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Agreement between current status and retrospective data for prevalence and duration of exclusive breast feeding from low- and middle-income countries surveys

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Abstract

Background: Indicators to assess exclusive breast feeding (EBF) status are based on current status data according to World Health Organization (WHO), specially to avoid recall bias or imprecise reporting.

Objective: To analyse the agreement between current status and retrospective data for prevalence and duration of EBF in low- and middle-income countries.

Methods: Cross-sectional study using Demographic and Health Surveys (DHS) datasets of infants under six months from 10 low- and middle-income countries. It was applied two kinds of data about EBF: (1) current status data: variables about breast milk and foods offered in the previous day (yes or no) and (2) retrospective data: variables about age at which foods were offered the first time. The prevalence of EBF was estimated the same way for current status and for retrospective data. The median duration for current status data was calculated according to WHO recommendation, and retrospective data were calculated using survival analysis. The Kappa coefficient was applied to assess the agreement of prevalence using both kinds of data.

Results: Prevalence of EBF was higher using current status data and differences between both data ranged from 0.5 to 6.4 percentage points. Kappa coefficient ranged from 0.74 (substantial) to 0.94 (almost perfect) in nine countries. Medians were higher using retrospective than current status data for two countries and lower for another two; however, differences were small (from 0.08 to 0.44 month). For six countries, breast-feeding practice was so low that it was not possible to calculate the median using either data.

Conclusions: The difference between prevalence and median estimated using current status and retrospective data is little and the agreement ranged to substantial and almost perfect. We suggest the use of retrospective data to estimate duration of EBF in cross-sectional surveys.

KEYWORDS

breast-feeding duration, breast-feeding prevalence, cross-sectional studies, exclusive breast feeding, survival analysis

1 | BACKGROUND

The concern with assessment, monitoring, and evaluation of breast feeding has led to the development (1991)[1] and revision (2008)[2] of infant feeding indicators. The indicators that are estimated using current status data are expressed as prevalence, suitable for large samples of infants, and applied to assess infant feeding at population level.[1] The questionnaire evaluating infant and young feeding practices includes a list of food, breast milk also, consumed in previous day. If all answers are 'no' for all foods and 'yes' for breast milk, the infant is classified as exclusively breast fed. These data are called current, because it refers to the previous day. The main reason for using current status data is to avoid recall bias or imprecise reporting, assuming that the previous day represents usual feeding of infants and young children.[2] A limitation of this data is the impossibility to estimate breast-feeding duration at individual level, because current status data are a binary variable calculated in aggregate way and does not express length. However, it is possible to estimate a population parameter—the median duration—from the individual current status data using the distribution of proportions of infants by age range (Figure S1).[2]

The assessment of duration of breast feeding or age at which foods were offered the first time is another way to assess feeding practices,[3] named retrospective data, which is relevant for evaluation of effectiveness of policies on breast-feeding duration and enables assess duration of breast feeding in individual and population levels. The retrospective data rely on the assumptions that the mother is a good informant and changes in infant feeding pattern are remarkable events to mothers. Arguments against using retrospective data rely on recall bias and heaping of data at certain age values because they are recalled as integer numbers.[2] Evidence gathered in studies have found a good accuracy in maternal retrospective for a period lower than three[4] and two[5,6] years and inaccuracy increases as the interval time of recall gets longer.[4]

In our revision, duration of breast feeding has been estimated either using current status or retrospective data.[7-12] The use of current status data has been recommended by WHO since 1990 to define indicators that represent the present situation (current status) of feeding practices without recall bias.

The DHS and Multiple Cluster Indicator Survey have used current status data aiming to describe the prevalence of breast feeding, to assess secular trend in a country and to compare prevalence among countries. Retrospective data are used mainly in cohort and longitudinal studies when the objective is assessing duration, surveillance, monitoring[7] data and relationship between breast feeding and health outcomes.[13]

Few studies have compared the prevalence of breast feeding using current status and retrospective data, and they suggested that the prevalence is higher when using current status.[11,14] These studies are mainly based in local or regional samples and carried out in high-income countries. However, low- and middle-income countries could benefit from the comparisons using cross-sectional datasets, which are available in these settings.

