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INVESTIGATION ON PREDICTING FAMILY PLANNING AND WOMEN'S AND CHILDREN'S HEALTH EFFECTS ON BANGLADESH BY CONDUCTING AGE STRUCTURE POPULATION MODEL

Rezaul Karim[1] , M. A. Bkar Pk[2], Md. Asaduzzaman[3], Pinakee Dey[4] M. Ali Akbar[5]

[1,4] Department of Mathematics, Faculty of Science, Mawlana Bhashani Science and Technology University, Tangail-1902, Bangladesh.

[1,2,5] Department of Applied Mathematics, Faculty of Science, Rajshahi University, Bangladesh.

[3] Department of CSE, R.P. Shaha University, Narayanganj.

[4] Department of Mathematics, Faculty of Science, Mawlana Bhashani Science and Technology University, Tangail-1902, Bangladesh.

[5] Department of Applied Mathematics, Faculty of Science, Rajshahi University, Bangladesh.

Email: **:** [1]rezaul.math@mbstu.ac.bd, [2]pkbakar@gmail.com, [3]mdasaduzzaman5566@gmail.com, [4]pinakeedey68@gmail.com, [5]ali_math74@yahoo.com

Corresponding Author: **Rezaul Karim**

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Abstract

Bangladesh has a higher population density than most other nations in the world. This project aims to evaluate the effects of experimental family planning and maternal and child health. Bangladesh saw changes in the use of contraceptives, the continuation of contraception, fertility, and infant and child mortality between 2012 and 2022. The project's current goal is to guarantee improved family health. To satisfy the changing needs and priorities of families and to provide better health for all, this paper has proposed several novel initiatives, such as enhanced health and family planning services, and enhancing maternal and child health. The goal of this project is to improve the health of women and children through family planning using an age-structured population model. It also covers the graphical presentation of the data using programs like Matlab, Mathematica, Excel, and others.

Keywords: Population Model, Sharpe-Lotka model, Gurtin MacCamy model, family planning, women's and child's health.

I. Introduction

Bangladesh has seen a significant drop in reproduction despite widespread poverty, underdevelopment, and the lack of factors thought to be required for a change in reproductive patterns. Several health measures, including life expectancy and newborn and child mortality, have also improved. "Total fertility in Bangladesh" decreased from almost six deliveries per woman in 2001 to roughly 3.3 in 2022—a half-decade in just 2022.The capacity to organize and implement these services has improved as a consequence of operational research in family planning and maternal-child health. Fredrick et al. [XII] have explored the Royal Kingdoms of Ghana, Mali, and Songhay Life in Mediaeval Africa. The fertility transition in Bangladesh has been described by Islam et al. [XIX] as Understanding the role of the proximate determinants of fertility. The use of family planning and the drop in birthrate in developing nations were also discussed by Lapham, R. J., & Mauldin, W. P. [XXIV]. Numerous health metrics have also improved, such as life expectancy and infant and newborn mortality. "Total fertility in Bangladesh" dropped from almost six births per woman in 2001 to roughly 3.3 in 2022—a half-birth decline in just two years. The majority of families in the whole country have access to family planning services that are widely available, affordable, and effective, as well as information, education, and communication. Operational research initiatives in family planning and maternal-child health have made it possible to better plan and execute these services. According to Kamal et al. [XXII], the following factors influence reproductive change in Bangladesh: Achievement in a demanding setting. The need for more affordable and long-lasting services has grown as a result of the national program's maturing, Bangladesh's population growth at a rapid pace, rising demand for family planning and other health Services, and dwindling chances for sustained support from foreign donors. When someone plans their family, they take into account the number of children they want, whether they want children at all, and according to we can use our paper [XXVIII]-[XXXIV].Abassian et.al. [I] have described five different perspectives on mathematical modeling in mathematics education. When they want them. Financial circumstances, career or work considerations, and marital status are some factors that may influence family planning decisions. If a person is sexually active, family planning may entail using contraception and other methods to manage when they conceive. Karim et al. [XXIII] used the Malthusian, Sharpe-Lotka, and Gurtin Mac-Camy models to study population projections for Bangladesh in the future. The Djenné people of West Africa have used family planning since the 16th century when doctors recommended women to space out their pregnancies by three years. Family planning encompasses not only contraception but also sex education, managing infertility, overseeing pre-conception counseling, and managing and preventing sexually transmitted infections. Preconception services are included in family planning, as per the United Nations and the World Health Organization. It is generally not advised to use abortion as your main method of family planning. The rate of contraceptive prevalence has already surpassed 50%. Bangladeshi women today give birth to only 2.3 children on average, down from 6.3 in the mid-1970s. Over 50% of married couples who are of reproductive age have access to modern contraception, up from just 8% in the early 1970s.From 150 newborn deaths per 1000 live births in 1973 to 94 in 1991, 47 by 2007 [XXX], and 43 in 2011, the infant

mortality rate had been steadily declining. Meanwhile, the under-five mortality rate decreased from approximately 260 deaths per 1000 live births to just 53 during the same period. Abayasekara [II] and Abeykoon [III] have also conducted surveys that show how a nation's population growth and composition are critical components of its economic system and policy. Fernando & N. Sri Lanka's [XIII] have described demographic conditions and associations for Asian Population and Development. J. D et al [24] have expanded interdisciplinary mathematical biology sciences. A study by Müller et al. [26] estimated methods for Distributed Parameter Systems, while a study by PRAYTNO et al. [XXXV] identified the use of Graph Thinking in Naturally Solving Mathematical Problems. Evaluations of extensions to coherent mortality forecasting models have been conducted by Shair et al. [XXXVII]. A generalization of the Logistic Law of Growth is Turner et al. [XXXIX] have expanded a Generalization of the Logistic Law of Growth and discussed forecasts in population. The proportion of 12-month-old children immunized increased from 54% in 1990 to 82.5% in 2011, and the country is expected to be polio-free in the near future. The analysis and projection of Bangladesh's future population using the logistic growth model has been explained by Ullah et al. [XL].Cleland et.al.[IX] have explained the Contraception and Health.Mitra et.al.[XXVI] stated that the Bangladesh Demographic and Health Survey. The Age-structured Population Model with Cannibalism has been described by El-Doma, M. [XI]. Barham [XLIII] has found the effects of family planning and child health interventions on adolescent cognitive functioning and Sastry, N. [XXXVI] expands the importance of international demographic research for the United States. Terano [XXXVIII] has analyzed mathematical models of population dynamics applied to Philippine population growth. Fred Brauer [XIV] has obtained nonlinear age-dependent Population growth under harvesting and F.R. Sharpe and A.J. Lotka. L [XV] has described a problem in age distribution. This essay aims to investigate the connection between family planning and women's and children's health using an age-structured population model. The purpose of this paper is

