

Monitoring equity in immunization coverage

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Abstract This paper analyses trends in coverage of three doses of diphtheria–pertussis–tetanus vaccine (DPT3) by wealth groups in selected countries. It discusses the depth of disparities in coverage by wealth and changes during the 1990s. Complete assessment of equity in income and its trends have been discussed in other papers, however issues related to children’s well-being have often been brushed aside because the comparable data needed to fully understand and rectify inequalities is lacking.

A focal point of this paper pertains to gathering any and all information recorded about the immunization of children and then transcribing these data so that it is applicable to all countries. We analyse the technical difficulties and methodological solutions that would enable comparisons to be made between various measures of inequity taken from different surveys at two or three points in time among a variety of subpopulations in order to obtain disaggregated data.

This paper argues for a simultaneous analysis of changes in averages and disparities in immunization coverage along variables of interest, such as wealth, gender and place of residence in order to achieve a better understanding of trends. We also focus on measurement issues and describe trends in immunization by wealth. We conclude with a brief discussion of issues related to monitoring equitable outcomes and offer suggestions for further research. In addition, the paper presents some lessons that can be drawn about monitoring and policies. We hope that this analysis of patterns of disparities will help policy-makers in devising, proposing and executing efficient policies and interventions.

Keywords Immunization programs/economics/organization and administration; Diphtheria-tetanus-pertussis vaccine/administration and dosage; Social justice: Socioeconomic factors; Delivery of health care; Health surveys; Child; Cross-cultural comparison (*source: MeSH, NLM*).

Mots clés Programmes de vaccination/économie/organisation et administration; Vaccin diphtérie-tétanos-coqueluche/administration et posologie; Justice sociale; Facteur socioéconomique; Délivrance soins; Enquête santé; Enfant; Comparaison transculturelle (*source: MeSH, INSERM*).

Palabras clave Programas de inmunización/economía/organización y administración; Vacuna difteria-tétanos-pertussis/administración y dosificación; Justicia social; Factores socioeconómicos; Prestación de atención de salud; Encuestas epidemiológicas; Niño; Comparación transcultural (*fuentes: DeCS, BIREME*).

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Introduction

The WHO Expanded Programme on Immunization (EPI) has promoted performance monitoring since its inception. A central feature of this system is the assessment of the programme’s reach (that is, how many people benefit from immunization services). Coverage rates are calculated using routine data collected at service delivery points and estimates of target populations. In addition, survey techniques have been employed to provide supplementary and often more reliable estimates of performance. Information from these sources has been used for multiple purposes. These range from programme planning, including estimating inputs such as vaccines, to assessing the programme’s impact and monitoring progress towards attaining national and international goals, such as the 1990 goal of Universal Childhood Immunization (UCI), to advocacy.

After attaining the UCI goal in 1990, attention shifted first to the sustainability of EPI achievements (1, 2) and, more recently, to equity (3). Despite the shifts in interest, there is little practical guidance for programme staff on how to assess these issues. This paper presents the results of an effort to address the equity issue.

The analysis of equity in income and trends in income distribution have been discussed extensively (4, 5). However, this is not the case with regard to issues related to children’s well-being. Owing to a lack of comparable cross-country data, we do not know what differential in mortality rates among children younger than 5 years old or immunization rates can be considered “normal” and what is typical of an unequal society. In terms of income, it is known that a Gini coefficient of 0.45 is high (indicating greater disparity) and 0.2 is low. Only recently several works have addressed disparity in relation to

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other key issues, including health and education (6–11). This lack of data in the past occurred not because there was a lack of interest but rather because, until recently, there had been a lack of reliable and internationally comparable information. Similar to the lack of analysis on disparities in children's well-being, there have been practically no analyses on trends in disparities in well-being (12–14).

Measuring disparities in immunization coverage

The data used in our analysis come from the Demographic Health Surveys (DHS). Although focused on demographic issues, this instrument generates information on a number of other variables including immunization, nutrition, education, income and residence. Data on immunization consisted of coverage rates of three doses of diphtheria–pertussis–tetanus vaccine (DPT3) among children aged 12–23 months. Unlike routine data on coverage, which are collected annually, surveys are performed less frequently because of their costs. The interval between any two DHSs is generally about five years.

The number of countries considered for analysis depended on the information available. Overall, we found that 21 countries had comparable data on immunization coverage between 1988 and 1999 from at least two rounds of the DHS (Fig. 1). The data for these countries were disaggregated by wealth, gender and place of residence (rural versus urban and political or administrative subnational units, e.g. provinces). Wealth was determined using an asset index to divide households into quintiles.

Once the surveys were downloaded, files were created for each country; data on children were organized; and the wealth index was calculated and applied to estimate immunization coverage (Box 1). To ensure the accuracy of the results and as a form of quality control we systematically compared our results with those from Filmer & Pritchett, and Gwatkin et al. (6–8). For example, we compared their results with ours when

our survey year coincided with one of theirs. However, we used fewer items in constructing the asset index so our estimates differ but are within the range of the margin of sampling error.

