The effect in fertility of increasing the Lactational Amenorrhea Method (LAM) in countries with low contraceptive prevalence: A simulation exercise

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Abstract:

When used properly, the Lctational Amenorrhea Method (LAM) has an efficacy rate of between 91% and 100%. Nevertheless, this efficacy is not indicative of the effect of LAM on the population, as women may have a protective infertile period, even when not using LAM. To estimate the true effect of LAM in the population, as compared to a population that do not use the method, we use a simulation method based on Bongaarts' proximate determinants of fertility. With this method we simulate the effect of effect of expanding LAM in low-contraceptive populations.

The Lactational Amenorrhea Method (LAM) is a natural family planning method that is based on the natural postnatal infertility that occurs when a woman is amenorrheic and fully breastfeeding.

In principle, LAM is being used when the following three conditions are met: 1) the menstrual period has not returned since delivery; 2) the mother is not feeding the baby with supplements;[i] and 3) the baby is less than 6 months old (Kennedy and Visness 1992).

It has been shown that when used properly LAM has an efficacy rate of between 91% and 100% (Díaz et al 1991; Kenndy and Visness 1992; Labbok et al 1997; Perez, Labbok and Queenan 1992; Peterson et al. 2000; Wade, Sevilla and Labbok 1994). LAM has been proved so efficient during the first six months postpartum, that some authors have recommended its use beyond six months, up to the twelfth month as long as conditions 1) and 2) are met (Labbok et al. 1994; Labbok et al. 1997).

LAM is a method safe to use, that has benefits both to the mother and to the children. Among the advantages of LAM that have been mentioned are that it does not rely on external commodities, which makes it free and easy to use when other methods are not accessible or are not acceptable; in addition, it does not depend on special behaviors relating to the sexual act (Labbok et al. 1997). Additionally, it has been found that LAM is a good transition method, as women that use LAM are more likely to use another method at six months postpartum than women who do not use LAM (Bongiovanni et al. 2005; Kennedy and Kotekchuck 1998; Wade, Sevilla and Labbok 1992). Benefits to the children include the fact that breastmilk is the ideal source of nutrition for infants and that it brings immunological protection against many infections (Kennedy and Trussell 2009).

Labbok et al (1994) explain that the three criterions of LAM have physiological motivations. On the one hand, menses return has been shown to be one of the clearer indicators of the return of

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fertility; on the other hand, intensive breastfeeding is associated with decreased fertility. Labbok et al (1994) explain that the impact of breastfeeding on fertility is significant when women are in an exclusive[2] or almost exclusive[3] breastfeeding scheme, or when the frequency of breastfeeds is high[4]; and little when the frequency of breastfeeds is low or when breastfeeding is minimal. This is because less than full breastfeeding is associated with a gradual increase in the occurrence of ovulation prior to menses and with a decreased duration of amenorrhea. Finally, the six-month time frame was chosen because the risk of ovulating prior to menses increases over time and weaning should commence at around this time.

Despite the fact that fertility is associated with intensive breastfeeding, it may be the case that after the birth of a child, women have a protective infertile period, even when not using LAM. This protective period can come from partial breastfeeding, or from pathologic amenorrhea. Consequently, the principles of LAM (the infertility that comes from lactation) may be present in the population, even when LAM is not being used. In a study among breastfeeding women in Baltimore and Manila, Gray et al. (1990) found that exclusive breastfeeding during the first six months postpartum reduced the risk of ovulation to 1.5%, but the authors also found that amenorrhoeic women with partial breastfeeding had a risk of ovulation below 10%. It is important to notice that most of these studies focus on women who are breastfeeding either partially or exclusively. When women who do not breastfeed are analyzed, the menses are supposed to return shortly after birth, irrespectively of the nutritional status of the mother (Bongaarts 1980). No study, at least that I am aware of concerns the return of fertility for women after they stop breastfeeding.

