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IMPROVING REPRODUCTIVE HEALTH

Global warming and reproductive health

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ABSTRACT

The largest absolute numbers of maternal deaths occur among the 40–50 million women who deliver annually without a skilled birth attendant. Most of these deaths occur in countries with a total fertility rate of greater than 4. The combination of global warming and rapid population growth in the Sahel and parts of the Middle East poses a serious threat to reproductive health and to food security. Poverty, lack of resources, and rapid population growth make it unlikely that most women in these countries will have access to skilled birth attendants or emergency obstetric care in the foreseeable future. Three strategies can be implemented to improve women's health and reproductive rights in high-fertility, low-resource settings: (1) make family planning accessible and remove non-evidenced-based barriers to contraception; (2) scale up community distribution of misoprostol for prevention of postpartum hemorrhage and, where it is legal, for medical abortion; and (3) eliminate child marriage and invest in girls and young women, thereby reducing early childbearing.

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1. Introduction

The world is more deeply divided demographically, economically, and in terms of the maternal and infant mortality ratios (MMR and IMR, respectively) than ever before. In 2010, the United Nations Population Division published revised population projections for the remainder of the 21st century [1]. These set a challenging agenda for FIGO, policymakers, and development agencies.

The contemporary world is separated into 3 very different environments. Forty-two percent of countries are at replacement level fertility, where the total fertility rate is less than or equal to 2.1. An additional 40% of countries are classified as intermediate fertility, averaging between 2.1 and 4.0 children per woman, with birth rates that will likely continue to decline. The remaining 18% of countries are classified as high fertility, where women have, on average, 4–7 children [1]. These high-fertility countries comprise the Sahel, extending across central Africa and on to Yemen, Afghanistan, and the northern states of India. The high-fertility countries are some of the least developed economically and remain lowest on the Human Development Index [2]. Most of the estimated 40–50 million women who deliver annually without a skilled birth attendant live in these regions. In addition, child marriage is common and polygamy widespread [3]. These regions are also ecologically unstable and vulnerable to climate change. Yemen, for example, is already short of water and the population is projected to grow from 24 million today to 59 million in 2050.

In both the high and low United Nations population projections for the second half of the 21st century, these high-fertility countries (current total population of 1.2 billion) will become the largest segment of the global population, with between 2.8 and 6.1 billion people (Fig. 1). The challenge facing the international community is that these high-fertility countries are also those with a weak or practically nonexistent health infrastructure. The proportion of deliveries without a skilled birth attendant is unlikely to fall in the foreseeable future, and these are the regions where the greatest absolute number of maternal deaths is likely to occur.

Yemen and Afghanistan are failing states, and Somalia has descended into chaos. The worst drought in 60 years is forcing hundreds of thousands of refugees to trek hundreds of miles to feeding centers in Kenya. The collision between global warming and rapid population growth has the potential to initiate a major humanitarian disaster in which women and children will be most affected. Forestalling such a disaster will require bold new policies to promote the reproductive health of women living in these countries, and major investments by the international community in women's health and education.

2. Global warming

While greenhouse gases are certain to continue to increase, predicting the impact of this change on specific regions of the world remains difficult. Changes in cloud cover, the melting of glaciers, and other variables lead to what is called an asymmetrical uncertainty. While absolute precision in forecasting the impact of climate change on high-fertility countries may remain illusory, the most likely scenario is that desertification will increase and rainfall will become more erratic. In a country such as Niger, where only 12% of the land has rain-fed

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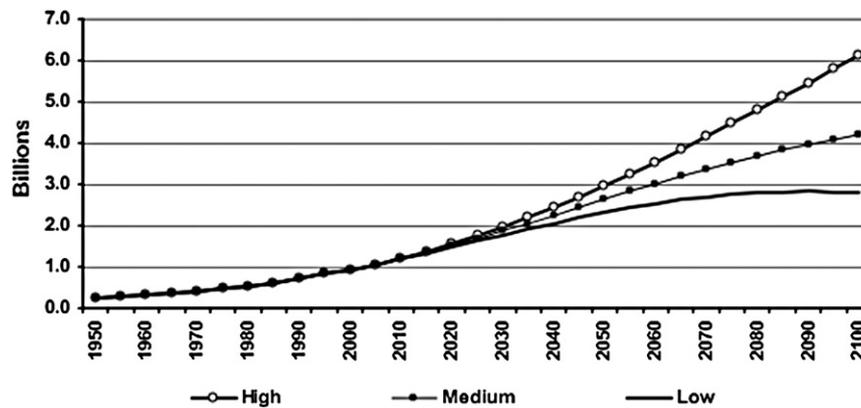


Fig. 1. High, medium, and low population projections for high-fertility countries, 1950–2100.

agriculture [4], crop yields will fall and the animal herds on which pastoralists depend will die.

