The effect of domestic violence on cardiovascular risk

by

Seetha Menon

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Department of Business and Economics
Faculty of Business and Social Sciences
University of Southern Denmark
Campusvej 55, DK-5230 Odense M
Denmark
E-mail: lho@sam.sdu.dk / http://www.sdu.dk/ivoe

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Abstract

The prevalence of metabolic risk factors that contribute to cardiovascular disease (CVD), such as hypertension and high plasma glucose levels have seen a substantial increase globally. Violence elevates stress and increases CVD risk and yet, there is sparse evidence on the relationship between domestic violence and CVD risk factors. This study presents new empirical evidence by leveraging biomarker data from a large nationally representative survey. I find (i) a consistent positive causal effect of physical violence on prevalence of hypertension amongst women, (ii) a positive causal effect of emotional and sexual violence on prevalence of hypertension amongst women, (iii) No discernible effects of domestic violence on CVD risk for the men in these relationships.

Keywords: Cardiovascular risk; domestic violence; hypertension; diabetes

JEL Codes: I12, I14, J12, J16

[1]Assistant Professor, Department of Business and Economics, University of Southern Denmark, Campusvej 55, Odense M 5230, Denmark, Tel: +4593507315, Email: smr@sam.sdu.dk

1 Introduction

Cardiovascular disease (CVD)[2] is the number one cause of death globally, taking an estimated 17.9 million lives each year (WHO). Individuals at risk of CVD often demonstrate raised blood pressure and blood glucose levels, amongst other indicators which can easily be measured, monitored and to some extent controlled. Identifying those at risk can prevent premature deaths.

Stress is a major contributor to increased CVD risk factors, not just in the case of hypertension (Liu et al., 2017) but also in the case of high blood glucose levels (Harris et al., 2017). Exposure to violence is inherently stressful, as established by several studies under several scenarios. Events of mass violence such as 9/11 attack or the Boston marathon bombings increase acute stress not just for those who were directly affected by these events (Liu et al., 2014) but also for those who were exposed to media coverage of such events (Holman et al., 2014; Thompson et al., 2019). Similarly, both the biological literature and the psychological literature, provide evidence that domestic violence exposure also increases stress. Yim and Kofman (2019) provides a systematic review of this evidence.

Domestic violence [3], in particular, is likely to lead to chronic stress as it often occurs over a long period of time, whereby the victims endure long-term exposure to violence. Yet, the effect of domestic violence on CVD risk is largely unknown. I estimate the causal effect of domestic violence on CVD risk by using a new instrumental variables strategy, instrumenting domestic violence with price of gold at the time of marriage [4]. I find a consistent positive effect of domestic violence on CVD risk which persists even when conditioning on health factors. Strikingly, in-spite of higher prevalence of CVD risk factors, I find no evidence of such an effect on the men, that is, the perpetrators/non-perpetrators of violence in these marriages.

[2]Cardiovascular diseases (CVDs) are a group of disorders of the heart and blood vessels and they include: coronary heart disease – disease of the blood vessels supplying the heart muscle; cerebrovascular disease – disease of the blood vessels supplying the brain; peripheral arterial disease – disease of blood vessels supplying the arms and legs; rheumatic heart disease – damage to the heart muscle and heart valves from rheumatic fever, caused by streptococcal bacteria; congenital heart disease – malformations of heart structure existing at birth; deep vein thrombosis and pulmonary embolism – blood clots in the leg veins, which can dislodge and move to the heart and lungs.

[3]Due to the contextual background (Section 2 provides a overview) and data limitations, in this paper, domestic violence is defined as physical violence by the man towards a woman in a cohabiting relationship.

[4]Menon (2020) shows that the price of gold at the time of marriage has an effect on domestic violence through initial marital endowments. Section 4 discusses the appropriateness and validity of this instrument in detail.

This paper offers three contributions. First, it provides causal empirical evidence to show that physical domestic violence has a statistically significant positive effect on CVD risk for the victims of violence, the women in these relationships. Second, it shows that sexual and emotional violence also have statistically significant positive effects on CVD risk for women. Third it shows that there are no discernible effects of domestic violence on CVD risk for the men in these relationships.

This paper contributes to the growing economics literature on the social and economic costs of domestic violence, for instance on: employment (Sabia et al., 2013), autonomy (Eswaran and Malhotra, 2011), health (Aizer, 2011) and child mortality (Rawlings and Siddique, 2020). It also contributes to the emerging epidemiological literature on the association of domestic violence on CVD risk (Section 2.1 provides a review). Furthermore, most of the existing literature on CVD risk uses self-reported measures from survey respondents to quantify this risk. Self-reported measures of cardiovascular risk have been shown to be an under estimate of actual prevalence as individuals may not be aware of their CVD risk status or may misreport due to social desirability bias or stigma. In addition, there is evidence that false reporting of CVD risk is significantly income graded (Johnston et al., 2009). This paper improves on this by using objective measures of CVD risk measured by trained interviewers during a large-scale nationally representative survey.

The rest of the paper is structured as follows. Section 2 summarises potential mechanisms through which domestic violence has an effect on CVD risk factors and outlines the CVD landscape in the country of analysis, India. Section 3 presents the data, analytical sample, domestic violence and CVD risk measures. Section 4 outlines the identification strategy. Section 5 presents the main results. Sections 6 & 7 present several robustness checks such as bounds for instrument endogeneity, the use of alternative estimators, and sensitivity analysis. Section 8 presents the results for the matched men in these marriages and Section 9 concludes.

2 Background

2.1 Emerging evidence on the relationship between domestic violence and cardiovascular disease

There are two main mechanisms through which domestic violence can have an impact on CVD risk, a biological mechanism and a behavioural mechanism. First, violence exposure is linked to not feeling safe, which in turn is associated with increases in basal cortisol[5] levels (Alhalal and Falatah, 2020; Johnson et al., 2008), post-traumatic stress disorder (PTSD), anxiety and depression (Ang, 2021; Devries et al., 2013; Golding, 1999). Over time, this increases a persons risk of cardiometabolic morbidities including hypertension and diabetes amongst others (Harris et al., 2017). Second, violence increases the adoption of maladaptive coping mechanisms, such as eating disorders, smoking, alcohol abuse, which in-turn increases vulnerability to cardiovascular disorders (Breiding et al., 2008).

In spite of these mechanisms, there is sparse epidemiological literature on the impact of domestic violence on CVD risk and the limited evidence we have is contradictory. For instance, with regards to hypertension, Sparrenberger et al. (2008) find that higher physical violence is associated with self-reported hypertension but not with actual objective measures of hypertension while Mason et al. (2012) find that emotional violence is associated with hypertension, but not physical or sexual violence. Stene et al. (2013) find a positive association between physical and sexual violence and the use of anti-hypertensive drugs. In contrast, Chandan et al. (2020) find no association between domestic violence and the development of hypertension.

