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An Impact Analysis of Sanitation Practices on Children's Health in Uttar Pradesh State in India

Isha Sharma [1]*, Asheref Illiyan [2], Srinivasu Bathula [3]

1 Research Scholar, Department of Economics, Jamia Millia Islamia, New Delhi, India

2 Professor, Department of Economics, Jamia Millia Islamia, New Delhi, India

3 Professor, Centre for the Study of Regional Development, JNU. New Delhi, India

***Abstract*:** Sustainable Development Goals such as Nutrition (Goal 2) and Clean Water and Sanitation (SDG 6) have set the blueprint for attaining collective actions by all the nations and their linkage cannot be overlooked while fulfilling the agenda by 2030. This paper analyses the impact of sanitation practices on health indicators particularly stunting, wasting and underweight of under 5 aged children in India using the primary data collected for 600 individuals from four districts of Uttar Pradesh namely Agra, Kanpur, Ghaziabad and Meerut. Multi-stage quota sampling has been adopted to identify the representative sample for the study. The statistical tools involved are descriptive statistics, Shapiro Wilk Test of normality, z-scores and binary probit regression. The paper concludes that sanitation significantly impacts the health of children across area and education with rural and those with no formal education facing the disproportionate brunt. The paper suggests an integrated and holistic policy framework by invoking the role of concerned stakeholders in building sustainable toilets such as EcoSan which operates without water and possess potential to convert excreta into useful agricultural resources.

***Keywords**: agricultural, regression, education, significantly*

I Introduction

Sanitation is a crucial socio-economic indicator for developing nations. Several instances indicate that lower sanitation levels have led to a host of diseases (WHO, 2019). This necessitates the urgency for sanitation to be recognized as a primary health issue globally. As per UNICEF (2013), there are still 2.4 billion people who do not have access to proper excreta disposal. Asia is home to four out of five of these individuals, with roughly one out of five living in China and India, respectively. The persistence of poor sanitation practices in large Asian cities with more than half of total population relying on the conventional pit latrines and septic tanks further aggravates the present scenario.

Such poor practices are often linked to transmission of diseases such as cholera, diarrhea and further exacerbates stunting. Evidence suggests that Bihar leads in stunting (48 per cent) followed by Uttar Pradesh (46 per cent) among the Indian states as per NFHS-4 (2015-16 data). Stunting along with wasting and underweight comprises the problem of malnutrition. Malnutrition, a major outcome resulting from nutrient deficiency roughly accounts for 50% of all diarrhea and intestinal worm infections as a direct consequence of inadequate water, sanitation and hygiene (WHO, 2008).

India is a nation with one of the youngest populations in this ageing world with children accounting for a major chunk of its population. India's demographic dividend is projected to peak in 2041 as per the Economic Survey 2018-19. This age group would further contribute to the formation of demographic dividend in India. This is again reinforced in the latest Economic Survey of 2021-22. However, inadequacy in excreta disposal and its catastrophic impacts on nutrition of children is still a pressing issue for a country like India. The situation becomes more severe

when taboos and beliefs related to sanitation come into play. However, there is improvement in the situation due to adoption of many programmes like Swachh Bharat Abhiyan.

There is a great disparity observed in perceptions formed across religions and castes in developing nations with Hindus resisting the formation of toilet construction near their houses. On the economic front, despite the supply side measures such as Swachh Bharat Mission (SBM) being duly taken into consideration by the Government of India for assessing the performance of sanitation, it is these perceptions and beliefs forming the demand side aspects which are often neglected in the Indian context. With zero hunger (goal 2) and sanitation (goal 6) as two of the major sustainable development goals, it is certainly more pressing for a country like India.

Several government initiatives such as Swachh Bharat Mission (2014) aimed to make India open defecation free. However, states like Gujarat, Andhra Pradesh and Maharashtra were declared open defecation free despite full access to toilets as per NSO's 2018 report on Drinking Water, Sanitation, Hygiene and Housing Conditions in India. This inadequacy in fulfilling the Open Defecation Free (ODF) targets stems to both demand and supply side attributes. Demand attributes in its true sense are influenced by the community's beliefs and social stigma attached to sanitation practices. Thus, a directed and focused approach is required to examine the importance of these contributory factors from the demand perspective on the nutritional requirements of the nation's building block. Henceforth, it would be reasonable to look from this perspective while assessing the relation between sanitation and health indicators of children. In this context, this paper is an attempt to identify the plausible explanations to the role of sanitation belief system and its bearing on the nutritional defects (stunting, underweight, wasting) by invoking these demand side attributes across socio-economic aspects (education and area).

