# The Causal Impact of Maternal Intimate Partner Violence on Child Weight: Evidence from Kyrgyzstan

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## Abstract

This paper examines the effect of maternal experience of physical intimate partner violence (IPV) on child weight among children of age 6-59 months. The IV strategy was employed to correct for the potential endogeneity of maternal IPV and estimate the causal impact. The analyses of Kyrgyzstan 2012 Demographic and Health Survey (n = 2773) indicate no impact of maternal IPV on child's BMI, underweight and obese status, however a decreased risk of overweight cause by child's exposure to domestic violence is found at 10% significance level. Disaggregated analysis shows that the intensity and direction of the causal relationship between maternal IPV and child weight might differ across children's various subgroups. Such divergent findings suggest a need for further research on mechanisms that can explain the contrasting heterogeneity observed in results.

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# Table of Contents

## Introduction

According to the new data from World Health Organization (Sardinha, Maheu-Giroux, Stöckl, Meyer & García-Moreno, 2022), on average, one in three women aged 15–49 report that they have been assaulted physically and/or sexually by their intimate partner at least once across their lifetime. Domestic violence against women by their husbands or male intimate partners, also commonly referred to as intimate partner violence (IPV), is the most widespread form of violence against women around the globe. IPV includes not only physical harm done by a woman's current or former intimate partner but other forms of violence such as sexual, or emotional abuse as well (World Health Organization, 2010). Due to its endemic nature, it is well-recognized and popular topic of research. However, while there is a substantial body of literature on the effects of IPV on woman's physical and mental well-being, much less research have been focused on its consequences for other outcomes, including those for children living in the same households where domestic abuse between their parental figures take place.

Children who are exposed to IPV are at high risk of acquiring different emotional and behavioral problems (Rosser-Liminana, Suria-Martinez, & Mateo Perez, 2020). It may lead to such issues as anxiety, depression, poor school performance, low self-esteem, and sometimes eating disorders (overeating or not eating enough) as well. The purpose of this study is to examine the effect of exposure to physical IPV against mothers on child weight among children of age below five.

There are several channels through which maternal IPV can affect the weight of a small child. An association between exposure to domestic violence and undernutrition in early childhood can be explained by children's mothers suffering from the numerous consequences of spousal abuse including depression, anxiety, emotional stress, physical pain, and substance abuse (Bonomi et al., 2019; Ellsberg, Jansen, Heise, Watts, & Garcia-Moreno, 2008). The deteriorated mental and physical health of a mother experiencing IPV might prevent her from

meeting the dietary needs of her young child by reducing her ability for preparation of healthy nutritious food in sufficient amounts and providing other care-giving behaviors (Anato, Baye, Tafese, & Stoecker, 2020). Previous studies found that exposure to IPV is associated with early cessation or shortened duration of breastfeeding (Normann et al., 2020).

Moreover, while mothers are usually fully responsible for their children's diet at early stages of childhood, with age a child becomes more and more independent and starts to pick his or her own food to eat. At the same time, they become more conscious of their surroundings, and therefore more perceptive and vulnerable to the effects of growing up in a dysfunctional family unit. Even at early age, exposure to domestic violence may have short-term effects such as difficulty with falling or staying asleep, higher irritability, fear, increased crying and other health and behavioral issues (Alessi & Hearn, 2007; Layzer, Goodson, & de Lange, 1986) that in turn can cause eating disorders such as overeating or not eating enough as a response to these stress factors (Moyer, DiPietro, Berkowitz, & Stunkard, 1997). Determining the direction of the relationship between exposure to maternal IPV and child weight is important given that such health conditions as childhood undernutrition or overweight can not only persist in adulthood (Power, Lake, & Cole, 1997), but pose numerous serious risks to health including impaired brain development, type II diabetes, coronary heart disease, etc. (Dietz, 1998).

To examine the impact of maternal IPV on child weight, I use the data from Demographic and Health Survey (DHS) conducted in Kyrgyzstan in year 2012. Kyrgyzstan is extremely relevant country for this research topic. With its pre-existing gender inequality, deep-rooted patriarchal attitudes and social stereotypes, Kyrgyzstan is the country where violence against a woman by her husband appears to be an acceptable and justifiable practice (International Alert, 2021; Suyarkulova, 2020). The statistics of the last years show a concerning trend: between the years of 2016 and 2020 the number of officially registered cases of domestic violence against women of age 18-49 has increased by almost 1.5 times, from 4,871 to 7,122 (National

Statistical Committee of the Kyrgyz Republic, 2021). This is an increase of about 46% compared to 8% increase in adult female population over that period.

However, despite the strong relevance of the topic in this region, little to no research has been done on examining negative externality created by IPV in Kyrgyzstan or any other country of Central Asia. To my knowledge, this study will be the first one to focus on investigating the effects of maternal IPV on child weight in one of the Central Asia countries. Moreover, while most of the existing literature on this topic in other regions examine the association between IPV and child weight outcomes, these studies do not address the issue of IPV's potential endogeneity. To account for this problem, I propose using the IV strategy with a mother's reported childhood experience of witnessing IPV between her parents as an instrument for her own experience of IPV later in adulthood. This instrument was also used by Assaad, Friedemann-Sánchez and Levison (2017) in their study examining the effects of maternal IPV on child's educational outcomes in Colombia.

