Measuring Use of the Lactational Amenorrhea Method through the Demographic and Health Surveys: Data Quality and Implications

(for presentation at the 2013 PAA annual meeting)

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ABSTRACT (144 words)
Our study purpose is to assess data quality of self-reported current use of the Lactational Amenorrhea Method (LAM) in the Demographic and Health Surveys (DHS). LAM, an important contraceptive method during the postpartum period, is a modern contraceptive with an effectiveness rate of 98% when used correctly. Our study's specific objectives are: 1) to examine accuracy of self-reported LAM use compared to the constructed gold standard variable, and 2) to explore differentials in accuracy measures by characteristics at the individual-level and survey-level by analyzing data from 73 DHS conducted in 45 countries since 1998. Findings reveal that on average only 26% of reported LAM users met criteria of accurate LAM practice across the surveys, indicating potentially unacceptably low user effectiveness at the population level. We discuss implications for future DHS data collection efforts, and implications for family planning and maternal and child health programming.

INTRODCTION

The Lactational Amenorrhea Method (LAM) is a highly effective modern method of contraception for postpartum women, guidelines for which were developed after years of research coupled with expert consultation. The development of LAM began in 1988 when a group of experts from around the world met in Bellagio, Italy to define a set of guidelines that a woman could use to predict her return to fertility during breastfeeding. After reviewing data, the expert group came to consensus, later coined the Bellagio Consensus, that breastfeeding can provide effective contraception, with risk of pregnancy of approximately 2 percent if the following criteria are met: 1) The mother has not experienced the return of her menstrual period; 2) The mother is fully or nearly fully breastfeeding; ***and*** 3) The baby is less than six months old (Kennedy et al., 1989). Guidelines for the use of the Bellagio Consensus were developed shortly thereafter, and the resulting contraceptive method was named for the first time—the Lactational Amenorrhea Method. In 1995, the expert group came together once again to assess results from several studies designed explicitly to measure LAM effectiveness (Perez Albarracin et al., 1992, Labbok et al., 1997). The data showed that the observed pregnancy rates among LAM users were less than 2 percent (LINKAGES Project, 1995, 1996). With this confirmation, LAM became more widely accepted as an effective modern method of family planning. Programmatic and policy efforts to incorporate LAM into the contraceptive mix began to gain traction.

More recent data have shown additional benefits to LAM beyond its contraceptive and infant nutrition benefits. In particular, research shows that women who use LAM are twice as likely to use family planning at 12 months post-partum than as women who simply breastfeed (Bongiovanni et al., 2005). Furthermore, as research accumulates on the risks to mother and baby of short birth spacing and on missed opportunities to integrate family planning into maternal and child health services, post-partum family planning, including LAM, is receiving greater programmatic emphasis from international donors, international organizations, non-governmental organizations, and countries themselves (LAM Interagency Working Group, 2010b, 2012). This greater programmatic emphasis has led to increased demand for programmatically relevant data on LAM, especially data on women's knowledge and use of LAM.

LAM and Demographic and Health Surveys

Demographic and Health Surveys (DHS) are nationally representative, population-based household surveys that collect cross-nationally comparable data on population, health, and nutrition indicators. Begun in 1984 and funded primarily by the United States Agency for International Development, the DHS Program has provided technical assistance to the implementation of over 260 DHS in more than 90 countries. Thanks to its high quality, internationally comparable data, DHS represent some of the best known and most widely used sources of health-related data from less developed countries.

The DHS core women's questionnaire is used to collect a wide range of information on fertility, family planning, maternal and child health, nutrition, and other health topics. It is administered to women 15-49 years of age who live in sampled households. To assess a woman's current contraceptive knowledge, the interviewer uses a question prompt for each of the individual methods, "Now I would like to talk about family planning - the various ways or methods that a couple can use to delay or avoid a pregnancy. Have you ever heard of (METHOD)?" Depending on the range of contraceptive methods available in each country, 10-15 different contraceptive methods, modern and traditional, are typically prompted. To assess a woman's

current use of contraception, the interviewer asks women who are not currently pregnant the following two questions—"Are you currently doing something or using any method to delay or avoid getting pregnant?"; if this question is affirmatively answered, the interviewer then asks the open-ended question, "Which method are you using." (ICF International, 2011) The interviewer then records all methods mentioned. If multiple methods are reported, the most effective method reported is used for tabulating current use, based on the following hierarchy: female sterilization, male sterilization, intrauterine contraceptive device, contraceptive injection, contraceptive implants, contraceptive pill, condoms, vaginal methods (foam, jelly, and suppository), LAM, periodic abstinence, withdrawal, and other methods (Rutstein and Rojas, 2006).

DHS has been the primary source of population-based LAM knowledge and use data from developing countries.[*] In 1998, questions to measure women's knowledge and current use of LAM were first included in DHS – Ghana DHS 1998 and Philippines DHS 1998 – based on data needs at the country level. Thereafter, many countries added LAM questions to their surveys. To meet growing global data needs, the DHS Program added the LAM-related questions to the core women's questionnaire in 2001 (ORC Macro, 2001a, ORC Macro, 2001b), as a result of the DHS core questionnaire revision process.