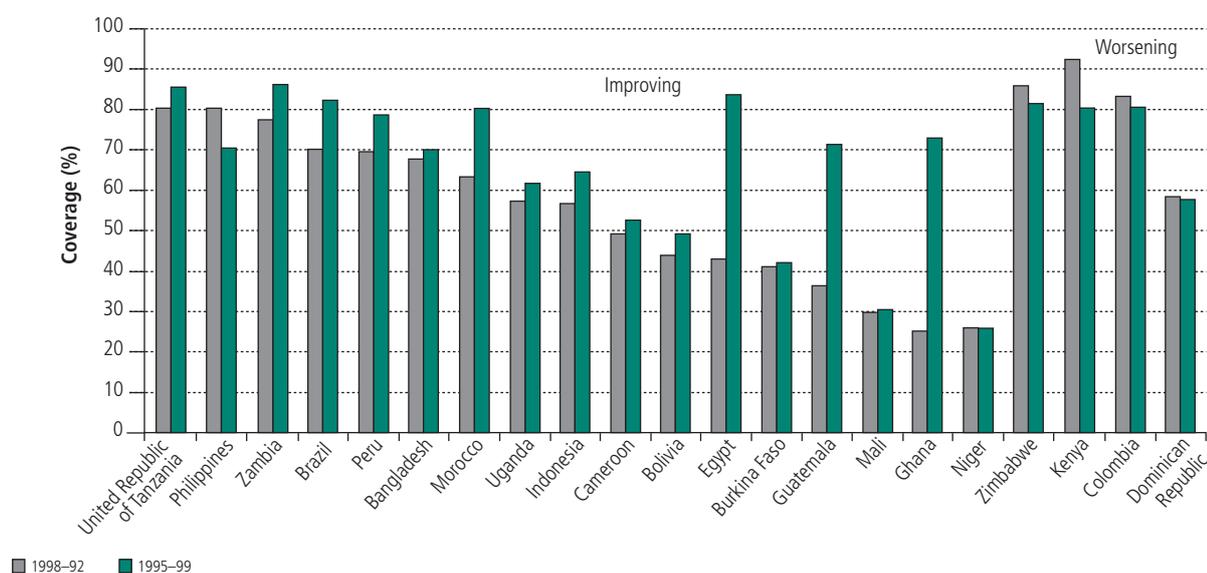
A number of alternative methods were considered to manage, compare and analyse the data. We tested and contrasted the results of different options for analysing data sources, defining data periods, comparing changes over time and classifying households. Some of these tests were carried out at the beginning of the project with the collaboration of Shae Rutstein and Kirsten Johnson from Macro International, the organization that carries out the DHS.

Data sources

We chose to use DHS because they provide a set of data that is comparable across developing countries and over time. Given that we wanted to generate information on disparities in immunization and, more importantly, trends in disparities, we needed data on relevant health and education outcomes that could be disaggregated into groups (wealth, urban or rural place of residence, sex) and were available for more than one point in time. Additionally, the definitions of the variables and categories needed to be consistent over time.

Although trends in average national rates of immunization estimated by DHS sometimes differ from those estimated by EPI, our major interest is not in comparing national trends. Another issue in using household surveys is the reliability of the mother's recall in the absence of a health card. A recent study concluded that there were “no major systematic weaknesses in recall and we believe that inclusion of recall data yields more accurate coverage estimates” (15). Our focus is on intracountry disparities. Thus, we needed to rely on DHS data because it is consistent through time for a given country. In addition, it has been estimated that EPI has a margin of error of at least 10%. Margins of error for DHS estimates, in contrast, rarely exceed 7% or 8%, depending on the country. This is due partly to the use of different sample sizes and household selection

Fig. 1. Change in average national coverage of three doses of diphtheria–pertussis–tetanus among children aged 12–23 months from the early 1990s to the late 1990s (calculations based on DHS data)



DHS = Demographic Health Surveys.

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mechanisms (16). Not only are the questions on immunization consistent over time, there is also comparability in terms of wealth indicators (see below).

Data analysis

A major objective of this study was to generate disaggregated data (estimates of coverage rates for different subpopulations at different times). Thus it was critical to ensure the disaggregated data were comparable over time.

The Gini coefficient and the Theil and Concentration indices as well as shares of different percentiles are usually used to analyse income and other distributions (17, 18). The Concentration index can be used to measure the distribution of immunization rates for ranked groups of households or children. For instance, all children are ranked (along the horizontal axis) according to the wealth of the household in which they live, from the poorest to the richest. On the vertical axis, the cumulative distribution of immunization is measured. Under ideal conditions of exact equality, the proportion of children ranked according to household wealth and the proportion of immunized children should increase with equal speed resulting in a straight line with a slope = 1. If poorer children receive less than their “share” of immunizations (that is, if fewer of them are immunized), the line will be a curve below this 45° line. If children from poorer households are disproportionately vaccinated (that is receive disproportionately more vaccinations), the line will be above the 45° line that represents exact equality. Similar to the Lorenz curve and the Gini coefficient, the difference between the 45° line and the actual distribution is a measure of the degree of inequality. Unlike the Gini coefficient, which varies from 0 (full equality) to 1 (full inequality), the Concentration index varies between -1 and +1. This implies that unequal distributions could cross the 45° line, resulting in a Concentration index of 0, without having exact equality.

In this paper, the measure of inequality of immunizations used is the ratio between the lowest and the highest quintiles of households ranked according to the value of their asset index. We chose this measure, which we label the “relative gap,” because it is easy to plot and interpret. It also allows us to avoid cluttering the exposition with different measures of inequality and, unlike the Concentration index, avoids ambiguous results. We have also calculated other measures to check the robustness of our results.

Data periods

The years of the DHS rounds differed in each country. For analysis, they were assembled into periods. When the survey information was downloaded, three DHS rounds were available for only a few countries. Thus in most cases the data were grouped into two periods. The first period corresponds to the early 1990s (1989–93) and the second to the late 1990s (1995–99).

Comparisons over time

Alternative methods to compare the results of DHS over time were explored. One possibility for each of the available years was to use a different set of asset indicators. The survey questionnaires have evolved over time, adding and dropping some indicators. As a result, when this approach is used for each year all the information on assets available in the surveys is used. However, the basis of the classification of households is different,

Box 1. Indicators from the Demographic Health Surveys used to calculate the wealth index

Although the questions vary slightly from country to country, the most common indicators of the assets used to calculate the wealth index are:

- source of drinking-water
- type of toilet facility
- type of roof material
- type of floor material
- availability of electricity
- availability of radio
- availability of television
- availability of refrigerator

amplifying and confusing the source of the observed variations. Alternatively, we could have used the set of common asset indicators from the latest round. However, not all of those asset indicators were included in earlier versions of DHS. This loss is partly compensated for by the better comparability of different rounds of the survey.

We decided to maximize comparability over time by always using the same assets. This requires the common assets to be the ones found in all rounds of the survey. This implies some loss of information (efficiency) in the estimates. It is important to measure this loss empirically, but it seems that the benefits in terms of comparability and the length of time under analysis compensate for this loss. We evaluated this loss and found that the rank correlation of households using all or some subsets of the available assets averaged >0.9.