The paper proceeds as follows. The next section discusses the existing literature on the effects of intimate partner violence on children health. Section 3 describes data and key variables used in this study followed by the empirical strategy presented in Section 4. Section 5 reports and discusses the estimation results, and Section 6 provides a conclusion.

## Literature review

Previous studies have concluded that children exposed to IPV are at increased risk of various psychological, emotional, social, and behavioral problems, including depression, anxiety, trauma, substance use and school-related issues during their childhood and adolescence (Wathen, & Macmillan, 2013, Graham-Bermann, Castor, Miller, & Howell, 2012; McTavish, MacGregor, Wathen, & MacMillan, 2016). Compared to the literature on the effects of maternal IPV on children's mental health, the body of research that is focused on its effects on physical health outcomes, including children's weight and nutrition status, is more limited. One of such studies was conducted by Boynton-Jarrett et al. (2010), who examined whether maternal IPV during pregnancy and early childhood has an impact on obesity risk among pre-school children in the US. Using logistic regression analysis, they found that the risk of obesity for the children of age 5, whose mothers reported experiencing chronic IPV (consistently during pregnancy and after it), is 80% greater than for their counterparts. Further analysis also showed that this negative effect on weight is larger for children living in low-income neighborhoods compared to those living in more well-off areas. Additionally, the research's results revealed that obesity risk due to exposure to domestic violence is greater for girls compared to boys.

Another recent US study, by Gooding et al. (2015), explored whether different types of childhood adversity, including exposure to domestic violence, are associated with body mass index. With the sample of 147 adolescents of age 13–17 years, they used linear regression analysis and found that the children who reported witnessing domestic violence were 6 times more likely to be overweight or obese than those who had not. In contrast to the study of Boynton-Jarrett and his colleagues (2010) for children of age 5, this study did not find any heterogeneous effects of childhood adversity on BMI among male and female adolescents. However, a similar study among 449 Finnish adolescents admitted to a psychiatric hospital unit

(Isohookana, Marttunen, Hakko, Riipinen, & Riala, 2016) showed that while there is no statistically significant association between domestic violence exposure and BMI among boys, the girls who reported witnessing domestic violence exhibited a 0.3-fold increased likelihood of being underweight compared to those who had not had such experience. Overall, it is difficult to draw any conclusions based on the existing evidence in developed countries since there are only few studies on the topic and their results vary substantially across different age groups, genders, and other socioeconomic factors.

As for developing countries, the relevant literature is also limited, and it is usually focused on examining the association between exposure to domestic violence and underweight status risk rather than obesity risk as it is in developed countries. The study in rural Bangladesh (Asling-Monemi, Naved, & Persson, 2009) with a longitudinal follow-up of more than 3000 live-born children found that exposure to any form of domestic violence, including physical, sexual, and emotional violence, was associated with lower weight at birth as well as with increased risk of being underweight and stunted 24 months later. This is consistent with the results from another study in Bangladesh (Rahman et al., 2012) that used DHS data and found that maternal experience of IPV is associated with an increased risk of underweight among children younger than 5 years. Interestingly, the similar research for Nigeria (Issah et al., 2022), which also used the DHS data, provided the opposite results to the Bangladesh studies, and showed that domestic violence against a mother is associated with a decreased risk of underweight for children of age 6–59 months.

Another relevant research on the topic was done by Aguero (2013), who estimated the costs of IPV on both mothers and children, considering such outcomes as reproduction and labor supply of a mother as well as the welfare of her child in Latin American and the Caribbean. He used DHS data on several countries and showed that maternal IPV creates a negative externality influencing short-term health outcomes of children of age below 5. To

check whether the resulting effects are causal, his study employed a natural experiment in Peru where women's centers of domestic violence prevention were established. By doing this, Aguero addressed IPV's potential endogeneity problem and found that domestic physical violence against children's mothers is associated with lower hemoglobin levels, higher likelihood of a child having diarrhea in the last week, and lower weight-for-height ratio.

Overall, the literature review on the topic of interest shows that due to the extremely limited number of studies and their different findings, the existing evidence is insufficient to draw conclusions on the effect of maternal IPV on child weight. And while, as it was mentioned before, there is noticeable difference in the studies' focus between developed and developing countries, the results did not always reveal that there is an increased risk of overweight or underweight associated with exposure to domestic violence among children in developed and developing countries, respectively. Therefore, in my research, I use several measures of child weight, including both overweight and underweight indicators.

Most of the studies on the relationship between maternal IPV and child health are focused on examining the association between these two factors. This paper contributes to the existing literature in two major ways. First, it addresses the issue of IPV's potential endogeneity and employs IV strategy to find the causal effect of maternal IPV on child weight. Second, using the data from one of the Central Asia's countries, Kyrgyzstan, it focuses on the region that was not covered in the previous studies on this topic.

## Data and Measurement

To estimate the impact of maternal intimate partner violence (IPV) on child weight on child weight, I use the data coming from the Demographic and Health Survey conducted in Kyrgyzstan in year 2012. The DHS is nationally- representative cross-sectional surveys that have been repeatedly conducted approximately every five years in more than 90 low- and middle-income countries since the mid-1980s. For the surveys, all women of the selected households between the ages of 15 and 49 are asked to complete an interview that contains the questions on different topics such as their fertility and reproductive health, housing characteristics, household population, employment, marriage, etc. The original sample of 2012 Kyrgyzstan DHS includes 8,208 women. I restrict the sample size to women who were selected and successfully interviewed for the domestic violence module and who had at least one child of age 6-59 months, whose weight and height was reported. In addition, based on my instrument variable's choice, I select only those observations where information on a woman's childhood experience of witnessing domestic violence between her parents is available. The final sample includes 2,773 observations of children of 2,103 mothers.

