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Can accurate data on birthweight be obtained from health interview surveys?

Arodys Robles[a,b] and Noreen Goldman[a]

Background Because hospital records rarely exist for a representative sample of the population in developing countries, researchers frequently rely on birthweight data from surveys. Yet, the quality of these data has rarely been evaluated. This study explores the accuracy of birthweight information in six demographic and health surveys in Latin America conducted in the early 1990s: two in Guatemala, and one each in Bolivia, Costa Rica, El Salvador and Peru.

Methods The quality of the birthweight reports is assessed by examining the plausibility of estimates of the proportion of newborns reported to have been weighed and estimates derived from the numerical weights, by characteristics of the delivery and maternal education.

Results The estimates suggest that a substantial proportion of women whose newborns were probably never weighed report a birthweight. For all of the surveys, with the possible exception of Costa Rica, the average birthweights appear to be too high, and the estimates of the prevalence of low birthweight too low. In addition, the data reveal anomalous patterns, such as higher birthweights for home as compared with hospital deliveries.

Conclusions These findings suggest that estimates of low birthweight derived from surveys in developing countries are likely to portray an overly optimistic picture of children's and women's health status. More information about the underlying source of these data are needed not only to provide additional insight into the degree of error characterizing existing estimates, but also to improve data collection strategies in future health interview surveys.

Keywords Birthweight, low birthweight, health interview survey

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Low birthweight continues to be a public health priority in many countries, because of its strong association with a child's subsequent risk of morbidity and mortality as well as the child's mental and physical development.[1,2] This is especially true in developing countries, where the prevalence of low birthweight is typically higher than in industrialized countries and where social and environmental conditions associated with low birthweight could potentially be improved through public health measures. Widespread use of the incidence of low birthweight as a measure of the health of neonates, pregnant women, and women of reproductive age and as an indicator of the level of social and economic development of a population have increased the need for accurate information on birthweight.[1,3]

Unfortunately, however, suitable data on birthweight are lacking in most poor countries. The major obstacle to obtaining birthweight information for a (nationally) representative sample in these populations is that a substantial fraction of newborns are not delivered in a hospital or clinic and would not be included in whatever record systems exist. Restriction of analyses to those infants born within the formal health care system is likely to result in bias since, on average, women who deliver in hospitals and clinics are of higher socioeconomic status[4–6] and are thus less likely to have low birthweight infants.

A partial solution to this problem has been the use of retrospective questions in health interview surveys of a population-based sample of mothers. For example, in surveys carried out in Asia, Latin America and Africa since 1990, the Demographic and Health Survey project has regularly included questions on birthweight for children born in the 5-year period prior to interview.[3] Although this approach potentially includes children born outside the formal health care system, a serious drawback is that most of these children are probably not weighed at the time of birth. Moreover, even those mothers who were told their infant's weight at the time of birth may no longer recall the correct figure.

[a] Office of Population Research, Princeton University, 21 Prospect Avenue, Princeton, NJ 08540, USA.

[b] PCP-INISA, University of Costa Rica, San José, Costa Rica.

Reprint requests to: Dr N Goldman, Office of Population Research, Princeton University, 21 Prospect Avenue, Princeton, NJ 08540, USA. E-mail: ngoldman@opr.princeton.edu

Several researchers have attempted to assess the quality of birthweight information collected in health interview surveys. In countries with complete vital registration systems, these assessments have involved a validation of the survey information. For example, studies in the US have compared mothers' reports of birthweight with vital statistics and concluded that the former provide accurate measures of birthweight.[7,8] By contrast, studies based on birthweight data collected from surveys in developing countries have not assessed the validity of maternal recall of birthweight information, presumably because of the lack of an accurate standard of comparison. Instead, these investigations have focused on the problem of missing information and have demonstrated that (a) biases are likely to result from restricting estimates of the frequency of low birthweight or its determinants to the select sub-sample of women who report birthweight information; and (b) use of subjective assessments of birthweight (i.e. relative size of the infant at birth) from the full sample of respondents, along with numerical birthweights where available, can reduce these biases.[3,9,10] The underlying assumption of these studies has been that although the numerical birthweights come from a non-random sub-sample and may be clustered around preferred values, they are generally accurate.