- To decrease fertility and limit population increase
- To denigrate early marriages
- To reduce the rate of newborn mortality
- To enhance women's health.

II. Methods and materials

(a) Age Structure Sharpe-Lotka Model

Let x (t, a) represent the age distribution or population density at time t relative to age. Let, $\nu(a)$ = an age-dependent birth rate.
$\mu(a)$ = An age-dependent death rate.

$\mu(a)\ x(t,a)\ dt$ = Number of the population of age a that dies in the small increment of time dt.

$x(t,a)\ \Delta a$ = Number of individuals with age between a and $a + \Delta a$ at time$t$.
$\sum x(t,a) = total\ population\ at\ time\ t$.
$\sum$x(t, a)Δa $\rightarrow \int_0^\infty x(t,a)da$ as Δa $\rightarrow$ 0

$\therefore x(t) = x(t,a)da$is the total population.

$$\therefore x(t+\Delta t, a+\Delta t)\Delta a \approx x(t,a)\Delta a - x(t,a)\mu(a)\Delta a\Delta t \quad (1)$$

Dividing (1) by Δa Δt, we get

$$\frac{x(t+\Delta t,a+\Delta t)\Delta a}{\Delta a\Delta t} - \frac{x(t,a)\Delta a}{\Delta a\Delta t} + \frac{x(t,a)\mu(a)\Delta a\Delta t}{\Delta a\Delta t} = 0$$

$$\Longrightarrow \frac{x(t+\Delta t,a+\Delta t)}{\Delta t} - \frac{x(t+\Delta t,a+\Delta t)}{\Delta t} + x(t,a)\mu(a) = 0 \Longrightarrow \frac{x(t+\Delta t,a+\Delta t)-x(t,a)}{\Delta t} + x(t,a)\mu(a) = 0 \quad (2)$$

Let Δt → 0 and x(t, a) is a differentiable function of a and t , then we have

$$\lim_{\Delta t\to 0} \frac{x(t+\Delta t,a+\Delta t)-x(t,a)}{\Delta t}$$

$$= \lim_{\Delta t\to 0} \frac{x(t+\Delta t,a+\Delta t)-x(t+\Delta t,a)}{\Delta t} + \lim_{\Delta t\to 0} \frac{x(t+\Delta t,a)-x(t,a)}{\Delta t}$$

$$= \lim_{\Delta t\to 0} x_a(t+\Delta t,a) + x_t(t,a)$$

$$= x_a(t,a) + x_t(t,a)$$

$$= \frac{\partial x(t,a)}{\partial a} + \frac{\partial x(t,a)}{\partial t}$$

$$= D_e x(t,a)$$

Where $D_e x(t,a)$ is a directional derivative of$x$.

$$\therefore D_e x(t,a) = \frac{\partial x}{\partial a} + \frac{\partial x}{\partial t}$$

Now from (2) we have

$$D_e x(t,a) + (x(t,a)\mu(a) = 0$$

$$\Longrightarrow x_a(t,a) + x_t(t,a)\mu(a) = 0 \quad (3)$$

which is known as the Foerster equation and more rapidly called the Mc Kendrick equation. Equation (3) is a first-order partial differential equation which requires condition on $x(t,a)$ in t and a.

(b) Gurtin-MacCamy model: Basic Equations:

In 1974, M.E. Gurtin and R.C. MacCamy presented a more practical version of a nonlinear, continuous, age-dependent, deterministic population model.

$$\frac{\partial x(a,t)}{\partial a} + \frac{\partial x(a,t)}{\partial t} + \mu\big(a,P(t)\big)x(a,t) = 0, \quad a> 0, t > 0$$

$$x(0,t) = \int_0^\infty v\big(a,p(t)\big)x(a,t)da, \quad t \geq 0$$

$$x(a,0) = \varphi(a), \quad a \geq 0$$

$$P(t) = \int_0^\infty x(a,t)da, \quad t \geq 0$$

In this model, we describe the dynamics of a biological population, closed to migratory movements, involving two independent variables a and t ($a\geq 0, -\infty < t < \infty$) which represent age and time respectively measured in the same unit and the following nonnegative functions:

a. the total population size function P(t)
b. the total birth rate function B(t)
c. the age-density function x (a, t)
d. the natality function ν (a, t, P), P ≥0
e. the mortality function μ(a, t, P) P ≥0
f. the initial age distribution function φ (a)

Regarding these functions, the following observations are in order.

(1) $x\ (a\ ,t\ )$ is the population of age a at time$t$. Therefore sum of the population at time t is

$$P(t) = \int_0^\infty x(a,t)da \tag{4}$$

and $B\ (t) =\ x(0,t)$; the number of new-born at time t is

(2) $B(t) = \int_0^\infty v\big(a,tP(t)\big)x(a,t)da, \qquad t > 0$ (5)

where

$\nu(a,t,P)$ is the average number of children born to an individual of age a at time t when the total population is P and $\nu(a,t,P(t))x(a,t)dadt$ is the number of offspring produced between the times t and $t +\ dt$ by individuals with ages between a and $a +\ da$.

