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Estimation and Analysis of Infant and Child Mortality in the whole of Bangladesh and Divisional Districts of Bangladesh

M. S. Hossain[1], M. K. Ali[2] and M. R. Islam[3]

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Authors and affiliations

[1]Md. Sabbir Hossain, Assistant Professor (Mathematics), Department of Business Administration, Bangladesh Islami University, Dhaka, E-mail: drmdsabbirhossain@gmail.com

[2]M. Korban Ali, Professor (Retired), Department of Statistics, University of Rajshahi, Bangladesh, E-mail: Korban48@yahoo.com

[3]Md. Rafiqul Islam, Professor, Department of Population Science and Human Resource Development, University of Rajshahi, Bangladesh, E-mail: rafique_pops@yahoo.com

Corresponding Author: Dr. Md. Sabbir Hossain

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ABSTRACT

Infant and child mortality rates are good indicators to show the scenario of health and nutritional status of the children of any country or region. Infant and child mortality in the whole of Bangladesh and divisional districts of Bangladesh estimated and identified the level of health of infants and children. The Orphanhood Method used the distribution of the female population by age in the whole of Bangladesh in 2011, and for eight divisional districts of Bangladesh such as Barisal, Chittagong, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur, and Sylhet collected from the Bangladesh Bureau of Statistics to fulfill the objective of the study. This study also used children everborn and surviving classified by age of the female population of Bangladesh in 2011. Results showed that the mortality rate was almost increasing with the age of the child, but high at all ages. The estimated infant mortality rate is 5.08% for the whole of Bangladesh, 4.07% for Barisal, 4.99% for Chittagong, 4.96% for Dhaka, 4.96% for Khulna, 4.95% for Mymensingh, 4.93% for Rajshahi, 4.92% for Rangpur, and 5.05% for Sylhet district of Bangladesh. Results also showed that there was no significant difference in infant and child mortality rates of the whole of Bangladesh and divisional districts of Bangladesh at ages 1, 2, 3, and 5 years. The government, non-government organizations, and policymakers should design effective and sustainable programs to reduce infant and child mortality rates in Bangladesh and to achieve the target of Sustainable Development goal 3 of World Health Organization.

Keywords: *Infant Mortality, Child Mortality, Child Health, Health Policy*

1. INTRODUCTION

Infant mortality is very high in Bangladesh compared to other countries. Although it is clear that neonatal and under-five child mortality has decreased gradually during the last two and half decades (Rajia et al. 2019). Mortality of Infants and children in Bangladesh is influenced by factors such as age at first marriage, age at first birth, birth interval, place of residence, administrative division, religion, education of parents, body mass index, gender of child,

children ever born, exposure to media, wealth index, birth order, occupation of mother, toilet facility (Rahman et al., 2021). A lot of factors like household income, education level of the mother, sanitation facilities, and maternal health also play a major role in reducing infant and child mortality (Rahmana et al., 2020). Institutional delivery, antenatal care, birth size, child sex, and wealth index also play an important role in reducing infant mortality in Bangladesh (Vijay & Patel, 2020). Maternal education helps strongly to reduce mortality rates of infants and children in Bangladesh (Wu, 2022). It has been studied that the first birth of a young mother faces higher mortality rates (Trommlerova, 2020). Every year about one million children are born in a short interval and a short birth interval is another important factor for child mortality in Bangladesh (Islam et al., 2023). A study on child mortality in Bangladesh focuses on pneumonia with other serious infections, birth asphyxia, prematurity, and low-birth-weight are the main causes for about half of all child deaths among children under the age of five years (Rahman et al., 2021). Preceding birth interval, the mother's age at first birth, and the mother's education and poor socioeconomic strata are important factors of infant mortality (Paul et al., 2022). Infant mortality is one of the leading public health problem issues all over the world and this problem is even on dangerous situation in low-income countries like Bangladesh. Estimation of mortality rates of infants and children of divisional districts of Bangladesh will be an advantage for taking proper steps based on the mortality rates of divisional districts for reducing mortality. Many studies conducted on mortality in the whole of Bangladesh (Hossain et al., 2024; Hossain et al., 2023; Hossain & Islam, 2013; Islam et al, 2016; Islam et al, 2014; Islam & Hossain, 2015; Islam & Hossain, 2014; Islam & Hossain, 2014a; Islam & Hossain, 2013; Islam & Hossain, 2013a). In this study, the estimated parameters provide information on the level of mortality of infants and children of the whole of Bangladesh as well as the divisional districts of Bangladesh. Therefore, the fundamental objective of this study is to estimate and analysis of the mortality of infants and children in Bangladesh as well as divisional districts of Bangladesh in the census year 2011.