It has been shown that when used properly LAM has an efficacy rate of between 91% and 100% (Díaz et al 1991; Kenndy and Visness 1992; Labbok et al 1997; Perez, Labbok and Queenan 1992; Peterson et al. 2000; Wade, Sevilla and Labbok 1994). Nevertheless, this efficacy is not indicative of the effect of LAM on the population, as it may be the case that women have a protective infertile period, even when not using LAM, after the birth of a child from partial breastfeeding, or pathologic amenorrhea. Consequently, the principles of LAM (the infertility that comes from lactation) may be present in the

In this paper we analyze the effect of expanding LAM in low-contraceptive populations, using two different simulation methods. The first of them, based on Bongaarts proximate determinants of fertility (Bongaarts, J. 1978), simulates that women who are on mixed breastfeeding and who never breastfed behave as if they were on exclusive breastfeeding for the first six months postpartum. On a variation of this method, we simulate that women who are on mixed breastfeeding and who never breastfeed behave as if they were on semiexclusive breastfeeding. In these exercises we estimate the Total Fertility Rate of second order and more, that is, the number of children that women who already have had a child would expect to have if they experienced the

[2] Exclusive breastfeeding is when no other liquid or solid is given to the child.
[3] When vitamins, liquids, or ritualistic feeds are given infrequently.
[4] The vast majority of feeds are breastfeeds, and there are intervals greater than 4 to 6 hours between breastfeeds.

fertility rates that prevailed today. Our results show that the effect of increasing LAM on the number of births in a country are modest, and the effect on the number of children that a woman can expect to have over their life time are often times an increase, rather than a decrease. This is because women with exclusive breastfeeding have shorter reported amenorrhea periods than women with mixed amenorrhea and women who never breastfeed.

Past efforts to estimate the effect of LAM and breastfeeding on births in the population

As mentioned before, the efficacy rate is not an adequate measure of the number of births that could be averted in a population when using a method, as the population who is not using a method may have some protective mechanism against pregnancy. This is particularly true in the case of the postpartum amenorrhea method, where the method relies on the postpartum amenorrhea that can be common to women who are not breastfeeding exclusively or who have morbid amenorrhea, even when not breastfeeding. A World Health Organization Multinational study to analyze the factors associated with the length of amenorrhea (World Health Organization Task Force on Methods for the Natural Regulation of Fertility 1998) determined that women who are fully breastfeeding have longer amenorrheas than women who are not breastfeeding; once the breastfeeding status was controlled for, women with low body mass index tended to have longer amenorrheas, a symptom of pathologic amenorrheas. In addition to these indicators, great variation was found between women of different origins, which may account for unobserved contextual and cultural differences in breastfeeding, nutritional status, and other aspects that are affecting the return of menses.

In a 2003 paper, Becker, Rutstein and Labbok estimate the effect of breastfeeding in six countries using DHS data. In their paper, the authors follow Bongaarts model of proximate determinants and assume that women who are not breastfeeding have an amenorrhea of 1.5 months. Then the authors estimate the median amenorrhea of women who are breastfeeding, and calculate, based on the number of months that women are not exposed to the risk of pregnancy in Bongaarts model, how many births would be averted[5]. Following Bongaarts model (Bongaarts 1978; Bongaarts and Potter 1983), this is what they do:

$$TFR = C_m * C_a * C_c * C_i * TF$$

Where the Cs are values between 0.0 and 1.0 that represent the effects of the proximate determinants of fertility as follows:

Cm=index of marriage

Ca=index of induced abortion

[5] The authors include two other simulations in which they consider the mean age of marriage, and mean birth interval. In this exercise, for simplicity of argument, we focus on their first simulation, which is derived directly from Bongaarts model.

Cc=index of contraception

Ci=index of postpartum infecundability. $C_i = {}^{20}/_{(18.5+i)}$ where i is the duration of the postpartum infecundable period. In cases where there is no breast-feeding in the population, i is estimated to be 1.5 which is the number of months that Bongaarts estimated for the return of menses in populations with no lactation (Bongaarts, 1978).

