

# Effective Methods for Mitigating Maternal Mortality in Developing Countries

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## ABSTRACT

Ninety-nine percent of maternal mortality occurs in developing countries; this is a global crisis, yet efforts to improve mortality rates in the short term have been largely uncoordinated and dispersed (Latt et al., 2019). Two promising options to reduce maternal mortality are improving access to contraception and distributing misoprostol, but to maximize investment potential the better method must be identified. This study examined the idea that increasing contraceptive access is the better short-term method to reduce maternal mortality in developing countries. The analysis centered on three studies on the effects of misoprostol and a single scoping projection on the effect of contraceptive distribution. The first study found that in transitioning from no misoprostol coverage to high misoprostol coverage, there could be a 25.49% reduction in maternal mortality. By contrast, a second study found that distributing misoprostol increased risk of maternal mortality because of increased hyperpyrexia, or elevated body temperature (Prata et al., 2014; Hofmeyr et al., 2013). A third study reported that misoprostol is unlikely to be misused and does not affect facility delivery rates (Tiruneh et al., 2019). By satisfying unmet need for contraception, there could be a 29% reduction globally in maternal mortality (Ahmed et al., 2012). Because there are limited studies available, it is difficult to draw a conclusion over which method is most effective. Based on current data, contraception distribution appears to be slightly more effective, but further research into both methods is necessary to guide resource distribution.

## Misoprostol

Misoprostol is a critical drug that is suggested for use in areas without substantial maternal healthcare access. Although originally used for treating gastroduodenal damage, its off-label uses include preventing and treating postpartum hemorrhage, which is defined as blood loss of 500mL or more after a birth (Allen & O'Brien, 2009; Anderson & Etches, 2007). Obstetrician and gynecologist Dr. Tamara Means (personal communication, January 24, 2022), who practiced for Johns Hopkins Medical System, describes that the most common type of postpartum hemorrhage is related to uterine atony, or the failure of the uterus to contract (Anderson & Etches, 2007). Misoprostol causes the uterus to contract and thus reduces the likelihood of or treats postpartum hemorrhage. It has significant advantages over other uterotonics, such as oxytocin, since it is both heat and light stable and thus does not require refrigeration (Anderson & Etches, 2007). Misoprostol is also generic and low-cost, and it can be administered orally as a tablet rather than as an injection (Anderson & Etches, 2007). As such, even the World Health Organization (WHO) Department of Reproductive Health and Research (2009), a leading authority on public health, recommends the usage of misoprostol in settings where it is not possible to use oxytocin or another injectable uterotonic.

Misoprostol can also be administered at home without skilled healthcare. Both women and community volunteers can correctly use misoprostol, even when illiterate (Management Sciences Health, n.d.). In Pakistan, administration of misoprostol by Traditional Birth Attendants for deliveries at home reduced postpartum hemorrhage by 24% (Mobeen et al., 2011). Similarly, in India, auxiliary nurses administered misoprostol for deliveries at home or at facility births without a doctor present, and there was a 50% greater reduction in postpartum hemorrhage in the control group than in the placebo group (Derman et al., 2006). Misoprostol can be utilized even by both attendants and patients

without extensive education and therefore may be an excellent choice in the treatment of postpartum hemorrhage in poor areas without medical professionals or strong infrastructure.

## Contraception

Contraception is defined as any method or device that is used in order to prevent pregnancy, including condoms, intrauterine devices, birth control pills, and implants. Across developing countries, large numbers of women have an unmet need for contraception, meaning that they do not desire another pregnancy but are not currently using a contraceptive method (Sedgh et al., 2016). Because of this, there is a higher risk of unintentional pregnancy, which can lead to maternal mortality due to abortion, dangerous pregnancies, or childbirth. Satisfying unmet need for contraception is a critical component of reducing maternal mortality.

## Methods

Four studies were analyzed: two studies examined the relationship between misoprostol and maternal mortality rates, one examined the relationship between misoprostol and facility delivery rates, and one examined the relationship between contraception and maternal mortality.

The first misoprostol study, titled “Modeling Maternal Mortality in Bangladesh: The Role of Misoprostol in Postpartum Hemorrhage Prevention,” and led by Ndola Prata MD, MSc, a public health physician and medical demographer from Angola, created a model of the effects of misoprostol usage on maternal mortality, estimating mortality for no, low, medium, and high misoprostol coverage. To do so, researchers trained field staff to administer misoprostol to women in Rangpur Division in Bangladesh and to record the effects. There were 118,500 women enrolled in the study, and 77,337 delivered during the study period. Postpartum hemorrhage and misoprostol administration statistics were recorded based on women’s self-reporting and verbal autopsies, and maternal mortality ratios in these communities were then compared to expected ratios from the Bangladesh Maternal Mortality Study. The data was analyzed using the Monte Carlo modeling technique using Crystal Ball 7 in order to model maternal mortality rates based on varying misoprostol coverage (Prata et al., 2014).

