Global Levels of Contraceptive Use by Married Women Have Risen, Especially in Developing Countries

The proportion of reproductive-age married women who use a modern or traditional contraceptive method rose from 55% to 63% between 1990 and 2010, according to a global analysis.[1] Most of the increase was due to a 10–percentage-point rise in contraceptive prevalence in the developing world, although contraceptive use also increased in developed countries. The proportion of married women with an unmet need for family planning declined from 15% to 12% worldwide, but remained above 25% in 42 countries, most of them in Africa. Overall, 146 million married women had an unmet need for family planning in 2010–131 million in the developing world and 15 million in developed countries.

To estimate contraceptive prevalence and unmet need among women aged 15–49 who were married (or in a cohabiting union), the researchers developed statistical models that incorporated data from Demographic and Health Surveys, Multiple Indicator Cluster Surveys, Reproductive Health Surveys and other nationally representative household surveys. Analyses incorporated 930 observations of contraceptive prevalence for 194 countries, and 306 observations of unmet need for 111 countries. For each country (and related region and subregion), the investigators estimated contraceptive prevalence and unmet need for family planning for every year from 1990 to 2010 and made projections to 2015. They modeled contraceptive prevalence with a logistic growth curve and unmet need for family planning as a function of contraceptive prevalence. Country-specific estimates and projections were created using a Bayesian hierarchical model that drew not only on observations for the country of interest but also on subregional, regional, and global information. In addition, the model took into account differences among survey observations in the measurement of contraceptive prevalence and the population group represented. The researchers calculated uncertainty intervals for all estimates and projections to enable assessment of whether changes over time were statistically significant.

The analyses revealed that between 1990 and 2010, contraceptive prevalence among married women of reproductive age increased from 55% to 63%. Most of this change was driven by a 10–percentage-point rise in prevalence (from 52% to 62%) in developing countries. In developed countries, the prevalence increased by three percentage points, from 68% to 71%. Prevalence increased faster during the 1990s than during the subsequent decade, both globally and in developing countries. In 2010, at least two-thirds of married women of reproductive age were using contraceptives in North America (77%), Latin America and the Caribbean (73%), Europe (72%) and Asia (67%); however, only three in 10 African women (31%) were doing so.

Regionally, the rise in contraceptive prevalence was greatest in Africa (14 percentage points), Latin America and the Caribbean (12 points) and Asia (10 points). Gains were smaller in North America (5 points) and Europe (4 points), the two regions where prevalence had been highest in 1990. Although increases tended to be greatest when baseline prevalence was lowest, this was not always the case; for example, in 1990, the prevalence in Oceania (60%) was similar to that in Latin America and the Caribbean (62%), but while prevalence rose substantially in the latter region, it showed no change in the former.

Similarly, prevalence and related gains often varied widely within regions. In Africa, substantial increases occurred in the Eastern (21 percentage points), Southern (16 points), and Northern (16 points) subregions, but gains were smaller (7–8 points) in Middle and Western Africa, the two subregions where prevalence had been lowest in 1990. Prevalence increased by at least 10 points in four of the five subregions in Asia; the exception was Eastern Asia, which had the highest prevalence in the world in both 1990 (77%) and 2010 (83%). In Europe, prevalence increased by eight and four percentage points in the Eastern and Northern subregions, respectively, but showed no meaningful change in the Southern and Western subregions.

Overall, prevalence increased by a statistically significant degree in 81 of the 194 countries. In absolute terms, increases in prevalence were greatest in Bhutan (50 percentage points), Cambodia and Swaziland (41 points each), Oman (35 points), and Malawi, Cape Verde and Iraq (33 points each). In 1990, prevalence had been less than 10% in 26 countries; by 2010, it remained under that threshold in only four: Chad, Mali, Sierra Leone and South Sudan. At the other end of the spectrum, the number of countries in which more than 80% of married women of reproductive age were using contraceptives increased from three to six (China, Costa Rica, Hong Kong, Malta, Norway and the United Kingdom). Only one country (Togo) had a statistically significant decline in prevalence.

As contraceptive use increased globally, levels of unmet need fell. Between 1990 and 2010, the proportion of reproductive-age married women who had an unmet need for family planning (either modern or traditional) declined from 15% to 12%. Nonetheless, the proportion with unmet need remained above 25% in three subregions (Eastern, Middle and Western Africa) and 42 countries (29 of them in Africa). One subregion (Eastern Asia) and four countries (China, Malta, United Kingdom and Costa Rica) had a level below 5%.

