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Does Access to Key Household Resources Help in Reducing Violence against Women?

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Abstract

Violence against women is not only widely recognized as a public health problem but also considered to be a severe violation of their fundamental human rights. Women and girls' vulnerability to both non-partner violence (NPV) as well as intimate partner violence (IPV) can be exacerbated by lack of access to water, sanitation and hygiene (WASH) resources as well as cooking fuel within households. However, the literature has ignored certain aspects of this linkage such as the impact of WASH resources on IPV or the impact of access to cooking fuel on NPV or IPV. We therefore attempt to quantify the impact of each of these key household resources on women's exposure to NPV when they step out of their homes to access the resources as well as IPV when they are unable to meet their own as well as their families' WASH and fuel needs. Using data from a large-scale survey (NFHS-4) for India and employing propensity score matching and inverse probability weighted regression adjustment techniques, we find that access to each of the household resources leads to lower physical IPV. Emotional IPV gets reduced with access to cooking fuel and toilets while sexual IPV decreases with provision of cooking fuel. Provision of all three key resources reduces physical NPV but there is no effect on sexual NPV.

Keywords: violence against women and girls, non-partner violence, intimate partner violence, water, sanitation and hygiene, clean energy, propensity score matching, inverse probability weighted regression adjustment

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1. Introduction

In most low income countries, there is insufficient access to safe drinking water, adequate sanitation and hygiene facilities (WASH henceforth) as well as clean cooking fuel at home (WHO, 2019a). This inadequacy particularly affects women and girls (Barnes and Sen, 2004; Kevany and Huisingh, 2013). In addition to this being a public health problem, the literature indicates that lack of access to, or inadequate provision of WASH facilities can increase vulnerability to gender based violence (GBV henceforth, Sommer et al, 2014). However, there is no comprehensive study that quantifies the impact of WASH resources and cooking fuel availability on GBV. We attempt to fill this gap by analyzing data from a large survey of Indian households to understand the impact of WASH and cooking fuel availability on GBV. In doing so, we estimate the impact on both IPV (intimate partner violence) and NPV (non-partner violence) and explain the different channels through which a lack of WASH facilities and lack of clean cooking oil at home can lead to such violence.

While the lack of WASH and cooking oil facilities can affect everyone, women and girls are disproportionately affected. In low-income countries, women and girls are frequently required to walk long distances in search of water supply for drinking, cooking, laundry (these tasks are typically relegated to women and girls), handwashing, as well as wait until evening hours to look for an open field or private place to defecate and satisfy their sanitation needs under the cover of darkness. Post-pubescent girls and women have the added difficulty of menstruation, which for a number of days per month increases their daily needs for water and sanitation. In addition, women with disabilities, pregnant women and those belonging to lower castes may face hindrances in the use of public sources of sanitation (Sommer et al, 2014). Household water insecurity may also increase the vulnerability of women to emotional and physical aspects of IPV as a penalty for failure to conduct household activities dependent on water such as cooking and cleaning exacerbate tensions within the household members coping with resource scarcity (Choudhary, 2020).

When access to local natural resources is scarce, women and girls can also be subjected to physical and sexual abuse during fuel collection and transport (ESMAP, 2013). The scope for such abuse rises as forests are depleted and women are forced to go into more remote areas to obtain fuel (WRC, 2011). Poor street lighting is another factor that amplifies the risks of abuse, assault and rape if women and girls have to move around at night for cooking fuel collection. Further, when they are unable to prepare a meal because of lack of such fuel, conflicts between family members can escalate, thus culminating in physical aggression and domestic violence in the household.[2]

[2] https://www.safefuelandenergy.org/issues/protection-gender.cfm last accessed 3rd August 2020.

There have been some studies on the impact of toilet construction on GBV. Gonsalves et al (2015) quantify the impact of toilet construction on reduced sexual violence in an urban township in South Africa using a mathematical simulation approach. There are some qualitative studies on the link between lack of toilet facilities in households and perception of violence faced by women in India (Belur et al, 2016; Khanna and Das, 2016). A few papers provide econometric analyses of the impact of toilet availability on NPV (Srinivasan, 2015; Jadhav et al, 2016) but there is no evidence for IPV. Chaplin (2017)'s survey of the literature finds that the linkage between GBV and sanitation is poorly researched and documented. When it comes to the effects of other key resources like water and cooking fuel, the literature is even more scant. The only study for the impact of water access on IPV is for Nepal (Choudhary, 2020) and there are no papers for NPV or for the impact of cooking fuel on GBV.

Our study makes four distinct contributions to the literature. This is the first comprehensive study to analyze the impact of all three key household resources (water, sanitation and cooking fuel) on both NPV and IPV. Second, our study uses data from a nationally representative survey which has greater potential for generalizability than local data-sets analyzed in some of the existing studies. We use household data for India obtained from the latest (fourth) round of the National Family Health Survey (NFHS-4 henceforth) conducted in 2015-16. Third, this is the only study to employ matching techniques to control for selection bias in the empirical estimation of the effects of household resources on GBV. Finally, unlike previous studies, we analyze the sub-categories of NPV (i.e. physical and sexual) and IPV (i.e. physical, sexual and emotional) separately.

The NFHS is a large-scale, multi-round survey conducted on a representative sample of households throughout India. It is a nationally important source of data on population, health and nutrition indicators for each state and union territory and has been widely used in studies related to both IPV and NPV (Sudha and Morrison, 2011; Sabri et al, 2014; Srinivasan, 2015; Paul, 2016; Jadhav et al, 2016; Ler et al, 2017; Pengpid and Peltzer, 2018; Ahmad et al, 2019). NFHS surveys are performed under the supervision of the Ministry of Health and Family Welfare (MoHFW), Government of India. The International Institute for Population Sciences (IIPS), Mumbai, has been appointed as the nodal agency for conducting the surveys by the MoHFW. Using data from NFHS-4 provides us with three advantages. First, NFHS-4 covers approximately 572,000 households from all 640 districts of India. Second, NFHS-4 is distinct from the previous three rounds (conducted in 1992-93, 1998-99, 2005-06) as it provides district level estimates for the first time pertaining to a number of important indicators on socio-economic factors and health. Third, the new information included in NFHS-4 pertaining to women is ownership of assets as a measure of empowerment as well as physical violence during pregnancy from husbands/partners as well as anyone else (IIPS and ICF, 2017; Ram et al, 2017).

In using NFHS-4 data to study the impact of WASH and cooking fuel resources on GBV, we face the challenge of drawing causal inferences from what is an observational dataset and not a randomized design. The treatment variable representing individuals' access to household WASH and fuel facilities is not random and may have possible relationships with both their observable and unobservable characteristics, causing selection bias. In the absence of appropriate instrumental variables, to mitigate such an endogeneity problem, this study estimates treatment effects by applying two methodologies that can control for the observed heterogeneity: propensity score matching (PSM henceforth) and inverse-probability-weighted regression adjustment (IPWRA henceforth) which can control for observed differences across the treatment and control groups. Individuals having access to household resources are considered to be the treatment group while non-users represent the counterfactual group or control group (N'dri and Kakinaka, 2020). Our review of the literature suggests that studies investigating the relationship between lack of sanitation resources in households and associated GBV have not used treatment effects estimation approaches.[3] Thus, to the best of our knowledge, our study is the first to use such approaches (PSM and IPWRA) to mitigate selection bias in analyzing the link between lack of access to key household resources and VAW.