When LAM questions were initially added, the core women's questionnaire included a description read by the interviewer, "Up to 6 months after childbirth, a woman can use a method that requires that she breastfeeds frequently, day and night, and that her menstrual period has not returned" (Rutstein and Rojas, 2006), with slight variations across surveys, particularly in describing breastfeeding practice (Annex 1). The description was subsequently removed from the core questionnaire around 2008 as a result of the DHS questionnaire revision process, which recurs every five years to ensure that DHS meet existing and emerging data needs. The revision process included an analysis of LAM data quality conducted by the DHS Project contractor, ICF Macro, and expert consultations. The unpublished analysis of LAM data exposed a major weakness of the LAM questions. Specifically, when the LAM description was included, many women misreported their use of LAM, oftentimes conflating it with breastfeeding. DHS data showed that the majority of self-identified LAM users in most countries did not meet one or more of the three elements of correct LAM practice, and could therefore not actually be using LAM correctly. Meanwhile, extensive stakeholder consultations revealed widespread agreement that women who were actually using LAM would know the local term for LAM and would be able to accurately report on actual LAM use. As a result of the analysis and consultations, the LAM description was dropped from the questionnaire, while descriptions for other methods remained (Arnold, 2012).

Despite this questionnaire change, LAM data quality concerns have continued, especially when LAM estimates in a given country have widely varied from one DHS to the next. For example, the Mozambique DHS 2003 estimated LAM use at 9.1% of all married women (Instituto Nacional de Estatistica et al., 2005) whereas the Mozambique DHS 2011 estimated it at 0.2% of all married women (Instituto Nacional de Estatística et al., 2012). Since 2011, several international groups have codified questions on LAM data quality in the form of publically available documents that describe the concerns and limitations of LAM data and offer suggestions for improvement (Institute for Reproductive Health at Georgetown University, 2011, MEASURE Evaluation, 2012). Heretofore, however, no study has systematically assessed the

[*] DHS does not typically collect LAM data in countries that do not have LAM programming.

data quality concerns related to LAM measurement in DHS. The research presented in this paper aims to remedy this knowledge and evidence gap. The purpose of this study is to assess data quality of women's current use of LAM as measured by DHS. The study's two specific objectives are: 1) to examine accuracy of self-reported LAM use, and 2) to explore differentials in accuracy of self-reported LAM use at the individual-level and the survey-level.

METHODS

Data

We reviewed the questionnaires of all DHS completed since 1998, when the LAM questions were first included in DHS, accessed via the MEASURE DHS website (www.measuredhs.com). A total of 86 surveys collected LAM data. Six of these surveys had limited data access (Cape Verde DHS 2005, Eritrea DHS 2002, Mauritania DHS 2000-01, Samoa DHS 2009, South Africa DHS 2003, and Turkmenistan DHS 2000), two had atypically small sample sizes (Dominican Republic DHS 1999 and Sao Tome and Principe DHS 2008-09), and five surveys excluded detailed feeding data necessary to assess the accuracy of LAM reporting (Armenia DHS 2005, Ethiopia DHS 2005, Jordan Interim DHS 2009, Moldova DHS 2005, and Rwanda Interim DHS 2007-08). We excluded these 13 surveys from our analysis, which ultimately included 73 surveys conducted in 45 countries between 1998 and 2011 (Annex 1). Of these 73 surveys, 41 included a short description of LAM that was read to interviewees. The description varied slightly by survey, mainly due to variation in feeding description (Annex 1).

Measurement

The quality of self-reported use of LAM can be assessed by comparing LAM self-report with other data collected by the survey, namely data on amenorrhea, feeding practices during 24 hours before the interview among children under-3 years of age, and postpartum period. While these data are also collected through women's self-report and are by no means perfect, previous published analyses of their quality indicate that "DHS data on maternal and child health are generally of very high quality." (Pullum, 2008, Pullum, 2006) Using these three data points, we constructed a set of binary variables to measure whether women met each of the three elements of accurate LAM practice. Data on amenorrhea allowed us to assess whether a woman met the first element, 'the mother has not experienced the return of her menstrual period'; data on feeding practices allowed us to assess whether a woman met the second element, 'the mother is fully or nearly fully breastfeeding'; and data on postpartum period allowed us to assess whether a woman met the third element, 'the baby is less than six months old'.

Defining "fully or nearly fully breastfeeding" proved to be the most challenging element of variable construction. The internationally recognized resource, *Family Planning: A Global Handbook for Providers*, offers practical guidelines to measure "fully or nearly fully breastfeeding". The *Handbook* defines "fully breastfeeding" as both exclusive breastfeeding (the infant receives no other liquid or food, not even water, in addition to breast milk) and almost-exclusive breastfeeding (the infant receives vitamins, water, juice, or other nutrients once in a while in addition to breast milk). It defines "nearly fully breastfeeding" to mean, "The infant receives some liquid or food in addition to breast milk, but the majority of feedings (more than three-fourths of all feeds) are breast milk." (Johns Hopkins Bloomberg School of Public Health/Center for Communication Programs and World Health Organization, 2011) Because the feeding data collected by DHS do not include information on the frequency or amount of each type of food or liquid the infant receives, it was not possible to construct a variable to capture the relative amount of breast milk out of total dietary intake of the infant. Thus, our feeding

variables are solely based on the type of food or drink given to the infant, with an assumption that the type and variety of food or drink given to the infant is associated with the relative amount of non-breast milk in the infant's total dietary intake.

We constructed three binary variables to measure accuracy of LAM practice. First, we categorized a woman as practicing LAM if she gave birth less than 6 months ago; her menstruation had not returned since the birth; her infant had been either exclusively breastfed or breastfed with water, but no other liquid, semisolid or solid food; ***and*** she did not use any other modern contraceptive method. This variable served as a gold standard practice in our analysis. Recognizing that LAM programming has recently emphasized and encouraged exclusive breastfeeding rather than fully or nearly fully breastfeeding (LAM Interagency Working Group, 2010a), we also constructed a binary variable in which a woman was considered practicing LAM if she met the initial three conditions and was exclusively breastfeeding (Definition 2). Finally, we constructed a third binary variable to categorize a woman as practicing LAM if she met the initial three conditions and her infant was breastfed with water or other liquid, but no semisolid or solid food (Definition 3). Importantly, the three constructed variables do not reflect a woman's intention to use LAM as a contraceptive method. Such information is a necessary component of being a true LAM user, beyond meeting LAM practice criteria, but is not available in DHS.