(3) $\mu(a,t,P)$is the death rate of the population of age an at time t when the total population is P. Thus $\mu(a,t,P(t))x(a,t)dadt$ is the number of individuals with ages between a and $a +\ da$ who die between the times t and $t +\ dt$.

(4) For any infinitesimal age-increment da, the number of individuals which are in the age category $[a + da\ ]$ at time t is equal to $(a,t\ )da$. In a small time increment Δt, the age of each individual is increased by Δt

Consequently, $x\ (a + \Delta t, t + \Delta t)da - x(a,t)da$, represents the net loss of individuals in the age category $[a, a + da\ ]$ during the time interval $[t\ , t + \Delta t\ ]$. Since there is no migration, this loss is entirely due to death, and thus

$$[x(a + \Delta t, t + \Delta t) - x(a,t)]da =\ \mu(a,t,P(t))x(a,t)da\Delta t$$

Or, $[x(a + \Delta t, t + \Delta t) - x(a,t) + \mu\big(a,t,P(t)\big)x(a,t)\Delta t]da = 0$

Dividing both sides by $da\Delta t$,

$$\frac{x(a + \Delta t, t + \Delta t)}{\Delta t} - \frac{x(a,t)}{\Delta t} + \mu\big(a,t,P(t)\big)x(a,t) = 0$$

$$or, \frac{x(a+\Delta t,t+\Delta t)-x(a,t)}{\Delta t} + \mu(a,t,P9t))x(a,t) = 0 \tag{6}$$

Let $\Delta t \to 0$ and $x(a,t)$ is differentiable function of $a$and t , then we have

$$\lim_{\Delta t\to 0} \frac{x(a + \Delta t, t + \Delta t) - x(a,t)}{\Delta t}$$

$$\lim_{\Delta t\to 0} \frac{x(a + \Delta t, t + \Delta t) - x(a, t + \Delta t)}{\Delta t} + \lim_{\Delta t\to 0} \frac{x(a, t + \Delta t) - x(a,t)}{\Delta t}$$

$$= \lim_{\Delta t\to 0} x_a\ (a, t + \Delta t) - x_t(a,t)$$

$$= x_a(a,t) - x_t(a,t)$$

$$= \frac{\partial x(a,t)}{\partial a} + \frac{\partial x(a,t)}{\partial t}$$
$$= Dx(a,t)$$

So

$$Dx(a,t) = \lim_{\Delta t \to 0} \frac{x(a+\Delta t, t+\Delta t) - x(a,t)}{\Delta t} \quad exists.$$

So from equation (6),

$$Dx(a,t) = -\mu\big(a,t,P(t)\big)x(a,t)$$

Thus

$$x(0,t)[S(a,t;P)S\big((a+\Delta a,t;P)\big] = -x(0,t)S(a,t;P)\mu(a,t;P(t+a)\Delta a$$

$$or\ \frac{S(a,t;P) - S(a+\Delta a,t;P)}{\Delta a} = -S(a,t;P)\mu(a,t+a,P(t+a)$$

Taking limit as Δa→ 0 on L.H.S we have,

$$\lim_{\Delta a \to 0} \frac{S(a,t;P) - S(a+\Delta a,t;P)}{\Delta a} = -S(a,t;P)\mu\big(a,t;P(t+a)\big)$$

$$or, S_a(a,t;P) = -\mu\big(a,t+a,P(t+a)\big)S(a,t;P)$$

$$where, S_a = \frac{\partial S}{\partial a} \quad , \quad since\ S(0,t;P) = 1, \quad this\ yields$$

$$S(a,t;P) = \exp\{-\int_t^{t+a} \mu\big(\tau - t, \tau, P(\tau)\big)d\tau\}$$

Now, let $\prod(a,t;\ P)$represents the probability that an individual will survive to age a at time t.Then

$$\Pi(a,t;P) = S(a,t-a;P) = \exp\{-\int_{t-a}^{t} \mu\big(\tau - t + a, \tau, P(\tau)\big)d\tau\}$$

(born at time t–a) Then λ(a, t; P) is the conditional probability of survival to age a at time t, given the survival to age a – t time 0 and hence

$$\lambda(a,t;P) = \frac{\Pi(a,t;P)}{\Pi(a-t,0;P)}\exp\{-\int_0^t \mu\big(\tau + t + a, \tau, P(\tau)\big)d\tau\}$$

Thus we have,

$$P(t) = \int_0^t B(t-a)\prod(a,t;P)da + \int_t^{\infty} \varphi(a-t)\lambda(a,t;P)da$$
$$= \int_0^t \Lambda(a,:P)B(a)da + \int_0^{\infty} \Gamma(a,t;P)\varphi(a)da$$

$$B(t) = \int_0^t \nu\big(a,t;P(t)\big)B(t-a)\Pi(a,t;P)da + \int_t^\infty \nu\big(a,t;P(t)\big)\varphi(a-t)\lambda(a,t;P)\varphi(a-t)da$$

$$= \int_0^t \nu\big(t-a,t;P(T)\big)\Lambda(a,t;P)B(a)da + \int_0^\infty \nu\big(t+a,t;P(t)\big)\Gamma(a,t;P)\varphi(a)da$$

$$where\ \Lambda(a,t;P) = \Pi(t-a,t;P) = \exp\{-\int_a^t \mu(\tau-a,\tau,P(\tau)d\tau\}$$

and $\Gamma(a,t;P) = \lambda(t+a,t;P) = \exp\{-\int_0^t \mu\big(\tau+a,\tau,P(\tau)\big)d\tau$

Over the past few decades, Bangladesh has made notable progress in lowering population growth and enhancing the health of mothers and children. The total fertility rate (TFR) dropped from 6.3 births per woman in 1975 to 3.4 in 1994 and finally to 2.3 in 2011 [VII] -[VIII]. This is a promising development. Early marital age: Of women between 20 and 49 years old, 23.8% were married before turning 18, and 62% of these women were married before turning 18 [XXXI]. The use of TFR and contraception is not increasing. The prevalence of contraception is 62% in the nation, although there are notable regional variations, with the eastern and western regions of Bangladesh having substantially lower CPRs. Teenage marriage contributes to a high teenage fertility rate because married teenagers have significantly lower CPR than other age groups.