The objective of the present analysis is to test this assumption by using data on numerical birthweights reported by mothers in six demographic and health surveys in Latin America. Although the focus of this analysis is on the consequences of reporting errors on estimates of low birthweight, we also examine estimates of mean birthweight since the latter are frequently reported instead of, or as a proxy for, the former. We evaluate the data by examining the plausibility of the resulting estimates rather than by validation with external sources of information, which are generally not available. This undertaking was motivated by an evaluation of data quality from a recent survey in Guatemala (EGSF) which indicated that many more women were reporting birthweights than were delivering children in health facilities, and that the reported birthweights were much higher than expected.[11] In the next section of the paper, we describe the data used in the analysis. Subsequently, we describe the logic underlying our assessments of data quality. In the following section, we present several tabulations related to the proportion of births that were reported to have been weighed and to the reported weights. Finally, we present some hypotheses about what factors may account for the observed anomalies and discuss the implications of our findings for the use of birthweight data from health interview surveys in developing countries.

Data

The analysis presented below is based on data from six demographic and health surveys in Latin America, conducted between 1991 and 1995: two in Guatemala (referred to by their Spanish acronyms, ENSMI[12] and EGSF,[11] and one each in Bolivia,[13] Costa Rica,[14] El Salvador,[15] and Peru.[16] Each of the surveys is based on a national sample of women of reproductive age, with the exception of the EGSF which is restricted to women living in rural areas of four departments of Guatemala.

Table 1 presents basic characteristics of these six surveys and summary information related to the collection of birthweight data and the sample of births. Weights were reported in kilograms in Bolivia and Peru, in pounds and ounces in El Salvador and Guatemala and in both units in Costa Rica. In most cases, birthweight information was obtained for births in the 5-year period prior to survey (3-year period in Bolivia and all last births in Costa Rica). Costa Rica is the only one of the countries in which the vital registration system is virtually complete and almost all births have a hospital record containing birthweight information.

The data in Table 1 reveal large variations across countries in the proportion of births for which mothers report that the newborn was weighed, ranging from virtually all births in Costa Rica to less than one-half in El Salvador. The discrepancies between the estimates for the two Guatemala surveys are primarily due to the different nature of the samples. For example, if the ENSMI sample of births is restricted to the rural areas of the four departments covered by the EGSF, the estimate of the per cent reporting that the newborn was weighed increases from 74.5 to 83.7, only slightly exceeding the estimate from the EGSF (81.2). Surprisingly, in the surveys that coded *don't know* responses to the question about birthweight, very few births appear in this category (the highest proportion occurs in Peru where 3.8% of births reported as having been weighed had a response indicating that the mothers did not know the actual weight). In addition, relatively few women report implausibly high birthweights or have missing information so that the overall percentages of births with an 'acceptable' weight are very similar to the corresponding percentages reported as having been weighed.

The percentages of births delivered in a health facility also vary considerably across surveys. However, with the exception of Costa Rica, these values show little relation to the percentages reporting that the child was weighed. In particular, in Guatemala, and to a lesser extent in Peru and Bolivia, the proportion of children with acceptable weights exceeds the proportion reported as having been born in a health facility. The wide range in infant mortality shown in the final row of Table 1 suggests substantial variation in average birthweight and the prevalence of low birthweight across the countries.

Methods

We assess the plausibility of the birthweight information by examining four types of patterns in the data: (a) percentages of births reported to have been weighed by place of delivery and type of assistance at delivery; (b) percentages of births reported to have been weighed by whether or not the infant received a post-partum check-up and type of assistance at delivery (for births delivered at home); (c) digit preference (i.e. heaping) in reported birthweights, by place of delivery and education of the mother; and (d) average birthweight and percentage low birthweight by place of delivery and education of the mother.

