Fertility Intentions and Maternal Health Behaviour During and After Pregnancy

Abstract

This study examined associations between fertility intentions and maternal health behaviours during and after pregnancy among a nationally representative sample of 3,343 women from India. Two waves (2005, 2012) of the India Human Development Survey were analyzed to investigate the influence of an unwanted birth on women's use of antenatal care, safe delivery, and timely postnatal care using binary and ordered logistic regression and propensity score weighting. 60 per cent of births were unwanted. Regression results show that, net of maternal and household characteristics associated with fertility intentions and maternal health, women with unwanted births were less likely to obtain antenatal care and had fewer antenatal tests performed. Unwantedness was also associated with a lower likelihood of delivering in an institutional setting and obtaining timely postnatal care. The relationships between unwantedness and antenatal and postnatal care were robust to models accounting for selection bias.

Key words: fertility; fertility intentions; maternal health; child health; India

Introduction

Women's utilization of maternal health services during and after pregnancy is known to be associated with better maternal and child health outcomes, reductions in maternal and infant mortality, and improvements in women's overall reproductive health (McDonagh 1996; Mattar et al. 2007; Li et al. 1996; Finger 1997; WHO 2005; Sines et al. 2007). Indeed, women's health behaviours during and after pregnancy are key devices of the World Health Organization's (WHO) Safe Motherhood Initiative (Freedman et al. 2007; AbouZahr 2003). The extant research highlights several individual- and household-level factors that influence women's utilization of maternal health services, including women's level of education (Celik and Hotchkiss 2000), women's autonomy in household decision-making (Mistry, Galal, and Lu 2009; Story and Burgard 2012), and the accessibility and quality of local maternal health facilities (Wild et al. 2010; Navaneetham and Dharmalingam 2002).

An important determinant of maternal and child health that has emerged in the demographic literature is the fertility intention associated with the birth (S. Brown and Eisenberg 1995; Gipson, Koenig, and Hindin 2008; S. Singh, Sedgh, and Hussain 2010; Sedgh, Singh, and Hussain 2014; Tsui, McDonald-Mosley, and Burke 2010). Nonetheless, there is limited research on the influence of fertility intentions on women's use of health services during and after pregnancy (Joyce and Grossman 1990; Gipson, Koenig, and Hindin 2008; Tsui, McDonald-Mosley, and Burke 2010; Kost and Lindberg 2015), which is important because inadequate use of maternal health services could lead to worse health outcomes for women and their babies, including a risk for higher maternal mortality (Alkema et al. 2016). Evidence from the Global South suggests that in some settings unintended pregnancies are associated with lower maternal investments in health, such as failing to obtain an adequate number of antenatal check-ups (Marston and Cleland 2003; Eggleston 2000; A. Singh, Singh, and Mahapatra 2013; Dibaba, Fantahun, and Hindin 2013) or have a

skilled birth attendant during delivery (Marston and Cleland 2003; A. Singh, Chalasani, et al. 2012). No studies to date have examined the association between the intendedness of births and women's timely use of postnatal care, which the present study investigates.

Our study builds on the limited research examining the relationship between fertility intentions and women's healthcare utilization during pregnancy and after birth in developing country settings, specifically India. We aim to provide several contributions. First, whereas most of the past studies of fertility intentions and women's health behaviour in India have been concentrated in rural areas (for example P. K. Singh et al. 2012; A. Singh, Singh, and Mahapatra 2013) (exception A. Singh, Chalasani, et al. 2012), our study relies on nationally representative data—the India Human Development Study (IHDS)—thus providing more generalizable results. Second, we use prospective measures of fertility intentions, focusing on births that were wanted versus those that were unwanted. Research by Koenig et al. (2006) from four states in rural India found that the retrospective measures of fertility intentions used by the current Demographic and Health Survey (DHS) could lead to significant underestimates of unwanted births. Thus, our prospective measures from a nationally representative sample are likely to provide more accurate estimates. Third, we analyze several detailed measures of antenatal and postnatal care that align with WHO recommendations for maternal and child health, but have yet to be explored in this context. Finally, we employ an adaptation of a propensity score weighting approach – inverse probability weighted regression adjustment (IPWRA) estimator – as a robustness check on the regression results to account for selection bias. This estimator is doubly robust thereby helping to determine whether differences in maternal health behaviours among women with wanted and unwanted births are because of differential maternal traits or because of differences in intention status.

India is an important setting to investigate these issues due to high rates of unintended

fertility and poor maternal health. As reported by Singh et al. (2018) using data from the United Nations and the National Family and Health Survey in India, nearly 50 per cent of the estimated 48.1 million pregnancies in India in 2015 were unwanted or mistimed (S. Singh et al. 2018). According to the World Health Organization (WHO), about 45,000 women in India died in 2015 due to preventable pregnancy-related complications, largely a consequence of the dearth of trained professionals to supervise deliveries, and inadequate antenatal services (Alkema et al. 2016).

