Working Paper

PARENTAL TOBACCO SMOKING AND CHILD MALNUTRITION

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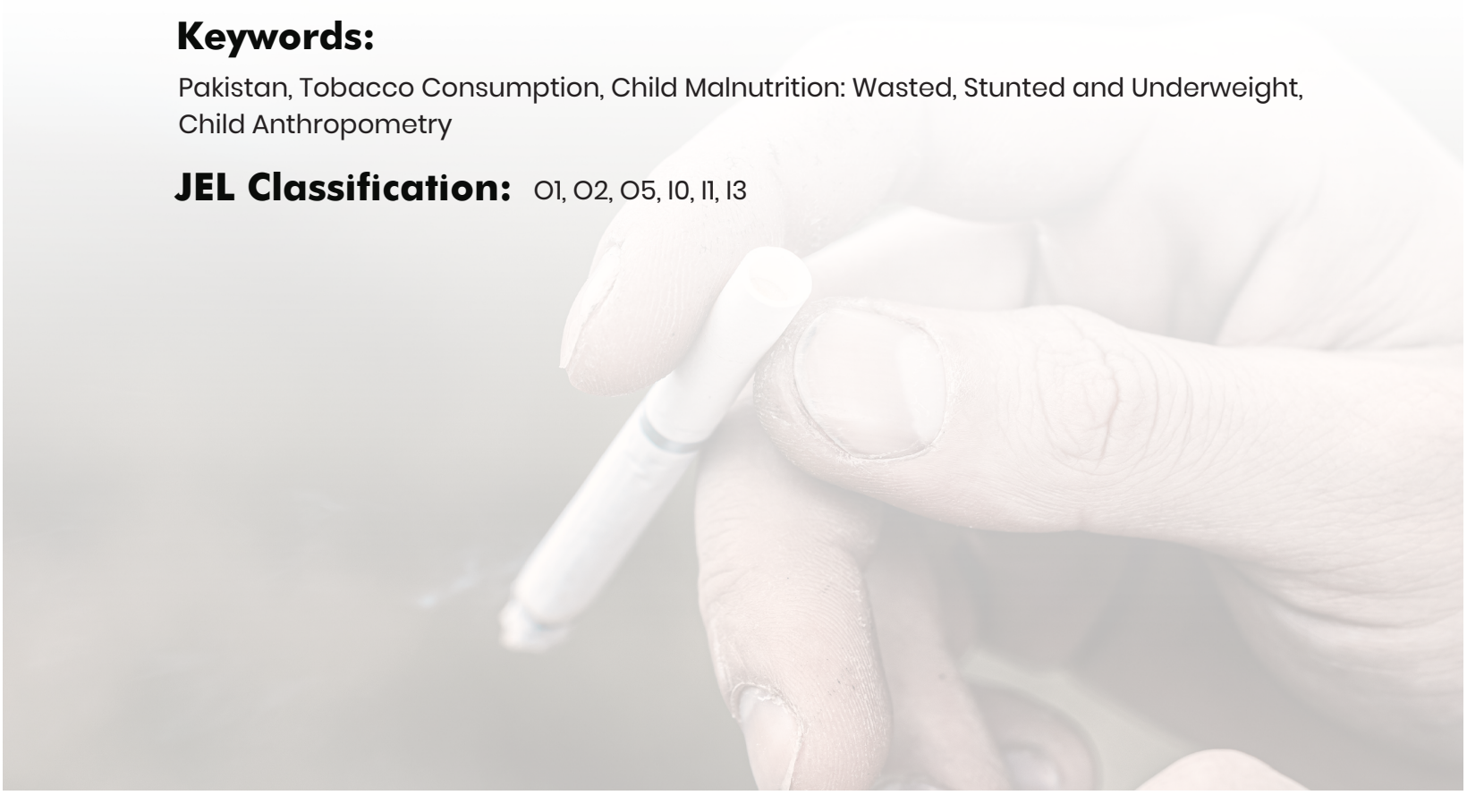
ABSTRACT

Parental smoking is highly prevalent in developing economies, which, along with using up scarce household income, exposes children to second-hand tobacco smoke leading to many health issues. Using the Pakistan Demographic and Health Survey (PDHS) 2017-18, we estimate the link between parental smoking and child malnutrition in Pakistan using height-for-age (HAZ), weight-for-age (WAZ), and weight-for-height z-scores (WHZ). The children were categorized into three groups. The first group was composed of children having mothers who smoke (maternal). The second group had children having fathers who smoked (paternal). Finally, the third group consisted of children who had either parent smoking (parental). The maternal, paternal, and parental prevalence of tobacco smoking was found to be 7%, 16.3%, and 21.6%, respectively, with higher rates in rural areas than urban areas. The results showed lower height-for-age z-scores (HAZ) among children exposed to smoking by parents. The association between maternal smoking and children's HAZ scores was stronger compared to paternal or parental smoking. The study found a negative association between maternal, paternal, and parental tobacco use and HAZ, with the relation being statistically significant in rural areas. On the other hand, no significant relationship between second-hand smoke and children's weight-for-height and weight-for-age was found. By employing the propensity score matching (PSM) method, the study found that children exposed to parental tobacco smoke had a lower HAZ score by 0.286 standard deviations. Considering that smoking also affects those around smokers, the need to take measures to discourage smoking becomes doubly important.

Keywords:

Pakistan, Tobacco Consumption, Child Malnutrition: Wasted, Stunted and Underweight, Child Anthropometry

JEL Classification: O1, O2, O5, I0, I1, I3



1 INTRODUCTION

Tobacco consumption is one of the leading causes of premature deaths, causing more than 8 million deaths per year worldwide (WHO, 2021c). As of 2020, around 22.3% of adults aged 15 and above (36.7% males and 7.8% females) consume any form of tobacco, while 17% (28.9% males and 5.2% females) consume smoked tobacco (WHO, 2021a). Globally, 33% of men, 35% of women, and 40% of children are regularly exposed to the dangerous second-hand effects of tobacco smoke . Although second-hand smoke exposure among children has fallen over the past 15 years, children are still more exposed to second-hand smoke than adults.

Low birth weight, premature birth, shorter baby length, increased risk of fetal mortality, congenital abnormalities, and childhood obesity are linked to mothers' exposure to second-hand smoke during pregnancy (Niu et al., 2016; Sunday & Kabir, 2019; Wahabi et al., 2013). Furthermore, children whose parents are tobacco users are at a higher risk of many health problems, including sudden infant death syndrome (SIDS), severe asthma, and ear and respiratory infections (US Department of Health and Human Services, 2006, 2010).

Stunting, wasting, and lower weight are among the health problems in children that may, directly and indirectly, be associated with parental tobacco consumption. In 2020, the global incidence of stunting and wasting was estimated to be 149.2 million and 45.4 million, respectively, while in Asia, the prevalence of stunting and wasting among children under the age of five years is estimated to be 53% and 70%, respectively (WHO, 2021b). These are linked to long-term health consequences that span all life stages. An increase in childhood morbidity and mortality, loss of physical development potential, increased risk of chronic diseases in adulthood, lower educational achievement, and diminished economic output are some of the consequences. The case against tobacco is further solidified in such instances since parental health choices pose long-term health costs to separate individuals (i.e., children) without the latter's consent.

In Pakistan, the prevalence of tobacco (chewed and smoked) consumption among all adult men and women (aged 15 years and above) is 31.8% and 8.6%, respectively (PDHS 2017-18). The prevalence of smoked tobacco, which has a second-hand health concern as well, is 18.2% and 5.7% for all adult men and women, respectively.

The global prevalence of smoking during pregnancy was estimated to be 1.7% in 2015 by Lange et al. (2018). The highest prevalence of smoking during pregnancy was in the European region, at 8.1%, and the lowest prevalence of smoking during pregnancy was in the African region, at 0.8%. However, child mortality rates are higher in South and Southeast Asia where aggressive tobacco control policies, including those to reduce second-hand smoke exposure, are less common and smokeless tobacco use is higher, particularly among women.

In Pakistan, the prevalence of tobacco use among the mother, father, and any parent of a child is 10.1%, 31.2% and 37.3%, respectively. Smoked tobacco is consumed by 7% of mothers and 16.3% of fathers.

(PDHS 2017-18)

Pakistan is a high tobacco-burden country with exposure to tobacco smoke at home being a 21%, more so for boys (22.9%) than for girls (18.2%)

(WHO, 2013).

Tobacco-using households in Pakistan spend roughly 2.7% of their monthly budget on tobacco, with poor households spending 3% of their budget (Saleem and Iqbal, 2021). For poor households, it means spending scarce resources on tobacco that could be otherwise used on something beneficial for health. The PDHS shows malnutrition among children to be rampant in the country. A very high 38% of the children under the age of five years are stunted, with 17% severely stunted; 7% wasted, with 2% severely wasted; and 23% are underweight, with 8% severely underweight. (PDHS, 2019).