In each case, we compare the resulting tabulations from the six surveys with expected patterns, under specific assumptions. Under the supposition that mothers report birthweights only for children that were actually weighed, mothers should be much more likely to report weights for births which took place in a health facility as compared with those occurring at home, since the latter seem unlikely to have scales unless they are brought to the home by a provider. Moreover, among home deliveries,

Table 1 Characteristics of the surveys and the sample of births[a]

	Bolivia	Costa Rica	El Salvador	Guatemala ENSMI	Guatemala EGSF	Peru
Year of survey	1994	1992–1993	1993	1995	1995	1991–1992
No. of women	8603	3618	6207	12 403	2875	15 882
Age of women	15–49	15–49	15–49	15–49	18–35	15–49
% of women in rural areas	37.5	43.1	39.9	56.6	100.0	22.5
Wording of birthweight question(s)[b]	Type II	Type I	Type I	Type II	Type II	Type II
Units for birthweight[c]	kgs (3)	kgs (3) & lbs	lbs	lbs	lbs	kgs (1)
No. of births in the analysis[d]	3654	1184	4574	9952	3344	9362
% of births reported as weighed[e]	52.1	98.7	45.3	74.5	81.2	64.2
% of births with an acceptable weight[f]	51.8	98.6	42.7	71.5	79.6	61.7
% of births delivered in health facility[g]	42.3	98.0	51.0	34.3	13.0	45.5
Infant mortality rate (per 1000 births)[h]	75	14	41	51	50	55

[a] The following estimates come from the published reports for the respective surveys:[11–16] the number of women, the per cent of women in rural areas, the per cent of births delivered in a health facility and the infant mortality rate. All estimates in this analysis (except numbers of women and births) for Bolivia, El Salvador, Guatemala ENSMI and Peru are weighted.

[b] The English translations of the questions used are approximately as follows:

Type I: How much did (NAME) weigh at birth?

Type II: Was (NAME) weighed at birth? [IF YES] How much did (NAME) weigh?

[c] The values in parentheses indicate the number of decimal places with which the weights were reported. All surveys with birthweights in pounds collected the information in pounds and ounces.

[d] These numbers are based on the following samples: Bolivia: the number of births within the 3 years before the survey; Costa Rica: the number of last live births within the 5 years before the survey; El Salvador: births that occurred between January 1988 and the 1993 interview; Guatemala ENSMI and Peru: births that occurred within the 5 years before the survey; Guatemala EGSF: births that occurred between January 1990 and the 1995 interview.

[e] In Costa Rica and El Salvador, mothers were not explicitly asked if the children were weighed so the estimates above refer to the percentages reporting a birthweight. In Guatemala ENSMI, Guatemala EGSF and Peru, these estimates included the following percentages reporting 'don't know' to the birthweight question: 1.0%, 1.9%, and 3.8%, respectively. In Bolivia, no 'don't know' responses were recorded.

[f] Acceptable birthweights exclude births with 'don't know' responses, missing information or weights of 6 kg (or its equivalent 13 lbs 3 oz) and above.

[g] The definition of medical facility varies across the surveys, but it typically includes hospitals, private clinics and government-sponsored health facilities.

[h] Except for Costa Rica, estimates of the infant mortality rate refer to the 5-year period prior to the survey. The estimate for Costa Rica is the official estimate for 1993.[20]

births delivered by a medical provider should be more likely to have a reported weight than those delivered by a midwife, and virtually no births delivered by a friend or relative should have reported weights.

Under the same assumption that mothers report weights only for children actually weighed, the proportion of births with reported weights should be independent of whether the children received a post-partum check-up, in the presence of controls for assistance at delivery. To the extent that births with post-partum check-ups are more likely to have reported weights, the data suggest that some women may have their child weighed *after* birth and incorrectly report the result as a birthweight.

The extent of heaping or clustering of responses—on multiples of 500 grams or a half-pound—provides an indication of the overall quality of the data, with high levels of heaping suggesting poor maternal recall. If we assume that women are reporting weights only for children actually weighed, we should see little difference in the extent of heaping by place of delivery. If heaping is greater among births delivered at home, however, this suggests that some of these newborns may never have been weighed (or that mothers may have been given a rounded estimate rather than a precise weight). The extent of heaping is examined in the presence of controls for education, because we expect that more educated mothers will have better recall of birthweight information and because maternal education is associated with place of delivery.