The results of our empirical analysis show that improved access to all three key household resources significantly reduces women and girls' exposure to physical IPV and physical NPV. In particular, we find from the PSM method that having access to cooking fuel, drinking water and toilet facilities reduces physical IPV by an average of 7.7%, 4.7% and 7.6% respectively. In the IPWRA method, the corresponding reductions turn out to be 1.2%, 0.8% and 1.7% respectively. Having access to the above three household resources, respectively leads to lower physical NPV by an average of 0.4%, 0.4% and 0.8% as per the PSM method. In the IPWRA method the reduction in NPV turns out to be 0.6%, 0.5% and 0.8% respectively. Some of the figures appear small but are statistically significant.

Furthermore, emotional IPV is reduced from provision of cooking fuel and sanitation facilities within the house. The reduction in emotional IPV due to availability of cooking fuel and toilets is 4% and 3.7% in the PSM method while the figures are 1.2% and 1.3% in the IPWRA method. Finally, sexual IPV decreases as a result of access to cooking fuel. We find that the reduction in sexual IPV, from having access to cooking fuel, is by an average of 2.3% using the PSM method and 0.9% using the IPWRA method. Thus, our results suggest that policy initiatives targeted at WASH, promotion of clean energy sources as well as related behavioral change have an impact on improving households' welfare through the associated decrease in GBV.

[3] Such 'matching techniques' have been used in the literature to study the causal impact of factors such as employment, child sexual abuse, financial management on GBV e.g. by Vyas and Heise, 2014; Jennings et al, 2015; Tsai, 2016 and Canedo and Morse, 2019.

The rest of the paper is organized as follows. Section 2 provides a background for the study's institutional setting. Section 3 describes our data and methodology while Section 4 reports and discusses our empirical results. Section 5 provides concluding remarks.

2. Background

2.1 Evidence on IPV and NPV

IPV, i.e. behavior by an intimate partner or ex-partner that causes physical, sexual or psychological harm, including physical aggression, sexual coercion, psychological abuse and controlling behaviors, is the most widely and commonly perpetrated form of violence by men against women worldwide (WHO, 2019b). India, like other South Asian countries, has high levels of violence against women. NFHS-4 finds that one in three married women in India has experienced IPV, with physical violence being the most common (30 percent), followed by emotional violence (14 percent) and sexual violence (7 percent) (Deosthali-Bhate et al, 2018). Further, the latest (2018) report of the National Crimes Records Bureau (NCRB) states that majority of cases under crimes against women out of total IPC crimes against women are registered under 'Cruelty by Husband or His Relatives' (31.9%) followed by 'Assault on Women with Intent to Outrage her Modesty' (27.6%), 'Kidnapping & Abduction of Women' (22.5%) and 'Rape' (10.3%). The causes of IPV against women have their origins in the social, cultural and economic context of India. Priya et al (2014) argue that gender perceptions lead to the perpetration of VAW, coupled with external influences.

Sexual violence perpetrated by people such as strangers, acquaintances, friends, colleagues, peers, teachers, neighbors and other family members towards women is referred to as non-partner sexual violence (Abrahams et al, 2014). Sexual violence encompasses acts ranging from verbal harassment to forced penetration as well as different degrees of coercion, from intimidation to physical force. Factors specifically thought to be associated with sexual violence perpetration include beliefs in family honor and sexual purity, ideologies of male sexual entitlement and weak legal sanctions for sexual violence (WHO, 2019b). Violent sexual acts take place in various contexts, but estimating the degree of sexual abuse is complicated for many reasons such as social norms that prevent the victim from obtaining formal support from legal or health systems (Rio and Valle, 2016). Consequently, statistics of GBV reported by the police suffer from under-reporting and therefore self-reported data collected through surveys such as NFHS may provide a more realistic picture.

2.2. Lack of WASH Facilities and GBV

The social makeup of societies in developing economies such as India is rapidly shifting as a result of significant internal migration, including from rural to urban areas, from small towns to big cities and even from one region of the country to another. As the population density in cities increases, variation in the characteristics of the population also increase, resulting in poor contact between groups of

residents. High levels of social disorganization in both urban and rural communities increase the risk of NPV in general and more so in vulnerable groups such as women and children (Srinivasan, 2015).

Access to 'sufficient, safe, acceptable, physically accessible and affordable water' is a basic human right, adopted by the United Nations (UN) General Assembly in 2010 (UNGA, 2010). It is also a prerequisite for reducing poverty, social progress and sustainable growth (Lowe et al, 2019). Regardless, less than 50 per cent of the population in India has access to safely managed drinking water, i.e., improved water supply located on-premises, available when needed and free of contamination (JMP, 2017). If families do not have a clean and secure source of water, ideally directly to their homes, then women and young girls become responsible for water collection. Such activity has the potential to expose them to tremendous physical and psychological stress, as well as the danger of GBV while walking to or collecting from water sources (Graham et al., 2016). Poor access to water can also affect the physical, emotional and economic health of women by exacerbating IPV (Kevany & Huisingh, 2013; Ayoade et al., 2015; Geere et al., 2018). Although there is currently a lack of analyses empirically linking household water problems to VAW, there is a theoretical basis to assume that these are connected. To begin with, living with water insecurity is emotionally challenging in itself and inter-personal conflict around water is so prevalent that it is considered by some scholars to be a central dimension of the water insecurity phenomenon (Jepson et al. 2017). Ethnographically-informed studies of very low-income and water-scarce populations indicate that household water insecurity can serve as a direct cause of intra-household disputes, increasing violence against women (Stevenson et al., 2012; Collins et al., 2017).

It is worth noting that the preferences of men and women over household resource control may be different and thus create conflict. Since women are typically among those with comparative lack of resource power, lower attributes of human capital, lower gender hierarchy status, and less mobility, shortage of resources such as water is likely to intensify their IPV exposure (Gilroy, 2015). Moreover, there is a danger that the water collection burden may simply be passed on to daughters if women engage in social security schemes. For instance, the eldest daughters are found to spend less hours in school when women participate intensively in the Mahatma Gandhi National Rural Jobs Guarantee Act (MGNREGA) public works programme in India. In the absence of their mothers, they face increased liability for household chores (Bárcia de Mattos and Dasgupta, 2017). Participation in MGNREGA has also been shown to increase overall GBV due to higher exposure to violence as well as male backlash within the household (Amaral et al, 2015).

When a household lacks toilet facilities, its inhabitants are forced to relieve themselves by using open areas. Although for both men and women open defecation is shameful, it is particularly problematic for the latter. Women who use the bush / open fields to relieve themselves do so either very early in the

morning or late at night to gain some privacy due to the embarrassment associated with such public defecation. This creates an unsafe environment, amplifying their vulnerability of women to attacks from miscreants (Srinivasan, 2015). Post-pubescent girls and women face additional menstrual management challenges that, for a number of days per month, increase their daily WASH requirements.

Open defecation has traditionally been the most prevalent among the poorest people, whether in towns or the countryside, since many of them are unable to afford toilet construction or reside in rented homes without toilets. A survey released by the National Statistical Office (NSO) in November 2019, titled "Drinking water, sanitation, hygiene and housing conditions in India", claims that about 28.7% of rural households across India still lack access to any form of latrines.