Table 1: Use of birth control method in Bangladesh, 1975-2022[XXX]

Year	Percentage
1975	8
1990	31
2000	54
2011	61
2022	62

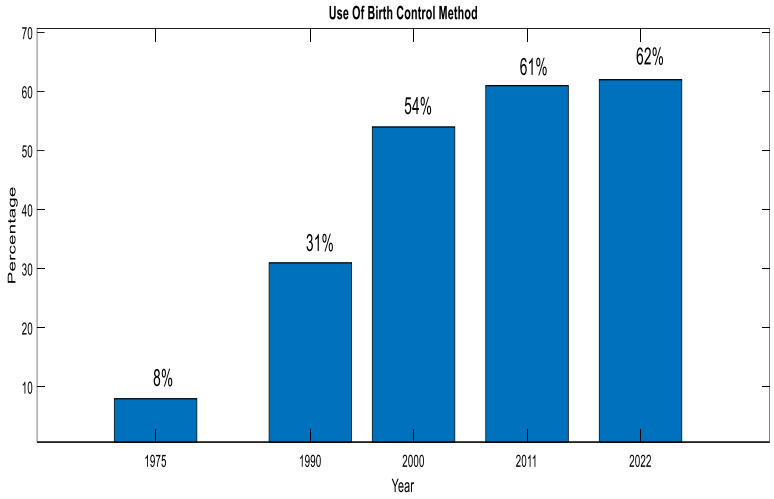

Fig. 1. Use of birth control method

Table 1 demonstrates that although the use of contraceptives did not increase in 2022, it did from 1975 to 2011. In 1975–1990, it was 8%–31%, and from 2011–2022, it was 61%–62% **(Figure 1).**

Oral contraceptive pills, implants, injectables, condoms, intrauterine devices (IUDs), tubectomy, vasectomy, and fertility awareness-based methods are among the contraceptive methods.
These techniques differ in their effectiveness and mode of action for avoiding unplanned pregnancies. An indicator of a method's efficacy is the number of pregnancies per 100 women who use it each year.

Table 2: Use of percentage of contraceptive methods in Bangladesh in 2022. [XXXIV]

Method		Use of percentage
Modern method	pill	25
	IUD	1
	Injection	11
	condom	7
	Tubectomy	5
	Vasectomy	1
	Implant	2
Old method		10
Total		62

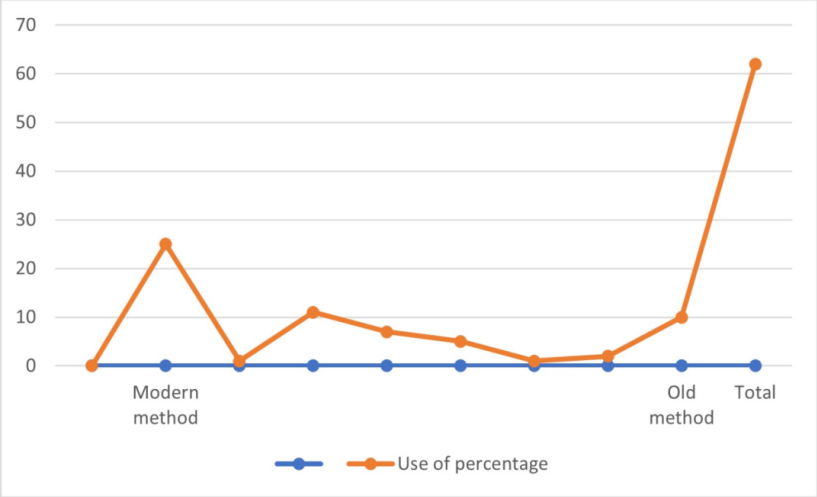

Fig. 2. Use of the percentage of family planning method

The Bangladesh Demographic and Health Survey (BDHS) claims that 62% of newlywed women in Bangladesh between the ages of 15 and 49 use contraceptives, with 54% using more contemporary methods. The percentage of people using contraceptives has risen dramatically from 8% in 1975 to 62% in 2022.

III. Contraceptive use of dynamics

The precise causes of the stabilization of contraceptive use in any nation cannot be determined. Three elements of the dynamics of contraceptive use determine the level of CPR:

(1) The extent to which contraceptive services are needed or demanded.
(2) Finding new people to accept contraception and
(3) Using the method for the full duration.

These three variables determine the increase in CPR. The frequency of interactions between FWAs and MWRA, along with initiatives pertaining to proper client screening, counselling, and side effect management,made it probable that the number of people quitting pills, injectables, and IUDs would have decreased and the average length of use would have increased.

Economic circumstances, maternal education, gender preference, and religion were found to be associated with the use of contraceptives, among other socioeconomic and cultural factors. Compared to uneducated women, women with primary or higher education use contraceptives at higher rates. In contrast to uneducated women, who tended to use injectables and permanent methods, educated women preferred pills, condoms, and traditional methods. Women residing in households with cultivable land used contraceptives at significantly lower rates than those in households without such land. Muslims were less likely than Hindus to use permanent methods or traditional methods. Adoption of contraceptives was positively impacted by both the husband and wife's approval of family planning; however, the women's approval was more significant for the adoption of temporary than permanent methods.