2. Data and Data Source

Secondary data of children everborn and surviving classified by age of female population have been used for the estimation of infant and child mortality of the whole Bangladesh and divisional districts of Bangladesh such as Barisal, Chittagong, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur and Sylhet. The distribution of the female population by age of

Bangladesh in 2011 has been taken from the Statistical Year Book of Bangladesh 2014 (Bangladesh Bureau of Statistics, 2016a, 2016b, 2017, 2018, 2019, 2020, 2021 & 2022). Children everborn and surviving classified by age of the female population of Bangladesh in 2011 are also taken from Population and Housing Census 2011, National Report: Volume-4 (Bangladesh Bureau of Statistics, 2015). To fulfill the above objective, the distribution of female population by age of divisional districts of Bangladesh in 2011 have been taken from Population and Housing Census 2011, Zila Report: Barisal; Chittagong; Dhaka; Khulna; Mymensingh; Rajshahi; Rangpur and Sylhet (Bangladesh Bureau of Statistics, 2015a, 2015b, 2015c, 2015d, 2015e, 2015f, 2015g & 2015h). Above mentioned data have been presented in Table 1 to Table 3.

Table 1: Population, Children Everborn and Children Died Classified by Age of Female Population of Bangladesh in 2011

Age	Female	Children Everborn	Children Died	Proportion	
				Children Surviving	Children Dead
15-19	6352398	698791	34758	0.9503	0.0497
20-24	7522419	5827632	357875	0.9434	0.0659
25-29	7254256	10017541	675290	0.9335	0.0586
30-34	5420658	12060312	960180	0.9227	0.0814
35-39	4859078	12280928	1192055	0.9092	0.0838
40-44	3980739	11819909	1364514	0.8848	0.1161
45-49	3016800	11314469	1497648	0.8676	0.1324

Table 2: Population, Smoothed Children Everborn and Children Died Classified by Age of Female Population of Barisal, Chittagong, Dhaka and Khulna District of Bangladesh in 2011

Age	Barisal					Chittagong				
	Female	Smoothed		Proportion		Female	Smoothed		Proportion	
		Children Everborn	Children Died	Children Surviving	Children Dead		Children Everborn	Children Died	Children Surviving	Children Dead
15-19	105712	11629	476	0.9591	0.0409	426764	46946	2335	0.9503	0.0497
20-24	108704	86239	5214	0.9395	0.0605	440818	327036	19765	0.9396	0.0604
25-29	106166	151247	10187	0.9326	0.0674	387644	530954	35959	0.9323	0.0677
30-34	86082	189135	15050	0.9204	0.0796	275246	607794	49301	0.9189	0.0811
35-39	79116	200132	19287	0.9036	0.0964	244341	602702	59189	0.9018	0.0982
40-44	65158	199362	22860	0.8853	0.1147	188544	571182	66022	0.8844	0.1156
45-49	53049	198960	26233	0.8682	0.1318	143877	539609	16089	0.8676	0.0263
		Dhaka					Khulna			
15-19	594981	65450	3256	0.9503	0.0497	101088	11120	551	0.9505	0.0495

20-24	760883	561384	34120	0.9392	0.0608	124092	96251	5908	0.9386	0.0614
25-29	686325	905934	61455	0.9322	0.0678	118352	167955	11367	0.9323	0.0677
30-34	463673	1013478	81461	0.9196	0.0804	94133	207064	16532	0.9202	0.0798
35-39	383586	984338	94129	0.9044	0.0956	85254	215816	20911	0.9031	0.0969
40-44	295195	900121	101176	0.8876	0.1124	70087	211903	24423	0.8847	0.1153
45-49	211485	793172	104989	0.8676	0.1324	55449	207961	27525	0.8676	0.1324

Table 3: Population, Smoothed Children Everborn and Children Died Classified by Age of Female Population of Mymensingh, Rajshahi, Rangpur and Sylhet District of Bangladesh in 2011