The possibility to estimate breast-feeding duration using retrospective data is mainly relevant in low- and middle-income countries because there is a large number of available datasets from DHS Program that can be used to analyse trend of breast feeding. The suboptimal breast-feeding duration reaches the 14th position in the overall ranking of the 43 risk factors to the global burden of disease, and it is classified as the second risk factor to increase the Disability Adjusted Life Years (DALY) among children under five years.[15] One of the six global goals to improve maternal and infant health until 2025 is to increase in at least 50% the prevalence of EBF in the first 6 month of life worldwide.[16]

This study intends to add more information to the literature regarding differences in EBF measurement. It provides information for researchers and policy makers on the implications of using retrospective or current status data when assessing prevalence and duration of EBF. Furthermore, it could open possibilities for both researchers and policy makers to investigate breast feeding-associated factors at individual and population level in the same analysis. Therefore, our objective was to analyse the agreement between current status and retrospective data for prevalence and duration of EBF in low- and middle-income countries.

Synopsis

Study question

To analyse the agreement between current status and retrospective data for prevalence and duration of exclusive breast feeding (EBF) using data from Demographic and Health Surveys.

What's already known

The World Health Organization recommends that current status data be used to assess breast-feeding indicators. One drawback of the current status data from DHS is the difficulty in using it to assess adherence to the WHO recommendation for breast-feeding duration. Retrospective data can be used for this purpose, but recall bias is a problem.

What this study adds

There is a substantial and almost perfect agreement between prevalence from retrospective and current status data (Kappa coefficient ranged from 0.74 to 0.96), and the highest median difference was 0.44 month. Therefore, retrospective data can be used to estimate duration of EBF in cross-sectional surveys.

2 | METHODS

2.1 | Design and settings

This study used cross-sectional data from the second phase of DHS Program (Macro International) (available at: http://www.measu

redhs.com/data/available-datasets.cfm). These surveys were previously approved by Ethics Committee from each country where surveys were carried out. The 25 countries selected represent 96.2% of all countries which have completed phase II, carried out from 1988 to 1993 (Figure 1).

The countries selected for our study were Burkina Faso (n = 661) and Malawi (n = 529) (low-income); Egypt (n = 837), India (n = 6599), Morocco (n = 471), Pakistan (n = 767), Philippines (n = 825) (lower-middle income); Colombia (n = 359), Namibia (n = 458), and Peru (n = 943) (upper-middle income).

2.2 | Sample

The eligible infants were those younger than 6 months, alive on the interview date, and who had lived with the mother/respondent. To be included in the present study, the country survey should have low frequency of inconsistent values (<2%) on age at introduction of foods groups, and of missing values (<2%) on infant feeding status in the last 24 hours (Figure 1). The inconsistent values included cases where the age of food introduction was higher than the current age of infant. We arbitrarily adopted the value under than 2% for missing to avoid bias in prevalence and duration estimative. These criteria kept more than 95% of all infant included in the survey.

The sampling design was similar in all countries, including clustering and stratification and evaluated infants under 6 months from 10 low- and middle-income countries. We used data of Phase II because the age of introduction for four foods groups and infant feeding status in the last 24 hours (previous day) were available.

