Unfinished Lives: The effect of domestic violence on neonatal and infant mortality

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Abstract

India accounts for 1.7 million child deaths, a quarter of global child mortality. The current literature has succeeded in establishing an association between domestic violence and child mortality, but has yet to present evidence of a causal relationship. In this paper we use an instrumental variable approach to analyse the causal impact of domestic violence against the mother on child mortality in the Indian context. Domestic violence is instrumented with the real price of gold at the month of marriage of the mother. Results lend evidence to a bias in OLS estimates and show a significant positive relationship between domestic violence and mortality. A one standard deviation increase in domestic violence translates to a 7.2 and 8.7 percentage point increase in both neonatal and infant mortality respectively.

Keywords: domestic violence; dowry; instrumental variable

JEL Codes: C26, J16 & J14

1 Introduction

According to the World Health Organisation classification, India falls within a region characterised by high mortality. Even within this region, with a child mortality rate of 53 per 1000 live births, India has higher child mortality than most of its neighbours. Over the years, India has established several programmes aimed at reducing child mortality, from the Family Welfare Programme in 1977 to the National Rural Health Mission in 2005[1] . These programmes rely on equitable healthcare and improved access to public health services with a distinct focus on rural areas and low socio economic status groups. Despite these efforts, India failed to achieve its former objective to reduce the Under Five Mortality Rate(U5MR) to less than 100 per 1000 births by the year 2000 (UNICEF, 2012). Several social and economic factors beyond access to healthcare can have an effect on child mortality. This paper aims to test the existence of a causal pathway between domestic violence against the mother and child mortality in India and provide new insight into the magnitude of its impact.

Violent behaviour is a recognised multifaceted problem with negative consequences for the individual, the economy and for the society as a whole. Unfortunately women, solely on account of their gender, face an increased threat of violent behaviour. Gendered violence is present without boundaries in every country irrespective of diverse social, economic and political backgrounds. In developing countries, violence against women causes more death and disability than cancer, malaria, traffic accident and wars combined (Morrison and Orlando, 1999). Although most societies look down upon gendered violence, in India the reality is that they are often endorsed under the garb of cultural practices, collective norms or religious beliefs. India is ranked 114 among 142 countries in terms of sex ratio in the Ricardo Hausman (2014). The poor ranking is attributed to female infanticide and the systematic neglect of daughters relative to sons. The prevalence rate of domestic violence in itself occupies a large variation among differing reports, from 17% (Martin et al., 1999) to 41% (Peedicayil et al., 2004). One possible explanation for this is the non-standardisation of survey questions regarding violence in the various reports and differences in the subjective interpretation of violence. However, a more plausible explanation is the under-reporting of incidences due to the social stigma attached to violence and the underestimation of violence in itself. Actual prevalence of violence in India is therefore at a risk of underestimation and is thought by experts to be much higher than reported.

The theories on the existence of domestic violence can be broadly classified into two:

[1] A comprehensive list of initiatives can be found in Infant and Child Mortality in India Levels, Trends and Determinants, NIMS, ICMR and Unicef, 2012.

the feminist theory and the evolutionary theory. The former identifies patriarchy as the root cause of domestic violence, whereby males use violence to exercise control over women (Dobash and Dobash, 1979) (Martin, 1981) (Yllo and Straus, 1990). Evolutionary theory posits that domestic violence stems from paternity uncertainty. In this view, violence stems from the insecurity that males feel when their partners are exposed to the possibility of sexual encounters with other males (Wilson and Daly, 1993). In India, where dowry practices still exist on a large scale, violence may also be used as a means of redistributing resources through extracting assets from the wife (Chin, 2012) or the wifes family (Bloch and Rao, 2002).

Domestic violence has far reaching consequences not just for the victim of abuse and for the household, but also for the economy of the country as a whole. The medical, policing and judicial costs due to violence have been quantified in a few developed countries as staggering amounts, such as 1.1 billion Dollars (Canadian) in Canada (Zhang, 2012) to 23 billion British Pounds per annum in Great Britain (Walby, 2004). Over the years, a number of in-depth analyses have been conducted in Western countries to determine the causes and quantify the effects of domestic violence (Tauchen et al., 1985) (Farmer and Tiefenthaler, 1997) (Iyengar, 2009). In contrast, the number of studies done in developing countries is extremely limited due to the lack of quality nationally representative data. This void in literature is of particular significance as the negative effects of violence have a multiplier effect in these countries due to the continued persistence of adverse social and economic conditions. Predictably, the estimated rate of violent death in low and middle income countries is twice that of a high income country (Waters et al., 2004).

One of the detrimental effects of domestic violence arises from the fact that women are abused during pregnancy. In addition to the apparent and well researched reduction in womens welfare, violence during pregnancy can have an impact on child mortality through various mechanisms. The most direct mechanism is through the effect of blunt physical trauma and the resulting harm caused to the foetus (Nasir and Hyder, 2003). A second mechanism is through the deterrent effect that violence has on womens access to pre-natal healthcare (Petersen et al., 2001). Third, persistence of post natal domestic violence also has a negative impact on child care, especially in terms of restricted access to post-natal healthcare and inadequate nutrition. Fourth, women who experience violence also tend to have higher levels of psychological stress, which is associated with low birth weight or pre-term delivery and are well known risk factors for neonatal and infant mortality (Campbell et al., 1999).

Peedicayil et al. (2004) estimate the prevalence of physical violence and determines

the factors associated with the violence during pregnancy in India. Overall, 41% of the sample had experienced some form of physical violence, out of which 12.9% also experienced violence during pregnancy. Factors that are associated with the risk of domestic violence are having husbands who consume alcohol, husbands having an affair, dowry harassment and husbands accusing the wife of having an extramarital affair. Other significant risk factors include a husbands low education, a husbands substance abuse, no social support, three or more children and household crowding. Recently, several studies have also identified financial stress faced by the household as a significant risk factor in determining domestic violence. Being an agrarian society, local precipitation shocks, too, have shown to have a significant effect on domestic violence. In periods of drought, husbands may attempt to extract more surplus from the wife to smooth their own consumption and thereby increase domestic violence and dowry deaths (Sekhri and Storeygard, 2014).

A few studies have established an association between domestic violence and child mortality in India. Jejeebhoy (1998) explores the link between wife beating during pregnancy and foetal and infant death using data from a community based survey during 1993-94 in Uttar Pradesh in the North and Tamil Nadu in the South of India. It allowed the authors to test for regional and religious differences within India. For the sample as a whole, 40% of women experienced violence. They highlight the association between womens experiences of wife beating and infant and foetal loss, even when conditioning on several social, economic and geographical factors. The paper concludes that these associations are stronger and more significant in Uttar Pradesh than in Tamil Nadu, as women in Tamil Nadu have some measure of autonomy due to the states egalitarian setting and kinship patterns (Dyson and Moore, 1983). A more recent investigation conducted by Koenig et al. (2010) is based upon a 2002-2003 follow-up study of a cohort selected from the 1998-99 National Family and Health Survey (NFHS 2) in four Indian states. The authors find that births to mothers who experienced multiple incidents of domestic violence had a 68% higher risk of perinatal and neonatal mortality. No differences in mortality rates were observed for births where the mother had experienced only one episode of violence. The research by Ackerson and Subramanian (2009) analyses the effect of domestic violence on child mortality using the more recent 2005-06 National Family Health Survey (NFHS 3). They find that maternal experience of physical violence increased mortality rates among all children and these associations do not differ according to the childs gender. Sexual and psychological violence were less strongly associated.

However, a limitation in all the studies thus far is that none of them account for the potential endogeneity of domestic violence. Endogeneity in this instance may arise due

to three concerns. The first of these is the high plausibility of systematic underreporting of domestic violence in India. For instance, women from rural areas may systematically underestimate their experience of violence and thus unknowingly underreport it. Similarly, women who do not work outside the house may have a systematically higher threshold of privacy and so withhold information about the existence and extent of domestic violence. This can lead to measurement error in the data generating process. The second concern arises due to the problem of omitted variable bias in OLS estimation procedures of child mortality. For example a low level of confidence of the mother, which is not captured in the data, may make her more vulnerable to domestic violence and simultaneously restrict the level of childcare she chooses to access. This is non-ignorable selection that can lead to inconsistent estimation in standard OLS models (Clarke and Windmeijer, 2012). The third is the possibility of reverse causality of domestic violence and child mortality. Since the timing of the violence is not available in the data, it is impossible to ascertain whether the experience of violence caused child mortality or the loss of a child subsequently led to domestic violence within the marriage. Thus the outcome variable may impinge on the independent variable, causing OLS estimates of the impact to be biased.

An innovative study in the United States overcomes this endogeneity by using the wins and losses of professional football teams to instrument domestic violence (Card and Dahl, 2011). This has rarely been done in studies in India. An exception is Eswaran and Malhotra (2011), who test whether domestic violence reduces women's autonomy. The authors use an index of the women's height relative to the average height within the state as an instrument for domestic violence.

This paper empirically tests if the positive association between domestic violence and mortality is just indicative of an association or represents a causal mechanism by exploiting exogenous variation in domestic violence through the real price of gold in India. A higher price of gold at the time of marriage of the mother may reduce the share of gold jewellery in the dowry basket. This may reduce the amount of valuable assets the bride has direct control over, which in turn exposes her to a higher risk of domestic violence. The IV estimates suggest that a one-step[2] change in domestic violence against the mother increases the likelihood of both neonatal mortality and infant mortality by 7.2 and 8.7 percentage points respectively.