Classification of households

The analysis of disparities can be done so that it emphasizes different dimensions, such as income level (rich versus poor), location (urban versus rural), sex or ethnolinguistic group (19). We concentrated on differentials stratified by level of household wealth. Household wealth is approximated using an asset index that is based on the presence in the household of certain durable goods (such as a radio, television or bicycle), the quality of the dwelling (e.g. roof and floor materials) and access to different types of water and sanitation. The index was constructed following the procedure described by Filmer & Pritchett, and Gwatkin et al. (6–8). This asset index was then used to stratify the households included in the DHS into quintiles.

There are advantages and disadvantages to using wealth rather than income to rank households (20). The clearest shortcoming is that the traditional analysis of welfare uses current expenditure (or income when data are not available). However, measuring expenditure and income in field surveys is problematic due to insufficient recall and because, among other reasons, some people might have incentives to overestimate or underestimate the real figures. There is also the problem of accounting for non-cash income. Using a measure of asset wealth is simpler and results in fewer measurement errors because the interviewer directly observes the objects needed to calculate the index. Furthermore, the assets represent previous expenditures by the household, so this method is not too different from the more traditional indicator.

Not only can the same asset indicators be used but so can the same cut-off points over time. This allows for changes in the size of groups. In other words, the cut-off values in an earlier DHS separate households into quintiles of equal size. Applying the same cut-off points to a later survey may result in five household groupings that are not of equal size. Thus by the time of the later survey some of the families in the poorest

quintile had obtained assets that allowed them to enjoy amenities that move them up into the middle class. This shift in the population from one quintile to another is an indirect measure of increasing income or wealth and can be associated with the idea of a fixed poverty line (as Sahn & Stifel have done for some African countries (21)). However, for the purposes of measuring inequality, it seems more advisable to maintain groupings of equal size at each point in time. Also because the surveys do not present panel data, there might be additional variance.

Classification of outcomes

Changes in the average rates of immunization coverage could result from any number of changes in the distribution and relative gap. Thus, changes in the national average do not imply a priori any particular modification in the relative gap. For example, an improvement in immunization coverage could go together with increases in the relative gap and could be accompanied by deterioration among disadvantaged and vulnerable children. Combining the various possibilities of improvements and deterioration in the average and in distribution, we obtain four plausible scenarios (Table 1).

This 2 x 2 classification based on average results and the relative gap between the wealthiest and poorest quintiles may need further subdividing. For instance, “improvement with inequity” may be the result of a situation in which the wealthiest 20% of households gain more than the poorest 20%. Thus the average improves while the relative gap widens. But it may also be the result of a deterioration occurring among the poorest 20% of households accompanied by an improvement in the overall average driven by gains occurring among the wealthiest 20%. Given that we are not only interested in equity but also in the actual outcome among the worst off, the “improvement with inequity” category may not capture all needed information.

Similarly, in the “worsening with an element of protection” category both groups see their situation deteriorate, and the relative gap is reduced. Alternatively, the relative gap can be reduced because the gains among the poorest 20% are small and dwarfed by the losses among the wealthiest 20%. In this case, both average welfare and the relative gap are reduced, but those who are among the worst off see improvements in their situation. We have not found this type of outcome in real-world cases of DPT3 coverage rates although they do happen for other indicators of children’s well-being.

EPI performance and equity monitoring

Fig. 1 gives an overview of data for 21 countries for which information on immunization showed overall improvements in rates of DPT3 coverage. The weighted average for the 21 countries

increased from a coverage rate of 64% at period 1 (1988–92) to 72% at period 2 (1995–99). Coverage rates increased from 5% to 25% in 17 countries; they remained stable in three (Bangladesh, the Philippines and the United Republic of Tanzania); and they declined in four (Colombia, the Dominican Republic, Kenya and Zimbabwe). Kazakhstan was not included in this analysis because there was a change in the way the data were recorded between the first and second DHS rounds.

When wealth was introduced into the analysis of immunization coverage, we found that trends in DPT3 coverage rates for children in the poorest quintile mirrored those of the general population (albeit at lower levels), showing improvements for the bottom quintile in 17 countries (Appendix 1, web version only, available at: <http://www.who.int/bulletin>). Coverage rates among the poorest children more than doubled in Egypt, Ghana, Mali, Morocco and Niger but remained stable in Bangladesh, Burkina Faso and the Dominican Republic.

The data revealed other interesting points. For example, in Cameroon children from the poorest households actually lost ground between the two periods studied although the national estimates showed a slight increase in coverage. In the Dominican Republic, the status of children in the poorest households remained unchanged although national estimates reported a decline for the same period. In Mali and Niger the data suggest that children from the poorest households achieved the sharpest gains in coverage.

An analysis of trends in immunization coverage identified notable differences in coverage rates among different income groups. These data confirm Vandemoortele’s observation that the poorest groups tends to be the last ones to have access to social services (22).