There is also some evidence that childhood exposure of violence leading to higher prevalence of diabetes in adults, but very limited evidence on adult exposure to violence. For example Mason et al. (2013) find an increased risk of Type 2 diabetes in survivors of emotional violence, but finds no effect of physical or sexual violence. Similarly, Chandan et al. (2020) also find an increased risk of Type 2 diabetes in survivors of domestic violence. More recently, Weitzman and Goosby (2021) find a positive association between the severity of domestic violence and

[5]Cortisol is a stress hormone that helps fuel your body's "fight-or-flight" instinct in a crisis. Is also keeps inflamation down, regulates blood pressure, and blood sugar.

high blood glucose levels and provide a comprehensive discussion of the mechanisms through which this effect operates.

2.2 Cardiovascular disease in India

India contributes to almost one-fifth of global CVD burden (WHO). CVD is also the leading cause of mortality in India with more than half of the total CVD deaths occurring in people younger than 70 years. This is likely to increase due to; population growth; population ageing and urbanizing; and rise in living standards which is likely to lead to more obesogenic lifestyles (Geldsetzer et al., 2018).

Hypertension is the most important risk factor for CVD. Several studies have shown that hypertension is on the rise in India (Chopra and Ram, 2019; Gupta et al., 2019). Hypertension led to 1.63 million deaths in India in the year 2016 alone as compared to 0.78 million in 1990 (Gakidou et al., 2017). In addition, there is limited awareness of being hypertensive or control of hypertension in the Indian population (Chopra and Ram, 2019; Gupta et al., 2019).

Type 2 diabetes, which accounts for 90% of all diabetes worldwide, is also an important risk factor for CVD. It is a chronic condition that affects the way our body metabolises sugar. India has an estimated 77 million diabetics (95% CI 62.4–96.4) - the 2nd highest in the world with an estimated 43 million being undiagnosed diabetes (International Diabetes Foundation).

Both, hypertension and Type-2 diabetes can be prevented to a great extent through a healthy lifestyle, can be managed through education, support and adoption of healthy lifestyles, combined with medication as required and there is evidence that, for some people, remission may be possible.

3 Data

I use data from the National Family and Health Survey (NFHS-4), India's version of the Demographic Health Survey (DHS) (IIPS and ICF, 2017). NFHS 4 was fielded between January, 2015 and December, 2016 and is based on a sample of households that is representative both

at national and state level. The dataset contains a rich variety of information, including individual, partner, and household characteristics, and a domestic violence module. Central to this research, a biomarker module was also implemented for the first time in NFHS-4.

3.1 Analytical Sample

The analytical sample consists of all women who are married, currently cohabiting with their husbands and who were selected and interviewed for the domestic violence and biomarker modules. Women who were previously diagnosed with hypertension or diabetes and/or taking medication to lower hypertension or diabetes are excluded. Women who have low blood pressure, that is, they are hypotensive are also excluded (Section 7.2 presents a sensitivity analysis that includes these women).

Table 1 presents the summary statistics for this analytical sample. The variables of interest are divided into time, spatial, socioeconomic and health for ease of interpretation. Also, in the section on results (Section 5) and on robustness checks (Section 6), these variables are added using the same classifications as presented in this table.

Women who were married from the year 1979 to 2016 are included in the estimations. The average age of the women in the sample is 32 years with a standard deviation of 7.5 years. 28% of the women in the sample are from households located in an urban area while, 72% are from households located in rural areas. There is suggestive evidence that there may be significant inter-state differences in the prevalence of hypertension (Lee et al., 2011) and I account for this by accounting for state fixed effects for 36 states and union territories in the estimations.

79% of the women are from Hindu households, 9% are from Muslim households, 7% are from Christian households and 5% are from other religions which include Sikhs, Jains, Buddhists and others. These numbers broadly reflect the religious composition of India. Much like religion, caste has been shown to be a non-trivial factor with regards to historical injustices and current access to opportunities. 20% of the sample is from a high caste background while the remaining are from Schedule Caste, Schedule Tribe and Other Backward Caste. The DHS records wealth as a composite measure of a household's cumulative living standard. Based on

Table 1: Summary Statistics

Category	Variable	Mean	SD
Time	Year of marriage	2002	8.3
	Age in years	31.87	7.54
Spatial[1]	Urban	0.28	
	Rural	0.72	
Socioeconomic	Hindu	0.79	
	Muslim	0.09	
	Christian	0.07	
	Other Religions	0.05	
	Schedule Caste	0.19	
	Schedule Tribe	0.20	
	Other Backward Caste	0.41	
	High Caste	0.20	
	Poorest	0.21	
	Poorer	0.22	
	Middle	0.21	
	Richer	0.19	
	Richest	0.17	
	No Schooling	0.33	
	$<$10 years	0.40	
	$>$10 years	0.27	
	Non-solid fuels	0.37	
	Solid fuels	0.63	
	Not currently working	0.75	
	Currently working	0.25	
Health[2]	BMI - Normal	0.06	
	BMI - Overweight	0.27	
	BMI - Obese	0.67	
	Non-smoker	0.88	
	Smoker	0.12	
	Does not drink alcohol	0.97	
	Drinks alcohol	0.03	
	Hours since last drank something	5.58	14.34
	Hours since last ate something	3.26	3.63
	N	34161	

[1]Also includes State fixed effects for 28 states & 8 union territories of India. [2] Also includes an indicator variable for whether the measurement was taken in the morning($<$12:00), afternoon(12:00 - 15:00) or night($>$15:00) for each measurement. Year of marriage ranges from 1979 to 2016 and age of the respondent in years ranges from 16 years to 49 years.

on a household's ownership of selected assets, such as televisions and bicycles; materials used for housing construction; and types of water access and sanitation facilities, a wealth quintile is created with households belonging to the categories of poorest, poorer, middle, richer and richest. 43% of the sample are from poorest or poorer wealth quintiles while the remaining are from

middle or rich wealth quintiles. Since CVD is traditionally thought of as *diseases of affluence*, the most stringent specification conditions on all 5 wealth quintiles in the estimations. In addition, Section 6.2 presents the results of a heterogeneity analysis by wealth. Previous studies have shown fuel type to have an effect on hypertension. Solid fuel users record higher systolic and diastolic blood pressure and is also associated with an increased risk of hypertension (Baumgartner et al., 2014; Yan et al., 2016). 37% of the women in the sample use non-solid fuels for cooking. 75% of the women in the sample are not currently in paid employment.