The decline in unmet need, as with the increase in contraceptive use, was greater in developing countries (from 17% to 13%) than in developed areas (from 11% to 9%). The subregions with the greatest declines in unmet need were Central America (from 21% to 12%), Northern Africa (from 24% to 15%), Southern Africa (from 22% to 14%) and Southern Asia (from 22% to 15%). In many other areas, such as Middle Africa, Western Africa, Southern Europe, Western Europe, North America and Oceania, little or no change occurred. Europe had a small decline (two percentage points).

Worldwide, 146 million married women of reproductive age had an unmet need for family planning in 2010, and 221 million had an

unmet need for modern methods. Because of population growth, the researchers estimate that by 2015 these numbers will increase to 153 million and 233 million, respectively. The vast majority of these women are in the developing world; in 2010, for example, 131 million married women in developing countries and 15 million in developed ones had an unmet need for any method.

One limitation of the study, the authors note, is the focus on women who were married or in a union, though the researchers add that their methodology can be used to generate estimates and projections for all women. A general challenge for measuring family planning trends is the lack of data on unmet need. In this study, data on unmet need were unavailable for 83 countries; although

their models provide "reasonable estimates" for these countries, the authors caution that "substantial uncertainty" surrounds the results. Nonetheless, they emphasize that their estimates can serve as a yardstick for tracking progress in local and global efforts to promote and provide family planning, such as the pledge made by participants at the 2012 London Summit on Family Planning to provide modern contraceptive methods to 120 million women in 69 of the world's poorest countries.—*P. Doskoch*

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Nine in 10 Abortion Patients in Mexico City Receive Contraceptive Counseling After Their Procedure

The vast majority of women who obtained a public-sector legal abortion in Mexico City received contraceptive counseling after their procedure and decided on a method to use, according to a survey conducted at three public health facilities.[1] Women who had been attended by a female physician were far more likely than those attended by a male physician to be offered postabortion contraception and to choose a method (odds ratios, 3.0 and 6.3, respectively). In addition, the odds of having been offered a method were higher among women who had had a surgical abortion than among those who had had a medication abortion (5.4), and lower among women who had visited a general hospital than among those who had terminated their pregnancy at a primary health center (0.1).

Since the legalization of abortion in Mexico City in 2007, local Ministry of Health facilities have provided free or low-cost first-trimester abortion services. To gauge the quality of the family planning counseling that surgical and medication abortion patients receive, and to determine whether service quality is associated with women's characteristics and the circumstances of their procedure, the investigators surveyed 402 women aged 18–46 at a general hospital, a maternity hospital and a primary health center between September and December 2009. Three-fifths of public-sector abortions in Mexico City that year were performed at these three locations.

Women aged 18 or older who had obtained a first-trimester procedure were asked to participate in the survey on the same day as their surgical abortion or on the day of their follow-up appointment for a medication abortion. In face-to-face interviews conducted at each facility, women provided their social and demographic characteristics, and answered questions about their abortion and the family planning services they had received, including the contraceptive methods offered to them and the information they had received about STIs and emergency contraception. The investigators conducted logistic regression analyses that controlled for women's age and education, among other characteristics, to identify factors associated with their having been offered contraceptives by their provider and with having chosen a method.

On average, women were 26 years old and had been at eight weeks' gestation at the time of their abortion. Six in 10 had at least one child and four in 10 were married or in a civil union. Most lived in Mexico City (71%) and had at least a high school education (60%). Roughly equal proportions of the sample came from each of the three facilities; half of respondents had had a medication abortion and a similar proportion had been attended by a female physician. Some 81% of the women had been using a method when they became pregnant, most commonly condoms (33% of the full sample), the pill (16%), the

IUD (15%) and the injectable (7%).