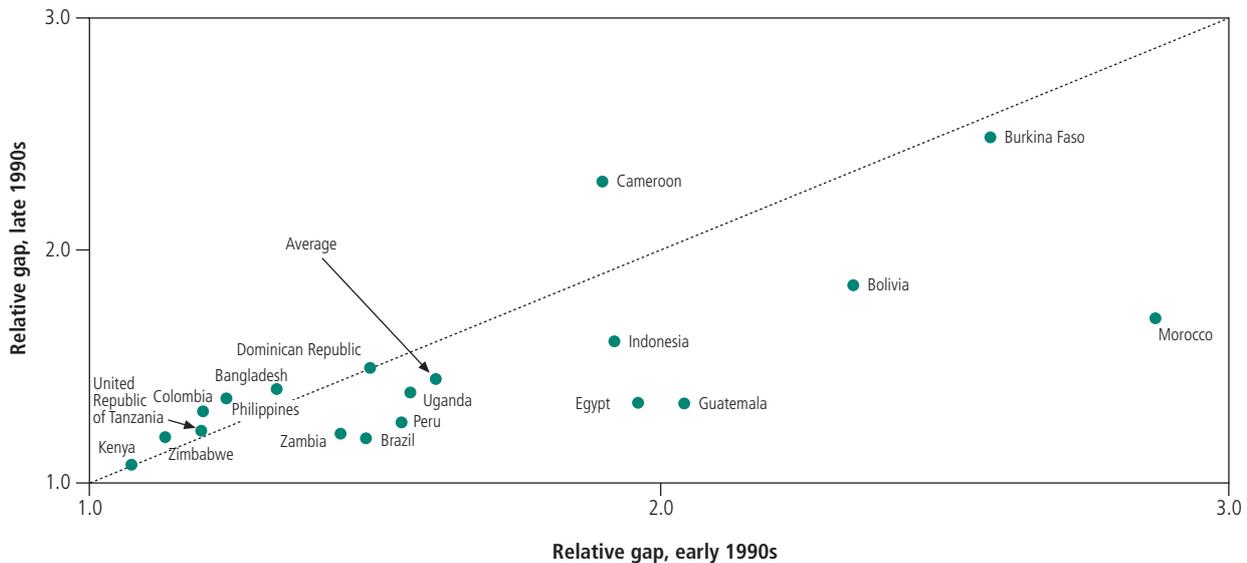
The relative gap in immunization between those in the wealthiest quintile and those in the poorest quintile decreased during the 1990s (Fig. 2). The horizontal axis measures the relative gap during the first period (the earliest DHS round) and the vertical axis measures the relative gap during the more recent period. The dots represent country observations, i.e. what the relative gap was in the first period and the second period. Observations on the solid diagonal line indicate that the relative gap was the same during both periods. However, most of the countries are in the lower area of the diagram. Thus the weighted average for the relative gap declined from 2.0 at the beginning of the 1990s to 1.5 in the second half of the 1990s.

The temporal changes we discuss refer to whether the observed differences between the relative gaps represent actual trends or are a statistical artefact. In other words, given the sample sizes, the errors around the quintile estimates are large and it may be that the differences are the result only of random sampling. The inputs for this statistical analysis are the standard

Table 1. Possible relationship between immunization rates and changes in average and relative gap between the wealthiest and poorest quintiles

| Trends | Relative immunization gap | | |
|------------------------------------|---------------------------|--|--|
| | | Narrowing | Widening |
| Overall immunization coverage rate | Improving | Best outcome | Improvement for those who are better off but not for those who are disadvantaged (improvement with inequity) |
| | Worsening | Worsening with an element of protection of the disadvantaged | Worst outcome |

Fig. 2. Changes in the relative gap between period 1 and period 2 in immunization coverage for three doses of diphtheria–pertussis–tetanus among children aged 12–23 months for selected countries. Some countries have been omitted to avoid clustering. (Calculations based on DHS data)



DHS = Demographic Health Surveys.

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errors of the variables in each period. Because the DHS is a cluster survey, a specific formula (provided by Macro International) is required to estimate these standard errors. McCloskey & Ziliak (23) have discussed the misguided reliance on the strict application of statistical tests that often fails to take into account the broad picture the data present. We attempted to avoid the pitfalls they identified. Thus we needed to assess the reliability of changes between the relative gaps, which are ratio estimators. We compared the changes between periods for the poorest quintile to determine whether the observed changes were statistically significant. We then followed the same procedure for the wealthiest quintile. If the differences were statistically significant improvements for the wealthiest quintile but not for the poorest, then the relative gap clearly increased. Similarly, if the difference in immunization coverage was not statistically significant for the wealthiest quintile between the two DHS rounds but the difference was statistically significant (and negative, showing a decline) for the poorest quintile, then disparities increased. Clearly, if there was no change for the wealthiest quintile and a statistically significant improvement for the poorest group, then the relative gap declined and disparity was reduced.

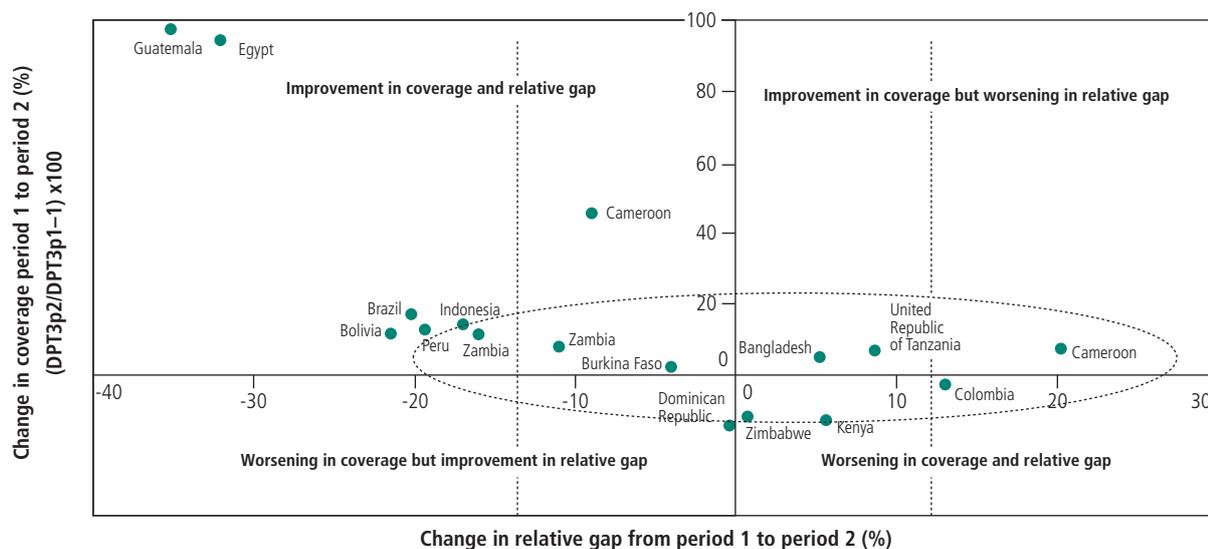
In Fig. 3, the vertical dotted lines represent the boundaries of statistical significance for changes in the relative gap along the horizontal axis. Zambia achieved a significant reduction in the gap (equity improved) but in Cameroon there was a significant increase in the gap (equity worsened); Bangladesh did not experience a significant change in the gap. The dotted oval represents the area of no significant change in average coverage (along the vertical axis). Thus, while Egypt and Kenya show significant changes at the national level, Uganda and Burkina Faso do not.