Despite the high levels of unintended fertility in India, few studies have evaluated the influence of fertility intentions for pregnancies carried to term on subsequent maternal health behaviours. Rather, past studies in the Indian context have focused primarily on the impact of fertility intentions on the health of the resulting child. For example, studies have examined the relationship between unintendedness and child acute respiratory infection, diarrhea (Jensen and Ahlburg 1999), stunting (Upadhyay and Srivastava 2016; A. Singh, Chalasani, et al. 2012), full vaccination by WHO standards, and child mortality (A. Singh, Chalasani, et al. 2012; A. Singh, Singh, and Mahapatra 2013). Three studies from India have examined the influence of unintended fertility on women's health outcomes or behaviours. First, Singh and colleagues' (A. Singh, Singh, and Mahapatra 2013) study of unintended pregnancy and maternal and child health found that women reporting unwanted births were 2.32 times as likely as those reporting wanted births to obtain inadequate prenatal care. Whereas this is one of the only studies that uses prospective data to examine the linkages between pregnancy intentions, women's use of prenatal care, and child vaccination in the context of India; it is limited to examining this relationship for residents of rural areas in four states: Bihar, Jharkhand, Maharashtra, and Tamil Nadu. Second, Singh and colleagues (A. Singh, Chalasani, et al. 2012) examined the association between unintended fertility and delivery supervision using family fixed effects to account for unobserved heterogeneity. Their

findings show that mistimed births were 1.3 times as likely as wanted births to be delivered in the absence of a trained birth attendant. However, this study relied on cross-sectional data, and the measurements of birth intention were retrospective, meaning that there could be recall bias due to ex post-rationalization (Bongaarts 1990, 2011; Bhushan and Hill 1996; Lightbourne 1985; Charles F Westoff 1991). Finally, (L. Singh, Rai, and Singh 2012)) examined the relationship between fertility intentions and antenatal care, safe delivery, and postnatal care among married adolescent (15-19) mothers in rural India. Although the authors document several correlates of maternal health behaviour, birth wantendness is not examined in the final regression models. Additionally, the measure of postnatal care only assesses whether women received one visit within 42 days of the birth. Our study extends this past work by using longitudinal data with prospective measurement of fertility intentions from India's first nationally representative panel survey (across both rural and urban areas). In addition, our study is the first in the Indian context to examine the relationship between women's fertility intentions and a detailed measure of postnatal care use that captures whether the visit meets the WHO recommendations for timely care.

Methods

Data

Our data come from two rounds of the India Human Development Survey (2005 and 2012). The 2005 survey includes data collected in face-to-face interviews with individuals in 41,554 households across 33 (now 34) States and Union territories, covering 1,503 villages and 971 urban regions in India (Desai et al. 2010). Follow-up interviews were conducted in 2012 with 83per cent of the households. Questions in the household module (e.g., questions on income, consumption, social capital) were answered by heads of household—often men—whereas the health (e.g., questions on fertility history, ideal number of children) and education modules were answered by ever-married women. In the present study our sample is limited to non-

pregnant, currently married women, aged 18-40 in 2005, who participated in both surveys and had at least one birth between 2005 and 2012.

Measures

Dependent variables. We analyze various aspects of women's antenatal behaviour, characteristics of their baby's delivery, and women's postnatal behaviour to investigate women's health investment in their pregnancies. In 2012, all women who had at least one birth between 2005 and 2012 were asked about the antenatal and postnatal care they received for their most recent birth since January 2005.

We analyze five dependent variables related to maternal investments in health during and after pregnancy. a) Any antenatal check-up: This variable measures whether women obtained any antenatal check-ups during their pregnancy. The variable takes a value of 0 if the woman obtained no antenatal care, and 1 if she obtained at least one antenatal check-up during her pregnancy. b) Adequate antenatal check-ups: The WHO recommends at least 4 antenatal check-ups during pregnancy (WHO 2006). This variable assesses whether women obtained an adequate number of antenatal check-ups during their pregnancy as recommended by the WHO. The variable takes a value of 1 if the woman obtains 4 or more antenatal check-ups during pregnancy and 0 otherwise. c) Antenatal check-up index: This is an additive index counting the number of different tests that the woman received during her pregnancy. Referring to their most recent birth since January 2005, women were asked: *'Did you have the following performed at least once during any of your antenatal check-ups for this pregnancy? i)) weight check-up, ii) blood test, iii) sonogram, iv) urine test, v) BP check, vi) amniocentesis, vii) internal check-up, viii) abdominal examination.'* The index values range from 0 to 8, with 0 indicating that no tests were performed and 8 indicating that all of the tests were performed at least once during the pregnancy. d) Delivery in institutional setting: The WHO recommends delivery under the assistance of a trained person (such as a doctor,

nurse, or health professional) or in an institutional setting (such as a hospital, private clinic, or nursing home) as standards for safe delivery (Department of Making Pregnancy Safer. 2007). This variable measures safe delivery and takes a value of 1 if the delivery took place in a Government hospital/clinic, private nursing home, or some other institution with health personnel; and it takes a value 0 if delivery took place at home. e) Postnatal care index: This variable is an indicator of maternal investment in women's postpartum health and the health of their baby. Guidelines for postnatal care by the WHO recommend that the first postnatal check-up should be within 24 hours of the birth, regardless of the place of birth(WHO 2014). Thus, the postnatal care variable is ordered and coded as follows: 0 if the woman avails no postnatal check-up; 1 if, in the 1-2 month period after the delivery a doctor or other health professional checked the woman's health, her child's health, or both, but the first check-up was more than 24 hours of birth; and 2 if the first postnatal check-up was within 24 hours of birth.

