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Effect of Hand-Washing Behavior on Children Health-Cost in Rural Bangladesh

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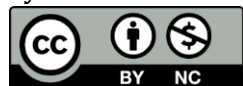
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ABSTRACT

Children's health status is an important issue in developing their physical and mental growth, which is somehow closely connected with behavior and the physical effects of other factors. Most of the parents and school authorities are not serious about children's health issues, which is a very common scenario in developing countries, that cause health-hazard. In this research, the authors try to find out the effect of child diseases and WTP for purchasing health-hygienic equipment on the health costs of children. Health-hazard is caused by several factors were living in an unhygienic environment, and malnutrition are the major factors in previous research. In this paper, the authors consider 300 primary school-going children who were affected in the year 2025, where a set of independent variables has been considered that affect the dependent variable. Firstly, from Models 1 and 2, it is highlighted that children's age, the educational level of children, households' monthly income, daily hand washing behavior, and freshwater supply act negatively on the number of diseases affecting children. Secondly, for Models 3 and 4, where ELC connects negatively with WTP for purchasing health-hygienic equipment. Moreover, parents' educational level, monthly income, and hand washing behavior act positively with WTP for purchasing health-hygienic equipment as well. Therefore, a child's disease and daily hand-washing behavior are negatively connected. School authorities and local government can play an effective role in enriching children's health status.

KEYWORDS

health cost, health-hazard, health-hygienic equipment, willingness to pay, hand-washing.



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Вплив гігієни миття рук на витрати з медичного обслуговування дітей у сільських районах Бангладеш

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Стан здоров'я дітей є важливим чинником їхнього фізичного та психічного розвитку, що тісно пов'язано з поведінковими особливостями та впливом різних зовнішніх факторів. Більшість батьків і шкільної адміністрації не приділяють належної уваги питанням дитячого здоров'я, що є поширеною ситуацією в країнах, що розвиваються, і призводить до виникнення ризиків для здоров'я. У цьому дослідженні автори намагаються з'ясувати вплив дитячих захворювань та готовності платити за придбання гігієнічного обладнання на витрати, пов'язані зі здоров'ям дітей. Загрози для здоров'я виникають через низку чинників, серед яких проживання в антисанітарних умовах і недоїдання, що вже було підтверджено попередніми дослідженнями. У статті розглянуто 300 учнів початкової школи, які хворіли протягом 2025 року, при цьому було використано набір незалежних змінних, що впливають на залежну змінну. По-перше, за результатами Моделей 1 і 2 встановлено, що вік дитини, рівень освіти дитини, місячний дохід домогосподарства, щоденна практика миття рук та наявність постачання чистої води мають обернений (негативний) зв'язок із кількістю випадків захворювань у дітей. По-друге, у Моделях 3 і 4 показано, що рівень освіти дитини має негативний зв'язок із готовністю платити за придбання гігієнічного обладнання. Водночас рівень освіти батьків, місячний дохід домогосподарства та щоденна практика миття рук позитивно пов'язані з готовністю платити за таке обладнання. Отже, ймовірність захворювань у дітей і щоденна практика миття рук мають обернений зв'язок. Шкільна адміністрація та органи місцевого самоврядування можуть відігравати важливу роль у покращенні стану здоров'я дітей.

КЛЮЧОВІ СЛОВА

витрати на охорону здоров'я, загрози для здоров'я, гігієнічні засоби для здоров'я, готовність платити, миття рук.

1. Introduction

Handwashing, as well as hand-hygienic training, is one of the emerging issues for health improvements and water-borne disease prevention in diarrhea and gastrointestinal infections in slum areas. According to the research of Chittleborough et al. [5], improper handwashing behavior of children, especially primary school-going children, is solely liable for illness and absence from primary school. In the papers by O'Reilly et al. [17] and Graves et al. [9], waterborne diseases are primarily responsible for the mortality issues of primary school-going children. This project is funded by the World Health Organization (WHO) [28]. However, most diarrheal infection is caused by bacteria, viruses, and protozoa in human beings spread from the instrument of one person to the mouth of another. Hands can turn into an effective factor for transmission of fecal pathogens, either via direct person-to-person communication or by food-contamination reported by Curtis et al. [7] and Vindigni et al. [27]. Human hands are one of the chief vehicles for transforming diarrheal and respiratory diseases, which are major issues for infant mortality and disease-affection. According to the additional research of Xuan et al. [30] and WHO [29], a global handwashing approach helps to reduce the probability of health disasters for children. WHO launches various kinds of projects to reduce the health concerns of parents. Halder et al. [10] define the importance of hand-washing day to reduce the probability of contracting various water-borne diseases.