2.2 Lack of Clean Cooking Fuel and GBV

The UN commitment to achieving 17 global goals by 2030 includes "access to affordable, reliable, sustainable and modern energy for all" (Kumar et al, 2017). At the household level, energy insecurity is defined as "the inability to adequately meet basic household energy needs" (Hernandez and Siegel, 2019). In developing countries, women and girls bear the responsibility not only of cooking for their families, but also of collecting the fuel needed to cook the family meal (Global Alliance for Clean Cookstoves, 2011). Hence, when they collect fuel or when they are outside after dark, they are at risk of physical and sexual assault (Rewald, 2017).

Some studies in India primarily analyze attitudes towards the use of clean cooking fuel, but not the associated GBV linked to the collection of fuel. Lewis and Pattanayak (2012) find that those who adopt cook-stoves are often of relatively high socioeconomic status and live in urban environments. Compared to their wealthier peers, poor households account for just a small part of overall LPG fuel consumption. In patriarchal cultures, they are less likely to adopt LPG, even though such households may have higher incomes. LPG is also less likely to be adopted by households belonging to disadvantaged communities, lower castes, lower social classes or indigenous groups (Kumar et al ,2017). Jain et. al (2019) show that in six of the most energy access-deprived states, viz., Bihar, Jharkhand, Madhya Pradesh, Odisha, Uttar Pradesh, and West Bengal, only about one-third of the rural population use LPG as their primary cooking fuel.

Across India, although 58 per cent of rural households use LPG, access is skewed towards upper classes, with 69 per cent of General households using LPG against just 38 per cent of Scheduled Tribe households. Similarly, access to clean cooking energy is limited for the urban poor due to constraints of affordability and documentation (Patnaik et al, 2019). In sum, while various studies have analyzed different aspects of how WASH and cooking fuel may lead to gender inequity, there is a lack of quantitative studies on the causal impact. Taboos regarding women's sexual and reproductive health,

including menstruation and dominant social norms that condone VAW mean that issues related to WASH and associated GBV are often not discussed by governments, communities, and the citizenry at large.

3. Data and Methodology

In order to carry out our empirical analysis, we use data from NFHS-4, 2015-2016. NFHS-4 also provides, for the first time, information on population and health indicators for all 7 union territories (UTs) and 640 districts in the country, along with data for all 29 states of India (Golder et al, 2016). The Household Questionnaire lists all members who are usual residents of the household as well as visitors who have stayed the night before the interview. Basic demographic information on age, sex, marital status and schooling, pertaining to each person is collected. Information is also collected on characteristics of the dwelling unit such as source of drinking water, time to get to water source, type of toilet facilities available and type of cooking fuel used. The information on age and sex of household members based on the household questionnaire is then used to further identify women who are eligible for individual interviews using the separate women's questionnaire. Information on various background characteristics of women such as demographics, socio economic status, empowerment indicators and husband/ partner's background are then collated through the women's questionnaire (IIPS and ICF, 2017).

Only one eligible woman per household is randomly selected in compliance with WHO guidelines on the ethical collection of such data in order to assess exposure to abuse. To ensure that the violence subsample is nationally representative, special weights are then used to account for the random selection of only one woman per household. For the measurement of NPV, married and unmarried women are asked about their experience of physical as well as sexual violence committed by anyone, other than a current or most recent husband, in the last one year. Additionally, information from currently married women about the violence committed by the current husband and from formerly married women about their most recent husband is collected to determine exposure to emotional, physical and sexual IPV (IIPS and ICF, 2017).

For our empirical analysis, the sample for assessing the impact of lack of WASH and fuel resources on NPV consists of 76,580 currently, formerly and never married women and for our parallel analysis pertaining to IPV, we have a dataset of 59,093 currently and formerly married women. In both samples, only those women who are usual residents of their households have been considered. Access to WASH and fuel resources in a household represents an intervention/ treatment wherein individuals using the facilities form the treatment group while nonusers, i.e., those without access constitute the counterfactual group or control group. However, such assignment of the treatment is non-random which can lead to a potential selection bias in estimation of the effects of treatment (Heckman &

Vytlacil, 2007; De Janvry et al, 2010). This is because the reasons for having access to WASH and fuel facilities can be based on observable household features of women as well as other unobservable characteristics, thus making the choice of usage endogenous. In order to overcome this problem, our study uses treatment effects estimation using matching and weighting methods. The premise behind such methods is to imitate randomization regarding the assignment of the treatment as is done in randomized controlled trials (RCTs) (N'diri and Kakinaka, 2020). Linnemayr and Alderman (2011) point out that the external validity of RCTs is limited and recommend the use of matching estimators such as propensity score matching method to overcome the problems associated with RCTs.

We analyze our data using two treatment effects methodologies, viz. PSM and IPWRA. The concept underlying PSM is that a vector of many covariates can be reduced to one dimension, which is subsequently given a score, by calculating the conditional probability of assignment to a treatment (access to key household resources in our case), based on values of observed covariates and all treatment confounders. This 'propensity score' is then utilized as if it were the only confounding covariate. Individuals are then matched based on similar propensity scores. Following this, the average difference between the matched participants is estimated, which is referred to as the average treatment effect on the treated (ATET) (Rosenbaum & Rubin, 1983), which is the measure of interest in our study.

PSM works under three assumptions. The first assumption is called the conditional independence assumption (CIA) or confoundedness. This assumption states that no unobservable variable affects both the likelihood of treatment as well as the outcome of interest after conditioning on covariates. The second assumption is the independent and identically distributed observations assumption, which requires the potential outcomes and treatment status of each unit to be independent of the potential outcomes and treatment status of all other units in the sample. The third assumption is the common support or overlap assumption which suggests that every observation comes with a positive probability of being both treated and controlled (N'dri and Kakinaka, 2020).

To create a propensity score, the first step is to use a logit regression with treatment as the outcome variable and suitable covariates as explanatory variables. The selection of covariates is based on tradeoffs between the effects of the variables on bias, i.e., distance of estimated treatment effect from the true effect as well as efficiency, i.e., accuracy of the estimated treatment effect (Garrido et al, 2014). Therefore, as the first step for our empirical analysis, we carry out estimation of propensity scores by applying a binomial logistic regression model. Each of the treatment variables (cooking fuel, drinking water and toilet facilities) is the outcome and is modeled dichotomously where presence of the resource in the household=1 and absence=0. In line with Howard and Bertram (2003), we define drinking water variable as yes (or equals 1) if a household reports that it has water available on premises. If the household reports time taken for water collection (going and returning in minutes), we define it as no

(or equals 0). Following Jadhav et al (2016), we define toilet facility variable as yes (or equals 1) if a household reports that it has a facility available (flush, pit latrine), if no facility/bush/field, the variable is defined as no (or equals 0). Adapting from Puzzolo et al (2019), we define cooking fuel variable as yes (or equals 1) if a household reports that it uses electricity, LPG/ natural gas and biogas and if it uses kerosene, coal/ lignite, charcoal, wood, straw/ shrubs/ grass, agricultural crop waste, dung cakes or anything else, the variable is defined as no (or equals 0). Following Jadhav et al (2016), the explanatory variables include those which can influence the availability of resources in the household, viz. place of residence (urban, rural), whether the dwelling has electricity (yes, no) and region of residence (south India, northeast India, east India, north India, central India, west India). Further details of the covariates are provided in Table 1 while the percentages of each type of IPV and NPV as per the 29 states and 7 UTs are highlighted in Table 2. Table 3 shows a break-up of the samples across different individual and household characteristics. Tables 4 and 5 report the logistic regression results pertaining to IPV and NPV respectively across all three treatment variables.