To assess differentials in reporting accuracy by women's background characteristics, we also constructed variables on age (5-year categorical), parity (primi vs. mutipara), education ($<$ vs. $\geq$ primary school completion), and residential area (urban vs. rural). Finally, to assess differentials in reporting accuracy by survey characteristics, we constructed a LAM description variable (inclusion vs. exclusion of LAM description), and a categorical survey region variable (Latin America and Caribbean, North Africa/Central Asia/Eastern Europe, South Asia/Southeast Asia, and Sub-Saharan Africa). We combined regions that had a smaller number of surveys.

Analysis

All analyses were conducted by survey first, and summary statistics were calculated across the surveys, with an individual woman being the unit of analysis. We compared reported LAM use with three constructed LAM practice variables described above and calculated two proportions: the proportion of self-reported LAM users who meet the practice criteria; and the proportion of women meeting practice criteria who are self-reported LAM users. The first estimate indicates accuracy of self-reported LAM use and is important to understand user effectiveness among self-identified LAM users, while the second estimate may provide programmatic implications for reaching women who may become LAM users. We did not adjust the estimates for individual survey's sampling weight since we aimed to calculate the accuracy measures among all interviewed women.

Our main gold standard practice is likely conservative in identifying infants whose breast milk intake exceed "three-fourths of all feeds" (LAM Interagency Working Group, 2010a), potentially underestimating the proportion of self-reported LAM users who meet the practice criteria, although it would not bias the proportion of women meeting practice criteria who are self-reported LAM users. Conversely, inclusion of other liquids, in particular formula, which cannot be distinguished in data, could overestimate LAM practice substantially. To assess impact of potential misclassification, we further calculated and compared the proportions using all three constructed LAM practice variables. Summary statistics, un-weighted for population size, were

calculated first across all 73 surveys and further compared by the questionnaire version (with *vs.* without LAM description) and region, using t-test.

Considering potential programmatic implications, we conducted further analyses to assess factors associated with accurate reporting among self-reported LAM users. Using data from 34 surveys in which the number of women reporting current LAM use exceeded 50 (Annex 2), we compared practice accuracy (i.e., whether or not meeting the gold standard practice criteria) by background characteristics. Chi-square tests were used to assess differential distributions.

We also examined error patterns among those who reported using LAM but did not meet the gold standard practice criteria, using the 39 surveys in which the number of eligible women exceeded 30. Among those, we examined which of the three LAM practice elements the women were failing to meet, calculating the proportion of women who did not meet postpartum timeframe, the proportion who had experienced their menses return, and the proportion who were not fully or nearly fully breastfeeding.

Again, all analyses were conducted by survey first, and summary statistics were calculated across the surveys. We considered p-values less than 0.05 statistically significant. STATA 11.0 statistical software was used for all analyses (Stata Corporation, College Station, USA).

RESULTS

Across the 73 surveys, an average of 0.8% of all women respondents reported current LAM use, while 29.7% reported currently using any contraceptive method and 22.4% reported currently using any modern contraceptive method. Meanwhile, an average of 3.7% of all respondents met the LAM practice criteria, regardless of their self-reported LAM use or intention to use LAM (Table 1). When the infant feeding criteria of the constructed LAM practice variable was relaxed (Definition 3), the average increased to 4.2% and, when the infant feeding criteria was tightened (Definition 2), the average decreased to 2.8%. No matter which definition was used, in all surveys the percentage of women who met LAM practice criteria was higher than the percentage of women who reported LAM use.

Among self-reported LAM users, only 25.5% met the accurate practice criteria. As expected, using the stricter Definition 2, the proportion was slightly lower at 20.1%, and using the more relaxed Definition 3, the proportion was slightly higher at 29.8%. These, however, were not statistically significantly different from the proportion using the gold standard practice definition (Table 2). Among women who met LAM practice criteria, 6.8% reported themselves as a LAM user and the estimate did not vary greatly across the three definitions (Table 2).

We also examined whether the proportion of accurate practice among self-reported LAM users varies by the questionnaire version (with *vs.* without LAM description) or geographical region (Table 3). The proportion was higher with a description compared to without, though the difference was not statistically significant (27.7% vs. 18.5%, respectively). All surveys with the proportion of accurate practice among self-reported LAM users higher than 60% included LAM description (Figure 1). With regard to regional patterns, the proportion was lowest in sub-Saharan Africa at 19.7% and highest in Latin America and Caribbean at 38.6% (Table 3).

Further analysis among incorrect LAM users (i.e., women who reported LAM use but did not meet the practice criteria) suggested the most common problem experienced by these women

was meeting the feeding criteria (i.e., they were not fully or nearly fully breastfeeding). Approximately 71% and 68% of incorrect LAM users gave liquid other than water and food, respectively, to their infants, disqualifying as correct LAM users. In total, 92% of them fed their infants either food or liquid other than water (Table 4). The second most common problem was meeting the postpartum timeframe (i.e., they were six months or more postpartum) (Table 4). Approximately 83% of incorrect LAM users gave birth 6+ months prior to the survey, half of whom gave birth more than 12 months prior (Figure 2). We attempted to assess any differential error patterns by the questionnaire version (with *vs.* with description) in order to understand whether inclusion of description affected any particular one of the three elements and, thus, improved practice accuracy (Table 3, Figure 1). However, there were no significant differences possibly due to small number of eligible surveys by version (n=35 and n=4, with and without description, respectively) (results not shown).