**Table 1.** Data cleaning and sample sizes

| Data cleaning steps | Number of observations | |
|---|---|---|
| | Women | Children |
| All women and children | 8208 | 15484 |
| ↓ Women selected and interviewed for domestic violence module | 6022 | 4574 |
| ↓ Children of age 6-59 months | 2364 | 3097 |
| ↓ Children with anthropometric data available | 2319 | 3027 |
| ↓ Women with data available on IPV between their parents in childhood (the instrument) | 2121 | 2773 |
| Final Sample | 2121 | 2773 |

Source: Kyrgyzstan 2012 DHS

The DHS provides information on three types of domestic violence. Ever-married women were asked questions on emotional, sexual, and physical violence committed by their current and former spouse/partner. In this paper, I focus exclusively on physical violence. The DHS allows to measure physical violence in several ways. In the survey, women are asked if they have ever experienced any of the following physical violent acts from their spouse or partner:

A. ever pushed, shook, or threw something at them

B. ever slapped them

C. ever punched them with fist or something harmful.

D. ever kicked, dragged, or beat them up

E. ever tried to strangle or burn them

F. ever threatened or attacked them with knife/gun or any other weapon

G. ever twisted their arm or pulled their hair

The acts above are considered as the forms of physical violence. For the main explanatory variable, I use five measures of maternal physical intimate partner violence. The first measure is created as a binary variable equal to one if a woman has ever experienced at least one of these physical acts, and zero otherwise. The second and third measures come from classifying these acts as severe violence or as less severe violence. Following DHS definition, less severe violence indicator is equal to one if a woman experienced A-C and G types of violent acts, and severe violence indicator is equal to one for D-F types of physical violence experienced. Moreover, since the reported maternal IPV could have occurred at much earlier time than a child's birth, and the children's weight and height parameters were recorded at the time of the survey, it may be a case that maternal experience of IPV may not affect child's nutritional status. Hence, the next measure of domestic violence is the indicator for any of the forms of violence mentioned above happening less than a year ago. Finally, the last measure of physical

violence is a count of the number of the violent acts mentioned above that a woman has ever experienced. Note that it is possible that a child's mother's husband or partner may not be a biological father for the child, therefore I use the term "partner."

There are four outcomes of interest for child weight. The first one is a child's body mass index (BMI). BMI can be calculated by using the reported values of height and weight in the imperial BMI formula: $BMI = \frac{weight(kg)}{height^2(m^2)}$ (National Institutes of Health, 1998). BMI is commonly used as a measure to indicate underweight, overweight and obesity among children and adults. According to the guidelines provided by National Institutes of Health (1998), if BMI of an adult is less than 18.5 then the person is considered as underweight, if BMI is 25 and more then overweight, and obese if the index is more than or equal to 30. I use these standards to create binary variables for underweight, overweight and obesity among mothers. As for children, their weight status category was defined by using the guidelines of The Centers for Disease Control (About Child & Teen BMI, 2018). According to these guidelines, children should be considered overweight if their age and gender specific BMI is at or above 85th percentile, obese if it is at or above 95th percentile, and underweight if it is below 15th percentile. Thus, apart from BMI values, I use the indicators for underweight, overweight and obesity among children as outcome variables as well.

**Table 2.** Child Weight Outcomes by Maternal Experience of IPV

| | Any physical IPV was experienced by mother | | | p-value of t-test of difference in means |
|---|---|---|---|---|
| | No | Yes | Total | |
| Child BMI (kg/m2) | 16.79 | 16.74 | 16.78 | 0.4598 |
| Underweight (%) | 14.08 | 12.85 | 13.78 | 0.4122 |
| Overweight (%) | 15.61 | 15.34 | 15.54 | 0.8664 |
| Obese (%) | 5.11 | 5.01 | 5.08 | 0.9240 |
| Sample size | 2,095 | 678 | 2,773 | |

Source: Kyrgyzstan 2012 DHS

As shown in Table 2, the bivariate association between the maternal experience of physical IPV and children's weight outcomes is statistically insignificant. It remains to be seen whether it stays insignificant after controlling for various observable confounding factors. Table 2 in Appendix lists all the control variables used in the analysis and provides descriptive statistics for the final child-level dataset of 2,773 observations. The average child BMI in the sample is 16.78, almost 14% of the children have underweight status, 15.5% of the children are overweight, with 5% of them having obesity. The physical domestic violence by partner was reported by mothers of 24.5% of the children, with almost 20% of the children having mothers who experienced IPV in the last year. The mention of only less severe forms of physical violence is present in 24% of the cases, while severe violence experience was mentioned by mothers of 4% of the children. The average number of violent acts is 0.58 for the whole final sample.

## Empirical Strategy

To estimate the impact of physical violence against mother on child weight outcomes, the following equation was used:

(1) $$Y_i = \beta * \mathrm{DV_i} + \delta * \mathrm{C_i} + \mathrm{u_i}$$

where $Y_i$ is an outcome variable for weight status or BMI of child $i$. $\mathrm{DV_i}$ is a measure of domestic violence against child $i$'s mother described in the previous section, so $\beta$ is the parameter of interest. The regression also includes a set of relevant control variables $\mathrm{C_{i,}}$ such as child age, gender, birth weight, mother and father characteristics, household wealth quintile, household composition characteristics and other factors that may impact child weight. The error term $\mathrm{u_i}$ captures the remaining factors determining a child's weight or weight status that cannot be explained by the observable covariates.

