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The Challenges of measuring child mortality when birth registration is incomplete*

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The challenges of measuring child mortality when birth registration is incomplete[1]

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One of the objectives of the Millennium Development Goals is the reduction of child mortality by two thirds in the period between 1990 and 2015, which is monitored by means of two indicators: the Infant Mortality Rate (IMR) and the Under Five Mortality Rate (U5MR). This paper reviews the methodological difficulties to obtain accurate measurements of these indicators in countries with incomplete civil registration systems. It reviews alternative ways to estimate these indicators from existent data sources and concludes that, although they provide good aggregate estimates, they are no substitutes for a complete system of vital registration from which key development indicators can be accurately estimated. Although the analysis is concentrated on the estimation of IMR, since it is more sensitive to incomplete data on birth registration, similar difficulties would be present in the estimation of U5MR.

Key development indicators: IMR and U5MR

The child mortality as a proxy indicator for quality of life and development was ratified in the 2000 United Nation Millennium Summit when its reduction was considered one of the eight priorities to be achieved by 2015. In particular this indicator is one of the most widely used indicators to assess the health status of countries, regions and communities because reflects the social, economic and environmental conditions in which children and others in society live.

But not only is child mortality a general quality of life indicator. It also reflects proper access to health care, and is therefore a relevant input to policy makers. For instance, the causes of death among newborns are closely related to the level of medical attention they received during delivery. Older infants and children die from infectious diseases associated with the health and poverty conditions of their living environment (water, sanitation, nutrition, etc.), with the level of education of their mothers, and with availability of health care and access to basic medical knowledge (Sen, 1998). Child mortality also is sensitive to the socio-economic context.

When this context deteriorates, children are at higher risk of dying from preventable diseases. The evolution of child mortality over a period of time becomes a key variable that can reflect the effectiveness of public policies in providing basic goods and services to families and communities. In a more general way, child mortality is also related to economic development. Regular estimates of child mortality are used for inter-country and inter-regional comparisons within countries because it reflects not only the health, , nutrition and social status, but also the economic conditions of people (Tadesse Wuhib, 2003). The negative correlation between child mortality and income reflects the

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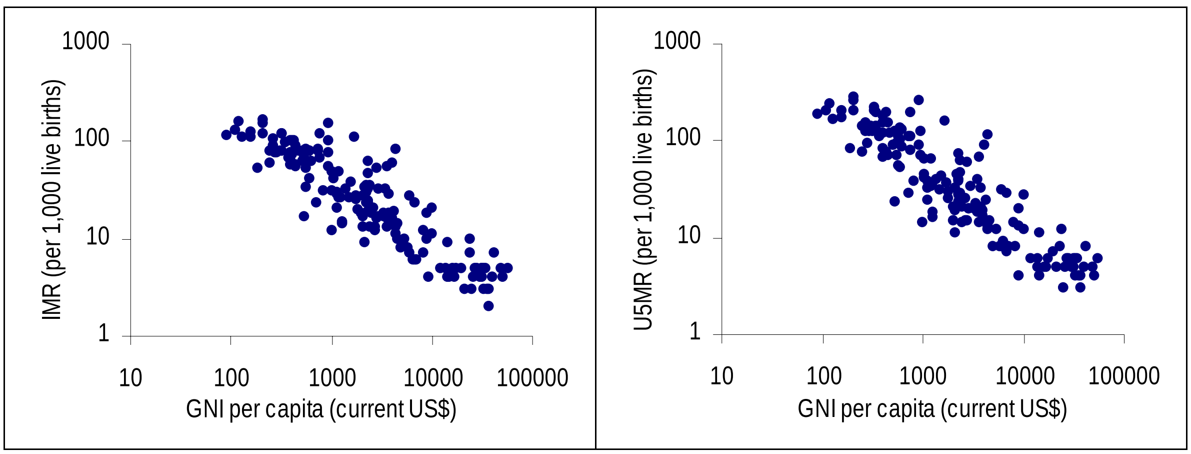
importance the child mortality as a policy instrument, i.e., when it is used to allocate resources, to design policies, and to monitor overall child and mother well being, particularly for international organizations aiming to reach the goal of reducing child mortality[3].

According to available information from 167 countries (World Bank, 2006) it is clear that infant and child mortality decreases as per capita income increases (Graph 1).[4] On average, in 2004 high income countries had child mortality rates that were 17 times lower than low income countries (122 and 7 per 1000 live births, respectively), according to the country classification of the World Bank. In addition, Wegman (2001) shows that the relationship between economic development and health is relevant, particularly in countries and regions with presently high rates of child mortality, WHO (2005) argues that the rapid reduction of infant and child mortality in Europe during the early 20th century suggests a clear association between overall living standards and mortality rates.

Graph 1: IMR, U5MR and GNI per capita, 2004*



* Both axis are expressed in logarithms
Source: Authors' estimates based on World Bank "World Development Indicator", 2006

Many countries in Latin America lack a complete system of birth registration that would permit proper monitoring of such an important indicator. The lack of accurate birth registration records restricts the capacity to generate timely and systematic estimates at an appropriate level of disaggregation to assess the impact of development policies over time and for specific population groups.