Among women who reported currently using LAM, reporting accuracy compared to the gold standard practice did not vary by background characteristics in most surveys. Among the 34 surveys (Annex 2), reporting accuracy was associated with education (< vs. ≥ primary school completion) positively only in five surveys and negatively in one (Zambia DHS 2001) (Table 5). Multiparous women had more accurate reporting in one survey (Jordan DHS 2002) and urban residence was positively related with accurate reporting in two (Peru DHS 2000 and Rwanda DHS 2005).

DISCUSSION

The expansion of LAM programming brings with it the increased demand for LAM-related data at both country and global levels. As the world's main source of LAM data from less-developed countries, DHS will continue to be called upon to meet these demands. We assessed accuracy of self-reported use of LAM as a current contraceptive method compared to a constructed gold standard practice variable in 73 surveys conducted in 45 countries between 1998 and 2011. Our study showed only 26% of self-reported LAM users met accurate practice criteria, indicating poor quality of self-reported LAM use across most DHS. Further, among women who reported currently using LAM, reporting accuracy did not vary by women's background characteristics in most surveys, unlike data quality patterns observed in other DHS indicators and reported in previous research (Choi and Sudhinaraset, 2010, Pullum, 2008, Pullum, 2006). We believe these findings have several programmatic, data collection, data analysis, and data interpretation implications.

With regard to programmatic implications, it was indicated that nearly 75% of women who report current use of LAM do not practice LAM correctly. If we were to extrapolate to the population level, this would equate to approximately 1.5 million women across our 45 surveyed countries who believe that they are using an effective modern method of contraception, but in reality are not (Annex 3). This false belief and, consequently, low user effectiveness could result in unintended pregnancy and a host of detrimental health and economic outcomes for women and their families. Family planning, maternal health, child health, and nutrition programming together must address this widespread misunderstanding of LAM among the general population broadly, and among women of reproductive age more specifically. Counseling and other forms of communication on LAM must be improved, with messages targeting the areas in which women seem to be struggling the most—degree of breastfeeding required and postpartum time limitations of method effectiveness.

Estimating the level of potential LAM use using a constructed practice variable may also provide programmatic insight, especially if efforts are underway to promote and scale-up LAM. Our analyses show that compared with women who self-identify as LAM users, many more women meet all three LAM practice criteria and may become LAM users if they intend to use LAM. By examining DHS data with this lens, country-level LAM program managers could estimate a reference point from which benchmarks for further LAM promotion and scale-up could be set. This constructed LAM practice variable, however, should be used with caution given that, among women who do not self-identify as LAM users, intent to use LAM is highly suspect.

With regard to data collection and analysis implications, our analyses suggest that inclusion of LAM description in DHS core women's questionnaire may improve data quality. Surveys in which a LAM description was read to interviewees appeared to have higher proportion of self-identified LAM users who use it correctly, though still low, in comparison to surveys that did not include the description. We could not assess potential mechanism for better reporting when the description is provided to survey respondents. If respondents understand the description correctly, women who use LAM incorrectly may recognize that they do not meet the criteria and thus avoid reporting as a user. However, it is also possible that women may report using LAM falsely if they misinterpret the long and complex description. Thus inclusion of description itself may not necessarily improve reporting quality, unless interviewers are trained to and able to explain the description clearly to respondents. Further study on the potential mechanism of reporting differential by questionnaire version would be helpful for the next DHS core questionnaire revision. Nevertheless, the high percent of women who gave births 6 or more months ago among the self-reported users (83%) – even when most surveys included LAM description (35 out of 39) – is alarming. Among the three elements of accurate LAM practice, the postpartum timeframe is relatively straightforward compared to the other two: postpartum amenorrhea and feeding. Well trained and supervised interviewers should be able to verify the response easily based on the date of last birth collected in the survey, although it is also important to acknowledge that interviewers do not necessarily verify use of other contraceptive methods. However, well-trained interviewers and a good questionnaire are limited to achieve high data quality, if there is wide spread, strong misunderstanding about what LAM is among the users. Additionally, during DHS data processing and report writing, countries should carefully review LAM data. Consideration may be given to including brief information in each DHS final report on quality of LAM self-report data.

Finally, in countries where self-identified LAM users represent a significant portion of modern method users and the proportion of LAM users who practice it correctly is low, researchers and program managers need to interpret DHS results on modern contraceptive prevalence carefully. For example, the Zambia DHS 2007 included LAM as a modern contraceptive method, with current use among all women reported at 4.1%, representing 16.7% of all modern contraceptive users (24.6%) (Central Statistical Office et al., 2009). Meanwhile, the proportion of LAM users who practice it correctly was a mere 20%. In effect, with an assumption that women use other modern methods correctly, true modern contraceptive use would have been at 21.3%, about 13% lower than the reported value. Although discrepancies between efficacy and user effectiveness exist in other modern contraceptive methods as well, the very low level of accurate practice is a great concern when LAM is used by a substantial proportion of modern methods users.

A similar picture is painted by current modern contraceptive prevalence trends as reported in the Uganda DHS 2000-01 and Uganda DHS 2006. Between the two Uganda surveys, modern

contraceptive prevalence among all women decreased from 16.5% to 15.4% (Uganda Bureau of Statistics and Macro International Inc., 2007, Uganda Bureau of Statistics and ORC Macro, 2001). This slight decrease was largely accounted for by LAM. To elaborate, the Uganda DHS 2000-01 included LAM as a modern contraceptive method, with current use among all women reported at 3.1%, representing 18.8% of all current modern contraceptive users (16.5%) (Uganda Bureau of Statistics and ORC Macro, 2001). However, the PPV of reported LAM use was only 24%. As with the Zambia DHS 2007, the true modern contraceptive prevalence calculated in the Uganda DHS 2000-01 would have been lower than reported, at 14.1% (approximately 15% lower than the reported value). Meanwhile, because LAM use was extremely low (0.0%) in the Uganda DHS 2006 and was not tabulated in the final report (Uganda Bureau of Statistics and Macro International Inc., 2007), it appeared that contraceptive prevalence decreased, when in reality, it had likely slightly increased. As illustrated by these examples, poor LAM data quality can negatively impact our understanding of levels and trends of contraceptive use.