The rest of the paper is structured as follows: Section II deals with the review of literature. Section III discuss the research methodology and measurement techniques used for defining the independent and dependent variables. Additionally, Section IV deals with the results and discussion of the paper. Further, Section V concludes the paper and provides policy implications in the arena of health and sanitation. Lastly, Section VI cites references for the paper.

II Literature Review

Cvjetanovic (1986) in his paper concludes that sanitation and water supply have an impact on people's health in both direct and indirect ways. The indirect effects come into play via socio-economic and educational improvements on the health of the population. Hence, it is crucial to incorporate both these effects while evaluating the impact of water supply and sanitation facilities in a developing nation like India. This is also observed by **Merchant et al. (2003)** where children who came from households with access to water and sanitation had a 17 per cent higher likelihood of reversing stunting than children who did not. The authors conclude that child growth is positively and independently correlated with greater access to water and sanitation. To add further, **Checkley et al. (2004)** find that children with a water connection who were 24 months old who lived in homes with tiny storage containers and insufficient sewage disposal were 18 cm shorter than those in homes with sewage and large storage containers. This questions the accessibility of the sanitation practices which is crucial to improve the nutritional status of children as per **Cuesta (2007)**. He observes that the best chances of reducing malnutrition are by providing flush toilets and community-based piped water distribution. This is even more important to avoid the spread of diseases like diarrhea as highlighted by **Arnold et al. (2013).**

Another interesting factor which comes into play due to this linkage is the Asian Enigma puzzle. **Spears et al. (2013, 2020)** finds that disparities in wealth alone do not adequately account for variations in average height between developing nations which brings in the inevitable role of sanitation and concludes that open defecation which is prevalent in India accounts for the major stunting among Indian children. The feasible solution is to investigate innovative strategies of reducing open defecation to solve the Asian Enigma. The focus should also be done on the WASH studies which have the potential to overcome the problem of open defecation (**Kwami et al. 2019)**. The acute malnutrition and WASH practices are negatively associated with each other as emphasized by **Van Cooten et al. (2019)** in his study. Additionally, there exist a statistically significant inverse relationship between socioeconomic status and under nutrition as per **Shrestha et al. (2020).** All this necessitates the significance of having access to a steady supply of safe, reliable water, which is required for good hygiene

practices, to lower the incidence of diarrhea and improve the nutritional status among children. This also holds true at national level where countries like Indonesia have experienced similar situations. This is contended by **Cameron et al. (2021)** who finds that access to toilets and living in a neighborhood where most neighbors have toilets are key factors in children's growth and development and that Water, Sanitation and Hygiene (WASH) investments ought to be a key component of any program supporting Indonesia's early childhood development. All this calls for sufficient empirical and theoretical evidence about the same especially in a developing country like ours which suffers from such caveats even in the present scenario.

III Methodology

Primary data collection is invoked in the paper which is collected from 600 individuals from selected districts in the state of Uttar Pradesh. Multi-stage Quota sampling method has been used to identify the representative sample for the study. In the first stage, all 75 districts in Uttar Pradesh have been divided into two different categories of sanitation practices adopted based on their performance in Swachh Survekshan[1] report of 2023. Under the second stage, the top and bottom two districts performing on the sanitation front has been identified. The last stage randomly selects individuals from urban and rural areas in the respective districts.

Post deciding the sampling strategy, the data is collected by conducting in-depth personal interviews using a structured Google form questionnaire. The questionnaire comprises the following sections - The demographic, economic, and social profile of the respondent including age, gender, religion, income, social position, educational background was catered to in Section I. Further, the accessibility of sanitation practices was assessed in Section II.

[1] Government of India conducts this survey to assess cleanliness of both rural and urban areas.

Moving further, Section III and IV talks about the awareness and perceptions respectively. Lastly, Section V discusses in-depth about the challenges faced in using these sanitation practices.

