Title

***'Exploring the Risk Factors and Prevention Strategies of Infertility for Both Men and Women in Bangladesh*: A literature Review'**

A thesis submitted in partial fulfilment of the requirement for the degree of
Master of Science in Public Health and Health Equity

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Declaration:

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The thesis '***Exploring the Risk Factors and Prevention Strategies of Infertility for Both Men and Women in Bangladesh*: A literature Review'** is my own work.

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Abstract

Background

Infertility is a public health issue in Bangladesh which has profound social, economic and psychological consequences. Despite about 3 million couples are experiencing infertility in Bangladesh, currently hardly any attention present for prevention of infertility in relation to preventable issues and access to fertility care is limited due to high costs, social stigma, and limited availability of treatment.

Objective

To explore the risk factors, current prevention strategies in Bangladesh and best practices from neighbouring countries for infertility prevention to provide evidence-informed recommendations for policymakers to improve infertility prevention and care in Bangladesh.

Method

This thesis is a comprehensive document and literature review was conducted of available peer reviewed, national, and grey data published in 2015-2025 using the Infertility Prevention Conceptual framework.

Result

Risk factors of infertility in Bangladesh for both men and women are lack of fertility education, malnutrition, tobacco consumption, high STI prevalence due to limited condom use, inadequate access to preconception and infertility care. High prevalence of teenage pregnancy, unsafe abortions, and home deliveries without skilled birth attendants increase the risk of secondary infertility. Although some indirect prevention strategies exist, they have not been fully effective in reducing infertility risk factors. There are some best practises from other countries such as policy, fertility education, preconception care which has better outcome on infertility prevention, fertility awareness and reduction of risky behaviour.

Conclusion and recommendations

By making infertility a public health priority, Bangladesh can adopt direct prevention strategies and best practices from other countries (like policy, fertility education, preconception care, access to fertility care) which has better outcomes for infertility prevention.

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Glossary

Infertility: WHO definition; infertility is a disease of the male or female reproductive system defined by the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse (1).
Infertility can be classified as primary or secondary
Primary infertility: Primary infertility refers to the inability to achieve pregnancy at all (1)
Secondary infertility- Secondary infertility occurs when a person has previously been pregnant but is unable to conceive again (1)
Fertility care: Interventions involving fertility awareness, support, and management aim to help individuals and couples achieve their reproductive goals and build a family. (2).
Optimal age of pregnancy-The optimal age to start achieving pregnancy is considered between early 20s and early 30s.

MR- MR is a procedure that uses manual vacuum aspiration or a combination of mifepristone and misoprostol to "regulate the menstrual cycle when menstruation is absent for a short duration." and allowed up to 10–12 weeks after a woman's last menstrual period. MR is a method of establishing non-pregnancy for a woman at risk of pregnancy, whether or not she actually is pregnant" (Bangladesh Institute of law and International Affairs, 1979) (3).

Dilation and curettage (D&C)- A common surgical procedure for managing incomplete abortions, later-term (more than 12 weeks) or complicated cases (3).

Preconception care - Preconception care involves steps to improve health before pregnancy, such as screening and treating infections, managing chronic diseases, improving nutrition, and encouraging healthy lifestyle habits (4).

Medically assisted reproduction (MAR): Reproduction achieved through a range of interventions, procedures, surgeries, and technologies designed to address different types of fertility impairments and infertility. These methods include ovulation induction and stimulation, ovulation triggering, all assisted reproductive technology (ART) procedures, uterine transplantation, as well as intrauterine, intracervical, and intravaginal insemination using semen from a husband, partner, or donor (2).
Assisted reproductive therapy (ART): WHO definition: All treatments or procedures involving the in vitro manipulation of human oocytes, sperm, or embryos to achieve pregnancy. This encompasses, but is not limited to, in vitro fertilization and embryo transfer, cryopreservation of gametes and embryos, donation of oocytes and embryos, and gestational surrogacy. (1).
In vitro fertilization: A medical process in which an egg is fertilized by sperm outside the body, such as in a test tube. (2).
Intra cytoplasmic sperm injection (ICSI): A technique in IVF where a single sperm cell is directly injected into an egg outside the body to achieve fertilization. (2).
Intra uterine insemination: A procedure in which sperm is placed directly into the uterus of a female to increase the chances of fertilization. (2).

Abbreviations

ANC- antenatal care

ART- Assisted Reproductive Technology

BADAS- Diabetic Association of Bangladesh

BES-Bangladesh Endocrine Society

BDHS- Bangladesh Demographic Health survey

CEDAW- Convention on the Elimination of All Forms of Discrimination Against Women.

CPR- Contraceptive prevalence Rate

CSE- Comprehensive sexuality education

CBA-Community Skilled Birth Attendant

DGHS- Directorate General of Health Services

DGFP- Directorate General of Family Planning

Family Welfare Assistants-FWAs

FSSB- Fertility and Sterility Society of Bangladesh

GCA-Gender-responsive Coastal Adaptation

GTB- genital tuberculosis

HPV- Human Papillomavirus

IVF- In Vitro Fertilization

ICPD- International Conference on Population and Development (1994)

ICPD+30- 30th anniversary of the International Conference on Population and Development (ICPD)

LAMC-long-acting modern contraceptives

LGBTQ-Lesbian, Gay, Bisexual, Transgender, and Queer

MEI-Men experiencing infertility

MoHFW- Ministry of Health and Family Welfare

MR- Menstrual Regulation

NGOs- Non-Governmental Organizations

NIPORT -National Institute of Population Research and Training

OOP- Out-of-pocket expenses

PCOS- polycystic ovary syndrome

PEI-Patients experiencing infertility

PHC- Primary health care

PHM- public health midwives

PPE-Personal Protective Equipment

PPP- Public-Private Partnership

RTI-Reproductive Tract Infection.

UNFPA: United Nations Population Fund

UNICEF: United Nations Children's Fund

UNDP: United Nations Development Programme

SDG- Sustainable Development Goals.

SMC-Social Marketing Company

SRHR- Sexual and Reproductive Health and Rights

SLT- smokeless tobacco

STI-Sexually Transmitted Infection

UHC- Universal Health Coverage.

UNFPA- United Nations Population Fund

WEI-Women experiencing infertility

WHO- World Health Organization

Introduction

Infertility is a global health problem which affects almost 17.5% of the adult population or approximately 1in 6 people experience infertility worldwide (5). Infertility is the failure to achieve a pregnancy after 12 months or more of regular unprotected sexual intercourse, and it can result from male, female, combined, or unexplained factors (1,6). Infertility can be classified as primary or secondary. Primary infertility refers to the inability to achieve pregnancy at all while secondary infertility occurs when a person has previously been pregnant but is unable to conceive again (1,6). Infertility can prevent people from exercising the basic rights to decide how many children they want, and when to have them. Addressing infertility for both men and women is a part of comprehensive sexual and reproductive health and right (SRHR) (7).

Infertility is ranked as the 5th highest serious global disability among populations below age 60 (World Report on Disability 2011) (8). Prevalence of infertility is 17.8% in high-income countries and 16.5% in low- and middle-income countries (5). However, there are differences between the high income and low- and middle-income countries because of the different availability in infertility care and different socio-cultural value surrounding childlessness (9).

In South Asia, infertility poses a growing challenge. South Asian women have experienced the highest average rate of increase in primary infertility worldwide, at 40.9 per 100,000 population. North Africa and the Middle East women had the second highest increase for primary infertility, at 38.5 per 100,000 (10). For secondary infertility, the highest increase globally was observed among women in North Africa and the Middle East (119.9 per 100,000). South Asian women had the second highest increase for secondary infertility, at 83.4 per 100,000 (10). Regarding primary infertility in men, North Africa and the Middle East (with a rate of change of 19.0 per 100,000) had the highest increasing rates. South Asia (with an average rate of change of 16.5 per 100,000) had the second highest increasing rates (10). Regarding secondary infertility in men, the highest increase was found in South Asian men (with an average rate of change of 48.4 per 100,000) and the lowest increase was observed among men in High-Income regions (with an average rate of change of 0.25 per 100,000) (10).

Many South Asian countries (e.g., Bangladesh, Nepal, Pakistan, Sri Lanka) which are low and middle income face significant resource constraints in healthcare, particularly in rural and underserved areas. Despite high prevalence of infertility, not everyone has equal access to fertility care and many people often face barriers due to high costs, social stigma, and limited availability of treatment (11,12,13). While infertility is a significant and growing concern across South Asia, Bangladesh stands out due to its particularly high and increasing prevalence, unique socio-cultural and environmental risk factors, and notable gaps in research and policy (14). As a physician and public health worker in Bangladesh, I have noticed the struggle of people experiencing infertility. By examining Bangladesh, this thesis aims to explore risk factors, prevention strategies for infertility and to provide recommendations that are not only relevant locally, but also applicable to other low-resource settings.

Chapter one:

1.1 Background

Demographic Information

Bangladesh is administratively divided into eight divisions and 64 districts. In 1971, Bangladesh became an independent country, separating from Pakistan. It is a democratic country since 1991 (15). Bangladesh has a high population (approximately 173.5 million in 2024) with nearly 60% of people living in rural areas. Females make up about half (50.8%) of the total population (16,17). Bangladesh has a relatively young population, with a median age of 25 years and about one-third of the population is under 15 years old (16,17,18,19). Life expectancy for both sexes is 72.7 years in Bangladesh in 2024 (20). The nation is ethnically homogeneous, with majority identifying as Bengali, and the main religion is Islam, followed by Hinduism and small minorities of other faiths. Family, tradition, and social harmony are very important in Bangladesh. Getting married and having children are important parts of life, linked to family pride and social expectations. Elders are highly respected. People care a lot about their reputation, as it affects their families. These cultural values influence how people make choices in relationships, education, and work (21). Literacy rates have improved in 2022, with 72% of women and 78% of men being literate, and educational attainment is higher in urban areas (22). Bangladesh has significantly reduced its fertility rate from nearly 7 children per woman in the 1970s to 2.3 in 2022 (23). This decline is attributed to robust family planning programs and increased life expectancy. However, challenges remain, including high rates of adolescent pregnancy and a large proportion of early marriages (24).