With regards to health indicators, 67% of the women are classified as obese and 27% are classified as overweight. 88% of the women do not smoke and 97% do not drink alcohol. Previous evidence has shown that the time since the respondent last drank (other than water) or ate something can have an effect on the measurement of hypertension and diabetes. Thus the DHS records this information in hours and these are included in the estimations. In addition, the time of day when the measurement was taken ie: morning, afternoon or evening, can also have an impact on the measurement (Benzeval et al., 2014). Therefore, these have also been included in the estimations.

3.2 Domestic Violence

A domestic violence module was implemented to a randomised subset of the respondents, subject to privacy being obtained during the interview. For 95.6% of the respondents, privacy was obtained these respondents were asked domestic violence questions.

Table 2: Cumulative ordinal index of domestic violence

Cumulative ordinal index of violence	Freq.	Percent
No Violence	24,339	71.25
Ever slapped	4,320	12.65
Ever pushed, shook or threw something	2,149	6.29
Ever twisted her arm or pulled hair	1,335	3.91
Ever punched with fist or hit by something harmful	921	2.7
Ever kicked or dragged by husband	822	2.41
Ever threatened or attacked with knife/gun or other weapon	200	0.59
Ever tried to strangle or burn	75	0.22
Total	34,161	100

Violence in the NFHS 4 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?* Table 2 presents the possible responses and the frequencies and percent they are reported in the analytical sample. Approximately 71% of women report no physical violence while 29% report enduring at least one form of physical violence.

Each of the above questions were allowed five responses as follows:

- *Never*
- *Not in the last 12 months*
- *Sometimes during the last 12 months*
- *Often during the last 12 months*

To avoid the problem of multiple hypothesis testing, I use the first component of a polychoric principle component analysis on all of the 4 responses to the 7 dimensions of violence. This first principle component accounts for 78% of the overall variability of domestic violence. This is standardised to have a mean of 0 and standard deviation of 1 for ease of interpretation.

3.3 Measures of cardiovascular risk

The biomarker module in India recorded measures of cardiovascular risk. Specifically, more than 97% of eligible women age 15-49 and 95% of eligible men age 15-54 had their blood pressure and random blood glucose measured (International Institute for Population Sciences (IIPS) and ICF, 2017). I use these to create two binary measures of cardiovascular risk:

1. **Hypertension:** Blood pressure was measured 3 times with an interval of 5 minutes in between to minimise random error. I use the average of the 3 measurements to create a binary variable coded as 1 if systolic blood pressure $>=$ 140 mmHg and/or diastolic blood pressure $>=$ 90 mmHg. This is classified as Stage 2 Hypertension by the American Heart Association.

2. **Diabetes:** Type 2 diabetes is usually measured using fasting glucose or blood glycated haemoglobin. However, the DHS measured random capillary blood glucose (RCBG) presumably because RCBG is more convenient for large numbers as it does not require

fasting. I code a binary variable as 1 if RCBG levels $>$ 140 mg/dL. This cutoff is chosen based on previous literature in the context of India by Ghosh et al. (2020), Susairaj et al. (2019) and Somannavar et al. (2009) and I ensure the results are robust to alternative cutoffs.

Figure 1: Kernel density plots of base CVD measure by violence

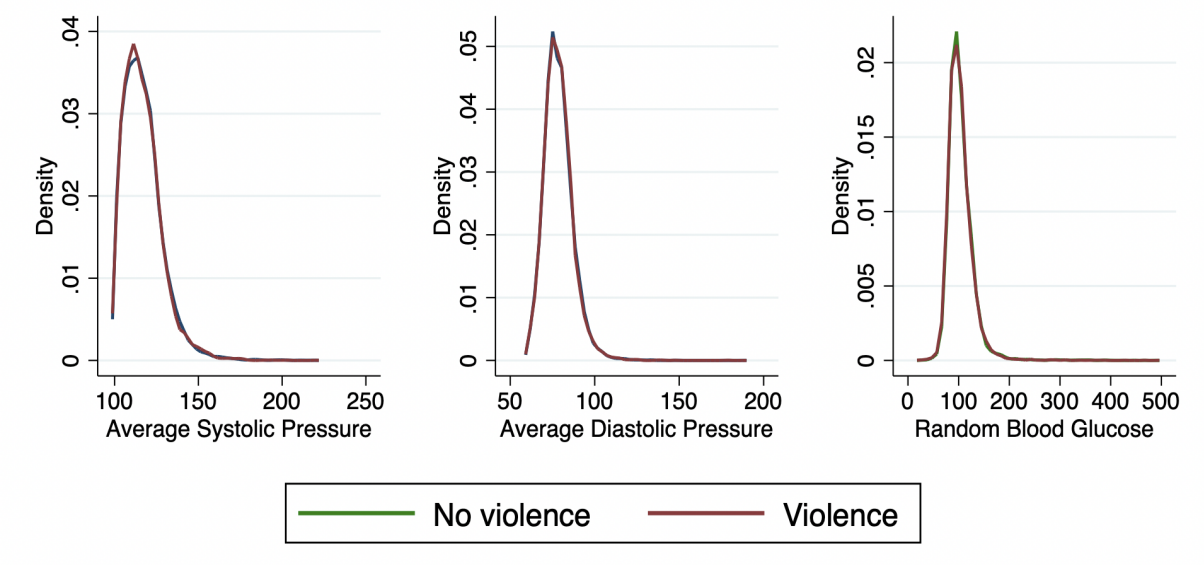


Table 3: Summary Statistics of CVD Measures

Variable	Full Sample	No DV	DV	t-test*
Panel A: Hypertension				
Average Systolic Pressure	116.92	116.98	116.75	0.129
Average Diastolic Pressure	78.59	78.6	78.56	0.726
Hypertension	0.10	0.10	0.10	0.462
N	29903	21371	8532	
Panel B: Diabetes				
Random Blood Glucose Level	103.05	103.26	102.52	0.016
Diabetes	0.052	0.052	0.052	0.886
N	34161	24339	9822	

*p-value of a t-test of unequal means
Note: Except for N, table reports means of each category

Figure 1 shows the kernel density plots of the base CVD measures of by whether any type of physical domestic violence was reported by the woman or not. The plots for the two groups closely overlay each other in all three cases. Table 3 presents the means of these base measures for the full sample and by whether domestic violence was reported or not and also provides the p-value of a t-test of unequal means. It also presents the means of the binary variables for

hypertension and diabetes. I exclude respondents who have low blood pressure in the main results (Section 7.2 presents sensitivity analysis that includes these women), and only compare respondents with normal blood pressure v. high blood pressure leading to a relatively smaller sample size for hypertension as compared to the sample size for diabetes.