They substitute the TFR for the number of births of second order and more (*B*), and estimate the number of births that would have been obtained had there been no lactation in the population (that is, holding the number of months of the infecundable period at 1.5), which allows them to estimate how many births are being averted thanks to breastfeeding:

$$B_{averted} = B_{observed}\left(1 - \left({}^{18.5 * 1.5}/_{20}\right)\right)$$

As a result of this exercise, Becker, Rutstein and Labbok (2003) conclude that breastfeeding contributes to avert an important number of births in the six countries that they are studying[6], and that the importance of breastfeeding depends on how prevalent this phenomena and contraception are in the country.

Nevertheless, the results of this exercise rely on two important assumptions, which may not hold true: 1) that women who do not lactate have an amenorrhea of only 1.5 months; and 2) that all women in a country are not lactating and decide to switch to a breastfeeding scheme. Furthermore, this simulation scheme allows to estimate the effect of breastfeeding, but not the effect of the lactation amenhorrhea method.

Methodology:

We build upon the method of Becker, Rutstein and Labbok (2003) to estimate the effect of the lactation amenhorrea method in women in low-contraceptive prevalence countries, but contrary to these authors we allow the period of amenorrhea to vary according to the breastfeeding scheme of the women. We begin by calculating the Total Fertility Rate of order two and more defined as the births of second order divided among women who have had at least one birth, and then estimate the median amenorrhea for women who were breastfeeding exclusively during the first six months, women who were breastfeeding exclusively beyond the six months, women who where breastfeeding almost exclusively (supplementing with teas and non-caloric liquids), women who were in a mixed breastfeeding (breastfeeding and supplementing with caloric liquids and solid food), and women who were not breastfeeding. Once we have this information, we estimate the total fertility rate as a weighted indicator of different amenorrhea periods and the percentage of women in each breastfeeding categories, as follows:

[6] Burkina Faso, Uganda, Indonesia, India, Brazil, and Peru.

$$TFR_2 = C_m * C_a * C_c * \frac{20}{18.5 + am_{NL} * NL + am_{Ex}Ex + am_{Mx}Mx + am_{SE}SE} * TF$$

Where:

am_{NL}=Median amenorrhea among non lactating women

NL=Percentage of non lactating women

am_{Ex}=Median amenorrhea among women in exclusive breastfeeding

Ex=Percentage of women in exclusive breastfeeding

am_{Mx}=Median amenorrhea among women in mixed breastfeeding

Mx=Percentage of women in mixed breastfeeding

am_{SE}=Median amenorrhea among women in Semiexclusive breastfeeding

SE=Percentage of women in semiexclusive breastfeeding

The time to the return of menses is taken as an indication of the of the fecundability of the women, as this is the way that Bongaarts' model (1978) specifies it because the first postpartum menstruation is closely associated with the return of ovulation, and consequently with the risk of pregnancy. In addition, different studies, both from the demographic and the biological fields have noted that there is a strong relationship between breastfeeding, amenorrhea and ovulation (Bongaarts and Potter date ; Wood 2008). In principle, in the absence of breastfeeding, menstruation returns on an average of about 1.5 to 2.0 months postpartum, while ovulation is resumed in the second posptpartum cycle (Wood 2008). Among lactating women, the return of ovulation can be delayed many months and is highly dependent upon the intensity of suckling (Wood 2008)[ii]. Furthermore, since the return of menses is easier to measure than the return of ovulation, different studies use postpartum amenorrhea as an indicator of the postpartum infecundable period (see for example Becker; World Health Organization 1998). That will be the strategy followed in this paper.

There are several other aspects worth mentioning about the relationship between the end of amenorrhea and its relationship with women's fecundability.