2. Literature Review

Heijnen and Greenland [11] report the effectiveness of handwashing among children with soap interventions and varying training facilities. This paper suggests behavioral change among children to introduce the habit factor. This research mainly focuses on the primary school intervention programs for root-level, basically, it addresses the issues in lower and middle-income countries. This research focuses on this behavior that sustains for a minimum of 45 days and lasts 12 months. Jamieson et al. [13] suggest that handwashing with soap has been recommended to be the most cost-saving method of tackling the global infectious disease, as it helps to lessen morbidity and mortality from several major infectious illnesses, including diarrheal [19]. According to Luby et al. [14], Rabie et al. [18], and Aiello et al. [2], proper hand-washing behavior reduces the possibility to affect by water-borne diseases from school and outside the home. However, Curtis et al. [6] and Freeman et al. [8] mention that most of the children are affected by food preparation and child eating and feeding, as well as unsafe drinking water. This paper mentions that a healthy hand-washing habit helps reduce the effects of water-borne diseases. In developing countries, most of the children do not get training about proper handwashing techniques, that lead their health-diseases badly. Moreover, October 15 is Global Handwashing Day, where the soap and its importance has been taught globally to fight against water-borne diseases. In addition, COWASH introduces a bilateral project between the Governments of Ethiopia and Finland-government which is working on water supply, sanitation, and hygiene, aggressively encourages the importance of hand washing with soap as a mainstreamed activity. Research by UNICEF [25] mentions that three out of 10 people (about 2.3 billion) do not have good access to clean their hands properly, where 670 million children do not have proper access to wash their hands properly. Additionally, 700 children die every day from different diseases connected to unsafe water, sanitation, and hygiene. However, the researchers named Luby, et al. [14] and Pengpid and Peltzer Oyiboand Nicholson, et al. [16] mentioned that the proper usage of qualified soap can reduce the possibility of spreading bacterial and other diseases that affects health-cost on children. Heijnen and Greenland [11] mentioned the behavioral changing nature in local level, including education, community mobilization, or social marketing.

According to the USAID (2014), globally, nutrition plays a crucial role in the health and socioeconomic development of any country. Malnutrition accounts for about 35% of deaths among children under 5 years aged roughly the world. Stunting, intense wasting, and intrauterine growth deceleration are the major factors for child mortality, responsible for about 2 million deaths every year. Malnutrition is a major cause of morbidity for all age groups, accounting for 11% of the disease burden globally. It is reported that improper hand-washing techniques are a major cause of spreading water-borne diseases, especially diarrhea. Diarrhea causes due to living in a poor status, consuming waste water, eating date-over foods, using unhygienic sanitation, and living in damp areas. In African areas,

these problems cause health disasters for children. In Uganda, malnutrition causes stunting and wasting in children under the age of 5. Undernourished children are more prone to diarrhea, especially in situations where there is the lowest exercise in sanitation and hygiene [19; 20; 22; 25; 26]. According to the Uganda Demographic and Health Survey (UDHS 2011), about 38% of children aged 6–59 months, and about 36% of women aged 15–49 years are badly affected by vitamin A deficiencies. The report WB (2022) mentions that about 6% of children aged between 6–23 months are fed appropriately, based on the suggested infant and young child feeding (IYCF) practices for our parents. This is parental surveys for African countries. Moreover, about 49% of children aged 6-59 months are anemic, 22% are mildly anemic. On the other hand, Nicholson et al. [16] developed a paper based on a hand-washing intervention on health outcomes with school absence in Indian urban communities, where a group of researchers conducted a project on a school-based program. To conduct this research, 35 matched pairs are haphazardly collected for participation in the surveys. For each area, the researchers focused on starting 30 households, including one “target” child in the first standard of a municipal-level school. The Children were atypically aged 5, although a minority were 6 or 7 years old. From the research outcomes, it is observed that about 1026 target children that begins to each treatment, also 179 (17%) in the intervention group and 191 (19%) in the control were not move into the “per-protocol” synthesis. The bulk of non-completion was due to families either leaving the area or refusing to participate, 165/179 (92%) for intervention and 182/191 (95%) for control.

3. Problem Statement

In this research, the group of authors tries to find out the impact of some independent variables on dependent variables, which has two types. Firstly, the authors try to estimate the effect of primary school-going children’s hand washing behavior on the number of children’s diseases in the year 2025. Secondly, how the children’s hand-washing behavior influences their parents to purchase hand-hygienic equipment per month. When there are more family-members stay in the family, the cost behind hand-hygienic equipment gets much, and is highly dependent on the household’s family income per month.