Figure 1: Districts of Bangladesh

Socio-Economic Situation

Bangladesh is classified as a lower-middle-income country by the World Bank in 2015, with a Gross National Income (GNI) per capita of approximately $2,765 in 2023 (25). Economic inequality remains a challenge, reflected in a GINI coefficient of 33.4% in 2022 (26). Bangladesh's annual real GDP growth is 6.4% in 2022. International poverty line of $2.15 a day is 5.0% and moderate poverty, based on $3.65 a day is 30.0% in 2022, with poverty rates higher in rural areas (25). Unemployment and underemployment are persistent issues, particularly among youth and women (27). Gender disparities in education, employment, and economic participation continue to affect social and health outcomes, including reproductive health (28).

Health System

Bangladesh's health system is overseen by the Ministry of Health and Family Welfare (MoHFW), which is responsible for policy and overall management (29). Two key directorates operate under this Ministry: The Directorate General of Health Services (DGHS), which manages general health services including hospitals and disease control (30), and the Directorate General of Family Planning (DGFP), which focuses on reproductive health and family planning programs (31). Health care is delivered at three levels: primary care (community clinics, union

health and family welfare centres and sub-districts health complexes), secondary care (district hospitals), and tertiary care (specialized hospitals and medical college hospitals), ensuring services from the grassroots to advanced referral centres (32). Primary health care (PHC) services are subsidized, and some services are free, but patients often face out-of-pocket expenses (OOP) primarily due to the unavailability of free medicines and diagnostics at these facilities (33).

Public sector financing accounts for only 23% of total health expenditures, with the remainder coming from private sources (34). The private health sector in Bangladesh includes for-profit, not-for-profit, and informal providers. Health insurance coverage is extremely limited; less than 1% of the population has any form of health insurance. Bangladesh's healthcare system faces challenges due to low government funding (35,36). In 2021, the government spent only 0.40% of Gross Domestic Product (GDP) on health, which is less than India, Sri Lanka, Nepal, and Bhutan (37). In Bangladesh, healthcare is almost entirely financed through out-of-pocket payments (73%) (37). This has led to more poverty. The proportion of people living on less than $2.15 a day increased from 3.11% in 2010 to 3.74% in 2016 (37).

Bangladesh faces a triple burden of disease, including communicable diseases (such as tuberculosis, dengue, and hepatitis), non-communicable diseases (NCDs) like diabetes and cardiovascular conditions, as well as maternal and childhood illnesses (38,39).

1.2 Problem Statement

Infertility is a public health issue in Bangladesh. Infertility affect both men and women with psychological, social, economic impacts, and there are systemic barriers to access infertility services for all (14).

In Bangladesh, about 3 million couples are infertile (14). According to Bangladesh Demographic Health survey (BDHS) 2022, primary infertility rate is 3.5% among women in the reproductive age group (23). The World Infertility Survey estimated infertility rates in South Asian countries and revealed that 15% of women aged 45–49 experience overall primary and secondary infertility in Bangladesh which is the highest rate in South Asia (14,40). Studies mentioned that in Bangladesh, about one-third of infertility cases are due to male factors, one-third due to female factors and one-third is unknown. (40-43).

The socio-cultural setting of Bangladesh encourages higher birth rates and as a social norm a couple must have children after marriage. If the couple cannot conceive after few years of marriage, the couple experiences social pressure particularly the women (41,44) The cultural context in Bangladesh imposes that a female is incomplete without motherhood and society often holds women responsible for infertility (14,44). This provides an extra psychological pressure on childless women (44). Due to less access to infertility care, women experience depression, social isolation, intimate partner violence, marital abandonment and divorce even when their male-partner is infertile (44,45,46). The men who are suffering from male factor infertility often consider it as a failure of masculinity,

isolating himself on fearing to be socially stigmatized on disclosure of his infertility condition (42). This can cause psychological distress and mental health problems for both the partners which affect their conjugal life, can lead to divorce and many men prefer remarriage, instead of taking treatment (42,44).

In Bangladesh, common causes of primary infertility for women are polycystic ovary syndrome (PCOS), ovarian dysfunction, tubal factors and endometriosis, and for men are lower sperm count, hormonal disorders, congenital or acquired testicular problem, male reproductive tract obstruction. Common causes for secondary infertility for women are injury of reproductive tract during unsafe delivery or abortion, and for men are lifestyle factors, sexually transmitted diseases, hormonal disorders (14,40). Most of the causes are amenable to treatment and treatment approaches (lifestyle modifications, hormonal therapies, medication, surgical interventions, or assisted reproductive technologies) vary depending on the underlying cause (40,43).

In Bangladesh, infertility hardly receives attention as policy makers mainly focus on population control (14,45). Infertility-related information, prevention, diagnosis, and treatment are often neglected within essential SRHR services (14). It is typically seen as a medical issue rather than a public health concern (42,45). Ignoring infertility in public health increases gender inequality, as social patriarchal norms unfairly blame women for childlessness (14,45) which undermine the country's commitment to achieving SDG 5 on gender equality (14).

In Bangladesh, infertility centres are mostly private and located in urban areas. This causes infertility services unaffordable and inaccessible for low income people and rural populations. Due to lack of health coverage, majority of the infertility patients undergo economic hardship while managing high treatment cost in private hospitals (43,46). This inequity is opposing Bangladesh government's goal of Universal Health Coverage and constitutional right to health for every citizen (14,43).

In Bangladesh, major challenges in addressing infertility include the absence of protocols for screening and referrals in primary healthcare, a shortage of trained providers, and inadequate infrastructure (14,42). Additionally, patients often lack awareness about infertility and available treatments (14,43). These deficiencies exacerbate inequities, particularly affecting rural and urban low-income populations who depend on informal traditional healers, sometimes worsening their condition and leading to further health complications (14,43).

Infertility information, prevention, early diagnosis and access to proper treatment is necessary for both men and women to improve health, marital and social relationship and to reduce economic hardship (42,43). Addressing infertility is associated with human rights, sexual and reproductive rights (autonomy to choose when and how to become a parent), gender equality, social justice, and countrywide progress (14,42).

1.3 Justification

Bangladesh, a South Asian country, is chosen for this study due to its unique demographic profile, high population density, and significant reproductive health challenges, including a notable burden of infertility. Despite remarkable progress in reducing fertility rates and improving maternal health, infertility remains a underprioritized issue and research topic in Bangladesh. As a result, most existing studies focus broadly on maternal health or family planning, but few studies explore the underlying risk factors of infertility, especially preventable ones, from Bangladeshi socio-cultural and health-system context. Most existing studies regarding infertility are fragmented, often focusing on women alone, and rarely address the broader social, behavioural, and policy dimensions of infertility. There is a critical knowledge gap in this regard due to lack of integrated and evidence-based research that systematically explores the risk factors of infertility, the effectiveness of current prevention strategies and best practices for infertility prevention from the context of Bangladesh (14,40).

Accessing infertility services, (information, prevention, diagnosis and treatment), a part of family planning, is as important as accessing contraception, maternal care and abortion services. In Bangladesh, where infertility treatment is costly and not easily accessible, prioritizing prevention is more practical and cost-effective. Strong prevention strategies can protect people's reproductive health, reduce social and emotional challenges related to infertility, and promote fairness by giving them an equal opportunity to have children if they wish. Primary prevention through education, awareness, and early care helps people make informed choices and avoid risk factors. Secondary prevention involves early detection and treatment of medical conditions that may threaten fertility, aiding to restore reproductive potential. Tertiary prevention ensures that, when infertility treatments are used, both mothers and babies are monitored to minimize health risks. Focusing on prevention ultimately benefits individuals and communities more sustainably than relying on costly treatments (47).

This study will review the risk factors, prevention strategies and interventions of infertility in Bangladesh. However, the prevention strategies for primary and secondary infertility are often not clearly differentiated and therefore, will not be dealt with separately in the findings section, unless where it makes sense. This thesis will also look at the strategies that work in other countries and how those strategies can fit Bangladesh's needs. The findings will help policymakers create better plans to prevent and manage infertility, reduce stigma, and improve health for everyone. This research will support national efforts and offer lessons for other countries facing similar problems.

The goal of this thesis is to shift attention from treating infertility to preventing it, which is necessary to improve lives and reduce social and economic challenges linked to infertility and infertility treatment in Bangladesh.

1.4 Objective

General Objective

To explore the risk factors, prevention strategies & interventions in Bangladesh and best practices from neighbouring countries for infertility prevention to provide evidence-informed recommendations for policymakers to improve infertility prevention and care in Bangladesh.

Specific Objectives

1. To explore the risk factors associated with infertility among men and women in Bangladesh.
2. To explore current prevention strategies and interventions addressing infertility in Bangladesh.
3. To explore best practices for prevention strategies for infertility from neighbouring or other low-resource countries.
4. To recommend policy actions and interventions for policymakers and stakeholders to enhance infertility prevention, awareness, and care in Bangladesh.

Chapter Two: Method

Study Design

A comprehensive document and literature review are conducted from available peer reviewed, national, and grey data.

Time Frame for Literature Inclusion

A 10-year period (2015–2025) is chosen for the literature review to ensure the findings are current and relevant. This time frame is widely accepted in public health research and helps to ensure that the recommendations are based on the most up-to-date and reliable evidence.

Sources

Data base and search engines: PubMed, Scopus, google scholar, google search engine, Bangladesh Journals Online (Bangla).

Institutional and Government websites: WHO, Guttmacher, World Bank, UNFPA, UNICEF, UNDP, Government of Bangladesh, MoHFW

Literature: published peer reviewed literature (international and Bangladesh), grey literature (Institutional and government reports and Demographic health surveys), infertility clinic websites and snowballing methods from literature references.