This paper is organised as follows. Section 2 provides a detailed data description. Section 3 outlines the identification strategy. Section 4 presents the main results. Section

[2]Domestic violence in the main model of this paper is an ordinal index with a range of 0 to 7

5 tackles several robustness checks and heterogeneity tests and Section 6 concludes.

2 Data

Data from the National Family and Health Survey (NFHS 3), Indias version of the Demographic Health Survey (International Institute for Population Sciences, 2007), is used for this study. The survey was fielded between November, 2005 and August, 2006, and is the third of a series of cross-sectional NFHS surveys. It is based on a sample of households which is representative both at national and state level; 124,385 eligible women of reproductive age (15-49) have completed interviews. The dataset contains a rich variety of information, including background characteristics, reproductive histories, antenatal, delivery and post natal care and husbands background. Within reproductive histories, births and deaths for children were recorded with the total number of births recorded at 256,782. A Status of Women and Spousal Violence module was also carried out in each of Indias 29 states. Mother level data has been merged with birth level data in order to evaluate mothers socio economic characteristics at the birth level.

2.1 Analytical Sample

The analysis is restricted to evermarried women who have had at least one birth. In addition, we restrict the sample to single live births. We also include only marriages that occurred after 1991 to improve the strength of the identification of the instrument (See discussion in Section 3.2).

We condition our analysis on various socio-demographic factors that have a proven association with child mortality in the given context. These are classified into child, mother, household and father level characteristics. Table 1 presents the summary statistics of the control variables, the dependent variables and the independent variable of interest for the analytical sample.

Our analytical sample contains more male births than female births, which is unsurprising given the permeation of ultrasound technology and the rampant sex selection in India (Bhalotra and Cochrane, 2010). On average, mothers in the sample have two reported births. The sample mean of number of years of education of the mother is 6 years, which translates into secondary education. More than half of the sample births occurred when the mother was between 20 and 26 years of age, with the average age of the mother at the time of birth at 23 years(standard deviation = 4.29). The average height of mothers in the sample is 152.4 centimetres (standard deviation = 5.85) and is thus representative of

Table 1: Summary Statistics

Variable		mean
Gender of the child	Male	0.52
	Female	0.48
Birth Order Number		1.78
Mother's Characteristics	Mother's Age at Birth	22.85
	Mother's years of Schooling	6.73
	Mother's Height (cm)	152.4
Location of Household	Urban	0.46
	Rural	0.54
Religion	Hindu	0.70
	Muslim	0.11
	Christian	0.14
	Other	0.06
Wealth Index	Poorest	0.09
	Poorer	0.14
	Middle	0.21
	Richer	0.27
	Richest	0.29
Caste Membership	Schedule Caste	0.17
	Schedule Tribe	0.18
	OBC	0.30
	High Caste	0.35
Dependent Variables	Neonatal Mortality	0.02
	Infant Mortality	0.04
Observations		44420

Mother included multiple times in case of multiple births, Standard deviations for mothers age at birth and height are reported in text. Quintiles of wealth index, which is a factor score of the households cumulative living standard based on asset ownership

the national average. More than half (56.5%) of the analytical sample is from a household located in a rural area and 48.8% is from middle or lower categories of the wealth quintile. In addition to the religious composition of India, the religious distribution of the analytical sample is indicative of differences in the average number of births according to religion. Specifically, 59.71% of the Christian households have more than one birth recorded as compared to Muslim and Hindu households where 57.54% and 41.81% have more than one birth recorded respectively. 34.36% of the sample belongs to a high caste.

2.2 Domestic Violence

One woman was selected at random from each household for the domestic violence module. Rural and urban samples were drawn within each state. Violence in the DHS 5 is measured using the modified Conflict Tactics Scale (CTS) (Straus et al., 1973) using the following set of questions: (Does/Did) your (last) husband ever do any of the following things to you?

1. **Slap you?**
2. **Twist your arm or pull your hair?**
3. **Push you, shake you, or throw something at you?**
4. **Punch you with his fist or something that could hurt you?**
5. **Kick you, drag you or beat you up?**
6. **Threaten to attack you with a knife, gun or any other weapon?**
7. **Try to choke you or burn you on purpose?**

Out of a total sample of 124,385 mothers, 40,682 were not eligible for the domestic violence module as there was more than one eligible respondent within the household. 477 eligible respondents were not surveyed as privacy could not be obtained. Subject to these criteria, 83,703 eligible respondents were interviewed. Each of the above questions was allowed five responses that are coded as follows:

- **No**
- **Often during the last 12 months**
- **Sometimes during the last 12 months**
- **Not in the last 12 months**
- **Yes, but currently a widow or timing missing**

Collectively the 7 items formed an alpha statistic of 0.83 suggesting it is acceptable to use them as a latent construct. Thus, for our main specification we create a factor score of physical violence using a principle component analysis on each of the 5 responses to the 7 dimensions of violence.

We also create an ordinal measure of domestic violence that is equal to the number of kinds of physical violence the respondent is exposed to. The independent variable is thus an index (0, 7) which is 0 if domestic violence does not exist in the household and progressively adds 1 for a non-zero response to each of the 7 questions mentioned above. 29.1% of the analytical sample has experienced at least one form of physical violence.Table 2 provides the summary statistics of the components of domestic violence and Figure 1 provides a histogram of this index.

Table 2: Components of Domestic Violence

Domestic Violence	mean
No Violence	0.72
Spouse ever slapped	0.13
Spouse ever twisted her arm or pulled her hair	0.06
Spouse ever pushed, shook or threw something	0.04
Spouse ever punched with fist or something harmful	0.02
Spouse ever kicked or dragged	0.02
Spouse ever threatened or attacked with knife/gun or other weapon	0.01
Spouse ever tried to strange or burn	0.00
Cumulative index of domestic violence	0.64
Principle component analysis of domestic violence	-0.01
N	46420

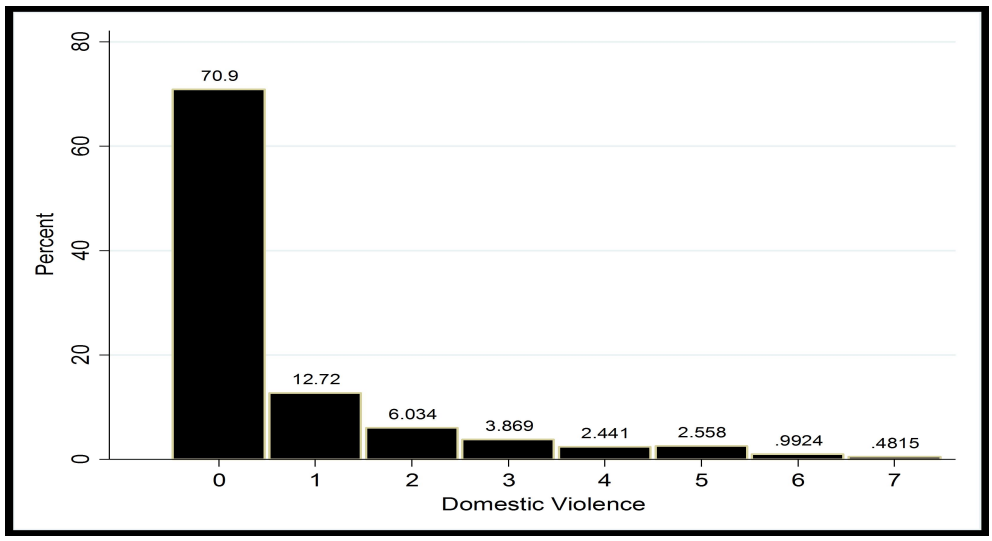

Figure 1: Cumulative index of domestic violence

2.3 Mortality

The dependent variable is a binary variable with 1 indicating mortality and 0 indicating survival. Sample selection problems are eliminated since the birth histories are retrospective and inclusion in the sample is not restricted to survival at survey date. We created subsets of the data based on age at the time of death and 2 models are estimated on the following dependent variables:

1. **Neonatal Mortality** **All deaths from the first day of life to 30 days of life, conditional on children who were born 30 days before the date of the survey to allow for full exposure to the risk of neonatal mortality. Thus children who are less than 30 days old at the time of the survey have been excluded from the model.**

2. **Infant mortality** **All deaths from the first day of life up to the first year of life,**

conditional on children who were born 1 year before the date of the survey to allow for full exposure to the risk of infant mortality. Thus children who are less than 1 year old at the time of the survey have been excluded from the model.

Table 3: T-Tests of Difference in Means of Mortality

	No Violence Reported	Violence Reported	t-tests of Equality*
Neonatal Mortality	Mean = .021	Mean =.025	0.020
Infant Mortality	Mean =.033	Mean = .042	0.000
N	33330	13090	

The number of births that resulted in a death in the neonatal model and the infant model is 1,030 (2.22%) and 1,639 (3.53%) respectively of the total sample of 46,420 births. The proportion of births that resulted in a death in the neonatal and infant model is 2.1% and 3.3% respectively when no violence was reported as shown in Table 3. When violence was reported, this increases to 2.5% and 4.2%. The proportion of births that resulted in a death is higher for both variables when violence was reported. There is a statistically significant difference in mortality between respondents who report the presence of domestic violence and respondents who do not report domestic violence in both the neonatal and infant stages of life.

