

The effects of mother education and intervening mechanisms on rural-urban child stunting: evidence from Pakistan

Efeitos da escolaridade das mães e dos mecanismos intervenientes no déficit de crescimento de crianças de áreas rurais e urbanas: evidências do Paquistão

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ABSTRACT

OBJECTIVES: Estimate the impact of mother schooling on rural-urban child chronic malnutrition from Pakistan. **MATERIALS AND METHODS:** The data on all education based pathways, such as socio-demographic and behavioral, were taken from Pakistan Demographic and Health Survey 2012-13 dataset. The data on all infants aged 0–59 months, whose height and weight were measured at the survey time, were selected for empirical analysis. Analyses with binary logistic regression model were used to determine the effect of mother formal schooling on rural-urban infant stunting after controlling for other factors deeply linked to her schooling. **RESULTS:** Empirical results showed that urban mothers having primary and secondary/higher education have less likelihood of stunting for their infants than rural mothers relative to illiterate mothers, implying that illiterate mothers have more stunted kids. Male household head and poor economic rank have more likelihood of stunting in both locations, relative to female household head and rich households. Among explanatory variables, maternal schooling, health seeking attitude, socioeconomic rank, empowerment, and child weight are highly significant predictors of stunting in rural-urban Pakistan. Despite of earlier significant outcomes, targeted interventions are important aiming at mothers having no education. **CONCLUSION:** Female education, along with various other pathways (her socioeconomic, empowerment and heal seeking thought), has reduced chronic malnutrition and has been a guarantee of better living standard, still targeted interventions are important aiming at mothers having no education by specifying a big share of federal and regional budget on female education.

Keywords: Stunting; Empowerment; Binary Logistic Regression; Pakistan.

RESUMO

OBJETIVOS: Estimar o impacto da escolaridade das mães na desnutrição crônica de crianças de áreas rurais e urbanas do Paquistão. **MATERIAIS E MÉTODOS:** Dados relacionados à educação materna, como sociodemográficos e comportamentais, foram extraídos da Pesquisa Demográfica e de Saúde do Paquistão 2012-13. Dados sobre crianças de 0 a 59 meses de idade, cuja altura e peso foram medidos durante a pesquisa, foram selecionados para análise empírica. Análises com o modelo de regressão logística binária foram usadas para determinar o efeito da escolarização da mãe sobre o déficit de crescimento de crianças, após o controle de outros fatores ligados à sua escolaridade. **RESULTADOS:** Os resultados empíricos mostraram que as mães urbanas com ensino fundamental e médio/superior têm menor probabilidade de terem filhos com déficit de crescimento do que as mães rurais em relação às mães analfabetas; as mães analfabetas têm maior probabilidade de terem filhos com déficit de crescimento. Homens chefes de família e baixa renda familiar têm maior relação com o déficit de crescimento em ambos os locais. Entre as variáveis explicativas, escolaridade materna, atitude em busca da saúde, nível socioeconômico, empoderamento e peso da criança são preditores significativos de déficit de crescimento em áreas urbanas e rurais do Paquistão. **CONCLUSÃO:** A educação feminina, juntamente com outras variáveis (nível socioeconômico, empoderamento e busca por atendimento de saúde), tem reduzido a desnutrição crônica e sido uma garantia de um melhor padrão de vida; ainda assim, intervenções direcionadas são importantes para mães com baixo nível educacional, demandando investimentos na educação feminina.

Palavras-chave: Transtornos de Crescimento; Empoderamento; Regressão Logística Binária; Paquistão.

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INTRODUCTION

Growth and development of children is badly affected by malnutrition not only in short run but also in long run^{1,2,3}. Malnourished children are physically, emotionally, and intellectually less productive and more susceptible to chronic illness and disabilities⁴. Stunting mainly explains an overall long term nutritional condition and is the foremost child health outcome because of its relationship with child morbidity, mortality, and adult performance later in life.