Substantial literature is available globally (Talukder, et al., 2022; Jaakola, et al., 2021; Paraje and Valdes 2021; Islam, Rana and Mohanty, 2020; Chowdhury et al 2011; Best et al., 2007; Goncalves-Silva, at al, 2005) establishing a link between parental smoking and child health, and on the impact of smoking during pregnancy on birth weight and size. However, when it comes to Pakistan, little is known about the effects of postnatal exposure to parental smoking on the physical health of children aged five years and below. To date, limited information is available in the country to illustrate the association between parental smoking and stunting, wasting, and underweight among children exposed to second-hand smoke.

The public health crisis caused by tobacco use is multi-pronged and poses many challenges for society in Pakistan and elsewhere. In the current study, we focus on the impact of parental tobacco consumption on child malnutrition outcomes in Pakistan, as exhibited through weight-for-height, height-for-age, and weight-for-age.

2. LITERATURE REVIEW

There are three main channels through which parental tobacco use can harm child health outcomes. Firstly, tobacco consumption during pregnancy has developmental effects on the child through purely biological effects, leading to weak genetics and a higher probability of child malnutrition. Secondly, smoked tobacco creates indoor pollution, which creates respiratory problems for the household members. Thirdly, there is also a more direct economic effect, which can harm child health due to parental tobacco consumption, especially among poor households where already the scarce resources are directed to tobacco use instead of something more useful. Poor households also have the highest tobacco consumption prevalence.

As stated above, due to its addictive nature, poor households spend significant proportions of their incomes on tobacco. This leads to the reallocation of expenditures from health, education, and nutrient-rich and plant-based foods towards tobacco, as also documented by Best et al. (2007) and Efroymson et al. (2001), which can harm child health. It is well known that maternal consumption of tobacco (smoked and non-smoked) during pregnancy leads to a heightened risk of child mortality (Wu et al., 2021; Bhatta and Glantz, 2019; Pandey and Lin, 2013), especially through the increasing incidence of sudden infant death syndrome (Dietz et al., 2010), small-for-gestational-age (Fantuzzi et al., 2008) and stillbirths (Inamdar et al., 2014), child morbidities, such as long term disruption of respiratory processes and developmental lung damage (Maritz and Harding, 2011), and low gestational age and low birth weight (Gupta and Sreevidya, 2004; Dietz et al., 2010).

Smoking also increases passive smoking exposure in children and indoor air pollution, which hurts child health and the probability of smoking later in life (DiFranza et al., 2004). Goel et al. (2004) found for an Indian sample that among non-smoking mothers, who were exposed to environmental tobacco smoke, there was a significantly higher incidence of pre-term birth (24.1% vs. 16.1%) and small-for-gestational-age babies (31.9% vs.17.2%) as compared to the unexposed mothers.

https://www.who.int/data/gho/data/themes/topics/topic-details/GHO/second-hand-smoke

Children's exposure to a tobacco-smoked environment also has an adverse impact on their health and increases the likelihood of adolescent smoking later in their life (DiFranza, Aligne, & Weitzman, 2004). Children's morbidity and death are considerably increased as a result of passive cigarette smoke exposure (Hwang, Hwang, Moon, & Lee, 2012). The infants who are exposed to parental smoking have lower forced expiratory flows (Stocks & Dezateux, 2003). Likewise, the children who are exposed to indoor tobacco smoke during infancy or childhood have a greater relative risk of respiratory outcomes, with infancy exposure having the highest relative risk (Zhuge et al., 2020).

Various studies show that children who are exposed to second-hand smoke (SHS) have a weight, length, and head circumference deficit by the third month compared to children not exposed to SHS (Fenercioglu, Tamer, Karatekin, & Nuhoglu, 2009). Children born to passive smokers have a lower Kaup index increase from birth to 3 years than children born to smokers, including passive smoking (Braimoh et al., 2017). Up to the age of 4 years, SHS exposure is associated with poorer child weight status. (Robinson et al., 2016). Likewise, daily exposure to SHS among pregnant women is found to be associated with a smaller head circumference at the time of birth than the non-exposed group (Soesanti et al., 2019).

A study by Semba, et al. (2007) found child stunting and wasting to be linked to SHS exposure, whereas the child underweight was not associated with SHS exposure. Some other studies give slightly different results. For instance, smoking by parents is found to be associated with a higher incidence of moderate underweight, severe underweight, moderate stunting, wasting, severe wasting, and severe stunting in children in various studies (Chowdhury et al., 2011; Best et al., 2007; Bonu, Rani, Jha, Peters, & Nguyen, 2004).

In contrast, some studies' findings are contrary to what is discussed above. For instance, some studies show that SHS is not linked to children being underweight, stunted, or wasted, at least not as severely as some other studies have found (Tielsch et al., 2009; Kyu, Georgiades, & Boyle, 2009). Likewise, Yang, Decker, and Kramer (2013) found no adverse developmental outcomes in children solely linked to parental smoking. They linked the observed association between parental smoking and child health as a residual confounded by genetic and environmental factors.

3. MATERIAL AND METHODS

3.1 Data

This study uses the most recently available round of the Pakistan Demographic and Health Survey (PDHS) 2017-2018 to examine the relationship between parental smoking and child health. The PDHS 2017-2018 is the fourth round of this nationally representative survey conducted by the National Institute of Population Studies (NIPS) as a part of the worldwide Demographic and Health Surveys (DHS) initiative. The survey collects information on socio-demographic, maternal, and child health variables from the sample households.

A stratified two-stage sample design was used in the 2017-18 PDHS. The survey covered the four provinces of Pakistan (Punjab, Sindh, Khyber Pakhtunkhwa, and Balochistan), as well as the territories of Gilgit Baltistan (GB), Azad Jammu Kashmir (AJK), Islamabad Capital Territory (ICT), and Federally Administered Tribal Areas (FATA). There were a total of 580 clusters chosen, with 28 families in each cluster. The survey was completed successfully in 561 clusters. A total of 11,869 households were successfully questioned out of the sampled 12,338 households in Pakistan (excluding territories), resulting in a 96% response rate. In Azad Jammu and Kashmir, the response rate was 98%, while in Gilgit Baltistan it was 99%.

These cited studies were not in any way funded by the tobacco industry and had clear disclaimers stating so. They are published in journals known for maintaining ethical values.

A total of 3,994 children (unweighted) aged 0-59 months were eligible for height and weight measurements (excluding Azad Jammu and Kashmir and Gilgit Baltistan). Valid dates of birth and measurements of both height and weight were included in the analysis for the three malnutrition indicators (height-for-age, weight-for-height, and weight-for-age). For 87% of the children in the sample, valid height observations were available, and for 91% of children, valid weight observations were available. Similarly, a total of 486 children (unweighted) under the age of 60 months were eligible for measurement in Azad Jammu and Kashmir, with 91% of the measured children having accurate height data and 92% having good weight data. A total of 314 children (unweighted) under the age of five years were eligible in Gilgit Baltistan, with 88% of the children having correct height data and 89% having accurate weight data.

The PDHS asks questions on paternal and maternal smoking. The respondents, i.e., mothers and fathers, were inquired about the number of manufactured cigarettes, hand-rolled cigarettes, kreteks, pipes full of tobacco, cigars, cheroots, cigarillos, water pipes, and other forms of tobacco they smoked per day. For this study's purpose, the tobacco status takes the value of 1 if the respondents use any or more than one of forms of the above-mentioned forms of tobacco and 0 otherwise. The PDHS, and consequently this study, focus only on smoking as a form of tobacco use. Tobacco use, therefore, in this study refers to smoking any of the tobacco products mentioned above.

The DHS consists of the National Centre for Health Statistics (NCHS) and the World Health Organization (WHO) defined z-scores of malnutrition. Considering the age and sex reference, these organizations describe malnutrition as low height-for-age (HAZ) defined as stunted, low weight-for-height (WHZ) defined as wasting, and low weight-for-age (WAZ) defined as underweight. The three indices were calculated using standard deviation (SD) units from the median of the reference population. Children having Z-scores for height-for-age (HAZ), weight-for-height (WHZ), and weight-for-age (WAZ) that were less than -2SD from the WHO reference population median were deemed stunted, wasting, and underweight, respectively.

Explanatory factors were chosen following a thorough study of the literature, and only those variables that showed a link to children's nutritional status and were available in the PDHS 2017–2018 dataset were included in the analysis. The regression analyses included sociodemographic factors; maternal, paternal, child and household characteristics; and type of residence.

To examine the association between parental tobacco smoking and child malnutrition, we categorized children's exposure to smoke into three groups. The first group included children whose mothers smoked tobacco in any form, so they were exposed to maternal smoking. The second group comprised children whose fathers smoked tobacco, so they were exposed to paternal smoking. The third group had children whose either parent smoked tobacco, including those children whose both parents smoked, exposing children to parental smoking.