3 Identification Strategy

To overcome the potential endogeneity of domestic violence, we need a valid instrument that is strongly correlated with the domestic violence and is uncorrelated with child mortality. This section first outlines the empirical specification and proceeds to discuss the validity of the real price of gold in India as a plausible source of exogenous variation.

3.1 Econometric Specification

To overcome the potential endogeneity of domestic violence, we need a valid instrument that is strongly correlated with the domestic violence and is uncorrelated with child mortality. This section first outlines the empirical specification and proceeds to discuss the validity of the real price of gold in India as a plausible source of exogenous variation. We seek to estimate the following equation:

$$Y_{ist} = \beta_1 X_{is} + \beta_2 C_{is} + \beta_3 S_s + \beta_4 M_i + \beta_5 T_t + {}_6 S_s * t + \varepsilon_{ist}$$

where, Y_{ist} is the outcome for each birth i in state s and year t ;

X_{is} is the domestic violence experienced by the mother of child i ;
C_{is} is a vector of socio demographic controls of household, mother and child;
S_s is a state dummy to control for state fixed effects;
M_i is month of birth fixed effects;
T_t is year of birth fixed effects;
$S_s * t$ is an interaction effect between the state and the year of birth of the child;
ε_{ist} is the error term.

Indias socioeconomic conditions vary considerably, especially between northern and southern states. State fixed effects have been included in all models to capture state specific effects. An interaction term for state specific trends has also been included to account for the differential trends of mortality rates within each of the states. Further, fixed effects for the year and month of birth have been included to account for seasonal variations in mortality (Brainerd and Menon, 2014), which is of particular significance in an agrarian society.

Due to the potential endogeneity of domestic violence, we estimate an IV where violence is instrumented by the price of gold at the time of marriage of the mother. β_1 is the coefficient of interest that defines the causal relationship between domestic violence and mortality.

3.2 Instrument for Domestic Violence

A number of studies have documented the effect of economic independence on domestic violence, both in developed and developing countries. A majority of them find that greater economic independence of the wife increases her options outside marriage, thereby reducing the risk of domestic violence (Farmer and Tiefenthaler, 1997) (Tauchen et al., 1985). Economic independence of an individual can be enhanced through several mechanisms. While perhaps the most extensively researched mechanism is through the employment of the woman[3], the examination of effects of alternative variables that enhance the bargaining power of women within the household has been limited.

One such variable in the context of India is dowry. Dowry practices continue to be

[3]Although employment does improve the bargaining power of the woman within the household, research shows divergent effects of womens employment on domestic violence in developing countries Chin (2012).

widespread in spite of being prohibited by law [4]. Historically, dowry was given as a voluntary gift to the bride. The groom or the grooms family had no claims to the dowry even after the death of the bride[5] Bühler (1964). It was anticipated to be an economic safety net for the bride. At present, the value of the dowry given is dependent upon the financial capacity of the brides family and increases with the positive attributes of the prospective groom (Becker, 1991)(Anderson, 2007). Cash and gold are two of the most prevalent forms of dowry in India in addition to silver, land, car, house etc.

Recent research into dowry in South Asia has led to two distinct theories of dowry motives: bequest as a pre-mortem inheritance and groomprice as a price that clears the marriage market. Although scholars have documented an increasing transformation of dowry from bequest to groomprice (Srinivas, 1984)(Banerjee, 1999), a dowry basket characteristically has elements of both. Research has also found these different regimes of dowry to have heterogeneous effects on womens welfare (Arunachalam and Logan, 2006). Bequest dowries improve the bargaining power of the woman within the household and may thus mitigate domestic violence against women within the household (Brown, 2009). This has also been cited as the reason why Indian women continue to support dowry practices, despite it being against the law.

Dowry elements with the motive of groomprice are usually a direct transfer of assets to the groom or the grooms family in the form of cash, land, residential property etc. Bequest dowries are less likely to involve cash only transfers as brides have limited control on cash only transfers. In contrast, dowry elements with the motive of bequest are usually a direct transfer of assets to the bride in the form of property or jewellery. India holds 11% of the worlds gold stock. 75% of this stock is in the form of jewellery (Grubb, 2015). Gold, one of the primary elements of dowry in India, is almost always given in the form of jewellery to the bride. Studies show that 75% of women in India claimed that their jewellery remained with them after marriage (Basu, 1999). Often a woman has her own locked trunk or a locker at a bank in which she stores her jewels (Hershman, 1981).

We speculate that a high price of gold at the time of marriage reduces the share of gold jewellery in the dowry basket. This reduces the value of assets the bride has direct control over, and in turn exposes her to a higher risk of domestic violence. As a result, the real price of gold at the time of marriage of the mother is used as an instrument in this

[4]The Dowry Prohibition Act, 1961.

[5]What (was given) before the (nuptial) fire, what (was given) on the bridal procession, what was given in token of (Such Property), as well as a gift subsequent and what was given (to her) by her affectionate husband, shall go to her offspring (even) if she dies in the lifetime of her husband. The Laws of Manu (c. 200 AD).

study.

We conducted an exploratory analysis of this mechanism using the Status of Women and Fertility (SWAF) data, which included questions regarding dowry types. The survey was fielded in 1993-1994 in the two districts of Uttar Pradesh and Tamil Nadu. Since the practice of dowry is illegal, the questions framed were imprecise and only provide an indication of dowry practices within the family. We coded a variable for the presence of gold dowry tradition within the family from information collected from answers to the question *Generally, in your family, is gold given as dowry?* The answers are coded as yes and no. This it is not a direct reference to ones own marriage but nonetheless provides a basis for tentative analysis of gold as a form of dowry and its impact on domestic violence.

Table 4: Summary Statistics of SWAF Data

Variable	Mean	Std. Dev.
Domestic violence binary variable with 1 indicating the presence of domestic violence.	0.39	0.49
Gold dowry binary variable with 1 indicating the prevalence of giving gold dowry in the community.	0.95	0.22
Cash dowry binary variable with 1 indicating the prevalence of giving cash dowry in the community.	0.45	0.50
Religion1 binary variable with 1 indicating Muslim	1.52	0.5
Household income - for the past 12 months (Indian Rupees)	20865	27589
State binary variable with 1 indicating Uttar Pradesh	1.43	0.5
SC/ST Membership binary variable with 1 indicating high caste	2.78	0.63
N	1650	

* The SWAF dataset for India has a single Christian respondent who has been excluded from this analytical sample.

Table 4 provides a summary of the relevant variables from the SWAF dataset. The question on domestic violence was framed as Does your husband ever hit or beat you? The Yes/No answers were coded into a binary variable. On average, about 40% of the respondents acknowledged the presence of domestic violence in the marriage, which is consistent with national estimates. 94% of the eligible respondents reported the giving of gold as a form of dowry as a social norm while 45% of the respondents reported the giving cash as a form of dowry as a social norm. There is a slight Muslim majority in the data with 861 Muslims and 789 Hindus. Average household income is at Rs.20,865 and 56.7% of them belong to the state of Tamil Nadu. Only 11% of the sample belongs to a low caste.

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Table 5: Association between Gold Dowry and Domestic Violence

Variables	**Domestic Violence**
Gold dowry	-0.18***
	-0.06
Cash dowry	-0.05**
	-0.03
Muslim	-0.04
	-0.03
Household income for the past 12months	-0.08***
	-0.02
Uttar Pradesh	0.10***
	-0.03
High Caste	-0.08**
	-0.02
N	1,650

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Standard Errors Clustered at Household Level

Additional Controls: Fixed effects for the year of birth of respondent

gold as a form of dowry as a social norm while 45% of the respondents reported the giving cash as a form of dowry as a social norm. There is a slight Muslim majority in the data with 861 Muslims and 789 Hindus. Average household income is at Rs.20,865 and 56.7% of them belong to the state of Tamil Nadu. Only 11% of the sample belongs to a low caste.

Table 5 presents the linear probability estimation results based on the SWAF data. Domestic Violence is the binary outcome variable while the regressor of interest is Gold Dowry. In this analysis, gold as a form of dowry has a negative association with the prevalence of domestic violence, reducing its likelihood by 18 percentage points. This relationship remains significant after conditioning on several variables such as religion, amount of cash dowry given, household income, caste membership, state fixed effects and fixed effects for the year of birth of the respondent. This is consistent with the assumed negative impact of gold dowry.

India imports 92% of its gold demand. The price of gold is determined by the London Price Fix twice a day and is external to the country. The national demand for gold in India is then determined through the interplay of this international gold price, share prices (rate of return on alternative financial assets), GDP, the exchange rate and rate of household financial savings (Vaidyanathan, 1999). We use data on the monthly price of gold in Indian Rupees (INR) per troy ounce from the World Gold Council. This series is shown in Figure 2.