Independent variables. The key independent variable measures women's prospective fertility intentions. We assess whether a woman's most recent birth was wanted versus unwanted by comparing the number of additional desired children in 2005 with the number of children born between 2005 and 2012. If the number of additional desired children in 2005 was less than the number of children born between 2005 and 2012 (including those who died in the interim), then the most recent birth was labelled as unwanted. If the number of additional desired children in 2005 was greater than or equal to the number of children born between 2005 and 2012, the most recent birth was labelled as wanted(Yeatman and Sennott 2015). This variable takes a value of 1 if the last birth was unwanted, and 0 if the last birth was wanted. Due to a lack of data on timing preferences, our analysis focuses on differences between wanted and unwanted births and does not account for mistimed births.

We also assess several variables measuring individual- and household-level characteristics in 2005 that have been shown to be important in past research on maternal health behaviours. First, socio-demographic traits are important determinants of maternal investment in health during and after pregnancy. For example, studies from developing countries have found women who are older, have higher parity, are less educated, and belong to poorer households have lower likelihoods of adequate maternal healthcare utilization (see for example (Simkhada et al. 2008; Ahmed et al. 2010; A. Singh, Chalasani, et al. 2012; Navaneetham and Dharmalingam 2002; Amin, Shah, and Becker 2010; Sharma 2004; Chandhiok et al. 2006; Pathak, Singh, and Subramanian 2010; A. Singh, Padmadas, et al. 2012). In the present study we control for the woman's age, which is coded continuously because models examining an age-squared term indicated it was not significant. We also control for the number of living children she had in 2005, education level (some primary education, primary complete, secondary complete, higher secondary complete, and college and more), and household asset quintile (5 dummy variables for each quintile ranging from the poorest to the richest). In India specifically, maternal healthcare utilization varies by several other factors. First, women belonging to lower castes such as Scheduled Castes (SC), Scheduled Tribes (ST), and Other Backward Classes (OBC) are less likely to utilize adequate maternal healthcare facilities such as safe delivery, and adequate postnatal and antenatal care, compared to those belonging to higher castes (A. Singh, Chalasani, et al. 2012; P. K. Singh et al. 2012; Navaneetham and Dharmalingam 2002; Pallikadavath, Foss, and Stones 2004; Matthews et al. 2005). In the present study we control for the woman's caste group by including four dichotomous variables indicating membership in a: forward caste group (FC), SCs, ST, or OBC. Second, some studies have found that Muslims are less likely to utilize safe delivery care compared to Hindus in India (P. K. Singh et al. 2012; Navaneetham and Dharmalingam 2002), whereas other studies have found mixed results for religious groups

(Sugathan, Mishra, and Retherford 2001). We control for women's religious group using three dichotomous variables for: Hindu, Muslim, or other religion. Third, a woman's region of residence is important to consider in order to better understanding socio-demographic processes in India. Specifically, a group of Northern States—including Bihar, Chhattisgarh, Jharkhand, Madhya Pradesh, Orissa, Rajasthan, Uttarakhand, and Uttar Pradesh—have higher populations, lower educational attainment, lower status of women, less adequate administration, and a larger prevalence of traditional norms and beliefs. These States have been termed as "Empowered Action Group (EAG)" States and are the focus of various government health and family planning programs. These States accounted for 46per cent of India's population in 2011 and 53per cent of the growth in population (Registrar General India 2011). Past studies have found that women residing in Northern EAG States are less likely to use maternal healthcare services compared to women in other areas (International Institute for Population Sciences Macro International 2007; P. K. Singh et al. 2012; L. Singh, Rai, and Singh 2012). Therefore, in the present study we include a binary variable for state of residence that takes a value of 1 if a woman lives in an EAG State and 0 if she lives in a non-EAG State. In addition, we control for whether a woman lives in an urban area (1) versus a rural area (0). Finally, studies on fertility in the context of South and Southeast Asia often take into account son preference (Hermalin et al. 1979; Foreit and Suh 1980; C Vlassoff 1990; De Silva 1991; Islam and Bairagi 2003; Roy et al. 2008; Carol Vlassoff 2012). To control for the effects of son preference we include a binary variable that indicates whether a woman has a living son (yes=1/no=0).

Sample

The sample for the current study was drawn from data for 3,462 non-pregnant, currently married women, aged 18-40 in 2005, who participated in both surveys, provided valid data on fertility intentions, and had at least one birth between 2005 and 2012. We used two measures

to determine whether women had a birth in the interim survey period: first, we subtracted the number of children ever born as reported in 2005 from the number of children ever born as reported in 2012. Second, we examined the number of children born after January 2005 as reported in 2012. We restricted our analysis to cases where a woman had at least one birth and there was consistency in the number of children reported via both measures. The analytic sample was limited to women with non-missing data on all study covariates. We dropped 3 percent (n=99) due to missing data on whether they had a living son in 2005; and <1 per cent (n=20) due to missing data on education. After dropping these cases, the final analytical sample consists of 3,343 women. The sample sizes for the dependent variables range from 3,059 to 3,246 women due to missing data (see Table 1).