Methodological difficulties to estimate child mortality

What are the data sources used to estimate child mortality rates in Latin America?, What are the methodological difficulties that crop up when trying to obtain accurate

[3] For instance, United Nations (2006) has recently shown that advances in infant and child survival have come more slowly to people in the lowest-income countries and to the lowest-income people in wealthier countries.

[4] Per capita GNI estimates are based on the Atlas method which smoothes exchange rate fluctuations by using a three-year moving average. They take into account all production in the domestic economy plus the net flows of factor income (such as rents, profits, and labor income) from abroad.

measurements of child mortality?, What is the degree of under-estimation of child mortality rates resulting from incomplete vital registration systems?. In this section we assess the problems that arise in the estimation of child mortality when using different data sources: surveys, census data and vital registration. We discuss their limitations to inform policy decisions in a timely fashion at the level of disaggregation necessary to allocate resources and implement policy interventions guaranteeing the basic right of children to a healthy life.

(a) Child Mortality from vital registration

Infant mortality rates (IMR) are calculated as the annual number of deaths of infants under one year of age per every 1,000 live births (UNSD, 2002). For accurate statistics on infant mortality to exist, a complete system of civil registration is required, otherwise infant mortality estimations could be biased, as we will argue below. The Demographic Yearbook of the UN Statistical Division reports estimated rates for countries where civil registration is considered reliable[5] (Table 1). In the 2002 edition of the Demographic Yearbook, only eleven countries in Latin America had reliable data for the estimation of IMR[6]. Table 1 reproduces the latest IMR estimates found in the 2003 Demographic Yearbook for these countries on a yearly basis. Since information comes from civil registrations systems, it is possible to have annual estimates with a relatively short delay for data compilation and processing.

Table 1. Infant mortality rates 1998 – 2003

	1998	1999	2000	2001	2002	2003
Costa Rica	12.6	11.8	10.2	10.8	11.1	10.1
Cuba	7.1	6.5	7.2	6.2	6.5	6.3
El Salvador	15	11.5	11.2	12.2	9.9	10.6
Guatemala	31.5	36.5	31.1	...	...	29.4
Jamaica	...	17.7	17.7	17.3	18.2	16.7
Mexico	15.8	14.5	13.8	13	...	...
Argentina	19.1	17.6	16.6	16.3	16.8	16.5
Chile	10.9	10.6	9.4	8.8	8.2	8.3
Peru	41	39	37.2	35.6	...	...
Uruguay	16.6	14.4	14.1	13.9	13.6	15
Venezuela	19.7	17.1	15.7	15.4	15.5	...

Notes: Only countries with a civil registration estimated complete (90% or better). For certain countries, there is a Discrepancy between the total number of infant deaths shown in this table and those shown in subsequent tables for the same year. Rates are the number of deaths of infants under one year of age per 1 000 live births.
Source: UNSD, Demographic Yearbook, 2002 and 2003

[5] Information is based on official data reported by governments. Each nation is asked to make its own estimate of completeness and IMRs are estimated for countries that meet two criteria: i) they have a "complete" registration system representing at least 90 percent of all infant deaths occurring in one year; and ii) counties have at least a total of 100 infant deaths a year. Based on the second criteria, IMR for several small countries in the Caribbean are not reported because numbers are very small. This is the case of Grenada, Guadeloupe, Martinique, Saint Kittis, St. Lucia, Grenadines and French Guiana (DYB, 2002).
[6] Costa Rica, Cuba, El Salvador, Guatemala, Jamaica, Mexico, Argentina, Chile, Peru, Uruguay y Venezuela.

The estimation of IMR from vital statistics directly assumes that the data indeed captures all births and deaths[7]. However, in countries where under-registration is proportionally large, the IMR estimates will be biased. Even in the eleven Latin American countries having the best vital record (as reported by the UN Yearbook), the level of under-reporting may reach 10 percent, which could result in significant errors in the estimation of IMR. When the birth and death of a child is not registered, both the numerator and the denominator are affected by the same absolute amount. However, its impact is proportionately larger in the numerator than in the denominator because the death of children is a rarer event. In that case, under-registration of children generates under-estimations of infant mortality[8]. When lack of birth and death registration is concentrated among population groups at higher risk, estimates of child mortality may be systematically under-estimated.

Recent studies for Latin American countries trying to assess the extent of under-reporting confirm the fact that the lack of registration in vital statistics is more frequent in poor households; in areas lacking basic health and education facilities, and in rural, indigenous and remote communities (Ordóñez and Bracamonte, 2006). Within urban areas, under-registration is prevalent among culturally, economically and socially marginalized communities. Duryea et. al. (2006) found a statistically significant correlation between the lack of birth registration and variables such as low education level of the parents, rural residence, low economic status and no access to prenatal care. Population groups that would be at greatest risk of early death.