If the only type of error in reports of birthweight is heaping of responses without systematic bias (e.g. mothers round the true birthweights to the nearest half-pound), then tabulations of average birthweight or the percentage low birthweight should still reveal the expected patterns by place of delivery and level of mother's education. Specifically, since previous studies show a strong and consistent association between birthweight and socioeconomic status (typically defined in terms of income, social class and/or education) in both developing and industrialized countries,[9,17] we expect that average birthweights will increase (and proportions of low birthweight will decrease) with increasing levels of maternal education. In addition, we expect that, even in the presence of controls for women's education, average birthweights will be higher (and the prevalence of low birthweight lower) for births delivered in health facilities than for those delivered at home, for two reasons. First, on average, families with greater resources are more likely to deliver in health facilities than are poorer families.[6,18] Second, women using health facilities at the time of delivery are more likely to have had modern prenatal care,[5,19] and presumably fewer pregnancy-related risk factors, as compared with women delivering at home. Deviations from these expected patterns provide

Table 2 Percentage of births reported to have been weighed, by place of delivery and type of assistance at delivery

	Bolivia		Costa Rica		El Salvador		Guatemala ENSMI		Guatemala EGSF		Peru	
	%	N	%	N	%	N	%	N	%	N	%	N
Hospital/clinic delivery	92.8	1507	99.2	1165	71.6	2335	99.2	2405	97.7	478	98.1	4226
Home delivery[a]	22.1	2121	*	*	16.6	2176	61.6	7477	78.4	2851	31.9	4997
Medical assistance at delivery[b]	50.0	180	*	*	†	†	91.2	69	44.9	136	65.2	353
Midwife assisting at delivery	35.4	393	*	*	19.2	1647	69.2	6219	80.2	2707	28.4	2800
Relative assisting at delivery[c]	15.6	1548	*	*	8.1	529	15.6	1189	*	*	29.7	1844
Total	52.1	3628	98.7	1184	45.1	4511	74.6	9882	81.2	3329	64.4	9223

* Fewer than 30 cases.

† No specific question on type of assistance was included in the survey. Among those delivering at home, the question distinguished between those assisted by a midwife, a relative or nobody.

[a] Primarily the respondent's home but also includes the midwife's home.

[b] Medical assistance at delivery includes primarily doctors, nurses and obstetric nurses; in the Guatemala EGSF it also includes hospital midwives and the staff of health centres.

[c] The category of relatives includes no assistance; in the Guatemala EGSF it also includes friends and curers.

additional evidence of errors in estimates of low and average birthweight.

Results

Percentages of births reported to have been weighed

Table 2 presents the percentages of births that mothers reported as having been weighed, by place of delivery and type of assistance at delivery. As expected, in each survey a higher proportion of births occurring in hospitals or clinics were reported as having been weighed as compared with births delivered at home. However, the percentages are surprisingly high among home-delivered births, particularly in the two Guatemala surveys. The estimates indicate that a non-negligible per cent of births delivered at home by midwives and even by relatives are reported as having been weighed. An analysis of focus groups of midwives in Guatemala (Hurtado, personal communication) indicated that few midwives carry scales to respondent's home. Thus, the estimates suggest that, at least in Guatemala, many mothers who report birthweights are either estimating the weights on their own or are obtaining this information from others. One possible source is midwives: the focus groups in Guatemala also revealed that midwives sometimes present mothers with a 'healthy' birthweight (based on their own guesses or assessments about normative values rather than from scales) as a way of assuring the mothers that their newborns are healthy (Hurtado, personal communication).

Table 3 explores the possibility that some birthweights may result from visits to health facilities or providers during the post-partum period, rather than at the time of delivery. The estimates, which are restricted to home deliveries, refer to the percentage of births for which mothers reported that the child was weighed, by whether or not the child received a post-partum check-up and by the type of assistance at delivery. Only the surveys in El Salvador and Guatemala (EGSF) collected information about post-partum visits. In the former survey, the question referred to well baby care at a health facility after birth; among those who brought the baby to a facility, the average timing was 48 days after birth. In the latter survey, the question referred to whether someone checked the baby within 40 days after birth; only biomedical providers or facilities are included in the category of post-partum check-up.

Table 3 Percentage of births reported to have been weighed among those delivered at home, by type of assistance at delivery and whether child received post-partum check-up[a]

	El Salvador		Guatemala EGSF	
	%	N	%	N
All deliveries				
No post-partum check-up	12.4	636	77.3	2587
Post-partum check-up	18.3	1540	89.4	264
Medical assistance at delivery[b]				
No post-partum check-up	†	†	34.3	105
Post-partum check-up	†	†	80.6	31
Midwife assisting at delivery				
No post-partum check-up	15.0	451	79.2	2475
Post-partum check-up	20.8	1196	90.5	232
Relative assisting at delivery[c]				
No post-partum check-up	5.5	185	*	*
Post-partum check-up	9.4	344	*	*
Total	16.6	2176	78.4	2851

* Fewer than 30 cases.