The majority of women discussed post-abortion family planning with their abortion provider (88%) and said they had been offered at least one method during their visit (82%). Women were most often offered an IUD (73%), the pill (46%), the injectable (34%) or condoms (22%); other options offered included the implant, the patch and sterilization (2–4%). While 95% of women seen by a female provider were offered a contraceptive method, the same was true for just 69% of those whose provider was male. Ninety percent of women chose a method at this time—most often the IUD (59%)—and the vast majority (88%) did not feel that the provider had tried to influence their choice. Most women who were provided with contraceptive counseling said they understood the counseling (97%) and felt it was adequate (93%), but considerably lower proportions reported receiving information on when to resume having sex (68%) or on STIs (38%) or emergency contraception (26%).

Multivariate logistic regression analyses revealed that women who had had a surgical abortion were more likely than those who had had a medication abortion to be offered a contraceptive method (odds ratio, 5.4). Compared with those who had visited a primary health center for their abortion, women who had gone to a general hospital had lower odds of having been offered contraception (0.1). Women who had been attended by a female physician were substantially more likely than those attended by a male physician to have been offered contraceptives and to have selected a method (3.0 and 6.3, respectively). Other characteristics, including women's parity and marital status, were not associated with having been offered a form of postabortion contraception or having selected a method.

The researchers note that their findings are consistent with those of previous studies on public abortion services in this setting, but caution that the results are not generalizable to all facilities in Mexico City because the survey was limited to three of the city's 13 public facilities that provided abortion care at the time. In addition, the sample had higher proportions of younger and childless women than did the public abortion client population, and women's responses may have been subject to social desirability bias. Despite these limitations, the investigators conclude that facilities in Mexico City provide

a "high level of postabortion family planning care," although they emphasize the need for increased focus on emergency contraception, STIs and personalized contraceptive counseling during such care.–*S. Ramashwar*

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Child Marriage Associated With Suboptimal Reproductive Health

Child marriage is associated with unintended pregnancy, low levels of contraceptive use early in marriage and limited use of maternal health services, according to an analysis of Demographic and Health Survey data from Bangladesh, India, Nepal and Pakistan.[1] In at least three of the countries, and sometimes in all four, women who had married before age 18 were more likely than those who had married later to have had an unintended pregnancy (odds ratios, 1.5–3.8), to have had multiple unintended pregnancies (2.3–24.2) and to have not used contraceptives before their first live birth (1.3–2.5). In addition, child marriage was frequently associated with reduced odds of having given birth in a facility and having had skilled personnel at the delivery (0.5–0.8).

Although previous research has linked child marriage with a range of adverse reproductive health outcomes, much of this work has been done in India. To assess whether these associations are widely present in South Asia, researchers analyzed data from the four largest countries in the region that had had a Demographic and Health Survey since 2005—Bangladesh (2007), India (2005–2006), Nepal (2006) and Pakistan (2006–2007). Analyses focused on women aged 20–24 who were married, divorced or widowed; women who did not live with their spouse were excluded. In addition to compiling descriptive statistics, the researchers carried out logistic regression analyses, separately for each country, to identify associations between age at marriage (categorized as 14 or younger, 15–17 or 18 or older) and 10 outcomes; they used Poisson regression to assess associations with an 11th outcome, antenatal visits. Sample sizes for most analyses were about 14,600 for India

and 1,500–2,100 for the other three countries; however, analyses of rapid repeat childbirth (giving birth within 24 months of a previous delivery) were restricted to women with at least two children and used much smaller samples (6,400 for India and 700–1,000 for the remaining countries). All regression models controlled for women's age, residence (urban vs. rural), household wealth, educational attainment, religion, geographic area and age gap between spouses. In addition, analyses of contraceptive use adjusted for number of living sons, and those of use of maternal health care adjusted for birth order.

Although the legal age at marriage is 18 in Bangladesh, India and Nepal, early marriage was common in all three countries, especially in Bangladesh, where 39% of respondents had married during middle adolescence (ages 15–17) and 38% during early adolescence (14 or younger). The proportions who had married during middle adolescence were even higher in India (42%) and Nepal (50%), although the prevalence of marriage during early adolescence was much lower in these countries (17% and 12%, respectively). Child marriage was least prevalent in Pakistan, where the age of consent for marriage is only 16; some 36% of respondents had married during middle adolescence, and 14% during early adolescence.

For two fertility measures, no evidence of detrimental outcomes emerged among women who had married as children. Although at least one in six women in each country had given birth within the first year of marriage, the odds did not differ according to the timing of marriage. Rapid repeat childbirth, which was reported by 33–66% of women, was negatively associated with child marriage in India and Nepal (odds ratios, 0.6–0.7), and not associated with age at marriage in the other countries.