As a consequence of the relationship between the intensity of suckling and the return of menstruation, in many cases amenorrhea ends before breastfeeding (Habich, 1985; Wood 2008). This makes the end of amenorrhea a better indicator of ovulation than the end of breastfeeding. An analysis on the determinants of the return of menses with 4118 breast-feeding mothers from China, Guatemala, Australia, India, Nigeria, Chile, and Sweden showed that there are several factors related with breastfeeding behaviors, the nutritional conditions of the mother, and unexplained contextual and cultural differences that determine the duration of amenorrhea. The authors of this study divide the determinants of the duration of amenorrhea in groups, the first of them being whether the woman is still breastfeeding (with no difference between partial and fully breastfeeding) or if the infant has been weaned, which is related to shorter amenorrheas. The second determinant of the duration of amenorrhea is the intensity of breastfeeding. The third is whether the mother has started giving supplements of any kind to the infant. The more supplementation is delayed, the longer the amenorrhea. The fourth determinant is parity. The authors show that higher parity women have longer amenorrheas, which they argue, can be related to their lower socioeconomic status. This is also the case with body mass index; low body weight is associated with a more prolonged bleedings, in part because of pathologic amenorrheas. Finally, in addition to these variables, there are unobserved contextual factors that make amenorrhea to vary from one country to the other (World Health Organization 1998).

It must also be noted that menses can be an imperfect indicator of ovulation among breastfeeding women as menstruation can either precede or follow ovulation (Wood 2008, Eslami 1990). This is especially true during the first six months postpartum, when evidence referring to the relationship between menses and ovulation can be mixed. A study by Eslami and colleagues (Eslami et al. 1990) with 40 postpartum breastfeeding women in Manila, in the Philippines, found that about 67 percent of menses in the first six months were anovular, whereas after six months postpartum the proportion of anovular fist menses was only 22 percent. On the other hand, a larger study with 236 urban Chilean women found that the first postpartum bleeding is a good indicator of the return of fertility among fully breastfeeding women, when within the first six months postpartum (Díaz et al. 1988).

As for the length of menses, several studies have reported that breastfeeding is associated with amenorrheas of twenty months or more. Wood et al. (1985, quoted in Wood 2008) found that, among Gainj women in Papua, New Guinea, breastfeeding delayed ovulation by a median of more than 20 months. Similarly, a study in the United States demonstrated, at the individual level, that anovulations of two years or more where not uncommon among women nursing frequently and over long periods (Stern et al., 1986, quoted in Wood 2008).

In this paper we use women who are breastfeeding exclusively and women who breastfeeding semiexclusively (those who are supplementing breastfeeding with water), given that some studies (Kennedy and Visness 1992) have found that the difference in the cumulative probabilities of ovulation and cumulative pregnancy rates between women who are exclusively breastfeeding and those who are partly breastfeeding is not considerable.[iii]

Long breastfeeding is of key importance for the survival of the child, as it promotes long birth intervals (DaVanzo et al. 1983, Hobcraft et al. 1983, Palloni and Millman, 1986, Palloni and Tienda, 1986), and also the nutrients and immunological protection that the children obtain from the mother are key for their survival (Wood 2008).

The evidence above refers to breastfeeding women. There is no study, to my knowledge, about the factors that associate to the length of amenorrhea for women who are not breastfeeding. If anything, as was mentioned above, the assumption is that in non-breastfeeding women, biological factors will prevail and the return of menses will be within the first two months postpartum. One can also question also whether the cultural and other sociodemographical factors that have been found in the literature to explain the differences in the duration of amenorrhea between breastfeeding women, such as context, nutritional status and parity play a role among non-breastfeeding women. This question is of key importance because as will be shown later, the data in this study indicates that median durations of amenorrhea among non-breastfeeding women are not close to 2.0. Furthermore, this being the main determinant of postpartum infertility, it is important to determine what explains the duration of postpartum infertility among these women.