Analyses

We first calculate descriptive statistics for the variables, including percentages, means, and standard deviations. Next, we examine the bivariate relationship between the wantedness of a birth and maternal healthcare utilization as measured by women's antenatal and postnatal health behaviour. Maternal healthcare utilization varies by both socioeconomic and demographic characteristics, however, the characteristics of the woman and her household could also impact the wantedness of the birth and thus serve as confounding factors. Previous research shows that fertility intentions and subsequent behaviour are associated with various social, demographic, and economic variables such as: age, education, assets, parity, area of residence, and son preference in the context of South and Southeast Asia (Morgan and Rackin 2010; Kodzi, Johnson, and Casterline 2010; Hermalin et al. 1979; Foreit and Suh 1980; C Vlassoff 1990; De Silva 1991; Islam and Bairagi 2003; Roy et al. 2008; Carol Vlassoff 2012; Dharmalingam, Rajan, and Morgan 2014; Dommaraju and Agadjanian 2009; Hayford and Agadjanian 2012). To account for this, we assess whether socio-demographic traits of the woman and her household mediate the relationship between the wantedness of

the birth and a woman's subsequent health behaviour using stepwise weighted logistic regression for binary outcome variables (i.e., any antenatal care, adequate antenatal care, and delivery in an institutional setting) and weighted ordered logistic regression for ordered outcome variables (antenatal check-up index and postnatal care index). Thus, we analyze two models for each dependent variable: The first model examines the bivariate association between the wantedness of a birth and maternal health behaviours, and the second model adds the socio-demographic traits of the woman and her household to investigate whether these traits mediate the relationship between a woman's fertility intentions and her maternal healthcare utilization.

Recent studies on fertility intentions and maternal health from the U.S. and India have used fixed effects models (Barber and East 2009; Guzzo and Hayford 2012; Joyce et al. 2000; Singh et al.2012) and propensity score matching (Kost and Lindberg 2015) to correct for selection bias. Propensity score analyses are less sensitive to model specification errors compared to regression models on outcomes (Kost and Lindberg 2015, Dehejia and Wahba 2002; Drake 1993; McCaffery et al.2013; Messer et al.2010; Stuart 2010). Therefore, in the present study we use an adaptation of propensity score matching (PSM)—the IPWRA estimator—as a robustness check to the stepwise regression models. This adjustment is useful for disentangling the impact of a woman's fertility intentions on her maternal investment in health, from the impact of other characteristics. While, propensity score matching (PSM) methods could be sensitive to bias when the treatment or the outcome model is impacted by confounding unobservable variables (Abadie and Imbens 2006; Imbens 2015, 2004; Kebebe and Shibru 2017), IPWRA estimators are doubly robust. This means that if either one of the treatment or outcome models is specified correctly, the effects of unwanted births on maternal healthcare utilization can be consistently estimated. IPWRA estimators model both treatment and outcome models to take into account non-random assignment of the treatment

(Abadie and Imbens, 2006; Abadie and Imbens, 2011; Cattaneo, 2010). Weighted regression coefficients are used to calculate the averages of the treatment level predicted outcomes for maternal healthcare utilization, where the weights are the inverse probabilities of treatment (see Cattaneo, 2010). In addition, we included sample weights: each observations' inverse probability weight (IPW) is multiplied by the sample weights in order to obtain unbiased effects based on the population of all births in India (see Kost and Lindberg 2015; DuGoff et al., 2013). In order to model the outcomes for maternal healthcare utilization, we use logistic regression for binary outcome variables (any antenatal care, adequate antenatal care, and delivery in an institutional setting) and Poisson regression for the count outcome variables (antenatal check-up index and postnatal care index). We account for a woman's age, number of living children in 2005, caste, religion, whether she has a living son, her education level, and the region and area of her residence. We use logistic regression to predict the unwantedness of a birth as a function of the same set of socio-demographic characteristics. All data were analyzed using Stata 15 (Stata Corp . 2017).

Results

Table 1 shows the descriptive statistics for the sample. Unwanted births comprised the majority of the births in the sample: around 60 per cent of women reported that their most recent birth was unwanted, whereas nearly 40 per cent reported that their most recent birth was wanted. 82 per cent of women in the sample got at least one antenatal check-up during pregnancy, however only 39 per cent obtained the adequate (four or more) number of check-ups as determined by the WHO. The mean score on the antenatal check-up index was 4.3; thus, on average women received four out of the eight recommended tests during their pregnancy. 59 per cent of women in the sample delivered in an institutional setting (in hospitals or private clinics) whereas 41 per cent of the women in the sample delivered at home. 39 per cent women in the sample obtain no postnatal check-up (for themselves or their

child), 25 per cent of women obtain at least one postnatal check-up in the 1-2 month period after the delivery but more than 24 hours after the birth. Finally, 36 per cent of women in the sample got their first postnatal check-up within 24 hours of the birth, therefore meeting the WHO recommendations for postnatal care. Nearly one in four (24 per cent) women in the sample belonged to the poorest households and 14 per cent of women belonged to the richest households. 24 per cent of women belonged to Forward caste groups and the rest belonged to SC, ST, and OBC groups. The majority of the women in the sample were Hindus (80 per cent), whereas 16 per cent were Muslims, and 5 per cent belonged to other religions. Around 20 per cent of the sample resided in urban regions. Educational attainment was very low: almost half (48 per cent) of women in the sample were illiterate and only 3 per cent had obtained a college degree. 55 per cent of women had a living son. Finally, 59 per cent of women resided in the EAG States, which are less developed and growing faster compared to the non-EAG States.

-Table 1 about here-

Table 2 shows maternal health behaviours by the wantedness of a woman's most recent birth since 2005. There are strong, consistent differences for women who reported that their most recent birth was unwanted versus wanted. 75 per cent of the women who had an unwanted birth had at least one antenatal check-up compared to 93 per cent of women who had a wanted birth. About 32 per cent of those who had an unwanted birth obtained the adequate number of antenatal check-ups as recommended by the WHO compared to about half of the women whose most recent birth was wanted. For women who had unwanted births, 24 per cent had no tests done during antenatal check-ups whereas 6 per cent obtained all eight tests during their pregnancy. In contrast, 8 per cent of those who had a wanted birth had no tests done whereas 20 per cent obtained all eight tests during their pregnancy. 45 per cent of women who had an unwanted birth obtained no postnatal check-up; whereas amongst

women who had wanted births only 30 per cent of women obtained no postnatal check-up. In contrast, 43 per cent of women who had a wanted birth obtained the first postnatal check-up within 24 hours of the birth compared to only 32 per cent of women who had an unwanted birth. Finally, half of those who had an unwanted birth delivered in an institutional setting, compared to 72 per cent of women who had a wanted birth. These results highlight the strong binary relationships between women's fertility intentions and their investments in health during and after pregnancy.