The second study was a review titled “Postpartum Misoprostol for Preventing Maternal Mortality and Morbidity” and was led by Justus Hofmeyr, at the Department of Obstetrics and Gynecology, East London Hospital Complex (2013). The researchers in this scoping review analyzed data to determine whether or not there was a significant change in maternal mortality as a result of misoprostol usage. The review included all women in the Cochrane database at least 24 weeks gestation who received misoprostol during the end of labor or in the postpartum period, versus a placebo group. The review encompassed 78 studies of 59,216 women and excluded 34 studies, and statistical analysis was done (Hofmeyr et al., 2013).

The final study on misoprostol was “Effect of Community-Based Distribution of Misoprostol on Facility Delivery: A Scoping Review” led by Gizachew Tadele Tiruneh, who works with the JSI Research & Training Institute, Inc. and The Last Ten Kilometers (L10K) Project in Addis Ababa, Ethiopia. This study analyzed evidence on effects of taking misoprostol on rates of facility deliveries, as a common concern regarding misoprostol distribution is the fear that it will encourage women to deliver at home instead of going to healthcare facilities. It also examined whether misoprostol was misused by participants. The study included peer-reviewed studies on misoprostol implementation from PubMed, Cochrane Review Library, Popline, and Google Scholar. There were three qualitative studies, seven observational studies, and four experimental or quasi-experimental studies, with a total population of 7564 women (Tiruneh et al., 2019).

The review regarding the relationship between contraception and maternal mortality was titled, “Maternal Deaths Averted by Contraceptive Use: An Analysis of 172 Countries,” conducted by various researchers affiliated with the Bloomberg School of Public Health. The researchers used information from the Estimation Inter-Agency

Group (MMEIG) database, the UN World Contraceptive Use 2010 database, and the UN World Population Prospects 2010 database, and they applied a statistical model to estimate the number of maternal deaths averted by contraceptive use in 172 countries in the year 2008. Using this same model, the researchers predicted how satisfying unmet need for contraception would affect maternal mortality rates in the future (Ahmed et al., 2012).

## Results

The data collected in these studies compares the efficacy of misoprostol with the efficacy of contraceptive usage, also considering any potential negative effects of misoprostol distribution.

There were widely varied results between the misoprostol studies. The study by Prata et al. found that with no misoprostol coverage, the average number of postpartum hemorrhage deaths expected would be 51 (standard deviation 9.30) per 100,000 live births; with low coverage (40%), the mean number of deaths expected would be 45 (standard deviation 8.26) per 100,000 live births; and for high coverage (80%), the mean number of PPH deaths would be 38 (standard deviation 7.04) per 100,000 deaths. Thus, in transitioning from no misoprostol coverage to high misoprostol coverage, there could be a reduction of 13 postpartum hemorrhage deaths per 100,000 births, or 25.49% (Prata et al., 2014).

However, the study by Hofmeyr et al. reached an entirely different conclusion, finding that misoprostol distribution increased the risk of maternal mortality and morbidity. This was due to hyperpyrexia, or elevated body temperature; versus placebo, misoprostol administration increased cases of hyperpyrexia by 8.5%, leading to some fatalities. All misoprostol deaths took place with doses of 600 micrograms or greater. The conflicting results between these studies raises questions on the efficacy of misoprostol in practice (Hofmeyr et al., 2013).

Some experts fear that misoprostol distribution will reduce rates of facility delivery or lead to women misusing the medication. However, the study by Tiruneh et al. found that misoprostol distribution has no significant effect on facility delivery rates (confidence interval of 95%) and the vast majority of women used the medication as instructed; there were a few isolated cases of misuse or improper self-administration (Tiruneh et al, 2019).

The contraception study by Ahmed et al. found that contraception usage reduced 44% of maternal deaths in 2008 (around 272,000 deaths), and satisfying remaining unmet need could decrease maternal mortality by 29% (104,000 deaths) (2012).