4. Methods and Materials

According to the UNICEF (2023), the proper hand-washing techniques are evaluated through a program from effective monitoring and evaluation techniques. This program covers the full techniques and monitoring of the hand-washing behavior within the primary-level children. To conduct this research, the researchers conduct baseline pilot survey with data collection, FDI, and a questionnaire survey to measure their behavior to reduce health costs by proper hand-washing techniques for children. This survey conducts within households’ level whose children are studying between classes 1 to 5, mainly in primary school. Most of the primary schools do not provide appropriate training because most of the primary teachers are not well-trained to teach their students. To conduct this research, the authors and their team selects south western region of Bangladesh, where most of the children’s development projects are accelerated to ensure health benefits for children. To conduct this research, Narail district has been selected, where there are 3 Upzilas has been located, of which Narail Sadar has been selected. Within the Narail Sadar, four villages have been selected where 300 households with 300 children have been chosen who take primary level education from class 1 to class 5. For this research, the research team selected 6 villages named Mulia, Sahabad, Chandibarpur, Tularampur, Shaikhati, and Auria. has been selected to conduct this research. However, Alam [3] regards water-borne diseases costing for children living in slum areas, where the research team consider set of independent variables, adding some variables which affects dependent variables mostly. The authors consider two types of dependent variables. However, one portion is the number of affected diseases in 2025, and the other is the payment WTP from the households’ perspective. It is very important to reduce children’s diseases because spending on WTP helps ensure seriousness about hygienic issues. Some households are not willing to spend more on purchasing hygienic which denotes a negative sign for children. It is the primary duty of all parents to spend a handsome amount of money for hygienic purposes; children always depend on the decision-making capacity of households. According to the UNICEF report (2022), the average households of Bangladesh spends 2.70 USD monthly for purchasing hygienic requirements to reduce the possibility of infection.

Table 1. Variable List Identification of Independent Variables Affecting Dependent Variables

Model 1 (Dependent variable): Number of diseases affecting times in the year 2025				
Model 2 (Dependent variable): Household WTP value to purchase hygienic equipment per month				
Explanatory variables (Indicators)	Description of variables	Measurement unit	Expected Sign	Sources of Variables
Socio-economic Variables				
AGC	Children Age	In Years	+ or -	[3; 12]
SXC	Children Sex	IF male 1, female 0	+ or -	[21]
ELC	Children's Education Level	Class 1 to 5	+ or -	[18]
PEL	Parent Education	Years of Schooling	-	[1; 21]
LSC	Living Status of Children	In Years	+	[15]
MIH	Parent Monthly Income	In BDT	+ or -	[1]
FMH	Household family member	In Numbers	+ or -	[1]
HNC	Daily Hand-washing Numbers of Children	In Numbers	+ or -	[3; 4]
HTN	Household Handwashing NGOs Training	(= 1 if household respondent participated in any hygiene-related activities undertaken by NGO; 0 – otherwise)	+ or -	[24]
HTS	Children's Handwashing Training by the School	(= 1 if children get training on handwashing, 0 = Otherwise)	+ or -	[23]
RNT	Having Radio or TV	(= 1 if household owns a radio and television; otherwise – 0)	+ or -	[4]
FWA	Fresh Water Availability	(=1 if water from all sources is available for 24 hours; 0 – otherwise)	-	[3]
PLF	Pit latrine facility	(=1 if collection container is narrow-necked; otherwise – 0)	-	[14]
DCD	Doctor Consultancy During diseases	= 1 if the household consults with doctors, 0 = Otherwise	+ or -	[14]

Source: Author's Articulation based on Field Survey, 2026.

The authors try to estimate the effect of interdependent variables on two individual dependent variables, which covers the vital sides of this hand-washing project. The health status of every child depends on the hygienic steps of households; it's a very effective approach to ensure the health and safety of children. The authors measure some descriptive statistics regarding these projects.

Educational Status of Children

Educational Qualification is highly connected with health cost; when the parents and household are literate, it helps them to take immediate steps for preventive activities.

Table 2. Parental Educational Status of Children

Class Duration	Frequency	Percent (%)
Class 1	65	21.67
Class 2	45	15.00
Class 3	64	21.33
Class 4	72	24.00
Class 5	54	18.00
Total	300	100.00

Source: Author's Articulation based on Field Survey, 2025.

From the above table, it is analyzed that about 22% of students achieve class 1 level education, and 15% students achieve class 2 level education. Total 300 students have been selected purposely for this hand washing project.