-Table 2 about here-

Table 3 shows results from stepwise weighted, logistic and ordered logistic regression models, examining the relationship between birth wantedness and three binary indicators of maternal investments in health (any antenatal care, adequate antenatal care, and delivery in an institutional setting), and two ordered indicators of maternal investments in health (antenatal check-up index and postnatal care index), respectively, after accounting for characteristics of the woman and her household. Model 1 for each of the dependent variables shows that women who had an unwanted birth were significantly less likely to avail proper antenatal care, delivery care, and postnatal care compared to those whose birth was wanted. After accounting for the control variables in Model 2, the values of the coefficients for the relationships between wantedness and maternal health behaviours in each set of models were attenuated, suggesting that women's individual and household characteristics explain some of these relationships. However, even after controlling for all maternal and household characteristics, having an unwanted birth remains a significant predictor of obtaining any antenatal care ($p<0.05$), obtaining the recommended number of antenatal tests ($p<0.05$), delivering in an institutional setting ($p<0.05$), and obtaining a higher score on the postnatal care index ($p<0.01$).

-Table 3 about here-

-Table 4 about here-

Table 4 shows the predicted probabilities for Models 1 and 2 for each of the dependent variables in Table 3 by the wantedness of the birth. The probability of getting at least one antenatal check-up for women who have an unwanted birth between 2005 and 2012 is 0.75 (panel 1, model 1); it increases to 0.89 (panel 1, model 2) after taking the control variables into account. In contrast, the probability of a woman getting at least one antenatal check-up when she has a wanted birth is 0.92 before taking into account other traits of the woman and her household; it goes up slightly to 0.93 after controlling for other factors. Though the difference between getting any antenatal check-up for those who had an unwanted birth versus a wanted birth decreases after taking into account the individual and household characteristics, women who had an unwanted birth are still significantly less likely to get at least one antenatal check-up ($p<0.05$). The probability of a woman who has a unwanted birth obtaining four or more antenatal check-ups is 0.32 (panel 2, model 1), whereas for those who have an wanted birth it is 0.50, a significant difference ($p<=0.001$). However, after taking into account maternal and household characteristics, there is no significant difference in the probability of obtaining the adequate number of antenatal check-ups between those who have a unwanted birth and those who have wanted births (panel 2, model 2). The probability of a mother who has an unwanted birth having all eight tests performed during antenatal check-ups is 0.07 (panel 3, model 1), whereas the probability for those who have a wanted birth obtaining all eight tests is 0.18. This difference decreases after taking the control variables into account. Nonetheless, women who have unwanted births are still significantly less likely to have a higher score on the antenatal check-up index compared to those who have wanted births ($p<0.05$) (panel 3, model 2). This difference decreases because women who have lower SES, less education, have a greater number of living children, and reside in rural regions of EAG states are less likely to obtain a higher number of

tests during antenatal check-ups. The probability of a mother who has an unwanted birth having a postnatal check-up performed within 24 hours of the birth is 0.31 (panel 4, model 1), whereas the probability for those who have a wanted birth is 0.44. After taking into account other maternal characteristics this difference decreases, however, women who have an unwanted birth are still significantly less likely to obtain higher scores on the postnatal care index compared to those who have a wanted birth ($p<0.01$) (panel 4, model 2). Finally, the probability of delivering in an institutionalized setting for women who have an unwanted birth is 0.50, compared to 0.72 for women with a wanted birth (panel 5, model 1). Although the difference between women with an unwanted and a wanted birth decreases in Model 2, the probability of delivering in an institutional setting is still significantly lower for those who have an unwanted birth compared to those who have a wanted birth ($p<0.05$) (panel 5, model 2).

-Table 5 about here-

Table 5 shows the potential outcome means for the various indicators of maternal healthcare utilization that we would find if women with wanted and unwanted births had similar distributions of socio-demographic characteristics. The IPWRA adjustment helps disentangle the impact of a woman's fertility intentions on her maternal investment in health, from the impact of other traits. After using IPWRA estimator, the differences observed among women with wanted and unwanted births in unadjusted stepwise logistic regression models analysing delivering in an institutional setting and the antenatal check-up index lose significance. However, women with unwanted births remain significantly less likely to obtain any antenatal check-up and to have a lower score on the index for postnatal care compared to women whose births were wanted. Moreover, the difference between women with wanted and unwanted births on the postnatal care index remains significant even if antenatal care is included as an explanatory variable in the model.

Discussion

Our results show that women's fertility intentions have a significant influence on maternal healthcare utilization in India, even after taking into account individual- and household-level characteristics that are associated with both fertility intentions and healthcare utilization. Specifically, we find that women who have unwanted births are significantly less likely than women whose births were wanted to obtain any antenatal check-ups, to receive the recommended tests during pregnancy, to deliver in an institutional setting, and to obtain timely postnatal care. After accounting for selection bias, we find that women who have an unwanted birth are significantly less likely to have any antenatal check-up and to obtain timely postnatal care, effects that are robust to their individual- and household-level characteristics.