In addition, the information on households classified by wealth can be combined with their geographical location. For example, a simple comparison of coverage of DPT3 and

full immunization (defined as immunization with bacille Calmette–Guérin, measles vaccine, three doses of DPT and polio vaccine, excluding a dose of polio vaccine at birth) for the 21 countries analysed reveals a high correlation between wealth and geographical location, two indicators of the success of immunization programmes. This comparison was carried out at the subnational level (province or state) as reported by the DHS, resulting in a correlation of 0.93. (Because we used all available DHS rounds for these countries we had data on 482 observations.) When comparing trends in the relative gap between the province or state with the highest and lowest immunization rates in a country, we found similar results to those found when analysing the wealth quintiles. Countries with a high relative gap in terms of wealth are also countries with a high relative gap in coverage rates in terms of geographical location (e.g. Burkina Faso and Cameroon). In addition, in countries such as Kenya and Zimbabwe inequality increased slightly both when households were classified by wealth and by province or state (although these changes were not statistically significant). In other countries, such as Brazil, Burkina Faso and Uganda, disparities (associated both with wealth and geographical location) declined, but not statistically significantly. Egypt and Guatemala on the other hand show the largest declines in disparity both when households are ranked according to wealth (Fig. 3) as well as when they are classified by province or state.

The intertemporal comparisons of disparities at the province or state level should be carried out carefully because in some cases the worst-ranked or the best-ranked province is not the same for both rounds of the DHS, and thus the relative gap ratio is not strictly comparable (18). Nevertheless, the use of geographical disparities complements the use of wealth disparities because, unlike with quintiles, there are politically accountable individuals associated with provinces or states. Of course, with each province or state there are also disparities related to wealth, so both measures should be monitored.

Fig. 3. Relationship between changes in the national average and relative gap in coverage of three doses of diphtheria–pertussis–tetanus among children aged 12–23 months for selected countries. Some countries have been omitted to avoid clustering. (Calculations based on DHS data)



DHS = Demographic Health Surveys.

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Discussion

An analysis of disaggregated data on immunization reveals information that is masked by the indicators conventionally used to assess a programme's performance. This illustrates how the report of an improvement (an increase in coverage rates) may mean different things for different subpopulations. Disaggregated data also show how the intended beneficiaries of the programme have fared over time and how children from the poorest households consistently lag behind children from relatively better off households. Such information is critical at this stage of the development of the EPI, especially as the interest in equity issues grows.

Estimating and analysing patterns of disparities are valuable tools for formulating, designing and implementing effective and efficient policies and interventions. Information on disparities is inextricably linked to various factors that contribute to a programme's sustainability, notably the political will to protect vulnerable children with effective vaccines, national and international commitments to immunization programmes and cultural and societal characteristics (2).

There are different strategies for achieving immunization goals, some which are much more equitable than others. An egalitarian strategy promotes universality, which is a fundamental principle of human and child rights (24). However, epidemiologically a population can be immunized (have herd immunity) at coverage rates below 100% (with different percentages needed for different pathogens). Thus as coverage rates increase, herd immunity is achieved before universal coverage. A further effort may be needed to reach the equity level, i.e. of all children being immunized. The rationale for pursuing herd immunity is essentially that it reduces the chances of contracting a disease. On the other hand, a human rights approach would be based on the premise that vaccinating all children reduces the chances even further. This is a more efficient strategy when contracting a disease at an older age carries more risk than contracting it at a younger age.

In so far as large inequalities represent a nonfulfilment of human rights and a potentially inefficient situation, it is important to consider the policies that prevent or promote reductions in inequality. Among the countries in which disparities were reduced (Table 1, Fig. 3) we find countries that have not enjoyed particularly high economic growth or drastic poverty reduction or performed particularly well in terms of introducing reforms advocated by the Bretton Woods institutions (25–29). On the contrary, their success seems to be in line with alternative and more concrete interventions in terms of sustaining sufficient expenditure, strengthening delivery and management systems, and ensuring that all children have equal access to vaccinations and integrated health services (12, 30–32).

Although our empirical evidence is concerned mainly with trends in outcomes, looking more specifically at a country that had a substantial reduction in disparity buttresses earlier arguments. In Egypt for instance, some of the elements that explain the success of EPI in general and in terms of reducing disparities in particular are related to strong technical implementation (e.g. maintenance of the cold-chain) and policy implementation (e.g. relatively high budget allocations). Not only was there wide geographical coverage but also all health units efficiently used charts and maps to highlight areas with deficient coverage where efforts had to be concentrated, proving the importance of disaggregated data for implementing EPI activities (33). In addition, responsibilities were divided among staff and there was no over-reliance on physicians. Moreover, universal access was emphasized and pursued through the decentralization of some activities while adequate financing for all provinces was maintained by the central government. This maintenance of financing is crucial in order to avoid the increased disparities that may result from decentralization. Decentralization often leads to increased disparities because the richest areas can afford more and better services than the poorer ones. Khaleghian addresses other issues related to the decentralization of immunization (34). In Egypt, technical training and support from the central government was also strong.

Conclusions

It is intuitively clear that programme targets and global goals should be set and monitored not only in terms of national averages but also in terms of reducing disparities and in relation to the poorest groups. In general however the poorest groups receive fewer services. Until a few years ago no large dataset gave a reliable picture of these disparities in developing countries. The availability of at least two rounds of the DHS allows these disparities to be explored for the first time at the subnational level (i.e. by geographical and wealth groups) across countries and across time.

Unfortunately, few countries experienced substantial reductions in disparities. Although there seem to be declines in the relative gap in many countries, these declines are small. This implies for most countries there have been few gains among the poorest groups. Thus, particular effort should be made to improve the situation of the poorest people. Action in this area can be justified on ethical, epidemiological and economic grounds.

Future research could include an analysis in the drop-off of DPT coverage from DPT-1 to DPT3. Elucidating disparities in wealth or location that affect this decline, which in some countries is as large as 30 percentage points, could be telling

for programme purposes. A comparison of DPT3 and other vaccines could also be pursued. Case studies to explore why some countries do better or worse than others are also needed in order to explain the observed trends.