Regarding inference, for all estimations I cluster the errors at DHS cluster level. The DHS clusters are the groupings of participating in the survey households that are geo referenced. The displacement is randomly carried out so that urban clusters have a distance range between 0 and 2 kilometers, while rural clusters have a range between 0 and 5 kilometers. I choose to cluster the errors at DHS cluster level since the respondents in the same clusters are likely to share some similar characteristics like income, neighbourhood, water quality and other socioeconomic and environmental factors, leading to the possible correlation between the error terms of such respondents. Overall, there are 314 clusters in the sample. I also considered clustering at household level but decided against it since there are only 2,121 households among the total of 2,773 observations in the sample meaning that in most of the cases there is only one child observation per household.

For the OLS estimator in the linear probability model (LPM) to be a consistent estimator of the causal effect of maternal IPV on child weight, it must be the case that IPV is conditionally exogenous, i.e., $\mathrm{DV_i}$ must be uncorrelated with the error term $\mathrm{u_i}$, conditional on $\mathrm{C_i}$ in the

equation (1). However, the conditional exogeneity assumption might not always hold. The incidence of domestic violence could be related to some unobservable variables that are correlated with both maternal IPV experience (conditional on $C_i$) and child weight. For example, if domestic violence against a child also takes place in a household, then it can simultaneously affect the likelihood of domestic violence against mother and the child's health. In this case, even with controlling for all the variables included in the equation (1), we are not able to isolate the effects of domestic violence against a mother from the effects of domestic violence against her child. Thus, if there exist some confounding factors that could be related to both maternal experience of physical IPV and child weight and that have been excluded from the analysis, then the OLS coefficient estimate of β will be biased.

I propose using IV strategy to account for possible endogeneity of IPV. Based on the available data I choose the instrument variable related to a child's mother's experience of domestic violence when she was a child. In particular, I use data on whether mother was exposed to maternal IPV between her own parents during the childhood. Such an IV strategy is crucially dependent on the proposed instrument's validity. I argue that in special cases my IV satisfies all the necessary conditions for a valid instrument and therefore can be used to address the potential endogeneity associated with exposure to maternal experience of IPV.

Withing the IV strategy, a two-stage linear probability model (2SLS) is implemented:

(2) $$DV_i = \pi * Z_i + \delta * C_i + v_i$$

where, in the first stage, $DV_i$ is predicted by the exogenous instrument $Z_i$ and the control variables $C_i$ from the equation (1). The instrument $Z_i$ is a binary variable equal to one if a child *i*'s mother reports witnessing domestic violence between her parents during her own childhood. In the second stage, the outcome, a child's BMI or nutritional status, is regressed on the predicted value of the potentially endogenous variable $DV_i$ from the first stage along with other control variables $C_i$.

***Identification assumptions***

As it was mentioned before, the IV strategy depends on the validity of the proposed instrument. In order to identify the causal effect of maternal experience of IPV on child weight with the use of 2SLS regression analysis, four main assumptions must hold. First, the selected instrument must be associated with maternal IPV (the relevance condition). Second, any effect of the instrument on child weight should be exclusively through its potential effect on maternal IPV (the exclusion restriction). Moreover, the proposed instrument must be as good as randomly assigned, i.e., independent of the child weight outcome and maternal IPV (the exogeneity assumption). Finally, the monotonicity assumption requires that the instrument affects all women's experience of IPV in the same way so that it does not increase adulthood experience of IPV for some women but decrease for others.

I conduct an empirical test by estimating the first stage equation (2) and provide evidence for the relevance of the instrument. I also argue that with the inclusion of appropriate controls for child, mother and household characteristics, the selected instrument - maternal childhood exposure to IPV – should be excludable from the child's weight outcome equation. The exclusion restriction requires that the instrument affects the child weight outcomes only through its effect on maternal IPV. Without controlling for possible alternative channels, this assumption may not always hold. Previous studies showed that adverse childhood experiences can lead to various long-term health, social and economic consequences (Edleson, 1999, Monnat, & Chandler, 2015). Due to exposure to domestic violence in childhood, a woman in adulthood can be at greater risk of several negative health outcomes that in turn can later affect the health of her child. If a mother has poor mental health, which is one of the prevalent conditions among adults who were exposed to domestic violence in childhood (Monnat, & Chandler, 2015), it can affect her child's weight as well, for example, when nutritional needs of her child are neglected due to her condition.

Including a set of child, mother and household characteristics helps to account at least partially for these alternative channels through which the instrument variable can affect the child weight outcomes. For instance, by including a mother weight and her child's birth weight to the model, I can control to some extent for the mother's health condition before, during and after pregnancy that was potentially affected by her adverse childhood experiences. The incidents of domestic violence between a woman's parents are likely to be an indicator of socioeconomic characteristics of her childhood household that probably affected her life decisions later in life. Therefore, her other current characteristics, such as wealth status, education level and employment status, are also likely to be correlated at the same time with both the instrument and child weight outcome. Thus, including all these various control variables helps to make the selected instrument excludable from the child's weight outcome equation and leave IPV as the only channel for impact.