Income Structure of Households

Income is the most heavyweight variable that helps to affect the dependent variable mostly; income-generating activities help households to make important decision-making activities.

From the above table, it is justified that about 11% of households earn an average of BDT 8,250 per month, where the minimum income is BDT 7,500, and the maximum income is BDT 10,000. Secondly, about 10% of households earn BDT 23,000 on average, the minimum income is BDT 21,500, and the maximum income is BDT 25,000 for this group. Moreover, about 7% of households earn BDT

43,000 on average in this group; the minimum income is BDT 41,500 BDT and the maximum income is 44,500 BDT in this research. When the households earn a satisfactory level, they will enhance to spend some portion for child health care.

Table 3. Household Family Income Scenario (Monthly Income in BDT)

Income Category (BDT)	Frequency	Percent (%)	Average Income	Minimum Income	Maximum Income
Below 10,000	32	10.66	8,250	7,500	10,000
10,000-15,000	42	14.00	13500	11,000	14,500
15,001-20,000	36	12.00	17,500	16,000	20,000
20,001-25,000	29	9.66	23,000	21,500	25,000
25,001-30,000	42	14.00	28,000	25,500	29,500
30,001-35,000	38	12.67	32,000	30,000	35,000
35,001-40,000	36	12.00	37,500	36,000	40,000
40,001-45,000	20	6.67	43,000	41,500	44,500
Above 45,000	25	8.33	48,000	46,000	57,000
Total	300	100.00			

Source: Author's Articulation based on Field Survey, 2025

Professional Status of Households

The research conducts in rural-areas in Bangladesh, most of the households are not serious about the hygienic issues, it is one of the alarming issues for health-disaster.

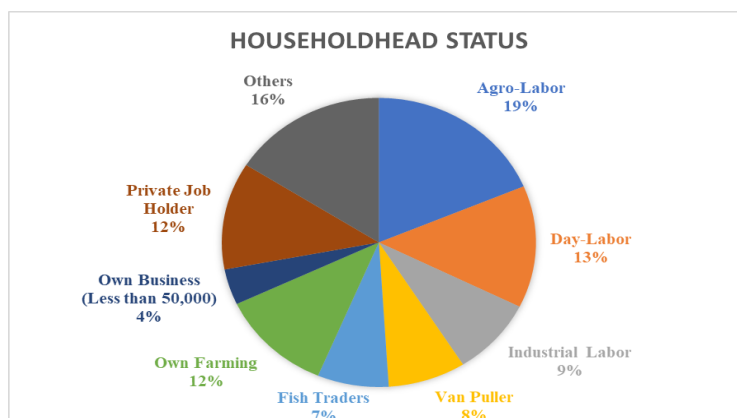


Figure 1. Status of Household Head

Source: Author's Articulation based on Field Survey, 2025.

Health status is solely connected with hygienic factors; the consciousness of parents does matter for this issue. The research is conducted from door to door, so the information about households affects the research objectives effectively. From the above figure, it is estimated that mostly 19% of households are agricultural-labor, and about 12% households are involved in their own farming where both paddy and livestock are engaged in these issues. Thirdly, only 7% households are involved in fish trading, and 4% of the households have their own invested business. The status and income level of households create an effective hygienic factor. Additionally, 13% of households are involved with a day laborer. Household status is solely connected with creating consciousness among health-hygienic issues; the health-hygienic instruments are not so much costly, but parents are not serious about cleanliness and other issues.

Households' WTP for Purchasing Health-hygienic Equipment's

Most of the households are not serious about paying WTP that is essential for health-hygienic factors. WTP is the dependent variable in this research, which is affected by most of the independent variables. From the above figure, it is seen that about 21% households are willing to pay between BDT 701 and 900 per month to ensure hygienic behavior, that help to lessen health costs for their family. Secondly, about 18% households spend between 101 to 300 to purchase basic equipment. Additionally, only 8% households are willing to spend more than 1000 BDT per month because they are the most serious group among this panel. According to Jahangir (2010), most of the households are not serious to pay handsome amount for ensuring health-hygienic issues, so the reference level is (BDT 575 to USD

5) to ensure health-hygienic issues. When the households agree to pay this amount, it indicates Yes means 1, otherwise 0.