However, care needs to be taken to keep a pro-equity bias from becoming a pro-poor bias — i.e. to keep “vaccines for all” from becoming “vaccines for the poor”. This may stigmatize the programme, and the better off may lose interest in funding the “programme for the poor”. The experience of successful countries, such as Egypt and Guatemala, indicate that narrow targeting was avoided. On the contrary, universality, appropriate funding, data analysis and geographical outreach were important in increasing both coverage and equity. ■

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Résumé

Surveillance de l'équité en matière de couverture vaccinale

Le présent article analyse les tendances par groupes de revenus de la couverture obtenue avec le vaccin combiné diphtérie/coqueluche/tétanos (DPT3) en trois doses, dans un certain nombre de pays. Il débat de l'ampleur des disparités de la couverture en fonction du niveau de richesse et des changements intervenus pendant les années 1990. L'évaluation complète des inégalités en termes de revenus et les tendances suivies par ces inégalités ont déjà été examinées dans d'autres articles, cependant les questions relatives au bien-être des enfants sont souvent écartées en raison du manque de données comparables nécessaires à la parfaite compréhension et à la rectification des inégalités.

L'article se focalise sur la collecte de toutes les informations enregistrées au sujet de la vaccination des enfants et sur la transcription de ces données de manière à les rendre applicables à tous les pays. Il analyse les difficultés techniques et les solutions méthodologiques qui permettraient des comparaisons à deux

ou trois instants entre diverses mesures de l'inéquité, tirées de différentes études parmi diverses sous-populations, en vue d'obtenir des données désagrégées.

Le présent article argumente en faveur d'une analyse simultanée des variations des moyennes et des disparités de la couverture vaccinale en fonction de paramètres intéressants, tels que la richesse, le sexe et le lieu de résidence, dans le but de parvenir à une meilleure compréhension des tendances. Il se concentre également sur les problèmes de mesure et décrit les tendances de la vaccination par niveau de revenus. Il conclut par une brève discussion des questions liées à la surveillance de l'équitabilité des résultats et formule des propositions de recherches ultérieures. Il présente en outre certaines des leçons pouvant être tirées à propos de la surveillance et des politiques. Les auteurs espèrent que cette analyse des schémas de disparité aidera les décideurs dans la conception, la formulation et la mise en œuvre de politiques et d'interventions efficaces.

Resumen

Vigilancia de la equidad en la cobertura de inmunización

En el presente artículo se analizan las tendencias de la cobertura con tres dosis de la vacuna contra la difteria-tétanos-tos ferina (DPT3) según los grupos sociales por nivel de riqueza. Se examinan la magnitud de las disparidades en la cobertura según la riqueza y los cambios registrados en ese sentido durante los años noventa. Si bien en otros artículos se ha hecho ya una evaluación exhaustiva de la equidad de ingresos y de sus tendencias, los aspectos relacionados con el bienestar de los niños se han dejado a menudo de lado por falta de los datos comparables necesarios para comprender y corregir plenamente las desigualdades.

Un elemento fundamental de este artículo es la recopilación de cualquier tipo de información registrada acerca de la

inmunización de los niños y la posterior traducción de esos datos para poder aplicarlos a todos los países. Analizamos las dificultades técnicas y las soluciones metodológicas que permitirían comparar diversas medidas de la inequidad extraídas de distintos estudios en dos o tres puntos temporales entre diversas subpoblaciones a fin de obtener datos desglosados.

En este artículo se aboga por analizar simultáneamente los cambios de los promedios y las diferencias de la cobertura vacunal en función de variables de interés como, por ejemplo, la riqueza, el género y el lugar de residencia, a fin de comprender mejor las tendencias. Abordamos también diversos aspectos relacionados con la medición y describimos las tendencias de la inmunización

en función de la riqueza. Para finalizar, analizamos brevemente algunas cuestiones relacionadas con el monitoreo de los resultados de equidad y sugerimos nuevas investigaciones. Además, el artículo presenta algunas lecciones que cabe extraer acerca del

monitoreo y las políticas. Esperamos que este análisis de las pautas de las disparidades ayude a los formuladores de políticas a idear, proponer y ejecutar políticas e intervenciones eficientes.

ملخص

رصد المساواة في التغطية بالتمنيع

في نقطتين أو ثلاث نقاط في الوقت المناسب من بين مجموعة متنوعة من الفئات السكانية الفرعية بغية الحصول على معطيات مصنفة. وتدعو هذه الورقة إلى إجراء تحليل فوري للتغيرات في المتوسطات والفروق في مستوى التغطية بالتمنيع، والناجمة عن المتغيرات الرئيسية مثل مستوى الثراء، والجنس، ومكان الإقامة، وذلك لفهم الاتجاهات بشكل أفضل. كما نركز في هذه الورقة على القضايا المتعلقة بالقياس، ونقوم بوصف اتجاهات التميميع المقترنة بمستوى الثراء. ونختتم الورقة بمناقشة موجزة للقضايا المتعلقة برصد حصيلة المساواة، ونقدم اقتراحات بالبحوث الموصى بإجرائها في هذا الإطار. كما تقدم الورقة بعض الدروس المستفادة بشأن الرصد والسياسات. ونأمل أن يكون هذا التحليل لأنماط الفروق عوناً لراسمي السياسات على ابتكار واقتراح وتنفيذ سياسات ومدخلات فعالة.