It is important to test whether participants with the same propensity score across treatment and control groups have a similar distribution of observable covariates or characteristics, independent of their exposure to treatment after both PSM and IPWRA techniques have been implemented (Austin & Stuart, 2015). A covariate is said to be balanced when its distribution does not differ over treatment thresholds. We compute standardized differences which take into account both means and variances (Rosenbaum and Rubin 1985; Austin 2009). A perfectly balanced covariate has a standardized mean difference of zero and variance ratio of one (StataCorp, 2013).

In PSM, various methods are available to match individuals based on their propensity scores. We use kernel matching technique where each treated individual is compared with a weighted average of observations of untreated individuals rather than a single observation. Kernel matching allows retaining the sample size by avoiding the need to discard unmatched observations without increasing bias as the weights are based on untreated individuals with closer propensity scores to treated individuals (Garrido et al, 2014).

Following the estimation of propensity scores, the ATET can be computed as follows (N'dri and Kakinaka, 2020):

$$ATET = E[Y_1|D = 1, p(x)] - E[Y_0|D = 0, p(x)]$$

where p(x) is the estimated propensity score, $E[Y_1|D=1, p(x)]$ is the expected outcome for the units that receive treatment (D=1), $E[Y_0|D=0, p(x)]$ is the expected outcome for the treated units' best matches and x is the set of relevant pretreatment characteristics as mentioned above.

However, the ATET estimated above using PSM can continue to suffer from biased results if the treatment model is not specified correctly (Robins et al, 2007; Wooldridge, 2007, 2010). To mitigate this problem, IPWRA estimation method is applied (Imbens & Wooldridge, 2009) in which two models are employed: one to predict treatment status and one to predict outcomes. This means that only one model must be correctly specified for the regression coefficients to provide consistent average treatment effects. Thus, this procedure has been referred to as "doubly robust" in the sense that if one model is mis-specified, the other should still hold (Austin & Stuart, 2015).

The use of IPWRA also requires conditional independence, independent and identically distributed observations and overlap assumptions. In addition to the misspecification issue, IPWRA improves on PSM in two further ways. The first one is the inclusion of controls for the observation's baseline characteristics in the outcome model. Both IPWRA and PSM must satisfy the conditional independence assumption, which states that no unobservable variable affects both the likelihood of treatment and the outcome of interest after conditioning on covariates. Since IPWRA includes more covariates in the outcome model than PSM, which includes only the covariates in the treatment model, this assumption is more likely to hold with IPWRA than with PSM. The second improvement is that, unlike PSM, which compares each treatment observation to control observations that have a similar likelihood of being treated in a restrictive way, IPWRA implicitly compares every unit to every other unit while placing higher weights on observations that have a similar likelihood of being treated and lower weights on observations that are dissimilar (N'dri and Kakinaka, 2020).

IPWRA estimators use a three-step approach for estimating treatment effects: (i) They estimate the parameters of the treatment model and compute inverse-probability weights; (ii) Using the estimated inverse-probability weights, they fit weighted regression models of the outcome for each treatment level and obtain the treatment-specific predicted outcomes for each subject and (iii) They compute the potential means of the treatment-specific predicted outcomes. By restricting the computations of the means to the subset of treated subjects, we can obtain the ATETs (StataCorp, 2013).

For the IPWRA estimator, we use a logit regression to specify both the outcome and treatment models. In the outcome model, both IPV and NPV are the dependent variables and are modeled dichotomously where the presence of each type of IPV (physical, sexual, emotional) =1, absence=0 and each type of NPV (physical, sexual) =1, absence =0. Following the literature (Kishore and Johnson, 2004; Sudha and Morrison, 2011; Jadhav et al, 2016), the common regressors for the outcome models which are expected to be risk factors for the experience of both IPV and NPV include the woman's age (15-49 years), ethnicity (scheduled caste, scheduled tribe, other backward classes), education (0-20 years) and religion (Christian, Hindu, Muslim, Sikh, others). In addition, marital status is also a common regressor.

For IPV only currently and formerly married women are considered while for NPV, along with ever married women, never married women are also taken into account.

For IPV, in addition to the above, the following regressors are included in the outcome model as risk factors, viz. number of unions (once, more than once), employment status of the woman (working, not working) , total children ever born (0-14), woman has control over how to spend her own money (yes, no), whether the woman is afraid of husband/ partner (yes, no), woman accepts IPV (yes, no), marital control exercised by husband/partner (yes, no) and whether the woman's father beat her mother, i.e. intergenerational IPV (yes, no), husband/ partner's employment status (working, not working), husband/ partner's education (0-20 years) and husband/ partner drinks alcohol (yes, no). These variables are highlighted in further detail in Table 1. The treatment model follows the same specification as mentioned earlier for PSM. Results of PSM and IPWRA estimations are highlighted in Tables 8 and 9 respectively.

4. Results and Discussion

We begin the discussion with the results of the logistic regression models that are necessary for estimating the propensity scores for each of the treatment variables. Table 4 shows the logistic regression results for the three treatment variables viz. cooking fuel, drinking water and toilet facility pertaining to the IPV sample. The results show that women belonging to households which have electricity supply have greater access to all three resources. With respect to region of residence, women belonging to northeastern, northern and western parts of India have lesser access to cooking fuel but more access to drinking water and toilet facilities within households. However, women from eastern and central regions of India have less access to all three resources. Further, women belonging to rural areas have lesser access to all three resources. The results are similar for the NPV sample as illustrated in Table 5.

Results of balance checks post treatment effects estimation are shown in Tables 6 and 7 respectively. They illustrate that although we find substantial differences on many unweighted covariates between treatment and control groups in the raw data, once we use matching and weighting techniques to balance the treatment and comparison groups, we obtain good balance on all covariates—all standardized differences are close to 0 and nearly all variance ratios are close to 1.

Table 8 presents the results for the impact of access to WASH and fuel resources on VAW using PSM. With respect to IPV, the estimates of the respective ATETs suggest that, having access to cooking fuel reduces exposure to physical IPV by an average of 7.7%, sexual IPV by 2.3% and emotional IPV by 4%. Access to drinking water in households causes physical IPV to be reduced by an average of 4.7%, sexual IPV by 1% and emotional IPV by 2%. Similarly, the availability of toilet facilities inside the

house causes physical IPV to go down by an average of 7.6%, sexual IPV by 1.7% and emotional IPV by 3.7%. Therefore, availability of each of the key household resources (WASH and cooking fuel) in a woman's house has a significant effect of reducing violence exercised by their husbands with the largest extent of reduction occurring for physical violence. Some studies have argued that gender roles may not change when key household resources are accessible, e.g. Clancy et al (2012) state, "Access to modern energy appears to enable women to fulfill their traditional roles (to their satisfaction and wellbeing) rather than bringing significant transformation in gender roles". However, it has also been argued that if women spend their time savings from access to energy on increasing their income, they may increase their bargaining power within the family (Rewald, 2017). Our findings attest to this improvement in the women's bargaining power which manifests in reduced violence exercised by husbands.