IV. Fertility

In Bangladesh, fertility was high in the earlier ages. The total fertility rate (TFR) was over 6.4 and 4.1 births per woman between 1983 and 1989. From roughly 4.1 in 1983–1993 to 2.7 in 1993–1995, the TFR decreased and seems to have stabilized at that point. In 1993, the ideal family size was greater than 3.0, and it has since somewhat decreased. Programs have the potential to increase the use of contraceptives.

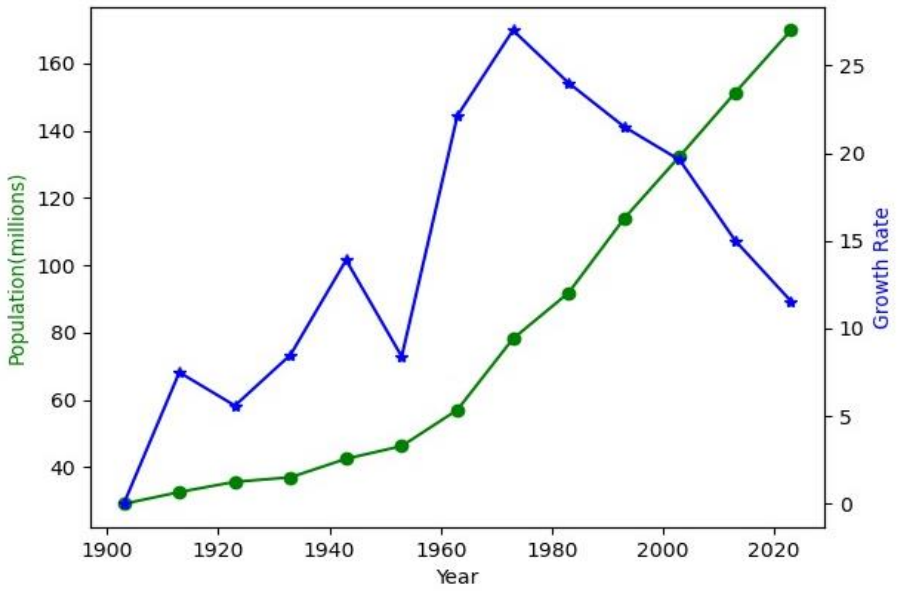

Fig. 3. The overall population (measured in millions) and the population growth rate (%). [X], [XXX].

Before it started to decline in the 1990s, the population growth rate was over 2%; by the 2010s, it was just over 1%. **(Figure 3).** Reducing rates of growth in population began to take place in the 1990s, mainly due to a sharp decline in fertility and a steady but gradual increase in the number of deaths. Bangladesh's rapid decline in fertility was attributed by most researchers to an efficient family planning program because the nation's socioeconomic conditions did not considerably improve during the study period [XVI] [XVII]. Because of the population's youthful age distribution, growth is anticipated to continue over the next few years even though the growth rate has been steadily declining. In just two short decades, the nation's total fertility rate (TFR) dropped precipitously as well, from 6.3 births per woman in the middle of the 1970s to 3.3 births per woman in the early 1990s (a decrease of three births per woman, or 48% of the TFR). [VII], [XXXI].

Table 3: Population size, TFR, CPR, growth rate in Bangladesh, 1903-2023. [VII]

Year	Population size(millions)	(TFR)	(CPR)	Growth rate
1903	29.04	4.043	0.75	
1913	32.56	4.621	3.56	7.5
1923	35.6	5.001	5.87	5.6
1933	36.94	5.213	7.56	8.5
1943	42.45	6.012	8.01	13.9
1953	46.23	6.359	8.73	8.4
1963	56.98	6.804	10	22.12
1973	78.13	6.91	12	27
1983	91.78	5.977	20	24
1993	113.87	4.061	40	21.5
2003	132.41	2.936	38	19.6
2013	151.34	2.212	42	15
2023	169.84	1.93	35	11.56

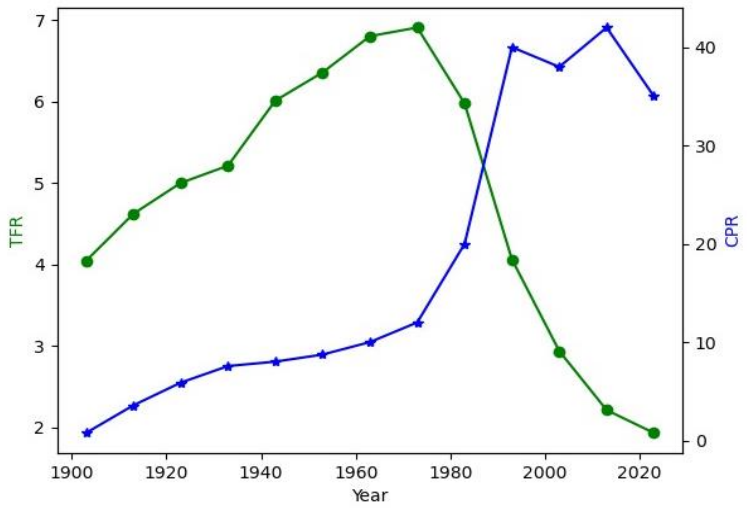

Fig. 4. Total fertility rate (TFR) and contraceptive prevalence rate (CPR) in Bangladesh. [X] [XLIII]

However, throughout the 1990s, the TFR stayed steady at roughly 3.3 births per woman, even though the use of contraception continued to rise (**Figure 4).** The TFR began to decline once more in the early 2000s following a decade of stasis, peaking at 2.7 births per woman in 2007 and 2.3 births in 2011. Nonetheless, the infant mortality rate has declined, going from 87 baby deaths per 1000 live births in 1993–1994 to 43 in 2011 [XLII]. There was a downward trend in the rates of overall mortality, under-five mortality, infant mortality, and child mortality. As a result, the average life expectancy at birth has also increased, from 55 years in 1981 to 68 years in 2011.