## Interpretation

According to this research, both misoprostol and contraception have the potential to create similar reductions in maternal mortality, but there is not enough research available to reach a concrete conclusion. Thus, researchers must delve further into the subject and the pros and cons of each method. For example, misoprostol can be distributed in certain communities, but trying to distribute it to every single isolated community globally may be unrealistic logistically. As a whole, contraception appears to be slightly more effective because no identified studies directly contradict its efficacy against maternal mortality as with misoprostol. Furthermore, contraception is already rapidly disseminating, and it has additional benefits, including giving women more control over their future and improving the health of existing children (Sohn, 2020). Still, contraception is stigmatized in many communities, and both misoprostol and contraception can have potential side effects, which many women fear.

## Limitations

Each of these studies did have limitations. The study by Prata et al. relied on verbal autopsies, which could have been inaccurate, and it is possible that women who received misoprostol had better access to healthcare facilities and thus lifesaving care in the event of an emergency (2014). Furthermore, in contrast to the Hofmeyr review, which included

many studies, this study was focused on a single region, limiting the applicability of the results. The study by Tiruneh et al. only examined English language studies and found that very few studies met their inclusion criteria. Hofmeyer and his colleagues had similar issues, finding that the number of maternal deaths were too small for meaningful statistical analysis. If a single study was excluded, misoprostol no longer had a statistically significant effect on maternal mortality and morbidity. Hofmeyer also included certain studies with high performance and detection bias (2013). Lastly, Ahmed and colleagues emphasized that datasets from countries can often be wildly inaccurate, and some data had to be estimated (2012).

As a whole, this analysis was limited by the lack of available articles pertaining specifically to efficacy of misoprostol and contraception relative to maternal mortality. This review could have been more thorough if there were more studies to analyze and stronger trends could be identified. Furthermore, because the authors utilized different statistical analysis measures, it was difficult to compare which study had more significant results.

## Misoprostol Accessibility

As previously mentioned, certain groups believe that the usage of misoprostol in poor communities will be detrimental, not decreasing mortality rates and causing significant side effects. In order to reduce the likelihood of pyrexia and deaths, lower dosages should be recommended. There are also concerns that, even if misoprostol does not affect facility delivery rates, women cannot properly assess the amount of blood they have lost and will not administer it at the right time, especially if there are multiple babies (Tiruneh et al., 2019). Another genuine concern is that misoprostol does not help everyone. Dr. Means described that not all postpartum hemorrhage can be treated with misoprostol: “sometimes it’s a cervical laceration, sometimes it’s a vaginal laceration . . . sometimes it’s surgical bleeding that does not respond to misoprostol” (personal communication, January 24, 2022). Anderson and Etches also describe that postpartum hemorrhage can be caused by uterine atony, but also retained placenta, invasive placenta, and trauma (2007). This factor, combined with other aforementioned reasons, has led the WHO Department of Reproductive Health and Research (2009) to not currently recommend misoprostol for community distribution; instead, it recommends further research into distribution at the community level.

## Contraception Accessibility

It is important to note that in many countries, lack of access is not the main reason that women do not use contraception. In a study of 52 countries between 2005 and 2014, researchers used Demographic and Health Surveys and found that the most common causes of unmet need for contraception were infrequent sex, unmarried status, and fear of side effects (Sedgh et al., 2012). These causes cannot be as easily addressed as a general lack of accessibility because they involve cultural stigmas and beliefs about low risk of pregnancy. For example, in western Kenya, 57% of teachers believed that contraceptive usage reduced future fertility (Meurice et al., 2021). Nevertheless, through increased education, contraceptive counseling, and cultural changes, more women should be encouraged to pursue contraceptive methods, even if they have infrequent sex, and should be assured of their safety.

## Conclusion

Maternal mortality is preventable with the advent of modern healthcare. Pregnancy and childbirth are beautiful processes, but not when they risk a woman’s health. While contraception may be slightly more effective in reducing maternal mortality than misoprostol, there has not been enough research into either. More has to be done to identify if misoprostol and contraception can truly both produce standard reductions in maternal mortality across the board, and if so, which method is more likely to be accepted and used safely in all communities. Special emphasis needs to be placed on directly comparing different plans to reduce maternal mortality and doing cost-benefit analysis, rather

than focusing on just one method. Once the better method is identified, foundations should allocate the majority of their resources to improving access to it in developing countries. Regardless of which method is more beneficial, consistent accessibility, especially due to supply chain issues exacerbated by the COVID-19 pandemic, must be prioritized. If distribution organizations work in tandem with vulnerable women, maternal mortality can be significantly reduced.

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