3.2 Methodology

The baseline method for regression analysis was the Ordinary Least Square (OLS). The Propensity Score Matching (PSM) method was also employed to gain deeper insights into the association between parental smoking and child malnutrition. Handicapped by the size of the sample available in the PDHS, we do not claim any causation, even where one is implicit, and take a conservative interpretation of the association between parental smoking and child health (see Table A-2) .

Matching methods are widely used in impact evaluation studies to tackle the problem of self-selection. In the current study, these methods compared the outcomes for children whose parents smoked tobacco (treatment group) to those whose parents did not smoke tobacco (control group). In this method,

Since the identification assumption tests carried out for the PSM hold in some instances, and do not in others, we assume association, and not causation, between parental smoking and child health in this study. See Table A-2 for test results.

the propensity scores are estimated, and the comparison between two groups can be done by assigning the probability of being in the treatment group. Rosenbaum and Rubin (1983) define the propensity score as "the probability of treatment assignment conditional on observed baseline characteristics".

In this technique, thus, a comparison group is created using a matched propensity score that is similar to the treatment group in terms of observable characteristics. These characteristics influence not just the outcome but also the participant's decision (to smoke or not to smoke in our case). For the current study, several variables (household and child characteristics) were controlled to minimize selection biases that could have influenced the results and were then correlated with child malnutrition and parental tobacco use.
We estimated the impact of tobacco consumption using various variants of the following equation based on the discussion above:

$$CH_{ij} = \beta_0 + \beta_1 Treatment_j + \gamma X + \varepsilon_{ij} \qquad (1)$$

In Equation 1, CHij represents health outcome (malnutrition) for a child i living in household j. X is a matrix of additional control variables. The treatment variable j, in this case, takes the value 1 if the parent is a tobacco user and 0 otherwise. The Average Treatment Effect on Treated (ATT) was estimated as the difference in mean outcomes of malnutrition among children of age less than five years in the treatment group to the children in the control group by using the results obtained from propensity score probit regression. The ATT to measure the impact of treatment on child health was estimated as follows:

$$ATT = E(Y_i^1 | D_i = 1) - E(Y_i^0 | D_i = 1) = E\left(Y_i^1 - Y_i^0 \middle| p(X)\right) \qquad (2)$$

4. LIMITATIONS OF THE STUDY AND FUTURE NEEDS

Anthropometric measures are hard to collect, and in Pakistan, it is only the PDHS that collects some related indicators at the national level. However, the PDHS dataset has certain limitations that are reflected in the study as well. These include:

- **The valid cases for some indicators are too low making the sample size inadequate to conduct some of the analyses. A bigger sample size, therefore, can make the study more robust and reliable.**
- **The impact of tobacco consumption needs to be probed from before the time of pregnancy to the gestation period and beyond. The PDHS, however, asks only about the current smoking status, so we have no idea about the duration of smoking and the time of life when, especially the mother, smoked.**

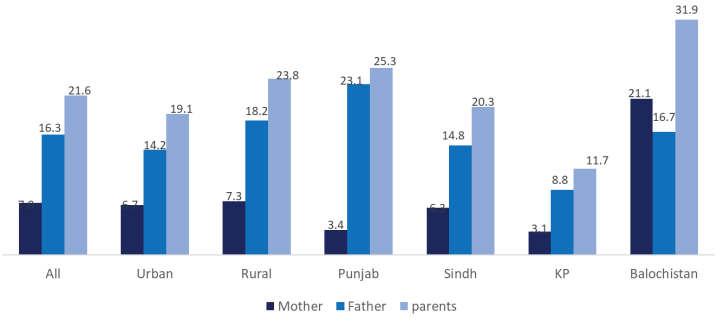
There is an urgent need for a larger, holistic study on the second-hand effects of tobacco consumption, including parental use, to gauge the exact extent of the damage it causes to those exposed without even consuming tobacco products.

5. RESULTS AND DISCUSSION

5.1 Prevalence of Tobacco Smoking Among Parents

In Pakistan, the prevalence of tobacco use among mothers is lower than that of fathers (see Figure 1). The maternal, paternal, and parental tobacco smoking rates were found to be 7%, 16.3%, and 21.6%, respectively. Looking at the regional trends, the rates were higher in rural areas than urban areas for all three categories of smoking, i.e., maternal, paternal, and parental. Across the four provinces, mothers had the highest rate of smoking in Balochistan, while fathers had the highest rate in Punjab. The proportion of children with either of the parents smoking was again the largest in Balochistan with near to one-third having at least one parent who smokes (see Figure 1).

Figure 1: Distribution of Tobacco Smoking Among Parents (%)

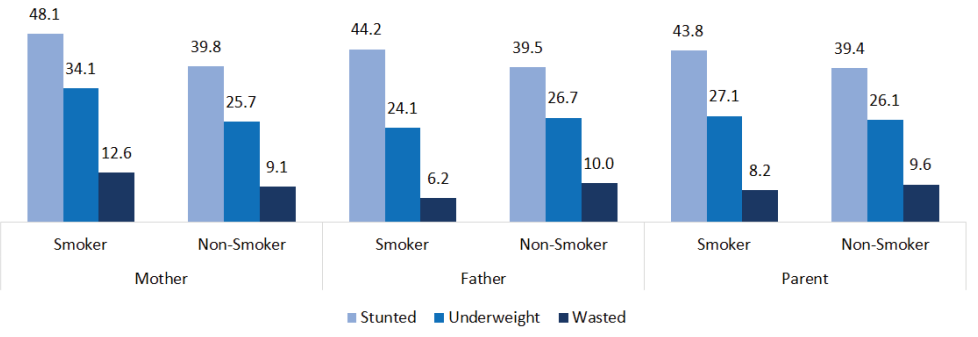


Source: Authors' calculations using the PDHS 2017-18 dataset.

5.2 Prevalence of Malnutrition Among Children of Smoking Parents

The prevalence of malnutrition (stunting, underweight, and wasting) among the children of tobacco-smoking parents is presented in Figure 2. The results show that all three indicators of malnutrition, namely, stunting, underweight, and wasting, among the children were high if the mother, father, or either smoked tobacco compared to those who did not smoke. Moreover, the prevalence of stunting, underweight, and wasting was higher among the children of tobacco-smoking mothers than tobacco-smoking fathers.

Figure 2: Distribution of Stunting, Underweight, and Wasting Among Children Aged <5 Years by Smoking Status of Parents (%)

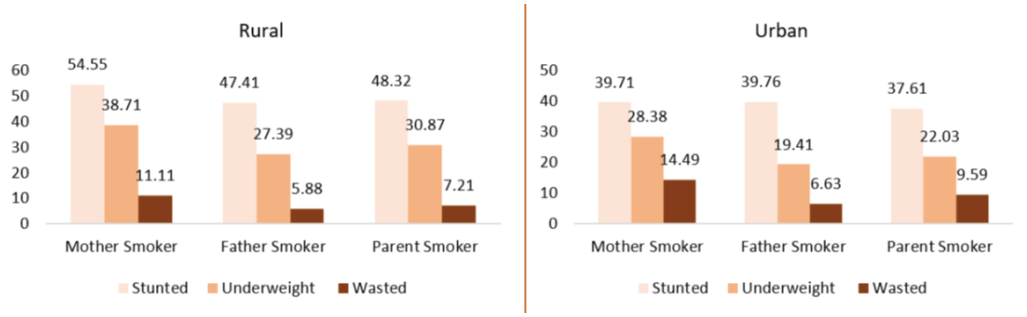


Source: Authors' calculations using the PDHS-2017-18 dataset.

5.2.1 Prevalence of Malnutrition Among Children of Smoking Parents by Region

Stunting, underweight, and wasting were found to be consistently higher among children of smoking parents in rural areas than those in urban areas (Figure 3). Moreover, in both urban and rural areas, the prevalence of stunting was higher than being underweight and wasting. Almost 54.5% of children were stunted in rural areas compared to 39.7% in urban areas if mothers were tobacco users. It is worth noting that the rates for all three indicators – stunting, wasting, and underweight – were higher when mothers were smokers, and the trend remains the same for both urban and rural areas (Figure 3). (The status of malnutrition among the children of tobacco-smoking parents across the four provinces is shown in the appendix Figure A1).