Next, with respect to NPV, we find that access to cooking fuel, drinking water and toilet facilities leads to lower physical NPV by 4%, 4% and 8% respectively. It implies that lesser the need to step out of the house to access WASH resources and cooking fuel, lower is the exposure to physical violence from non-partners. Availability of toilets inside the house also has a relatively largest impact on reducing violence. Therefore, the Indian government's recent schemes of building more toilets (Swachh Bharat or Clean India Mission) and providing clean cooking fuel to poor women in the form of free LPG cylinders (Ujjwala scheme) may bring about the additional benefit of reduced violence experienced by vulnerable women. The Indian government has also embarked on a scheme of providing piped water at every rural home within 2024. Our results imply that such interventions to bring water access to rural households will also contribute to the reduction of violence faced by rural women.

In Table 9, we present the IPWRA results which provide estimates of the Potential Outcome Means (POMs) (for those without access to key resources) along with corresponding ATETs. As the IPWRA method has the property of being doubly robust, these estimates serve as a robustness check for our previous findings based on PSM. The results indicate that due to lack of access to cooking fuel, the percentage of women experiencing physical IPV is 17.4%, sexual IPV is 4.6% and emotional IPV is 9.8%. However, the estimates of the respective ATETs suggest that, the POM figures reduce by 1.2% to 16.2% for physical IPV, by 0.9% to 3.7% for sexual IPV and by 1.2% to 8.6% for emotional IPV if these women are able to access the same. Second, the percentage of women experiencing physical IPV among those who do not have access to clean drinking water is 19.8% and this number decreases by 0.8% to 19% if they get access. Although the extent of reduction appears to be small in some cases, the effects are statistically significant. Third, the percentage of women experiencing physical IPV among those who do not have access to toilet facilities within households is 18.4% and this number reduces by 1.7% to 16.7% if they are given access. The percentage of women experiencing emotional IPV among those who do not have toilet access is 9.9% and this number reduces by 1.3% to 8.6% if access is

provided. With respect to NPV, we find that access to clean cooking fuel, clean drinking water and toilet facilities within households helps in reducing the percentage of women who experience physical NPV from 5% to 4.4%, 4.8% to 4.3% and 5% to 4.2% respectively. However, the coefficients pertaining to effect of access to all three resources on sexual NPV do not achieve statistical significance.

Based on the above findings, we conclude that provision of each of the three main household resources can lead to a reduction in the level of physical violence – both from intimate partners as well as from non-partners. Emotional violence from partners gets reduced as a result of access to toilets and cooking fuel. In the case of sexual violence, we find a reduction in response to access to cooking fuel but the effect of the other two resources is weaker (statistically significant in PSM but not in IPWRA). Therefore, policies aimed at providing access to WASH and energy facilities should be mindful of the advantages experienced by women and girls in terms of lower experience of abuse and aggression in various forms. Subsequent programming and policy implementation should be carried out through active consultation with women and girls in targeted areas to take cognizance of their needs and priorities as they stand to significantly gain in terms of reduced exposure to violence. These programmes, if well planned and implemented, may provide an incentive to shift gender norms and promote improvements in behavior (Lowe et al, 2019).

There is evidence in the literature that encouraging women to make decisions on sanitation can boost household and community performance outcomes (Kayser et al, 2019). Our findings suggest that the inclusion of women in decision-making and governance of water, sanitation and cooking fuel can contribute to their empowerment and improved well-being. Studies from India show male heads taking decisions about toilet acquisition, whereas, women were responsible for maintenance, keeping the system functioning and fetching water for flushing (Wijk-Sijbesma, 1998; O'Reilly, 2010; Coffey et al, 2014). Further, it has been found that men seem to be less inconvenienced by the absence of a toilet and hence, tend to have a lower interest and willingness to install and use sanitary facilities. Thus, low priority among men for sanitation or water resources may result in lower adoption for the household overall (UNHRC, 2011). However, the need to include thoughts and opinions of women and girls on sanitation in planning and execution of facilities for the same has been strongly advocated (Wijk-Sijbesma, 1998; Chambers, 2009; Khanna and Das, 2016). Our findings indicate that measures aimed at promoting sanitation and improving sanitation behavior should be planned to resolve dynamics at the household level. Strategies need to be built to accommodate both sexes of different age groups in decision-making at different stages of sanitation intervention (pre and post latrine construction) in view of the important roles played by men and women in supporting projects. Mass media advertisements should concentrate on both sexes to avoid strengthening patriarchal assumptions (Routray et al, 2017). With regard to cooking fuel, Pachauri and Rao (2013) point out that there is poor empirical evidence

on the connection between access to improved energy and better results for women. Our findings contribute to this gap by showing the positive outcomes resulting from improved access to cooking fuel.

However, a variety of reasons can constrain the implementation of policies to provide WASH and cooking fuel resources. For example, women can rely on traditional forms of energy because of ease, reliability or affordability, even after having access to cleaner solutions. Barnes and Sen (2004) find that in rural India, even high-income households still use biomass because it is free. Therefore, in planning energy access programmes, it is imperative that governments and organizations are cognizant of the needs and constraints of women and households. Moreover, the adoption of such household resources may be greater in communities with higher initial levels of social capital (Cameron et al, 2019).

5. Conclusion

The existing literature has documented (mainly through qualitative research) that unequal access to key household resources such as WASH and cooking fuel can lead to conflicts within the household to the extent of increasing various forms of violence faced by women from their partners. Moreover, when women have to step outside the house to access these key resources, they may get exposed to potential perpetrators of physical assaults or sexual crimes leading to increased incidence of non-partner violence. However, there is no comprehensive study that studies the effect of access to key household resources on VAW. In this paper we study a large sample of Indian women and employ propensity score matching and inverse probability weighted regression adjustment techniques to examine the impact of key household resources on VAW.

Our results show that while access to the key resources of cooking fuel, toilet and clean drinking water reduces physical IPV, emotional IPV gets reduced with improved access to cooking fuel and toilets while sexual IPV gets reduced with better provision of cooking fuel. In case of NPV, provision of the key resources leads to lower physical NPV. Our findings imply that policies and programs aimed at addressing VAW need to be recognize the importance of providing key household resources to vulnerable women. While WASH and cooking fuel facilities are usually provided as part of anti-poverty programs, these resources can have the added impact of bringing down violence faced by the women in the target households, thereby potentially causing another type of welfare enhancement by improving the well-being of the beneficiaries.

Our study has a few limitations. First, while we are able to significantly improve on earlier studies by controlling for selection on observables, to analyze the impact of household resources on reducing VAW, we are unable to control for unobserved heterogeneity. We are also unable to identify the exact mechanisms or motivations due to which the violence reduction happens in each case. Second,

provision of some of the resources like toilets and cooking fuel have been significantly increased in India in the past few years which our dataset is unable to capture as it pertains to 2015-16. Unfortunately, this is the latest large-scale survey of this nature that is available for India. Third, we are unable to comment on the persistent or dynamic effects of resource availability on violence over a period of time. These issues can be taken up in future research as better datasets become available.