Age	Mymensingh					Rajshahi				
	Female	Smoothed		Proportion		Female	Smoothed		Proportion	
		Children Everborn	Children Died	Children Surviving	Children Dead		Children Everborn	Children Died	Children Surviving	Children Dead
15-19	194694	21417	1065	0.9503	0.0497	109392	12034	599	0.9502	0.0498
20-24	242714	187541	11603	0.9381	0.0619	140042	111922	6869	0.9386	0.0614
25-29	234790	327254	22239	0.9320	0.0680	139618	197644	13368	0.9324	0.0676
30-34	180438	401323	32308	0.9195	0.0805	110811	243129	19596	0.9194	0.0806
35-39	163226	416595	41043	0.9015	0.0985	102616	249976	24652	0.9014	0.0986
40-44	141415	409159	47779	0.8832	0.1168	82032	240053	27927	0.8837	0.1163
45-49	105643	396213	52785	0.8668	0.1332	109392	12034	599	0.9502	0.0498
	Rangpur					Sylhet				
15-19	110805	12189	606	0.9503	0.0497	211806	23300	1159	0.9503	0.0497
20-24	146839	115552	7189	0.9378	0.0622	181173	142806	8760	0.9387	0.0613
25-29	148091	202824	13803	0.9319	0.0681	163388	248896	17003	0.9317	0.0683
30-34	111366	249494	19957	0.9200	0.0800	152307	313068	24609	0.9214	0.0786
35-39	102971	259859	25243	0.9029	0.0971	115937	330815	30611	0.9075	0.0925
40-44	84922	256544	29652	0.8844	0.1156	101609	326181	36187	0.8891	0.1109
45-49	67758	254125	33638	0.8676	0.1324	211806	23300	1159	0.9503	0.0497

3. METHODS AND METHODOLOGICAL ISSUES

3.1 Data Calculating and Smoothing

Children everborn and children who died after birth in divisional districts of Bangladesh have been calculated and shown in Table 2 and Table 3 by using the data: female population, children everborn, children who died after birth in Bangladesh, and female population of Bangladesh by age in the census year 2011. In this study, it is observed that there are some kinds of unpredicted distortions in the data if children everborn and children who died after birth in divisional districts of Bangladesh are placed on graph paper. Therefore, an adjustment is important and needed to minimize these unpredicted distortions. In this situation, children everborn and children who died after birth by age of the female population

of Barisal, Chittagong, Dhaka, Khulna, Mymensingh, Rajshahi, Rangpur, and Sylhet districts are smoothened using the Package Minitab Release 12.1 by smoothing technique "4253H, twice" (Velleman, 1980). These smoothed data are also presented in Table 2 and Table 3. After that, the smoothed data have been used to estimate infant and childhood mortality.

3.2 Orphanhood Method

Average number of children everborn, proportion of children surviving and dead have been calculated by using the number of children everborn and the number of children surviving by age of female population.The mean age of child bearing is given by

$$m = 2.25\frac{p_3}{p_2} + 23.95$$

where, P_2 and P_3 are the average number of children everborn to women of aged 20-24 years and 25-29 years respectively (United Nations, 1967). The set of Brass Multipliers have been estimated corresponding to m by linear interpolation technique. Then probabilities of dying q(x) from birth to age x, where x=1, 2, 3 and 5 obtained by multiplying proportion of children dead and corresponding Brass multipliers.

4. RESULTS AND DISCUSSION

The probability of dying of children by age in Bangladesh and Divisional Districts of Bangladesh in 2011 is estimated and presented in Table 4. The estimated mortality rate of infants is 05.08% of whole Bangladesh, 04.07% for Barisal, 04.99% for Chittagong, 04.96% for Dhaka, 04.96% for Khulna, 04.95% for Mymensingh, 04.93% for Rajshahi, 04.92% for Rangpur and 05.05% for Sylhet. It is also calculated that the mortality rate of children at age 5 years is 08.24%of whole Bangladesh, 08.01% for Barisal, 08.17% for Chittagong, 08.09% for Dhaka, 08.04% for Khulna, 08.10% for Mymensingh, 08.10% for Rajshahi, 08.04% for Rangpur and 07.09% for Sylhet. It is seen that the mortality rate of children in Bangladesh in 2011 at the age of 5 shows the highest value, 08.24%. After plotting the above-mentioned values of the divisional districts of Bangladesh in Figure 1, it is also seen thatat age 1 the lowest mortality rate is 04.07% for Barisal and the highest for Sylhet is 05.05%, whereas at the age of 5, the lowest mortality rate is 07.94% for Sylhet and the highest rate is 08.17% for Chittagong. The mortality rate may increase continuously with the age of the child. But very high mortality rate was observed for children at the age of 5 years compared to the earlier age