Some 14–24% of women in each country had had an unintended pregnancy, and 2–4% had had more than one such pregnancy. Both outcomes were positively associated with child marriage. In every country but Bangladesh, the odds of having had an unintended pregnancy were elevated among women who had married at age 14 or younger (odds ratios, 1.6–2.9) or at ages 15–17 (1.5–3.8), and in all four countries, women in one or both early marriage groups were more likely than women who had married later to have had multiple unintended pregnancies (odds ratios, 2.3–24.2). Marriage during early or middle

adolescence was consistently and positively associated with having had a pregnancy that ended in miscarriage, stillbirth or abortion (the three outcomes were grouped together, as per the source data); the associations were weakest in India (1.4–1.6) and strongest in Bangladesh (3.4–4.5).

The researchers examined three measures of contraceptive use. In every country but Pakistan (for which data were unavailable), women who had married before age 15 were less likely than those who had married at age 18 or older to have used contraceptives before their first live birth (odds ratios, 1.5–2.2); findings were similar among women who had married at ages 15–17 in India and Bangladesh (1.3–2.5). Perhaps because women who had married early had attained their desired family size at a young age, child marriage was often positively associated with current contraceptive use. In India and Bangladesh, women in one or both child marriage groups were more likely than those who had married as adults to be using a modern method (odds ratios, 1.5–2.6), and child marriage was positively associated with having been sterilized in India (5.4–10.4) and Nepal (4.7–9.1), the only countries where the number of women who had undergone the procedure was sufficient to permit analysis.

Analyses of maternal health care use were restricted to women's most recent birth. The number of antenatal visits they had had generally did not differ by age at marriage, although Bangladeshi women who had married before age 15 and Nepalese women who had married at ages 15–17 reported 8–15% fewer visits than did their counterparts who had married at age 18 or older.* Child marriage was frequently, but not consistently, associated with reduced odds of having delivered at a health care facility and having had skilled delivery personnel; in every country, the odds of one or both outcomes were lower among women in at least one of the child marriage groups than among women who had married as adults (odds ratios, 0.5–0.8).

The study's limitations, the authors note, include its reliance on self-reported, cross-sectional data; the small samples in some analyses; and the grouping of stillbirths and spontaneous and induced abortions. Nonetheless, the findings suggest that in South Asia, "child marriage is significantly asso-

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*Results for this outcome were reported as coefficients rather than as odds ratios because they were from Poisson regression models.

ciated with poor fertility outcomes, lower contraceptive use early in the marriage, and inadequate maternal health care use," and underscore the potential value of interventions that target women who married early. Unfortunately, designing and implementing such interventions can be a challenge, the researchers add, because women who marry early often leave school, do not work outside the home and have restricted mobility, "which makes them a hard-to-reach population for reproductive health programs."—*P. Doskoch*

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Young Men Who Feel That Wife Beating Is Sometimes Acceptable Have Elevated Fertility Desires

In a study of gender attitudes and ideal family size in five high-fertility East African countries, 15–24-year-old males who believed that wife beating is sometimes justified wanted 0.2–0.7 more children than did their counterparts who did not justify such behavior.[1] Two other measures of gender attitudes—the belief that a husband has ultimate decision-making authority in a household and has a right to sex—were less consistently associated with elevated fertility aspirations, but one or both were positively linked with fertility desires in two of the five countries.

In East Africa, the mean ideal family size is high, and total fertility rates are among the highest in the world. Numerous studies have found that males' fertility aspirations are associated with actual fertility rates, and that a female's fertility preferences are related to those of her partner. To explore the relationship between gender attitudes and fertility preferences, researchers analyzed data from the five East African countries—Ethiopia, Rwanda, Tanzania, Uganda and Zambia—that had a total fertility rate greater than 5.0 children per woman (using 2008 estimates) and had had a Demographic and Health Survey with a men's questionnaire since 2005 that covered key gender-related variables (all data were from 2005–2007). The authors focused on males aged 15–24 because most such men are entering conjugal unions and beginning their reproductive years. Analytic samples consisted of about 1,000–1,100 young men each from Tanzania and Uganda and 2,000–2,500 each from Ethiopia, Rwanda and Zambia. Linear and logistic regression analyses were used to identify associations between ideal family size and young men's gender attitudes and demographic characteristics.