Table 1- Search Strategy

	Step 1	Step 2	Step 3	Step 4
Chapter	**Broad key words**	**Additional key Words**	**Principle key words**	**Additional key words**
Background	Fertility OR Infertility OR Childlessness		Bangladesh AND Fertility OR Infertility OR Childlessness	Demographic Cultural Political Economic Health System
Problem analysis	Fertility OR Infertility OR Childlessness		Bangladesh AND Fertility OR Infertility OR Childlessness	Public health problem Consequences Human rights-based approach Policies
Risk factors of infertility	Fertility OR Infertility OR Childlessness	Risk factors OR Determinants	Bangladesh AND Fertility OR Infertility OR Childlessness	Lifestyle factors Organizational and

Interventions and prevention strategies	Fertility OR Infertility OR Childlessness	Intervention Strategies Prevention Management Programs	Bangladesh AND Fertility OR Infertility OR Childlessness	Environmental exposures Contraceptive use Age Genetic factors Infections Abortion Teenage pregnancy Fertility education
Best Practices	Fertility OR Infertility OR Childlessness		South Asia OR Low resource setting AND Fertility OR Infertility OR Childlessness	
Policies/ approaches		Strategies Policies Interventions	Bangladesh OR South Asia OR LMIC AND Fertility OR Infertility OR Childlessness	

Inclusion Criteria

1. Publications in English or Bangla.
2. Literature focusing on infertility risk factors or prevention strategies/interventions in Bangladesh.
3. Studies from other low and middle-income countries or global best practices (prevention strategies) that are relevant and adaptable to Bangladesh are included.
4. Both peer-reviewed and reputable grey literature (e.g., WHO, government reports).

Exclusion Criteria

1. Studies published before 2015.
2. Studies exclusively focused on high-income countries without relevance to Bangladesh or similar settings.
3. Articles not available in full text or not in English/Bangla.

Conceptual Framework

Conceptual Model of Infertility Prevention as a framework is used for this thesis (48). This framework is chosen because it aligns well with the objectives of exploring the risk factors and prevention strategies of infertility for both men and women in Bangladesh. I am using this conceptual framework because it provides a comprehensive, structured, and internationally recognized approach to understand and address the complex issue of infertility. It ensures that my thesis covers all relevant factors—risk factors, prevention strategies, and best practices at all necessary levels, and is grounded in the latest scientific thinking.

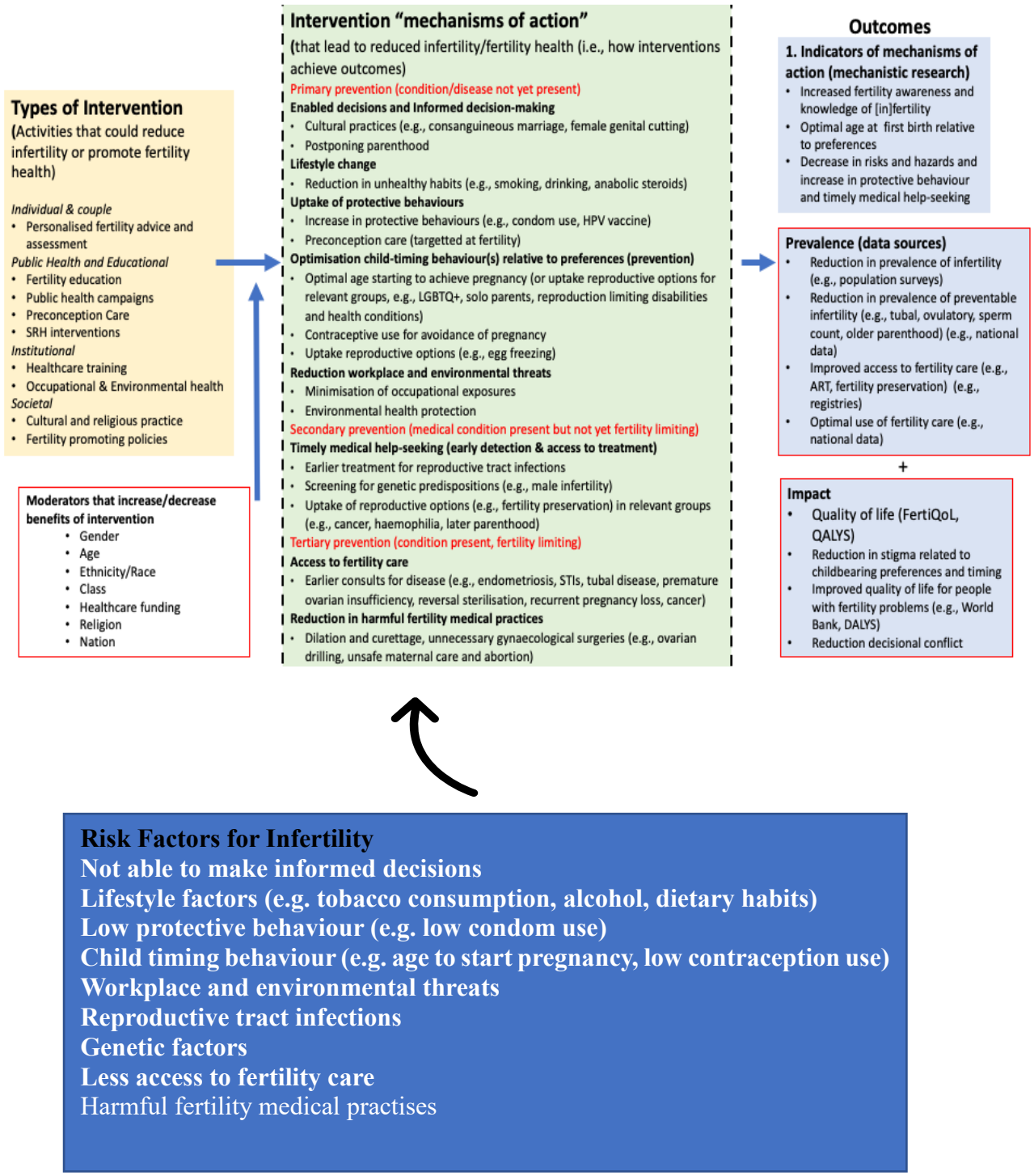

Fig 2- CONCEPTUAL MODEL OF INFERTILITY PREVENTION

To explore the risk factors of infertility, I slightly modified the visual of the conceptual framework and added a box of risk factors. The elements mentioned in this box are linked to the conceptual framework's box of mechanism of action and clearly show which risk factors the prevention steps target.

To explore the prevention strategies and interventions for infertility in Bangladesh, the box of the framework containing types of interventions is used to analyse the types of interventions. The box of the framework containing mechanism of actions is used to describe on how these strategies work. The box of moderators is used to explain the moderators that increase/decrease the benefits of intervention.

To explore the best practices for prevention strategies of infertility from neighbouring countries of Bangladesh or other low-resource countries, the box of mechanism of actions is used to describe on how these strategies work. The box of moderators is used to explain the moderators of intervention. The box of outcomes is used to describe what outcomes these best practices must be qualified as "best practice"

To recommend to policymakers for infertility, the recommendations is structured according to the framework, ensuring they address all relevant levels, identify gaps at each level and mechanisms of action. Recommendations are given based on the evidence of what works, considering contextual moderators (cultural acceptability, resource availability) identified in the literature.

Chapter Three: Results

In this result section, I will begin by describing the risk factors for infertility in Bangladesh according to the box of risk factors. Next, I will describe the current prevention strategies of Bangladesh, classifying their types and explain their mechanism of actions and moderators. Finally, I will review the best practices from neighboring countries of Bangladesh and other low-resource countries and their demonstrated outcomes (according to the framework).

3.1 Risk factors of infertility in Bangladesh

3.1.1 Not able to make informed decision

In the patriarchal society of Bangladesh, most of the Bangladeshi women have no independent voice in childbearing. This lack of autonomy is especially pronounced among women with low education or rural backgrounds (49). Most women and men in Bangladesh have little knowledge about fertility (such as how age or health risks affect their ability to have children) (41,43). Misconception about infertility is present across all economic and educational backgrounds, with only few exceptions (14). Most people are not aware of preventive measures and even those actively seeking medical help often do not understand the underlying causes of their infertility (14,43). Men in Bangladesh are not able to make informed decisions about infertility because of poor awareness, limited male-oriented services, cultural stigma (related to male infertility), and economic barriers (41,42).

Fertility education in Bangladesh is limited and not widely integrated into public health or school curricula. Most efforts are focused on expanding women's general education and improving access to family planning services. Formal fertility education including topics like fertility awareness, infertility, and reproductive health is still lacking (14,50). The health system provides limited counselling or education about fertility, making harder for couples to make informed choices (14). Lack of fertility information can prevent people from making informed decisions, causing delays in seeking treatment for fertility problems. It can also lead to unprotected sex and unsafe abortions, resulting in untreated infections and the use of harmful local remedies, all of which increase the risk of infertility (14).

3.1.2 Lifestyle factors

Tobacco consumption

Any form of tobacco consumption (including smoking and smokeless tobacco) reduces sperm quality in men and egg quality in women which increases risk of infertility (51,52,53). In Bangladesh about 20.4 million adults smoke, with a smoking prevalence of 16.8% among those aged over 15 in 2022(54). Due to socio-cultural norms in Bangladesh, smoking is higher among men (34.1%) compared to women (0.4%, mostly wealthy young women in urban areas) (54). However, smokeless tobacco (SLT) use is higher among women (24.8%) than men (16%) (54). SLT is part of the culture as it is cheap, easy to get and popular among rural people (55).

Smoking prevalence is the highest among men with low-income living in urban slums (56). A study in Bangladesh revealed that all the males who are diagnosed with low sperm count had been smoking for 5 to 10 years or more (57). Another study mentioned patients experiencing infertility (PEI) who smoked had significantly lower sperm count and motility than the non-smokers (58).