† No specific question on type of assistance was included in the survey. Among those delivering at home, the question distinguished between those assisted by a midwife, a relative or nobody.

[a] In Guatemala, this category refers to infants seen by a doctor, nurse, or personnel at a health centre or post. In El Salvador, this category refers to births taken to a hospital or clinic.

[b] Medical assistance at delivery includes primarily doctors, nurses and obstetric nurses; in the Guatemala EGSF it also includes hospital midwives and the staff of health centres.

[c] The category of relatives includes no assistance; in the Guatemala EGSF it also includes friends and curers.

The estimates demonstrate that for each type of assistance at delivery, the proportion reported as having been weighed is higher for children with post-partum check-ups than for children not receiving check-ups. Thus, the results suggest that some of the reported weights are likely to have been obtained

Table 4 Heaping of reported birthweights by place of delivery and maternal education, according to whether weights were reported in kilograms or pounds

	Weight reported in kilograms[a]								Weight reported in pounds[b]					
	Bolivia		Costa Rica[c]		Peru		Costa Rica[c]		El Salvador		Guatemala ENSMI		Guatemala EGSF	
	%	N	%	N	%	N	%	N	%	N	%	N	%	N
Hospital/clinic delivery	29.3	1331	13.6	590	25.5	4019	85.8	564	79.7	1564	51.1	2276	72.0	461
No education	45.0	45	*	*	30.6	189	*	*	84.1	196	63.1	509	80.5	82
1–6 years	37.2	444	14.7	334	28.0	990	83.8	272	81.8	615	52.0	1142	71.7	286
>6 years	24.3	842	12.4	249	24.4	2840	87.4	285	76.9	753	42.6	625	65.6	93
Home delivery	56.7	551	*	*	54.4	1562	*	*	92.0	329	89.7	4406	96.3	2194
No education	69.7	60	*	*	67.9	213	*	*	92.9	92	92.6	2152	97.5	910
1–6 years	56.8	339	*	*	56.8	829	*	*	94.4	165	87.3	2126	95.3	1208
>6 years	52.1	152	*	*	45.2	520	*	*	84.5	72	81.1	128	97.4	76
Total	36.2	1882	13.5	594	32.6	5581	85.7	573	81.8	1893	71.9	6682	92.1	2655

* Fewer than 30 cases.

[a] Heaping for weights reported in kilograms is measured as the proportion of births with weights in multiples of 500 grams.

[b] Heaping for weights reported in pounds is measured as the proportion of births with weights in multiples of half-pounds (8 ounces).

[c] In Costa Rica weights were reported in pounds (49.1%) or in kilograms (50.9%). Kilograms are used in official birth certificates and hospital records.

subsequent to the time of birth. On the other hand, this explanation fails to account for the non-trivial fraction reported as having been weighed among children that were delivered at home and did not subsequently receive post-partum care.

Heaping of reported birthweights

The estimates in Table 4 indicate that a substantial fraction of birthweights are reported in rounded numbers, namely multiples of 500 grams or 8 ounces. The estimates exceed 70% in four of the surveys: Costa Rica (for responses in pounds), El Salvador, Guatemala ENSMI and Guatemala EGSF.

As expected, the degree of heaping typically varies by mother's education, with more educated women revealing less clustering at rounded numbers. For a given level of maternal education, the degree of heaping for home deliveries consistently exceeds that for hospital deliveries. The differential degree of heaping by place of delivery suggests that the heaping is not due solely to poor recall of exact weights, but also to the nature of the birthweight data given to mothers at the time of birth. That is, mothers delivering at home may have been given rounded estimates of birthweight in the first place or the mothers may have estimated the weights themselves.