Post-independence India had a closed economy characterised by a desire for self-sufficiency. Rigid control of gold sales and taxation led to an extensive black market of

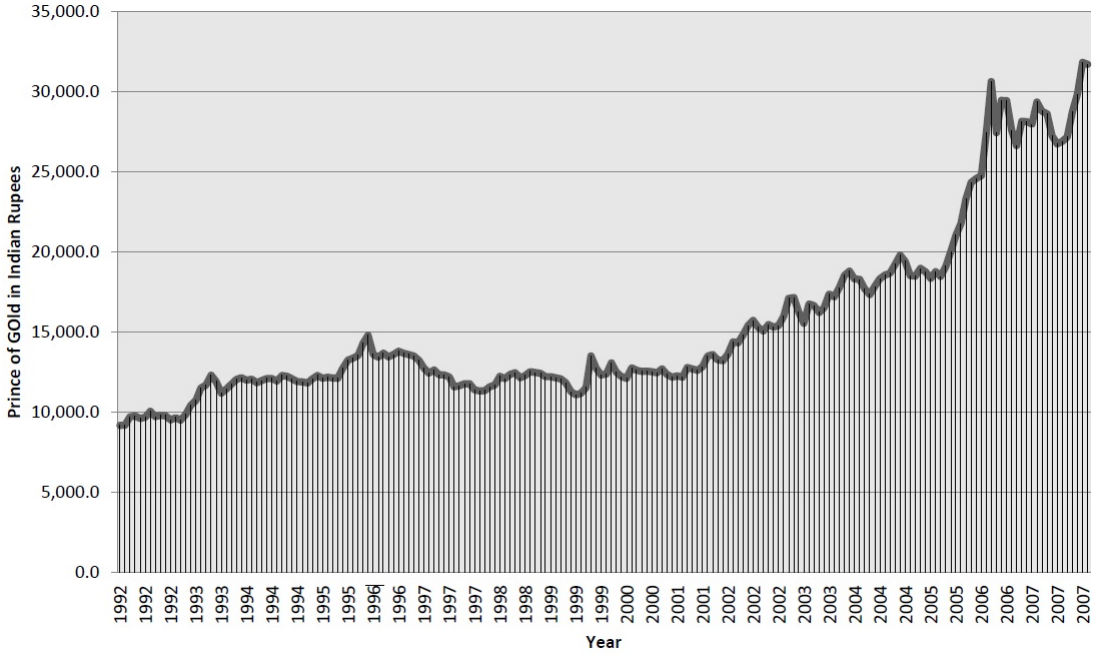

Figure 2: Time series of the price of gold

gold through smuggling. Gold prices within the country were thus not determined through previously mentioned global market forces, but by local market forces (Vaidyanathan, 1999). In 1991, on the verge of bankruptcy, Indias economy changed drastically when it adopted more liberal economic policies. Due to this structural break, the estimation is restricted to mothers who were married post 1991, after which we expect the world price of gold to be a more accurate measure of the Indian price of gold.

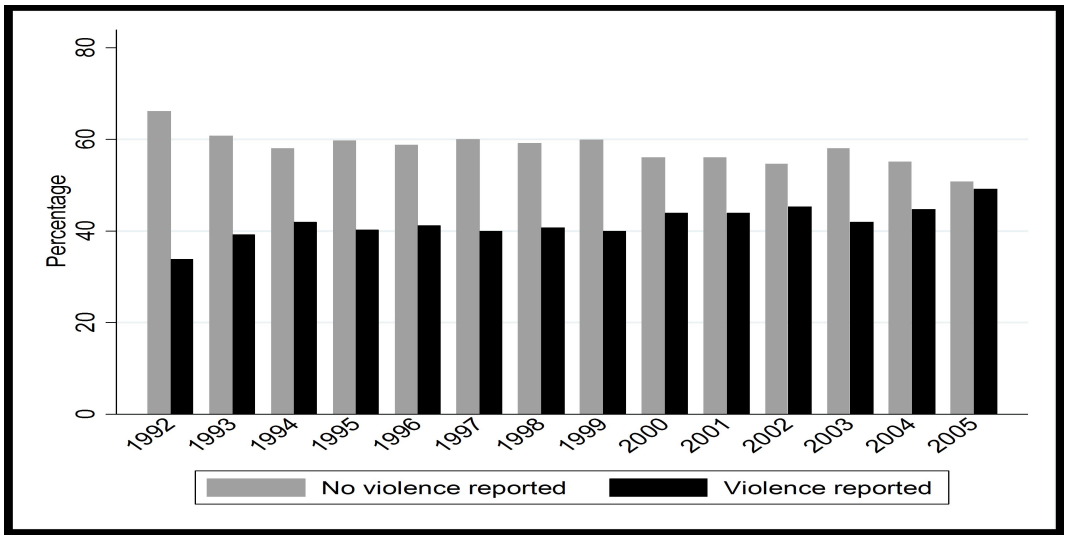

Figure 3: Mean of births by domestic violence and year of marriage

Figure 3 is a histogram representing the mean of births within each year of mar-

riage in our sample range broken down by whether domestic violence was reported or not weighted by the national domestic violence weight provided with the DHS. The number of observations in each year of marriage and the proportion of the estimation sample with the presence of domestic violence by the year of marriage is provided in the appendix A.6. There are sufficient numbers of observations within each year to enable identification of the first stage IV regression.

4 Results

We present a discussion of the IV first stage statistics followed by the instrumental variable estimation results. Table 6 presents the first stage statistics of the two-stage least square estimation. We have also included a square term of the real price of gold to capture the non-linearity evident in the price of gold plots (Figure 2). The Durbin-Wu-Hausman test rejects the null that the variables are exogenous with a p-value of 0.03. This test itself relies on the assumption that the instrument is valid and therefore is limited in terms of reliability. The instrument must be uncorrelated with the outcome variable, which is theory driven. The instrument must be strong to account for significant variation in the endogenous regressor. The stronger association between the price of gold and domestic violence, the stronger will be the identification of the model, leading to higher efficiency. The test of strength is an F-Test for the significance of the instrument in the first stage of the IV Model. Price of gold exceeds the Stock and Yogo critical value of 10 with a test statistic of 29.12. Price of gold at marriage is a significant predictor of domestic violence.

Column 1 and Column 2 in Table 7 present the second stage results of the two-stage least squares estimation for neonatal and infant mortality respectively. Violence is a significant predictor of child mortality in both stages of the childs life. In the first 30 days a one-step increase in domestic violence increases the likelihood of both neonatal mortality and infant mortality by 7.2 and 8.7 percentage points relative to the mean respectively.

Analysing this in the general framework by applying the optimal generalised method of moments (gmm) with a weighting matrix that is optimal when the error term is heteroskedastic, maintains the positive relationship between domestic violence and child mortality in both models with a magnitude of 6.2 and 7.3 percentage points in columns 3 and 4. The gmm estimator gives us lower point estimates with tighter standard errors. Similarly limited information maximum likelihood model (liml) gives us point estimates of 8.5 and 10.3 percentage points at the 5% significance level for the neonatal and infant mortality models respectively (not shown).

Table 6: IV First Stage Statistics

Variables	
	Domestic Violence
Price of Gold at Marriage	0.0002***
	[0.000]
Price of Gold at Marriage^2	-0.000***
	[0.000]
Female Child	-0.008
	[0.012]
Income Category: Poor	-0.067**
	[0.032]
Income Category: Middle	-0.177***
	[0.03]
Income Category: Richer	-0.288***
	[0.031]
Income Category: Richest	-0.517***
	[0.034]
Mothers Age at Birth	-0.191***
	[0.05]
Mothers Height	-0.040***
	[0.011]
Household located in Rural Area	-0.158***
	[0.015]
Muslim	0.048**
	[0.021]
Christian	-0.029
	[0.027]
Other Religion	0.035
	[0.030]
Scheduled Caste	0.214***
	[0.020]
Scheduled Tribe	0.003
	[0.025]
Other Backward Class	0.003
	[0.016]
Birth Order Number	0.101***
	[0.009]
Mothers Years of Schooling	-0.022***
	[0.002]
N	46420
Instrument Diagnostics:	
Durbin-Wu-Hausman (p value)	0.01
Hansens J test of over- identifying restrictions (p value)	0.81
F Statistic	29.12

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Robust Standard Errors Clustered at Mother Level

Additional Controls: State fixed effects, Month of birth fixed effects, Year of birth fixed effects, State Fixed time trends, Mother's age at birth^2 Mother's age at birth^3

Table 7: IV Second stage results

	2sls Estimator		**GMM Estimator**	
	Neonatal Mortality	**Infant Mortality**	**Neonatal Mortality**	**Infant Mortality**
Domestic Violence	0.072**	0.087**	0.062**	0.073**
	[0.036]	[0.044]	[0.027]	[0.035]
Female Child	-0.006***	-0.007***	-0.006***	-0.007***
	[0.001]	[0.002]	[0.001]	[0.002]
Wealth Quintile: Poor	0.004	0.002	0.003	0.001
	[0.005]	[0.007]	[0.004]	[0.005]
Wealth Quintile: Middle	0.006	0.002	0.004	0.000
	[0.007]	[0.008]	[0.005]	[0.007]
Wealth Quintile: Richer	0.011	0.008	0.008	0.005
	[0.009]	[0.012]	[0.007]	[0.009]
Wealth Quintile: Richest	0.019	0.016	0.014	0.011
	[0.014]	[0.017]	[0.011]	[0.014]
Mother's age at birth	-0.007	-0.016	-0.009	-0.018*
	[0.010]	[0.012]	[0.009]	[0.011]
Mother's height	-0.005**	-0.007**	-0.005***	-0.007***
	[0.002]	[0.002]	[0.002]	[0.002]
Household located in rural area	0.013**	0.015**	0.012**	0.013**
	[0.005]	[0.006]	[0.004]	[0.005]
Muslim	-0.004	-0.006	-0.004	-0.006*
	[0.003]	[0.004]	[0.003]	[0.003]
Christian	0.000	-0.001	0.000	-0.001
	[0.004]	[0.005]	[0.003]	[0.004]
Other Religion	-0.007*	-0.008	-0.007**	-0.008*
	[0.004]	[0.006]	[0.003]	[0.004]
Schedule Caste	-0.011*	-0.014*	-0.009*	-0.011*
	[0.006]	[0.008]	[0.005]	[0.006]
Schedule Tribe	0.001	0.007	0.001	0.007*
	[0.004]	[0.005]	[0.003]	[0.004]
Other Backward Caste	0.003	0.004	0.003	0.004*
	[0.002]	[0.003]	[0.002]	[0.002]
Birth Order Number	-0.006**	-0.006*	-0.006**	-0.005**
	[0.002]	[0.003]	[0.002]	[0.002]
Mother's years of schooling	0.001	0.000	0.000	0.000
	[0.001]	[0.001]	[0.000]	[0.001]
N	46420	46420	46420	46420
Mean (dep var)	2.21	3.53	2.21	3.53
s.d (dep var)	14.72	18.45	14.72	18.45