ملخص: تحلل هذه الورقة اتجاهات التغطية بثلاث جرعات من لقاح الدفتريا والشاهوق والكزاز (اللقاح الثلاثي) من قِبَل فئات تختلف في مستوى الثراء في بلدان متنامية. وتناقش الورقة عمق الفروق في التغطية وفقاً لمستوى الثراء والتغيرات التي حدثت خلال عقد التسعينات. وتناقش ورقات أخرى التقييم الكامل للمساواة في الدخل واتجاهاته، بالرغم من تجاهل القضايا المتعلقة بعافية الأطفال نظراً لنقص المعطيات المقارنة اللازمة لفهم ظاهرة الجور والتفاوت فهماً كاملاً وتقويمها. وتركز هذه الورقة أيضاً على جمع بعض أو جميع المعلومات المدونة حول تمنيع الأطفال ثم تكييف هذه المعطيات بما يلائم تطبيقها على جميع البلدان. ونقوم في هذه الورقة بتحليل الصعوبات التقنية والحلول المنهجية التي تتيح إجراء مقارنات بين مختلف معايير الجور والتفاوت المستمدة من مختلف المسوحات

References

- Ackerman L. *Immunizations in Africa: issues and trends*. Washington, DC: USAID; 1994 (Technical Paper No. 13).
- UNICEF. *Sustainability of achievements: lessons learned from universal child immunization. Report of a Steering Committee*. New York: UNICEF; 1996.
- Claeson MC, Griffin T, Johnston M, McLachlan A, Soucat A, Wagstaff A, et al. *Health, nutrition and population: PRSP sourcebook*. Washington, DC: The World Bank; 2001.
- Cornia GA. *Liberalization, globalization and income distribution*. Helsinki: UNU/ World Institute for Development Economics Research; 1999.
- Van der Hoeven R. *Poverty and structural adjustment: some remarks on trade-offs between equity and growth*. Geneva: International Labour Organization; 2000.
- Filmer D, Pritchett L. *Estimating wealth effects without expenditure data – or tears: an application to educational enrollments in states of India*. Washington, DC: The World Bank; 1998.
- Filmer D, Pritchett L. *Education attainment of the poor (and rich): DHS evidence from around the globe*. Washington, DC: The World Bank; 1998.
- Gwatkin DR, Rutstein S, Johnson K, Pande R, Wagstaff A. *Socio-economic differences in health, nutrition, and population: country notes*. Washington, DC: The World Bank; 1999.
- Sahn D, Stifel D, Younger S. *Intertemporal changes in welfare: preliminary results for 9 African countries*. Ithaca (NY): Center for Food and Nutrition Policy; 1999 (Working Paper 94).
- Bollen K, Glanville J, Stecklov G. *Socioeconomic status and class in studies of fertility and health in developing countries*. Chapel Hill (NC): Carolina Population Center; 1999 (WP-99-13).
- Cleland J, Bicego G, Fegan G. *Socioeconomic inequalities in childhood mortality: the 1980s to the 1990s*. *Health Transition Review* 1992;2:1-18.
- Minujin A, Delamonica E. *Mind the gap! Child mortality differentials*. *Journal of Human Development* In press.
- Stecklov G, Bommier A, Boerma T. *Trends in equity in child survival in developing countries: an illustrative analysis using Ugandan data*. Chapel Hill (NC): Carolina Population Center; 1999.
- Schneider M, Castillo-Salgado C, Loyola-Elizondo E, Bacallao J, Mujica O, Vidaurre M, et al. *Trends in infant mortality inequalities in the Americas*. *Journal of Epidemiology and Community Health* 2002;56:538-41.
- Brown J, Monasch R, Bicego G, Burton A, Boerma JT. *An assessment of the quality of national child immunization coverage estimates in population-based surveys*. Chapel Hill (NC): Carolina Population Center; 2002 (WP -02-53).
- World Health Organization. *The EPI coverage surveys*. Geneva: WHO; 1991. WHO document WHO/EPI/MLH/91.10.
- Anand S, Diderichsen F, Evans T, Shkolnikov V, Wirth M. *Measuring disparities in health: methods and indicators*. In: Evans, T, Whitehead M, Diderichsen F, Bhuiya A, Wirth M, editors. *Challenging inequities in health: from ethics to action*. Oxford: Oxford University Press; 2001.
- Kunst A. *Cross-national comparisons of socio-economic differences in mortality*. The Hague: CIP; 1997.
- Gwatkin DR. *Health inequalities and the health of the poor: what do we know? What can we do?* *Bulletin of the World Health Organization* 2000;78:3-18.
- Minujin A, Bang JH. *Indicadores de inequidad social acerca del uso del "índice de bienes" para la distribución de hogares*. [Indicators of social inequality in the use of "índice de bienes" for the distribution of homes]. *Desarrollo Económico* 2002;42:129-46. In Spanish.
- Sahn D, Stifel D. *Poverty comparisons over time and across countries*. *World Development* 2000;28:2123-55.
- Vandemoortele J. *Absorbing social shocks, protecting children and reducing poverty: the role of basic social services*. New York: UNICEF; 2001 (Evaluation, Policy and Planning Series No. 00-001).
- McCloskey D, Ziliak T. *The standard error of regression*. *Journal of Economic Literature* 1996; 34:97-114.
- Lewin E. *Programming for the realization of children's rights*. Panama: UNICEF Regional Office for Latin America and the Caribbean; 2000.
- UNDP. *Human development report*. New York: UNDP; 1999.
- The World Bank. *World development report*. Washington, DC: The World Bank; 2000.
- Minujin AJ, Vandemoortele J, Delamonica E. *Economic growth, poverty and children*. *Environment and Urbanization* 2002;14:23-43.
- UNICEF. *Poverty reduction begins with children*. New York: UNICEF; 2000.
- Maxwell S. *Heaven or hubris: reflections on the new 'new poverty agenda'*. *Development Policy Review* 2003;21:5-25.
- Cornia GA, Jolly R, Stewart F, editors. *Adjustment with a human face*. Oxford: Oxford University Press; 1987.
- Mehrotra S, Jolly R. *Development with a human face*. Oxford: Oxford University Press; 1997.
- Rohde JE. *Disparity reduction: a strategy for children in the 1990s*. New York: UNICEF; 1989 (Background Document No. 24).
- Cobb LK, Baer FC, Debay MJP, El Ferali MA, Kashmiry A. *Final assessment of the Egypt child survival project (263-0203)*. Washington, DC: USAID Mission to Egypt; 1996 (POPTech Report No. 96-073-41).
- Khaleghian P. *Decentralisation and public services: the case of immunization*. In: *The economics of vaccination in low and middle income countries technical workshop* London: London School of Hygiene and Tropical Medicine; 2003.