CONCLUSION

It is imperative that LAM-related programming work to improve women's understanding and effective use of the method. LAM self-report data quality will remain poor until women truly understand the criteria of the method and correctly apply it. In the meantime, DHS should work to improve LAM data quality from the margins—potentially incorporating the LAM description into all country surveys, better training and supervision of interviewers, adding appropriate information in final reports discussing LAM quality concerns, and working closely with host countries to determine whether LAM data collection and/or reporting is appropriate and consistent. Finally, researchers and program managers should view LAM data with caution and make considerations for LAM data quality in contraceptive trend analyses and syntheses.

Table 1. Level of self-reported current use of LAM and women who meet practice criteria, among all female respondents 15-49 years* (%) (n=73)

	Mean	SD	Minimum	Maximum
Reported users	0.8	1.1	0.0	5.6
Women who meet practice criteria				
Definition 1, gold standard practice	3.7	2.2	0.3	9.2
Definition 2	2.8	1.9	0.2	8.5
Definition 3	4.2	2.2	0.8	9.4

* Estimate in each survey was an un-weighted value among all respondents.
LAM: lactation amenorrhea method
SD: Standard Deviation.
Definition 1: Those (1) who gave birth less than 6 months ago, (2) whose menstruation had not returned, (3) who does not use any other modern contraceptive methods, and (4) whose infant had been either exclusively breastfed or breastfed with water, but no other liquid, semisolid or solid food.
Definition 2: Those who met the initial three conditions listed in Definition 1 and whose infant was exclusively breastfed
Definition 3: Those who met the initial three conditions listed in Definition 1 and whose infant was breastfed with water or other liquid, but no semisolid or solid food

Table 2. Proportion of self-reported LAM users who meet practice criteria, and proportion of women meeting practice criteria who are self-reported LAM users: by practice definition (%) (n=73)

	Mean	SD	Minimum	Maximum	t-test p-value*
Proportion of LAM users who meet practice criteria					
Definition 1, gold standard	25.5	18.6	0.0	79.1	reference
Definition 2	20.1	18.0	0.0	76.7	0.077
Definition 3	29.8	19.9	0.0	80.2	0.182
proportion of women meeting practice criteria who are LAM users					
Definition 1, gold standard	6.8	8.1	0.0	33.3	reference
Definition 2	6.5	7.3	0.0	26.6	0.782
Definition 3	6.6	7.8	0.0	30.8	0.869

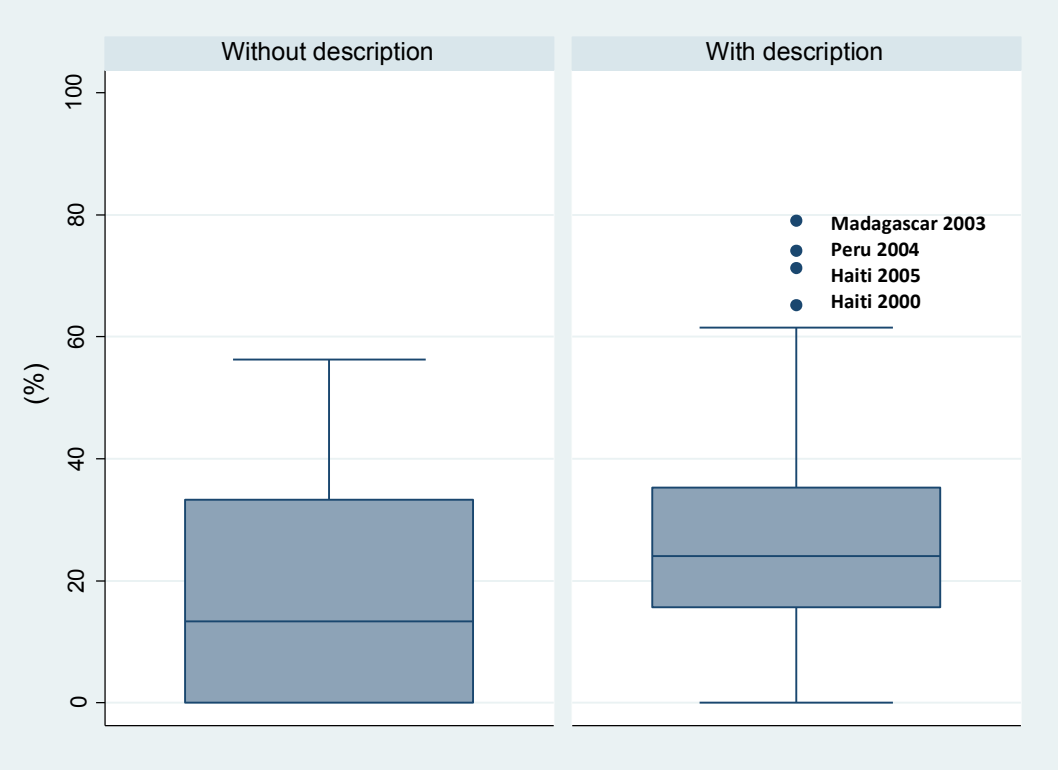
*t-test for differential distribution compared to the corresponding measures using the definition 1.
LAM: lactation amenorrhea method
SD: Standard Deviation.
Definition 1: Those (1) who gave birth less than 6 months ago, (2) whose menstruation had not returned, (3) who does not use any other modern contraceptive methods, and (4) whose infant had been either exclusively breastfed or breastfed with water, but no other liquid, semisolid or solid food.
Definition 2: Those who met the initial three conditions listed in Definition 1 and whose infant was exclusively breastfed
Definition 3: Those who met the initial three conditions listed in Definition 1 and whose infant was breastfed with water or other liquid, but no semisolid or solid food