The background characteristics of the country samples varied: Some 17–48% of young men lived in urban areas, 10–53% had at least some secondary education, 81–91% were unmarried and 85–93% had no living children. The percentage of respondents' households in which women's mean educational attainment was a year or less ranged from 12% in Zambia to 71% in Ethiopia. Total fertility rates varied from 5.3 children per woman in Ethiopia to 6.3 in Uganda, and young men's mean ideal number of children ranged from 3.8 in Rwanda to 4.8 in Tanzania; in every country but Tanzania, young men desired about 1.5 fewer children than the actual fertility rate.

Endorsement of the three gender attitude measures varied widely as well. The proportion of respondents who thought that wife beating was justified in at least one situation (i.e., if she burns the food, neglects the children, argues with her husband, goes out without telling him or refuses to have sex) ranged from 40% in Rwanda to 68% in Uganda. Men's agreement that a husband should be the final decision maker in at least one of three areas (how to spend a wife's earnings, how many children to have, and visits to family and friends) varied from 35% in Ethiopia to 83% in Tanzania. For the third gender measure, respondents were asked whether, if a wife refuses to have sex with her husband, he has the right to get angry, refuse to give her money or other support, force her to have sex, or have sex with another woman; agreement with at least one of these scenarios ranged from 32% to 66%.

In unadjusted regression analyses, men's gender attitudes were generally associated with elevated fertility desires: In all five countries, justification of wife beating was correlated with men wanting 0.4–0.9 more children, and in every country but Uganda, agreeing that a husband has decision-making authority and a right to sex was associated with wanting 0.2–0.7 more children. Notably, for each additional year of education among women in the household, men wanted 0.1–0.2 fewer children. To assess whether justification of wife beating was a reliable indicator of other male-dominant attitudes, the authors conducted an adjusted regression analysis and found that in each country such justification was associated with the belief that a husband has sexual rights (odds ratios, 2.6–6.6) and decision-making authority (1.5–2.6, except in Uganda).

In multivariate logistic regression analyses that controlled for men's background characteristics and women's educational attainment, justification of wife beating was the only gender attitude that was correlated with ideal family size in all five countries. Respondents who felt that wife beating was sometimes justified wanted to have 0.2–0.7 more children than did other young men. The beliefs that a man has a right to sex and has ultimate household decision-making authority were associated with increased fertility aspirations (0.2–0.4 more children) in two countries and one country, respectively. Finally, in an analysis that pooled data from all five countries and controlled for demographic variables and country, the belief that wife beating is sometimes justified was associated with wanting 0.4 additional children.

The investigators noted a number of study limitations: the low explanatory power of the final models, possible bias from the exclusion of some nonnumeric responses and missing data on women's educational attainment. However, they also pointed out several strengths, including the use of high-quality survey data, the inclusion of widely used fertility and gender attitude measures, and a welcome focus on young men's attitudes and fertility desires in a selection of high-fertility countries. The researchers suggest that East African governments that want to reduce their countries' fertility levels "may need to address the cultural transmission of traditional masculine values in younger cohorts," perhaps by employing some of the "growing number of programmatic interventions that encourage shared reflection on gender norms and values and that promote gender equality."—*J. Thomas*

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Low-Dose Mifepristone Regimens Are Effective And Safe for Early Abortion

Medication abortion regimens consisting of 200 mg of mifepristone followed by misoprostol are highly effective and safe during early pregnancy, according to an analysis of pooled data from 87 prospective trials.[1] Treatment failure occurred in 5% of the 45,000 women with evaluable data; ongoing pregnancy occurred in 1%. The odds of medication abortion failure were higher in trial groups in which at least 25% of women were more than eight weeks' pregnant than in groups with a lower proportion of such women (odds ratio, 1.5), and higher in groups taking misoprostol less than 23 hours after mifepristone administration than in those instructed to take it 23–72 hours after receiving mifepristone (2.1).