According to the regional estimates of 2014, south Asian countries, especially India, Pakistan, and Bangladesh, are facing malnutrition problem⁵. In Pakistan, malnutrition rates are seen very high as compared to the developed world⁶. The stunting rate decreased from 67% in 1977 to 40–50% until the end of the 1990s. It is still very high when it is compared to global average rate. According to the National Nutrition Survey (2011)⁷, the rate of infant stunting in Pakistan was 43.7%. A higher stunting rate in rural areas (46.3%) relative to urban areas (36.9%) is an alarming situation. This huge difference in rural and urban stunting is mainly due to the difference of education and access to public health facilities. Pakistan Demographic and Health Survey (PDHS) also have stated the same conclusions about stunting.

Every year, millions of children are dying as a result of stunting in the world. In 2011, 25% worldwide children under age 5 have been found stunted. It is estimated that 165 millions kids, i.e. 80% of the world's stunted children, are living in 14 developing countries. Pakistan is also one of them. More than 9.6 million Children in Pakistan are experiencing chronic malnutrition (stunting) during the early age of their childhood and this number is the third highest over worldwide. The United Nations Children's Fund (UNICEF) passed a declaration to reduce stunting by 34% till 2017 with the cooperation of the Pakistan government⁸. Pakistan has shown an increasing commitment to the development of social sector, which have made some important achievements. Thus, UNICEF has launched a program named by "Stop Stunting" in Pakistan to obtain the desired outcome of 1.9 million fewer kids with stunted growth by 2017.

Comparative to short period measures of child health failure, stunting is the most meaningful measurement to detect the long term reasoning of child growth failure and it is much more helpful to get the Millennium Development Goals of one and four (poverty and child growth). In addition, short term indicators of wasting and overweight can easily be cured by improvements in nutrition, while stunting can be permeative, by influencing the important organs, i.e. brain and kidneys, which in turn impacts IQ, education, income level, various chronic diseases etc.⁹. Stunting is a logical indicator which gives a detailed summary of child health deficit¹⁰. Consequently, stunted children are more susceptible to infections and have poor cognitive growth, lower learning performance in their childhood^{11,12}, decreased adult stature, reduced productivity and salary in adulthood^{13,14}. Many empirical evidences support the view that these influences maybe passed on to the later generations¹⁵.

An overview of the earlier literature helps to identify the aims of the current study. The objectives of the current study is to prove that stunting is a reasonable indication for infant health outcome; and to examine the effect of mother schooling and related linkages on infant stunting. Following the earlier literature, a higher illiteracy rate of mothers in rural-urban Pakistan will evaluate the significance of mother education in determining stunting (long run infant health outcome) using Demographic and Health Survey, 2012–13 (DHS) dataset. It is anticipated that under the light of current study's findings, where decision makers will be able to propose logical strategy to upgrade the nutritional level of children age under five, it will also motivate the family to change its fatalistic and traditional thought of medical health care to accepting and utilizing the latest health services via improving female awareness and autonomy.

MATERIALS AND METHODS

The data on all explained and explanatory variables were taken from PDHS 2012–13. The data on all infants aged 0–59 months, whose height and weight were measured at the survey time, were selected for empirical analysis.

The dependent variable of this study is infant stunting (long run infant nutritional deficit). Height-for-age measures the linear growth of children. A child whose Z-score for height-for-age is more than two standard deviations (-2SD) below the median of the World Health Organization (WHO) reference population is considered stunted. Finally, the dependent variable is stunting (stunted=1 vs. normal=0)^{16,17,18}.

$$Z - \text{Score} = \frac{\text{Measured Value} - \text{Average Value for the Reference population}}{\text{Standard Deviation of the Reference population}}$$

WHO Anthro software was utilized to build height-for-age z-scores to represent stunting.

DESCRIPTION OF INDEPENDENT VARIABLES

Mother formal schooling: This key confounding variable was classified as no schooling=0, primary schooling=1 and secondary/higher schooling=2.