Thus, incomplete birth registration systems may result in under-estimating the true values of IMR. The direction of this under-estimation can be calculated by considering the countries with a reliable system of civil registration according to UN criteria and the available under-registration estimates of birth[9]. Assuming that under-reporting of birth is concentrated in children born in high risk households, it can be demonstrated that (i) in countries with low levels of under-registration (Chile, Costa Rica, Argentina and Uruguay) estimates of infant mortality rates are fairly reliable, and (ii) in countries with large population groups at higher risk, under-estimations of infant mortality may be much higher (Guatemala, Mexico, Peru, and in particular El Salvador).

Consequently, the absence of complete vital registration systems (births and/or child deaths) generates under-estimations of infant mortality rates. As we will see below, the household surveys would generate better estimates of infant mortality since they capture non-registered children. The two countries having official estimates in DYB and survey estimates from DHS or PAHO confirm the fact that IMR estimates from household surveys are closer to IMR estimates from civil registrars that have been corrected for under-reporting.

[7] For a discussion on this issue, see Aleshina and Redmond, 2003

[8] Using a similar argument, it can be demonstrated that IMRs calculated from household surveys will under-estimate IMR when not corrected for maternal mortality.

[9] Estimates from UNICEF (2005), Duryea (2006), Ordoñez and Bracamonte (2005), or the 10 percent upper limit of the UN. We are assuming that the level of under-reporting affects births and deaths by the same percentage.

(b) Child mortality from household surveys

In the absence of complete vital records, governments have sponsored household surveys to collect data on the reproductive history of women at childbearing age, often in coordination with International Organizations and bilateral donors. In Latin America, fifteen countries have Demographic and Health Surveys (DHS) from which IMR estimates are reported. Table 2 shows the countries and the years for which Demographic Health Surveys have been collected. UNICEF sponsors Multiple Indicator Cluster Surveys (MICS) from which estimates for infant mortality can also be generated. Only 5 countries in Latin America have a MIC Survey[10].

Table 2: Years of DHS Household Surveys Available

Country	Year of Most Recent Survey	Previous Available Surveys
Bolivia	2003	1998, 1994, 1989
Brazil	1996	1991, 1986
Colombia	2005	2000, 1995, 1990, 1986
Ecuador	1987	N/A
El Salvador	1985	N/A
Guatemala	1995	1987
Haiti	2000	1994-95
Mexico	1987	N/A
Nicaragua	2001	1997-98
Paraguay	1990	N/A
Peru	2004	2000, 1996, 1982, 1986
Trinidad y Tobago	1987	N/A

Source: Demographic and Health Surveys (DHS)

Survey data is widely used in Latin America to estimate infant and child mortality. Most MDG Country Reports in the region are using this source of information to monitor the objective to reduce child mortality. Survey data is collected from a sample of women, specifically selected to represent the characteristics of the total population. DHS surveys are designed to provide information on a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition[11]. The problem when calculating IMR from survey data is that infant mortality is such a rare event that estimates based on a few observations redound in large sampling errors, in many cases larger than what could be considered appropriate to inform policies and monitor their implementation[12]. Sampling errors in the estimation of mortality rates are influenced, not only by the traditional problems of sample size in the survey and sample design, but also by the level of mortality itself.

[10] Countries are Bolivia, Cuba, Dominican Republic, Guyana and Venezuela. Information on these surveys can be found in: www.childinfo.org/MICS2/Gj99306m.htm

[11] http://www.measuredhs.com/aboutsurveys/dhs/start.cfm

[12] These results are similar to the obtained by Korenromp, E. *et al* (2004) in an exhaustive analysis of 41 DHS surveys conducted between 1986 y 2002 in 41 African countries. They argue that not all trends between subsequent surveys were statistically significant, a fact that is frequently ignored in trend analysis. Analysis of differences at sub-national levels is very useful to highlight spatial inequities. Again this kind of analysis is often reported without any consideration of the statistical significance of eventual differences.