[XXXIV]. Additionally, from 2.5% in 1974 to 1.4% in 2011, the population growth rates decreased. A common pattern for demographic transition was the decline in fertility following the drop in mortality. However, Bangladesh's population has changed due to two time-separated factors that have accelerated population growth. It appeared that Bangladesh's demographic transition was still in the pre-transitional stage until the 1960s, based on data shown in Table 3. When Bangladesh started the first stage of demographic change in the 1960s, it saw a sharp decline in mortality; however, until the 1980s, there was a moderate decline in birth rates. It was around 1980 that Bangladesh saw the beginning of the second phase of its demographic transition as the fertility rate began to fall more quickly. The third phase of Bangladesh's population transition is just beginning.

Table 4: Modern contraceptive use and need for all women.[XLI], [XXXII] and [XLVIII]

Year	Total users of modern contraceptive method	Modern contraceptive prevalence rate (mCP)	Percentage of women estimated to unmet need for modern cotraceptive method	Percentage of women estimated to have their demand with a modern contraceptive method
2012	17930000	43.50%	17.40%	71.40%
2013	18650000	44.30%	16.90%	72.40%
2014	19130000	44.60%	16.70%	72.70%
2015	19540000	44.70%	16.80%	72.70%
2016	19880000	44.60%	16.80%	72.70%
2017	20030000	44.20%	17%	72.10%
2018	20570000	44.70%	16.80%	72.60%
2019	21110000	45.20%	16.50%	73.30%
2020	21590000	45.60%	16.30%	73.60%
2021	22080000	46.60%	16.20%	73.90%
2022	22510000	46.40%	16.10%	74.20%

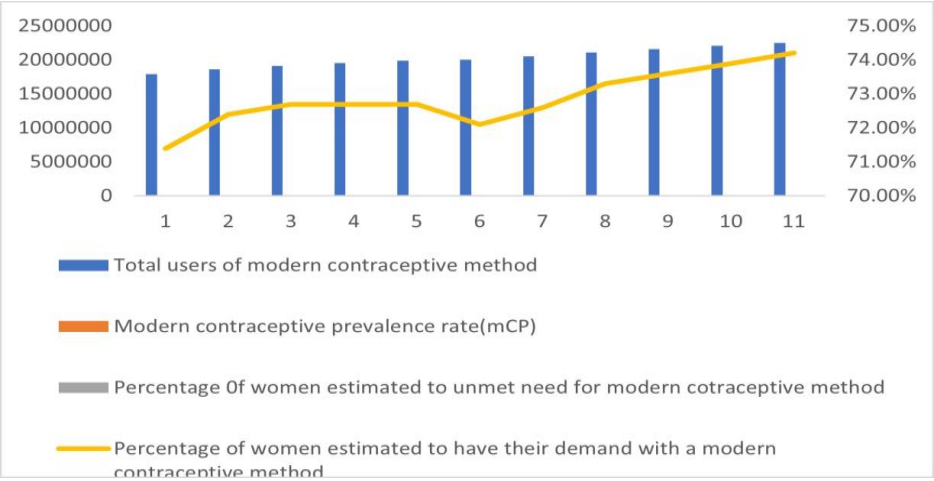

Fig. 5. Modern contraception needs for all women.

A rise in the overall number of modern contraceptive users, the prevalence rate of modern methods, and the proportion of women whose family planning needs are satisfied by modern methods (mDS and mUN), respectively, are all shown in Table 4. The percentage of women who do not meet their need for modern methods of contraception is declining, as seen in **Figure 5.**

Table 5: Impacts of modern contraceptive use among all women.[XXXVII]

Year	Number of unintended pregnancies averted due to modern contraceptive use	Number of unsafe abortions averted due to modern contraceptive use	Number of maternal deaths averted due to modern contraceptive use
2012	6490000	3415000	8100
2013	6750000	3552000	8400
2014	6930000	3643000	8700
2015	7080000	3721000	8800
2016	7200000	3785000	9000
2017	7250000	3815000	9100
2018	7450000	3918000	9300
2019	7650000	4021000	9600
2020	7820000	4112000	9800
2021	8000000	4206000	10000
2022	8150000	4287000	10000

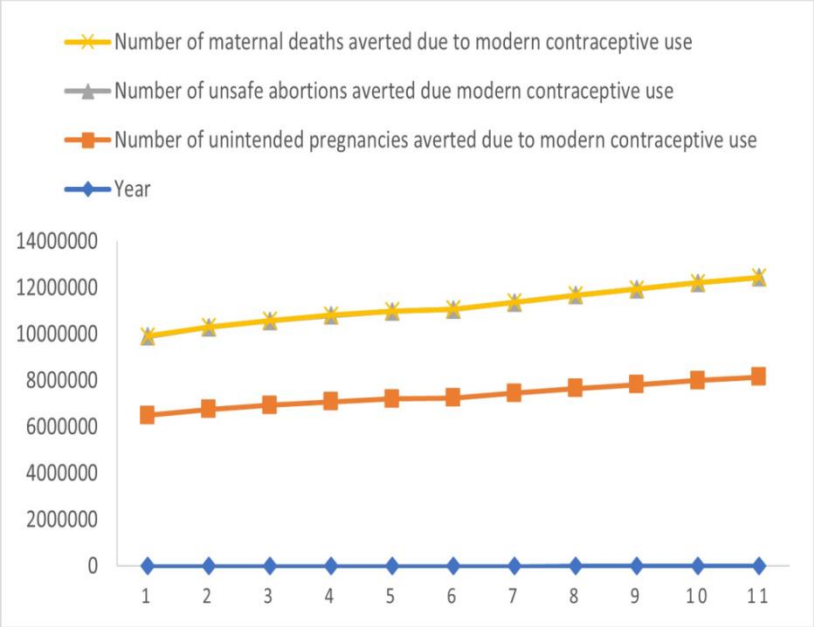

Fig. 6. Effects of all women using modern contraceptives.