Figure 3: Distribution of Stunting, Underweight, and Wasting by Region and Tobacco Smoking Status of Parents (%)

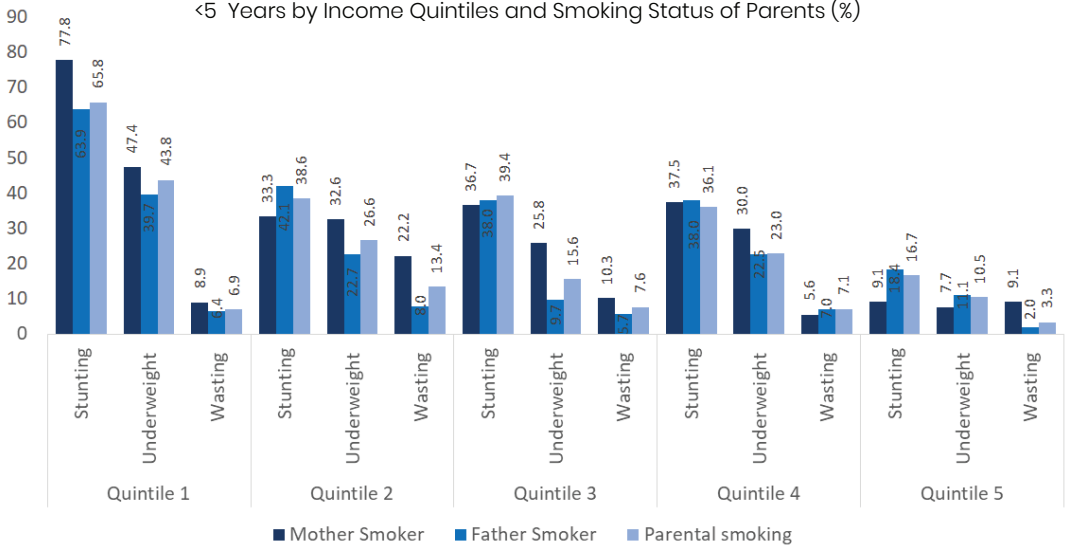


Source: Authors' calculations using the PDHS-2017-18 dataset.

5.2.2 Prevalence of Malnutrition Among Children of Smoking Parents by Income

Quintile-wise distribution of malnutrition is presented in Figure 4. It can be seen from the figure that in the lower quintile the prevalence of malnutrition was higher compared to the upper quintiles. Only a negligible proportion was stunted and underweight in the topmost quintile (Q5). Comparing Q1 to Q5, we can see that the malnutrition rates among children of smoking parents were much higher for children in Q1 across all indicators (Figure 4).

Figure 4: Distribution of Stunting, Underweight, and Wasting Among Children Aged <5 Years by Income Quintiles and Smoking Status of Parents (%)



Source: Authors' estimation using the PDHS-2017-18 dataset.

5.2.3 Effect of Parental Tobacco Smoking on Malnutrition of Children

Ordinary Least Square (OLS) Analysis

Table 1 reports the impact of maternal, paternal, and parental use of tobacco on the WHO-defined measures of height-for-age (HAZ) z-score. It may be mentioned here that the study analyzed all three measures of malnutrition among children, namely weight-for-age, height-for-age, and weight-for-height z-scores. However, as found in most of the studies, no significant association was found between maternal, paternal, and parental tobacco smoking with WAZ and WHZ scores. Therefore, these results are not reported.

The analysis in the current study shows that the prevalence of being stunted among children of tobacco-smoking parents was higher than being underweight. In both univariate and multivariate models, maternal, paternal, and parental use of tobacco was associated with a high prevalence of stunting. Tobacco smoking by the father, mother, or either was associated with lower HAZ scores among children. Children with maternal smoking had a HAZ score lower by 0.412 standard deviations, while paternal smoking was associated with a 0.237 standard deviation decrease in HAZ score.

Controlling for mother's age and education, father's education, family size, the number of children in the family aged under five years, children's sex and age, the number of rooms, and region showed a negative and significant association of tobacco smoking with HAZ scores. The results show that a higher level of education of mothers and fathers compared to no education had a positive and significant impact on HAZ scores. Family size had a negative and significant relationship with HAZ scores, i.e., if the family size was large then the prevalence of stunting among the children would be higher. On the other hand, the more the number of rooms, the lower the prevalence of stunting, that is, the HAZ score would be higher. The number of rooms, which primarily is a function of wealth, determines the possible congestion in a household, which directly impacts the level of second-hand smoke in the house including that for children. The number of children aged under five and the sex of children had no significant relationship with the HAZ score.

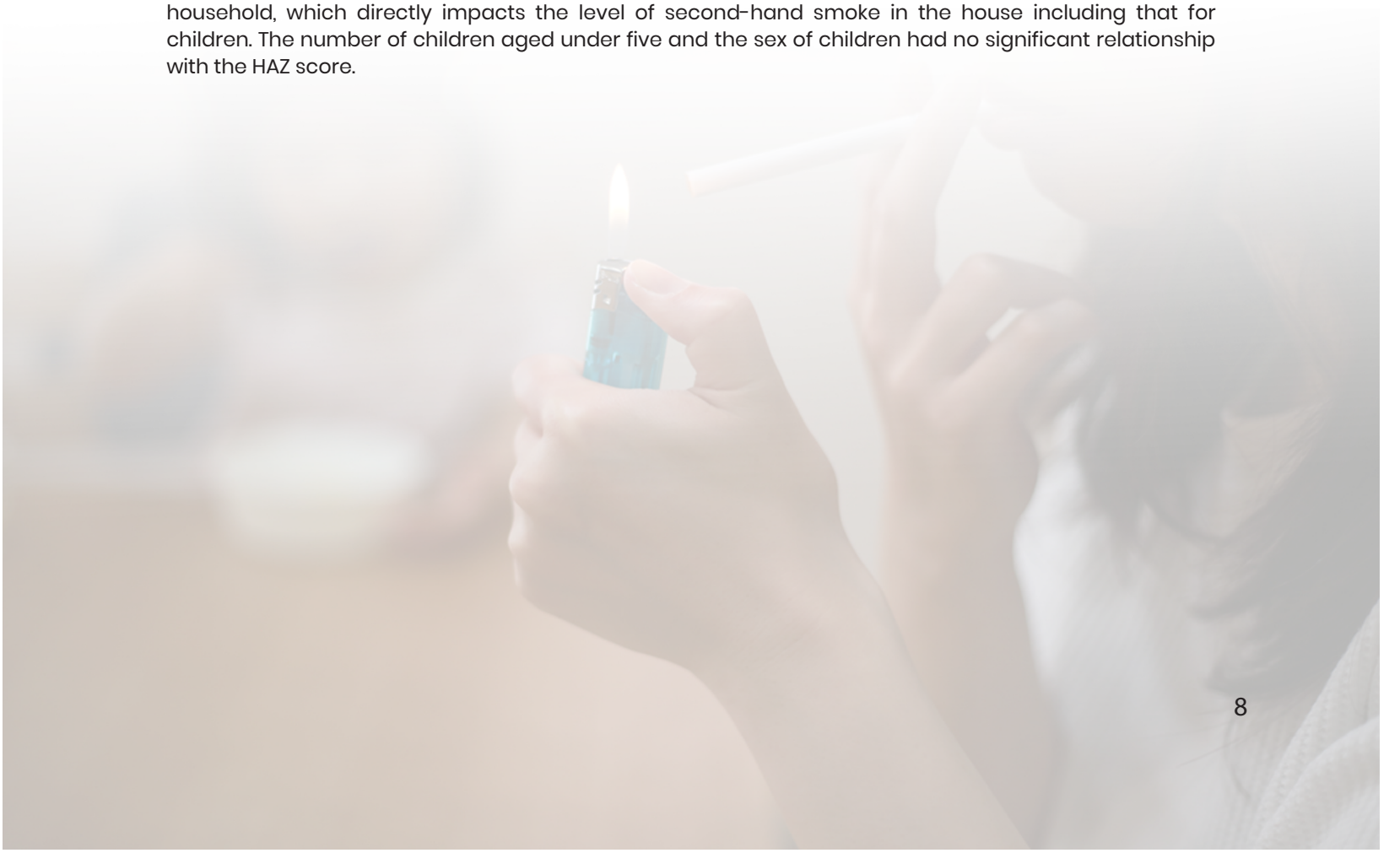


Table 1: Parental Tobacco Smoking and HAZ Score of Children

VARIABLES	HAZ	HAZ	HAZ	HAZ	HAZ	HAZ
Mother	-0.412***	-0.229*	---	---	---	---
	(0.145)	(0.136)	---	---	---	---
Father	---	---	-0.237**	-0.238***	---	---
	---	---	(0.0960)	(0.0907)	---	---
Parent	---	---	---	---	-0.272***	-0.216***
	---	---	---	---	(0.0868)	(0.0819)
Age Mother	---	0.0266***	---	0.0285***	---	0.0283***
	---	(0.00603)	---	(0.00608)	---	(0.00607)
Primary_Mother	---	0.372***	---	0.387***	---	0.383***
	---	(0.103)	---	(0.103)	---	(0.103)
Secondary_Mother	---	0.517***	---	0.528***	---	0.526***
	---	(0.0962)	---	(0.0962)	---	(0.0962)
Higher_Mother	---	0.734***	---	0.736***	---	0.734***
	---	(0.121)	---	(0.121)	---	(0.121)
Primary_Father	---	0.0594	---	0.0611	---	0.0577
	---	(0.101)	---	(0.101)	---	(0.101)
Secondary_Father	---	0.264***	---	0.261***	---	0.260***
	---	(0.0917)	---	(0.0916)	---	(0.0916)
Higher_Father	---	0.251**	---	0.243**	---	0.243**
	---	(0.113)	---	(0.113)	---	(0.113)
Family Size	---	-0.0516***	---	-0.0542***	---	-0.0529***
	---	(0.0129)	---	(0.0129)	---	(0.0129)
Children Under 5	---	0.0391	---	0.0430	---	0.0417
	---	(0.0328)	---	(0.0328)	---	(0.0328)
Female Children	---	0.0646	---	0.0595	---	0.0620
	---	(0.0661)	---	(0.0661)	---	(0.0661)
Age of Children	---	-0.0255***	---	-0.0258***	---	-0.0256***
	---	(0.00194)	---	(0.00194)	---	(0.00194)
Number of Rooms	---	0.152***	---	0.152***	---	0.151***
	---	(0.0371)	---	(0.0370)	---	(0.0371)
Rural	---	-0.167**	---	-0.159**	---	-0.159**
	---	(0.0703)	---	(0.0704)	---	(0.0704)
Constant	-1.593***	-1.834***	-1.581***	-1.848***	-1.562***	-1.848***
	(0.0366)	(0.255)	(0.0387)	(0.255)	(0.0398)	(0.255)
Observations	2,450	2,448	2,450	2,448	2,450	2,448
R-squared	0.003	0.138	0.002	0.140	0.004	0.140

Source: Authors' estimations using the PDHS 2017-2018 dataset.