Household wealth index: It presents her socioeconomic level. Principle component analysis was used to calculate the wealth index by DHS. In short, wealth index scores were classified as poor=0 and rich=1.

Protected water: It was used as proxy for household head environment condition. The supply of drinking water often verifies the quality of water consumed by children and other family members. In this study, drinking water was categorized into two sources such as protected=0 and not protected=1.

Gender of household head: It was a suitable proxy for mother empowerment (male=0 and female=1).

Mother visiting to a doctor for prenatal care: It was a proxy for health seeking mind-set. Knowledge of family planning/knowledge of tuberculosis disease (if she does not know about them=0 and otherwise=1) indicates her health care information.

Mother body mass index (BMI) (BMI = weight kg/height m²): It was categorized as underweight=0 (BMI < 18.5 kg/m²), normal=1 (BMI 18.5–24.9 kg/m²), overweight=2 (BMI 25.0–29.9 kg/m²), and obese=3 (BMI ≥ 30.0 kg/m²). It explained her nutrition status.

Breastfeeding: Not breastfed=0 and breastfed=1 illustrates child care attitude.

Living children in a household and mother age at first birth (continuous variables): The living children take into account of parents' time for childcare where they also measure birth space (reproductive behavior). These proxy explanatory variables were used for empirical analysis in the absence of their direct measures in database.

Child birth weight (continuous variable): It represents his biological condition.

Mother economic status (not working=0 and working=1), child gender (male= 0 and female=1), and child age (continuous variable) measuring gender inequality¹⁹ are controlled demographic and socioeconomic factors.

BIVARIATE AND BINARY LOGIT ANALYSES

Both bivariate and binary logit analyses were used to determine the effect of mother formal schooling on rural-urban infant stunting after controlling for other factors deeply linked to her schooling. These types of analyses offered two conclusions about rural-urban child stunting; whether they are stunted or not. To conduct bivariate analysis, the chi-square statistics was used to find the connection between each of the explanatory variables and the children nutritional status for a long period (stunting). The chi-square bivariate analysis did not incorporate confounding impacts; thus, binary logit model was used to show the net effects of each confounder controlling other factors. Finally, as dependent variable was in the binary form, binary logistic regression model was employed based on a final sample size of 1,930 and 1,397 for urban and rural regions, respectively. A $p < 0.05$ probability value highlights statistically significance of the predictors and all analyses were conducted with the help of SPSS.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

There was no need any ethical approval for this research because it is based on the Pakistan Demographic Health Survey 2012-13 secondary data collected by National Institute of Population Studies Islamabad, Pakistan. Therefore, any consent from participants was not needed.

RESULTS

The empirical and descriptive outcomes regarding the key objective of this paper are given in table 1. Empirical results of bivariate analysis showed a significant relationship between mother schooling, her health seeking attitude, socioeconomic level, empowerment, environment, child sex, weight and age, and rural-urban infant stunting. The proportion of infants suffering from chronic malnutrition was higher in rural location than in urban location. The data depicted an interesting picture of mothers' schooling: the population of illiterate

mothers was higher in the urban region (52.7%) than in rural location (32.3%); and rural mothers showed more secondary/higher schooling (37.4%) than urban mothers (12.3%). Another important factor revealed that majority of the poor households (33.6%) belonged to urban region, and rich class (93.6%) lived in rural area. Surprisingly, 91.6% urban and 94.6% rural households were headed by males.

It implies that majority of the mothers were running homes in both regions. A total of 81.4% urban and 88.3% rural households were deprived from safe drinking water. On average, mother age at 1st birth (21 years old), living children (four), their weight (10 kg), and their age (30 months old) were coincided in both regions. Mother normal nutritional level was little satisfactory in both regions (60.0% in urban area and 49.7% in rural region). About infants deprived from breastfeeding, 41.7% were from urban areas and 47.2% from rural areas (Table 1).