Table 3. Proportion of self-reported LAM users who meet practice criteria*: by questionnaire type and region (%)

Subgroup	n	Mean	SD	t-test p-value†
Questionnaire type				
Without description	17	18.5	18.0	reference
With description	55	27.7	18.5	0.080
Region				
Latin America and Caribbean	14	38.6	22.4	0.010
North Africa/Central Asia/Eastern Europe	9	29.0	7.5	0.018
South Asia/South East Asia	9	27.3	18.3	0.279
Sub-Saharan Africa	40	19.7	17.0	reference

LAM: lactation amenorrhea method
*According to the gold standard practice, Definition 1.
†t-test for differential distribution compared to the reference group's.
SD: Standard Deviation.

Figure 1. Box plots of Proportion of self-reported LAM users who meet practice criteria: by questionnaire type



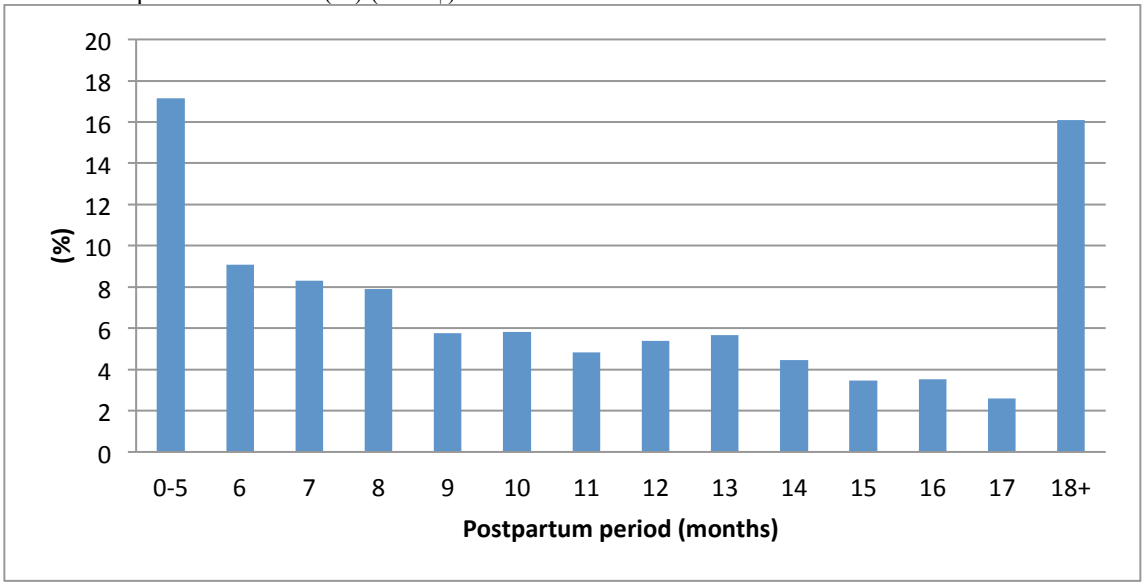
LAM: lactation amenorrhea method
* According to the gold standard practice, Definition 1.

Table 4. Postpartum period, return of menstrual period, and feeding practice among women who are self-reported LAM users but do not meet practice criteria* (%) (n=39†)

	Mean	SD	Minimum	Maximum
who gave birth 6months or more ago	82.8	14.2	36.5	100.0
whose menstrual period returned	23.8	14.1	2.7	61.4
who gave liquid other than water	71.2	14.4	48.6	100.0
who gave food	67.9	23.7	0.0	94.7
who gave liquid other than water or food	91.9	7.1	67.3	100.0

LAM: lactation amenorrhea method
*According to the gold standard practice, Definition 1.
†Restricted to 39 surveys where the denominator exceeded 30.
SD: Standard Deviation.

Figure 2. Average distribution of postpartum period in months among women who are self-reported LAM users but do not meet practice criteria* (%) (n=39†)



*According to the gold standard practice, Definition 1.
†Restricted to 39 surveys where the denominator exceeded 30.

Table 5. Proportion of reported LAM users who meet practice criteria* by background characteristics (%) (n=34†)