Since the proposed instrument is determined at much earlier stage than the birth of a child, I also argue that it is independent of both the child's weight and his or her exposure to maternal IPV. Thus, the independence assumption is likely to hold as well. Finally, there is also the monotonicity assumption that must be satisfied for the instrument to be valid. Monotonicity implies that while childhood witnessing of domestic violence between parents could lead to experiencing spousal abuse in adulthood for some women, it must not be a reason for not experiencing IPV for others. For example, the monotonicity condition is violated if there are some mothers with no IPV experience reported who has avoided abusive relationships, whether consciously or unconsciously, because of their traumatic exposure to domestic abuse in childhood. While this is possible, previous literature found that women who were exposed to domestic violence in childhood are likely to be more tolerating towards partner violence in adulthood (Ehrensaft et al., 2003), therefore I assume that this is in general the case for women in Kyrgyzstan as well.

## Results and Discussion

In Table 2, I provide the results of the first stage equation estimation with and without control variable included in a model. These estimation results can be used to check whether maternal experience of witnessing domestic violence between her parents has sufficient explanatory power as an instrument. As shown below, the F-statistic for the instrument in the first stage is above 40 for almost all considered measures of domestic violence, which indicates a strong correlation of the instrument with mothers' experience of IPV. The exception is the F-statistic of approximately 6 in the first stage equation where experience of severe violence is used as a measure of domestic violence. Therefore, I apply IV strategy only for four of the five considered measures of IPV, for which the relevance condition is shown to be satisfied.

**Table 2.** First Stage of IV estimation

| | (1) Physical IPV ever | (2) Less severe IPV | (3) Severe IPV | (4) IPV last year | (5) # of IPV forms |
|---|---|---|---|---|---|
| Model 1: without control variables | | | | | |
| IPV b/w mother's parents' | 0.269*** | 0.271*** | 0.062*** | 0.262*** | 0.735*** |
| | (0.033) | (0.032) | (0.017) | (0.033) | (0.093) |
| First stage F statistic | 68.64 | 69.62 | 13.91 | 62.95 | 61.95 |
| Adjusted $R^2$ | 0.05 | 0.05 | 0.01 | 0.06 | 0.05 |
| Model 2: with control variables | | | | | |
| IPV b/w mother's parents' | 0.223*** | 0.225*** | 0.041** | 0.222*** | 0.581*** |
| | (0.032) | (0.032) | (0.017) | (0.032) | (0.092) |
| First stage F statistic | 47.41 | 48.61 | 5.60 | 49.18 | 40.12 |
| Adjusted $R^2$ | 0.17 | 0.17 | 0.08 | 0.16 | 0.16 |

Note: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.10$
Sample size is 2,773 in all regressions. Robust standard errors clustered at DHS cluster level are in parentheses. Control variables contain a set of child, mother, mother's partner, household, and demographic characteristics.

The results of OLS and 2SLS regression estimations are summarized in Table 3, which shows the effects of exposure to maternal IPV on child weight. The four panels contain the

results for the four different measures of IPV, for which the selected instrument was shown to be valid. The four columns display the results for the four weight outcomes, respectively. For the sake of comparison, the first and the second rows of each panel contain the OLS and 2SLS regression results, respectively.

**Table 3.** Effects of Maternal Intimate Partner Violence on Child Weight

| | | (1) BMI | (2) Underweight | (3) Overweight | (4) Obesity |
|---|---|---|---|---|---|
| *Panel A: any physical IPV ever experienced by mother* | | | | | |
| OLS: | any physical IPV | -0.066 | -0.012 | -0.003 | -0.001 |
| | | (0.099) | (0.015) | (0.018) | (0.010) |
| IV: | any physical IPV | 0.206 | -0.054 | -0.152* | -0.024 |
| | | (0.480) | (0.082) | (0.088) | (0.052) |
| *Panel B: any physical IPV of less severe kind ever experienced by mother* | | | | | |
| OLS: | any less severe IPV | -0.025 | -0.004 | -0.007 | -0.000 |
| | | (0.097) | (0.016) | (0.018) | (0.010) |
| IV: | any less severe IPV | 0.204 | -0.053 | -0.150* | -0.024 |
| | | (0.476) | (0.081) | (0.087) | (0.052) |
| Panel C: any physical IPV experienced by mother last year | | | | | |
| OLS: | any physical IPV last year | -0.053 | 0.001 | -0.008 | -0.004 |
| | | (0.104) | (0.017) | (0.020) | (0.011) |
| IV: | any physical IPV last year | 0.207 | -0.054 | -0.153* | -0.024 |
| | | (0.481) | (0.082) | (0.088) | (0.052) |
| Panel D: number of physical IPV's forms ever experienced by mother | | | | | |
| OLS: | # of physical IPV forms | 0.005 | -0.005 | -0.001 | -0.003 |
| | | (0.031) | (0.005) | (0.006) | (0.003) |
| IV: | # of physical IPV forms | 0.079 | -0.021 | -0.058* | -0.009 |
| | | (0.184) | (0.032) | (0.034) | (0.020) |

Note: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.10$
Sample size is 2,773 in all regressions. Robust standard errors clustered at DHS cluster level are in parentheses. A set of child, mother, mother's partner, household, and demographic characteristics is included as control variables in each regression.