4 Identification

This paper uses an instrumental variable estimation to deal with two sources of endogeneity. First, omitted variable bias in the form of variables such as lifestyle factors or stress which is both associated with domestic violence and CVD risk simultaneously. Second, it is plausible that there may be non-random measurement error (for instance, rich people may under report domestic violence as compared to poor people) in the domestic violence measure. While there is an increase in women's willingness to report crimes in India (Amaral et al., 2019; Iyer et al., 2012; Sekhri and Storeygard, 2014), it is widely accepted that measures of domestic violence in the Indian context is an under estimation of the true prevalence. This may cause attenuation bias as observed changes in domestic violence, caused by measurement error will not correspond to a change in CVD risk. Under these conditions, a standard ordinary least squares estimation will be biased towards zero.

The identification of this paper relies on Menon (2020), which shows that the deviation of the price of gold at the time of marriage from its long-term trend is a proxy for initial marital endowment through dowry (in the form of gold jewellery) and examines its effect on domestic violence. The author finds a significant positive effect of an unusually high price of gold at the time of marriage on domestic violence[6]. Menon (2020) outlines two potential mechanisms for this effect:

1. **Quantity effect:** If the amount of gold in the dowry basket is flexible, women have less gold (as demand for gold jewellery in India is price elastic (Mukherjee et al., 2017)) under their control and this reduces their bargaining power within the marriage.

[6] Bhalotra et al. (2020) has also found that motivated by dowry costs, monthly changes in gold prices lead to an increase in girl relative to boy neonatal mortality.

2. **Value effect:** If the amount of gold in the dowry basket is fixed, an unsually high price of gold at the time of marriage increases the value of gold in the dowry basket. Husbands could use domestic violence as a means to extract resources from the wife as shown by previous research (Anderson and Genicot, 2015; Bloch and Rao, 2002).

The positive effect of the price of gold at the time of marriage on domestic violence is robust to conditioning on several socio-demographic, temporal and spatial factors. The author also eliminates several alternative mechanisms that may be driving this effect. Specifically, the deviations in the price of oil at the time of marriage as a placebo test has no significant effects on domestic violence suggesting the results are not an artefact of general market fluctuations and that the price of gold is of particular significance in the Indian marriage market. The author also shows that the marriage date is not postponed in response to a high price of gold, that the effects are not driven by changes in wealth endowment of the household, and that the effects are not driven by adjustments in marital match characteristics.

Following this, I use the deviation of the price of gold at the time of marriage from its long-term trend as a plausibly exogenous instrument for domestic violence. This instrument has several advantages. First it is set well before the measurement of violence or of the CVD measures [7]. Second, the price of gold is external to the country as it is determined by the London Price Fix twice a day. Third, gold prices are highly volatile and given that gold market analysts often fail to accurately predict gold price trends because of the inherent uncertainty in gold price fluctuations, there is no compelling reason to believe that the average individual is able to accurately do so. Fourth, by using the distance of the short-term stochastic component from the trend, concerns about potential common evolution of gold prices and economic development is attenuated.

I use data on the monthly price of gold in Indian Rupees (INR) per gram from the World Gold Council. Table 4 presents the summary statistics of the deflated price of gold series. The average price of gold at the time of marriage for the analytical sample is 7.8 INR/gram with a standard deviation of 6.87 INR. Similar to Menon (2020), I use the Hodrick-Prescott high pass

[7]There might be a concern that the price of gold at the time of marriage might in some way affect the wealth of the household. Menon (2020) show that conditional on price of gold at the time of survey, the effect of price of gold at the time of marriage on domestic violence persists. Furthermore, anthropological evidence

Table 4: Price of gold summary statistics

Variable	N	Mean	SD	Min	Max
Price of Gold Series (gms)	34161	7.8	6.87	0.49	24.99
Stochastic Components	34161	-0.01	0.96	-2.83	4.78
Trend	34161	7.81	6.73	0.83	21.63
Distance from trend	34161	-7.82	6.72	-24.35	-0.44

Price of gold is the monthly price of gold per gram in Indian Rupees deflated and indexed to 1999 prices.
Data Source: World Gold Council

filter to separate the time series of the price of gold into its trend and stochastic components and take the distance of the price of gold at the time of marriage from its trend as the instrument for domestic violence.

The identifying equation for woman *i*, in state *s* of age *a* is:

1st Stage: $\text{DV}_{isa} = \alpha_0 + \beta_1 P_i + \beta_2 C_{isa} + \beta_3 S_s + \beta_4 A_a + \varepsilon_{isa}$

2nd Stage: $\text{Y}_{isa} = \alpha_0 + \beta_1 \widehat{DV}_{isa} + \beta_2 C_{isa} + \beta_3 S_s + \beta_4 A_a + \varepsilon_{isa}$

Y_{isa} is either hypertension or diabetes measured for woman *i* in state s and age *a*;

DV_{isa} is domestic violence;

$P_i = P_{stochastic} - P_{trend}$, is the difference from the trend of the real price of gold at the month of marriage of the woman;

C_{isa} are time, spatial, socio-demographic and health controls;

S_s are state fixed effects;

A_a are age fixed effects;

ε_{isa} is the error term.

5 Results

The results in each table is presented in columns that sequentially adds the following covariates for each specification. Column 1 presents the bivariate estimates of the effect of the deviation of the price of gold at the time of marriage on the binary outcome variable for hypertension or diabetes. Column 2 additionally conditions on time covariates of year of marriage and for age in years. Column 3 adds spatial covariates in the form of state fixed effects and rural versus urban location of the household. Column 4 adds sociodemographic covariates such

as religion, caste, wealth quintile, years of schooling, fuel type and employment. Column 5 additionally adds health and lifestyle related covariates of body mass index, smoking status, alcohol consumption. Column 5 also conditions on time since the last time respondent ate anything and time since the respondent drank anything other than water, and conditions on the time of day that the specific outcome variable was measured. All estimations use robust standard errors clustered at the year-month level as this is the source of identifying variation for the instrument.

Table 5: OLS Estimates of effect of domestic violence on CVD risk

	(1)	(2)	(3)	(4)	(5)
	Panel A: Hypertension				
Domestic Violence	-0.008	-0.021**	-0.012	-0.012	-0.013
	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)
N	29903	29903	29903	29903	29903
Mean - Hypertension	0.10	0.10	0.10	0.10	0.10
	Panel B: Diabetes				
Domestic Violence	-0.007	-0.014	-0.014	-0.008	-0.005
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
+ Time		✓	✓	✓	✓
+ Spatial			✓	✓	✓
+ Socioeconomic				✓	✓
+ Health					✓
N	34161	34161	34161	34161	34161
Mean - Diabetes	0.052	0.052	0.052	0.052	0.052

Robust standard errors clustered at month and year of marriage in parenthesis $***p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variable of hypertension/diabetes is a binary indicator with 1 indicating hypertension. Domestic violence is standardised with a mean of 0 and standard error of 1. Column 1 presents the results of a bivariate probit estimation. Column 2 additionally conditions on age fixed effects and year of marriage trend. Column 3 includes state fixed effects and rural/urban fixed effects. Column 4 adds religion, caste, wealth quintile, schooling, fuel type and working status fixed effects. Column 5 adds bmi, smoking, alcohol consumption, hours since last ate, hours since last drank and time of measurement.