Alcohol consumption

Excessive alcohol consumption can increase the risk of infertility by reducing sperm quality in men and increase risk of endometriosis in women (59). However, Bangladesh is consistently ranked among the countries with the lowest alcohol consumption rates in the world (0.09 litters of pure alcohol per person per year) due to strong cultural and religious influences (60). Alcohol use in Bangladesh is common among some indigenous groups (1% of the population) and the Christian minority (0.3%, 2022 census) due to traditional practices (61). A study mentioned that prevalence of alcohol consumption among tribal is 48.9% (62). However, there is no direct research quantifying whether alcohol-related infertility is a larger issue in these groups.

Malnutrition and Dietary habits

Malnutrition includes both undernutrition (such as underweight and micronutrient deficiencies) and overnutrition (excessive calories intake from protein, fat, or carbohydrates, overweight and obesity) (WHO,63). Underweight and overweight both increase risk of infertility in men and women (64,65). A study using BDHS 2017-18 data revealed 19.7% of adult men suffer from undernutrition and 32.7% men are overweight/obese (66). Another study using BDHS 2022 data revealed, about 10% women and of reproductive age (15–49 years) are underweight (BMI < 18.5) and 56% of women are overweight/obese (67).

Undernutrition is a risk factor for infertility in Bangladesh (14,40). Undernutrition and underweight can cause irregular or absent menstrual cycles, impair ovulation, reduce fertility in women and can affect sperm quantity and hormones in men (64). The prevalence of undernutrition is higher in rural areas (11.2%) than urban areas (6.7%) because of poverty, lower rate of education, lack of knowledge about nutrition and health, early marriage and less access to health care (40,68)

Overnutrition (overweight/obesity) can cause ovulatory or menstrual dysfunction and hormonal imbalance which can lead to PCOS which is a major risk factor for female infertility in Bangladesh (69,70). For men, overweight/obesity can impair sperm quality, erectile dysfunction and can lead to infertility (71). The prevalence of overnutrition is higher in urban areas (63.7%) than rural areas (55.5%) (67) because of urbanization, sedentary lifestyles, increase in processed food intake, and decline in vegetable consumption (72). Prevalence of infertility in Bangladesh is higher in obese men and women (69,71). A study revealed one third (29%) of PEI are obese (73).

Lack of physical activity

Insufficient physical activity is linked to increased body fat, causing lower testosterone level and reduce sperm quality in men, and hormonal imbalances, irregular periods, and ovulation problems in women which can lead to infertility (74)

Lack of physical activity is a large and growing problem in Bangladesh. A survey mentioned that one in three adults (34.5%) does not get enough physical activity, which is higher in urban areas (37.7%) than rural (31.6%) areas and higher in women (53.6%) compared to men (15.4%) (75). Women face more barriers (such as safety concerns, social stigma, limited access to female-friendly exercise spaces) to do physical activity than men. Rural populations have less access to structured exercise opportunities (76,77). In Bangladesh, increased physical activity improves fertility conditions among PEI (78).

3.1.2 Low protective behavior

Low condom use

Low condom use increases the risk of sexually transmitted infections (STIs), especially during unprotected sex outside of a fixed, married relationship (WHO,79). Low condom use in Bangladesh significantly increases the risk of infertility as STIs are key contributors to tubal and pelvic damage leading to infertility (14,80). Condom use can prevent unintended pregnancies and unsafe abortions and reduce risk of secondary infertility (14,40).

Premarital and extramarital sex are more common among males but very few Bangladeshis openly admit these relationships due to strong social stigma (81,82). 27% of ever-married women aged 15–24 reported premarital sex (82). These relationships can cause unprotected sex and increase risk of STIs and infertility in men and increase risk of unintended pregnancy, unsafe abortion and infertility in women (14,81). A study revealed only 5.9% of married women in urban Dhaka have ever used condoms (83). Low condom use is common due to limited knowledge, misconceptions about harmful effects, early sexual debut, difficulty negotiating condom use with partner, and preference for other contraceptive methods (82,83). Most married STI patients in Bangladesh, reported that they do not use condoms during their most recent sexual encounters or used them inconsistently, reaffirming the role of low condom use in STI transmission within marriage and thus increasing the risk of infertility (84).

3.1.3 Child timing behavior

Age starting to achieve pregnancy

Optimal age of pregnancy is early 20s to early 30s. Pregnancies in teenagers (under 20) and aged over 35 increase the risks of secondary infertility (72,85). According to BDHS 2022, over half of girls are married before age 18 and 27% of girls marry before age 16 in Bangladesh. The average age of marriage for women is around 18 years and average age at which women have their first child is about 18.2 years

(23). Adolescence pregnancy rate is 23.7% (first births most commonly occurring between the ages 14- 18) and 18% have had a live birth (23,24).

In Bangladesh, adolescent girls often become pregnant before their bodies are fully matured and 1 in 3 married adolescent girls experience complications during pregnancy (24,86) A study in Bangladesh reports that among adolescent pregnancies, the complications are severe anaemia (65%), foetal distress (56%), pre-eclampsia (35%), and eclampsia (33%) (87). These complications can damage reproductive tract or lead to infections that may cause secondary infertility (85,86). Additionally, inadequate access to reproductive health services and poor nutritional status among teenage mothers (especially in rural areas) further increases these risks (85,86).

Women over the age of 35 experience a natural decline in egg quality and quantity, leading to increased risk of age-related infertility in Bangladesh (73,88). Among women above 30, hypothyroidism is one of the risk factors for infertility (89). In Bangladesh about 4% to 7% of women suffer from hypothyroidism (90). A study in Dhaka found that subclinical hypothyroidism was present in 34.8% of women with primary infertility and 59.5% in secondary infertility cases. Hypothyroidism disrupts fertility by causing anovulatory cycles and sex hormone imbalances, which impair normal ovulation and menstrual regularity (91).

However, men in Bangladesh often postpone parenthood especially in urban areas due to financial instability and emotional unpreparedness (92). Higher age (over 35) increases the risk of chronic conditions like diabetes for both men and women (prevalence is 13.75% in 2018) (93.94). Studies from Bangladesh report diabetes can cause erectile dysfunction, poor sperm quality, and hormone issues and diabetes is linked to male infertility (95,96). In women, Gestational diabetes (prevalence in Bangladesh is 35% among pregnant women in 2018) can cause PCOS and later can cause secondary infertility (97,98).

Not using contraception to avoid pregnancy

Not using contraception to avoid pregnancy increases the chance of unplanned and closely spaced pregnancies, leading to unsafe abortions, reproductive tract infections and increase risk of secondary infertility (14,99). Nationally, about 38–40% of married women do not use any contraception (BDHS 2022) (23). According to BDHS 2014, Sylhet division of Bangladesh has the lowest modern contraceptive use (only 25%), highest unintended pregnancy rate (21–26%) and highest prevalence of infertility (16.73 percent) (73,100). Reduced access to well-equipped health facilities leads to lower use of long-acting modern contraceptives (LAMC). In Sylhet, LAMC use is the lowest, and women travel the farthest to the nearest facility—about 8.25 to 8.34 km, compared to the national average of 6.36 km (101).

3.1.4 Workplace and Environmental threats

Occupational exposure

About 35% of Bangladesh's workforce was employed in agriculture in 2023 and among them majority (58%,18.4 million) were women (102). Most of the farmers use pesticide in Bangladesh but they usually do not use protective measures while applying pesticides (103). Pesticides exposure can lower sperm count and quality, disturb hormone levels, and damage reproductive cells in men and increase risk of infertility in women by disrupting hormonal level (104).

Currently, 5 million (60% women and 40% men) people work in the garment industry in Bangladesh (located in urban areas) (105). These garments workers are exposed to heavy metals (lead, cadmium mercury) and chemicals during the textile dyeing process which disrupt sperm quality, hormone levels and increase risk of male and female infertility (71,106).

In Bangladesh, female healthcare workers face higher infertility risks due to exposure to chemicals, radiation, and stress (78). High occupational stress and sometimes long sitting hours can lower sperm quality and increase the risk of male infertility (especially in among businessmen and service holders) (71).

Environmental exposure

65% of Bangladesh's population is exposed to arsenic-contaminated drinking water-primarily from groundwater sources such as wells. Mainly in rural areas in Bangladesh, high levels of arsenic exposure are significantly linked to delayed menarche (late onset of first menstruation), which is associated with an increased risk of infertility in adulthood in women (107).

Rising sea levels, and saltwater intrusion are serious risks for women's reproductive health and infertility in Bangladesh. In coastal areas such as Khulna, saltwater exposure causes menstrual hygiene problems, infections, miscarriages, and even causes some women to lose their uterus. (108).

3.1.5 Reproductive tract infections

In Bangladesh, the most common STI includes non-gonococcal urethritis (NGU), gonorrhea, chlamydia, syphilis, genital herpes, and, to a lesser extent, genital scabies, chancroid and STIs are more common in men (109). STIs if left untreated increase the risk of infertility. Gonorrhea and chlamydia can lead to pelvic inflammatory disease in women and epididymitis in men, causing tubal damage or obstruction and leading to infertility (80,109). Syphilis and genital herpes cause reproductive tract scarring and impair fertility. Low condom use, lack of awareness, stigma and limited laboratory and treatment resources are significant risk factors for ongoing STI transmission and delayed care-seeking behaviors can lead to infertility (84,109)

A study revealed genital tuberculosis (GTB) is a major risk factor for primary infertility (observed in 63.33% of cases) (110) in Bangladesh, a country with a high TB burden (174 cases per 100000 population in 2019). Female GTB is estimated

to represent about 0.5% of all TB cases (111). Women of reproductive age, with history of TB or immunocompromised conditions or living in high-prevalence area, are at greatest risk of GTB and infertility (112,113). GTB can damage reproductive tract in men but less frequently reported as a cause for male infertility in Bangladesh (78)

In women, Human Papillomavirus (HPV) can cause cervical disease that may affect fertility. In Bangladesh 8,268 new cases of cervical cancer diagnosed in women in 2020 (114) and HPV infection is moderately high in pregnant women (115). No direct research exists quantifying HPV infection rates among infertility patients in Bangladesh.