of children for the whole of Bangladesh and divisional districts of Bangladesh in 2011. It is a challenge for Bangladesh to achieve the targets of Sustainable Development Goal 3 (SDG 3) by reducing neonatal mortality to 12 and under-five mortality to 25 deaths per 1000 live births by 2030 for healthy lives for all ages (Targets of Sustainable Development Goal 3, n.d.).

Table 4: Probability of Dying of Children by Age of Bangladesh and Divisional Districts of Bangladesh in 2011

Age	Bangladesh	Barisal	Chittagong	Dhaka	Khulna	Mymensingh	Rajshahi	Rangpur	Sylhet
1	0.0508	0.0407	0.0499	0.0496	0.0496	0.0495	0.0493	0.0492	0.0505
2	0.0681	0.0617	0.0618	0.0620	0.0628	0.0631	0.0624	0.0632	0.0632
3	0.0590	0.0673	0.0678	0.0678	0.0678	0.0679	0.0675	0.0679	0.0686
5	0.0824	0.0801	0.0817	0.0809	0.0804	0.0810	0.0810	0.0804	0.0794

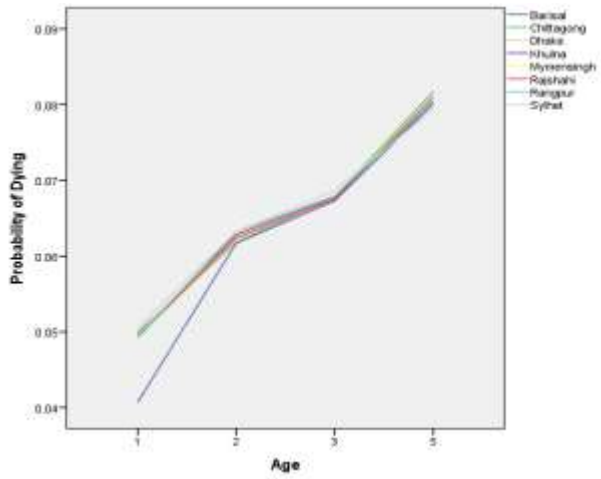

Figure 1: The Graph of Estimated Probability of Dying of Children of Divisional Districts of Bangladesh in 2011. X Axis Represents Age and Y Axis Represents Probability of Dying

5. Conclusion

The mortality rate of infants and children is one of the important factors of nutritional and health level of children. There was no notable difference in the mortality rates of infants and children in the whole of Bangladesh and the divisional districts of Bangladesh in 2011. The mortality rate is almost increasing with the age of children but shows a high rate at the age of 5 years for both the whole Bangladesh and divisional districts of Bangladesh, and these are

alarming for child health. The highest mortality rate is observed for Sylhet at age of 1 and for Chittagong at age of 5 years. The government, policymakers, and non-government organizations should take Proper, strong, and sustainable steps such as increasing education awareness, confirmation of immunization programs, assuring proper home care, appropriate feeding of infants and children, improving healthcare facilities, and providing programs that are effective for whole Bangladesh as well as extra attention for Sylhet and Chittagong to achieve the target goals of SDG 3 by the year 2030. Research organizations or individual researchers may use mortality rate at ages 1, 2, 3, and 5 for linking to adult mortality for the population of Bangladesh as well as divisional districts of Bangladesh, and another step may take to estimate and analyze infant and child mortality of Bangladesh for all districts of Bangladesh.

Declaration of Conflicting Interests

The author declared no potential conflicts of interest concerning the research, authorship, and/or publication of this article.

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Ethics Statement

This study used secondary data sources (Bangladesh Bureau of Statistics). No intervention or experiment was associated with this report. Bangladesh Bureau of Statistics obtained ethical approval from the Government of Bangladesh. In addition, the authority obtained informed consent from respondents before the interview.

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