The results of the IV regressions of maternal IPV on child's overweight status show that holding everything else constant there is about 15% decrease in risk of overweight for a child due to his or her exposure to maternal IPV of less severe kind either during last year or earlier. Moreover, one additional form of physical IPV experienced by mother is found to be associated

with 5.8% decrease in probability of her child being overweight. These estimates are statistically significant only at 10% level. The association found between maternal IPV and a decreased risk of overweight suggests consistency with the results of Aguero (2013) who found that maternal IPV is associated negatively with child's BMI. At the same time, compared to Aguero's results, I do not find any significant relationships between children's exposure to domestic violence and their BMI.

Overall, in all other cases both OLS and IV regressions yield small and statistically insignificant coefficient estimates of the effect of maternal IPV on child weight. This lack of strong associations between different measures of IPV and children weight outcomes may result in case maternal experience of domestic violence does not affect the quality or quantity of food consumed by her child, thereby not influencing the child's weight in my research's context. However, while this may be true, it is also possible that there are other reasons behind the null findings of this study. For example, such results might happen due to women under-reporting their experiences of IPV. The shame, stigma and other possible repercussions associated with others knowing may prevent some respondents from disclosing sensitive information (World Health Organization, 2013). Missing or incomplete data on domestic violence could cause the relationship between maternal IPV and child weight to be underestimated, since the number of exposed to domestic violence children would have been lowered in the dataset. Thus, inability to account for this kind of potential bias is one of the limitations of the study.

Furthermore, except for maternal experience of IPV during the last year, other measures of IPV used do not specify the time when the incidents of domestic violence took place. Thus, if mother has experienced IPV much earlier than child's anthropometric measurements were taken then it would not be surprising for maternal IPV not influencing child's BMI and

nutritional status. With the available data it is impossible to explore the effect of frequency, duration, or time of occurrence of domestic abuse against mother on child health.

Finally, the reliability of 2SLS regression results crucially depends on the selected instrument's validity. As discussed before, although I argue for the instrument being able in general to satisfy the four major IV assumptions, there still can be cases when some of the assumptions do not hold. For example, while I control for a set of child, mother and household observable characteristics it is impossible to take into account all possible alternative pathways through which the instrument can affect child weight apart from influencing it through maternal IPV. For instance, the presence of other forms of domestic violence such as child abuse and neglect may both affect child weight outcomes and be correlated with mother's childhood exposure to IPV (Lünnemann, Van der Horst, Prinzie, Luijk, & Steketee, 2019), thereby violating the exclusion condition. Thus, being unable to account for more cases when IV assumptions such as exclusion restriction and monotonicity might not hold presents another limitation of the study.

***Heterogeneity Analysis***

It is also possible that while, overall, the effect of maternal IPV on child weight is insignificant in most cases, it can be statistically different from zero for some of the subgroups of children in the sample. In case there are opposite heterogenous effects, it could be an explanation for the overall insignificant results in the full sample. I conduct subsample analysis by child's gender, age group, parental education, type of region (urban vs rural) and household's wealth quantile. Table 3 in Appendix presents the 2SLS regression estimation results for several subsamples.

I find that the effect of maternal IPV on overweight status is still negative, now twice larger than for the whole sample, and statistically significant at 5% level for the group of pre-school children of age older than three years. The coefficient estimates of -0.36 to -0.34 indicate

that if a child of this age group is exposed to maternal physical IPV, holding other things constant there is about 35% decrease in risk of overweight for him or her as a result of this exposure. For the younger group (6-36 months), I find association between maternal IPV and a decreased risk of underweight at 10% significance level, which is consistent with the results of the similar research conducted in Nigeria (Issah et al., 2022), which showed that children of age below 5 with maternal IPV reported are less like to be underweight than their counterparts. As discussed previously, the mechanisms through which maternal IPV can affect child weight may differ in earlier and later stages of child development. This might explain the contrasting effects of exposure to domestic violence on weight of toddlers (1-3 years of age) and pre-school children (3-5 years of age) in this study.

The subsample analysis also provides evidence for the heterogeneous effects between girls and boys. I find that if a mother of a girl has ever experienced IPV of physical type, then the girl is about 26% less likely to be overweight (at 10% significance level), holding other factors fixed. The results also show that one more form of physical IPV experienced by mother is associated with 9.3% decrease in risk of overweight for a female child. At the same time, the coefficient estimates of interest for male children are statistically insignificant. This is consistent with previous studies' findings of girls facing greater obesity or underweight risks due to exposure to domestic violence compared to boys (Boynton-Jarrett, Fargnoli, Suglia, Zuckerman, & Wright, 2010; Isohookana, Marttunen, Hakko, Riipinen, & Riala, 2016).

The heterogeneous effects are also present between the groups of children whose both parents (mother and her partner) have higher education and those with parents who have only secondary education. While there is statistically significant negative effect of maternal IPV on BMI and risk of overweight in the subsample of higher educated parents, there are null findings in all cases in the subsample of parents with high-school diploma only. Dividing the sample by those living in rural and urban areas, I get similar results, where there is association between

maternal IPV and a decreased risk of being overweight among children in cities, but no statistically significant relationships between exposure to domestic violence and child weight among children from rural regions.

Thus, we can see that for some groups of children such as those of age 3-5 years, from higher educated families, living in urban regions or females, the negative effect of maternal IPV on risk of overweight is stronger than for the full sample. While it seems to be not strong enough to cause an increase in risk of underweight among Kyrgyzstan children of age 6-59 months, we can still observe that some groups of children are more affected by domestic violence happening in their household than others. The direction of the relationship between exposure to maternal IPV and child weight sometimes differ between groups as well. Such divergent findings suggest a need for further research on exploring the mechanisms that can explain the observed heterogeneity in results.