Appendix 1. Coverage rates of three doses of diphtheria–pertussis–tetanus vaccine among children aged 12–23 months, by wealth quintile

| Country | Year | Coverage rate ^a | | | | | Total coverage for all quintiles | Relative gap |
|-----------------------------|------|------------------------------|------|------|------|------|----------------------------------|--------------|
| | | Wealth quintile ^b | | | | | | |
| | | 1 | 2 | 3 | 4 | 5 | | |
| Africa | | | | | | | | |
| Burkina Faso | 1992 | 25.7 | 34.2 | 32.2 | 46.0 | 66.4 | 40.6 | 2.6 |
| | 1999 | 23.9 | 34.9 | 42.4 | 44.9 | 60.3 | 41.2 | 2.5 |
| Cameroon | 1992 | 37.2 | 35.5 | 38.0 | 52.1 | 70.4 | 47.5 | 1.9 |
| | 1998 | 30.7 | 41.6 | 47.8 | 68.3 | 73.5 | 50.9 | 2.4 |
| Egypt | 1988 | 27.1 | 35.2 | 44.5 | 54.6 | 53.1 | 42.6 | 2.0 |
| | 1995 | 70.6 | 78.9 | 83.9 | 89.4 | 93.9 | 83.0 | 1.3 |
| Ghana | 1988 | 8.2 | 13.2 | 18.7 | 31.4 | 55.6 | 24.3 | 6.8 |
| | 1998 | 60.5 | 67.2 | 72.9 | 76.8 | 92.0 | 72.2 | 1.5 |
| Kenya | 1993 | 78.0 | 84.0 | 90.5 | 88.3 | 95.5 | 87.2 | 1.2 |
| | 1998 | 69.0 | 71.6 | 82.9 | 82.9 | 84.7 | 77.8 | 1.2 |
| Mali | 1987 | 10.2 | 16.2 | 19.5 | 33.3 | 40.0 | 23.8 | 40.0 |
| | 1996 | 17.6 | 25.0 | 35.3 | 29.4 | 39.7 | 29.7 | 2.3 |
| Morocco | 1987 | 32.1 | 55.1 | 63.5 | 79.1 | 92.2 | 62.9 | 2.9 |
| | 1992 | 57.8 | 73.4 | 82.9 | 94.8 | 97.9 | 78.5 | 1.7 |
| Niger | 1992 | 25.5 | 33.3 | 26.6 | 14.8 | 37.8 | 25.4 | 1.5 |
| | 1998 | 19.0 | 11.4 | 20.1 | 20.9 | 65.3 | 25.1 | 3.4 |
| United Republic of Tanzania | 1992 | 76.5 | 72.6 | 77.4 | 83.7 | 88.5 | 79.5 | 1.2 |
| | 1996 | 74.4 | 80.7 | 86.1 | 89.6 | 92.3 | 84.8 | 1.2 |
| Uganda | 1988 | 50.4 | 44.8 | 56.6 | 57.9 | 78.6 | 57.0 | 1.6 |
| | 1995 | 55.3 | 49.8 | 61.9 | 64.4 | 76.6 | 61.4 | 1.4 |
| Zambia | 1992 | 63.7 | 70.2 | 76.4 | 84.4 | 91.5 | 76.7 | 1.4 |
| | 1996 | 78.9 | 84.5 | 85.7 | 86.2 | 95.0 | 85.8 | 1.2 |
| Zimbabwe | 1994 | 81.8 | 81.9 | 80.5 | 90.1 | 90.3 | 85.2 | 1.1 |
| | 1999 | 79.1 | 82.8 | 76.0 | 82.3 | 84.4 | 80.9 | 1.1 |
| Latin America | | | | | | | | |
| Bolivia | 1994 | 28.4 | 38.5 | 38.9 | 49.1 | 69.0 | 42.5 | 2.4 |
| | 1998 | 37.0 | 40.5 | 44.9 | 65.9 | 67.9 | 48.6 | 1.8 |
| Brazil | 1986 | 58.5 | 52.1 | 82.6 | 88.1 | 86.7 | 69.9 | 1.5 |
| | 1996 | 65.9 | 83.0 | 89.5 | 91.2 | 79.2 | 80.7 | 1.2 |
| Colombia | 1990 | 65.8 | 80.9 | 82.1 | 85.0 | 86.1 | 78.9 | 1.3 |
| | 1995 | 65.3 | 75.5 | 75.4 | 86.7 | 87.6 | 76.8 | 1.3 |
| Dominican Republic | 1991 | 44.3 | 57.8 | 55.7 | 68.3 | 65.2 | 57.0 | 1.5 |
| | 1996 | 47.3 | 42.0 | 62.9 | 71.1 | 70.2 | 57.6 | 1.5 |
| Guatemala | 1987 | 27.3 | 32.1 | 34.4 | 45.6 | 55.8 | 35.7 | 2.0 |
| | 1999 | 64.0 | 67.2 | 63.6 | 70.5 | 77.4 | 67.7 | 1.2 |
| Peru | 1992 | 55.6 | 65.4 | 73.9 | 78.0 | 87.5 | 68.4 | 1.6 |
| | 1996 | 69.2 | 77.2 | 79.0 | 82.2 | 86.8 | 77.2 | 1.3 |
| Other countries | | | | | | | | |
| Bangladesh | 1994 | 61.0 | 66.5 | 61.6 | 76.8 | 81.0 | 67.2 | 1.3 |
| | 1997 | 59.3 | 60.1 | 75.1 | 77.5 | 80.2 | 69.2 | 1.4 |
| Indonesia | 1991 | 39.1 | 47.4 | 54.6 | 67.0 | 77.4 | 55.8 | 2.0 |
| | 1997 | 51.6 | 57.6 | 63.0 | 67.9 | 82.2 | 64.1 | 1.6 |
| Philippines | 1993 | 70.4 | 79.9 | 84.4 | 85.7 | 87.7 | 80.1 | 1.2 |
| | 1998 | 57.5 | 68.4 | 75.0 | 79.1 | 82.1 | 70.3 | 1.4 |

^a Coverage rates are percentages.^b Quintile 1 represents the poorest households; quintile 5 represents the richest households.