Tables 2 and 3 depict binary logistic results. Odds ratio (OR) was taken into account of explaining significance level of explanatory variables. Comparing with illiterates, urban mothers having primary and secondary/higher (OR = 0.765 & 0.616; $p < 0.05$) (1- exponent of the log odds) were facing little less chances of stunting for their infants than rural mothers (OR = 0.776 & 0.669; $p < 0.1$ & 0.05). Approximately, infants with the odds of 1.397 and 1.552 were more stunted (OR = 1.397 & 1.552; $p < 0.10$) as households were headed by male in both urban and rural regions, respectively.

Relative to rich household, infants were 1.544 and 1.662 times (OR = 1.544 & 1.662; $p < 0.01$ & 0.05) more likelihood of stunting in both urban-rural locations, respectively, as they lived in a poor household. Mothers' attitude toward avoiding from advanced medical amenities resulted in more chances of infant stunting with the odds of 1.295 and 1.615 (OR = 1.295 & 1.615; $p < 0.01$) in both urban-rural resident areas, respectively, against mothers struggling for better medical care. An insignificant relationship between health information and infant stunting was assessed. The heavier infants were estimated less stunted by 25% (OR = 0.756; $p < 0.01$) and 21% (OR = 0.790; $p < 0.01$) in urban and rural regions, respectively. Male infants in both urban (OR = 1.219; $p < 0.1$) and rural areas (OR = 1.229; $p < 0.05$) were more susceptible to stunting comparing with female kids. The likelihood of infant stunting was 1.057 and 1.045 times (OR = 1.057 and 1.045; $p < 0.01$) higher, with an increasing trend of child age in both locations, but this effect was looking weaker. Only rural infants who were not breastfed were relatively found more stunted (OR = 1.243; $p < 0.1$). The number of infants being a reproductive factor has not a significant impact on stunting. As urban mother age increased at the time of first birth, it led to only 3% (OR = 0.973; $p < 0.05$) less chances of her child stunting; however this impact got weaker. Mother nutritional rank and her economic working had insignificant association with infant stunting controlling for other variables. Only better urban environment condition (indicated by protected water) was causing 23% (OR = 0.772; $p < 0.05$) less chronic malnutrition for infants. Preliminary empirical analysis confirmed no violation of the following assumptions (normality, heteroscedasticity, and multicollinearity).

Table 1 – Descriptive and bivariate analysis

Variables	Urban infants N = 1,930	Chi-square (sig.)	Rural infants N = 1,397	Chi-square (sig.)
Stunted	978 (50.7%)		628 (45.0%)	
Not stunted	952 (49.3%)		769 (55.0%)	
Mother formal schooling		35.25 (0.000)*		39.62 (0.00)*
No schooling	1,018 (52.7%)		451 (32.3%)	
Primary schooling	675 (35.0%)		423 (30.3%)	
Secondary/higher schooling	237 (12.3%)		523 (37.4%)	
Socioeconomic status		29.81 (0.000)*		22.27 (0.00)*
Poor	648 (33.6%)		90 (6.4%)	
Rich	1,282 (66.4%)		1,307 (93.6%)	
Health knowledge		1.34 (0.24)		1.98 (0.27)
Heard family planning	365 (18.9%)		455 (32.6%)	
Did not heard about family planning	1,565 (81.0%)		942 (67.4%)	
Gender of household head		3.32 (0.05)†		2.56 (0.099)‡
Male	1,768 (91.6%)		1,322 (94.6%)	
Female	162 (8.4%)		75 (5.4%)	
Mother working		1.27 (0.25)		0.682 (0.4)
Not working	1,419 (73.5%)		1,161 (83.1%)	
Working	494 (25.6%)		226 (16.2%)	
Mother BMI		4.043 (0.25)		5.94 (0.11)
Underweight	260 (13.5%)		112 (8.0%)	
Normal	1,158 (60.0%)		694 (49.7%)	
Overweight	380 (19.7%)		395 (28.3%)	
Obese	132 (6.8%)		195 (14.0%)	
Breastfeeding		0.057 (0.811)		1.005 (0.31)
No	804 (41.7%)		660 (47.2%)	
Yes	1,126 (58.3%)		737 (52.8%)	
Child sex		6.52 (0.04)†		4.53 (0.08)‡
Male	985 (51.0%)		719 (51.5%)	
Female	945 (49.0%)		678 (48.5%)	
Safe drinking water		3.50 (0.05)†		2.94 (0.86)‡
Protected water	359 (18.6%)		164 (11.7%)	
Not protected water	1,571 (81.4%)		1,233 (88.3%)	
Living infants		18.74 (0.095)‡		32.01 (0.004)*
Mother age at 1 st birth		57.44 (0.0)*		28.00 (0.30)
Child weight (kg)		145.8 (0.001)*		199.9 (0.05)†
Child age (months)		95.28 (0.002)*		94.66 (0.00)*
Health seeking attitude		17.7 (0.000)*		42.05 (0.00)*
No	1,262 (65.4%)		584 (41.8%)	
Yes	659 (34.1%)		813 (58.2%)	