## Conclusion

This paper explores the causal effect of maternal experience of IPV on child weight among children of age 6-59 months using the data from Kyrgyzstan 2012 DHS survey. The IV strategy, with mother's childhood exposure to domestic violence between her parents used as an instrument, was employed to correct for the potential endogeneity of maternal IPV. No association has been found between domestic violence against mothers and children's weight outcomes in the standard OLS estimation results. The IV estimates of maternal IPV suggest no impact of maternal IPV on child's BMI, underweight and obese status as well, however 15% decrease in risk of overweight (at 10% significance level) due to children's exposure to maternal IPV is found. At the same time, heterogeneity analysis revealed that the intensity and direction of the causal relationship of interest might differ across various subsamples of children. Thus, perhaps the most important conclusion to make from this study is that the relationship between exposure to maternal IPV and child weight is not so straightforward as existing literature would suggest. Further research on Kyrgyzstan and other countries of Central Asia might help to understand the mechanisms that can explain the observed heterogeneity in the results. Another way to extend the study is to address its previously discussed limitations, for example, by finding better instrument candidates for maternal IPV.

However, despite its limits, this study is still unique in its examination of the causal relationships between maternal IPV and child weight in Central Asia region, particularly addressing IPV's potential endogeneity problem and using multiple measures of domestic violence and child weight. The use of such nationally representative data as DHS provides another strength of the study by making its findings generalizable at a national level.

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# Appendix

**Table 1.** Maternal Experience of physical IPV (%) by Mother's Parents' Violence

| Any physical IPV between mothers' parents in childhood | Any physical IPV experienced by mother | | |
|---|---|---|---|
| | No | Yes | All |
| No | 89.2 | 70.1 | 84.5 |
| Yes | 10.8 | 29.9 | 15.5 |
| Total | 100.0 | 100.0 | 100.0 |
| Sample size | 2,095 | 678 | 2773 |

Source: Kyrgyzstan 2012 DHS

**Table 2.** Descriptive Statistics, Children Ages 0-5, Kyrgyzstan, DHS 2012

| **Variable** | **Mean** | **Standard Deviation** |
|---|---|---|
| *Dependent variables:* | | |
| BMI (kg/m2) | 16.78 | 2.026 |
| underweight | 0.138 | 0.345 |
| overweight | 0.155 | 0.362 |
| obese | 0.051 | 0.220 |
| *Instrumental variable:* | | |
| Physical IPV between mother's parents' | 0.122 | 0.327 |
| *Endogenous regressors:* | 0.310 | 0.463 |
| any physical IPV experienced by mother ever | 0.245 | 0.430 |
| less severe physical IPV experienced by mother | 0.243 | 0.429 |
| severe physical IPV experienced by mother | 0.043 | 0.204 |
| any physical IPV experienced by mother last year | 0.198 | 0.398 |
| number of physical IPV's forms | 0.584 | 1.222 |
| *Child variables:* | | |
| child is male | 0.516 | 0.500 |
| child's age (months) | 30.902 | 15.563 |
| child's age-squared/100 | 11.970 | 10.074 |
| child's birth weight (kg) | 3.252 | 0.508 |
| *Mother variables:* | | |
| mother's age | 29.146 | 5.724 |
| mother's BMI | 23.966 | 4.100 |
| mother's education primary or no | 0.004 | 0.063 |
| mother's education secondary | 0.552 | 0.497 |
| mother's education higher | 0.444 | 0.497 |
| mother's employment status | 0.194 | 0.395 |
| mother's pregnant status | 0.107 | 0.310 |
| mother reports abuse by parents | 0.023 | 0.151 |
| *Partner-of-mother variables:* | | |
| partner's education primary or no | 0.005 | 0.071 |
| partner's education secondary | 0.653 | 0.476 |
| partner's education higher | 0.342 | 0.474 |
| partner is drinking alcohol | 0.397 | 0.489 |

| | | |
|---|---|---|
| *Household variables:* | | |
| wealth quintile 1 (reference category) | 0.215 | 0.411 |
| wealth quintile 2 | 0.220 | 0.414 |
| wealth quintile 3 | 0.225 | 0.418 |
| wealth quintile 4 | 0.194 | 0.396 |
| wealth quintile 5 (richest) | 0.145 | 0.352 |
| *Household composition variables:* | | |
| household head is child's biological father | 0.525 | 0.499 |
| number of siblings in household | 1.702 | 1.278 |
| number of women in household | 1.179 | 0.460 |
| number of people in household | 5.837 | 1.759 |
| *Geographic variables:* | | |
| urban (vs. rural) | 0.261 | 0.440 |
| Bishkek (reference category) | 0.078 | 0.268 |
| Batken | 0.123 | 0.328 |
| Chui | 0.101 | 0.301 |
| Djalal Abad | 0.104 | 0.305 |
| Issyk Kul | 0.119 | 0.324 |
| Naryn | 0.111 | 0.315 |
| Osh City | 0.078 | 0.269 |
| Osh Oblast | 0.123 | 0.329 |
| Talas | 0.162 | 0.369 |
| Sample size | 2,773 | |