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Robust Standard Errors Clustered at Mother Level

Additional Controls: State fixed effects, Month of birth fixed effects, Year of birth fixed effects, State Fixed time trends, Mother's age at birth^2 Mother's age at birth^3

Previous results (Osters, 2009) find that although mortality is high from 0 to 6 months, it does not explain excess female mortality.In our results, girls have lower risk of mortality in both models. A possible explanation is that since sex-selective abortion is rampant in India, the girl children that are eventually born are only desired births (Bhalotra and Cochrane, 2010). The height of the mother is an index of the mothers nutritional status. It has a negative relationship with the likelihood of mortality in both models, which is in line with the existing literature (Bhalotra and Rawlings, 2011)(Monden and Smits, 2009). Rural location of household increased the risk of death in both models. This is congruent with the well documented lack of adequate health- and post-natal care available for the inhabitants of rural India (Section 5.4). Muslim children have a slight advantage in the infant mortality model as has been established previously (Bhalotra et al. 2010). Births to minority religions and scheduled castes relative to Hindus and high caste have a lower likelihood of mortality although this is significant only at the 10% level. We explore this further in the robustness checks (Section 5.4). Children born later in the birth order have a higher chance of survival in the neonatal model.

We present the OLS results in the appendix. OLS estimations have a small but highly significant positive effect of domestic violence on the likelihood of both neonatal and infant mortality (Columns 1 and 2, Table A.1). The domestic violence coefficient is not statistically significant in the stringent OLS specification (Columns 3 and 4, Table A.1), which is inclusive of all controls that are used in our IV specifications.

5 Robustness Checks

In this section we test the robustness of the estimates based on alternative specifications of domestic violence and by exploring heterogeneous effects.

5.1 Alternate Measure of Violence

Table A.2 report the results for estimations when domestic violence has been coded as a cumulative ordinal index (as in Figure 1) with 0 indicating that the respondent did not report any form of physical violence. Coding violence as a cumulative index reduces the strength of the instrument in the first stage with a lower F statistic at 15.3. The coefficients are consistent with the baseline IV estimation with a lower magnitude of 4 and 4.7 percentage point increase in risk of mortality in neonatal and infant models respectively.

We also examine the result of specifying separate iv2sls regressions on each dimension

of violence separately and present the results in Table A.3 of the appendix. Thus each dimension of domestic violence is our main variable of interest and each cell within the table are coefficients and standard errors from running these separate regressions. We find that the dimension 1 (Spouse ever slapped) does not significantly contribute to the index. A possible explanation is that the physical harm caused by this dimension is not large enough to be identified by the estimation. Dimensions 2 (Spouse ever twisted her arm or pulled her hair), 3 (Spouse ever pushed, shook or threw something) and 4 (Spouse ever punched with fist or something harmful) contribute the most to the index with increasing magnitudes of the coefficients as expected.

5.2 Weighted Least Squares

All of the estimations in this paper uses cluster robust standard errors at the mother level to account for possible heterogeneity arising from multiple births to a mother. There is considerable debate regarding the use of weights when attempting to identify causal estimates (Solon et al., 2013). The use of state fixed effects in the estimations should negate the effects of differential probability of being sampled into the domestic violence module. Nonetheless as an additional robustness check we re-estimate our main results using the national domestic violence weight provided in the Demographic Health Survey. Table A.4 in the appendix presents the resulted of the weighted regressions. Although slightly less precisely estimated, we continue to observe a positive relationship between domestic violence and neonatal and infant mortality with a magnitude of 6.6 and 7.2 percentage points respectively.

5.3 Age at Marriage

A possible concern with using the price of gold at the time of marriage as an instrument for domestic violence post marriage could be that the price of gold may affect the age of the mother at which the marriage occurs. It is conceivable that a higher price of gold at the time of marriage induces families to postpone the marriage in anticipation of a future drop in the price. We test this relationship in our analytical sample and find a positive association between the price of gold and the age at marriage but the magnitude of the effect size is small (Column 1, Table A.5) and it is only significant at a p-value of 0.10. An increase of one standard deviation in the price of gold increases the age at marriage by 5.7 months. This effect disappears when conditioning on the year of marriage fixed effects (Column 2, Table A.5). Given the continued high prevalence of arranged marriages in India, a short term increase in the price of gold is unlikely to have an effect on the age

of marriage.

5.4 Heterogeneous Effects

We now investigate whether the effect of violence on mortality varies depending on the child's gender and caste, location and the socioeconomic status of the household.

Table A.7 presents the results of the iv2sls estimations on girls and boys seperately. We see that girls have a 10.3 percentage point higher likelihood of dying in the neonatal model and 11.4 percentage point higher likelihood of dying in the infant model. In contrast we find no significant effects of domestic violence on the death of boys.

Table A.8 presents the results of separate regressions based on the caste membership of the household. As can be seen in columns 7 and 8, births to households belonging to other backward castes have a significantly higher likelihood of mortality with magnitudes of 7.5 and 7.6 percentage points respectively.

We now investigate if violence has a different impact depending on the location of the household in A.9. India has a large divide in terms of access to resources between rural and urban areas. There have also been recent suggestions of a widening disparity between rural and urban development structures in India. In households located in rural areas, domestic violence increases the likelihood of neonatal and infant mortality by 15.5 and 16.7 percentage points respectively. A χ^2 test of statistical difference in the estimated parameters for an urban versus a rural household results in a p value of 0.00 in the neonatal model and the infant model. There are no significant effects in households located in urban areas. This could be due to the fact that in urban areas the negative impact of violence is mitigated by a better access to resources in terms of social support, child care and health care. Moreover, the magnitude of the effect of mothers height on child survival is higher in households located in rural areas. The height of the mother is acting as a proxy for nutritional status of the mother and this nutritional status is likely to be reflected on subsequent child nutritional status as well. Child marriages and births to mothers at a very low age is more prevalent in the rural areas of India. Accordingly, children with a higher birth order number have a lower likelihood of mortality in the rural areas.

Table A.10 presents the results of a split sample test based on the wealth of the household as classified within the DHS. DHS constructs the wealth index from household-level data using principle component analysis. It is a composite index based on information regarding ownership of household items, dwelling characteristics, home construction materials and access to a bank or post office account. This score is then divided into population

quintiles with each quintile given a rank from 1 (poorest) to 5 (richest). For the purpose of this analysis, we classified households from the bottom two quintiles as Low Socioeconomic Status (SES), while households from middle, rich and richer categories have been coded as High SES. This simple classification allows us to estimate the effects of domestic violence on mortality in poorer families where such effects are likely to be magnified.

In the estimation sample, 46% of the low SES category and 37% of the high SES category have reported domestic violence. As expected, the results highlight differences in the effect of violence by SES. Families in the Low SES categories have a higher likelihood of child death when faced with the presence of domestic violence in both models. A low SES status results in a 7.7 percentage point increase in the likelihood of mortality in the neonatal model and a 7.3 percentage point increase in the likelihood of mortality in the infant model. A χ^2 test of statistical difference in the estimated parameters for low SES versus high SES households results in a p value of 0.00 in the neonatal model and the infant model. This result coupled with the previous finding of significant effect only in rural location of household may also be at least partially driven by a social desirability bias in the reporting of domestic violence.

6 Conclusion

This study constitutes a significant first step towards establishing a causal link between domestic violence and infant mortality. We find a significant positive relationship between domestic violence and both neonatal and infant mortality. Importantly, we avoided the problem of endogeneity by using the real price of gold as a source of exogenous variation in domestic violence. The results remained consistent through alternative measures of domestic violence and through several robustness tests.

Our analytical sample is affected by sample selection as we are unable to include foetal deaths. Thus the births in our sample are foetuses that came to full term and are therefore likely to be stronger foetuses. Thus the magnitude of effects reported in this paper are likely to be a lower bound of actual effect sizes.

This research could be enhanced by more extensive data on the timing of violence and the cash values of various kinds of dowries. Given the prevalence of both domestic violence and dowry practices in India, there is an inherent need for this data. However, the illegality of dowry and domestic violence and subsequent underreporting of each could make further accurate data collection difficult and must be addressed methodologically for precision in future analysis, for example by changing key survey parameters to overcome

underreporting and systematic measurement errors.