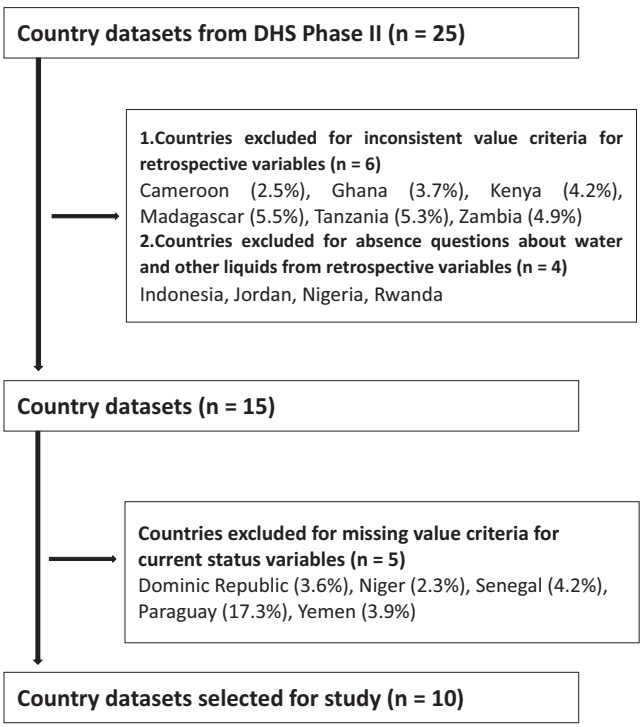

FIGURE 1 Flow chart of surveys selection. Phase II, DHS

2.2.1 | Current status and retrospective data

Exclusive breast feeding was defined as proposed by the WHO,[1] and duration of EBF was estimated based on data on food intake in previous day (current status data) and the age (months) at which four groups of food (formula/other milks, plain water, other liquids, solid, or mushy foods) were offered for the first time (retrospective data).

For current status data, infants who did not receive any food besides breast milk in the previous day were classified as being exclusively breast fed, and for retrospective data, infants who did not receive any foods since birth were classified as exclusively breast fed until the youngest age for a food or other liquid.

For current status data, missing values and *do not know* answers for any variables were replaced by null value—if a yes/no question, these values are replaced by *no* and if a numeric response is required, these values are replaced by *0*.[1] For the retrospective information on the age at introduction of food groups, missing values, *do not know* answers, and duration of exclusive breast feeding recoded only one day was replaced by 0.0164 (0.5 day/30.44). For infants who had never been breast fed the value zero was replaced by 0.001 to avoid zeroes in survival analysis; and the variable duration of EBF was recoded to the age of the infants, for those who were exclusively breast feeding. The percentage of missing data and do not know for all datasets varies from 0.3% to 1.8%. We tested the analysis without these replacements, and the results were the same as including, so we prefer to maintain all infant cases.

2.3 | Data analysis

2.3.1 | Prevalence of exclusive breast feeding

The prevalence of EBF was calculated for current status and retrospective data, and it was described by country and by age range (0-1.9 months, 2-3.9 months, and 4-5.9 months). We used Kappa coefficient to assess agreement between prevalence using retrospective and current status data. The reference values for kappa were as follows: slight (0.0-0.2), fair (0.21-0.4), moderate (0.41-0.60), substantial (0.61-0.80), and almost perfect (0.81-1.00).[17] The prevalence was calculated incorporating complex sample design and sample weight for retrospective and current status data.

2.3.2 | Duration of exclusive breast feeding

The median duration of EBF also was estimated using current status or retrospective data. For current status data, initially, we obtained the number of infants by three age groups (0-1.9 months, 2-3.9 months, and 4-5.9 months). The distribution of infants was smoothed by estimating a moving average of three groups (previous, current, and following value of the distribution). The second step was to calculate the percentages of infants classified as exclusively breast fed in each age range. The third step was to calculate the median of EBF by linear interpolation between the midpoint of the first age range for which the proportion falls below 50% and next youngest midpoint age range. This procedure is recommended by WHO[1]

to calculate median for current status data. The final equation to calculate the median is described in Figure S1.

For retrospective data, we calculated the median duration of EBF using Kaplan-Meier analysis.

We did not use statistical test to compare medians by Kaplan-Meier and method proposed by WHO (2010)[1] because the assumptions for these strategies are different and the process of calculation is incompatible. We estimated how much is the difference of median calculated by WHO (2010)[1] and by Kaplan-Meier using a Z-score estimative. First, we calculated the crude difference between these medians (median calculated by Kaplan-Meier—median calculated by WHO (2010)[1]). After, it was calculated the standard deviation by multiplying the standard error of mean by the number of failures (infants that stopped EBF).