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Table 1- List of Variables and Their Categories used in the Study

Variables	
Exposure to violence	Code
Physical IPV	
no	0
yes	1
Emotional IPV	
no	0
yes	1
Sexual IPV	
no	0
yes	1
Sexual NPV	
No	0
Yes	1
Physical NPV	
no	0
yes	1
Individual characteristics	
ethnicity	
scheduled caste	1
scheduled tribe	2
other backward classes	3
None of them	4
marital status	
currently married	1
formerly married	2
Never married	3

religion	
Christian	1
Hindu	2
Muslim	3
Sikh	4
Others	5
Household characteristics	
electricity	
no	0
yes	1
cooking fuel	
no	0
yes	1
drinking water	
no	0
yes	1
toilet facility	
no	0
yes	1
de jure region of residence	
south India	1
northeast India	2
east India	3
north India	4
central India	5
west India	6
de jure place of residence	
urban	0

rural	1
Union characteristics	
no. of unions of woman	
once	1
more than once	0
psychological control by husband/partner	
no	0
yes	1
IPV justified by woman	
no	0
yes	1
marital control exercised by husband/partner	
no	0
yes	1
woman's work status	
no	0
yes	1
husband/partner's work status	
no	0
yes	1
husband/partner drinks alcohol	
no	0
yes	1
woman's control over her own money	
no	0
yes	1

intergenerational IPV (woman's father beat her mother)	
no	0
yes	1

Table 2- Percentage State/UT Share of IPV (N=59,093) and NPV (N=76,580)

Region of residence	emotional IPV	physical IPV	sexual IPV	sexual NPV	physical NPV
andaman & nicobar islands	5.47	9.38	1.17	0.32	7.77
andhra pradesh	15.67	34.43	4.05	0.26	7.01
arunachal pradesh	12.99	21.20	5.33	0.22	3.05
assam	9.73	17.30	4.53	0.03	3.49
bihar	18.34	37.18	11.99	0.20	4.69
chandigarh	4.35	14.49	4.35	0.00	1.11
chhattisgarh	12.38	26.88	4.85	0.36	5.65
dadra and nagar haveli	13.19	18.68	3.30	0.00	1.87
daman and diu	12.22	15.56	5.56	0.44	8.81
delhi	10.54	22.89	5.12	0.66	4.37
goa	4.36	9.59	0.22	0.17	1.89
gujarat	9.32	14.32	3.66	0.11	2.48
haryana	11.76	25.68	8.23	0.27	7.01
himachal pradesh	3.17	2.83	1.55	0.06	0.66
jammu and kashmir	7.96	5.81	2.18	0.09	2.46
jharkhand	6.77	21.65	5.61	0.13	2.80
karnataka	11.02	17.99	5.13	1.60	6.67
kerala	6.78	8.55	3.17	0.12	1.24
lakshadweep	3.16	4.21	2.11	0.00	0.00
madhya pradesh	10.17	25.98	6.85	0.40	4.72
maharashtra	7.92	16.27	2.38	0.27	2.48
manipur	11.95	34.36	10.35	0.14	6.70
meghalaya	11.07	20.00	3.88	0.11	7.84
mizoram	6.73	10.66	2.28	0.45	1.13
nagaland	7.36	7.36	4.28	0.27	1.69
odisha	9.03	24.02	6.77	0.16	6.14
puducherry	16.38	26.42	4.37	0.19	9.23
punjab	6.12	15.21	3.41	0.14	4.05
rajasthan	6.49	18.52	3.01	0.07	3.08

sikkim	2.79	1.72	1.07	0.00	1.62
tamil nadu	19.74	34.95	6.68	0.30	12.59
telangana	17.88	34.64	5.17	0.35	9.24
tripura	10.53	18.71	9.16	0.14	2.41
uttar pradesh	10.72	25.61	6.27	0.26	5.02
uttarakhand	4.32	7.08	3.01	0.18	3.15
west bengal	10.18	18.73	6.85	0.32	3.71

Table 3- Description of the sample

Variables	IPV (N=59,093)			NPV (N=76,580)	
exposure to violence					
physical	Freq.	Percent		Freq.	Percent
no	46,469	78.64		73062	95.41
yes	12,624	21.36		3518	4.59
emotional	Freq.	Percent			
no	52,937	89.58			
yes	6,156	10.42			
sexual	Freq.	Percent		Freq.	Percent
no	55,895	94.59		76,383	99.74
yes	3,198	5.41		197	0.26
individual characteristics					
ethnicity	Freq.	Percent		Freq.	Percent
scheduled caste	10,609	17.95		13481	17.60
scheduled tribe	10,352	17.52		14304	18.68
other	23,380	39.56		29295	38.25
other backward classes	14,752	24.96		19500	25.46
Marital status					
Currently married	56,243	95.18		60146	78.54
formerly married	2,850	4.82		3171	4.14
Never married				13263	17.32

religion	Freq.	Percent		Freq.	Percent
Christian	3,829	6.48		5773	7.54
Hindu	44,887	75.96		56433	73.69
Muslim	7,586	12.84		10565	13.80
Sikh	1,225	2.07		1607	2.10
others	1,566	2.65		2202	2.88
woman age in years (mean, SD)	33.13	8.05		30.890	9.140
woman education in years (mean, SD)	5.98	5.2		6.600	5.220
household characteristics					
electricity	Freq.	Percent		Freq.	Percent
no	6,332	10.72		8075	10.54
yes	52,761	89.28		68505	89.46
cooking fuel	Freq.	Percent		Freq.	Percent
no	35,610	60.26		46232	60.37
yes	23,483	39.74		30348	39.63
drinking water	Freq.	Percent		Freq.	Percent
no	20,418	34.55		26302	34.35
yes	38,675	65.45		50278	65.65
toilet facility	Freq.	Percent		Freq.	Percent
no	22,387	37.88		28056	36.64
yes	36,706	62.12		48524	63.36
de jure region of residence	Freq.	Percent		Freq.	Percent
south India	9,138	15.46		11118	14.52
northeast India	6,942	11.75		10530	13.75
east India	10,584	17.91		13130	17.15
north India	12,539	21.22		16756	21.88
central India	13,652	23.1		17475	22.82
west India	6,238	10.56		7571	9.89

de jure place of residence	Freq.	Percent		Freq.	Percent
urban	17,743	30.03		23214	30.31
rural	41,350	69.97		53366	69.69
union characteristics					
no. of unions of woman	Freq.	Percent			
once	57,937	98.04			
more than once	1,156	1.96			
psychological control by husband/partner	Freq.	Percent			
no	12,811	21.68			
yes	46,282	78.32			
IPV justified by woman	Freq.	Percent			
no	29,637	50.15			
yes	29,456	49.85			
marital control exercised by husband/partner	Freq.	Percent			
no	30,932	52.34			
yes	28,161	47.66			
woman's work status	Freq.	Percent			
no	39,727	67.23			
yes	19,366	32.77			
husband/partner's work status	Freq.	Percent			
no	2,395	4.05			
yes	56,698	95.95			
husband education in years (mean, SD)	7.55	4.99			
husband/partner drinks alcohol	Freq.	Percent			
no	40,579	68.67			
yes	18,514	31.33			

woman's control over her own money	Freq.	Percent			
no	33,174	56.14			
yes	25,919	43.86			
intergenerational IPV (woman's father beat her mother)	Freq.	Percent			
no	47,583	80.52			
yes	11,510	19.48			

Table 4- Logit regression results (IPV, N=59,093)

variables	**cooking fuel**	**drinking water**	**toilet facility**
	Coef.	Coef.	Coef.
electricity	2.218 (0.068)***	0.242 (0.029)***	1.843 (0.040)***
de jure region of residence			
south India (ref.cat.)	-	-	-
northeast India	-1.036 (0.039)***	0.606 (0.036)***	2.744 (0.058)***
east India	-1.746 (0.038)***	-0.270 (0.031)***	-0.650 (0.033)***
north India	-0.516 (0.032)***	0.549 (0.031)***	0.850 (0.033)***
central India	-1.261 (0.033)***	-0.211 (0.029)***	-0.616 (0.032)***
west India	-0.566 (0.039)***	0.527 (0.038)***	0.048 (0.038)
de jure place of residence	-2.363 (0.023)***	-1.164 (0.023)***	-2.019 (0.027)***
intercept	-0.039 (0.074)	1.167 (0.041)***	0.273 (0.051)***

Note: ***, **, and * denote the significance at the 1%, 5%, and 10% levels, respectively.