3.1.7 Genetic factors and Family history of infertility

In men, genetic abnormalities such as Y-chromosome microdeletions—particularly in the AZFc region—are linked to conditions like low sperm quality, contributing to male infertility (116). A study in Bangladesh have identified Y-chromosome microdeletions in 20% of men with infertility who are tested (117). For women, genetic causes such as primary ovarian insufficiency and chromosomal abnormalities are recognized contributors for infertility (40,118) However, in the Bangladeshi context, consanguineous marriage (prevalence 6.6%) increases the risk of miscarriage, child mortality, and genetic disorders but its association with infertility is still under research (116).

3.1.8 Less access to fertility care

In Bangladesh, access to fertility care is hard to reach for rural and urban low-income people. A study in Bangladesh revealed that only one third of the PEI came to take treatment from infertility clinics. Among these patients, 30% only visited once without completing all investigations, 35% completed investigation but did not take treatment and 33 % patients took treatment (43). Due to high treatment cost, distance, low awareness regarding early intervention and advanced infertility treatments, most of the patients cannot access fertility care in Bangladesh (43,119)

Infertility patients especially rural or low-income people (both men and women) mostly choose informal traditional healers, herbalists, spiritual or folk treatments or remain untreated (practice prayers, amulets, holy water) due to concerns regarding treatment cost, misconceptions and stigma around infertility and low access to advanced infertility treatment (like IVF) (43). The traditional healers in Bangladesh usually use herbal remedies, religious rituals, or spiritual practices rather than evidence-based medicine. Without timely and appropriate care, treatable conditions (like infections or hormonal issues or tubal blockages) can worsen, making infertility permanent or harder to manage. In some cases, traditional remedies or procedures may even cause additional harm, such as reproductive tract infections, injury or uterine damage, further reducing the chances of conception. (14,43).

3.1.9 Harmful fertility medical practices

Unsafe abortion and unsafe Menstrual regulation

Under Bangladesh's penal code of 1860, induced abortion is illegal except to save a woman's life. Menstrual regulation (MR) is a procedure permitted by Bangladesh government (see glossary). Half of the married women do not know about MR and do not have access to it. In Bangladesh, 48% pregnancies are unintended and among them 60% ended in abortion (120). Most procedures to terminate unintended pregnancies (unsupervised use of abortion pills, traditional or herbal remedies, insertion of foreign objects into the uterus, improperly performed manual vacuum aspiration or menstrual regulation) are performed by unskilled providers or in unhygienic conditions or by the woman herself, which causes infections, uterine perforation, injury, incomplete abortion, and sepsis, leading to secondary infertility (14,120). When Dilation and Curettage (D&C) (see glossary) is performed by unskilled providers or in unhygienic conditions, it causes reproductive tract injury or infections (121). These infections frequently cause scarring and damage to the uterus and fallopian tubes, leading to tubal blockage and secondary infertility (120,121). Moreover, staff at some authorized clinics lack enough knowledge, leading to unsafe abortions and MR, which also raise infertility risk (14). There were an estimated 1,194,000 induced abortions in Bangladesh, which are mostly performed in unsafe conditions or by untrained providers. 384,000 women suffered complications from unsafe abortion, and about one-third of those needing facility-based treatment did not receive it in 2014 (latest data) (120). A study revealed that 27% of women experiencing infertility (WEI) reported a history of abortion (122).

Unsafe obstetric practices

According to BDHS 2022 only 35% of women in rural areas received at least four antenatal care (ANC) visits in Bangladesh (23). Low coverage of adequate ANC means that many women enter labor without necessary health monitoring, education, preparedness and early detection of complications. This makes them highly vulnerable to preventable complications and they are mostly exposed to unsafe obstetric practices (as they lack access to health facility). In Bangladesh about 35% deliver at home or outside formal health settings (23). Majority of these (forceful) home deliveries, especially in rural areas, are done by individuals who lack formal medical training and in unhygienic conditions. Unsafe obstetric practices such as unsterile deliveries, improper management of postpartum complications, and unsafe manual removal of the placenta can lead to reproductive tract infections, sepsis, and pelvic inflammatory disease, ultimately resulting in tubal damage and secondary infertility (14,40).

3.2 Current prevention strategies and interventions for infertility in Bangladesh

First, I will explain the policy level and then I will explain the primary, secondary and tertiary prevention.

3.2.1 Policy level Intervention

Current Policy

One of the goals of Bangladesh's National Health Policy (2011) under MoHFW is "To strengthen and accelerate family planning and reproductive health services to achieve replacement level of fertility". One of the principles is to effective coordination of family planning with health to achieve expected goals of family planning (123).

Policy level Intervention

This policy framework has been effective to address rapid population growth which had been a major concern for Bangladesh in previous decades. Total fertility rate has been reduced in Bangladesh (2.1 in urban areas and 2.4 in rural areas in 2022) (23). However, this policy does not capture the full range of reproductive health requirements. This policy does not include infertility care (prevention, diagnosis, or treatment) and there is no clear recognition of infertility as a public health problem. Because of this, very limited public hospital offers infertility services. There is no national guidelines or standards for infertility care, no public-private partnership, and no financial protection mechanisms for affected individuals. There is no evidence of large-scale, government-led public health campaigns specifically targeting infertility in Bangladesh. Most private infertility clinics operate privately and sets their own standards. There is no national regulation or quality control and patients may be at risk as quality can vary (14,40). DGFP in Bangladesh made tentative commitments in 2021 to Share-Net Bangladesh to incorporate infertility into upcoming operational plans; however, concrete policies and dedicated funding for infertility remain lacking. (14).

Policy makers. underprioritize infertility issue as they are focused on population control. Social, economic, and psychological impact of infertility cannot be measured without proper research. Due to social taboo in Bangladesh, couples do not willing to disclose their infertility status which makes difficult for the researcher to gather data. Due to lack of data and research, donors show less interest to allocate fund for infertility. Furthermore, infertility is treated as a 'female thing' and SRHR is considered as related to only contraception and maternal health in Bangladesh (14,99).

The lack of affordable, accessible, quality infertility services violates human rights and the right to health. This undermines Bangladesh's obligations under international agreements such as ICPD+30 and SDG to ensure access to infertility care as a part comprehensive SRHR (14).

While there are no policies and no direct infertility prevention strategies that focuses on infertility prevention in Bangladesh, there are some interventions that address the different underlying risk factors. These indirect interventions are described below.

3.2.2 Primary Prevention

Fertility Education for enabled decision making

(Type of interventions - Public health and educational)

In Bangladesh, there are no direct programs that focus on fertility education for preventing infertility. Since 1970, Bangladesh's national family planning program (FPP) spreads fertility education nationwide through 185,000 of female community health workers (CHWs) (also known as Family Welfare Assistants (FWAs). Through home visits and group meetings (especially in rural communities), FWAs raise awareness about menstrual hygiene, good nutrition, contraceptives, and early treatment of gynaecological issues to prevent infections and complications. FWAs mainly focused on birth control but they are not trained on mitigating the risks of infertility; still, their overall work indirectly supports infertility prevention (124).

Since 1994, Female Secondary School Stipend Program made secondary school free for rural girls. Studies show this program increased girls' education by 14–25%, giving women more knowledge and power to make healthy choices and seek care. Thus, this may indirectly help to reduce health risks that can cause infertility (125).

Comprehensive sexuality education (CSE) in Bangladesh is included in the national curriculum through subjects like Physical Education and Health junior secondary students. Although all students in government and private schools (both in urban and rural areas) technically have access to CSE content but in practice, coverage and quality vary widely (urban schools deliver more comprehensive content). Its implementation is inconsistent due to cultural sensitivities, lack of teacher training, and limited government policy support. The topics such as safe sex, contraception, and condom use, are absent in CSE in Bangladesh due to socio-cultural barriers (50).

Lifestyle change

Prevention strategy for tobacco consumption

(Type - Public health and educational)

The government enforces tobacco control law, Smoking and Tobacco Products Usage (Control) Act, 2005 (amended in 2013 and covers all forms of tobacco), which bans smoking in public places, puts restrictions on advertising, promotion, and sponsorship for both cigarette and SLT products, and promotes mandatory graphic health warnings on packaging. The government is working on increasing tobacco taxes, building public awareness campaigns and community-based interventions to reduce smoking. This policy by restricting tobacco use and reducing exposure to tobacco's reproductive toxins indirectly helps to reduce the risk of infertility in Bangladesh (126).

Nationally in Bangladesh, prevalence of tobacco consumption dropped from 20.9% in 2019 to 16.8% in 2022. Between 2009 and 2022, smoking declined by 13% but

this is too slow to achieve Bangladesh's goal to achieve a 40% reduction by 2030 (54). Some pictorial warnings on SLT products include messages about pregnancy risks but SLT control is less effective due to weaker enforcement, and cultural acceptance. Infertility is rarely highlighted in health campaigns to reduce tobacco consumptions. Enforcement gaps, early age of smoking initiation, and rising use of e-cigarettes are ongoing concerns (127).

Prevention strategy for malnutrition

(Type- Public health and educational)

The National Nutrition Policy 2015 in Bangladesh aims to fight malnutrition for all citizens through strategies like nutrition education, promoting diverse and safe foods, providing micronutrient supplements (iron, folic acid, calcium), and encouraging healthy eating and physical activity in schools and communities (130). Nutrition services provide direct nutrition support, food security and hygiene nationwide. Rural people benefit from local nutrition centers, health education and better food programs (128,129).

A national representative study mentioned the rate of underweight in women aged between 15–49 dropped from 30% in 2007 to 12% in 2018. However, the proportion of well-nourished women was almost same, 58% in 2007 and 56% in 2018 and obesity rate increased from 12% in 2007 to 32% in 2018 (130).

While there has been progress in reducing undernutrition and improving food security, challenges remain in obesity control, fully implementing and coordinating programs nationwide. Blockages include limited funding, gaps in service delivery and difficulties in reaching vulnerable groups in rural areas. Monitoring and evaluation systems are still being strengthened and integration of nutrition objectives across all sectors is ongoing (130,131).