IV Results and Discussions

The paper invokes an in-depth impact analysis of sanitation practices and health indicators for the children aged under five years residing in both urban and rural areas of the selected districts of Uttar Pradesh. These sample districts are mainly: Ghaziabad, Meerut, Agra and Kanpur. Table 1 represents the socio-economic profile of the respondents.

Table 1: Socio-Economic Profile of the Respondents (N=600)

Variable	Sub-variable	Frequency (in Percentage)
Gender	Male	205(47.5)
	Female	95 (52.5)
Social Class	General	263 (43.8)
	Other Backward Class	20 (34.8)
	Scheduled Caste	15(13.8)
	Scheduled Tribe	2(8.5)
Area	Urban	300 (50)
	Rural	300 (50)
Education	Primary	130 (38.3)
	Secondary	17 (14.8)
	Higher Secondary	10 (14.5)
	Graduation and above	3 (9)
	Illiterate	140 (23.3)

Source: Authors' Calculation from Field Survey

To delve deeper into the linkage between sanitation practices and health indicators, it is a pre-requisite to infer the status of both these variables. Table 2 represents the status of open defecation amongst the sample. The practice of defecating in areas such as forests and open spaces and not in closed spaces such as toilet is known as Open Defecation. It is an affront to dignity and puts the health of the community and the nourishment of children at risk. As per the World Health Organisation (2022), open defecation attributes to 11.1 per cent in India with 17.01 per cent in rural areas and 0.55 per cent in urban areas with Agra and Kanpur being the major contributors. Similarly, the primary data in Table 2 also reflects the same story with both these districts practicing 66.66 per cent and 80.66 per cent open defecation respectively in contrast to top-performing ones with 44 per cent and 50.66 per cent respectively. The story is quite similar in rural areas of Agra and Kanpur with 46.66 per cent and 49.33 per cent practicing open defecation respectively. This is worrisome and is reflective of the fact that the place of residence does alter the choice of whether to practice open defecation or to use a toilet. This might be plausible due to lack of awareness pertaining in Agra and Kanpur.

Table 2: Status of Open Defecation in Selected Districts of Uttar Pradesh (in Percentage)

Districts	**Open Defecation (urban)**	**Open Defecation (rural)**
Agra	17.33	46.66
Kanpur	22.66	49.33
Ghaziabad	6.66	22.66
Meerut	12	26.66

Source: Authors' Calculation from Field Survey

To infer the status of stunting, underweight and wasting which is low height for age, low weight for age and low weight for height respectively, the calculation needs to be done in z-scores. This measures how much an individual value varies in reference to the median value. Table 3 highlights the status of health indicators across the sampled districts each of which is categorized in urban and rural areas. The table depicts that Agra tops the chart by having the highest percentage of stunted and wasted children both at moderate (between -2 and -3 standard deviations of the median) and severe (less than -3 standard deviations of the median) level. One of the plausible reasons for this could be the poor performance of the district in terms of sanitation practices. This will be catered in Table 4 which represents the causal link between sanitation practices and health.

Table 3: Status of Health Indicators in Selected Districts of Uttar Pradesh (N=600)

Status of Health Indicators (in Percentage)	**Ghaziabad**		**Meerut**		**Agra**		**Kanpur**	
	Rural	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**	**Rural**	**Urban**
Moderately Stunted	10.6	5.3	8	2.6	**40**	16	35	10.6
Severely Stunted	4	1.6	5.3	1.3	**22.6**	5.3	21.3	4
Moderately Underweight	8	2.6	6.6	1.3	17.3	9.3	**25.3**	12
Severely Underweight	6.6	1.3	2.6	1.3	13.3	3	**21.3**	2.6
Moderately Wasted	5.3	1.3	4	2.6	**30.6**	8	26.6	9.3
Severely Wasted	2.6	0	2.3	1.3	**10.6**	2.6	6.6	4

Source: Authors' Calculation from Field Survey

The results in Table 3 are supported by the Partnerships and Opportunities to Strengthen and Harmonize Actions for Nutrition in India (POSHAN)[2] report which portrays the disproportionate brunt of severe stunting and wasting in Agra.