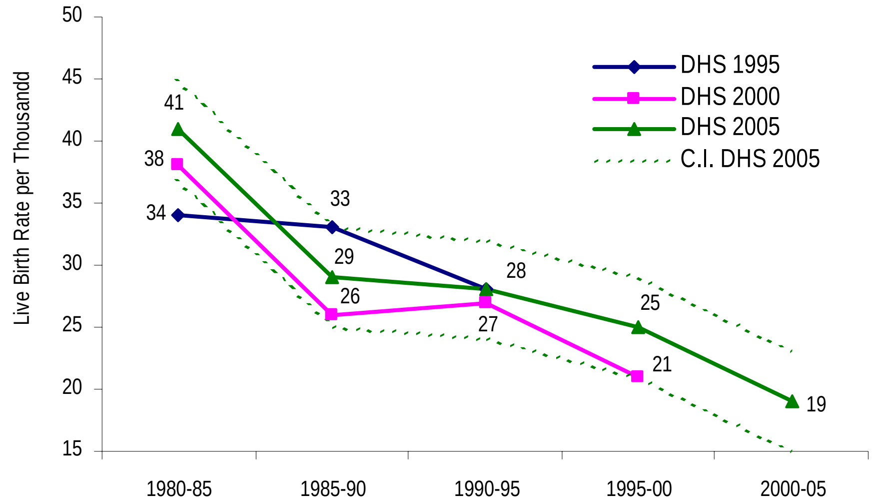
IMRs from survey data are defined as the probability of dying between birth and exactly one year of age. It is expressed per each 1,000 live births. Since the death of infants under 1 year of age is a rare event, even rarer than the death of children under 5, the estimation of the probability of dying is subject to considerable error and random variations. Great caution must be taken to interpret results. Assessing the trends of infant mortality rates over time offers uncertain results. Graph 2 illustrates the evolution of IMR in Colombia from 1980 to 2005 according to three household surveys collected in three different years using the same methodology. Uncertainty around the estimation of IMR makes it difficult to draw a firm conclusion as to the evolution of infant mortality for short periods. The sample size used in household surveys is not large enough to allow comparisons for periods shorter than ten years. An additional difficulty in the estimation of IMR when using survey data is the quality of the birth history data when trying to collect information from the past. Omission and misreporting of birth date and death age for deceased children are likely to be more frequent at longer recall periods[13].

A similar uncertainty exists in the calculation of IMR for different socio-demographic groups. Estimates of infant mortality disaggregated by area of residence (urban/rural or provinces), by the level of education of mothers, or by access to medical care, are a useful guide for both the allocation of public resources and the design of health interventions. Yet, differences in the incidence of infant mortality when estimated from household data are only indicative of actual differences[14].

[13] Other errors or problems in IMR measures not analyzed here, which can affect their reliability in general and comparability across countries, are (a) The fact that efforts to lower infant mortality usually are strongly based on an effort to expand birth attendance by adequate personnel, usually implies that the worst off population is being registered both at birth and death better than before, and (b) The fact that different countries use different criteria for the definition of live births and thus change in this case both the numerator and the denominator (varying criteria for weight, month of pregnancy-delivery, size/length of newborn).

[14] The web site where DHS data can be consulted (www.measuredhs.com) contains tabulations with IMR estimated for different population groups. The methodological appendix of each survey provides a comprehensive discussion of warnings that must be taken to interpret the data.

Graph 2. Evolution of Infant Mortality according to Three Surveys



Note: C.I. DHS 2005 is the minimum confidence interval (corresponding to urban area) applied to each estimated point.
Source: Colombia Demographic and Health Surveys, 1995, 2000, 2005)

The DHS survey for Bolivia carried out in 2003 interviewed 17654 women aged between 15-49 years. The point estimate for infant mortality was 54 infant deaths per 1,000 live births with a confidence interval of 48-60 per 1,000. This is, we know that the true value for the IMR in the population would be in that range with 95 percent certainty. Any attempt to disaggregate this rate, even for large population groups, increases uncertainty. In urban areas, for example, the confidence interval of the estimated IMR is 36-51 and for rural areas is 57-76. Countries with smaller samples would have wider confidence intervals denoting the increased uncertainty surrounding the estimation of differences in the health conditions of different socio-demographic groups. This is the case of Nicaragua 2001 that surveyed 13060 women, Haití 2000 with 10159, or Ecuador 1987 with 4713, among others[15].

Large non-sample errors also represent a problem in the estimation of IMR from sample surveys. They are subject to considerable error as a result of omissions in the reporting of infant deaths, or of the erroneous reporting of deaths occurring outside the period of reference.[16] The death of a child is always a traumatic event; cultural values, the age of women and family history may influence the responses. Barriers produced at the time of the interview due to the way that the questions are asked may also lead to inaccurate reporting of data. Confidence in the estimation depends on the level of omission of children who die shortly after birth, especially when death of the child occurred long before the survey year. Errors in the reported age of children who died are another factor that may distort results. Non-sampling errors may be higher when reconstructing the reproductive health histories of women in poor households and vulnerable groups whose fertility rates and home births are higher. In these groups, unreported births and child

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[15] Reports for each country can be seen in www.measuredhs.com/aboutsurveys/dhs/surveys.cfm
[16] An exhaustive evaluation of this type of errors has been done by Curtis (1995) who uses 26 DHSs, six of which correspond to LAC.

deaths tend to be higher; they are not captured by vital registries but also are more difficult to capture by household surveys.

Thus, sampling (measurable) and non-sampling (difficult to measure) errors in the estimation of IMR based on survey data are often large, which leads to great uncertainty about the true population values[17]. Estimates of IMR from survey data are useful in the evaluation of long-term trends and are indicative of differences among broad population groups. However, their sample size may not be large enough to provide information at more disaggregated levels and for shorter-term intervals. Unless explicit provisions are taken to include particularly vulnerable groups in the sample, mortality estimates generated from sample surveys may under-estimate actual mortality rates.