The extant research from the Global South examining the association between fertility intentions and women's health behaviours has shown mixed results. Some studies have found that unintendedness is associated with beginning antenatal care later and failing to obtain the required number of antenatal care visits (Barrick and Koenig 2008; Bassani, Surkan, and Olinto 2009; Eggleston 2000). Other studies have found an inconsistent relationship between fertility intentions and antenatal care utilization (Marston and Cleland 2003; Gage 1998). Thus, scholars have called for additional research on the impact of unwanted births on various dimensions of maternal healthcare in developing country settings (Gipson, Koenig, and Hindin 2008). Our study responds to this call, building on this body of past research in several ways. First, we rely on a prospective measure of fertility intentions that is able to capture a woman's desire for future fertility prior to when a pregnancy occurs and therefore avoids the potential bias in retrospective measures (Yeatman and Sennott 2015; Koenig et al. 2006). Second, we use two waves of the first nationally representative study from India, which are both generalizable and ideal for investigating the influence of fertility intentions on

women's subsequent health behaviours. Finally, our study is the first to examine the association between fertility intentions and women's use of timely postnatal care using while accounting for possible selection bias. Together, our results highlight an important factor—maternal healthcare utilization—that could negatively influence both a woman and her baby's health during an unwanted pregnancy and even after birth, as under-utilization of healthcare services is associated with poor health outcomes (Dibaba, Fantahun, and Hindin 2013).

Our study found several socio-demographic characteristics of the woman and her household that were associated with women's healthcare utilization. First, compared to the poorest women, those belonging to the richest households (households in the fourth asset quintile) were more likely to find contraception and health facilities more affordable and accessible, consistent with other research from a variety of developing countries (Ahmed et al. 2010)(Miles-Doan and Brewster 1998), and specifically the Indian context (Pathak, Singh, and Subramanian 2010; A. Singh, Chalasani, et al. 2012; A. Singh, Padmadas, et al. 2012; P. K. Singh et al. 2012; L. Singh, Rai, and Singh 2012; Kesterton et al. 2010). Second, compared to women who were illiterate, women who had more education (those who had secondary, higher-secondary, or college degrees) were more likely to use antenatal care facilities, deliver in institutional settings, and obtain timely postnatal care (Sunil, Rajaram, and Zottarelli 2006; A. Singh, Chalasani, et al. 2012; P. K. Singh et al. 2012; Amin, Shah, and Becker 2010; Ahmed et al. 2010; Kesterton et al. 2010). This may be because educated women are more likely to communicate with their husbands and other family members on issues linked to health (Navaneetham and Dharmalingam 2002; P. K. Singh et al. 2012), making it more likely that they will have support to seek health services when needed. Further, women with higher education are also more likely to have access to higher quality healthcare facilities and, in general, to more often utilize healthcare facilities because they are more aware of the benefits (P. K. Singh et al. 2012; Celik and Hotchkiss 2000). Third, we

found that women residing in urban areas were more likely than those residing in rural areas to obtain antenatal care. This is in contrast to past research from India that found no differences in antenatal care utilization by urban versus rural settings (Navaneetham and Dharmalingam 2002). These conflicting findings may be a result of our use of nationally representative data covering more areas of the country than in past studies. Fourth, our results showed that women residing in non-EAG States were more likely to have access to and knowledge about proper contraception and health facilities and thus were more likely to utilize adequate antenatal, safe delivery, and timely postnatal care compared to those who reside in EAG States, similar to findings from other studies (P. K. Singh et al. 2012; L. Singh, Rai, and Singh 2012). Finally, consistent with past research, we found that women with higher number of living children in 2005 were less likely to avail adequate pregnancy care (Navaneetham and Dharmalingam 2002). These women may forego extensive care during pregnancy because they have larger families and thus greater resource constraints; they also have more experience with childbirth and therefore may have greater confidence in home delivery and caring for themselves and their infants (Navaneetham and Dharmalingam 2002; Santhya et al. 2008; P. K. Singh et al. 2012; Wong et al. 1987; Elo 1992; Bhatia and Cleland 1995; Raghupathy 1996).

Despite high levels of unintended fertility in India, few studies have evaluated the impact of unintended pregnancies carried to term on maternal healthcare utilization (for important exceptions see (Jensen and Ahlburg 1999; A. Singh, Chalasani, et al. 2012; A. Singh, Singh, and Mahapatra 2013; Upadhyay and Srivastava 2016)). It is crucial to address this issue because enhancing global access to sexual and reproductive healthcare services and incorporating reproductive health into national policies are important targets of the United Nations Sustainable Development Goals (SDG) for 2030 (United Nations Secretary General 2014). Maternal health is a pivotal part of family planning policy initiatives; it is also key to

India's commitments to the SDG of ensuring healthy lives and promoting wellbeing at all ages. Though maternal mortality in India has declined over time, it remains high, especially in EAG States (Sample Registration System 2018). Increasing women's use of antenatal and postnatal care is likely to bring about improvements in both maternal and child health outcomes (McDonagh 1996; Mattar et al. 2007; Li et al. 1996; Finger 1997; WHO 2005; Sines et al. 2007). Moreover, our results show that unwanted births are very common among women in India—nearly two-thirds of births (60 per cent) in the sample were unwanted. Thus, increasing access to and acceptability of effective contraception is essential for ensuring women and couples are able to avoid pregnancies they do not want, which will also aid in improving both maternal and child health.