Although 600 mg of mifepristone followed by misoprostol is specified in most medication abortion regimens approved by government regulatory agencies worldwide, a 200-mg dose of mifepristone is widely used. Moreover, standards for the dose, route and timing of misoprostol have not been established. In the current analysis, researchers compiled existing data on the safety and effectiveness of medication abortion regimens consisting of 200 mg of mifepristone followed by misoprostol and used logistic regression to examine the associations between trial and population characteristics and abortion failure and ongoing pregnancy.

The data, collected at 314 sites in 35 countries (including more than a dozen developing nations), come from 87 published and unpublished trials in which at least one group of women was treated with an abortion regimen consisting of 200 mg of mifepristone followed by misoprostol. The majority of the trials were conducted between 1994 and 2011 (24 did not report data collection dates); 36 were randomized and 51 were prospective cohort or case series studies. Data on ongoing pregnancies were reported for 117 of the 120 study groups. For each trial, the researchers abstracted information on the study design, treatment protocol, number of women, participant characteristics, and the numbers of abortion failures, ongoing pregnancies, hospitalizations and blood transfusions. The analyses were limited to women who had received mifepristone, had had a gestational age of up to 63 days, had not had an ectopic pregnancy and had had a known abortion outcome.

The prescribed dose of misoprostol in the study regimens ranged from 200 to 6,400 mcg; in most cases, the drug was given in one dose, but in 13 groups women received divided doses over 1–7 days. Misoprostol was administered vaginally, orally, buccally or sublingually; most commonly, women received 800 mcg of misoprostol vaginally or 400 mcg orally. The time between mifepristone and misoprostol administration was 0–72 hours, and while some protocols required women to take misoprostol in the clinic, others allowed all or most women to take it at home. Abortion outcomes were evaluated 1–21 days after administration of mifepristone; in half of the trial groups, ultrasound was used to determine the regimen's success. In all, outcome data were available for 45,528 women.

Medication abortion failure occurred in 5% of cases; across trial groups, this percentage ranged from 0% to 40%. Half of all trial groups had failure rates below 5%, and more than 90% of women were in groups with failure rates below 9%. One percent of women had ongoing pregnancies; more than 90% were in trial groups in which fewer than 3% of women reported ongoing pregnancies. Across all trial groups, 0.3% of women were hospitalized and 0.1% received blood transfusions; hospitalizations and transfusions were less common in trials in which women could take misoprostol at home than in trials requiring misoprostol administration in the clinic.

Multivariate analyses revealed that the odds of medication abortion failure were elevated in trial groups in which at least 25% of women were more than eight weeks pregnant, compared with groups in which fewer than 25% of women were more than eight weeks pregnant (odds ratio, 1.5). The odds of abortion failure were also higher in groups that took misoprostol less than 23 hours after mifepristone administration than in groups that took it 23–72 hours after mifepristone (2.1). At most misoprostol dose levels (400 mcg, 600 mcg and ≥800 mcg), the odds of abortion failure were lower with vaginal, buccal and sublingual administration than with oral administration (0.2–0.6); the likelihood of failure did not differ among women receiving vaginal, buccal or sublingual administration. For oral and vaginal administration, abortion failure was less likely at misoprostol doses of 800 mcg or higher than at doses of 400 mcg (0.6–0.7); for sublingual administra-tion, a dose of 600 mcg was associated with lower odds of medication abortion failure than a dose of 400 mcg (0.3). In general, the associations between misoprostol dose and route and ongoing pregnancy were similar to those for medication abortion failure of any type. Rates of abortion failure rate and ongoing pregnancy were similar across geographic regions (classified as Europe, the Americas or other).

The authors cite a number of limitations, some of which were related to the nature of the studies examined. For example, the data permitted exploration of heterogeneity across patient populations, but not among individual patients, and the researchers were unable to control for unmeasured confounding by randomization. Nonetheless, given that an abundance of research "conducted in disparate settings over nearly two decades using a variety of regimens and treatment protocols" demonstrates the effectiveness of 200-mg mifepristone regimens, the authors suggest that future explorations "focus on service delivery issues: increasing access, reducing cost, enhancing patient comfort and ensuring availability of ancillary services such as contraception that can aid women in reaching their reproductive goals."—*L. Melhado*

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HIV Linked to Many Pregnancy-Related Deaths In Sub-Saharan Africa

About one in four pregnancy-related deaths in Sub-Saharan Africa are attributable to HIV, according to an analysis of demographic and surveillance data collected from 1989 to 2012.[1] Seventeen percent of pregnant women in the study areas were infected with HIV, and the mortality rate was substantially higher among these women than among pregnant women without the virus (14 vs. 2 deaths per 1,000 person-years). Overall, about 88% of deaths among pregnant and postpartum women with HIV were attributable to the virus.