Tables 5 presents the ordinary least square estimates (OLS) for the effect of domestic violence on hypertension and diabetes. It is likely that the worst cases of domestic violence is not captured in the sample, due to death or serious injury, and thereby the OLS estimate is reflecting Simpson's paradox (Blyth, 1972). Nonetheless, these estimates are imprecisely estimated in all specifications.

Table 6 presents the instrumental variable probit estimates for the effect of domestic vio-

Table 6: Instrumental variable estimates of the effect of domestic violence on hypertension

	(1)	(2)	(3)	(4)	(5)
Panel A: Reduced Form Estimates			**Hypertension**		
Price of Gold	0.041***	0.010***	0.009**	0.008**	0.008**
	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
Panel B: 1st Stage Estimates			**Domestic Violence**		
Price of Gold	0.015***	0.014***	0.015***	0.012***	0.011***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Panel C: 2nd Stage Stage Estimates			**Hypertension**		
Domestic Violence	0.938***	0.560***	0.491***	0.586***	0.572***
	(0.014)	(0.157)	(0.169)	(0.191)	(0.201)
+ Time		✓	✓	✓	✓
+ Spatial			✓	✓	✓
+ Socioeconomic				✓	✓
+ Health					✓
N	29903	29903	29903	29903	29903
Mean - Hypertension	0.10	0.10	0.10	0.10	0.10
1st Stage F Statistic	318.145	45.847	53.399	31.917	30.314

Robust standard errors clustered at month and year of marriage in parenthesis $***p < 0.01$, $** p < 0.05$, $* p < 0.1$. Dependent variable of hypertension is a binary indicator with 1 indicating hypertension. Domestic violence is standardised with a mean of 0 and standard error of 1.
Panel A presents linear regression estimates. Panel B and Panel C present 1st stage estimates and 2nd stage results of instrumental variable probit regression respectively. Column 1 presents the results of a bivariate estimation. Column 2 additionally conditions on age fixed effects and year of marriage trend. Column 3 includes state fixed effects and rural/urban fixed effects. Column 4 adds religion, caste, wealth quintile, schooling, fuel type and working status fixed effects. Column 5 adds bmi, smoking, alcohol consumption, hours since last ate, hours since last drank and time of measurement.

lence on the probability of hypertension. Panel A presents the reduced form estimates of the effect of price of gold at the time of marriage on hypertension. The estimated effect of price of gold on hypertension in the bivariate estimation is 4.1 percentage points and in the most stringent specification in Column 5 is reduced to 0.8 percentage points. In all specifications, the effect is positive and precisely estimated. Panel B presents the first stage estimates of the effect of price of gold at the time of marriage on domestic violence. The strength of the instrument can be evaluated using the 1st stage F statistics presented at the bottom of the table for each specification. As expected, the strength of the instrument falls as additional covariates are added in each subsequent column, but nonetheless in all specifications the strength of the instrument is sufficiently high (Stock and Yogo, 2002).

Table 7: Instrumental variable estimates of the effect of domestic violence on diabetes

	(1)	(2)	(3)	(4)	(5)
Panel A: Reduced Form Estimates			**Diabetes**		
Price of Gold	0.024***	-0.000	-0.000	0.001	0.001
	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
Panel B: 1st Stage Estimates			**Domestic Violence**		
Price of Gold	0.016***	0.015***	0.015***	0.012***	0.011***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Panel C: 2nd Stage Stage Estimates			**Diabetes**		
Domestic Violence	0.822***	-0.003	-0.025	0.059	0.087
	(0.030)	(0.299)	(0.284)	(0.367)	(0.382)
+ Time		✓	✓	✓	✓
+ Spatial			✓	✓	✓
+ Socioeconomic				✓	✓
+ Health					✓
N	34161	34161	34161	34161	34161
Mean - Diabetes	0.052	0.052	0.052	0.052	0.052
1st Stage F Statistic	399.476	52.855	60.389	35.699	32.966

Robust standard errors clustered at month and year of marriage in parenthesis $***p < 0.01$, $** p < 0.05$, $* p < 0.1$.
Dependent variable of diabetes is a binary indicator with 1 indicating diabetes. Domestic violence is standardised with a mean of 0 and standard error of 1.
Column 1 presents the results of a bivariate probit estimation. Column 2 additionally conditions on age fixed effects and year of marriage trend. Column 3 includes state fixed effects and rural/urban fixed effects. Column 4 adds religion, caste, wealth quintile, schooling, fuel type and working status fixed effects. Column 5 adds bmi, smoking, alcohol consumption, hours since last ate, hours since last drank and time of measurement.

Panel C presents the 2nd stage estimates of the effect of the fitted values of domestic violence on probability of hypertension. In all specifications, domestic violence has a precisely estimated positive effect on the probability of hypertension in women. The estimated effect of the most stringent specification presented in Column 5 is 57 percentage points, which translates to a marginal effect of 0.8 percentage points when all covariates are set at their mean. Adding covariates sequentially does not alter the results by much which provides evidence to the plausibility of conditional independence assumption. Interestingly, the size of the estimate changes very little between columns 4 and 5 which provides evidence that health behaviours such as smoking or drinking, or even BMI, are not the primary mechanisms through which this effect operates. The instrumental variable 2nd stage estimations show the local average treatment effect (LATE) for the compliers as opposed to the average treatment effect (ATE) because we

would expect that there are women for whom the price of gold at the time of marriage will not have any impact on domestic violence (non compliance to treatment assignment). On the other hand, the reduced form estimates in Panel A are the intent to treat (ITT) effect.

Table 7 presents the instrumental variable estimates for the effect of domestic violence on the probability of having diabetes. As with Table 7, Panel A presents the reduced form estimates, Panel B presents the 1st stage estimates and Panel C presents the 2nd stage results. I find no evidence of an effect of domestic violence on the probability of developing Type 2 diabetes. This result is robust to using alternative cutoffs for measuring diabetes. For instance, coding diabetes as 1 if blood glucose levels are $>$ 150 mg/dL or $>$ 240 mg/dL as done in Weitzman and Goosby (2021) supports these null findings.

6 Robustness Checks

In this section, I relax the strict exclusion restriction by estimating bounds around the estimated effect to quantify the degree of endogeneity required for the estimated β to include zero. As the main results in the previous section use probit estimations in the second stage, I also examine if the results are consistent when using a linear probability model in the second stage by using the base measures of average systolic pressure, average diastolic pressure and blood glucose levels as continuous CVD measures.