* p < 0.01; † p < 0.05; ‡ p < 0.10.

Table 2 – Empirical association between urban child stunting and its determinants

Variables	B	Sig.	OR	95.0% CI (LB-UB)	
Socioeconomic status (1)	0.435	0.000*	1.544	1.234	1.933
Mother working (1)	0.094	0.421	1.098	0.874	1.380
Breastfeeding (1)	-0.015	0.892	0.985	0.796	1.220
No schooling		Ref.			
Primary schooling	-0.268	0.01*	0.765	0.618	0.948
Secondary/higher schooling	-0.485	0.00*	0.616	0.440	0.862
Child sex (1)	0.206	0.036 [‡]	1.229	1.013	1.490
Child weight (kg)	-0.280	0.00*	0.756	0.719	0.795
Age	0.056	0.00*	1.057	1.047	1.068
Gender of household head (1)	0.334	0.062 [‡]	1.397	0.983	1.986
Protected water (1)	-0.259	0.048 [†]	0.772	0.597	0.998
Mother age at 1 st birth	-0.027	0.048 [†]	0.973	0.948	1.000
Health seeking attitude (1)	0.258	0.01*	1.295	1.044	1.605
Mother BMI (underweight)		Ref.			
Normal	-0.380	0.115	0.684	0.427	1.097
Overweight	-0.243	0.235	0.784	0.525	1.172
Obese	0.096	0.664	1.101	0.713	1.699
Living infants	-0.031	0.197	0.969	0.925	1.016
Health knowledge (1)	-0.088	0.500	0.916	0.710	1.182
Constant	1.65	0.001	5.234		

B: Coefficients of the corresponding independent factors; Sig.: Level of significance at which regressor is affecting dependent factor; OR: Odds ratio; 95.0% CI: 95% confidence interval; LB-UB: Upper bound and lower bound; * p < 0.01; † p < 0.05; ‡ p < 0.10.

Table 3 – Empirical association between rural child stunting and its determinants