In 2011, the United Nations set a goal of reducing the number of HIV-related maternal deaths in low- and middle-income countries by 50% within five years. However, determining the proportion of maternal deaths that

are attributable to HIV has been hindered by a lack of empirical data; recent mathematical models and systematic reviews have yielded global estimates ranging from 6% to 25%. To estimate the contribution of HIV to maternal mortality in eastern and southern Africa, where the prevalence of HIV is among the highest in the world, investigators analyzed data from six independently established cohort studies in five countries. Although their protocols differ, the six studies have all collected data on births, deaths, pregnancies and HIV (cases of which were identified both from biological testing and from "verbal autopsy" interviews with family, friends and caregivers). At least 15 years of HIV data were available from the studies in Kisesa, Tanzania (1994–2011); Manicaland, Zimbabwe (1994–2008); Masaka, Uganda (1989–2011); and Rakai, Uganda (1994–2009). About a decade of data were available from Karonga, Malawi (2003–2012), and from uMkhanyakude, South Africa (2003–2011).

The authors examined pregnancy-related mortality, defined as any death occurring during pregnancy or up to 42 days postpartum; because they counted all such deaths, they did not use the term "maternal mortality," which excludes deaths from accidental or incidental causes. Women were assumed to be at risk for pregnancy and pregnancy-related mortality from ages 15 to 49. Mortality rates were calculated per 1,000 person-years. Women who tested positive for HIV were classified as having become infected halfway between their last negative and first positive tests; if a woman's positive HIV status had been determined during a verbal autopsy, the researchers assumed she had become infected five years earlier.

Overall, the six studies provided data on about 138,100 women and 636,200 person-years of follow-up, during which 87,000 pregnancies and 235 pregnancy-related deaths were reported. Data on HIV status were available for 321,900 (51%) of the person-years, 49,700 (57%) of the pregnancies and 118 (50%) of the pregnancy-related deaths. The prevalence of HIV among women of childbearing age was 17% for the overall sample; at individual study sites, it ranged from 7% (Kisesa) to 35% (uMkhanyakude). The prevalence was lower among pregnant or postpartum women than among other women (11% vs. 18%).

Of the 118 pregnancy-related deaths among women whose HIV status was known, 60 occurred among women who had the virus.

The mortality rate during pregnancy and the postpartum period was 14 per 1,000 person-years among women with HIV and 2 per 1,000 among uninfected women. The crude mortality rate among pregnant or postpartum women with HIV was eight times that among their uninfected counterparts (mortality rate ratio, 8.2); after adjustment for age, the rate ratio was slightly higher (9.0).

Overall, among pregnancy or postpartum women with HIV, about 12 deaths per 1,000 person-years, or about 88% of deaths, were attributable to the virus. Among all pregnant or postpartum women whose HIV status was known, the virus was responsible for 1.3 deaths per 1,000 person-years, or 45% of deaths. By extrapolating from these figures and using United Nations estimates of regional HIV prevalence, the researchers estimate that about 24% of deaths among pregnant or postpartum women in Sub-Saharan Africa can be attributed to HIV.

In general, the impact of HIV on mortality was substantially lower among women who were pregnant or postpartum than among those who were not. One reason, the authors note, is that fertility falls rapidly with duration of HIV infection; thus, pregnant women with HIV tend to have been infected more recently than other women with the virus, and are less likely than those women to die from HIV-related causes.

Limitations of the study, the researchers note, include the relatively small number of pregnancy-related deaths in the study areas, the reliance on verbal autopsies to identify some such deaths and the lack of information on many women's HIV status. Given the high proportion of pregnancy-related deaths that are attributable to HIV, the authors recommend that HIV care, reproductive health services and safe motherhood programs be integrated, and that safe motherhood interventions strive to prevent not only obstetric causes of deaths but also non-obstetric ones. Ensuring that pregnant women with HIV have access to antiretroviral medication and related care, they add, "should cause HIV-related deaths in women of childbearing age to decline rapidly."—*P. Doskoch*

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