Climate change is driven primarily by higher per capita consumption in the North. The poorest 1 billion people living on less than US \$2 per day contribute only 3% of the world's carbon footprint, yet the loss of healthy life years resulting from global warming could be as much as 500 times greater in Africa than in Europe [5].

Rapid population growth in high-fertility countries will make it exceedingly difficult for these countries to adapt to climate change. In an already fragile ecologic system, the increasing destruction of trees for firewood and by animal herds will exacerbate the adverse effects of climate change. In Niger, approximately 2 million tons of wood is burned annually, primarily to cook food; yet only 1 million tons of new wood grows and this will likely decrease as global temperatures rise.

3. The Sahel

In Arabic, *Sahel* means “shore.” The ecologically defined region comprises a 2000-mile strip of land fringing the southern border of the Sahara desert, starting where the Atlantic Ocean meets Senegal and ending where Eritrea meets the Red Sea. Over 50 million individuals live in this region today.

Scientists studying geologic deposits have shown that even before global warming, the region was subject to severe and prolonged droughts [6]. Droughts that used to occur once every 10 years or more are now occurring every 5 years or even more frequently. The Sahel, in words that are unusually direct for a United Nations agency, “is almost inevitably heading towards an environmental disaster” [7].

4. Rapid population growth

Current projections estimate that the population of Niger will grow from 15 million today to almost 60 million in 2050, while assuming that total fertility will be reduced by half (Fig. 2). As a result of the population momentum built into the current high-fertility countries, even if everyone in Niger was to have only 2 children tomorrow, the population would continue to grow [8]. Based on current population projections, all countries of the Sahel and across into Yemen and Afghanistan are likely to witness continued population growth during the second half of the 21st century. Marriage is virtually universal throughout the Sahel. As the number of women exposed to pregnancy increases, the absolute number of women dying in childbirth will also increase.

Rapid population growth, combined with a weak educational infrastructure, is outpacing the ability of many governments to reduce illiteracy. In Niger, only 15% of girls enter primary school and only 1% complete it. A mere 1 in 1000 girls graduates from secondary school [9]. Population growth is outstripping economic growth and, given the lack

of education for young girls and women, the chances of developing nonagricultural sources of employment are minimal.

5. Strategies for MMR reduction

5.1. Limitations of the current obstetric services

The categorization of total fertility rates into replacement, intermediate, and high reflects options for reducing maternal mortality (Table 1). Forty percent of the world's population at replacement-level fertility or below has maternal mortality ratios ranging from 6 (Australia and Canada) to 50 (Ukraine) per 100 000. These relatively low ratios were likely brought about by increased access to skilled birth attendants and a high proportion of deliveries occurring in excellent obstetric facilities. The MMR in some intermediate-level countries remains relatively high, but it is likely to continue to decline as skilled birth attendants become more available and access to emergency obstetric care continues to improve.

In high-fertility countries, particularly in the Sahel, conditions are likely to deteriorate because of climate change. It is unlikely that strategies built around increasing access to skilled birth attendants and emergency obstetric care can be brought to scale. In Sub-Saharan Africa as a whole there were an estimated 204 000 maternal deaths during 2008 (MMR 640 per 100 000) [10]. Seven out of every 10 deaths occur in 16 countries where fewer than 50% of births are attended by a skilled birth attendant. Many of these countries, such as Chad, Mali, Niger, Eritrea, Somalia, and Ethiopia, are located in the Sahel. From 1990–2010, there was little improvement in the percentage of births attended by skilled professionals among these countries, and improvement is unlikely in the future [11]. Many physicians and midwives have migrated to more developed settings and this trend is likely to continue. Lack of access to health facilities,

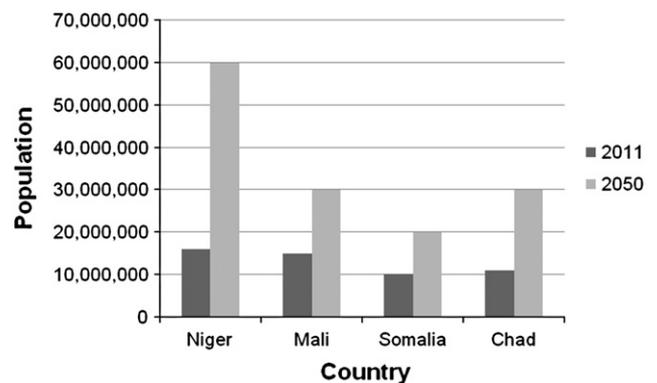


Fig. 2. Current and projected populations of several high-fertility countries, 2011–2050.