Variables	B	Sig.	OR	95.0% CI (LB-UB)	
Breastfeeding (1)	0.217	0.087 [‡]	1.243	0.969	1.594
Child sex (1)	0.198	0.085 [‡]	1.219	0.973	1.528
Child weight (kg)	-0.236	0.00*	0.790	0.744	0.838
Living infants	0.033	0.305	1.034	0.970	1.101
Socioeconomic status (1)	0.508	0.05 [†]	1.662	0.992	2.784
Health seeking attitude (1)	0.479	0.00*	1.615	1.261	2.068
Mother age at 1 st birth	0.014	0.360	1.015	0.984	1.046
Mother working (1)	-0.023	0.886	0.978	0.719	1.330
Protected water (1)	0.109	0.545	1.115	0.783	1.588
Mother BMI (underweight)		Ref.			
Normal	-0.075	0.730	0.928	0.606	1.420
Overweight	-0.153	0.511	0.858	0.544	1.354
Obese	-0.165	0.524	0.848	0.511	1.408
No schooling		Ref.			
Primary schooling	-0.254	0.098 [‡]	0.776	0.574	1.048
Secondary/higher schooling	-0.401	0.01*	0.669	0.486	0.921
Gender of household head (1)	0.439	0.096 [‡]	1.552	0.925	2.604
Age	0.044	0.00*	1.045	1.032	1.057
Health knowledge (1)	-0.151	0.235	0.860	0.671	1.103
Constant	0.227	0.673	1.254		

B: Coefficients of the corresponding independent factors; Sig.: Level of significance at which regressor is affecting dependent factor; OR: Odds ratio; 95.0% CI: 95% confidence interval; LB-UB: Upper bound and lower bound; * p < 0.01; † p < 0.05; ‡ p < 0.10.

Table 4 – Empirical association between urban child stunting and its determinants

	Subject factor	Region	Predicted values		% age correct
			Normal children	Stunted children	
Observed values	Normal children	Urban	584	181	76.3
		Rural	604	340	64.0
	Stunted children	Urban	306	316	50.8
		Rural	301	659	68.6
Overall percentage		Urban			64.9
		Rural			66.3

The cut value is 0.50.

Table 4 presents both sensitivity and specificity diagnostic analysis. The sensitivity analysis concluded that 76.3% and 64.0% babies were correctly assessed without stunting issue by their mothers, while the specificity analysis indicated that about 50.8% and 68.6% children was accurately a victim of stunting subject in the urban and rural regions, respectively. The overall success rate of prediction was 64.9% and 66.3% for both regions, respectively, that was above the threshold level. Thus, both diagnostic tests led to the significance of odd ratios in the logistic regression. Furthermore, Hosmer Lemeshow test showed that insignificant value of chi-square points out that the data best fit the model.

DISCUSSION

Being a national, large, and consistent data, the DHS database facilitates to explore the pattern of long term child health outcome in Pakistan. In these outcomes, primary and secondary/higher schooling of mothers was significantly recorded as more protective measure to escape under-five infants from stunting relative to mothers without education in both regions (urban and rural) of Pakistan. Mother's education impact on long run health outcome was higher in urban location than in rural area. Monteiro et al.²⁰ and Deshmukh et al.²¹ also commented that the higher female education worked as a key factor contributing to reduce stunting in case of Brazil. The finding of the present study is also aligned with others^{10,22,23}. Maternal formal education, as a proxy for socioeconomic status, was noticeably attached to less stunting in both urban and rural regions. A realistic expression for this relationship is that maternal schooling may directly affect child growth by increasing female knowledge and sovereignty in a family and community^{3,24}. As result, appropriate and meaningful health-seeking thoughts, hygiene, and better feeding practices are conveyed to mothers²⁵. Some studies stated a negative link between mother education and infant mortality²⁶. However, some studies are seen failed to explain an association between mother education and child health²⁷. These findings imply that an improvement of child health status in the long run is considerably possible by the female formal schooling in both locations.

Mother with poor socio-economic rank was significantly linked to more chronic malnutrition for her kids in both regions because of having enough resources

to maintain their nutrition and to save them from illness and deficiency of nutrients. This trend was higher in rural area than in urban location. This important conclusion is also supported by Boyle et al.²⁸ and Nkurunziza et al.²⁹. Lower stunting in urban areas is a result of favorable economic conditions which leads to the most caring practices for infants and their mothers³⁰. Ukwuani and Suchindran³¹ also confirms this findings, that infants linked to wealthy families have less chances of stunting as compared to children linked to poor families in Nigeria. These outcomes are completely contradicted to Fakir and Khan³² who proved that infant health is not impacted by household assets. A variety of research literature reveals that children having socioeconomic status are more stunted than those infants belong to rich backgrounds^{33,34}.