While our study makes significant contributions to understanding differences in women's utilization of maternal healthcare services during and after pregnancy based on their fertility intentions, there are some limitations. The measures on the number of antenatal check-ups, the number of tests performed during the antenatal check-up, women's use of timely postnatal care, and whether the delivery was in an institutional setting for the last birth after 2005 were self-reported by women in 2012 and thus could be susceptible to recall bias (Yeatman and Sennott 2015). Second, given the length of time between the two surveys (7 years), there is a chance of misclassifying births since women's fertility intentions could have changed over the time period (Kodzi, Johnson, and Casterline 2010; C F Westoff and Ryder 1977; Sennott and Yeatman 2012; Yeatman, Sennott, and Culpepper 2013). Finally, future studies should expand on our findings to examine the relationship between mistimed births and women's healthcare utilization, particularly their use of postnatal care.

Our results linking fertility intentions and maternal health behaviours in India can inform service delivery strategies by highlighting the need to provide women with knowledge

about antenatal and postnatal care, and particularly the importance of receiving timely postnatal care for births regardless of where they occur. For example, it would be beneficial for health providers and at-home birth attendants to be cognizant of the differences among women in health behaviours based on their fertility intentions for the birth. Additionally, when women and their husbands do not want any more children, adequate facilities and services should be available and accessible to them so that they are able to fulfil their intentions and avoid future births (Kost and Lindberg 2015). Providers of maternal health services could improve their counselling services for all pregnant women to encourage them to seek antenatal and postnatal care (Dibaba, Fantahun, and Hindin 2013) aligning with the WHO recommendations. India has several interventions under the umbrella of National Rural Health Mission (NRHM) that aim at improving maternal and child health in rural regions. For example, the NRHM aims to provide every village in India with trained female community health workers who connect the public health system and the community by providing door-to-door counselling on family planning, the importance of birth spacing, and other aspects of maternal and child health in rural areas. Further, programs such as the Janani Shishu Suraksha Karyakram (launched in 2011), encourage women who would deliver at home to instead deliver in institutional settings by giving them incentives such as free delivery (including caesarean deliveries) and free transport from home to health institutions in both rural and urban areas. Improving maternal and child health outcomes in India will also require attention to the structural characteristics that serve as barriers to women accessing adequate prenatal and postnatal care, including socioeconomic status, education, and living in rural areas.

Table 1 Weighted summary statistics

	N	Per cent/Mean (sd)
Dependent variables		
Any antenatal check-up	3,246	82
Adequate antenatal check-ups	3,204	39
Antenatal check-up index	3,059	
No tests done (0)		17.06
All tests done (8)		11.84
Postnatal care index	3,221	
No check-up		39.14
First check-up after 24 hours		24.55
First check-up within 24 hours		36.31
Delivery in institutional setting	3,230	59
Independent variables		
Unwanted birth	3,343	59.7
Age	3,343	24.714 (4.837)
Number of living children	3,343	1.682 (1.203)
Household asset quintile		
Poorest	3,343	23.4
Second quintile	3,343	21.9
Third quintile	3,343	24.1
Fourth quintile	3,343	16.9
Richest	3,343	13.7
Caste Group		
Scheduled castes (SC)	3,343	24.8
Scheduled tribes (ST)	3,343	7.7
Other backward classes (OBCS)	3,343	43.9
Forward castes(FC)	3,343	23.5
Religion		
Hindu	3,343	79.8
Muslim	3,343	15.7
Other religion	3,343	4.5
Urban	3,343	19.9
Education		
Illiterate	3,343	47.7
Incomplete primary	3,343	6.7
Primary	3,343	28.7
Secondary	3,343	8.5
Higher secondary	3,343	5.2
College and higher	3,343	3.3
Son alive	3,343	54.9
Empowered action group (EAG) state	3,343	58.8

Table 2 Maternal investments in health by birth wantedness in India (weighted per cent).

	Wanted birth	Unwanted birth
Any antenatal check-up	92.4	75
Adequate antenatal check-ups	49.9	31.7
Antenatal check-up index		
No tests done	7.7	23.7
All tests done	19.8	6.2
Postnatal care index		
No check-up	30.44	45.06
First check-up after 24 hours	26.64	23.12
First check-up within 24 hours	42.92	31.82
Delivery in institutional setting	72.2	50.1

Table 3

Logistic regression models examining birth wantedness and maternal investments in health in India.