Table 1
Obstetric strategies by fertility rate.

Total fertility rate	2 and under	2.1 to 4	Over 4
Maternal mortality rate	6–50	40–550	500–1500
Population change	Late childbearing, high contraceptive prevalence, safe abortion available. Unintended pregnancy rate in the USA remains high.	Large unmet need, but birth rates likely to continue to fall if the barriers to family planning are removed and appropriate investments made.	Limited unmet need, continued high population growth (double or triple by 2050) and continued growth likely into the foreseeable future. Delaying first birth plays an important role in slowing population growth.
Policies	Most national health systems provide complete family planning coverage.	Subsidy of commodities and training still needed. Some countries still make abortion illegal. Remove non-evidenced-based barriers to family planning. Engage the private sector.	Define and enforce laws raising the age of marriage. Keep girls in school. Provide girls and young women a “safe space.” Task shifting in family planning and community empowerment. Comprehensive abortion care (CAC) is needed.
Safe motherhood	Low MMR already. Further declines possible.	Achieve universal access to skilled birth attendants plus task shifting at community level. Emergency obstetric care.	Focus on the 40–50 million women in these regions who deliver at home without a skilled attendant. Reduce high MMR by family planning at the community level, plus misoprostol for PPH and CAC also at community level.
Cost to international community	Zero.	Commodity subsidies, some training, and countering misinformation.	Commodity and informational back-up to make misoprostol widely available for controlling PPH. Conditional cash transfers to keep girls in secondary school, investing in “safe spaces” for girls going through puberty. Improve access to family planning and social marketing. Empower communities, counter misinformation, and CAC.

medical staff, and drugs combined with the cost of transportation and other fees deter many women from using the limited facilities that are available [12]. The World Health Organization has estimated that in Niger there are only 288 physicians (0.2 per 10 000 population) and 2115 nursing and midwifery personnel (1.4 per 10 000 population) serving a population of nearly 16 million [13]. The training of new health professionals is simply not keeping pace with the increase in the number of fertile women.

5.2. Achievable strategies

While striving for an increase in the number of skilled birth attendants and improved access to medical facilities is a laudable goal, tens of millions of women are going to continue to deliver at home without access to skilled birth attendants. Bangladesh is an example of a country that has made a commitment to increase the number of skilled birth attendants, improve access to emergency obstetric care, and build more health facilities. However, by 2007 only 2000 out of a planned 15 300 skilled birth attendants had been deployed [14]. Fortunately, a good deal can be done to help those vulnerable women who will continue to deliver at home without a skilled birth attendant.

5.2.1. Family planning

A woman cannot die from a pregnancy she does not have. Analysis of the remarkable decline in maternal mortality ratios over the past century in Europe suggests that approximately half the reduction in mortality was due to family planning, while the other half was due to improved obstetric care [15]. From 1990–2008, maternal mortality declined by more than 60% in Eastern Asia, resulting in an MMR of 41 per 1000 women. The contraceptive prevalence in Eastern Asia is 86%, as opposed to 22% in Sub-Saharan Africa [10].

Family planning is a choice, not a diagnosis, and it is possible to empower communities to distribute many methods of contraception. Operations research in Ethiopia and elsewhere has shown that community members can use the injectable contraceptive depot medroxyprogesterone acetate (DMPA) safely and responsibly [16]. Unfortunately, family planning remains over medicalized in many settings, particularly in French-speaking Africa, where eliminating non-evidence-based unnecessarily conservative policies (such as measuring blood chemistry before prescribing oral contraceptives) has proved difficult to reverse [17].

Family planning is highly cost-effective. One estimate puts the cost of family planning at US \$6.10 to \$34.59 (2007) per couple years of protection [18,8], while some social marketing programs are even less expensive.