Concerted policy initiatives directed at the identification and eradication of domestic violence can effectively reduce neonatal and infant mortality levels in India. This could set helpful examples for developing countries where public health funding dedicated to the lowering of child mortality is frequently limited. Public policy addressing key aspects of improving absolute levels of gender equality tend to be relatively inexpensive and, if incorporating mechanics aimed at the reduction of domestic violence, should induce a reduction in child mortality.

References

Leland K Ackerson and SV Subramanian. Intimate partner violence and death among infants and children in india. *Pediatrics*, 124(5):e878–e889, 2009.

Siwan Anderson. The economics of dowry and brideprice. *The Journal of Economic Perspectives*, pages 151–174, 2007.

Raj Arunachalam and Trevon D Logan. On the heterogeneity of dowry motives. Technical report, National Bureau of Economic Research, 2006.

Kakoli Banerjee. Gender stratification and the contemporary marriage market in india. *Journal of Family Issues*, 20(5):648–676, 1999.

Srimati Basu. *She comes to take her rights: Indian women, property, and propriety*. SUNY Press, 1999.

Gary S Becker. A treatise on the family (enl. ed.). *Cambridge, Mass: Harvard*, 1991.

Sonia Bhalotra and Samantha B Rawlings. Intergenerational persistence in health in developing countries: The penalty of gender inequality? *Journal of Public Economics*, 95 (3):286–299, 2011.

Sonia R Bhalotra and Tom Cochrane. Where have all the young girls gone? identification of sex selection in india. 2010.

Francis Bloch and Vijayendra Rao. Terror as a bargaining instrument: A case study of dowry violence in rural india. *American Economic Review*, pages 1029–1043, 2002.

Elizabeth Brainerd and Nidhiya Menon. Seasonal effects of water quality: The hidden costs of the green revolution to infant and child health in india. *Journal of Development Economics*, 107:49–64, 2014.

Philip H Brown. Dowry and intrahousehold bargaining evidence from china. *Journal of Human Resources*, 44(1):25–46, 2009.

Georg Bühler. *The Laws of Manu. Translated with Extracts from Seven Commentaries by G. Bühler*. Delhi, Motilal Banarsidass [1964], 1964.

Jacquelyn Campbell, Sara Torres, Josephine Ryan, Christine King, Doris W. Campbell, Rebecca Y. Stallings, and Sandra C. Fuchs. Physical and nonphysical partner abuse and

other risk factors for low birth weight among full term and preterm babies: A multiethnic case-control study. 150(7):714–726, 1999.

David Card and Gordon B Dahl. Family violence and football: The effect of unexpected emotional cues on violent behavior. *The Quarterly Journal of Economics*, 126(1):103, 2011.

Yoo-Mi Chin. Male backlash, bargaining, or exposure reduction?: womens working status and physical spousal violence in india. *Journal of Population Economics*, 25(1):175–200, 2012.

Paul S Clarke and Frank Windmeijer. Instrumental variable estimators for binary outcomes. *Journal of the American Statistical Association*, 107(500):1638–1652, 2012.

R Emerson Dobash and Russell Dobash. *Violence against wives: A case against the patriarchy*. Free Press New York, 1979.

Tim Dyson and Mick Moore. On kinship structure, female autonomy, and demographic behavior in india. *Population and development review*, pages 35–60, 1983.

Mukesh Eswaran and Nisha Malhotra. Domestic violence and women's autonomy in developing countries: theory and evidence. *Canadian Journal of Economics/Revue canadienne d'économique*, 44(4):1222–1263, 2011.

Amy Farmer and Jill Tiefenthaler. An economic analysis of domestic violence. *Review of Social Economy*, 55(3):337–358, 1997.

Marcus Grubb. Gold demand trends full year 2014. Technical report, World Gold Council, 2015.

Paul Hershman. Punjab kinship and marriage, ed. hilary standing, 1981.

Radha Iyengar. Does the certainty of arrest reduce domestic violence? evidence from mandatory and recommended arrest laws. *Journal of Public Economics*, 93(1):85–98, 2009.

Shireen J Jejeebhoy. Associations between wife-beating and fetal and infant death: impressions from a survey in rural india. *Studies in family planning*, pages 300–308, 1998.

Michael A Koenig, Rob Stephenson, Rajib Acharya, Lindsay Barrick, Saifuddin Ahmed, and Michelle Hindin. Domestic violence and early childhood mortality in rural india: evidence from prospective data. *International journal of epidemiology*, 39(3):825–833, 2010.

Del Martin. *Battered wives*. Volcano Press, 1981.

Sandra L Martin, Amy Ong Tsui, Kuhu Maitra, and Ruth Marinshaw. Domestic violence in northern india. *American journal of epidemiology*, 150(4):417–426, 1999.

Christiaan WS Monden and Jeroen Smits. Maternal height and child mortality in 42 developing countries. *American Journal of Human Biology*, 21(3):305–311, 2009.

Andrew R Morrison and María Beatriz Orlando. Social and economic costs of domestic violence: Chile and nicaragua. 1999.

Khurram Nasir and Adnan A Hyder. Violence against pregnant women in developing countries review of evidence. *The European Journal of Public Health*, 13(2):105–107, 2003.

Emily Osters. Proximate sources of population sex imbalance in india. *Demography*, 46(2): 325–339, 2009.

Abraham Peedicayil, Laura S Sadowski, Lakshman Jeyaseelan, Viswanathan Shankar, Dipty Jain, Saradha Suresh, and Shrikant I Bangdiwala. Spousal physical violence against women during pregnancy. *BJOG: An International Journal of Obstetrics & Gynaecology*, 111(7):682–687, 2004.

Ruth Petersen, Alexandra Connelly, Sandra L Martin, and Lawrence L Kupper. Preventive counseling during prenatal care: Pregnancy risk assessment monitoring system (prams). *American Journal of Preventive Medicine*, 20(4):245–250, 2001.

Yasmina Bekhouche Saadia Zahidi Ricardo Hausman, Laura D. Tyson. Global gender gap report. Technical report, World Economic Forum, 2014.

Sheetal Sekhri and Adam Storeygard. Dowry deaths: Response to weather variability in india. *Journal of development economics*, 111:212–223, 2014.

Gary Solon, Steven J Haider, and Jeffrey Wooldridge. What are we weighting for? Technical report, National Bureau of Economic Research, 2013.

Mysore Narasimhachar Srinivas. *Some reflections on dowry*. Number 1983. Published for the Centre for Women's Development Studies, New Delhi, by Oxford University Press, 1984.

MA Straus, SL Hamby, S Boney-McCoy, DB Sugarman, and D Finkelhor. Conflict tactics scales (cts). 1973.

Helen V Tauchen, Ann Dryden Witte, and Sharon K Long. Domestic violence: A non-random affair, 1985.

UNICEF. Infant and child mortality in india: Levels, trends and determinants, 2012.

A Vaidyanathan. Consumption of gold in india: Trends and determinants. *Economic and Political Weekly*, pages 471–476, 1999.

Sylvia Walby. *The cost of domestic violence*. Department of Trade and Industry , United Kingdom, 2004.

Hugh Waters, Adnan Hyder, Yogesh Rajkotia, Suprotik Basu, and Julian Ann Rehwinkel. The economic dimensions of interpersonal violence., 2004.

Margo Wilson and Martin Daly. An evolutionary psychological perspective on male sexual proprietariness and violence against wives. *Violence and victims*, 1993.

Kersti Yllo and Murray A Straus. Patriarchy and violence against wives: The impact of structural and normative factors. *Physical violence in American families: Risk factors and adaptations to violence in*, 8(145):383–399, 1990.

Ting Zhang. *An estimation of the economic impact of spousal violence in Canada, 2009*. Department of Justice Canada, 2012.

Appendix

Table A.1: Linear probability results

	Neonatal Mortality	**Infant Mortality**	**Neonatal Mortality**	**Infant Mortality**
Domestic Violence	0.002**	0.004***	0.000	0.001
	[0.001]	[0.001]	[0.001]	[0.001]
Female Child			-0.006***	-0.007***
			[0.001]	[0.002]
Wealth Quintile: Poor			0.000	-0.002
			[0.004]	[0.005]
Wealth Quintile: Middle			-0.004	-0.010**
			[0.004]	[0.005]
Wealth Quintile: Richer			-0.005	-0.011**
			[0.004]	[0.005]
Wealth Quintile: Richest			-0.008*	-0.015**
			[0.004]	[0.005]
Mother's age at birth			-0.018**	-0.028**
			[0.008]	[0.009]
Mother's height			-0.007***	-0.009***
			[0.001]	[0.002]
Household located in rural area			0.005**	0.005**
			[0.002]	[0.002]
Muslim			-0.002	-0.004
			[0.002]	[0.003]
Christian			0.000	-0.001
			[0.003]	[0.004]
Other Religion			-0.006*	-0.006
			[0.003]	[0.005]
Schedule Caste			0.000	0.000
			[0.002]	[0.003]
Schedule Tribe			0.001	0.006
			[0.003]	[0.004]
Other Backward Caste			0.004*	0.005*
			[0.002]	[0.002]
Birth Order Number			-0.002*	0.000
			[0.001]	[0.001]
Mother's years of schooling			-0.000**	-0.001***
			[0.000]	[0.000]
N	46420	46420	46420	46420
Mean (dep var)	2.21	3.53	2.21	3.53
s.d (dep var)	14.72	18.45	14.72	18.45