Prevention strategy for obesity and physical inactivity

(Type- Public health and educational)

MoHFW has launched The National NCD Control Program in Bangladesh in 2010. This program prioritizes the prevention and management of NCDs (obesity, diabetes, cardiovascular diseases). This program works to improve primary health care (PHC) facilities, so they could better promote healthy lifestyles, focus on preventing risk factors such as tobacco use, unhealthy diet, physical inactivity, screen for NCDs early, and provide management at the local level (132).

This program indirectly can help to reduce risk factors of infertility related to lifestyle factors and chronic conditions (obesity, diabetes). However, currently, awareness activities, NCD screening and referrals are ongoing in only 66 sub-districts across 31 districts out of 64 districts. This program's effectiveness has been limited due to funding shortages, lack of integrated service delivery and monitoring, and insufficient specialized healthcare staff and nutritionists. PHC

facilities in Bangladesh are not yet fully ready to provide complete prevention and care for NCDs (133). In 2018, NCDs accounted for 67% of all deaths (22% of these is considered premature) which was 44% in 2002 (134).

Uptake of Protective Behaviour

Increase in condom use

(Type- Public health and educational)

Since 1990, the Social Marketing Company (SMC), a non-profit organization, leads nationwide condom promotion and distribution. Using commercial marketing techniques—such as branding, mass media, and broad distribution—SMC focuses especially on rural and hard-to-reach areas. Now, condoms are sold through over 200,000 outlets, with hundreds of staff and around 17,000 health providers trained annually to improve counselling and service quality. SMC's approach in Bangladesh heavily favours family planning messaging in its condom promotion to prevent untended pregnancies which help to reduce secondary infertility risk. However, SMC give less focus on using condoms to STI prevention or infertility prevention (135).

HPV vaccine (Type- Public health and educational)

After a nationwide campaign in 2023, the HPV vaccine was incorporated into the routine immunization schedule for girls in class V and out-of-school ten-year-old. By early 2025, it vaccinated 5.6 million girls aged 10–14 with 93% coverage (136)**.** However, adult women and men remain largely unvaccinated as they are not included in the current national vaccination program. A study in urban Dhaka revealed only 2% women received an HPV vaccine (137).

Preconception care

(Type- Public health and educational)

In Bangladesh, preconception care includes health checks, counselling, and treatment of fertility-related conditions to improve health before pregnancy. Preconception care aims to reduce risk factors that may harm future pregnancies (like gestational diabetes), reduce unintended pregnancies related complications and unsafe abortions which all can lead to secondary infertility (138). Bangladesh has developed consensus guidelines to support healthcare providers in delivering consistent preconception care services, emphasizing nutrition, weight management, tobacco avoidance, screening for infections and chronic diseases and referral (139).

The Diabetic Association of Bangladesh (BADAS), in collaboration with MoHFW runs a national preconception care program since 2016. This is a growing service, but access is still limited (only 50 preconception care corners nationwide). There is a free helpline for information on preconception care. Educational material is accessible online in Bangla and English for the public and health professionals (140). Preconception care is provided through counselling at marriage registration, health check-ups at BADAS centres, and distribution of educational materials. During marriage registration, trained religious leaders (Kazi, who does marriage registration) provide counselling, share information and raise awareness about healthy lifestyles before pregnancy and disease prevention, distribute educational materials and encourage new couples to visit preconception care centres for health screenings. So far, 400 religious' leaders and 300 health care providers served pre-conception care to 30000 newlywed couple (142).

Bangladesh Endocrine Society (BES) Guidelines recommend that women planning pregnancy, especially those with a history of thyroid disorders or infertility, should undergo thyroid function screening as part of preconception counselling. It helps to detect and treat thyroid problems early to prevent infertility (141).

These efforts aim to empower couples to make informed decisions before pregnancy, reduce health risks and promote early medical help seeking for pregnancy. However, this initiative is less accessible to rural population (140).

Optimal age starting to achieve pregnancy

There is no specific intervention in Bangladesh that directly promotes optimal age for starting pregnancy to reduce infertility. However, family planning programs aim to reduce teenage pregnancies and encourage couples when to have children but have lack of male involvement.

Intervention for teenage pregnancy

(Type-Public health and Education)

Most teenage pregnancies happen for girls married before 18 in Bangladesh. The government's National Plan of Action to End Child Marriage in Bangladesh (2018) aims to end marriage under age 15 and reduce marriage under 18 for girls by 2041. The strategies include: raising community awareness about the harms of child marriage, enforcing the Child Marriage Restraint Act (2017), providing legal help to victims, expanding social safety net programs, keeping girls in school, empowering adolescents with life skills, and participating in decision-making. The plan involves government, NGOs, civil society, and local leaders to ensure action nationwide (142). This plan focusses on girls, families, and communities in both urban and rural areas. Over 6 million people benefited from this intervention through awareness campaigns, legal support, education programs, and social protection schemes (143). However, the reduction of child marriage rate is only 1.1% in each year for last ten years and it is mainly due to lack of strict enforcement of minimum marriage age laws, education and social protection (143,144).

National Adolescent Health Strategy (2017–2030) aims to standardize adolescent-friendly health services across the country to increase early detection and treatment of reproductive issues. Coverage of these services is uneven; rural areas often lack trained staff or face cultural barriers (145).

Intervention for uptake of reproductive options (egg freezing)

There are no documented public health interventions in Bangladesh specifically designed to support the uptake of infertility-related reproductive options for LGBTQ (Lesbian, Gay, Bisexual, Transgender, and Queer), solo parents, later parenthood or people with reproduction-limiting disabilities. Lack of policy attention, resource constraint, social stigma and discrimination make these groups face greater barriers to access fertility care (14).

Contraceptive use for avoidance of pregnancy

(Type - Public health and educational)

Bangladesh government since 1970 with national FPP, ensures access to modern and traditional contraceptive methods—including pills, injectables, implants, IUDs, and condoms—through health centers, pharmacies, community clinics, and door-to-door visits by family planning workers. This program provides free or low-cost contraception to prevent pregnancy and led to a high CPR, 62% nationally with modern methods (54.7%) in 2022 among married women aged 15–49 (CPR was only 8% in 1975) (146,124)

This intervention reduces Bangladesh's total fertility rate from 6.3 births per woman in 1975 to 2.3 in 2022 (23). Contraceptive use can prevent complications from closely spaced or high-risk pregnancies and reduce risks of infections or reproductive damage that may lead to infertility (100). But still, 17% of reproductive age women have unmet contraceptive need (146).

Minimisation of occupational exposures

(Type-Institutional)

To reduce pesticide exposure among farmers in Bangladesh, existing interventions are increasing such as farmer training and awareness on safe pesticide handling, promoting the use of personal protective equipment (PPE) and encouraging integrated pest management (IPM) to reduce reliance on chemical pesticides. Bangladesh government banned dangerous pesticides and set rules to stop misuse. However, many farmers still overuse pesticides, lack training, and don't use PPE, showing a need for better enforcement and education (104,105)

For industrial workers, Bangladesh has a national occupational safety and health (OSH) system that enforces safety laws, gives training, and provides PPE in risky jobs and special rules exist for industries with chemical or radiation risks. While these interventions are not focused only on infertility, these actions indirectly help to protect fertility by reducing harmful exposures at work (147).

Interventions for Environmental Threats

(Type-Institutional)

Gender-responsive Coastal Adaptation (GCA) Project promote rainwater harvesting and health education to avoid saline water and menstrual hygiene specially for women in coastal areas of Bangladesh. This project installed 228 community-based rainwater harvesting plants and 41 pond-based plants across five Sub districts in Khulna and Satkhira. Over 30,934 households now have access to safe drinking water, and 13,000 households received large tanks to store rainwater for use in the dry season which helped to reduce reproductive health complications, and better menstrual hygiene in women which reduces risk of infertility (148).

The Bangladesh National Policy for Arsenic Mitigation, adopted in 2004, has been useful for nationwide screening, public awareness campaigns, promoting alternative safe water sources (such as deep tube wells and arsenic removal filters), and health management for arsenic exposure. Yet, its effectiveness is constrained by sustainability challenges and gaps in continuous monitoring and community engagement (149).

3.2.3 Secondary Prevention

Earlier treatment for reproductive tract infections

(Type-Public health intervention)

Bangladesh government has National Guidelines for the Management of STIs and RTIs in 2018 (updated version of 2006) which is used by healthcare providers who are trained to spot, treat, and refer RTI cases. In rural areas where lab tests are not available, healthcare providers use symptoms to find and treat RTIs (150).

In 2007, the estimated prevalence of RTI symptoms among women aged 15–49 was 11.1%. and in 2014 (latest data), the prevalence was 13.4%. The burden of RTIs remained relatively stable or even increased in some regions after the guidelines were disseminated. However, this national initiative aims for universal coverage but barriers like staff shortages and stigma limit full access to rural areas. Rural populations only get benefitted when local clinics and health workers use this guideline and maintain the quality and consistency of care (151).

Bangladesh's National Tuberculosis Control Programme (NTP) reduced TB prevalence by about 9% from 2015 to 2019 (111). Recent studies mentioned less prevalence of GTB among infertility patient (78). A study mentioned after completing anti-tubercular treatment (ATT), 16.67% of women with GTB-related infertility in Bangladesh conceived naturally without IVF (110).

Screening for genetic predisposition

(Type-Institutional)

Several leading IVF centres now offer Preimplantation Genetic Testing (PGT), which helps to identify mutations or chromosomal anomalies in couples experiencing unexplained infertility and allows couples with genetic disorders to select embryos (for IVF) without known genetic defects. However, these screenings are very expensive and only available in private infertility hospitals in Bangladesh (40).

Uptake of reproductive options in relevant group

(Type-Institutional)

In Bangladesh, fertility preservation interventions are available in private hospitals for specific high-risk groups such as cancer patients, those with genetic disorders like haemophilia, and individuals planning later parenthood (40). A study among breast cancer patients under age 45 in Bangladesh, revealed that fertility preservation options were discussed and offered before starting chemotherapy, though uptake remains low (6%) due to limited awareness among both patients and healthcare providers, financial constraints and limited multidisciplinary counselling (152).