(c) Child mortality from census data

In the 1980s, the population census in Latin American countries have incorporated questions to allow the identification of specific population groups—such as indigenous, afro-descendents and handicapped—as well as to facilitate drawing demographic tendencies. This census information is used to generate indirect measurement of fertility and mortality[18]. Currently, most population census contains enough information to estimate fertility and mortality rates[19]. In the absence of complete vital registration systems, census data can provide a useful source of information for the estimation of IMRs[20].

Census data does not have the problem of under-registration that is prevalent in vital statistics. Since its coverage is universal, the data also allows for various levels of disaggregation by geographical area as well as for the computation of mortality rates for specific groups defined according to socio-demographic characteristics, race, ethnicity and others. Although census data is widely used to generate national estimates, especially when drawing inter-temporal trends to make comparisons among countries[21], data disaggregation to assess the evolution of basic indicators among various population groups has not become a regular practice[22].

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[17] For a discussion on this issue see, Aleshina and Redmond, 2003 and the methodological appendix of DHS surveys for the various countries (http://www.measuredhs.com/countries).

[18] Direct estimations are based on vital registration or on dated events from retrospective birth histories while indirect methods calculate mortality rates from the number of children ever born and the proportion of deaths, classified by five-age groups of mothers. Assumptions made on indirect estimates can introduce an additional bias in the calculation of mortality rates (Fernando, 1985; Preston, 1985). One of the methods most widely used to generate indirect estimates was developed by Brass in 1964. In countries with poor vital records, indirect estimation will usually yield higher IMR estimates

[19] Questions must be responded by women at reproductive age. Census questionnaires used between 1995 and 2004 can be seen in: http://mdgs.un.org/unsd/demographic/sources/census/censusquest.htm

[20] Since 1968, CEPAL/CELADE publishes the Boletín Demográfico based on information from population census in Latin America and the Caribbean. It contains, among other, populations projections for countries, birth and mortality rates, life expectancy and the distribution of the population (http://www.eclac.cl/cgi-bin)

[21] An example of this is in Boletines Demográficos No. 67 (2001) y 74 (2004) del CELADE (www.eclac.cl/celade/default.asp).

[22] See, for instance, Chackiel, J. (2005) "Métodos de estimación de la fecundidad y la mortalidad a partir de censos. Una aplicación a pueblos indígenas de Panamá", Notas de Población No. 79, CEPAL/CELADE (www.eclac.cl/publicaciones/xml/5/23525/notas79-cap6.pdf).

Census data is collected every 10 years and although regular updates can be done to facilitate monitoring of national targets, estimates are subject to assumptions made on the demographic characteristics of the population and their mobility. For the estimation of IMR, census data does not allow for direct and regular measurement with the frequency required for the design of policy interventions. IMR is a very sensitive indicator that can capture sudden changes in the living conditions of families and their access to medical attention and it is concentrated in high-risk groups. Timely yearly estimates of IMR with enough disaggregation by factors such as level of income, geographical area and ethnicity, is an essential input for policy decisions and resource allocation.

Will Latin American countries meet the target of child mortality reduction?

Different data sources provide slightly different answers to this question. In Table 3 the infant mortality rates in Latin American countries as reported by UNDP (2003) demonstrate adequate progress to meet the MDG target by 2015[23]. Only two countries, Belize and Uruguay, fall below the rate required to meet the MDG target for reduction in child mortality. The progress in Costa Rica, Haiti, Honduras and Panama is slightly slower than required but their IMRs show a significant reduction since 1990[24]. Based on this information one could conclude that progress towards the goal of child mortality reduction is generally on track in Latin America, even if it must be accelerated in a few countries (including some with already low mortality rates like Costa Rica and Uruguay) and requires substantial efforts in Belize and Haiti (whose progress in the last 14 years has been very slow and where child mortality betrays some of the highest rates in the region).

The Latin American Center for Demography (CELADE for its Spanish acronym), instead, uses census data to project average IMRs at 5-year intervals. Table 4 shows most countries making adequate progress to reach the MDG target. This is the case even for those countries whose IMRs are the highest in the region (i.e., Bolivia and Haiti). Costa Rica, Chile and Cuba experienced fast progress well before the 1990s. Only a few countries in the Caribbean (i.e., Guyana, Belice, Puerto Rico and Martinica) are not on track to meet the target.

According to available sources, infant mortality has systematically decreased in the last few decades. Some factors that explain such reduction is the reduction in the cost of basic health care due to fast improvements in medical technology, and the increasing level of education of women who thereby augment their capacity to care for their children's health (WHO, 2005, Chap. 5). Cheaper basic health care would have contributed towards more effective control of infectious, parasitic and respiratory diseases, and higher levels

[23] According to United Nations (2003), although the target relates specifically to under-five mortality, infant mortality is relevant to the monitoring of the target since it represents an important component of under-five mortality.

[24] Progress to reduce child mortality by 2/3 between 1990 and 2015 requires a 2.67 percent annual decline of IMR and U5MR. The first column in Tables 1 and 2 shows the actual annual rate of decline of countries between 1990 and 2004.

of women education would have facilitated significantly the application of technological advances to prevent disease.