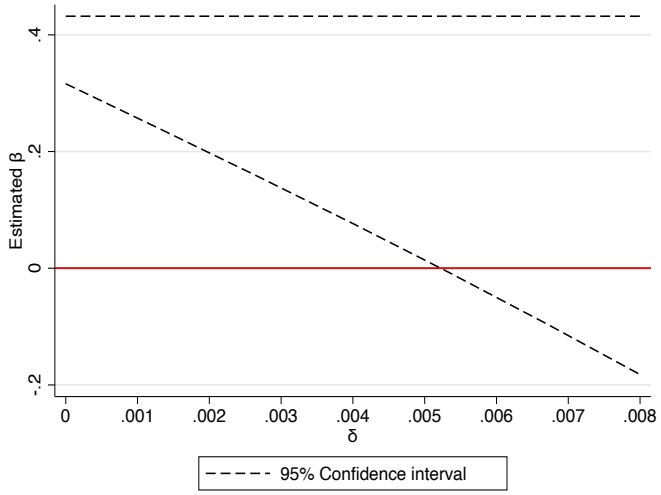
6.1 Bounds on instrument validity

In India, gold is viewed not just as an investment but also has unique socio-cultural norms[8] such that once purchased, gold is rarely sold (Mukherjee et al., 2017). This means that approximately 25000 tonnes (Narayanan et al., 2020) of gold hoarded by Indian households is idle in the economy fuelling a recent attempt by the Indian government to introduce a Gold Monetization Scheme in 2015, with limited success. Given this, it is likely that the exclusion restriction holds true and price of gold at the time of marriage does not impact CVD through channels such as

[8]For instance, gold is seen as a sign of prosperity and traditionally considered an asset to be passed on as inheritance.

household wealth as gold jewellery is rarely sold. Nonetheless, I test if the main results are robust to some degree of instrument endogeneity.

Figure 2: Conley-Hansen-Rossi bounds test for instrument validity



Union of confidence intervals (UCI) bounds drawn for varying levels of delta, the direct effect of the price of gold at the time of marriage, using Stata command plausexog (Clarke and Matta, 2018) 95% confidence intervals generated from robust standard errors clustered at month and year of marriage. Includes all controls used in the most stringent specification in Column 5, Table 6.

Figure 2 presents the bounds of the second stage effect of domestic violence on hypertension, allowing a degree of endogeneity in the instrument using the estimator developed by Conley et al. (2012). Specifically, I allow the direct effect of the price of gold on hypertension to range from zero, i.e. perfectly exogenous to 0.008 which is the reduced form effect of the price of gold on hypertension, presented in Column 5, Table 6. The bounds of the second stage estimation do not include zero so long as the direct effect of the price of gold on hypertension is less than 0.005. This shows that the positive effect of domestic violence on hypertension is robust to a large degree of instrument endogeneity amounting to 62.5% of the reduced form effect.

6.2 Alternative estimators

The main results are estimates from instrumental variable probit regressions since the outcome variables of interest are binary indicating the probability of hypertension or diabetes. I also test if the results are sensitive to using two-stage linear instrumental variable regressions. To do so, I use the base measurements of average systolic pressure in Panel A, average diastolic pressure

in Panel B, and random blood glucose level in Panel C, as continuous outcome variables in Table 8. The first stage statistics remain the same as in Tables 6 and 7.

Table 8: Instrumental variable estimates of the effect of domestic violence on base measures

	(1)	(2)	(3)	(4)	(5)
	Panel A: Average Systolic Pressure				
Domestic Violence	20.009***	3.992**	3.121*	3.733	3.685
	(1.629)	(1.939)	(1.717)	(2.284)	(2.302)
N	29903	29903	29903	29903	29903
Mean (Dep var)	116.916	116.916	116.916	116.916	116.916
	Panel B: Average Diastolic Pressure				
Domestic Violence	16.980***	3.332**	2.580**	3.321**	3.281**
	(1.231)	(1.325)	(1.154)	(1.551)	(1.559)
N	29903	29903	29903	29903	29903
Mean (Dep var)	78.591	78.591	78.591	78.591	78.591
	Panel C: Random Blood Glucose Level				
Domestic Violence	24.173***	2.055	1.768	4.318	5.318
	(2.283)	(3.476)	(3.303)	(4.412)	(4.571)
+ Time		✓	✓	✓	✓
+ Spatial			✓	✓	✓
+ Socioeconomic				✓	✓
+ Health					✓
N	34161	34161	34161	34161	34161
Mean (Dep var)	103.046	103.046	103.046	103.046	103.046

Robust standard errors clustered at month and year of marriage in parenthesis ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variable of average systolic pressure, average diastolic pressure and random blood glucose level are continuous. Domestic violence is standardised with a mean of 0 and standard error of 1.
Column 1 presents the results of a bivariate instrumental variable estimation. Column 2 additionally conditions on age fixed effects and year of marriage trend. Column 3 includes state fixed effects and rural/urban fixed effects. Column 4 adds religion, caste, wealth quintile, schooling, fuel type and working status fixed effects. Column 5 adds bmi, smoking, alcohol consumption, hours since last ate, hours since last drank and time of measurement.

When focusing on the most stringent specification in Column 5, the effect of domestic violence on average diastolic pressure is precisely estimated while the others are imprecisely estimated, however, the sign of the estimate is positive in all 3 panels and across all 5 specifications in each panel. In column 5, the magnitude of the causal effect of domestic violence on diastolic blood pressure is 3.3 mmHg, which is considerable. To put this in perspective, lowering diastolic blood pressure by 5 mmHg reduces the risk of stroke by an estimated 34% and

ischaemic heart disease by 21% (Law et al., 2003). The magnitude of the effect found in this paper is also comparable to the that of reducing alcohol intake by 3 drinks per day on diastolic blood pressure (Roerecke et al., 2017).

7 Sensitivity Analysis

In this section, I check if the results are heterogeneous by wealth and if the results remain consistent when using alternative types of violence. I further check if the effect is attributable contemporary domestic violence rather than the long-term measure used in the main reults. I also explore if the results for hypotension is consistent with the main results and examine if these results hold true for the men in these marriages.

7.1 Heterogenous effects by wealth

CVD has traditionally been thought of as disease of affluence (Trowell and Burkitt, 1981). However, this has been challenged as risk factors such as smoking may decrease once they have peaked, and because in high-income countries CVD is increasingly concentrated amongst the low income groups (Ezzati et al., 2005; Marmot et al., 1984). Given this, it is interesting to examine whether the causal effect of domestic violence on hypertension and diabetes differs by wealth status in India. The summary statistics for these categories in the analytical sample is provided in Table 1, Section 3.1.