We did not consider sample weights and complex sample design to calculate duration of breast feeding (expressed in median for retrospective and current status data) because it was not possible to use it in the method proposed by WHO (2010). All the statistical analysis were performed in Stata SE 13.1 and R for windows.

3 | RESULTS

In this study, we selected 10 low- and middle-income countries and for all of them, more than 90% of infants were considered eligible (Table S1).

The prevalence of EBF using current status data ranged from 1.7 in Malawi to 49.3% in Pakistan, and the prevalence using retrospective data ranged from 1.2% to 43.3% in these countries. The prevalence of EBF was higher using current status data, except for Burkina Faso. The difference between prevalence using current status and retrospective data ranged from 0.5 to 6.4 percentual points. In general, the coefficients indicated evident agreement between retrospective and current status data, with almost perfect agreement for most countries analysed. Kappa coefficient was classified as fair for Burkina Faso, substantial for Malawi, Pakistan, and Colombia and almost perfect for Egypt, India, Morocco, Philippines, Namibia, and Peru (Table 1). The same comparison of prevalence using retrospective data and current status data was made by age range for each country, and the prevalence was also higher for current status data, except for Burkina Faso (Figure 2).

The median duration of EBF, using current status data, had to be assigned instead of calculated for 6 countries, following WHO formula. For these countries, the proportion of EBF in the first age range (0-1.9 months) was below 50% and therefore their median was expressed as below half month. It was not possible to calculate the exact value for median using current status data; therefore, the size of the difference in median from both kinds of data could not be assessed (Table 2). The difference of median duration calculated using current status and retrospective data ranged from 0.08 to 0.44 month. For Egypt and Peru, the median duration was higher for retrospective data, and the difference were 0.36 and 0.15 month, respectively. For India and Morocco, the median duration was higher using current status data and the difference was 0.08 and 0.44 month, respectively (Table 2).

TABLE 1 Prevalence of exclusive breast feeding (EBF) using current status and retrospective data by country for infants under 6 mo, and the agreement (kappa) between these two estimates. DHS, Phase II

Countries	Retrospective data (%)	Current status data (%)		Kappa
		No	Yes	
Burkina Faso (LIC)	No	92.6	1.9	0.25
	Yes	4.3	1.2	
Malawi (LIC)	No	98.0	0.8	0.64
	Yes	0.3	1.0	
Egypt (LMIC)	No	55.5	6.9	0.85
	Yes	0.4	37.3	
India (LMIC)	No	56.4	3.4	0.90
	Yes	1.4	38.8	
Morocco (LMIC)	No	49.0	7.6	0.81
	Yes	1.7	41.6	
Pakistan (LMIC)	No	72.4	5.2	0.73
	Yes	4.3	18.2	
Philippines (LMIC)	No	72.5	2.3	0.91
	Yes	1.3	23.9	
Colombia (UMIC)	No	88.7	2.2	0.78
	Yes	3.6	7.5	
Namibia (UMIC)	No	86.3	0.2	0.94
	Yes	1.1	12.3	
Peru (UMIC)	No	67.7	0.6	0.91
	Yes	3.1	28.6	

Abbreviations: DHS, Demographic and Health Surveys; LIC, low-income country; LMIC, lower-middle-income country; UMIC, upper-middle-income country.

Table 3 shows that the difference between the medians varied from 2 to 13 days, with a global average of 7.73 days, indicating that the expected error of median estimation is approximately 8 days. All the z-scores are less than 2 indicating that no difference was large enough to be considered non-standard.

The probability of being exclusively breast fed using retrospective data for each country was described in the Figure 3. These survival probability graphics are important to know the velocity of exclusive weaning and also to identify critical age periods for interruption of exclusive breast feeding. Although the median duration for retrospective data for Egypt and Morocco was 2.0 and for India and Peru was 1.0 (Table 2), the velocity of weaning was very different (Figure 3).