Table 3. Infant Mortality Rate in 1990 and 2004

	Infant Mortality Actual annual rate of progress (%)	Infant mortality rate (under 1) 1990 (3) (2)	Infant mortality rate (under 1) 2004 (3) (2)
Argentina	-2.7	26	16
Belize	-1.3	39	32
Bolivia	-2.8	89	54
Brazil	-2.6	50	32
Chile	-3.8	17	8
Colombia	-2.9	30	18
Costa Rica	-2.2	16	11
Cuba	-3.2	11	6
Dominican Republic	-3.3	50	27
Ecuador	-3.3	43	23
El Salvador	-3.5	47	24
Guatemala	-3.2	60	33
Haiti	-2.0	102	74
Honduras	-2.1	44	31
Mexico	-2.7	37	23
Nicaragua	-2.9	52	31
Panama	-2.1	27	19
Paraguay	-2.6	33	21
Peru	-4.3	60	24
Uruguay	-1.8	20	15
Venezuela	-2.4	24	16
Latin America and Caribbean		43	26
Required rate to reach the goal (1)	-2.7		

(1) Formula for calculating the annual rate of progress of Infant mortality rate, UNDP, 2003, Human Development Report, . [(X t1 - X t0) / X t0] / t 1 - t 0
(2) Source: UNICEF, World Health Organization, United Nations Population Division and United Nations Statistics Division.
(3) Probability of dying between birth and exactly one year of age expressed per 1,000 live births.

In the context of the highly unequal societies that exist in Latin America, national trends on infant mortality may, nonetheless, hide different realities within each country. Rapid improvements in the health of children in some areas are not necessarily matched by equal progress in the health of children in rural areas, poor households and traditional communities. However, the evolution of infant mortality at lower levels of disaggregation and for specific groups is subject to greater statistical uncertainty. As a result, policy makers are deprived from key information about the evolution of IMR, precisely at the level at which policy interventions would be most needed. While census and survey data provide useful sources of information to estimate IMRs, they cannot be a substitute for a complete system of vital registration. A complete system of vital statistics is the only data source that can allow for proper disaggregation of infant mortality for specific population groups and geographical areas, and for the design of appropriate policy interventions to improve the health of children. It is also the only source of information that can allow this estimation to be effected on an annual basis, in contrast to the census data (which becomes available every 10 years) or the household data (every 3-5 years).