For ease of interpretation and so as to not dilute the strength of the instrument in the first stage, I combine the poorest and poorer categories and middle, richer and richest categories. Columns 1 and 2 in Table 9 presents the effect of domestic violence on hypertension for the Poor and Middle/Rich households where I find a positive but imprecisely estimated effect. Column 3 and column 4 presents the effect of domestic violence on diabetes. I find imprecisely estimated negative relationship in the poor households and a positive relationship in the middle/rich households.

Table 9: Instrumental variable estimates of main results by wealth

	(1)	(2)	(3)	(4)
	Hypertension		**Diabetes**	
	Poor	**Middle/Rich**	**Poor**	**Middle/Rich**
Domestic Violence	0.156	0.592	-0.210	0.371
	(0.408)	(0.388)	(0.414)	(0.594)
+ Time	✓	✓	✓	✓
+ Spatial	✓	✓	✓	✓
+ Socioeconomic	✓	✓	✓	✓
+ Health	✓	✓	✓	✓
N	12793	17112	14624	19537
1st Stage F-Statistic	16.753	15.246	21.248	14.852
Mean (dep var)	0.096	0.102	0.048	0.055

Robust standard errors clustered at month and year of marriage in parenthesis ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variable of hypertension is a binary indicator with 1 indicating hypertension. Dependent variable of diabestes is binary with 1 indicating diabetes. Domestic violence is standardised with a mean of 0 and standard error of 1. Columns 1 and 3 present the results for households that are classified as poorest and poorer and Columns 2 and 4 present the results for households that are classified as middle, rich or richer according to the DHS wealth index.

7.2 Low blood pressure

The main results of this paper excludes women who are hypotensive, ie. have average systolic pressure $<=$ 90 mm/hg or have average diastolic pressure $<=$ 60 mm/hg. While the causes of hypotension are less understood than that of hypertension, it is associated with hormonal imbalances, heart failure or arrhythmia, heat strokes, ageing, genetic makeup, and dehydration amongst others. Unlike hypertension, hypotension with no symptoms is almost never serious and only becomes a medical issue if it becomes symptomatic.

As an extension, I examine the effect of domestic violence on the probability of hypotension. Hypotension is defined as a binary variable which is 1 if the respondent has low blood pressure and is 0 if the respondents blood pressure is within the normal range. Thus this analysis excludes women who are hypertensive. Panel A in Table 10 presents the reduced form estimates of the effect of price of gold at the time of marriage on hypotension. Panel B presents the 1st stage statistics of the effect of price of gold on domestic violence and Panel C presents the 2nd stage estimates of the effect of domestic violence on hypotention. I find a negative effect of domestic violence on the probability of hypotension in all 5 specifications shown in the 5 columns, which is analogous to the main results of this paper, as chronic stress induced by

domestic violence, increases blood pressure and thus reduces the likelihood of hypotension.

Table 10: Instumental variable estimates of effect of domestic violence on hypotension

	(1)	(2)	(3)	(4)	(5)
Panel A: Reduced Form Estimates			**Hypotension**		
Price of Gold	-0.020***	-0.007*	-0.007*	-0.007*	-0.008*
	(0.002)	(0.004)	(0.004)	(0.004)	(0.004)
Panel B: 1st Stage Estimates			**Domestic Violence**		
Price of Gold	.0170***	.015***	.015***	0.012***	0.011***
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)
Panel C: 2nd Stage Estimates			**Hypotension**		
Domestic Violence	-0.756***	-0.415**	-0.428**	-0.538**	-0.559**
	(0.032)	(0.203)	(0.194)	(0.218)	(0.219)
+ Time		✓	✓	✓	✓
+ Spatial			✓	✓	✓
+ Socioeconomic				✓	✓
+ Health					✓
N	30731	30731	30731	30731	30731
Mean - Hypotension	0.123	0.123	0.123	0.123	0.123
1st Stage F Statistic	413.97	48.176	55.561	32.453	29.911

Robust standard errors clustered at month and year of marriage in parenthesis ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variable of hypotension is a binary indicator with 1 indicating hypotension. Domestic violence is standardised with a mean of 0 and standard error of 1.
Panel A presents linear regression estimates. Panel B and Panel C present 1st stage estimates and 2nd stage results of instrumental variable probit regression respectively. Column 1 presents the results of a bivariate estimation. Column 2 additionally conditions on age fixed effects and year of marriage trend. Column 3 includes state fixed effects and rural/urban fixed effects. Column 4 adds religion, caste, wealth quintile, schooling, fuel type and working status fixed effects. Column 5 adds bmi, smoking, alcohol consumption, hours since last ate, hours since last drank and time of measurement.

7.3 Alternative types of violence

The main results of this paper focuses on physical violence as physical violence questions in the DHS elicit a detailed response with greater variation, rather than a yes/no binary response. The domestic violence module in the DHS also includes questions on emotional and sexual violence which elicited simple yes/no responses. As an extension to the main results, I check if the positive relationship between physical violence and hypertension (and the imprecise estimates between physical violence and diabetes) holds true in the case of emotional and sexual violence.

Table 11 presents the results for this estimation. I find a positive precisely estimated effect

Table 11: Instrumental variable estimates of effect of emotional and sexual violence

	(1)	(2)	(3)	(4)
	Hypertension		**Diabetes**	
Any emotional violence	2.199***		0.401	
	(0.608)		(1.743)	
Any sexual violence		2.837***		0.491
		(0.807)		(2.243)
+ Time	✓	✓	✓	✓
+ Spatial	✓	✓	✓	✓
+ Socioeconomic	✓	✓	✓	✓
+ Health	✓	✓	✓	✓
N	29903	29903	34161	34161
Mean (dep var)	0.10	0.10	0.052	0.052
First stage F	19.066	14.166	18.720	12.912

Robust standard errors clustered at month and year of marriage in parenthesis ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$.
Dependent variable in Columns 1 and 2 is binary with 1 indicating hypertension. Dependent variable in Columns 3 and 4 is binary with 1 indicating diabetes. Any emotional violence and any sexual violence is binary with 1 indicating the presence of the corresponding type of violence.

of emotional and sexual violence on hypertension shown in Column 1 and Column 2 respectively. The marginal effect of emotional violence and sexual violence on the probability of hypertension is 52 percentage points and 68 percentage points respectively. I do not find evidence for an effect of emotional or sexual violence on diabetes as shown in Column 3 and Column 4. Thus, the effect of emotional and sexual violence on hypertension and diabetes supports the main findings.