The study also carried out a region-focused analysis of the association between parental tobacco smoking and HAZ scores. The results show that the possibility of being stunted was higher in the rural region compared to the urban (Table 2). In both urban and rural areas, maternal, paternal, and parental smoking, all had a negative association with the HAZ score. All three relationships were statistically significant in rural areas, while in urban areas paternal smoking had the strongest effect on the children's HAZ score (Table 2).

Table 2: Parental Tobacco Smoking and Children's HAZ Score by Region

VARIABLES	HAZ	HAZ	HAZ	HAZ	HAZ	HAZ
Rural						
Mother	-0.539***	-0.347*	---	---	---	---
	(0.197)	(0.185)	---	---	---	---
Father	---	---	-0.218*	-0.235*	---	---
	---	---	(0.130)	(0.123)	---	---
Parent	---	---	---	---	-0.299**	-0.261**
	---	---	---	---	(0.119)	(0.112)
Controls	NO	YES	NO	YES	NO	YES
Urban						
Mother	-0.195	-0.138	---	---	---	---
	(0.210)	(0.203)	---	---	---	---
Father	---	---	-0.176	-0.224*	---	---
	---	---	(0.141)	(0.135)	---	---
Parent	---	---	---	---	-0.156	-0.172
	---	---	---	---	(0.126)	(0.121)
Controls	NO	YES	NO	YES	NO	YES

Source: Authors' estimations using the PDHS 2017-2018 dataset.
Note: Regression is adjusted for maternal age, maternal education and paternal education level, child age, number of children under 5 years of age, family size, and number of rooms in a household.

The sex of the child was also considered while examining the link between tobacco use and malnutrition (Table 3). When comparing male and female children, stunting was found to be higher in male children. Maternal, paternal, and parental smoking of tobacco was negatively and significantly associated with the HAZ score of male children, while in the case of female children only maternal smoking was associated with lower HAZ scores. Higher stunting rates for male children might sound counter-intuitive, given the perceived male sex preference existing in the country, but the result is supported by the literature. A male child is more likely to be malnourished than a female child, especially from 0-39 months (Thurstans, et al., 2020; Bork, et al., 2017).

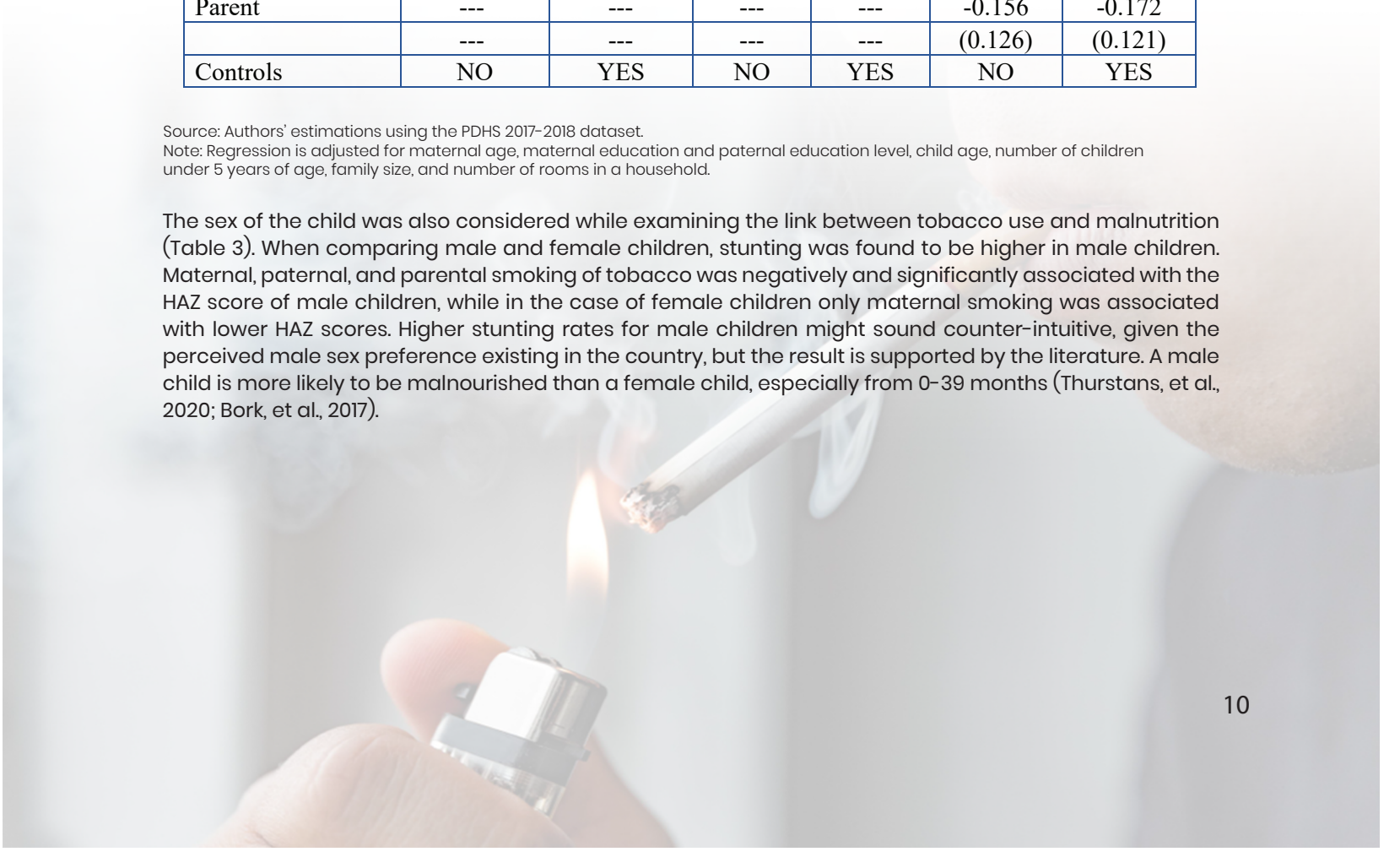


Table 3: Parental Tobacco Smoking and Children's HAZ Score by Sex

VARIABLES	HAZ	HAZ	HAZ	HAZ	HAZ	HAZ
Male						
Mother	-0.466**	-0.298	---	---	---	---
	(0.213)	(0.201)	---	---	---	---
Father	---	---	-0.404***	-0.363***	---	---
	---	---	(0.136)	(0.130)	---	---
Parent	---	---	---	---	-0.428***	-0.345***
	---	---	---	---	(0.124)	(0.118)
Control	NO	YES	NO	YES	NO	YES
Female						
Mother	-0.366*	-0.170	---	---	---	---
	(0.197)	(0.185)	---	---	---	---
Father	---	---	-0.0538	-0.118	---	---
	---	---	(0.136)	(0.128)	---	---
Parent	---	---	---	---	-0.111	-0.0950
	---	---	---	---	(0.121)	(0.114)
Control	NO	YES	NO	YES	NO	YES

Source: Authors' estimations using the PDHS 2017-2018 dataset.
Note: Regression is adjusted for maternal age, maternal education and paternal education level, child age, number of children under 5 years of age, family size, and number of rooms in a household.

Propensity Score Matching Analysis

Table 4 presents the pre-matching summary for the three groups. i.e., children exposed to maternal, paternal, and parental smoking. This is needed to investigate the relationship of tobacco use by mothers, fathers, and either parent with children's anthropometry, indicative of their status vis-à-vis malnutrition. (The estimates of the probit model with the treatment and control groups are given in Table A-1.)