	Any antenatal check-up		Adequate antenatal check-ups		Antenatal check-up Index		Postnatal care Index		Delivery in institutional setting	
Variables	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Unwanted birth	-1.399***	-0.455*	-0.764***	0.038	-1.030***	-0.265*	-0.550***	-0.317**	-0.954***	-0.336*
	(0.172)	(0.193)	(0.122)	(0.145)	(0.106)	(0.116)	(0.106)	(0.117)	(0.125)	(0.159)
Age		-0.006		0.031+		0.028+		0.008		0.040*
		(0.022)		(0.016)		(0.016)		(0.015)		(0.017)
Number of living children		-0.298**		-0.281***		-0.313***		-0.122+		-0.300***
		(0.098)		(0.084)		(0.063)		(0.067)		(0.080)
Household asset quintile (ref: poorest)										
Second quintile		0.221		0.333+		0.131		-0.033		0.060
		(0.205)		(0.196)		(0.163)		(0.167)		(0.180)
Third quintile		0.672**		0.870***		0.556***		0.611**		0.149
		(0.243)		(0.214)		(0.163)		(0.190)		(0.210)
Fourth quintile		1.183***		0.488*		0.672***		0.286		0.234
		(0.301)		(0.217)		(0.176)		(0.198)		(0.220)
Richest		0.870*		0.473+		0.851***		0.503*		0.762*
		(0.4217)		(0.2512)		(0.2004)		(0.2344)		(0.3006)
Caste Group (ref: FC)										
Scheduled castes		0.356		-0.096		-0.045		0.015		-0.121
		(0.2443)		(0.1731)		(0.1506)		(0.1746)		(0.1893)
Scheduled tribes		1.061***		0.052		0.216		-0.332		-0.756**
		(0.2962)		(0.2726)		(0.2040)		(0.2369)		(0.2643)
Other backward classes		0.051		0.268+		0.302*		0.219		-0.181
		(0.213)		(0.155)		(0.128)		(0.146)		(0.163)
Religion (ref: hindu)										
Muslim		0.099		-0.044		-0.129		-0.162		-0.633**
		(0.238)		(0.204)		(0.155)		(0.168)		(0.196)
Other Religion		-0.527		0.200		-0.505**		-0.146		-0.653*
		(0.358)		(0.256)		(0.183)		(0.227)		(0.258)
Urban		0.388+		0.305*		0.426***		0.224+		0.917***
		(0.200)		(0.136)		(0.111)		(0.125)		(0.147)
Education (ref: illiterate)										
Incomplete primary		0.307		0.222		0.248		-0.249		-0.144
		(0.340)		(0.227)		(0.181)		(0.214)		(0.217)
Primary		1.008***		0.705***		0.841***		0.181		0.322+
		(0.213)		(0.173)		(0.140)		(0.149)		(0.168)
Secondary		0.870*		0.755**		0.761***		0.368		0.623*
		(0.434)		(0.259)		(0.189)		(0.241)		(0.297)
Higher secondary		1.378*		1.047***		0.789***		0.053		0.745*
		(0.643)		(0.284)		(0.220)		(0.279)		(0.310)
College and higher		2.700**		1.643***		1.140***		0.829*		3.186**

		(0.858)		(0.323)		(0.227)		(0.333)		(1.055)
Son alive		-0.180		-0.421**		-0.149		-0.325**		-0.271+
		(0.177)		(0.150)		(0.120)		(0.125)		(0.148)
EAG state		-1.393***		-1.239***		-1.830***		-0.181		-0.666***
		(0.182)		(0.129)		(0.112)		(0.120)		(0.138)
Ancillary parameters++										
cut1					-2.260***	-2.346***	-0.774**	-0.421		
					(0.098)	(0.387)	(0.084)	(0.359)		
cut2					-1.727***	-1.685***	0.248*	0.648		
					(0.095)	(0.380)	(0.085)	(0.361)		
cut3					-1.444***	-1.312***				
					(0.098)	(0.376)				
cut4					-1.217***	-0.997**				
					(0.095)	(0.376)				
cut5					-0.857*** (0.087)	-0.494 (0.376)				
cut6					0.322*** (0.084)	0.264 (0.374)				
cut7					0.445***	1.335***				
					(0.086)	(0.394)				
cut8					1.496***	2.680***				
					(0103)	(0.389)				
Constant	2.499***	2.755***	-0.003***	-0.903*			0.826***	0.465	0.956***	0.477
	(0.153)	(0.564)	(0.088)	(0.405)			(0.087)	(0.387)	(0.100)	(0.434)
Pseudo R-square	0.058	0.241	0.025	0.199	0.019	0.132	0.010	0.035	0.037	0.175
N	3,246	3,246	3,204	3,204	3,059	3,059	3,221	3,221	3,230	3,230

Note: Robust standard errors in parentheses

*** p<0.001, ** p<0.01, * p<0.05, + p<0.10

++: a) These are cut points that are used to differentiate the adjacent categories of the index on women's score on the antenatal care index. For example, cut1 is the estimated cut point on the latent variable that differentiates those with no tests performed during antenatal check-ups from those with a score of 1, 2, 3, 4,5,6,7 or 8 on the antenatal care index, when values of the independent variables are zero.

b) These are cut points that are used to differentiate the adjacent categories of the index on women's score on postnatal care. For example, cut1 is the estimated cut point on the latent variable that differentiates those with no postnatal check-ups from those who have their first postnatal check-up longer than 24 hours after they give birth (score of 1), and those who have their postnatal check-up within 24 hours of giving birth (score of 2), when values of the independent variables are zero.

Table 4

Predicted probabilities of maternal investments in health by birth wantedness in India.

	Any antenatal check-up		Adequate antenatal check-ups		Antenatal check-up Index (full score)		Postnatal care (first check-up within 24 hours of birth)		Delivery in institutional setting	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Wanted birth	0.924	0.925	0.499	0.354	0.183	0.067	0.438	0.40	0.722	0.686
Unwanted birth	0.75	0.886	0.317	0.363	0.074	0.052	0.310	0.323	0.5	0.609

Table 5 Potential outcome means for women with unwanted and wanted births using IPWRA estimator

	Wanted birth	Unwanted birth
Any antenatal check-up	0.847*	0 .801
Adequate antenatal check-ups	0.377	0.383
Antenatal check-up index	4.35	4.13
Postnatal care index	1.064**	0.921
Delivery in institutional setting	0.608	0.559

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