To establish the linkage between sanitation and health indicators, it is crucial to run the binary probit regression. The reason for selecting this regression technique is mainly due to two reasons: Firstly, the data appears to be normally distributed with the Shapiro Wilk Test value of 0.87 which indicates normality. This is depicted in Table 4.

Table 4: Impact of Access to Sanitation Practices on Health Indicators (Stunting)

Test	Statistics	P-value
Shapiro-Wilk Test	0.87	0.79

Source: Authors' Calculation from Field Survey

The null hypothesis of normality will be accepted as the p-value exceeds the benchmark of 0.05 in this test. This shows that the data is normally distributed. Moreover, this implies that values are centred around the mean of the data and not on the extreme ends like in the logistic regression. Secondly, the dependent variable is binary, that is, having two categories mainly 0 and 1 for the major variables such as stunting, wasting and underweight. The former category indicates no stunting in a child and the latter category indicates that the child is stunted. This is represented in Table 5.

[2] This is a yearly survey conducted by the Bill and Melinda Gates Foundation whose underlying principle is to provide evidence-based decision making for nutrition.

Table 5: Impact of Access to Sanitation Practices on Health Indicators (Stunting)

Variables	Stunting
Access to Sanitation Practices	-3.584
Area	-5.793
Gender	4.871
Social Class	-2.341
Education	-6.892
Breastfeeding by mother	-3.765
Constant	3.456
R - Square	0.79
Adjusted R - Square	0.73
Observations	600

Source: Authors' Calculation

Similar coding is done for the wasting and underweight children of the selected districts of Uttar Pradesh. Table 4 shows that access to sanitation, area, social class, education and breastfeeding practices are negatively related with stunting. This implies an inverse relation of stunting with each of these variables. This holds true as per Spears (2020) where contextual factors such as place of residence, breastfeeding practices play a crucial role in negatively impacting the stunting amongst young children aged under five years of age.

V Conclusions and Policy Implications

Collating the findings using both the datasets indicate that sanitation acts as a primary determinant of nutritional status of children. Results from primary dataset depict that access to sanitation improves the anthropometric measures of stunting, wasting and underweight problems in children. These form an indispensable part of the cognitive development of children, especially who are in their initial phase of development (aged up to 5 years as capturedby the NFHS-5 dataset). The impact of sanitation varies greatly across area and education. One plausible reason for this could be their notions of purity which hinders the toilet construction in proximity to their respective place of residence. For the rural residents, however, the major reason could be the lack of awareness regarding the sanitation campaigns. Further, estimates from Sanitation, Quality,

Use, Access and Trends (SQUAT)[3] dataset enable us to delve deeper by analyzing the role of beliefs and social stigma associated with sanitation. Such norms play immense role in shaping thestereotypes about sanitation, thereby affecting the usage of clean water and toilet facility especially in a developing country like India. These beliefs associated with the toilet facility are found to improve the health of children highlighting their imperative role in arena of nutrition. Varying greatly across religion and area, such beliefs should not be overlooked while devising policies invoked in drawing linkages between sanitation and nutrition.

On the policy making front, in recent times. several government initiatives such as Swachh Bharat Mission incepted since 2014, has been successful in largely reducing open defecation. However, focusing merely on supply side and neglecting the demand side of sanitation will not enable us to achieve the long-term objectives in this arena. The key takeaway from the paper hinges on the finding that such national level campaigns are not tailor made to meet the requirements of people residing in areas with distinct socio-cultural norms and beliefs. Hence, incorporation of beliefs should be duly taken into consideration while assessing the complementarity between sanitation and nutrition. At the panchayat (local) level, initiatives such as conducting workshops to spread awareness regarding open defecation, displaying street play and films to showcase the inevitability of sanitation and hygiene in our daily lives. The Anganwadi workers should be encouraged to conduct weekly meetings so that good sanitation practices are instilled in people residing in urban areas. On the urban and semi-urban front, Indian cinema can play a dominant role in inculcating the cultural values by showcasing the ill effects of open defecation before premiering any movie inthe hall. This might capture the attention of people and have a long-lasting effect since visual representations are often easy to retain. Such initiatives adopted at national, state and local level which lays emphasis on the role of beliefs can help eradicating the problem of open defecation and thereby serves as an effective tool for the policymakers.

[3] This dataset is collected by the r.i.c.e institute for tackling the issue of sanitation in India.

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