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The effects of women's education on maternal health: Evidence from Peru

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ABSTRACT

This article examines the causal effect of women's education on maternal health in Peru, a country where maternal mortality has declined by more than 70% in the last two and a half decades. To isolate the effects of education, the author employs an instrumented regression discontinuity that takes advantage of an exogenous source of variation—an amendment to compulsory schooling laws in 1993. The results indicate that extending women's years of schooling reduced the probability of several maternal health complications at last pregnancy/birth, sometimes by as much as 29%. Underlying these effects, increasing women's education is found to decrease the probability of short birth intervals and unwanted pregnancies (which may result in unsafe abortions) and to increase antenatal healthcare use, potentially owing to changes in women's cognitive skills, economic resources, and autonomy. These findings underscore the influential role of education in reducing maternal morbidity and highlight the contributions of women's education to population health and health transitions.

Over the last twenty-five years Peru has experienced a dramatic decline in maternal mortality, from approximately 250 deaths per 100,000 live births in 1990 to 70 deaths per 100,000 live births in 2015 (World Bank, 2015). There are many potential explanations for this decline, including economic growth (Shen and Williamson, 1999), the expansion of healthcare (Angeles et al., 2005), and falling fertility rates (Martin and Juarez, 1995). This article investigates the potential role of women's education, which has risen in Peru almost as dramatically as maternal mortality has fallen (World Bank, 2015). Specifically, it explores the individual-level effects of women's education on maternal health outcomes that are associated with an increased risk of maternal mortality and further investigates related behavioral changes, such as changes in fertility practices and healthcare utilization.

A positive relationship between women's education and maternal health is well documented (Falkingham, 2003; Karlsen et al., 2011; Onah et al., 2006; Raghupathy, 1996). However, few studies have been able to determine whether women's education has a *causal* effect or whether the link between education and maternal health is attributable to factors correlated with both, such as household wealth (or poverty). Identifying whether increasing women's education actually alters their behavior and improves their health outcomes is an important step toward refining theoretical models of the determinants of maternal mortality and requires exploiting an exogenous source of variation in education, for instance, randomly incentivizing school attendance for some children but not others (Baird et al., 2010), taking advantage of spatiotemporal variation in school construction (Duflo, 2001), or leveraging changes in educational policies (Behrman, 2015a, 2015b).

A small but growing number of studies employing exogenous sources of variation has recently confirmed that women's education influences demographic behaviors related to reproductive health. These studies have shown, for example, that improving women's access to schooling decreases their desired and realized fertility (Behrman, 2015a; Breierova and Duflo, 2004), delays their sexual debut (Baird et al., 2010), and improves their ability to negotiate sex (Baird et al., 2010). They've also shown that increasing women's education protects against sexually transmitted infections (Behrman, 2015b; De Neve et al., 2015) and reduces the risk of child mortality (Grépin and Bharadwaj, 2015). These effects of women's education on fertility, disease transmission, and child wellbeing give rise to the possibility that women's education affects maternal health as well: as education expands and fertility falls, women's

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exposure to maternal health complications should diminish alongside their number of pregnancies and births (Winikoff and Sullivan, 1987). Moreover, if education enhances health-seeking behaviors, then this may lead to the prevention and early detection of complications during pregnancy and childbirth and reduce the risk of death when complications arise (Carroli et al., 2001).

In the following pages, I review the different perspectives on why women's education should benefit maternal health, and in turn, lead to reductions in maternal mortality. I then assess the health effects of women's education by exploiting an exogenous reform in compulsory schooling law in Peru that extended the required number of years of schooling by 5 years. I use an instrumented regression discontinuity (RD) to test the effects of education on preventable and semi-preventable[1] maternal health conditions associated with an increased risk of maternal mortality and to examine the effects of women's education on the precursors to maternal health.

1. Women's education and maternal health

Historically, Peru has had one of the highest rates of maternal mortality in the Western hemisphere, though these rates have fallen precipitously in recent years (World Bank, 2015). The most common causes of maternal mortality[2] in Peru include complications related to unsafe abortion (which is highly restricted), hemorrhage, preeclampsia, infections, and obstructed birth (Amnesty International, 2009). Many of these conditions are aggravated by short birth spacing and high fertility (>=5 births) (Conde-Agudelo et al., 2007; Trussell and Pebley, 1984). Fortunately, though, they can often be detected and managed by a healthcare professional before they become fatal (Kassebaum et al., 2014; McCarthy and Maine, 1992). Fertility practices related to birth spacing and unwanted pregnancy, and the use of antenatal healthcare, are thus two of the most important contributors to maternal wellbeing.