By lowering unwanted pregnancies, abortions, pregnancy-related morbidity, and pregnancy-related mortality, contraception helps people and families control their fertility (WHO-2014). It has been noted that in low- and middle-income countries, women over 35 use contraception. Even though over 95% of people are aware of contraception, the DHS survey and other studies found that the percentage of unintended pregnancies rose with age and was highest among women between the ages of 35 and 49.

V. Infant and Child Mortities

More Effective maternal and child health services have coincided with the expected improvement in infant and child health linked to the decrease in fertility brought about by the use of contraceptives. In actuality, infant and child mortality has significantly decreased. When fertility and the use of contraceptives were being designed. Consequently, research on the decline in infant and child mortality over one-year intervals has not been feasible. Figure 7 displays annual trends in infant and child mortality. However, rather than falling, Bangladesh's infant mortality rate fluctuated to 150, which was a relatively high rate. In contrast, child mortality in Bangladesh dropped sharply in the early 1980s, from more than 30 per 1,000 to about 20 per 1,000 in the early 1990s. But in the early 1980s, it was low—just over 10 per 1,000—and it gradually decreased to about 6-7 per 1,000 in the early 1990s. Figure 7, a baby death toll of approximately 125 per Additionally, the project helped the local health programme organize EPI activities and obtain ORS and other supplies in the event of a diarrhea epidemic or other disaster, such as flooding. It is extremely challenging to lower neonatal mortality.

Table 6: Women aged 15-39 years old and over by age group and children died after birth, 2022[XXXIX]

Age	Number of Children	Children died after birth						
		Total	%	Bangladesh	Sharpe-Lotka model	Gurtin-MacCamy model	Error of Sharpe-Lotka	Error of Gurtin-MacCamy
15-19	6208871	34958	0.598	0.92	0.893	1.369	0.02	0.02
20-24	6813990	347515	4.95	19.6	23.97	27.569	0.739	0.897
25-29	7957607	787016	13.13	174.39	176.1	186.56	5.455	6.01
30-34	5507978	913809	19.96	680.63	789.8	865.46	26.38	28.2
35-39	5272599	1490484	28.55	1890.6	2408	3503.8	75.35	113.49

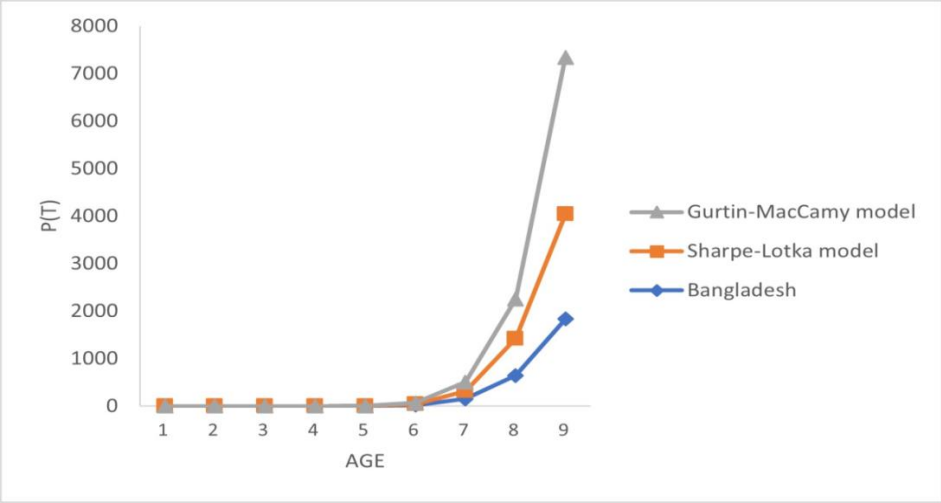

Fig. 7. Children died after birth and women in the age group of 15 to 39 years old.

Table 7: Group deaths in the last 12 months among the population aged 5 to 34 years and over by residence, age, and sex decreased 2022. [XLI], [XLIII].

Age	Total	Bangladesh	Sharpe-lotka model	Gurtin-MacCamy model	Error of Sharpe lotka model	Error of Gurtin-MacCamy model
5-9	1442584	0.1	0.289	0.293	0.13	0.019
10-14	1234660	2.416	3.526	3.786	0.03	0.04
15-19	86231	15.976	18.678	21.197	0.27	0.29
20-24	759194	36.136	48.71	49.814	0.57	0.59
25-29	749029	85.834	138.74	145.16	1.3	1.4
30-34	596816	225.56	418.14	453.26	4.3	4.3

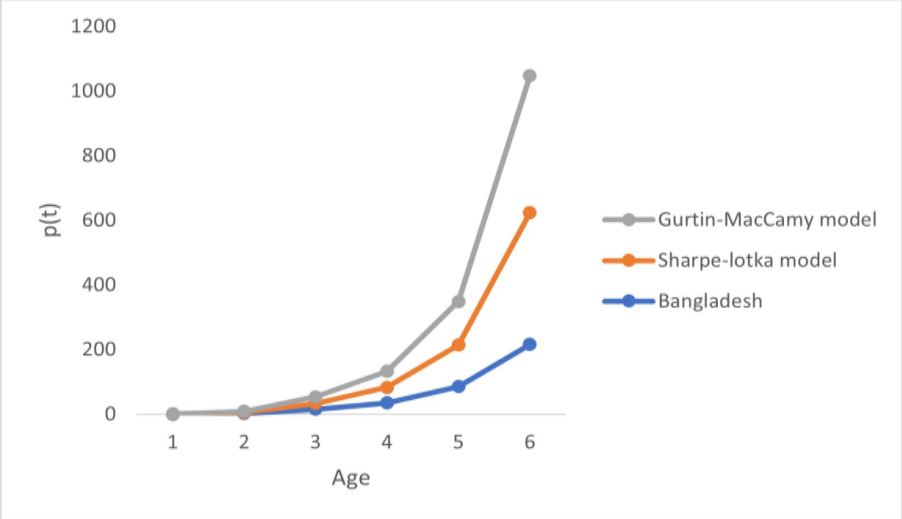

Fig. 8. Deaths in the age group of 5–34 years old and over during the past 12 months