5.2.2. Traditional birth attendants

Since it was founded in 1972, *Gonoshasthaya Kendra* (GK), roughly translated as “The People’s Health Centre,” in Bangladesh has skilled and supervised traditional birth attendants (TBAs), but left them as self-employed members of the rural community, responsible to that community. GK currently provides services to approximately 1 million people and 80% of rural women in its catchment area are delivered by TBAs. GK has reduced the MMR from approximately 300 to 186 per 100 000 births. This is 40% lower than the MMR for the rest of Bangladesh [14]. However, GK is an exception, and most efforts to evaluate TBA training have failed to show a significant positive impact on MMR [19]. In retrospect, this is not surprising as until the advent of misoprostol there were no practical interventions that TBAs could implement with any significant potential of reducing the MMR (washing hands or cutting the umbilical cord with a clean razor blade are good ideas, but unlikely to lower a high MMR). Unfortunately, even if the diagnostic skills of TBAs could be improved, predicting obstetric complications prior to delivery is notoriously difficult. Misoprostol ushers in a different era for all TBAs in all settings.

5.2.3. Community distribution of misoprostol

Postpartum hemorrhage is the most common cause of maternal death in low-resource settings. Misoprostol is a powerful uterotonic that is heat stable, easily administered orally, and relatively low cost. Several studies have demonstrated that misoprostol is as effective as oxytocin in preventing postpartum hemorrhage in low-resource settings. In 2009, Eftekhari et al. [20] found that mean blood loss was significantly lower among women receiving misoprostol compared with oxytocin. In another study, women receiving misoprostol suffered significantly less blood loss 4 hours post surgery compared with women receiving oxytocin [21]. In practice, where hospitals are overburdened, refrigeration may not exist, and not every woman has an intravenous drip, misoprostol is consistently better than oxytocin in controlling postpartum hemorrhage [22]. In home deliveries without a skilled birth attendant, misoprostol has been used safely by community health workers to control postpartum hemorrhage [23,24]. The drug is typically distributed during pregnancy and then

self-administered by the pregnant woman as soon as the baby is delivered. In Afghanistan, the cost of training TBAs, including the use of misoprostol, ranged from US \$3 to \$17 per trainee. Bradley et al. [25] concluded that such training could prevent over 1600 cases of postpartum hemorrhage and save over US \$115 000 per 10 000 births in low-resource settings.

Nigeria was the first low-resource country to approve misoprostol for obstetric indications and the government is currently scaling up distribution at the community level. It will be impossible to achieve a significant reduction in the MMR in low-resource settings unless the community distribution of misoprostol is an established strategy. In Bangladesh, community distribution of misoprostol is now government policy. Several hundred thousand women have used the drug and preliminary evaluation suggests an 80% reduction in postpartum hemorrhage [26]. Given modest budgets and appropriate policies, the use of misoprostol could be scaled up in all high-fertility countries where its widespread use has the greatest potential to save the highest number of maternal lives.

5.2.4. Abortion

Abortion is illegal in most of Sub-Saharan Africa, except for South Africa and Ethiopia. Both first trimester manual vacuum aspiration (MVA) and medical abortion can be performed safely, even in low-resource settings. Ethiopia is a world pioneer in the safe and effective use of medical abortion using misoprostol provided by community health extension workers. Medical abortion has the advantage over MVA in that many providers can be taught at the same time and without clinical contact with a stream of individual patients. Where abortion is illegal, MVA or uterine evacuation with misoprostol are appropriate, safe, and cost-effective ways of treating incomplete abortions [15]. Abortion should always be made available in the framework of comprehensive abortion care where women receive the best possible family planning advice, including the immediate provision of contraception.

5.2.5. Child marriage

High-fertility countries will not slow population growth until the average age of marriage and first birth is raised. Bruce and Bongaarts [27] calculated that increasing the age of marriage by 5 years reduces population growth between 15% and 20%. Globally, 25 000 underage girls are married to older men every day. In Niger, where the average age of marriage is under 16 years, 1 in 5 women have 10 or more children [9]. These women rarely have the opportunity to learn how to manage childbearing later in life. To reduce child marriage, girls should be kept in school and empowered to decide when and if they want to marry and have children.

6. Conclusions

Forty to 50 million women deliver each year without a skilled birth attendant, mostly in high-fertility countries that are particularly vulnerable to climate change. Family planning, community distribution of misoprostol, and delaying the first birth are essential strategies in slowing rapid population growth in these high-fertility countries and must be combined with the maximum investment in health and education infrastructure. Slowing rapid population growth is a prerequisite to allow countries vulnerable to climate change to develop appropriate adaptive policies. Without investing in women, huge numbers of deaths from starvation and rising levels of violence could occur over the remainder of the 21st century.

Conflict of interest

The authors confirm that they have no conflicts of interest to disclose.

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