A surprising finding is the high degree of heaping for reported birthweights in Costa Rica, a country in which virtually all births occur in medical facilities and are weighed at the time of birth. As noted earlier, weights were recorded either in kilograms or in pounds in the Costa Rica survey—about half of births fall into each category—although all weights are recorded in kilograms on hospital records. The estimates indicate that heaping is minimal for the responses in kilograms, but substantial for weights reported in pounds. Although Costa Rica adopted the metric system about two decades ago, it is possible that some mothers who were uncomfortable with the metric system were given approximate weights in pounds at the time of birth (perhaps by nurses) or converted the weights themselves. In these cases, mothers would be likely to recall weights to the nearest whole or half-pound. More generally, the greater degree of heaping for pounds as compared with kilograms across surveys in Table 4 probably reflects a greater tendency for mothers to use other preferred values (such as 0.2 and 0.8) for kilograms.

Average birthweight and frequency of low birthweight

Tables 5 and 6 present mean birthweights and the prevalence of low birthweight, respectively, by place of delivery and maternal education. In general, the results are not consistent with our expectation. In particular, except in Costa Rica and Peru, the mean birthweights either decrease with increasing maternal education or show virtually no variation by education; similar patterns occur with regard to the prevalence of low birthweight (weights below 2500 grams or 5 pounds, 8 ounces). In addition, in half of the surveys, average birthweights for home deliveries are higher (and the prevalence of low birthweight is lower) than the corresponding values for hospital deliveries; these differences persist within categories of maternal education and are especially pronounced in Guatemala and among more educated mothers in El Salvador. While these differentials would be expected if health facilities were used primarily for problem pregnancies, they are inconsistent with the selective use of biomedical services in these countries by women of higher socioeconomic status.

Overall, the estimates in Tables 5 and 6 suggest higher than expected values of average birthweight and lower than expected frequencies of low birthweight, for all countries. In Costa Rica, the estimated prevalence of low birthweight can be validated on an aggregate level with birthweight data from hospital records: the estimate based on 76 115 births with hospital records (95% of all births) in 1993 is 6.7%[20]—a value which slightly exceeds the survey estimate of 5.9%. More importantly, the mean birthweights derived from each of the other surveys are at least as large as that for Costa Rica, although the

Table 5 Mean birthweight (g)[a] by place of delivery and maternal education

	Bolivia		Costa Rica		El Salvador		Guatemala ENSMI		Guatemala EGSF		Peru	
	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N	Mean	N
No education	3551	106	*	*	3457	291	3249	2680	3444	993	3148	404
1–6 years	3472	785	3224	616	3401	792	3289	3282	3476	1497	3251	1843
>6 years	3409	996	3308	536	3289	848	3147	759	3415	170	3325	3394
Hospital/clinic delivery	3444	1331	3266	1154	3319	1564	3153	2276	3219	461	3310	4019
No education	3655	45	*	*	3459	196	3133	509	3184	82	3233	189
1–6 years	3511	444	3230	606	3352	615	3181	1142	3227	286	3288	990
>6 years	3397	842	3310	534	3259	753	3124	625	3225	93	3321	2840
Home delivery	3432	551	*	*	3530	329	3336	4406	3512	2195	3235	1562
No education	3446	60	*	*	3451	92	3288	2152	3469	910	3068	213
1–6 years	3408	339	*	*	3569	165	3385	2126	3536	1208	3200	829
>6 years	3485	152	*	*	3539	72	3339	128	3646	77	3356	520
Total	3441	1882	3263	1167	3356	1893	3252	6682	3461	2656	3291	5581

* Fewer than 30 cases.

[a] Birthweights reported in pounds were converted to grams in El Salvador, Guatemala and Costa Rica.

Table 6 Percentage of births that are low birthweight[1] by place of delivery and maternal education