Health care training

(Type-Institutional)

Since 2013 specialized courses in Reproductive Endocrinology & Infertility aim to strengthened local expertise in infertility management in Bangladesh and to train limited number of physicians in advanced infertility care (153). There is no governmental training program for nurses that focuses on infertility in Bangladesh. However, National Institute of Population Research and Training (NIPORT) provides a range of training since 2019 for FWAs on reproductive health and family planning, but available curricula and training guidelines primarily focus on fertility reduction (contraception), safe motherhood, adolescent health but not specifically infertility prevention (154).

The Fertility and Sterility Society of Bangladesh (FSSB) is a professional organization. Since 2021, FSSB works by organizing scientific conferences, academic courses, and training programs to improve expertise among healthcare providers regarding infertility. It also publishes the Bangladesh Journal of Fertility & Sterility, a platform for sharing research and clinical updates (153).

3.2.4 Tertiary prevention

Access to Fertility Care

(Type-Institutional)

In Bangladesh, about 75% to 83% of the population (roughly 130 to 145 million people) cannot afford or access to personalized fertility advice and assessment. Only17% to 25% of people who are considered above middle class can access these services. The patient who are taking infertility treatment, their monthly family income ranges from 15000-40000 BDT (76,155).

Private fertility clinics in Bangladesh offer consultations regarding fertility, including endometriosis, tubal disease, premature ovarian insufficiency, and recurrent pregnancy loss. Men often face challenges to access fertility care due to lack of male infertility services (41,42). Mental health support is provided in private hospitals as part of infertility treatment (156). However, some infertility cases may never be treatable or preventable and there is lack of mental health support for these couples. Due to lack of policy support, community clinics and public hospitals which have the potential to provide basic infertility care and prevention are underutilized (14). Recently, few tertiary public hospitals have started offering very limited basic infertility services at lower costs, but these are not accessible to people living in rural areas (60% of total population) (153).

Reduction in Harmful Fertility Practices

(Type - Public health and educational)

Bangladesh's National Strategy for Maternal Health (2019–2030) provides comprehensive, evidence-based clinical guidelines which include standards for antenatal care, skilled birth attendance, safe delivery, emergency obstetric care, postpartum care, training, protocols, and quality standards for health workers, emphasizes referral systems and multi-sectoral approaches to reach the most vulnerable (157). Health facility deliveries in Bangladesh was increased to 65% in 2022 from 53.4% in 2019 (23). These guidelines aim to improve the quality of maternal health services at all levels of health system nationwide, but coverage is still lower in rural areas (58.6% receive at least one ANC) compared to urban areas (78.8%). In 2017, 47% women received four or more ANC visits but in 2022 it is 41%. In 2017, 82% women received at least one ANC visit but in 2022 it reduced to 65% (23). Only 78% of women who gave birth in a health facility received postnatal care from a medically trained provider within two days after delivery (23). This guideline's impact is limited by workforce shortages, uneven service quality, weak management, persistent inequities, and low demand for facility-based care, especially in rural areas (158,159).

Bangladesh has a government strategy, Community Skilled Birth Attendant (CSBA) program, since 2003 to train and deploy skilled birth attendants (SBAs) who can assist with home deliveries, especially in rural areas. Studies show home deliveries by CSBAs are relatively low (around 6%), partly due to lack of community awareness, limited CSBAs numbers (only 4,000 and deployment especially in some rural areas. busy schedules of providers, and inadequate supervision (160).

The Obstetrical and Gynecological Society of Bangladesh successfully advocated for safer post-abortion care techniques like Manual Vacuum Aspiration (MVA) and misoprostol which is now included in national health plans. Training and commodity provision in hospitals led to reduced dilation and curettage use and increased adoption of long-acting contraceptives (161)

3.3 Best Practices from other countries

Sri Lanka

Sri Lanka is classified as a lower-middle-income country by world bank. Infertility care is part of a comprehensive national reproductive health policy which focus on quality, affordability, and accessibility of infertility care (162). Basic infertility services (screening, diagnosis) are available in public hospitals and few Government-Sector IVF treatment is also available (163). Sri Lanka has recently developed and introduced formal national guidelines for infertility treatment, including assisted reproductive technologies (ART) and other infertility treatment protocols. These guidelines are intended to be followed by all hospitals and healthcare institutions providing infertility services to ensure high-quality, safe, and ethically conducted care (164).

Sri Lanka is recognized by WHO and UNICEF for having a best practice intervention in preconception care in South Asia. The country's Service Package for Newly Married Couples, launched in 2011 (expanded nationwide by 2018), is a comprehensive program that includes risk screening, counselling, physical assessments, vaccinations, health education, nutritional interventions and family planning services for the newlyweds couple during two preconception care sessions at local primary health care clinics (free of costs). Couples are typically registered during home visits by the local public health midwives (PHM) soon after marriage. About 60% of newlyweds registered and attending at least one session in 2018. The program is considered a best practice for infertility prevention because it ensures that risk factors for infertility (such as RTIs, malnutrition, and chronic diseases) are detected and addressed before couples attempt conception and promote healthy lifestyle, provide early counselling, referrals, and continuous monitoring. The program uniquely provides universal, systematic preconception care to all newly married couples across the country (165-168).

This intervention is also considered as a best practice for fertility education and contraceptive use in South Asia. The sessions cover a wide range of topics including family planning, contraception, overall sexual and reproductive health and infertility risks by engaging couples before their first pregnancy. This program aims to proactively equip couples with knowledge and resources for informed reproductive decision-making (165). Family planning service in Sri Lanka, engage men as equal partner in family planning which promote joint informed decision making, share responsibility for contraception and reproductive health and helps to address gender norms (169). Sri Lanka integrated RTI/STI prevention and treatment within family planning services. PHM provide RTI/STI services (screening, counselling, treatment, and education) at community level and promote safer sexual behaviours and condom use. This helps early detection and treatment of infections that can cause reproductive tract damage if untreated and thus can help to prevent infertility (170).

In south Asia, Sri Lanka currently has the highest contraceptive prevalence rate 70% with 54% modern contraceptive use, lowest unmet need for contraception (7.5%) and lowest unintended pregnancy 17.2%. (according to Sri Lanka's latest

DHS data 2016). This program helped to reduce unintended pregnancy which was 23% in 2010. (171).

Teenage pregnancy in Sri Lanka declined from 6.5% in 2009 to 3.8% in 2023 which is highlighted by UNFPA as best practise in South Asia (172). Key strategies include Nationally standardized CSE in schools, mandatory teacher training in CSE, adolescent-friendly health clinics nationwide, strictly enforced legal marriage age 18, community and parent engagement (173,174).

For CSE, Sri Lanka introduced the latest International Technical Guidance on Sexuality Education (ITGSE 2018) developed by UNESCO. Sri Lanka is gradually overcoming cultural barriers of CSE delivery by involving families, adapting materials to local norms, and sensitizing educators and health workers (175).

According to latest DHS 2016 Sri Lanka, 99% of mothers from a skilled provider received antenatal care, 99.5% of births were assisted by skilled provider and 99% of mothers received postnatal care in the first two days after delivery (176).

There are about 6,000 Public Health Midwives (PHMs) across Sri Lanka, each covering 3,000 to 5,000 people with an established geographic area, offering home-based and clinic services for pregnant women, supporting rural women throughout pregnancy, delivery, and post-natal care. They link community members with healthcare facilities and encourage institutional care but also provide home-based deliveries where necessary (177,178).

Among South Asian countries, Sri Lanka stands out as a best practice example for tobacco reduction, achieving a relatively low smoking prevalence (under 15%) and Sri Lanka's tobacco control success is attributed to strong government policies, enforcement of smoke-free environments, and public health campaigns aligning with WHO standards (179).

“Safety + Health for All Plantation Workers in South Asia” project was implemented by the International Labour Organization (ILO) in Sri Lanka, India, and Nepal from January 2021 to December 2024. This intervention is recognized as a best practice by ILO because it addresses occupational exposures at policy, workplace, and individual levels using evidence-based strategies. This program improved sanitation, reduces harmful chemical exposures, educated workers about good hygiene, helps them access healthcare faster and increased awareness for better occupation risk management. These steps lower the chances of infections and reproductive health problems that can cause infertility. Over 33,000 plantation workers were benefited from improved workplace safety and gave women a stronger voice in workplace decisions (180).

The infertility rate of Sri Lanka is 4.6% in 2020 (181). However, above mentioned strategies in Sri Lanka, help to improve fertility knowledge, reduce risk factors of infertility (such as teenage pregnancy, unintended pregnancy, unsafe delivery, smoking, occupational exposure reproductive tract infections) and increase protective behaviours (contraceptive use) (170,182).

Bhutan

Infertility Prevention and Management Guideline from Bhutan is developed and published by the Department of Public Health, Ministry of Health, Bhutan in 2025. The document provides a comprehensive framework for the prevention and management of infertility, integrating global best practices with strategies relevant to Bhutan's context. It includes protocols for diagnosis, treatment, prevention, and referral, and is designed to guide healthcare providers and policymakers across the country. The guideline is new, and no research article is available for its outcome (183).

India

India's Assisted Reproductive Technology (ART) Regulation Act, 2021 sets clear, ethical standards for ART clinics, ensures patient safety, and protects the rights of women and children born through ART. The law requires clinics to be registered, mandates proper screening and counselling, and enforces strict penalties for unethical practices and unsafe treatments. The Act has improved the quality and transparency of fertility care, making ART services safer and more reliable (184).

India has public awareness and treatment option campaigns to reduce stigma around infertility and IVF. These campaigns emphasize that infertility is a medical condition that can be addressed with professional help, encourage individuals to seek timely diagnosis and treatment (185). India is seen as a best practice hub for egg freezing and genetic testing because it combines advanced technology, trained specialists, and wide accessibility. Telemedicine allows women across India to access expert fertility advice and services. India has established dedicated organizations like the Fertility Preservation Society of India (FPSI) to promote awareness, support and ensure patients receive information and referrals about fertility options before starting cancer treatment (186,187).