4 | COMMENT

4.1 | Principal findings

Our results suggest that the prevalence of EBF is higher using current status data, and the median duration of EBF is higher using retrospective data. However, there is an almost perfect agreement

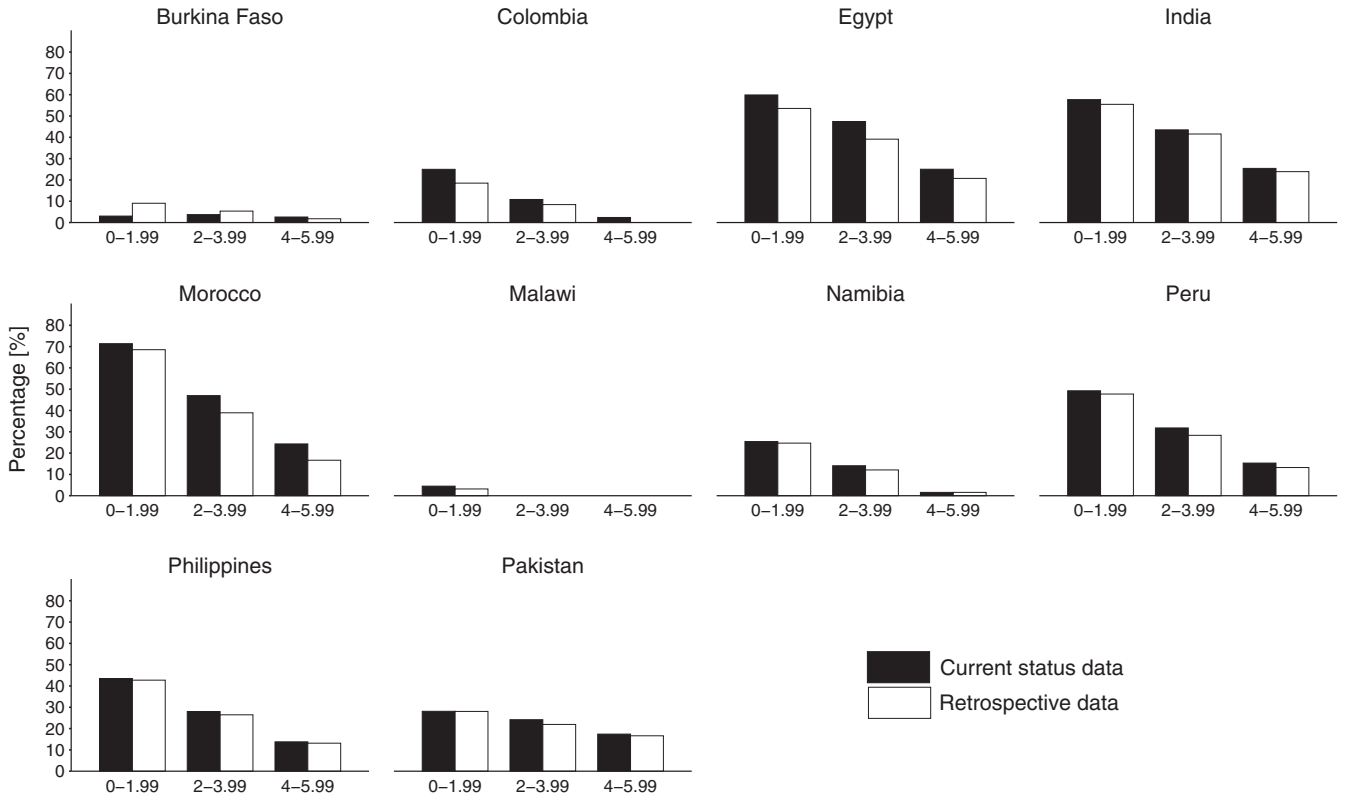

FIGURE 2 Prevalence (%) of exclusive breast feeding by age range and country for infants. DHS, Phase II

between prevalence from retrospective and current status data and the highest median difference was 0.44 month.