To obtain the median amenorrhea, I use women's own definition of whether they have resumed menstruating or nor at the time of the interview. With this information and the number of months that have passed since their delivery I construct period life tables that allow me to obtain the median amenorrhea in each country. This strategy differs somewhat from the approach used by other authors who prefer more complex indicators to indicate the end of amenorrhea[iv] (see Labbock et al. 1997), arguing that women can sometimes misidentify their first bleedings for menstruations. Unfortunately, the data I use does not allow this detail in the analysis. The same data has been used, however, by other authors (see for example Becker)

Data:

We use data from the Demographic and Health Surveys for the following countries: Benin 2006, Burkina Faso 2007, Haiti 2005, Indonesia 2003, Mali 2005, Nigeria 2008, and Zambia 2007. We chose these countries because they had low contraceptive use prevalence, and enough cases of women breastfeeding exclusively. Table 1 shows the contraceptive use prevalence and total fertility rate of the countries included in the modeling exercises

Table 1: Contraceptive use prevalence and total fertility rate of the countries included in the modeling exercise

COUNTRY	CONTRACEPTIVE USE PREVALENCE		TOTAL FERTILIY RATE
	All Methods	Modern Methods	
Nigeria 2008	15	10	5.7
Malí 2005	8	6	6.6
Haití 2005	32	25	3.5
Indonesia 2003	61	57	2.6
Burkina Faso 2007	13	9	5.9
Benin 2006	17	6	5.6
Zambia 2007	41	33	6.2

SIMULATION I: TOTAL FERTILITY RATE

	Nigeria, 2008	Haiti,2005	Indonesia,2003	Burkina Faso,2007
TFR of order 2 and more	5.2	3.8	2.5	5.2
Simulation 1	6.2	5.7	4.3	5.8
Simulaiton 2	5.3	5.2	2.8	4.7

Simulation 1: Simulated TFR of order 2 and more if mothers who never breastfeed and mothers who followed a mixte breastfeeding, were to breastfeed exclusively
Simulation 2: Simulated TFR of order 2 and more if mothers who never breastfeed and mothers who followed a mixte breastfeeding, were to breastfeed semiexclusively, even if this breastfeeding lasted more than six months.

The results of these simulations show that if all women who never breastfeed or women who were breastfeeding in a mixed scheme (supplementing with caloric liquids and solids) were to breastfeed exclusively for six months, the total fertility rate would increase in all cases. This is because women who do not breastfeed or women who are breastfeeding in a mixed schedule have a more prolonged amenorrhea than women who breastfeed exclusively. This increase can be as extreme as to increase almost two children in the case of Haiti (from 3.8 to 5.7) and Indonesia (from 2.5 to 4.3).

If women were to change from their mixed scheme or not breastfeeding to breastfeeding semiexclusively, and allowed to breastfeed for a longer period, that is not to cut breastfeeding at six months, the effect on the TFR would be almost insignificant.

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[i] Occasional tastes of food and liquids are permitted, as long as they do not replace a feeding at the breast or given regularly (Kennedy and Trussell 2009) .

[ii] It is not clear yet what is more important for the continuation of anovulation, if suckling frequency, duration of the suckling episode, or the total duration of suckling over a 24-hour period (Wood 2008).

[iii] According to Kennedy and Visness review, the cumulative probability of ovulation of partly breasfeeding women was 30.9 at 6 months postpartum and 67.3 at 12 months postpartum, whereas for women following the three criteria of LAM this probability was 27.2 at six months postpartum. Similarly, the cumulative probability of pregnancy for partly breastfeeding women was 2.9 at six months postpartum and 5.9 at 12 months postpartum, while for women following LAM it was 0.7 at six months postpartum.

[iv] For example, Labbok et al. (1997) measure the end of amenorrhea by the presence of two contiguous days of bleeding that the woman considered similar to a menstrual bleed or heavier, or two contiguous days of spotting and one day of bleeding or three contiguous days of spotting.