Table 4: Mean Testing for Treated and Control Groups

	Mother			Father			Any Parent		
Variable	**Control**	**Treated**	**Difference**	**Control**	**Treated**	**Difference**	**Control**	**Treated**	**Difference**
Mother									
Age	28.8	29.8	-0.99***	28.6	30.5	-1.9***	28.5	30.3	-1.8***
Illiterate	0.55	0.64	-0.09***	0.55	0.55	0.00	0.55	0.57	-0.02
Primary	0.14	0.09	0.05***	0.13	0.14	-0.01	0.13	0.13	0.00
Secondary	0.19	0.16	0.03	0.19	0.20	-0.01	0.19	0.19	0.00
Higher	0.13	0.11	0.02	0.13	0.11	0.02	0.13	0.11	0.02
Father									
Illiterate	0.27	0.37	-0.10***	0.27	0.31	-0.04***	0.26	0.32	-0.06***
Primary	0.19	0.16	0.03	0.19	0.20	-0.01	0.19	0.18	0.01
Secondary	0.34	0.30	0.04	0.34	0.33	0.01	0.34	0.33	0.01
Higher	0.20	0.17	0.03	0.21	0.16	0.05***	0.21	0.17	0.04***
Household Characteristics									
Family	9.35	11.08	-1.73***	9.52	9.20	0.32	9.43	9.58	0.15
Children	2.43	2.84	0.41***	2.45	2.48	-0.03	2.44	2.52	-0.08
Gender	0.49	0.52	-0.03	0.49	0.48	0.01	0.49	0.49	0.00
Age of	29.0	32.0	-0.30***	29.13	29.64	-0.15	28.91	30.29	-1.38*
Rooms	2.33	2.60	-0.27***	2.38	2.22	0.16***	2.38	2.28	0.10
Region	0.52	0.54	-0.02	0.51	0.58	-0.07***	0.51	0.58	0.07***

Source: Authors' estimations using the PDHS 2017-2018 dataset.

Except for the sex of the children, the difference in the mean values of other household characteristics, such as family size, the number of children under the age of 5, the age of children, and the number of rooms were statistically significant between the tobacco smoking and non-smoking mothers. Among the household characteristics and for fathers, only the number of rooms differed significantly between tobacco smoking and non-smoking fathers. On the other hand, for the parental smoking group, the age of the children differed significantly between smoking and non-smoking parents.

Among the individual-level characteristics, the mean age of mothers in the treated group was higher than in the control group. Tobacco-smoking mothers and fathers were also more illiterate, whereas the mean value for mothers with primary education was higher for those not smoking tobacco. These descriptive data show that children with maternal, paternal, or parental tobacco smoking were quite different in terms of observed characteristics. These differences in average values motivate the use of the PSM technique for evaluating the influence of tobacco smoking on malnutrition.

Table 5 reports the estimates of different matching methods. The estimates show the difference in mean outcomes for the prevalence of stunting among children aged five to twelve years in the treatment group compared to the control group. Nearest neighbor, Kernel, and Stratification matching methods were applied to estimate the association.

At the national level, all matching methods provided a significant and negative impact on the HAZ score. The negative and significant sign represented an adverse impact of tobacco smoking on the HAZ score. The HAZ score of the children whose parents were smokers was a 0.286 standard deviation lower than the children whose parents did not consume tobacco. In the case of maternal tobacco smoking, the results were significant and negative for the nearest neighbor and kernel matching, while for paternal smoking the results were significant for kernel and stratification matching methods. The estimated impact of maternal smoking on HAZ score was higher than paternal or parental smoking.

The results of the region-focused analysis are reported in Panel B and Panel C of Table 5. The estimates from the stratification matching method were negative and significant for all three categories, maternal, paternal, and parental, in rural areas. For urban areas, only kernel matching showed a negative and significant impact of paternal and parental tobacco smoking on the HAZ score. In rural areas, the association with paternal tobacco smoking was stronger than that in urban areas (-0.224 vs -0.186).

The results of the analysis for the effect of a child's sex on HAZ score are reported in Panel D and Panel E of Table 5. The male children showed a stronger relationship, compared to female children, who were exposed to second-hand smoke. All the matching methods showed a negative and significant impact on male children for maternal, paternal, and parental tobacco smoking. All the estimates, except for the nearest neighbor matching, were found to be higher for parental smoking than maternal or paternal smoking for the male children. Similarly, the association between parental smoking and female children was more pronounced than maternal or paternal smoking.

Table 5: Propensity Score Matching for Parental Tobacco Smoking on HAZ Score

Matching Methods	Mother	Father	Parent
A: Overall			
Nearest Neighbor	-0.335***(0.108)	-0.291(0.191)	-0.286*** (0.136)
Kernel Matching	-0.392***(0.143)	-0.238***(0.07)	-0.254***(0.132)
Stratification	-0.303(0.21)	-0.234***(0.118)	-0.233***(0.102)
B: Rural			
Nearest Neighbor	-0.223(0.329)	-0.314(0.232)	-0.123(0.142)
Kernel Matching	-0.461(0.191)	-0.224***(0.068)	-0.276(0.039)
Stratification	-0.419***(0.165)	-0.235***(0.044)	-0.285*(0.168)
C: Urban			
Nearest Neighbor	0.482(-0.336)	-0.006(0.162)	0.157(0.191)
Kernel Matching	-0.166(0.243)	-0.186***(0.082)	-0.164***(0.083)
Stratification	-0.014(0.266)	-0.182(0.273)	-0.177(0.114)
D: Male			
Nearest Neighbor	-0.626***(0.228)	-0.366***(0.149)	-0.487***(0.201)
Kernel Matching	-0.375***(0.11)	-0.379***(0.051)	-0.383***(0.122)
Stratification	-0.336***(0.174)	-0.378*(0.227)	-0.36***(0.14)
E: Female			
Nearest Neighbor	-0.149(0.202)	-0.25*(0.136)	-0.396***(0.096)
Kernel Matching	-0.357*(0.221)	-0.073(0.145)	-0.119***(0.06)
Stratification	-0.277***(0.113)	-0.097*(0.055)	-0.111(0.148)

Source: Authors' estimations using the PDHS 2017-2018 dataset.
Note: Robust standard errors are reported in parentheses. ***, **, and * show the significance at 1, 5, and 10 %, respectively.

6. CONCLUSIONS

The current study explored the effect of parental tobacco smoking on the anthropometric development of children in Pakistan. It is a country with high tobacco use and a wide-ranging stunting problem among children. Analyzing a possible relationship between parental tobacco smoking and stunting of children, therefore, is crucial to take effective measures to reduce tobacco use in Pakistan.

The analysis revealed that the prevalence of stunting, underweight, and wasting was high in the children whose parents smoked tobacco compared to the children whose parents did not smoke tobacco. Comparing stunting, underweight, and wasting among children of tobacco smokers, stunting was far more prevalent than underweight and wasting. This association between tobacco use of the parent(s) and stunting (lower HAZ score) remained, and significantly so when we applied OLS and various propensity score matching methods. The effect of mothers' smoking on the HAZ score was found to be higher than that of fathers' smoking as the intensity of malnutrition was lower in the latter instance.

The high malnutrition among the children of tobacco-smoking parents could be due to low spending on food items as expenditure on tobacco reduces the budget available for other necessary food items. The results showed that the households with no tobacco users devoted a larger proportion of money to food items, education, and health care, and the prevalence of malnutrition was high in the children of tobacco users (Best et al., 2007). Therefore, reducing tobacco use would benefit children's health through increased consumption expenditures on things having a positive impact (Saleem and Iqbal, 2021; Nayab, et al., 2019).

Furthermore, when compared to urban areas, rural communities had a higher prevalence of malnutrition. This might be related to low literacy among people and a lack of understanding of the negative consequences of tobacco smoking on children. Furthermore, tobacco smoking had a greater impact on male children than on female children. Likewise, children from the poorest quintile had a higher malnutrition risk than the upper quintiles. This might be due to the high use of tobacco in the poorest quintile along with a large proportion of tobacco expenditures in the overall budget. When comparing the top and bottom quintiles, the proportion of spending allocated to tobacco expenses was lower in the top quintile.

The detrimental effects of second-hand smoke on children with smoking parents makes the implementation of policies to reduce tobacco consumption an investment in the future generations of the country. The low HAZ scores among children of tobacco-smoking parents, as this study finds, stresses the need to make tobacco control an integral part of public health policies.

REFERENCES

Best, Cora M, Kai Sun, Saskia de Pee, Martin W Bloem, Gudrun Stallkamp, and Richard D Semba, "Parental tobacco use is associated with increased risk of child malnutrition in Bangladesh," Nutrition, 2007, 23 (10), 731–738.

Bhatta, Dharma N, and Stanton Glantz, "Parental tobacco use and child death: Analysis of data from demographic and health surveys from South and South East Asian countries," International journal of epidemiology, 2019, 48 (1), 199–206.

Bonu, S., Rani, M., Jha, P., Peters, D. H., & Nguyen, S. N, "Household tobacco and alcohol use, and child health: an exploratory study from India," Health Policy, 2004, 70(1), 67-83.