As depicted in Fig. 1, this study conceptualizes women's education as an essential, underlying determinant of maternal health (and implicitly maternal mortality). The effects of education are assumed to predominantly flow through women's cognitive skills, material resources, and autonomy, which should in turn affect their fertility practices and healthcare use, and ultimately their health outcomes.

First, as others have shown, education should have a positive effect on women's cognitive skills (Smith-Greenaway, 2013). Greater cognitive skills, and especially literacy, should benefit maternal health by increasing women's ability to seek information about their own health and by assuring that women are better able to follow written instructions (for example, understanding directions on a box of medication). Similar explanations have been given for why mothers' literacy protects against child mortality (Smith-Greenaway, 2013).

Second, women's education should improve their economic opportunities and status (Psacharopoulos and Patrinos, 2004). As depicted in Fig. 1, increased opportunities for gainful employment may compete with childbearing in ways that lead women to reduce or postpone childbearing (Barber, 2001). Moreover, the greater economic resources enjoyed by women with more education may influence maternal health by shaping the extent to which they can afford and access healthcare (Thaddeus and Maine, 1994). This is especially true in Peru, where transportation costs and the cost of

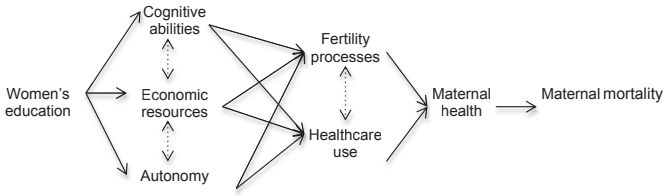

Fig. 1. Conceptual Model of Pathways by which Women's Education Affects Maternal Health and Mortality.

medical services are two of the most commonly cited barriers to ante- and postnatal healthcare (Amnesty International, 2009).

Third, education may further improve maternal health by bolstering women's autonomy in the home (Ahmed et al., 2010). In Peru, men have traditionally been the economic providers for their families and the ones to determine how household resources are spent (Fuller, 2001). However, if education increases women's employment or earnings, then women's greater ability to provide for their families may grant them more decision-making power within the home (Lundberg and Pollak, 1993), including decisions about whether resources are spent on their own healthcare (Ahmed et al., 2010). Under the assumption that at least some women would seek more medical attention given the opportunity to do so, increasing women's decision-making over their own healthcare should result in improvements to their health (Fig. 1).

Together, education-related improvements in women's cognitive skills, economic resources, and autonomy should affect maternal health via changes in their fertility practices (Fig. 1). For instance, if education increases economic opportunities and economic opportunities disincentivize childbearing, then education should motivate contraceptive use (Behrman, 2015b). These effects of education on contraceptive use should in turn decrease the likelihood of high fertility and short birth intervals, both of which increase the risk of pregnancy complications (Conde-Agudelo et al., 2007). They should also decrease the likelihood of unintended pregnancies (Trussell et al., 2013), which may indirectly decrease the demand for unsafe abortions (Rose and Lawton, 2012), which account for 6.1% of maternal deaths in Peru (Amnesty International, 2009 p.14).

Beyond these fertility-related changes, women's education may affect maternal health via their use of antenatal healthcare. Antenatal healthcare visits should increase the detection of hypertensive disorders and anemia (McCarthy and Maine, 1992), which can contribute to preterm birth (Scholl and Reilly, 2000) and convulsions, brain hemorrhaging, comas, or cardiac arrest during pregnancy (Duley, 1992; Rush, 2000; Sibai et al., 2005). Moreover, delivering children in hospitals and other formal healthcare centers, as opposed to in one's home, should improve postnatal health by reducing the risk of postpartum infection and providing skilled birth attendants who are equipped to address complications during delivery (Graham et al., 2001). Thus, the hypothesized, positive effects of women's education on healthcare utilization may help to alleviate the direct causes of maternal mortality through the prevention of semi-avoidable complications and the early detection and management of unpreventable complications or preexisting conditions.

To summarize, women's education is theorized to protect maternal health by 1) influencing fertility practices that aggravate the risk of maternal morbidity and 2) increasing women's access to and use of preventative and palliative antenatal healthcare. These changes in fertility practices and healthcare use should stem from education's effects on women's cognitive skills, economic resources, and autonomy (Fig. 1).

[1] Semi-preventable refers to conditions that can be detected and managed before they become life threatening.

[2] Maternal mortality is defined as death during or within 42 days after pregnancy owing to pregnancy-related conditions (Say et al., 2014).