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Robust Standard Errors Clustered at Mother Level

Additional Controls: State fixed effects, Month of birth fixed effects, Year of birth fixed effects, State Fixed time trends, Mother's age at birth^2 Mother's age at birth^3

Table A.2: Violence as a cumulative ordinal index

	Neonatal Mortality	**Infant Mortality**
Domestic Violence	0.040*	0.047*
	[0.021]	[0.026]
Female Child	-0.006***	-0.007***
	[0.001]	[0.002]
Wealth Quintile: Poor	0.003	0.001
	[0.005]	[0.006]
Wealth Quintile: Middle	0.003	-0.001
	[0.006]	[0.007]
Wealth Quintile: Richer	0.006	0.002
	[0.007]	[0.009]
Wealth Quintile: Richest	0.013	0.009
	[0.012]	[0.015]
Mother's age at birth	-0.01	-0.019*
	[0.009]	[0.011]
Mother's height	-0.006**	-0.008***
	[0.002]	[0.002]
Household located in rural area	0.011**	0.013**
	[0.004]	[0.005]
Muslim	-0.004	-0.006
	[0.003]	[0.004]
Christian	0.001	0.001
	[0.004]	[0.004]
Other Religion	-0.008*	-0.008
	[0.004]	[0.005]
Schedule Caste	-0.009	-0.010
	[0.005]	[0.007]
Schedule Tribe	0.000	0.006
	[0.004]	[0.005]
Other Backward Caste	0.004*	0.005*
	[0.002]	[0.003]
Birth Order Number	-0.006**	-0.005*
	[0.002]	[0.003]
Mother's years of schooling	0.000	0.000
	[0.001]	[0.001]
N	46420	46420
Mean (dep var)	2.21	3.53
s.d (dep var)	14.72	18.45

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Robust Standard Errors Clustered at Mother Level

Additional Controls: State fixed effects, Month of birth fixed effects, Year of birth fixed effects, State Fixed time trends, Mother's age at birth^2 Mother's age at birth^3

Table A.3: Main specification results on each dimension of violence

	Neonatal Mortality	**Infant Mortality**
Spouse ever slapped	0.018	0.018
	[0.025]	[0.031]
Spouse ever twisted her arm or pulled her hair	0.072**	0.086*
	[0.036]	[0.045]
Spouse ever pushed, shook or threw something	0.073*	0.086*
	[0.041]	[0.051]
Spouse ever punched with fist or something harmful	0.126*	0.152*
	[0.067]	[0.082]
Spouse ever kicked or dragged	0.147	0.177
	[0.091]	[0.110]
Spouse ever threatened or attacked with knife/gun or other weapon	0.523	0.656
	[0.327]	[0.410]
Spouse ever tried to strange or burn	0.418	0.517
	[0.262]	[0.328]
N	46420	46420
Mean (dep var)	0.022	0.035
s.d (dep var)	0.147	0.185

Note: Each cell within the table are coefficients and standard errors from running separate regressions.

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Robust Standard Errors Clustered at Mother Level

Additional Controls: State fixed effects, Month of birth fixed effects, Year of birth fixed effects, State Fixed time trends, Mother's age at birth^2 Mother's age at birth^3

Table A.4: Weighted IV second stage results

	Neonatal Mortality	**Infant Mortality**
Domestic Violence	0.066*	0.072*
	[0.034]	[0.040]
Female Child	-0.003*	-0.003
	[0.002]	[0.002]
Wealth Quintile: Poor	-0.001	-0.005
	[0.004]	[0.004]
Wealth Quintile: Middle	0.006	0.003
	[0.005]	[0.005]
Wealth Quintile: Richer	0.005	-0.003
	[0.006]	[0.007]
Wealth Quintile: Richest	0.01	0.002
	[0.010]	[0.012]
Mother's age at birth	-0.005	-0.007
	[0.015]	[0.018]
Mother's height	-0.009***	-0.011***
	[0.002]	[0.002]
Household located in rural area	0.012**	0.012**
	[0.004]	[0.005]
Muslim	-0.002	-0.005
	[0.003]	[0.004]
Christian	0.001	-0.004
	[0.006]	[0.008]
Other Religion	-0.009	-0.013*
	[0.006]	[0.007]
Schedule Caste	-0.018**	-0.017**
	[0.007]	[0.009]
Schedule Tribe	-0.004	0.002
	[0.005]	[0.006]
Other Backward Caste	0.003	0.003
	[0.003]	[0.003]
Birth Order Number	-0.006**	-0.006**
	[0.002]	[0.003]
Mother's years of schooling	0.001	0.000
	[0.001]	[0.001]
N	33901	33901
Mean (dep var)	2.21	3.53
s.d (dep var)	14.72	18.45

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Robust Standard Errors Clustered at Mother Level

Additional Controls: State fixed effects, Month of birth fixed effects, Year of birth fixed effects, State Fixed time trends, Mother's age at birth^2 Mother's age at birth^3

Table A.5: Association between the price of gold and age at marriage

	(1)	(2)
	Age at Marriage	**Age at Marriage**
Price of Gold at Marriage	0.000*	0.000
	[0.000]	[0.000]
Price of Gold at Marriage^2	0.000	0.000
	[0.000]	[0.000]
Wealth Quintile: Poor	0.003	0.012
	[0.111]	[0.111]
Wealth Quintile: Middle	0.049	0.065
	[0.108]	[0.108]
Wealth Quintile: Richer	0.412***	0.436***
	[0.111]	[0.110]
Wealth Quintile: Richest	1.257***	1.299***
	[0.125]	[0.125]
Height	-0.038	-0.033
	[0.043]	[0.043]
Household located in rural area	-0.246***	-0.253***
	[0.060]	[0.060]
Muslim	-0.815***	-0.827***
	[0.084]	[0.084]
Christian	0.906***	0.889***
	[0.137]	[0.137]
Other Religion	0.532***	0.538***
	[0.122]	[0.122]
Schedule Caste	-0.489***	-0.509***
	[0.074]	[0.073]
Schedule Tribe	-0.430***	-0.437***
	[0.104]	[0.104]
Other Backward Caste	-0.308***	-0.311***
	[0.063]	[0.063]
Mother's years of schooling	0.245***	0.240***
	[0.007]	[0.007]
N	46420	46420
Mean (dep var)	18.77	18.77
s.d (dep var)	3.99	3.99

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Robust Standard Errors Clustered at Mother Level

Additional Controls: State fixed effects in columns (1) & (2) and year of marriage fixed effects in column (2)

Table A.6: Proportion of sample with the presence of domestic violence by year of marriage

Year of marriage	**N**	**mean**	**sd**
1992	4633	0.27	0.45
1993	4579	0.32	0.47
1994	4179	0.33	0.47
1995	4894	0.31	0.46
1996	4381	0.31	0.46
1997	3852	0.27	0.45
1998	3863	0.29	0.45
1999	3636	0.27	0.44
2000	3858	0.28	0.45
2001	2921	0.26	0.44
2002	2369	0.22	0.42
2003	1786	0.19	0.39
2004	1149	0.19	0.39
2005	320	0.16	0.37
Total	46420	0.28	0.45

Table A.7: Child Gender

	Neonatal Mortality		Infant Mortality	
	Male	Female	Male	Female
Domestic Violence	0.044	0.103**	0.06	0.114*
	[0.045]	[0.051]	[0.056]	[0.062]
Wealth Quintile: Poor	0.003	0.007	0.003	0.004
	[0.006]	[0.009]	[0.008]	[0.011]
Wealth Quintile: Middle	0.001	0.012	-0.001	0.006
	[0.008]	[0.010]	[0.010]	[0.013]
Wealth Quintile: Richer	0.002	0.021	-0.001	0.017
	[0.011]	[0.014]	[0.013]	[0.018]
Wealth Quintile: Richest	0.008	0.031	0.007	0.026
	[0.017]	[0.021]	[0.021]	[0.025]
Mother's age at birth	-0.016	0.002	-0.024	-0.007
	[0.015]	[0.013]	[0.016]	[0.016]
Mother's height	-0.009***	-0.001	-0.011***	-0.002
	[0.002]	[0.003]	[0.003]	[0.003]
Household located in rural area	0.009	0.017**	0.012*	0.018**
	[0.006]	[0.007]	[0.007]	[0.008]
Muslim	-0.003	-0.004	-0.006	-0.006
	[0.004]	[0.005]	[0.005]	[0.006]
Christian	0.003	-0.005	0.002	-0.006
	[0.005]	[0.006]	[0.006]	[0.007]
Other Religion	-0.002	-0.015**	-0.002	-0.016*
	[0.005]	[0.007]	[0.007]	[0.009]
Schedule Caste	-0.006	-0.017*	-0.007	-0.020*
	[0.008]	[0.009]	[0.010]	[0.011]
Schedule Tribe	-0.001	0.004	0.005	0.009
	[0.005]	[0.006]	[0.006]	[0.007]
Other Backward Caste	0.002	0.005	0.004	0.004
	[0.003]	[0.004]	[0.004]	[0.004]
Birth Order Number	-0.005*	-0.008**	-0.006*	-0.006
	[0.003]	[0.004]	[0.003]	[0.005]
Mother's years of schooling	0.000	0.001	0.000	0.000
	[0.001]	[0.001]	[0.001]	[0.001]
N	24149	22271	24149	22271
Mean (dep var)	2.49	1.91	3.85	3.18
s.d (dep var)	15.6	13.71	19.25	17.54