Braimoh, T. S., Kobayashi, S., Sata, F., Sasaki, S., Goudarzi, H., Yila, T. A., … Baba, T., "Association of prenatal passive smoking and metabolic gene polymorphisms with child growth from birth to 3 years of age in the Hokkaido Birth Cohort Study on Environment and Children's health," Science of The Total Environment, 2017, 605, 995-1002.

Case, Anne and Christina Paxson, "Parental behavior and child health," Health Affairs, 2002, 21 (2), 164–178.

Chowdhury, F., Chisti, M. J., Hossain, M. I., Malek, M. A., Salam, M. A., & Faruque, A. S. G., "Association between paternal smoking and nutritional status of under-five children attending Diarrhoeal Hospital, Dhaka, Bangladesh," Acta Paediatrica, 2011,100(3), 390-395.

Dejmek, J., Solansk y, I., Podrazilová, K., & Srám, R. J., "The exposure of nonsmoking and smoking mothers to environmental tobacco smoke during different gestational phases and fetal growth," Environmental health perspectives, 2002, 110(6), 601-606.

Dietz, Patricia M, Lucinda J England, Carrie K Shapiro-Mendoza, Van T Tong, Sherry L Farr, and WilliamMCallaghan, "Infant morbidity and mortality attributable to prenatal smoking in the US," American journal of preventive medicine, 2010, 39 (1), 45–52.

DiFranza, Joseph R, C Andrew Aligne, and Michael Weitzman, "Prenatal and postnatal environmental tobacco smoke exposure and childrenâˇAZ' s health," Pediatrics, 2004, 113 (Supplement 3), 1007–1015.

Drope, J, N Schluger, Z Cahn, S Hamill, F Islami, A Liber, N Nargis, and M Stoklosa, "The Tobacco Atlas," 2018.

Efroymson, Debra, Saifuddin Ahmed, Joy Townsend, Syed Mahbubul Alam, Amit Ranjan Dey, Ranjit Saha, Biplob Dhar, Aminul Islam Sujon, Kayum Uddin Ahmed, and Oliur Rahman, "Hungry for tobacco: an analysis of the economic impact of tobacco consumption on the poor in Bangladesh," Tobacco control, 2001, 10 (3), 212–217.

Fantuzzi, Guglielmina, Valentina Vaccaro, Gabriella Aggazzotti, Elena Righi, Stefano Kanitz, Fabio Barbone, Giuliano Sansebastiano, Mario Alberto Battaglia, Valerio Leoni, Leila Fabiani et al., "Exposure to active and passive smoking during pregnancy and severe small for gestational age at term," The Journal of Maternal-Fetal & Neonatal Medicine, 2008, 21 (9), 643–647.

Fenercioglu, A. K., Tamer, I., Karatekin, G., & Nuhoglu, A., "Impaired postnatal growth of infants prenatally exposed to cigarette smoking," The Tohoku journal of experimental medicine, 2009, 218(3), 221-228.

GATS, Global Adult Tobacco Survey Pakistan, 2016.

Gilani, Sara Ijaz and David A Leon, "Prevalence and sociodemographic determinants of tobacco use among adults in Pakistan: findings of a nationwide survey conducted in 2012," Population health metrics, 2013, 11 (1), 1–11.

Goel, Poonam, A Radotra, I Singh, A Aggarwal, D Dua, et al., "Effects of passive smoking on outcome in pregnancy," Journal of postgraduate medicine, 2004, 50 (1), 12.

Goodchild, Mark, Nigar Nargis, and Edouard Tursan d'Espaignet, "Global economic cost of smoking-attributable diseases," Tobacco control, 2018, 27 (1), 58–64.

Gupta, Prakash C, and S Sreevidya, "Smokeless tobacco use, birth weight, and gestational age: a population-based, prospective cohort study of 1217 women in Mumbai, India," Bmj, 2004, 328 (7455), 1538.

Hwang, S.-H., Hwang, J. H., Moon, J. S., & Lee, D.-H., "Environmental tobacco smoke and children's health," Korean Journal of Pediatrics, 2012, 55(2), 35.

Inamdar, Aadil S, Raymond E Croucher, Mrunalini K Chokhandre, Mohammed H Mashyakhy, and Valeria CC Marinho, "Maternal smokeless tobacco use in pregnancy and adverse health outcomes in newborns: a systematic review," Nicotine & Tobacco Research, 2014, 17 (9), 1058–1066.

Bork, Kirsten A., and A. Diallo, "Boys Are More Stunted than Girls from Early Infancy to 3 Years of Age in Rural Senegal", The Journal of Nutrition, 2017, 147(5),5, Pages 940–947.

Jaakkola JM, Rovio SP, Pahkala K, Viikari J, Rönnemaa T, Jula A, Niinikoski H, Mykkänen J, Juonala M, Hutri-Kähönen N, Kähönen M, Lehtimäki T, Raitakari OT, "Childhood exposure to parental smoking and life-course overweight and central obesity",. Annals of Medicine, 2021, 53(1), 208-216.

Kyu, H. H., Georgiades, K., & Boyle, M. H., "Maternal smoking, biofuel smoke exposure and child height-for-age in seven developing countries," International journal of epidemiology, 2009, 38(5), 1342-1350.

Lange, Shannon, Charlotte Probst, Jürgen Rehm, and Svetlana Popova, "National, regional, and global prevalence of smoking during pregnancy in the general population: a systematic review and meta-analysis," The Lancet Global Health, 2018, 6 (7), e769–e776.

Maritz, Gert S and Richard Harding, "Life-long programming implications of exposure to tobacco smoking and nicotine before and soon after birth: evidence for altered lung development," International Journal of Environmental Research and Public Health, 2011, 8 (3), 875–898.

Nayab, D., Nasir, M., Memon, J. A., & Siddique, O., "Switch, Reduce, or Quit: How Do Smokers Respond To Tobacco Tax Increase In Pakistan?", 2021, Pakistan Institute of Development Economics (PIDE), Islamabad.

Niu, Z., Xie, C., Wen, X., Tian, F., Yuan, S., Jia, D., & Chen, W.-Q., "Potential pathways by which maternal second-hand smoke exposure during pregnancy causes full-term low birth weight," Scientific reports, 2016, 6(1), 1-8.

Paraje, G. & N. Valdés, "Changes in parental smoking behavior and children's health status in Chile", Preventive Medicine, 2021, 153: 1-10.

Pandey, Shanta, and Yuan Lin, "Adjusted effects of domestic violence, tobacco use, and indoor air pollution from the use of solid fuel on child mortality," Maternal and child health journal, 2013, 17 (8), 1499–1507.

PDHS. (2019). Pakistan Demographic Health Survey. Retrieved from https://dhsprogram.com/pubs/pdf/FR354/-FR354.pdf

Quelhas, D., Kompala, C., Wittenbrink, B., Han, Z., Parker, M., Shapiro, M., . . . Morris, S., "The association between active tobacco use during pregnancy and growth outcomes of children under five years of age: a systematic review and meta-analysis," BMC public health, 2018, 18(1), 1-17.

Robinson, O., Martínez, D., Aurrekoetxea, J. J., Estarlich, M., Somoano, A. F., Íñiguez, C., . . . Sunyer, J., "The association between passive and active tobacco smoke exposure and child weight status among Spanish children," Obesity, 2016, 24(8), 1767-1777.

Rosenbaum, Paul R and Donald B Rubin, "The central role of the propensity score in observational studies for causal effects," Biometrika, 1983, 70 (1), 41–55.

Saleem, W, and M. Asif, The Crowding Out Effect of Tobacco Spending in Pakistan, 2021, Karachi: SPDC.

Semba, R. D., Kalm, L. M., De Pee, S., Ricks, M. O., Sari, M., & Bloem, M. W., "Paternal smoking is associated with increased risk of child malnutrition among poor urban families in Indonesia," Public health nutrition, 2017, 10(1), 7-15.

Siddiqi, Kamran, Scheherazade Husain, Aishwarya Vidyasagaran, Anne Readshaw, Masuma Pervin Mishu, and Aziz Sheikh, "Global burden of disease due to smokeless tobacco consumption in adults: an updated analysis of data from 127 countries," BMC Medicine, 2020, 18 (1), 1–22.

Soesanti, F., Uiterwaal, C. S., Grobbee, D. E., Hendarto, A., Dalmeijer, G. W., & Idris, N. S., "Antenatal exposure to second-hand smoke of non-smoking mothers and growth rate of their infants," Plos one, 2019, 14(6), e0218577.

Stocks, J., & Dezateux, C., "The effect of parental smoking on lung function and development during infancy," Respirology, 2003, 8(3), 266-285.

Sunday, S., & Kabir, Z., "Impact of carers' smoking status on childhood obesity in the growing up in Ireland cohort study," International Journal of Environmental Research and Public Health, 2019, 16(15), 2759.

Talukder, A., M. Mahmudul Hasan, & Asikunnaby, "Assessing association between paternal smoking status and child malnutrition in Albania: An application of ordinal regression model", Human Nutrition & Metabolism, 2022, 27: 1-5.