Egypt

In Egypt, Sunni Muslim authorities issued a fatwa in 1980 approving IVF for married couples as a religiously permissible solution to infertility with the condition that only the husband's and wife's gametes are used (third-party donation is not allowed). This religious guidance has been influential not only in Egypt but also in other Sunni-majority countries such as Jordan, Saudi Arabia, and Turkey. In Egypt, when religious leaders support infertility treatments, people feel more comfortable seeking medical help early instead of only relying on traditional healers or religious rituals. Now, Egypt has the highest IVF success rates (40–60% per cycle) in the region, due to early treatment seeking in younger age, advances in technology and the encouragement from religious authorities (188,189).

Chapter Four: Discussion

In Bangladesh, the risk factors of infertility for both men and women include inability to make informed decisions due to lack of fertility education, lifestyle factors (tobacco consumptions, malnutrition, insufficient physical activities), low condom use (which can cause STI), low contraceptive use (which causes unintended pregnancy and leads to unsafe abortion), teenage pregnancy complications, chronic conditions (diabetes, hypothyroidism), reproductive tract infection (STI, GTB, HPV), occupational exposure (pesticide and industrial heavy metal exposure), environmental threats (arsenic and salt water exposure), less access to fertility care and harmful medical practices (unsafe delivery and abortions). Rural and urban low-income populations in Bangladesh have higher risk for infertility, as they are more exposed to risk factors of infertility such as malnutrition, smoking and SLT, and inadequate access to preconception or infertility care. Moreover, rural people have arsenic exposure, pesticide exposure and urban low- income people have industrial heavy metal exposure which increase infertility risks. High prevalence of teenage pregnancy, lack of ANC and unsafe home deliveries are also high in rural areas which increase the risk of secondary infertility. Most research on infertility in Bangladesh has focused on patients who can access and afford treatment (above middle-income) at private hospitals and there is a lack of national data on underprivileged population. The extent to which these risk factors contribute to infertility among these rural and urban low-income people who cannot access infertility care remains unknown.

There is no policy or direct prevention strategies for infertility in Bangladesh. Although some indirect prevention strategies exist, they are not fully effective in reducing infertility risk factors. However, in Sri Lanka infertility care is a part of comprehensive national reproductive health policy and has a guideline on infertility treatment. Bhutan has a specific guideline for infertility prevention and management and India has ART regulation act. Bangladesh can learn from these countries and can integrate infertility care (covering information, prevention, diagnosis, and treatment) as a part of national reproductive health policy, develop a specific guideline for infertility prevention and management and develop ART regulation act to ensure quality infertility care. To develop infertility policy and guidelines in Bangladesh would require multi-level efforts directed by MoHFW, (DGFP), supported by donor agency, NGOs and research institutions. To implement this policy Bangladesh may face several challenges like funding, lack of research and data, lack of trained health care workers, public infrastructure, social and cultural barriers regarding acceptance of advance treatment. By resource allocation and public-private-partnership, public and private sector can jointly invest in research, train health care providers, upgrade health facilities, and set quality standards for infertility care. Community clinics and sub-district hospitals which have the potential to provide basic infertility care and prevention can be utilized to decentralize infertility care (14). Bangladesh, as a Muslim country can learn from the strategies used in other Muslim countries especially Egypt and engage religious leaders to make IVF religiously permissible solution to infertility to encourage early treatment seeking, to reduce reliance on unproven traditional

remedies and to make IVF acceptable. Integrating infertility services into public hospitals, subsidizing private hospitals and engaging religious leaders Bangladesh can increase access to quality fertility care and can advance personalized fertility advice and assessment.

In Bangladesh, family planning services traditionally focus on women and there is lack of male involvement in family planning and reproductive health. However, family planning service in Sri Lanka, engage men as equal partner in family planning which promote joint informed decision making, share responsibility for contraception and reproductive health, lifestyle and behaviour change for infertility prevention and destigmatize care-seeking for infertility (169). Bangladesh can learn from Sri Lanka and actively engage men in family planning services for infertility prevention.

There is lack of fertility education and quality CSE is in Bangladesh. However, Sri Lanka integrated fertility education in pre-conception care and have international standardized CSE (175). Bangladesh can learn from Sri Lanka and intergrade fertility education and standard CSE nationwide and can overcome cultural barrier of CSE delivery by involving families, mandatory training and sensitizing educators and adapting materials to local norms In Bangladesh, many people do not have access to preconception care. However, in Sri Lanka, nationwide PHM provide risk screening, counselling and referral, vaccinations, nutritional interventions during home visit. Bangladesh can provide nationwide pre-conception care at community level like Sri Lanka by training FWAs who are already doing home visits and community meetings for family planning (contraception). Bangladesh can increase early RTI/STI screening in community level like Sri Lanka. There is no public awareness campaign in Bangladesh for infertility prevention to reduce stigma around infertility and no intervention for LGBTQ population. However, India have public awareness and treatment option campaigns around infertility. Like India, Bangladesh can launch public awareness campaign focusing on both men and women to reduce stigma and raise awareness to communicate with empathy, knowing that some infertility cases may never be treatable (14). Condom use for STI prevention is not adequately promoted in Bangladesh despite condom use can give dual protection (STI and unintended pregnancy prevention). To reduce teenage pregnancy, Bangladesh can learn from Sri Lanka (which is recognized for its low teenage pregnancy rate) and strictly enforce legal marriage age 18 for girls, engage parents and community and expand adolescent-friendly health clinics nationwide.

Although a large of people are at risk through pesticide and industrial chemical exposure in Bangladesh, there is lack of occupational health policy targeting infertility prevention and existing indirect prevention strategies are not effective to reduce infertility risks, However, Safety + Health for All Plantation Workers in South Asia" project has improved reproductive health among plantation worker in Sri Lanka, India and Nepal (180). Though it not a direct strategy for infertility prevention, but Bangladesh can learn from this project and develop occupational policies to reduce infertility risks. Bangladesh can increase uptake of reproductive options like India. There is a lack of trained health care providers for performing

safe delivery and safe MR especially in rural areas of Bangladesh. However, Sri Lanka has deployed PHM nationwide to reduce harmful medical practises. Bangladesh government need to train and deploy more trained health care providers in rural areas to raise awareness and ensure safe delivery and MR.

The application Conceptual Model of Infertility Prevention as a framework has been highly valuable for structuring my thesis on infertility prevention strategies in Bangladesh and best practices in similar countries of Bangladesh. By systematically incorporating all elements of the framework, types of interventions, mechanisms of change, moderators of intervention and prevention outcomes, it has enabled a comprehensive exploration of preventative efforts. The added focus on 'risk factors', represented by a new box in the model, has enriched the framework and allowed for integration of context-specific determinants of infertility.

Chapter Five: Conclusion

Bangladesh's high infertility risk is driven by a complex interplay of social, cultural, economic, and environmental factors, compounded by inadequate healthcare access. Prevention strategies in Bangladesh addressing these risk factors do not focus on infertility prevention. By making infertility a public health priority, Bangladesh can adopt direct prevention strategies and best practices (like policy, fertility education, preconception care, access to fertility care) from other countries (like Sri Lanka) which have better outcomes for infertility prevention.

5.1 Limitation

This study is a review of available literature and documents. There is a challenge of quantification of the contribution of risk factors to infertility due to lack of research. The design of this thesis did not allow for conducting key informant interviews with different stakeholders. This could have provided more information which are undocumented.

5.2 Recommendation

Policy and Social level

- Bangladesh needs to expand its current policy framework to include infertility care (covering information, prevention, diagnosis, counselling and treatment), research, development of public health infrastructure, training health care providers and regulation in infertility care with public private partnership to ensure equitable access for all.
- Government should develop national infertility prevention and management guidelines.
- Community clinics and sub-district hospitals which have the potential to provide basic infertility care and prevention can be utilized to decentralize infertility care.
- Government should engage religious and community leaders to encourage early treatment seeking, to reduce reliance on unproven traditional remedies and to make IVF acceptable and increase uptake of reproductive options.

Individual and Couple level

- MoHFW should actively engage men in family planning services and promote joint informed decision making, lifestyle and behaviour change for infertility prevention and to destigmatize care-seeking for infertility.

Public health and educational level

- Bangladesh should intergrade fertility education in pre-conception care and nationally standardized CSE overcoming cultural barrier by involving families, mandatory training and sensitizing educators and adapting materials to local norms.

- MoHFW should provide nationwide pre-conception care by training FWAs who are already doing home visits for family planning services.
- Focusing on both men and women, Bangladesh should launch public awareness campaign for infertility prevention to reduce stigma around infertility and raise awareness to communicate with empathy as some infertility cases may never be treatable
- Bangladesh should expand condom promotion for dual protection (STI and unintended pregnancy prevention) and increase early screening of RTI/STI at community level.
- To reduce teenage pregnancy, Bangladesh should strictly enforce legal marriage age 18 for girls, engage parents and community and expand adolescent-friendly health clinics nationwide.

Institutional

- Bangladesh government should develop and implement occupational health policy for infertility prevention especially for agricultural workers (pesticide exposure) and industrial workers (heavy metal exposure)
- MoHFW should train and deploy trained health care providers in rural areas to raise awareness and ensure safe delivery and MR
- MoHFW should keep data regarding detection and regulation regarding infertility for future research
- Further research should be done on infertility in Bangladesh with a focus on the rural and urban low-income population who have higher risk for both male and female factor infertility (primary and secondary) and have less access to currently available indirect prevention strategies regarding infertility.

Annex 1: AI Declaration

KIT Institute (Masters or Short course) Participants
Declaration for Use of Generative AI (GenAI)

Check the box that applies to your completion of this assignment:

☐ I confirm that **I have not used** any generative AI tools to complete this assignment.

☒ I confirm that **I have used** generative AI tool(s) in accordance with the *"**Guidelines for the use of Generative AI for KIT Institute Master's and Short course participants".*** Below, I have listed the GenAI tools used and for what specific purpose:

Generative AI tool used	Purpose of use
1.Perplexity	Research

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