Empirical outcomes in table 2 and 3 also declared rural-urban mother empowerment (shown by female household head) as a significant and effective explanatory variable which gives a guarantee better nutritional outcome in future. Hong and White-Means³⁵ contradict to this result, but it is favored by Das Gupta³⁶ who empirically estimated that mothers with strong influence and will in a family affairs (empowered mothers) have healthier infants. Simon et al.³⁷ also favors the preceding outcome that female empowerment in household matters help to maximally utilize the scarce resources to get the optimal level of nutrition for their kids. While working females are understood economically more empowered, their relationship with infant stunting is inconsistent in our results. Another supporting argument is that urban women are generally observed with a higher decision-making influence relative to their counterparts³⁰.

Higher child weight, in both locations, was significantly causing least chances of stunting as shown above. Favoring this study, Rahman et al.¹⁸ also reported the higher malnutrition risk among low birth weight infants. Child weight is also linked to the mother nutritional level explicitly during pregnancy³⁸. Hence, healthy mothers have well healthy infants. However, these empirical estimates about mother nutrition reveals were highly insignificant. Only rural mothers feeding their infants were facing significantly less stunting risk for their infants because breastfeeding gives hygienic and better nutritional outcome, affects childhood life span, and prevents them from poor growth. Breastfeeding also saves infants from the threat of short term diseases and provides balance nutrients in foods. This conclusion is aligned with Mbwana et al.³⁹.

Mothers following health care attitude (indicated by prenatal care visit of mothers) in both regions (urban and rural) had not stunted infants because of availing health facilities timely. This trend was also stronger in rural region than urban area. A positive, but weaker impact of child age on stunting was estimated in both regions at a higher significant level. This result is also matched with Sarmiento et al.⁴⁰. However, a positive, but insignificant association between health information and infant health was estimated.

Within reproductive variables, living children in rural-urban areas showed inconsistent outcome. This result is contradicted to Kavosi et al.⁴¹ who highlighted a greater risk of malnutrition in large families. Urban mothers had more stunting risk due to having less experience about health care. Ukwani and Suchindran³¹ oppose this outcome.

The protected water, a proxy for household environment situation, was noticeably and negatively affecting infant stunting in urban region, because safe drinking water saves infant long term malnutrition. Anwar et al.⁴² favor this outcome via confirming a significant and negative link between toilet and secured drinking water facilities and stunting. Smith et al.³⁰ estimated a weak association of piped water with infant nutritional status, but found out a strong and positive association in urban location.

To reduce stunting risk among infant age fewer than 5 years is the foremost target of the government of Pakistan and various worldwide agencies. Thus, it is important to identify the predictors that can directly or indirectly impact stunting so that the stakeholders can propose evidence-based policy for the betterment of long term child health. Identification of these factors has been a major challenge for the researchers of public health. Recent global studies have identified the following factors which can cause the child survival: maternal illiteracy, her nutritional status, breastfeeding, family income level, environmental conditions, many other demographic, social, and economic factors^{43,44}. Many studies conducted on Pakistan, India, and Bangladesh called poor mothers' education, lower socio-economic position, low birth weight, and poor access to health center as the main risk factors^{2,3,28,45}. In short, high illiteracy, poverty and food insecurity are the key reasons of increasing trends of acute and chronic malnutrition in Pakistan commission report (2011)⁷.