4.2 | Strengths of the study

The consistence of results across country; the standardization of current status and retrospective variables in all datasets, which contributed to decrease bias associated with different kinds of data; the selection of the same kind of information for current status and retrospective data—both data asked the mother about the foods offered to her infant; the exclusion of inconsistent data for retrospective, such as the age of infant being lower than the age of food introduction and datasets with high proportion of missing cases. Also, the selection of infants under six months decreased the recall bias because of short recall time. Recall bias must be considered in epidemiological studies, but there are other important factors that may decrease the validity of the retrospective data, such as appropriate questions and ways of asking questions about feeding practices.[9] We decided to use another information on breast feeding that is available in cross-sectional national surveys—retrospective data. In addition, the main source of data for breast feeding and other relevant health outcomes came from cross-sectional surveys in low- and middle-income countries.

We highlight the external validity of this study, because it can be used in large national samples of surveys and may be applied for public policy evaluation. Lastly, we highlight one relevant additional information from retrospectively data: the survival probability of EBF. Using this analysis, it was possible to notice the difference of EBF pattern among countries, to provide a more complete situation from pool of infants under 6 months and to how far the infants are from WHO recommendation.

TABLE 2 Median (months) of exclusive breast feeding using current status and retrospective data by country for infants under 6 mo. DHS, Phase II

	Current status data	Retrospective data
Countries	Median (months)	
Burkina Faso (LIC)	<0.50[a]	0.02
Malawi (LIC)	<0.50[a]	0.02
Egypt (LMIC)	1.64	2.00
India (LMIC)	1.08	1.00
Morocco (LMIC)	2.44	2.00
Pakistan (LMIC)	<0.50[a]	0.02
Philippines (LMIC)	<0.50[a]	0.02
Colombia (UMIC)	<0.50[a]	0.02
Namibia (UMIC)	<0.50[a]	0.02
Peru (UMIC)	0.85	1.00

Abbreviations: DHS, Demographic and Health Surveys; LIC, low-income country; LMIC, lower-middle-income country; UMIC, upper-middle-income country.
[a]For these countries, it was not possible to calculate the median duration using WHO recommendation.

TABLE 3 Breast-feeding median duration using retrospective and current status data, standard deviation, Z-score and difference (days) for infants from four countries. DHS, Phase II

Countries[a]	Median (retrospective data)	Median (current status)	Difference between medians (crude)	Standard deviation	Z-score	Difference (days)
Egypt	2.0	1.64	0.36	1.92	0.19	11
India	1.0	1.08	0.08	2.12	−0.03	2
Morocco	2.0	2.44	−0.44	1.96	−0.22	13
Peru	1.0	0.85	0.15	2.06	0.07	5
All			−0.003			7.73

[a]For Burkina Faso, Malawi, Pakistan, Philippines, Colombia, and Namibia, it was not possible to calculate the median duration using WHO recommendation. Therefore, the Z-score was not calculated for differences od medians between current status and retrospective recall.