7.4 Long-term versus contemporary violence

The main results presented in Section 5 accounts for all types of physical violence that ever occurred within the marriage as long-term exposure to domestic violence leads to chronic stress which leads to adverse CVD outcomes. On the other hand, a contemporary measure of violence might be more linked to current measures of CVD. Table 12 presents the results when using a contemporary measure of domestic violence which is the first component of a polychoric principle component analysis of all 7 dimensions of domestic violence, when both responses of "Never" and "Not in the last 12 months" (detailed in section 3.2) are coded as zero. This first component accounts for 79% of the overall variability of domestic violence. This is standard-

ised to have a mean of 0 and a standard deviation of 1 for ease of interpretation as done in the main estimations.

Table 12: IV 2nd stage estimates of the effect of contemporary domestic violence on CVD

	(1)	(2)	(3)	(4)	(5)
			Panel A: Hypertension		
Domestic Violence	0.971***	0.574***	0.504***	0.595***	0.580***
	(0.014)	(0.158)	(0.171)	(0.191)	(0.201)
+ Time		✓	✓	✓	✓
+ Spatial			✓	✓	✓
+ Socioeconomic				✓	✓
+ Health					✓
N	29903	29903	29903	29903	29903
Mean - Hypertension	0.10	0.10	0.10	0.10	0.10
1st Stage F Statistic	152.967	49.443	61.961	38.699	36.921
			Panel B: Diabetes		
Domestic Violence	0.889***	-0.002	-0.025	0.059	0.087
	(0.024)	(0.304)	(0.291)	(0.369)	(0.383)
+ Time		✓	✓	✓	✓
+ Spatial			✓	✓	✓
+ Socioeconomic				✓	✓
+ Health					✓
N	34161	34161	34161	34161	34161
Mean - Diabetes	0.052	0.052	0.052	0.052	0.052
1st Stage F Statistic	189.706	58.699	70.444	44.664	42.433

Robust standard errors clustered at month and year of marriage in parenthesis ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variable of hypertension is a binary indicator with 1 indicating hypertension. Dependent variable of diabetes is a binary variable with 1 indicating diabetes. Domestic violence is standardised with a mean of 0 and standard error of 1.
Column 1 presents the results of a bivariate estimation. Column 2 additionally conditions on age fixed effects and year of marriage trend. Column 3 includes state fixed effects and rural/urban fixed effects. Column 4 adds religion, caste, wealth quintile, schooling, fuel type and working status fixed effects. Column 5 adds bmi, smoking, alcohol consumption, hours since last ate, hours since last drank and time of measurement.

The results are consistent with the main findings in that the contemporary measure of domestic violence leads to higher hypertension but has no effect on diabetes. In addition, the magnitude of the effect on hypertension in Column 5 of Panel A, Table 12 is higher than when compared to the measure for long-term violence presented in the main results, which supports the hypothesis that a contemporary measure of violence might be more linked to current measures of CVD.

8 What happens to men?

Table 13: Instrumental variable estimates of effect of domestic violence on hypertension - Men

	(1)	(2)	(3)	(4)	(5)
			Panel A: Hypertension		
Domestic Violence	0.852***	0.214	0.210	0.380	0.354
	(0.026)	(0.213)	(0.213)	(0.241)	(0.254)
+ Time		✓	✓	✓	✓
+ Spatial			✓	✓	✓
+ Socioeconomic				✓	✓
+ Health					✓
N	27914	27914	27914	27914	27914
Mean - Hypertension	0.199	0.199	0.199	0.199	0.199
1st Stage F Statistic	299.885	47.245	54.843	32.781	31.773
			Panel B: Diabetes		
Domestic Violence	0.805***	0.044	0.038	0.171	0.156
	(0.031)	(0.222)	(0.216)	(0.265)	(0.287)
+ Time		✓	✓	✓	✓
+ Spatial			✓	✓	✓
+ Socioeconomic				✓	✓
+ Health					✓
N	32950	32950	32950	32950	32950
Mean - Diabetes	0.092	0.092	0.092	0.092	0.092
1st Stage F Statistic	377.293	54.492	61.912	36.532	34.278

Robust standard errors clustered at month and year of marriage in parenthesis ***$p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Dependent variable of hypertension is a binary indicator with 1 indicating hypertension. Domestic violence is standardised with a mean of 0 and standard error of 1.
Column 1 presents the results of a bivariate instrumental variable probit estimation. Column 2 additionally conditions on age fixed effects and year of marriage trend. Column 3 includes state fixed effects and rural/urban fixed effects. Column 4 adds religion, caste, wealth quintile, schooling, fuel type and working status fixed effects. Column 5 adds bmi, smoking, alcohol consumption, hours since last ate, hours since last drank and time of measurement.

There are several reasons why it is interesting to look at the effect of domestic violence on cardiovascular risk amongst the partnered husbands that is, the perpetrators/non-perpetrators of violence in the analytical sample. First, there is consistent evidence in the economic literature of concordance in health behaviours/outcomes amongst spouses (Davillas and Pudney, 2017; Fadlon and Nielsen, 2019; Patel et al., 2017; Saarela et al., 2019). This suggests that men who are partnered with women with high probabilities of cardiovascular risk, would themselves have a high probability of cardiovascular risk. Second, previous descriptive research suggests

domestic violence increases the risk of hypertension in perpetrators (Lindman et al., 1992; O'Neil and Scovelle, 2018).

While the DHS has a focus on women who are the primary respondents, they collect very detailed information on the husbands too, including biomarkers. The analytical sample for men in matched pairs is slightly smaller due to missing information. In spite of higher prevalence of both hypertension (20%) and diabetes (10%) in men, and identical time and spatial categories of conditional variables, I find no significant causal effects of domestic violence on hypertension or diabetes [9] in men as shown in Table 13.

9 Conclusion

Domestic violence has historically been thought of as a *hidden health burden*. This paper shows that the health burden arising from domestic violence is indeed likely to be higher than previously thought, by showing a statistically and economically significant positive causal effect of domestic violence on an established CVD risk factor: hypertension. To put this in perspective, the effect size found in this paper is comparable to that of reducing alcohol intake by 3 drinks per day on diastolic blood pressure (Roerecke et al., 2017). The magnitude of the effects found in this paper is also likely to be a lower bound as women with a higher predisposition to heart disease are less likely to be in the sample.

This paper also eliminates health behaviours such as smoking or drinking or even underlying BMI as the mechanism through which this effect operates. This is but a first step, as future work to identify the mechanism through which this effect operates requires detailed data on biomarkers of stress, such as cortisol or C-reactive protein, in addition to data on domestic violence. Comprehensive domestic violence data linked to administrative health records would be an exciting avenue to further unpack these mechanisms in a causal framework.

[9] Using the 2015-2016 Indian DHS data, Weitzman and Goosby (2021) also do not find a significant association between domestic violence perpetration and blood glucose levels in men.

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