Firstly, Caldwell⁴⁶ concluded mothers' education is a key factor influencing the health of their children. He also estimated that the children of literate mothers enjoyed a good health relative to less educated or uneducated mothers. Education makes the mothers more active and helps them to take the right and quick decisions about their children's health problem⁴⁷, birth space, and family size²². National Nutrition Survey (2011)⁷ concluded that mother education was closely related to infant stunting and found that the percentage of malnutrition was lower among the children of more educated and literate. According to latest PDHS's report, stunting ranges from 21% among children whose mothers have achieved higher education to 55% among those whose mothers

have no education. A similar inverse relationship was observed between household wealth and stunting. Children in the poorest households were three times more likely to be stunted (62%) than children in the wealthiest households (23%)⁷. Some comparative studies showed a negative association between mother education and child survival⁴⁸. Conversely, several past studies failed to estimate a strong causal link between mothers' formal education and child survival²⁷. It has become a need to recognize the linkage through which maternal education links to infant health in both urban and rural locations.

Various studies dealing with the impact effect of mother formal schooling on child survival has presented many pathways. It is stated that parents schooling promoted infant health through their literacy and numeracy skills, health knowledge, and income. They also presented potential pathways associating mother education to child survival, i.e. health-related information, numeracy expertise, and exposure to advanced society which enabled mothers more responsive to latest medications²⁵. Communities containing educated females were enriched with better clinical, piped water, and sanitation amenities, and they provided an environment of exchange of health care information²⁷. There are only few empirical works examined the relative contribution of these pathways, particularly in one study of Frost et al.⁴⁷, but this work also considers these pathways in context of disparities that are evident among mothers' economic and nutritional position, health knowledge, health seeking thought, reproductive behavior, and empowerment in both rural-urban locations of Pakistan. Furthermore, maternal nutritional level may also be included as a pathway linking maternal schooling to child survival. Thus, this unique study estimates the impact of mother schooling on chronic malnutrition incorporating all possible pathways mentioned earlier on the ground of rural urban inequalities.

CONCLUSION

This study findings imply that female education, along with various other pathways (her socioeconomic, empowerment, and heal seeking thought), has reduced chronic malnutrition and has been a guarantee of better living standard, still targeted interventions are important aiming at mothers having no education by specifying a big share of federal and regional budget on female education. Furthermore, targeted outcomes can be achieved through functionalizing this budget via both (federal and provincial) educational ministries. Particularly, public and private institutions should enhance the enrollment for secondary/postsecondary classes because it shows strong link with long-term child health in both regions. Individually, mothers (especially the young ones) should learn health care knowledge from different channels. For this purpose, UNICEF is also facilitating Pakistan to enhance children nutrition level. Breastfeeding rate should be improved by mothers and they should be away from higher usage of infant formulas as suggested by UNICEF. For enhancing nutritional condition of children age fewer than 5 years in Pakistan, some interventions are urgent aiming at reducing incidence of low birth weight besides improving women's formal schooling.

The validity of this study is that it is supported by PDHS 2012-13 dataset on child birth weight and other variables which are collected by a trustworthy source of National Institute of Population Studies Islamabad, Pakistan. However, there are some limitations in the present study. Firstly, only a selected sample of newborn babies, whose mothers could record their birth weight on health card during the survey, was considered. Secondly, many important variables, like maternal nutrition level, life style, and their diet, could not be controlled in the study due to lack of these variables in the survey data. Thirdly, several proxy variables, for instance mother empowerment, economic status, reproductive attitude, environment, knowledge, and health seeking mind-set were incorporated in this study because of not finding their direct measures in the dataset.

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AVAILABILITY OF DATA AND MATERIALS

The datasets used and analyzed in the current study is available from the corresponding author on reasonable request.

PRIOR PRESENTATION

Data from this study was presented and published by international agency, USAID, with the title of "Pakistan Demographic and Health Survey 2012-13"

CONFLICTS OF INTERESTS

The authors declared that they have no conflict of interest.

AUTHORS CONTRIBUTION

All authors contributed to study idealization, analysis and interpretation of data and manuscript writing, approving the published final. They declare themselves responsible for content of the article, ensuring its accuracy and integrity.



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