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Robust Standard Errors Clustered at Mother Level

Additional Controls: State fixed effects, Month of birth fixed effects, Year of birth fixed effects, State Fixed time trends, Mother's age at birth^2 Mother's age at birth^3

Table A.8: Household Caste

	High Caste		**Schedule Caste**		**Schedule Tribe**		**Backward Caste**	
	(1)	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**
	Neonatal Mortality	**Infant Mortality**	**Neonatal Mortality**	**Infant Mortality**	**Neonatal Mortality**	**Infant Mortality**	**Neonatal Mortality**	**Infant Mortality**
Domestic Violence	0.074	0.123	-0.043	-0.074	0.13	0.108	0.075**	0.076*
	[0.098]	[0.142]	[0.046]	[0.061]	[0.131]	[0.134]	[0.037]	[0.042]
Female Child	-0.007**	-0.006*	-0.009**	-0.010**	-0.006	-0.012**	-0.002	-0.004
	[0.002]	[0.003]	[0.004]	[0.005]	[0.004]	[0.005]	[0.003]	[0.003]
Wealth Quintile: Poor	0.000	-0.005	0.005	-0.002	-0.01	-0.016	0.014	0.019
	[0.011]	[0.017]	[0.009]	[0.013]	[0.013]	[0.014]	[0.011]	[0.012]
Wealth Quintile: Middle	0.012	0.016	-0.012	-0.027*	0.000	-0.017	0.01	0.015
	[0.017]	[0.025]	[0.011]	[0.016]	[0.018]	[0.019]	[0.010]	[0.012]
Wealth Quintile: Richer	0.014	0.021	-0.015	-0.035	0.005	-0.009	0.013	0.016
	[0.026]	[0.038]	[0.016]	[0.022]	[0.021]	[0.021]	[0.012]	[0.014]
Wealth Quintile: Richest	0.017	0.028	-0.025	-0.045	0.02	-0.001	0.026	0.026
	[0.036]	[0.053]	[0.023]	[0.032]	[0.032]	[0.033]	[0.017]	[0.019]
Mother's age at birth	0.001	0.004	-0.082**	-0.110**	-0.013	-0.046**	-0.017	-0.021
	[0.017]	[0.020]	[0.034]	[0.043]	[0.018]	[0.022]	[0.017]	[0.018]
Mother's height	-0.006	-0.008	-0.008**	-0.009	0.000	-0.004	-0.005	-0.007*
	[0.004]	[0.005]	[0.004]	[0.006]	[0.006]	[0.007]	[0.004]	[0.004]
Household located in rural area	0.01	0.014	-0.003	-0.007	0.014	0.015	0.015**	0.014**
	[0.009]	[0.013]	[0.010]	[0.013]	[0.014]	[0.014]	[0.005]	[0.006]
Muslim	-0.007	-0.014	-0.003	-0.014	0.04	0.035	-0.004	-0.009
	[0.010]	[0.015]	[0.018]	[0.022]	[0.063]	[0.066]	[0.005]	[0.006]
Christian	-0.001	-0.003	-0.008	-0.017	0.036	0.042	-0.006	-0.006
	[0.011]	[0.014]	[0.013]	[0.016]	[0.026]	[0.026]	[0.007]	[0.008]
Other Religion	-0.009	-0.016	0.001	0.002	0.03	0.043	0.013	0.02
	[0.008]	[0.012]	[0.011]	[0.016]	[0.030]	[0.030]	[0.016]	[0.022]
Birth Order Number	-0.005	-0.006	0.004	0.005	-0.007	-0.004	-0.009**	-0.006
	[0.005]	[0.007]	[0.005]	[0.007]	[0.007]	[0.007]	[0.004]	[0.004]
Mother's years of schooling	0.000	0.000	0.000	-0.002	-0.001	-0.002	0.001	0.001
	[0.001]	[0.002]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
N	16320	16320	7716	7716	8408	8408	13976	13976
Mean (dep var)	0.018	0.028	0.025	0.039	0.022	0.042	0.025	0.038
s.d (dep var)	0.135	0.164	0.155	0.194	0.147	0.200	0.157	0.192

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Robust Standard Errors Clustered at Mother Level

Additional Controls: State fixed effects, Month of birth fixed effects, Year of birth fixed effects, State Fixed time trends, Mother's age at birth^2 Mother's age at birth^3

Table A.9: Location of household

	Neonatal Mortality		**Infant Mortality**	
	Urban	**Rural**	**Urban**	**rural**
Domestic Violence	-0.015	0.155*	0.004	0.167*
	[0.040]	[0.081]	[0.048]	[0.092]
Female Child	-0.006**	-0.006**	-0.005**	-0.009**
	[0.002]	[0.003]	[0.002]	[0.003]
Wealth Quintile: Poor	0.012	0.006	0.012	0.006
	[0.011]	[0.009]	[0.014]	[0.011]
Wealth Quintile: Middle	0.005	0.019	0.008	0.016
	[0.012]	[0.015]	[0.015]	[0.017]
Wealth Quintile: Richer	0.004	0.025	0.01	0.021
	[0.017]	[0.019]	[0.021]	[0.022]
Wealth Quintile: Richest	-0.005	0.031	0.003	0.026
	[0.023]	[0.022]	[0.028]	[0.025]
Mother's age at birth	0.000	0.002	-0.005	-0.008
	[0.015]	[0.019]	[0.017]	[0.022]
Mother's height	-0.006**	-0.009**	-0.007*	-0.012**
	[0.003]	[0.004]	[0.004]	[0.004]
Muslim	0.001	-0.005	-0.004	-0.003
	[0.004]	[0.008]	[0.005]	[0.009]
Christian	0.001	0.009	0.000	0.01
	[0.005]	[0.010]	[0.006]	[0.011]
Other Religion	-0.003	-0.006	-0.006	-0.003
	[0.004]	[0.010]	[0.006]	[0.011]
Schedule Caste	0.004	-0.026*	0.000	-0.028
	[0.007]	[0.015]	[0.008]	[0.017]
Schedule Tribe	0.002	-0.001	0.002	0.006
	[0.005]	[0.007]	[0.006]	[0.009]
Other Backward Caste	0.005*	0.000	0.006*	0.000
	[0.003]	[0.006]	[0.003]	[0.006]
Birth Order Number	0.000	-0.011**	0.000	-0.010*
	[0.003]	[0.005]	[0.003]	[0.006]
Mother's years of schooling	0.000	0.002	-0.001	0.001
	[0.001]	[0.001]	[0.001]	[0.002]
N	21529	24891	21529	24891
Mean (dep var)	2.21	2.21	3.53	3.53
s.d (dep var)	14.72	14.72	18.45	18.45

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Robust Standard Errors Clustered at Mother Level

Additional Controls: State fixed effects, Month of birth fixed effects, Year of birth fixed effects, State Fixed time trends, Mother's age at birth^2 Mother's age at birth^3

Table A.10: Socio-economic status of household

	Neonatal Mortality		**Infant Mortality**	
	Low SES	**High SES**	**Low SES**	**High SES**
Domestic Violence	0.077**	0.004	0.073*	0.069
	[0.036]	[0.065]	[0.042]	[0.087]
Female Child	-0.008**	-0.005**	-0.011***	-0.004*
	[0.003]	[0.002]	[0.003]	[0.002]
Mother's age at birth	-0.016	0.005	-0.029**	0.008
	[0.013]	[0.013]	[0.015]	[0.016]
Mother's height	-0.007**	-0.006**	-0.008**	-0.007*
	[0.003]	[0.003]	[0.004]	[0.004]
Household located in rural area	0.020**	0.004	0.023**	0.005
	[0.007]	[0.003]	[0.008]	[0.004]
Muslim	-0.008	-0.001	-0.01	-0.005
	[0.007]	[0.003]	[0.008]	[0.004]
Christian	0.009	-0.007	0.013	-0.015**
	[0.007]	[0.005]	[0.008]	[0.007]
Other Religion	-0.009	-0.003	-0.002	-0.007
	[0.009]	[0.004]	[0.011]	[0.006]
Schedule Caste	-0.020**	0.003	-0.019*	-0.006
	[0.009]	[0.009]	[0.011]	[0.012]
Schedule Tribe	-0.002	0.003	0.002	0.004
	[0.006]	[0.007]	[0.007]	[0.009]
Other Backward Caste	0.002	0.005*	0.001	0.004
	[0.005]	[0.003]	[0.006]	[0.004]
Birth Order Number	-0.009**	0.000	-0.007*	-0.001
	[0.003]	[0.003]	[0.004]	[0.004]
Mother's years of schooling	0.001	-0.001	0.000	0
	[0.001]	[0.001]	[0.001]	[0.002]
N	20500	25920	20500	25920
Mean (dep var)	2.21	2.21	3.53	3.53
s.d (dep var)	14.72	14.72	18.45	18.45

Robust standard errors in parentheses *** p¡0.01, ** p¡0.05, * p¡0.1

Robust Standard Errors Clustered at Mother Level

Additional Controls: State fixed effects, Month of birth fixed effects, Year of birth fixed effects, State Fixed time trends, Mother's age at birth^2 Mother's age at birth^3