Table 5- Logit regression results (NPV, N=76,580)

Variables	**cooking fuel**	**drinking water**	**toilet facility**
electricity	2.264 (0.061)***	0.241 (0.025)***	1.842 (0.036)***
de jure region of residence			
south India (ref.cat.)	-	-	-
northeast India	-0.992 (0.033)***	0.578 (0.031)***	2.759 (0.049)***
east India	-1.715 (0.034)***	-0.287 (0.028)***	-0.675 (0.030)***
north India	-0.483 (0.028)***	0.568 (0.028)***	0.852 (0.030)***
central India	-1.229 (0.030)***	-0.187 (0.026)***	-0.635 (0.028)***
west India	-0.532 (0.035)***	0.563 (0.035)***	0.058 (0.035)**
de jure place of residence	-2.345 (0.020)***	-1.158 (0.020)***	-2.033 (0.024)***
intercept	-0.138 (0.067)**	1.148 (0.036)***	0.304 (0.046)***

Note: ***, **, and * denote the significance at the 1%, 5%, and 10% levels, respectively.

Table 6- Balance Checks- IPV (N=59,093)

Table 6.1- PSM

cooking fuel						
		Raw		Matched (ATET)		
Means	Treated	Untreated	StdDif	Treated	Untreated	StdDif

electricity	0.989	0.829	0.578	0.989	0.989	0.000
northeast India	0.102	0.128	-0.080	0.102	0.102	0.000
east India	0.087	0.240	-0.422	0.087	0.087	0.000
north India	0.250	0.187	0.153	0.250	0.250	0.000
central India	0.178	0.266	-0.211	0.178	0.178	0.000
west India	0.135	0.086	0.155	0.135	0.135	0.000
de jure place of residence	0.413	0.889	-1.150	0.413	0.413	0.000
		Raw		Matched (ATET)		
Variances	Treated	Untreated	Ratio	Treated	Untreated	Ratio
electricity	0.011	0.141	0.077	0.011	0.011	1.000
northeast India	0.092	0.111	0.825	0.092	0.092	1.000
east India	0.080	0.182	0.437	0.080	0.080	1.000
north India	0.188	0.152	1.233	0.188	0.188	1.000
central India	0.147	0.195	0.751	0.147	0.147	1.000
west India	0.117	0.079	1.479	0.117	0.117	1.000
de jure place of residence	0.243	0.099	2.449	0.243	0.243	1.000
drinking water						
		Raw		Matched (ATET)		
Means	Treated	Untreated	StdDif	Treated	Untreated	StdDif
electricity	0.917	0.848	0.216	0.917	0.917	0.000
northeast India	0.133	0.087	0.148	0.133	0.133	0.000
east India	0.146	0.242	-0.245	0.146	0.146	0.000
north India	0.240	0.159	0.205	0.240	0.240	0.000
central India	0.202	0.286	-0.197	0.202	0.202	0.000
west India	0.122	0.074	0.160	0.122	0.122	0.000
de jure place of residence	0.623	0.846	-0.521	0.623	0.623	0.000
		Raw		Matched (ATET)		
Variances	Treated	Untreated	Ratio	Treated	Untreated	Ratio

electricity	0.076	0.129	0.590	0.076	0.076	1.000
northeast India	0.116	0.080	1.452	0.116	0.116	1.000
east India	0.125	0.183	0.679	0.125	0.125	1.000
north India	0.183	0.134	1.367	0.183	0.183	1.000
central India	0.161	0.204	0.789	0.161	0.161	1.000
west India	0.107	0.069	1.553	0.107	0.107	1.000
de jure place of residence	0.235	0.131	1.800	0.235	0.235	1.000
toilet facility						
		Raw		Matched (ATET)		
Means	Treated	Untreated	StdDif	Treated	Untreated	StdDif
electricity	0.964	0.776	0.582	0.964	0.964	0.000
northeast India	0.177	0.020	0.543	0.177	0.177	0.000
east India	0.112	0.288	-0.450	0.112	0.112	0.000
north India	0.264	0.127	0.350	0.264	0.264	0.000
central India	0.167	0.336	-0.397	0.167	0.167	0.000
west India	0.112	0.095	0.057	0.112	0.112	0.000
de jure place of residence	0.574	0.906	-0.817	0.574	0.574	0.000
		Raw		Matched (ATET)		
Variances	Treated	Untreated	Ratio	Treated	Untreated	Ratio
electricity	0.035	0.174	0.199	0.035	0.035	1.000
northeast India	0.145	0.020	7.274	0.145	0.145	1.000
east India	0.100	0.205	0.487	0.100	0.100	1.000
north India	0.194	0.111	1.748	0.194	0.194	1.000
central India	0.139	0.223	0.624	0.139	0.139	1.000
west India	0.100	0.086	1.160	0.100	0.100	1.000
de jure place of residence	0.245	0.085	2.868	0.245	0.245	1.000

Table 6.2- IPWRA

Variables				
cooking fuel				

	Standardized differences		Variance Ratio	
	Raw	Weighted	Raw	Weighted
electricity	0.578	-0.002	0.077	1.022
De jure region of residence				
Northeast India	-0.080	0.006	0.825	1.015
East India	-0.422	0.026	0.437	1.081
North India	0.153	0.080	1.233	1.106
Central India	-0.211	0.074	0.751	1.143
West India	0.155	0.026	1.479	1.059
De jure place of residence	-1.150	0.058	2.449	1.024
drinking water				

	Standardized differences		Variance Ratio	
	Raw	Weighted	Raw	Weighted
electricity	0.216	0.048	0.590	0.870
De jure region of residence				
Northeast India	0.148	-0.025	1.452	0.949
East India	-0.245	-0.029	0.679	0.945
North India	0.205	0.032	1.367	1.041
Central India	-0.197	0.010	0.789	1.015
West India	0.160	0.042	1.553	1.107
De jure place of residence	-0.521	-0.023	1.800	1.012

toilet facility				
	Standardized differences		Variance Ratio	
	Raw	Weighted	Raw	Weighted
electricity	0.582	0.009	0.199	0.958
De jure region of residence				
Northeast India	0.543	0.036	7.274	1.064
East India	-0.450	-0.016	0.487	0.962
North India	0.350	0.005	1.748	1.005
Central India	-0.397	0.049	0.624	1.095
West India	0.057	-0.009	1.160	0.978
De jure place of residence	-0.817	-0.035	2.868	1.011