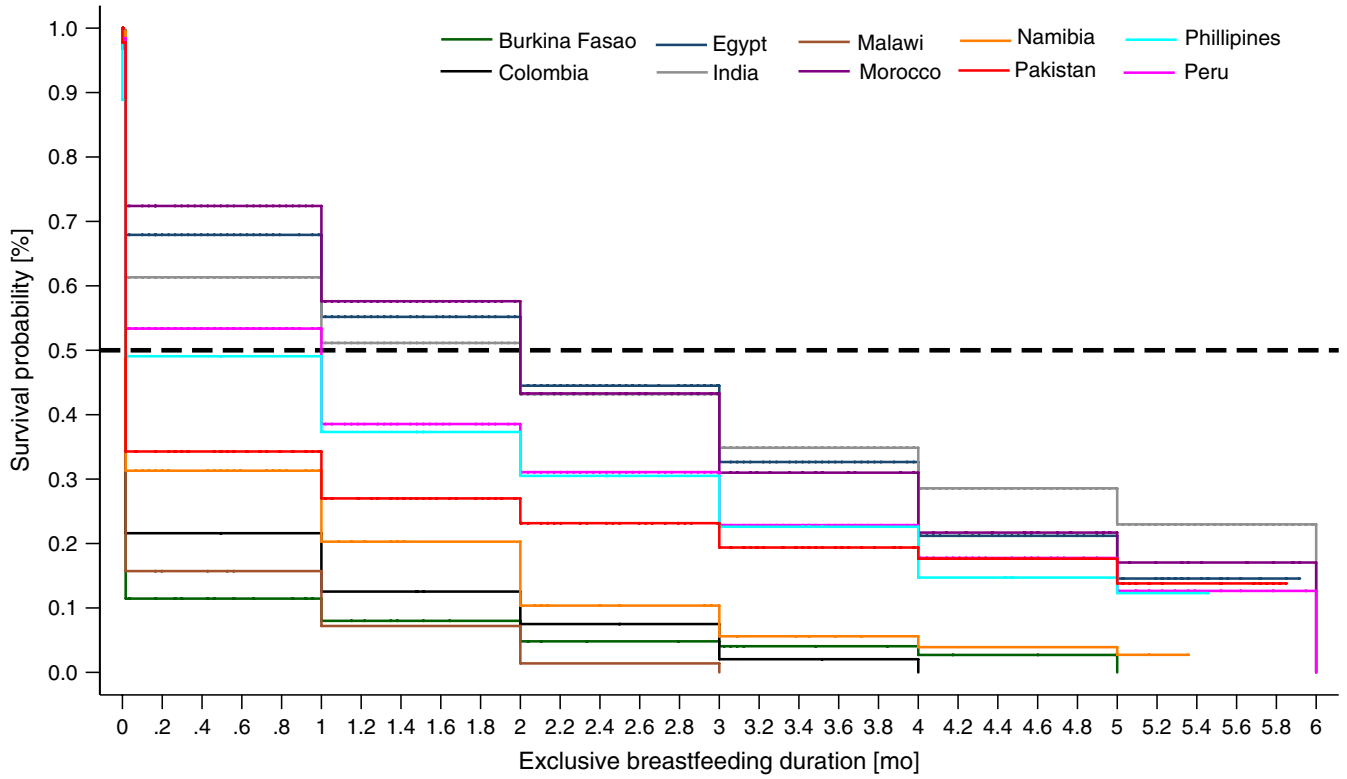

FIGURE 3 Survival probability of exclusive breast feeding for infants by country. DHS, Phase II

We acknowledged that by achieving a good agreement between the two measures we cannot guarantee that both measures are correct. However, it is unlikely that both measures present a bias driving them in the same direction to have a high agreement rate without being valid. In addition, current status data are recommended by WHO and it has been extensively used in both government reports and scientific studies to estimate prevalence of BF. Therefore, by showing the good agreement between these two measures we are adding evidence to support that both measures are similar.

4.3 | Limitations of the data

The cross-sectional design of all datasets does not allow us to compare the age of introduction of foods longitudinally (gold standard data). Therefore, it was not possible to conclude whether current status data under- or overestimate the prevalence and medians. We could, however, assess if these estimates are similar or different. Another possible limitation is that some studies observed a less accurate data on the age of introduction of food comparing with the one on the age when breast feeding was interrupted.[4,5,18,19] One possible explanation is that breast feeding is an important and single event when compared to the age of food introduction. Regardless, in our study, the time of retrospective was short (6 months), which contributes to decrease recall bias, and the number of foods is reduced—only four variables which contributed to increase the quality of information. Finally, we identified two aspects that retrospective and current status data do not allow to conclude: (a) the performance of current status data to assess breast-feeding median

without underestimation and (b) where, in time, retrospective starts to be biased.

