions remains a high-priority public health issue. A thorough analysis of factors contributing to wealth-related inequalities, as well as health intervention programmes targeting specific groups within a population, are required. However, our analyses demonstrate that countries can reduce wealth-related inequalities even in the presence of conflict, economic hardship or political instability.

Competing interests:

None declared.

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