Table 4 LAC: INFANT MORTALITY, 1950-2020

Countries	Infant mortality rate (per 1000)														Advance*	
	50-55	55-60	60-65	65-70	70-75	75-80	80-85	85-90	90-95	95-00	00-05	05-10	10-15	15-20	50-05	90-15
Latin America	127.7	114.2	102.1	92.3	81.7	69.8	57.5	47.5	39.0	32.4	26.2	22.5	19.3	16.6	5.2	2.41
Argentina	65.9	60.4	59.7	57.4	48.1	39.1	32.2	27.1	24.4	21.8	15.0	13.4	12.0	10.7	4.6	2.27
Bolivia	175.7	169.7	163.6	157.5	151.3	131.2	109.2	90.1	75.1	66.7	55.6	45.6	38.1	32.6	3.5	2.34
Brasil	134.7	121.9	109.4	100.1	90.5	78.8	63.3	52.4	42.5	34.1	27.3	23.6	20.3	17.1	5.3	2.54
Chile	120.3	118.3	109.0	89.2	68.6	45.2	23.7	18.4	14.1	11.5	8.0	7.2	6.5	5.9	15.8	2.62
Colombia	123.2	105.3	92.1	82.2	73.0	56.7	48.4	41.4	35.2	30.0	25.6	22.0	19.1	16.9	5.2	2.13
Costa Rica	93.8	87.7	81.3	67.7	52.5	30.4	19.2	17.4	14.5	11.8	10.5	9.9	9.3	8.8	9.2	1.76
Cuba	80.6	69.9	59.4	49.7	38.5	22.3	17.4	15.9	15.3	9.6	6.1	4.8	4.0	3.4	14.8	4.22
Ecuador	139.5	129.4	119.2	107.1	95.0	82.4	68.5	55.5	44.2	33.3	24.9	21.1	17.6	14.0	6.1	3.16
El Salvador	151.1	137.0	122.7	110.3	105.0	95.0	77.0	54.0	40.2	32.0	26.4	21.5	17.5	14.4	6.3	2.95
Guatemala	140.8	133.8	126.7	115.5	102.5	90.9	79.3	67.1	54.8	45.5	38.6	30.1	22.6	18.1	4.1	3.00
Haiti	219.6	193.5	176.2	165.2	152.2	139.2	122.1	100.1	74.1	66.1	59.1	54.1	49.1	44.1	3.9	1.87
Honduras	169.3	153.9	135.5	119.0	103.7	81.0	65.0	53.0	43.0	35.0	31.2	27.8	24.6	21.5	5.7	2.08
Mexico	121.2	101.5	88.0	79.4	69.0	56.8	47.0	39.5	33.1	27.7	20.5	16.7	13.7	11.5	6.5	2.88
Nicaragua	172.3	150.7	131.3	113.8	97.9	90.1	79.8	65.0	48.0	35.0	30.1	26.1	22.8	19.6	6.1	2.67
Panama	93.0	74.9	62.7	51.6	43.7	36.3	31.6	29.6	27.0	23.7	20.6	18.2	15.7	13.5	4.8	1.94
Paraguay	73.4	69.7	62.3	58.6	53.1	51.0	48.9	46.7	43.3	39.2	37.0	34.0	30.8	26.9	2.1	1.56
Peru	158.6	148.2	136.1	126.3	110.3	99.1	81.6	68.0	55.5	42.1	33.4	28.7	25.4	22.6	5.1	2.57
Dominican Republic	149.4	132.2	117.5	105.0	93.5	84.3	62.5	54.1	46.6	40.0	34.4	29.4	25.3	21.7	4.7	2.14
Uruguay	57.4	53.0	47.9	47.1	46.3	42.4	33.5	22.6	20.1	17.5	13.1	12.0	11.0	9.9	4.6	2.04
Venezuela	106.4	89.0	72.8	59.5	48.7	39.3	33.6	26.9	23.1	20.7	17.5	15.8	14.1	12.8	6.4	1.86
Antillas Neerlandesas	69.0	51.0	42.0	35.0	28.0	22.0	18.0	17.0	16.3	14.2	12.6	11.1	9.8	9.2	5.8	1.76
Bahamas	78.8	56.3	48.3	41.2	38.2	35.4	29.6	23.1	20.4	19.1	17.7	16.6	13.5	12.3	4.6	1.68
Barbados	132.0	87.0	61.0	46.0	33.0	27.0	16.9	15.2	14.0	12.4	10.9	9.7	9.2	8.7	12.9	1.63
Belize	88.0	78.0	69.0	60.0	52.0	45.0	39.3	35.9	34.6	33.3	31.1	28.9	26.8	25.0	2.9	1.36
Guadalupe	79.5	60.0	48.9	44.9	38.5	31.9	24.7	22.0	9.2	8.3	7.4	6.7	6.2	5.8	11.3	2.60
Guyana	119.0	105.0	95.0	82.0	79.0	67.0	69.3	65.6	56.7	55.6	51.2	44.1	38.7	34.1	2.5	1.68
Guyana Francesa	103.4	89.1	73.1	51.4	45.9	42.9	32.0	25.0	19.9	16.4	14.3	12.7	11.1	9.7	7.7	2.16
Jamaica	91.9	78.3	61.4	51.6	45.0	37.0	30.5	27.0	24.3	21.9	19.9	18.1	16.3	14.9	4.8	1.64
Martinica	64.7	55.7	47.7	42.3	34.7	21.9	14.0	10.1	7.6	7.0	6.8	6.7	6.2	6.0	9.6	1.45
Puerto Rico	63.4	51.4	44.8	33.3	25.3	19.7	17.2	13.8	11.6	11.0	10.3	9.7	9.2	8.7	6.3	1.42
Santa Lucia	114.6	105.3	81.1	47.7	39.1	29.3	22.7	20.1	16.9	16.9	14.8	13.1	11.9	10.8	8.2	1.62
Suriname	89.2	76.2	63.5	54.6	48.8	44.0	40.3	36.1	33.4	29.1	25.7	22.3	19.5	17.3	3.7	1.89
Trinidad y Tabago	76.0	63.0	48.0	45.6	41.1	32.0	25.3	19.7	16.3	15.1	14.1	13.1	12.1	10.9	5.6	1.57

* Year 1 / Year 0

SOURCE: CEPAL/CELADE: www.eclac.cl/celade/proyecciones/basedatos_BD.htm

Differential progress in child mortality

Disaggregated information on child mortality for Latin America countries points at differential results depending on the social status and place of residence of children, as well as mother's education. In this section we present some evidence of the important differences that exist across broadly defined groupings in order to highlight the limitations of current data sources to catalog the variations at the level of disaggregation that would be relevant to inform policy decisions.

With some variations depending on the data source, and except for a handful of countries, Latin American estimates of IMR show adequate progress to meet the MDG target of reducing child mortality by two thirds in 2015. As indicated, though, progress has not been uniform for different population groups within the countries. Since 1995, PAHO is working on a Regional Initiative of Core Health Data which includes an analysis of the evolution of health statistics (PAHO, 2000). There are about 20 countries that systematically publish sub-national data for which it is possible to calculate IMRs at sub-national geographical units for the period 1995-98. Average IMR have important differences by country, from a low 6.3 deaths per 1,000 life births in Canada to 87.3 in Bolivia. But differences within countries can also be rather large. In Colombia, for example, the country with the largest inequality in this indicator, infant mortality in the highest incidence region is over 6 times larger than the lowest incidence region. Regional differences unfortunately are fairly large within almost all countries (PAHO, 2000).