Country	Year	All	By background characteristics									
			Education				Parity			Residence			
			<primary completion	≥primary completion	p-value‡		1	≥2	p-value‡	rural	urban	p-value‡	
Armenia	2000	24.0	-	24	n/a		26	22	0.710	19	29	0.309	
Bolivia	2003	43.1	36	53	0.003	§	41	55	0.065	42	44	0.783	
Bolivia	2008	41.9	32	46	0.239		42	42	0.975	42	42	0.964	
Cameroon	2004	16.9	7	20	0.219		17	17	0.977	18	16	0.860	
Chad	2004	24.8	25	18	0.606		25	17	0.340	26	21	0.343	
Colombia	2000	27.5	26	29	0.796		27	33	0.731	32	22	0.407	
Colombia	2005	28.5	25	31	0.400		31	21	0.197	24	34	0.189	
Colombia	2010	14.3	0	22	0.029	§	11	27	0.170	13	16	0.741	
Dominican Republic	2002	55.6	58	52	0.591		56	56	1.000	50	58	0.502	
Dominican Republic	2007	13.0	5	22	0.030	§	14	11	0.787	10	17	0.368	
Gabon	2000	14.3	19	12	0.359		15	10	0.680	16	13	0.720	
Guinea	2005	21.4	21	20	0.939		20	30	0.483	23	16	0.452	
Haiti	2005	71.3	72	69	0.782		71	71	0.965	75	63	0.258	
Jordan	2002	23.2	-	23	n/a		20	50	0.008	§	20	26	0.323	
Jordan	2007	34.2	31	35	0.782		36	25	0.251	26	40	0.084	
Madagascar	2003	79.1	83	78	0.617		83	65	0.077	89	74	0.106	
Madagascar	2008	57.4	52	62	0.263		59	53	0.543	59	55	0.678	
Mali	2001	19.6	20	14	0.717		21	0	0.106	20	17	0.739	
Mali	2006	29.5	29	33	0.882		31	14	0.348	41	15	0.025	§
Morocco	2003	24.0	24	29	0.613		25	18	0.417	23	27	0.478	
Mozambique	2003	22.2	22	23	0.940		23	15	0.079	23	17	0.116	
Nicaragua	2001	26.1	20	38	0.013	§	23	34	0.173	25	28	0.690	
Niger	2006	18.7	19	0	0.236		19	13	0.354	20	14	0.266	
Nigeria	2003	21.4	15	27	0.227		20	50	0.152	19	24	0.588	
Nigeria	2008	8.8	7	10	0.424		9	8	0.788	7	12	0.132	
Peru	2000	36.6	20	46	0.006	§	33	56	0.071	25	48	0.008	§
Peru	2004	74.1	83	72	0.326		72	79	0.458	77	72	0.523	
Rwanda	2000	20.0	18	23	0.646		22	8	0.225	22	17	0.564	
Sierra Leone	2008	7.4	7	9	0.811		7	8	0.890	8	7	0.897	
Tanzania	2010	6.7	5	8	0.578		7	0	0.458	8	0	0.337	
Turkey	2003	30.2	37	24	0.283		33	20	0.326	31	30	0.929	
Uganda	2000	24.2	25	23	0.805		24	25	0.926	25	21	0.632	
Zambia	2001	28.9	36	15	0.021	§	29	29	0.982	33	19	0.134	
Zambia	2007	18.8	17	22	0.333		18	30	0.132	19	18	0.915	

LAM: lactation amenorrhea method

*According to the gold standard practice, Definition 1.

†Restricted to 34 surveys where the number of women who reported currently using LAM exceeded 50.

‡P-value for chi-square test for differential distribution

§P-value<0.05

Annex 1. List of 73 surveys with lactation amenorrhea method data

Country	Survey year	LAM description included	LAM description type*
Albania	2008	No	-
Armenia	2000	Yes	B
Armenia	2010	No	-
Azerbaijan	2006	Yes	B
Benin	2001	Yes	A
Benin	2006	Yes	A
Bolivia	2003	Yes	E
Bolivia	2008	Yes	E
Burkina Faso	2003	Yes	A
Burundi	2010	Yes	F
Cambodia	2000	Yes	A
Cambodia	2005	No	-
Cambodia	2010	No	-
Cameroon	2004	Yes	A
Chad	2004	Yes	A
Colombia	2000	Yes	D
Colombia	2005	Yes	D
Colombia	2010	Yes	D
Congo Brazzaville	2005	Yes	A
Dominican Republic	2002	Yes	E
Dominican Republic	2007	Yes	E
Ethiopia	2011	No	-
Gabon	2000	Yes	A
Ghana	1998	No	-
Ghana	2003	Yes	A
Ghana	2008	No	-
Guinea	2005	Yes	B
Guyana	2009	No	-
Haiti	2000	Yes	A
Haiti	2005	Yes	A
Honduras	2005	Yes	E
Indonesia	2002	Yes	A
Indonesia	2007	Yes	A
Jordan	2002	Yes	A
Jordan	2007	No	-
Kazakhstan	1999	Yes	B
Kenya	2008	No	-
Lesotho	2004	Yes	A
Madagascar	2003	Yes	A

Madagascar	2008	Yes	A
Malawi	2000	Yes	A
Mali	2001	Yes	B
Mali	2006	Yes	B
Morocco	2003	Yes	A
Mozambique	2003	Yes	D
Nicaragua	2001	Yes	D
Niger	2006	Yes	B
Nigeria	2003	Yes	A
Nigeria	2008	Yes	A
Peru	2000	Yes	D
Peru	2004	Yes	E
Philippines	1998	Yes	C
Philippines	2003	Yes	C
Philippines	2008	No	-
Rwanda	2000	Yes	A
Rwanda	2005	Yes	A
Rwanda	2010	No	-
Senegal	2005	Yes	A
Senegal	2010	Yes	A
Sierra Leone	2008	No	-
Swaziland	2006	Yes	A
Tanzania	2000	Yes	A
Tanzania	2004	Yes	A
Tanzania	2010	No	-
Timor-Leste	2009	No	-
Turkey	2003	Yes	A
Uganda	2000	Yes	A
Uganda	2006	No	-
Zambia	2001	Yes	A
Zambia	2007	Yes	A
Zimbabwe	1999	Yes	B
Zimbabwe	2005	No	-
Zimbabwe	2010	No	-

LAM: lactation amenorrhea method

*A: Up to 6 months after childbirth, a woman can use a method that requires that she breastfeeds frequently, day and night, and that her menstrual period has not returned; B: Women can use a specially taught method of pregnancy avoidance to delay the return of the menstrual period by feeding their child nothing but breast milk for up to six months after a birth; C: Method used by women with less than 6 months old baby, whose period has not returned, and are breastfeeding the baby day and night. The baby may be given little or no food or drink other than breast milk; D: After a birth, a woman would be protected from pregnancy while breastfeeding frequently until menstruation will return; E: While menstruation has not returned, women can only breastfeed their children within the first 6 months prevent pregnancy; F: After giving birth, a woman exclusively breastfeeds her infant child to prevent the return of her period; -: No description provided.