4.4 | Interpretation

Higher prevalence of EBF is a common outcome in studies that compare current status and retrospective data.[10,11,14,20] However, these studies did not assess the duration of EBF using both source of information. The size of the difference between prevalence was lower in our study when compared to the literature, and a possible reason is that in these studies the retrospective data were collected prospectively. Another possible reason is that in our study retrospective data were recorded in integer numbers against decimal ones in prospective studies in which mothers could recall more reliably. In Morocco, the median of EBF from current status data was higher than retrospective data. One possible explanation is the higher percentage of missing values in current status data (1.8%) than in retrospective data (0.9%).

The duration of breast feeding for countries with very low or very high frequency of EBF could not be calculated from current status data. The impossibility to calculate the median from current status data at that frequency level is because the proportion of EBF in the first age range (0-1.9 months) was below 50% and the first term of formula (Figure 2) was not possible to obtain. This may suggest that for these countries, only retrospective data could provide feasible estimates. Also, it is necessary to investigate the specific factors in each country that might be contributing to the difference between these indicators. In our study, the smallest difference in the median of EBF between retrospective and current status data was showed in Peru (0.15) and the highest was in Morocco (0.44) and the average difference for four countries was only 7.7 days. Therefore, the size of differences was not large in all countries, suggesting that despite the criticism regarding the quality of retrospective measures, both measures were quite similar. It was expected that median duration would be higher for retrospective data because with this type of data we can use survival analysis. In this analysis, infants that were exclusively breast fed at the time of the interview were censored, which means that the duration of EBF did not stop in that specific age registered in the interview. It was not possible to calculate how much higher was the duration, but it was possible to notice that it was higher. The main reason to use current status data is to avoid recall bias, but our results suggested that this bias during the first 6 months was minimized.

In this regard, our results highlighted the feasible use of retrospective data in cross-sectional surveys for assessing the duration of EBF. One positive aspect of retrospective data is the possibility to use survival analysis to estimate the duration of EBF. This analysis allows different treatment for infants that are still breast feeding, while indicators using current status data treat equally all cases. This difference could be the reason for lower median from current status data. Some positive reasons to use retrospective data are *policy purpose* since retrospective data allow us to evaluate the effectiveness of pro-breast-feeding policies and *analytical* because retrospective data contain full information *versus* data obtained from the previous 24h (current status data).

Once current status data are recommended by WHO, some studies about modelling purpose[12,21] were designed for policy evaluation. A previous study analysed median duration of EBF from current status data using parametric model, nonparametric model, and spline fitting. The first one underestimated the median duration for younger infants and overestimated for older ones when it was compared with classical current status median calculation. The second one considered the distribution of current status as a monotonic series, but the actual data of exclusive did not show this distribution, so the estimative was not accurate. And, the third one showed a problem that the knots were specific for each country age range distribution and it was not possible to compare among countries.[21] Some characteristics of the data do not allow us to apply statistical analysis commonly used to model breast-feeding estimators at the population level. This characteristic about the data adds additional effort on how to set the breast-feeding status and how to define some concepts to describe and investigate this relevant public health issue.[21] The generalized additive models for the current status enable incorporation of covariates, but these variables can only be available at the same time as the current status variables. Some covariates referring to past exposure can be incompatible with the current status data of breast feeding. Therefore, retrospective data could be more feasible to evaluate the effectiveness of public policies.

5 | CONCLUSIONS

The prevalence of EBF using retrospective and current status data is similar and showed substantial or almost perfect agreement. Our results have positive implications from the public health perspective. Acknowledging the differences observed, the assessment of duration of EBF, specifically from cross-sectional national surveys, that has been poorly explored, could be used more frequently, instead of using only current status data. In this sense, our results open the discussion about the use of retrospective information to calculate prevalence and duration, and show how measures calculated from this source of data differs from the usual and recommended current status data. We suggest that retrospective data may be also used in cross-sectional surveys to estimate median duration of breast feeding.

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SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

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