Source: Kyrgyzstan 2012 DHS

**Table 3.** IV regression estimations by different groups of children aged 6-52 months

| | BMI | Under weight | Over weight | Obesity | BMI | Under weight | Over weight | Obesity |
|---|---|---|---|---|---|---|---|---|
| | **Age < 36 months** | | | | **Age ≥ 36 months** | | | |
| any IPV | 0.297 | -0.150 | -0.037 | 0.033 | 1.107 | 0.142 | -0.363** | -0.114 |
| | (0.618) | (0.091) | (0.109) | (0.072) | (0.687) | (0.154) | (0.145) | (0.070) |
| less severe IPV | 0.294 | -0.148* | -0.036 | 0.032 | 1.096 | 0.141 | -0.359** | -0.113 |
| | (0.611) | (0.090) | (0.108) | (0.071) | (0.679) | (0.153) | (0.143) | (0.069) |
| IPV last year | 0.312 | -0.157* | -0.039 | 0.034 | -1.037* | 0.133 | -0.340** | -0.107* |
| | (0.649) | (0.095) | (0.114) | (0.076) | (0.630) | (0.144) | (0.134) | (0.065) |
| # of IPV forms | 0.112 | -0.056 | -0.014 | 0.012 | 0.434 | 0.056 | -0.142** | -0.045 |
| | (0.233) | (0.035) | (0.041) | (0.027) | (0.280) | (0.061) | (0.061) | (0.028) |
| Observations | 1630 | 1630 | 1630 | 1630 | 1143 | 1143 | 1143 | 1143 |

| | Male | | | | Female | | | |
|---|---|---|---|---|---|---|---|---|
| any IPV | 0.391 | -0.091 | -0.061 | 0.007 | -1.010 | 0.022 | -0.262* | -0.076 |
| | (0.577) | (0.104) | (0.116) | (0.065) | (0.821) | (0.132) | (0.140) | (0.092) |
| less severe IPV | 0.388 | -0.090 | -0.060 | 0.007 | -1.001 | 0.022 | -0.259* | -0.075 |
| | (0.573) | (0.104) | (0.115) | (0.064) | (0.814) | (0.131) | (0.139) | (0.092) |
| IPV last year | 0.381 | -0.089 | -0.059 | 0.007 | 1.073 | 0.023 | -0.278* | -0.081 |
| | (0.565) | (0.102) | (0.113) | (0.063) | (0.866) | (0.140) | (0.148) | (0.098) |
| # of IPV forms | 0.158 | -0.037 | -0.024 | 0.003 | -0.358 | 0.008 | -0.093* | -0.027 |
| | (0.236) | (0.043) | (0.047) | (0.026) | (0.295) | (0.047) | (0.050) | (0.033) |
| Observations | 1430 | 1430 | 1430 | 1430 | 1343 | 1343 | 1343 | 1343 |
| | **Poor (wealth status)** | | | | **Rich (wealth status)** | | | |
| any IPV | -0.245 | -0.252* | -0.239 | -0.056 | 0.565 | 0.299 | 0.153 | 0.123 |
| | (0.815) | (0.145) | (0.157) | (0.085) | (1.067) | (0.203) | (0.210) | (0.143) |
| less severe IPV | 0.242 | -0.249* | -0.236 | -0.055 | 0.565 | 0.299 | 0.153 | 0.123 |
| | (0.807) | (0.144) | (0.155) | (0.085) | (1.067) | (0.203) | (0.210) | (0.143) |
| IPV last year | 0.240 | -0.247* | -0.234 | -0.055 | -0.640 | 0.339 | 0.173 | 0.139 |
| | (0.796) | (0.143) | (0.152) | (0.083) | (1.203) | (0.239) | (0.241) | (0.168) |
| # of IPV forms | 0.128 | -0.132* | -0.125 | -0.029 | 0.201 | 0.107 | 0.054 | 0.044 |
| | (0.429) | (0.080) | (0.087) | (0.046) | (0.387) | (0.077) | (0.076) | (0.051) |
| Observations | 1207 | 1207 | 1207 | 1207 | 941 | 941 | 941 | 941 |
| | **Secondary education (both parents)** | | | | **Higher education (both parents)** | | | |
| any IPV | 0.310 | 0.010 | -0.115 | -0.006 | -2.278** | 0.006 | -0.339** | -0.081 |
| | (0.865) | (0.144) | (0.159) | (0.095) | (1.050) | (0.156) | (0.152) | (0.103) |
| less severe IPV | 0.309 | 0.010 | -0.114 | -0.006 | -2.251** | 0.006 | -0.335** | -0.080 |
| | (0.861) | (0.144) | (0.158) | (0.094) | (1.035) | (0.155) | (0.150) | (0.102) |
| IPV last year | 0.295 | 0.010 | -0.109 | -0.006 | -2.193** | 0.006 | -0.326** | -0.078 |
| | (0.822) | (0.137) | (0.151) | (0.090) | (0.988) | (0.151) | (0.142) | (0.098) |
| # of IPV forms | 0.102 | 0.003 | -0.038 | -0.002 | -0.855** | 0.002 | -0.127** | -0.030 |
| | (0.284) | (0.047) | (0.053) | (0.031) | (0.404) | (0.059) | (0.057) | (0.038) |
| Observations | 1251 | 1251 | 1251 | 1251 | 676 | 676 | 676 | 676 |

Note: *** $p \leq 0.01$, ** $p \leq 0.05$, * $p \leq 0.10$

Standard errors are heteroscedasticity-robust and clustered by DHS clusters, are in parentheses. The control variables such as additional child, mother, mother's partner, household and demographic factors were included in each regression.