	Bolivia		Costa Rica		El Salvador		Guatemala ENSMI		Guatemala EGSF		Peru	
	%	N	%	N	%	N	%	N	%	N	%	N
No education	3.3	106	*	*	10.8	291	13.6	2680	9.0	993	13.5	404
1–6 years	5.5	785	7.1	616	9.7	792	9.1	3282	7.1	1497	10.8	1843
>6 years	6.1	996	4.3	536	11.1	848	10.4	759	8.2	170	6.8	3394
Hospital/clinic delivery	5.4	1331	5.9	1154	11.4	1564	12.6	2276	14.3	461	7.5	4019
No education	3.8	45	*	*	9.7	196	15.4	509	19.5	82	9.4	189
1–6 years	4.7	444	7.1	606	11.0	615	12.4	1142	13.3	286	10.2	990
>6 years	5.8	842	4.3	534	12.1	753	11.2	625	12.9	93	6.6	2840
Home delivery	6.7	551	*	*	7.0	329	9.5	4406	6.5	2195	11.0	1562
No education	2.9	60	*	*	13.3	92	13.0	2152	7.9	910	17.4	213
1–6 years	6.7	339	*	*	5.6	165	6.3	2126	5.6	1208	11.8	829
>6 years	7.9	152	*	*	2.4	72	4.3	128	2.6	77	7.1	520
Total	5.7	1882	5.9	1167	10.6	1893	10.9	6682	7.8	2656	8.4	5581
Including half of weights reported at 2500 g	7.7	1882	6.3	1167							10.2	5581

* Fewer than 30 cases.

[a] Low birthweight is defined as weights below 2500 grams for weights reported in grams and below 5 pounds 8 ounces for weights reported in pounds and ounces.

level of infant mortality in Costa Rica is between one-third and one-fifth the level elsewhere (Table 1). According to Table 6, low birthweight has the lowest prevalence in Bolivia (5.7%), the country with the highest infant mortality rate. Even smaller frequencies of low birthweight are reported by the most educated women delivering at home in Guatemala and El Salvador —values which are considerably below those found in Western industrialized countries. Some of the estimates in Tables 5 suggest that these biases are not restricted to home deliveries: for example, the mean birthweight among hospital deliveries in three of the five surveys (most notably Bolivia) exceeds the corresponding value for Costa Rica.

The final row of Table 6 indicates that one source of the underestimates of low birthweight is a heaping of reported birthweights on 2500 grams (for those surveys reporting in grams). For example, if the estimates of low birthweight were to include one-half of these responses (on the assumption that these reports are equally likely to come from children weighing more and less than 2500 grams), the estimated prevalence of low birthweight would increase by a modest amount in Bolivia and in Peru.

Discussion

The results presented above suggest a substantial degree of error in the reports of birthweight obtained from health interview surveys in Latin America. These errors take several different forms. One type of error appears to result from women reporting

birthweights for children that were probably never weighed, primarily those delivered at home without modern medical assistance. A second type of error seems to be the consequence of some mothers using a weight obtained from a post-partum check-up in lieu of a birthweight. It is likely that in both cases the reported weights are too high. A third type of error, which coincides with the preceding ones, is the clustering of reported weights, most frequently at integral numbers of pounds or kilograms. Heaped responses are prevalent not only for births that were unlikely to have been weighed (i.e. home deliveries), but also for hospital deliveries. Although heaped responses could produce unbiased estimates of birthweight, the results presented here suggest that this is not the case. The estimated weights appear too high on average, particularly for births delivered at home but also for births delivered at health facilities. The degree of error varies across surveys, with highly anomalous patterns in the Guatemala surveys and somewhat less aberrant ones in Bolivia and El Salvador, generally plausible estimates in Peru (although a substantial fraction of home deliveries have reported birthweights), and probably fairly accurate data in Costa Rica (except for a high degree of heaping for estimates given in pounds).

This analysis demonstrates some of the dangers associated with relying on survey data for birthweight information. One obvious problem is a resulting underestimate of low birthweight, one that would portray an overly optimistic picture of children's and women's health status. A second problem is misleading differentials. For example, the estimates presented here could lead to inferences that home deliveries produce healthier infants than hospital deliveries and that increases in maternal education have little or even detrimental effects on the prevalence of low birthweight. While such patterns may occur in select areas, it is implausible that they pertain to major sections of Latin America.

The analysis has also revealed a quandary, namely how or why so many women delivering at home report a birthweight for their child. It is quite likely that many of these weights were estimated either by the person assisting at delivery or by the mother herself. These values are especially likely to be heaped and to exceed the true weight. While there is some evidence indicating that Guatemalan midwives estimate weights as a way of assuring their patients that the newborn is healthy, the explanations are likely to differ across countries. Obtaining more information about the source of the birthweight information, by means of individual interviews or focus groups, would not only provide additional insights into the results presented here but would offer some guidance as to how future health interview surveys might increase the accuracy of birthweight information.

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