Table 7- Balance checks NPV (N=76,580)

Table 7.1-PSM

Variables						
cooking fuel						
		Raw			Matched (ATET)	
Means	Treated	Untreated	StdDif	Treated	Untreated	StdDif
electricity	0.990	0.832	0.575	0.990	0.990	0.000
northeast India	0.122	0.148	-0.075	0.122	0.122	0.000
east India	0.084	0.229	-0.404	0.084	0.084	0.000
north India	0.258	0.193	0.156	0.258	0.258	0.000
central India	0.178	0.261	-0.201	0.178	0.178	0.000
west India	0.127	0.080	0.154	0.127	0.127	0.000
de jure place of residence	0.410	0.885	-1.145	0.410	0.410	0.000

		Raw			Matched (ATET)	
Variances	Treated	Untreated	Ratio	Treated	Untreated	Ratio
electricity	0.010	0.140	0.073	0.010	0.010	1.000
northeast India	0.107	0.126	0.852	0.107	0.107	1.000
east India	0.077	0.176	0.439	0.077	0.077	1.000
north India	0.191	0.156	1.229	0.191	0.191	1.000
central India	0.147	0.193	0.760	0.147	0.147	1.000
west India	0.111	0.074	1.502	0.111	0.111	1.000
de jure place of residence	0.242	0.102	2.378	0.242	0.242	1.000
drinking water						
		Raw			Matched (ATET)	
Means	Treated	Untreated	StdDif	Treated	Untreated	StdDif
electricity	0.918	0.849	0.216	0.918	0.918	0.000
northeast India	0.155	0.105	0.148	0.155	0.155	0.000
east India	0.138	0.236	-0.253	0.138	0.138	0.000
north India	0.247	0.164	0.206	0.247	0.247	0.000
central India	0.200	0.282	-0.192	0.200	0.200	0.000
west India	0.115	0.069	0.159	0.115	0.115	0.000
de jure place of residence	0.620	0.843	-0.519	0.620	0.620	0.000
		Raw			Matched (ATET)	
Variances	Treated	Untreated	Ratio	Treated	Untreated	Ratio
electricity	0.075	0.128	0.587	0.075	0.075	1.000
northeast India	0.131	0.094	1.390	0.131	0.131	1.000
east India	0.119	0.180	0.659	0.119	0.119	1.000
north India	0.186	0.137	1.355	0.186	0.186	1.000
central India	0.160	0.202	0.791	0.160	0.160	1.000
west India	0.101	0.064	1.583	0.101	0.101	1.000
de jure place of residence	0.236	0.132	1.779	0.236	0.236	1.000
toilet facility						

		Raw			Matched (ATET)	
Means	Treated	Untreated	StdDif	Treated	Untreated	StdDif
electricity	0.963	0.776	0.576	0.963	0.963	0.000
northeast India	0.203	0.024	0.591	0.203	0.203	0.000
east India	0.106	0.284	-0.461	0.106	0.106	0.000
north India	0.268	0.134	0.338	0.268	0.268	0.000
central India	0.163	0.341	-0.417	0.163	0.163	0.000
west India	0.104	0.090	0.050	0.104	0.104	0.000
de jure place of residence	0.576	0.906	-0.813	0.576	0.576	0.000
		Raw			Matched (ATET)	
Variances	Treated	Untreated	Ratio	Treated	Untreated	Ratio
electricity	0.036	0.174	0.206	0.036	0.036	1.000
northeast India	0.162	0.023	7.010	0.162	0.162	1.000
east India	0.095	0.203	0.467	0.095	0.095	1.000
north India	0.196	0.116	1.688	0.196	0.196	1.000
central India	0.137	0.225	0.608	0.137	0.137	1.000
west India	0.093	0.082	1.145	0.093	0.093	1.000
de jure place of residence	0.244	0.085	2.868	0.244	0.244	1.000

Table 7.2- IPWRA

Variables				
cooking fuel				
	StdDif		Variance ratios	
	Raw	Weighted	Raw	Weighted
electricity	0.575	-0.002	0.073	1.015
De jure region of residence				
northeast India	-0.075	0.007	0.852	1.017
east India	-0.404	0.024	0.439	1.076
north India	0.156	0.073	1.229	1.091

central India	-0.201	0.067	0.760	1.128
west India	0.154	0.024	1.502	1.056
de jure place of residence	-1.145	0.052	2.378	1.022
drinking water				
	StdDif		Variance ratios	
	Raw	Weighted	Raw	Weighted
electricity	0.216	0.046	0.587	0.874
De jure region of residence				
northeast India	0.148	-0.024	1.390	0.956
east India	-0.253	-0.026	0.659	0.948
north India	0.206	0.031	1.355	1.039
central India	-0.192	0.007	0.791	1.011
west India	0.159	0.040	1.583	1.107
de jure place of residence	-0.519	-0.023	1.779	1.012
toilet facility				
	StdDif		Variance ratios	
	Raw	Weighted	Raw	Weighted
electricity	0.576	0.008	0.206	0.963
De jure region of residence				
northeast India	0.591	0.017	7.010	1.025
east India	-0.461	-0.012	0.467	0.971
north India	0.338	0.011	1.688	1.012
central India	-0.417	0.052	0.608	1.106
west India	0.050	-0.012	1.145	0.971
de jure place of residence	-0.813	-0.017	2.868	1.005

Table 8- PSM estimation results (IPV N=59,093 and NPV N=76,580)

Variables	Cooking fuel	Drinking water	Toilet facility
ATET			
Physical IPV	-0.077 (0.005)***	-0.047 (0.004)***	-0.076 (0.007)***
Sexual IPV	-0.023 (0.002)***	-0.010 (0.002)***	-0.017 (0.003)***
Emotional IPV	-0.040 (0.004)***	-0.020 (0.003)***	-0.037 (0.005)***
Physical NPV	-0.004 (0.002)*	-0.004 (0.001)**	-0.008 (0.004)*
Sexual NPV	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)

Note: ***, **, and * denote the significance at the 1%, 5%, and 10% levels, respectively.

Table 9- IPWRA estimation results (IPV N=59,093 and NPV N=76,580)

Variables	Cooking fuel	Drinking water	Toilet facility
POM			
Physical IPV	0.174 (0.005)***	0.198 (0.003)***	0.184 (0.007)***
Sexual IPV	0.046 (0.003)***	0.048 (0.002)***	0.043 (0.003)***
Emotional IPV	0.098 (0.004)***	0.097 (0.002)***	0.099 (0.005)***
Physical NPV	0.050 (0.003)***	0.048 (0.001)***	0.050 (0.004)***
Sexual NPV	0.002 (0.000)***	0.002 (0.000)***	0.002 (0.000)***

ATET			
Physical IPV	-0.012 (0.005)**	-0.008 (0.004)**	-0.017 (0.007)**
Sexual IPV	-0.009 (0.003)**	0.000 (0.002)	-0.000 (0.003)
Emotional IPV	-0.012 (0.004)**	-0.000 (0.003)	-0.013 (0.005)**
Physical NPV	-0.006 (0.003)***	-0.005 (0.002)***	-0.008 (0.004)**
Sexual NPV	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)

Note: ***, **, and * denote the significance at the 1%, 5%, and 10% levels, respectively.

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