Tielsch, J. M., Katz, J., Thulasiraj, R. D., Coles, C. L., Sheeladevi, S., Yanik, E. L., & Rahmathullah, L., "Exposure to indoor biomass fuel and tobacco smoke and risk of adverse reproductive outcomes, mortality, respiratory morbidity and growth among newborn infants in south India," International Journal of Epidemiology, 2009, 38(5), 1351-1363.

Thurstans, S., Opondo, C., Seal, A., Wells, J., Khara, T., Dolan, C., Briend, A., Myatt, M., Garenne, M., Sear, R., & Kerac, M, "Boys are more likely to be undernourished than girls: a systematic review and meta-analysis of sex differences in undernutrition", BMJ Global Health, 2020, 5(12).

US Department of Health and Human Services. (2006). The health consequences of involuntary exposure to tobacco smoke: a report of the Surgeon General.

US Department of Health and Human Services, A report of the surgeon general: How tobacco smoke causes disease: What it means to you, 2010, Retrieved from http://www. cdc. gov/tobacco/data_statistics/sgr//consumer_booklet/pdfs/consumer. pdf

Wahabi, H. A., Alzeidan, R. A., Fayed, A. A., Mandil, A., Al-Shaikh, G., & Esmaeil, S. A., "Effects of second-hand smoke on the birth weight of term infants and the demographic profile of Saudi exposed women," BMC public health, 2013, 13(1), 1-6.

WHO, "WHO report on the global tobacco epidemic 2021: addressing new and emerging products," 2021.

WHO, WHO global report on trends in the prevalence of tobacco use 2000-2025, World Health Organization, 2019.

WHO, "Pakistan Global Youth Tobacco Survey (GYTS)', 2013, Retrieved from www.emro.who.int/images/stories/tfi/documents/GYTS_FS_PAK_2013.pdf?ua=1

WHO, "Global Report on Trends in Prevalence of Tobacco Use 2000-2025", 2021a, Retrieved from https://www.who.int/publications/i/item/9789240039322.

WHO, "Levels and trends in child malnutrition", 2021b, UNICEF (9240025251) Retrieved from https://apps.who.int/iris/handle/10665/341135

WHO, "WHO report on the global tobacco epidemic 2021: addressing new and emerging products," 2021c, Retrieved from https://www.who.int/publications-detail-redirect/9789240032095

Wu, Han, Jiahong Sun, and Bo Xi, "Parental tobacco and indoor second-hand smoking exposure and the risk of offspring under-five mortality in low-and middle-income countries," Indoor air, 2021.

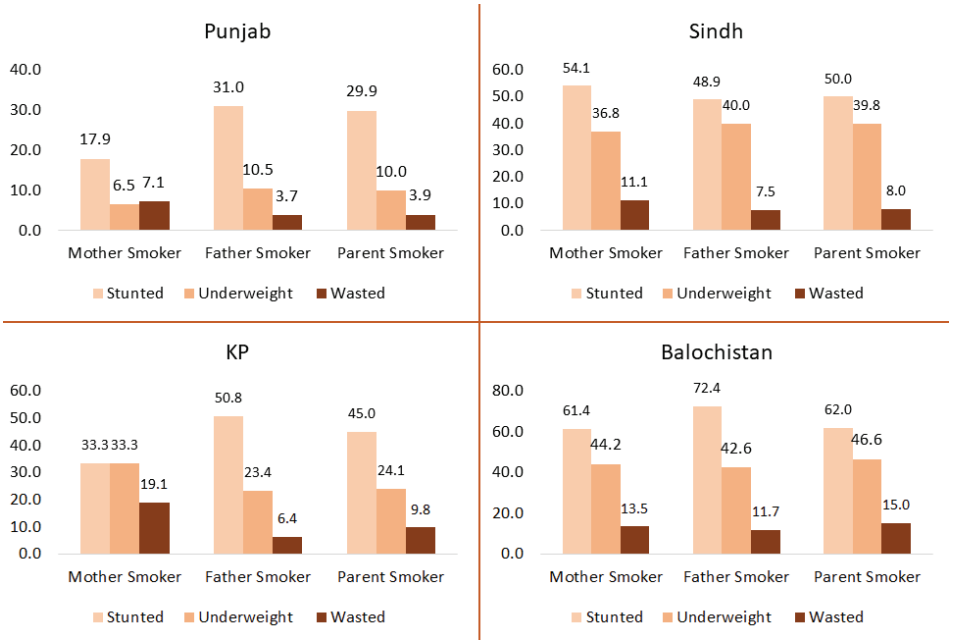
Yang, Seungmi, et al. "Exposure to parental smoking and child growth and development: a cohort study", BMC Pediatrics, 2013,13(104).

Zhao, Luhua, Lazarous Mbulo, Evelyn Twentyman, Krishna Palipudi, and Brian A King, "Disparities in smokeless tobacco use in Bangladesh, India, and Pakistan: Findings from the Global Adult Tobacco Survey, 2014-2017," Plos one, 2021, 16 (4), e0250144.

Zhuge, Y., Qian, H., Zheng, X., Huang, C., Zhang, Y., Li, B., Sun, Y., "Effects of parental smoking and indoor tobacco smoke exposure on respiratory outcomes in children," Scientific reports, 2020, 10(1), 1-9.

APPENDIX

Figure A-1: Stunting, Underweight, and Wasting Among Children Aged < 5 years of Tobacco Smoking Parents



Source: Authors' calculations using the PDHS 2017-2018 dataset.

Table A-1: Probit Estimates for Propensity Score

	Mother	Father	Any Parent
Age Mother	0.0113*	0.0349***	0.0312***
	(0.00638)	(0.00512)	(0.00476)
Primary_Mother	-0.251**	0.0901	0.0151
	(0.127)	(0.0896)	(0.0846)
Secondary_Mother	-0.0344	0.185**	0.135*
	(0.108)	(0.0827)	(0.0778)
Higher_Mother	0.00111	0.0540	0.0348
	(0.138)	(0.107)	(0.0997)
Primary_Father	-0.241**	-0.0678	-0.152*
	(0.110)	(0.0850)	(0.0803)
Secondary_Father	-0.203**	-0.113	-0.149**
	(0.0978)	(0.0785)	(0.0730)
Higher_Father	-0.275**	-0.243**	-0.235**
	(0.125)	(0.0997)	(0.0918)
Family Size	0.0287**	-0.0251**	-0.00366
	(0.0134)	(0.0112)	(0.0103)
Children Under 5	0.0123	0.0848***	0.0543**
	(0.0338)	(0.0284)	(0.0262)
Female Children	0.0594	-0.0466	-0.00684
	(0.0730)	(0.0574)	(0.0536)
Age of Children	0.00454**	-0.00140	0.000578
	(0.00213)	(0.00169)	(0.00157)
Number of Rooms	0.00817	0.000376	-0.0168
	(0.0381)	(0.0319)	(0.0296)
Rural	0.0218	0.159***	0.149***
	(0.0777)	(0.0609)	(0.0568)
Constant	-2.129***	-1.965***	-1.762***
	(0.225)	(0.178)	(0.166)
Observations	2,826	2,826	2,826

Source: Authors' estimation using the PDHS 2017-2018 dataset.
Note: Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1

Table A-2: Estimated Propensity Scores

		Mother	Father	Any Parent
Overall	Mean Propensity Score	0.070	0.163	0.215
	SD	0.033	0.058	0.064
	Region of common support	[0.014, 0.228]	[0.043, 0.406]	[0.084, 0.460]
	Significance of balancing property	Satisfied	Satisfied	Not satisfied
	Number of blocks	4	5	9
Rural	Mean Propensity Score	0.076	0.182	0.239
	SD	0.031	0.079	0.081
	Region of common support	[0.033, 0.233]	[0.034, 0.546]	[0.073, 0.550]
	Significance of balancing property	Satisfied	Satisfied	Satisfied
	Number of blocks	4	6	4
Urban	Mean Propensity Score	0.071	0.142	0.191
	SD	0.044	0.049	0.066
	Region of common support	[0.019, 0.252]	[0.056, 0.383]	[0.077, 0.453]
	Significance of balancing property	Not satisfied	Not satisfied	Not satisfied
	Number of blocks	6	3	6
Male	Mean Propensity Score	0.072	0.167	0.216
	SD	0.037	0.069	0.072
	Region of common support	[0.029, 0.265]	[0.040, 0.464]	[0.090, 0.508]
	Significance of balancing property	Satisfied	Satisfied	Satisfied
	Number of blocks	3	5	3
Female	Mean Propensity Score	0.073	0.159	0.217
	SD	0.031	0.057	0.067
	Region of common support	[0.018, 0.227]	[0.042, 0.353]	[0.077, 0.459]
	Significance of balancing property	Not satisfied	Satisfied	Satisfied
	Number of blocks	4	5	4

Source: Authors' estimation using the PDHS 2017-2018 dataset.

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