The WHO's Health Report of 2005 documents the evolution of mortality rate gaps between the children of rich and poor families in the 21 countries in the world where child mortality decreased. In most cases, an overall declining mortality rate was accompanied by a widening of the gap between the children in poor and rich families. Five countries in Latin America are included in this report. Only Dominican Republic managed to reduce the gap between rich and poor in the period 1986-96. In the other four cases—Bolivia (1994-98), Peru (1986-2000), Colombia (1986-200) and Guatemala (1987-98)—mortality gaps between rich and poor children widened (WHO, 2005).

Differential progress in infant mortality is apparent for countries having DHS surveys for at least two points in time. The percentage reduction of IMR is very different across different groupings. In most countries, children born to mothers with low education and no access to antenatal or delivery care present the lowest rates of progress. Whenever we have geographical disaggregation within a country, similar slow progress is registered in poor areas and isolated regions. In other countries there were reversals on infant mortality among higher risk groups. Mortality rates actually increased among women with no antenatal or delivery care in Brazil, rural areas in Haiti, and poorest regions in Nicaragua[25].

All these estimations, however, are subject to large fluctuations due to the uncertainty surrounding the estimation from sample surveys that contain few observations on the occurrence of infant deaths. Even for large population groups, IMR estimates are only indicative of the true values and make comparisons difficult. Lower levels of disaggregation at the municipal or community level, by ethnic groups and the like, are not possible without a complete system of vital statistics.

Disaggregation of infant mortality for various income groups and other socio-demographic characteristics reveals important differences in the access to health care, sanitation and other resources to prevent disease and early death. Estimation of infant mortality for particular groups and geographical areas is a critical policy instrument. A complete system of vital registration is the only source of information that would provide

[25] Information is available in the website where DHS statistics are published: http://www.measuredhs.com

data to generate direct estimates of child and infant mortality on a yearly basis and at the level of disaggregation required to inform policy.

The large number of children who are "inexistent" in the public records – and probably not fairly represented in the household surveys – restricts proper identification of relevant areas of intervention and design of policies to improve access to basic public services and the health status of children.

Conclusions

Infant mortality is widely used as a proxy indicator to assess the development status of countries because it synthesizes many of the factors that determine the children's well-being and opportunities for survival. As a proxy indicator of development it provides useful information to identify priority areas of intervention, to learn about the status of vulnerable groups as well as possible reversals in the living conditions of particular regions or population groups due to unforeseen natural disasters or economic hardship. The importance of this indicator for development policy makes the lack of accurate and timely estimators particularly troublesome. We have discussed some of the difficulties to generate robust measurements of infant mortality with the periodicity and level of disaggregation that are required to inform policy. Incomplete birth registration of a large number of children in Latin America restricts the estimation of this key indicator of development.

Recent research has shown the problem of under-registration of children in Latin America. Many children who did not survive their first year of life are probably missing from the vital registration systems as well. In the absence of complete registration systems, infant mortality rates are frequently estimated from survey and census data. Rates calculated from these sources are indicative of true population values. The downside is that data collection is performed at fairly large time intervals (10 years in the case of census and 3-5 years in the case of household surveys). Several other restrictions prevent accurate estimation of IMR for particular socio-demographic groups and small regions where policy interventions are usually needed the most.

Universal registration at birth is essential for the development of an accurate civil registration system. This would help resolve problems of under-registration of births and the risk of under-representing particularly vulnerable population groups in the estimation of infant mortality and other development indicators. A complete civil registration system is the only source of information that can provide timely and adequate data for the design of policy interventions that help close the development gaps characteristic of Latin American countries.

In the process of developing complete civil registration systems, better coordination between in-country data producers and international organizations will be essential. International organizations, such as WHO, UNICEF, the UNSD, and multilateral financial institutions, such as the WB and IDB, have traditionally supported the development of statistical institutions in Latin America. They are best positioned to help improve the methodologies required to generate robust estimates of child mortality at a lower level of disaggregation which would directly support adequate monitoring of child mortality and design of specific policy actions based on priority geographical areas and traditionally excluded groups[26]. Systematic collection of survey data, however, should not compromise strengthening of the civil registration systems, as the primary source of information for accurate estimation of population trends, birth and mortality rates.

In addition, as HMN[27] (2006) has suggested, the initiatives to better vital events data system will only yield sustainable results if it is taken in conjunction with existing national and district-level information strategies, governance structures and social-development monitoring agendas. In improving the measurement and monitoring of vital events the health sector cannot act alone. Within each country ministries of health, national statistics offices, and ministries of regional and local government are all likely to be key stakeholders and should be encouraged to coordinate and collaborate in this endeavor.

[26] Many of these problems will be addressed by the Child Mortality Coordination Group (CMCG) recently formed by UNICEF, WHO, the World Bank and the United Nations Population Division (see CMCG, 2006).

[27] HMN is The Health Metrics Network, a global partnership founded to improve the supply and use of information to improve decision making for health in developing countries (Bill and Melinda Gates Foundation, DANIDA, DFID, European Commission, OECD, SIDA, UNICEF, UNFPA, UNSD, USAID, WB, WHO, are some the partners of HMN). See www.who.int/healthmetrics.

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