Table 8: Maternal deaths 12 months prior to the survey by age and residence, 2022. [XVII]

Age	Total women	Total maternal deaths	Per capita maternal deaths in Bangladesh	Sharpe - Lotka model	Gurtin MacCamy model	Error of Sharpe -Lotka model	Error of Gurtin-MacCamy model
10-14	7734517	295	0.0045	0.0051	0.0046	0.0003	0.0004
15-19	6108871	1080	0.0196	0.0742	0.1254	0.008	0.0087
20-24	6613990	1215	0.0389	0.2363	0.2783	0.034	0.03
25-29	6957607	1050	0.0156	0.5974	0.647	0.0735	0.0824
30-34	5107978	470	0.0102	1.1711	1.114	0.214	0.245
35-39	5072599	1230	0.0459	8.134	7.987	0.904	0.912

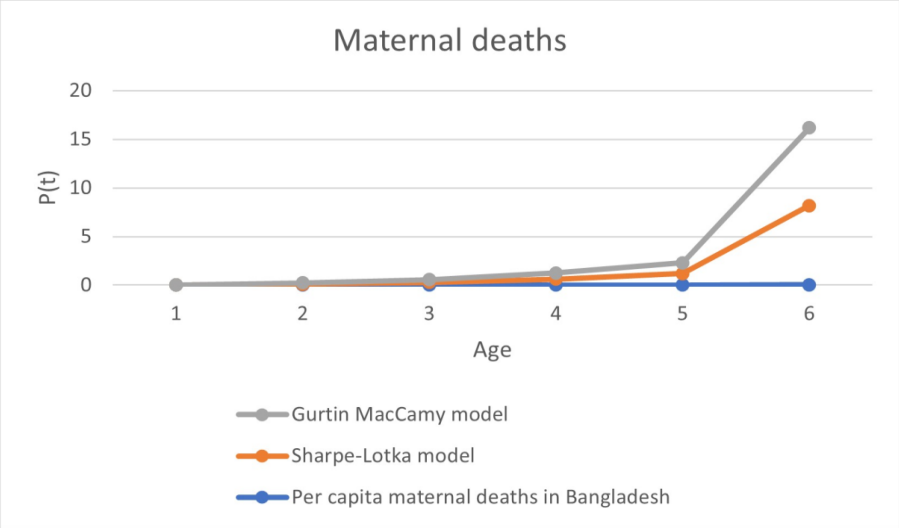

Fig. 9. Maternal deaths by age and place of residence 12 months before the survey, 2022.

The important relationship between the Bangladesh population curve and the Gurtin-MacCamy and Sharpe-Lotka models is depicted in **Figure 5**. The population curves do not cross over. The Bangladesh $P(t)$ curve is less exponential than the Gurtin-MacCamy and Sharpe-Lotka model $P(t)$ curves. Thus, the Gurtin-MacCamy and Sharpe-Lotka models provide some closure to Bangladesh's population growth process. Here Figure 6 represents the impacts of modern contraceptive use among all women and Figure 7 represents Women aged 15-39 years and over by age group and children who died after birth. Also, this article represents the population aged 5-34 years and over by age group deaths in the last 12 months, and **Figure- 9** represents maternal deaths 12 months before the survey by age and residence, 2022.

VI. Enhancing the health of expectant mothers and newborns and enhancing child nutrition

Reproductive health's main objective is to improve the health of expectant mothers and their offspring. Comprehensive EOC services will be phased in by the 1CDDDR.B MCH-FP Extension Project (Rural), and the project is dedicated to providing technical support for this process. The Project aims to further strengthen referrals and links from the local level to the various levels of service providers and facilities based on the lessons learned from the EOC intervention. Low birth weight is one of the primary causes of perinatal and neonatal morbidity and mortality in Bangladesh.

As part of its Nutrition Intervention, this paper aims to lower the incidence of low birth weight and malnutrition in children under two years old. The goals will be attained with the support of increased food intake during pregnancy, breastfeeding, health education, and child growth monitoring.

VII. Result and Discussion

We cover a range of family planning topics in this study, such as managing contraceptive supplies, preventing infections, and providing counselling. Bangladesh's sociodemographic landscape is evolving quickly. **Table 3 shows that**, in less than a generation, fertility has decreased by half; child survival has improved, leading to notable increases in life expectancy; and the prevalence of contraception has increased, rising from approximately 7% in 1975 to over 49% in 1996–97. The final results of these Project interventions will impact other efforts and future service plans to sustain family planning and health in the nation.

VIII. Conclusion.

In conclusion, the enormous amount of interventions addressing family planning and the sustainability of health care is heartening. They imply that interventions aimed at increasing the use of cluster spots, fixed-site, service centers, and combined health and family planning services from a single location offer affordable alternatives to the current community-based delivery of MCH and family planning services at the doorstep by fieldworkers, without having a negative impact on CPR. It has also been found that formal valuing structures and systems for collecting fees for services are both feasible and acceptable and that the majority of people are willing to pay for family planning and health services.

However, it is appropriate to make sure that any established cost recovery system includes a safety net of free services for the underprivileged. Contraception receives insufficient funding and investment almost everywhere. The state should not only fulfill its legal duties under human rights standards, but also make sure that the rights to sexual and reproductive health are respected, safeguarded, and realized. A thorough and scientific education on sex should also be a part of the curricula.

Conflict of Interest:

The author declares that there was no conflict of interest regarding this paper.

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