Annex 2. List of 34 surveys in which the number of women reporting current LAM use exceeded 50 and background characteristics of those women

Country	Year	N*	Background characteristics (%)					
			Education		Parity		Residence	
			<primary completion	≥primary completion	1	≥2	rural	urban
Armenia	2000	75	0	100	43	57	49	51
Bolivia	2003	297	58	42	16	84	43	57
Bolivia	2008	93	27	73	26	74	28	72
Cameroon	2004	59	25	75	20	80	47	53
Chad	2004	343	97	3	7	93	69	31
Colombia	2000	51	53	47	12	88	55	45
Colombia	2005	144	40	60	27	73	60	40
Colombia	2010	56	34	66	20	80	43	57
Dominican Republic	2002	72	60	40	25	75	33	67
Dominican Republic	2007	77	52	48	23	77	53	47
Gabon	2000	84	38	62	12	88	45	55
Guinea	2005	103	95	5	10	90	76	24
Haiti	2005	80	68	33	39	61	70	30
Jordan	2002	177	0	100	9	91	46	54
Jordan	2007	146	9	91	19	81	42	58
Madagascar	2003	86	21	79	23	77	33	67
Madagascar	2008	129	49	51	26	74	67	33
Mali	2001	143	95	5	7	93	87	13
Mali	2006	61	95	5	11	89	56	44
Morocco	2003	262	92	8	11	89	75	25
Mozambique	2003	648	98	2	13	87	82	18
Nicaragua	2001	157	67	33	26	74	61	39
Niger	2006	374	98	2	10	90	81	19
Nigeria	2003	70	47	53	6	94	53	47
Nigeria	2008	328	41	59	12	88	61	39
Peru	2000	123	36	64	15	85	51	49
Peru	2004	108	17	83	31	69	44	56
Rwanda	2000	80	61	39	16	84	63	38
Sierra Leone	2008	54	80	20	22	78	72	28
Tanzania	2010	75	52	48	9	91	85	15
Turkey	2003	63	48	52	24	76	41	59
Uganda	2000	198	76	24	12	88	79	21
Zambia	2001	114	66	34	6	94	72	28
Zambia	2007	256	68	32	9	91	83	17

*Number of women who reported currently using LAM

Annex 3. Estimated number of women who use lactation amenorrhea method incorrectly by country*

Country	Survey year	Number of female respondents 15-49 years of age	Respondents who reported using LAM but did not meet practice criteria†		Female population 15-49 years of age in 2010 (thousands)‡	Estimated number of women who use LAM incorrectly (thousands)
			Number	Percent out of total		
Albania	2008	7584	15	0.2	856	2
Armenia	2010	5922	15	0.3	858	2
Azerbaijan	2006	8444	40	0.5	2,746	13
Benin	2006	17794	21	0.1	2,094	2
Bolivia	2008	16939	54	0.3	2,497	8
Burkina Faso	2003	12477	12	0.1	3,875	4
Burundi	2010	9389	1	0.0	2,202	0
Cambodia	2010	18754	1	0.0	3,915	0
Cameroon	2004	10656	49	0.5	4,764	22
Chad	2004	6085	258	4.2	2,538	108
Colombia	2010	53521	48	0.1	12,604	11
Congo Brazzaville	2005	7051	34	0.5	978	5
Dominican Republic	2007	27195	67	0.2	2,587	6
Ethiopia	2011	16515	2	0.0	20,027	2
Gabon	2000	6183	72	1.2	386	4
Ghana	2008	4916	0	0.0	5,971	0
Guinea	2005	7954	81	1.0	2,292	23
Guyana	2009	4996	4	0.1	196	0
Haiti	2005	10757	23	0.2	2,588	6
Honduras	2005	19948	12	0.1	1,964	1
Indonesia	2007	32895	15	0.0	67,437	31
Jordan	2007	10876	96	0.9	1,552	14
Kazakhstan	1999	4800	35	0.7	4,442	32
Kenya	2008	8444	20	0.2	9,809	23
Lesotho	2004	7095	3	0.0	554	0
Madagascar	2008	17375	55	0.3	4,875	15
Malawi	2000	13220	32	0.2	3,310	8
Mali	2006	14583	43	0.3	3,482	10
Morocco	2003	16798	199	1.2	9,086	108
Mozambique	2003	12418	504	4.1	5,559	226
Nicaragua	2001	13060	116	0.9	1,555	14
Niger	2006	9223	304	3.3	3,359	111
Nigeria	2008	33385	299	0.9	36,410	326
Peru	2004	41648	28	0.1	7,718	5

Philippines	2008	13594	18	0.1	23,873	32
Rwanda	2010	13671	26	0.2	2,622	5
Senegal	2010	15688	11	0.1	3,035	2
Sierra Leone	2008	7374	50	0.7	1,454	10
Swaziland	2006	4987	37	0.7	307	2
Tanzania	2010	10139	70	0.7	10,200	70
Timor-Leste	2009	13137	2	0.0	239	0
Turkey	2003	8075	44	0.5	20,134	110
Uganda	2006	8531	2	0.0	7,298	2
Zambia	2007	7146	208	2.9	2,893	84
Zimbabwe	2010	9171	9	0.1	3,160	3
TOTAL					310,302	1,464

*Most recent survey was used if there are multiple surveys with data on lactation amenorrhea method.
†Compared to the gold standard practice, Definition 1.
‡Source: World Population Prospects, the 2010 Revision. http://esa.un.org/unpd/wpp/index.htm

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