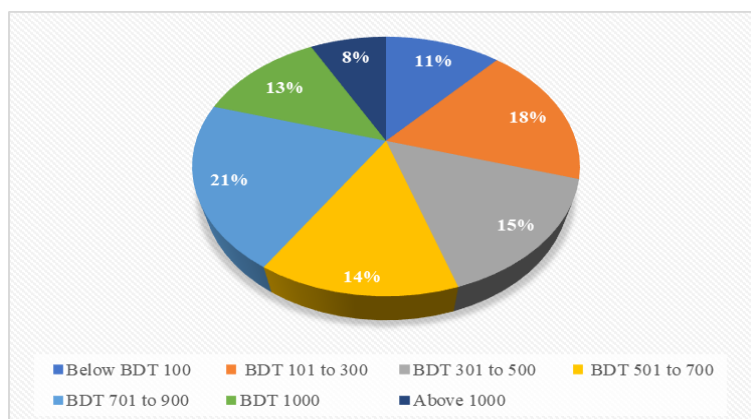


Figure 2. Monthly Household WTP for Health-Hygienic Equipment's

Source: Author's Articulation based on Field Survey, 2025.

Table 4. Research Result of Children's Diseases Affecting Numbers and Household Willingness to Pay to Purchase Health-hygienic Equipment affected by Independent Variables, Dependent Variables

Symbols	Children Affecting Number of Diseases (CDAN)		Household Willingness to Pay to purchase Health-hygienic Equipment Per Monthly (WTPHH)	
	Model 01: Poisson Regression Model (PR)	Model 02: Marginal Effect of Passion Model (MPR)	Model 03: WTP Logit Model (WTPLM)	Model 04: Marginal Effect of WTPLM
AGC	-3.075*	-1.079*	-0.055	-0.097
SXC	3.007	0.782	0.009	0.165
ELC	-2.877**	1.072**	-0.387*	0.929*
PEL	-1.9788	-1.005	1.912**	1.017**
LSC	0.0312	0.4007	-0.0398	-0.985
MIH	-2.069*	-1.089*	1.026*	1.003*
FMH	-0.215	-0.1136	0.372	0.269
HNC	-2.065**	-1.789**	0.243**	0.988**
HTN	-2.98	-1.94	-0.506	-0.006
HTS	0.098	0.478	0.036	0.019
RNT	-0.165	-1.89	0.045*	-0.069*
FWA	-2.265**	-1.894**	-0.169	-0.132
PLF	1.003	0.336	1.984	1.456
DCD	-0.126	-0.653	0.568	0.698
PLF	1.198	1.067	0.158	0.174
Constant	-0.065		0.000	
Observations	282		288	
Log Likelihood Ratio	-28.08		-36.56	
Probability > chi2	0.045		-16.97	
Pseudo R ²	0.039		0.465	

Note: Standard errors in parentheses *** p < 0.01, ** p < 0.05, * p < 0.1.

Source: Author's Articulation based on Field Survey, 2026.

5. Results and Discussion

From Table 2 (Models 1 and 2), it is observed that the AGC (children's age) is negatively connected with the number of children's diseases affecting numbers, which is statistically significant at 10% level. When the children's age level increases with every year, the probability of their diseases affecting them will increase significantly. Secondly, this research has been conducted by classes 1 to 5. When a child overcomes every class, it will create some level of consciousness among them to lessen the probability. It is statistically significant at 5% level. Thirdly, the monthly income of a household has a negative connection with child affecting numbers, when the household earns more, that will create a greater health need. It is statistically significant at 10% level. Fourthly, HTN (Daily Hand-washing Numbers of

Children) has a negative connectivity with child disease numbers. When children wash their hands with proper guidance and sincerity, it helps to lessen diseases, and it is statistically significant at 10% level. Fifthly, freshwater supply plays an effective role in lessening the possibility of diseases; freshwater affect positively on diminishing diseases. It is statistically significant at 5% level.

From Table 2 (Models 3 and 4), it is observed that the ELC (children's educational status) is negatively connected with WTP for health-hygienic equipment that is statistically significant at 10% level. Secondly, PEL (Parent Educational Level) has a positive connection for WTP for purchasing health-hygienic equipment that is statistically significant at 5% level. Additionally, thirdly, HTN (Daily Hand-washing Numbers of Children) has positive connectivity with WTP. When children wash their hands with proper guidance and sincerity, it will emphasis their parents to purchase health-hygienic equipment, it is statistically significant at 10% level. Fourthly, when households are connected with media from Radio and TV, it will help to purchase more health-hygienic equipment for children. It is statistically significant at 10% level.

6. Conclusions

Child health maintenance is the biggest and most challenging issues which is somehow dependent on the school authority and family-education. Most of the families in the rural region are not serious about child health, that cause health hazards for children. Most of the NGOs and influencing association should have taken responsibility to create seriousness among parents, it is a painful truth that their activities are not satisfactory and impinging for lower level.

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