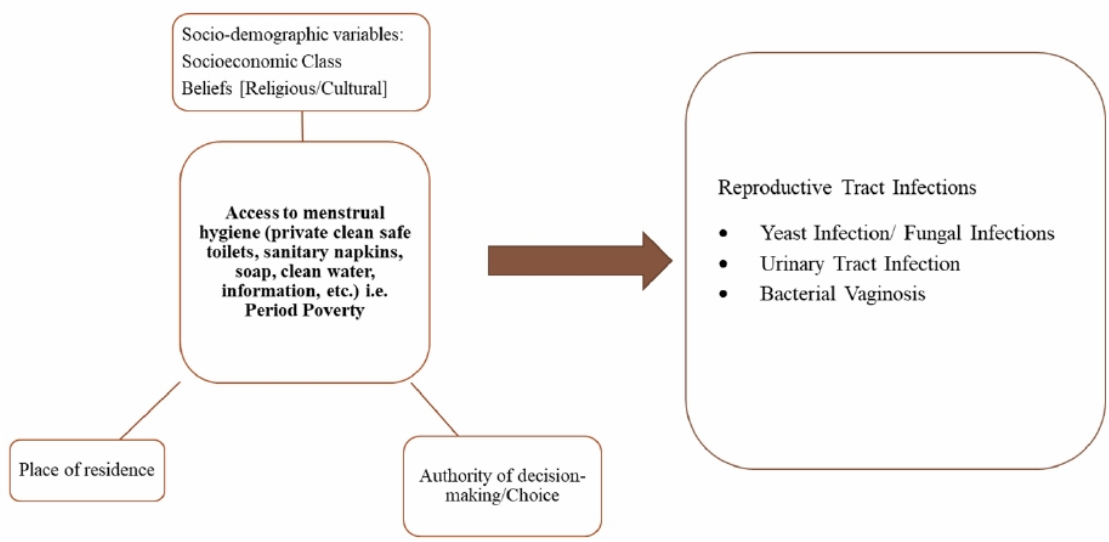
Independent variables	Dependent variables
• Socio-demographic variables: ▪ Income level ▪ Beliefs [Religious/Cultural] • Place of residence • Authority of decision-making/Choice • Access to menstrual hygiene (private clean safe toilets, sanitary napkins, soap, clean water, etc.) i.e., Period Poverty	Reproductive Tract Infections • Yeast Infection/ Fungal Infections • Urinary Tract Infection • Bacterial Vaginosis

1.6. Conceptual framework



1.7. Operational definitions

Menstrual Hygiene Management:
MHM is the access to proper menstrual health and hygiene management, which includes "accurate and timely knowledge, available, safe, and affordable materials, informed and comfortable professionals, referral and access to health services, sanitation and washing facilities, positive social norms, safe and hygienic disposal and advocacy and policy"[22].
Period Poverty:
Period Poverty is defined as the absence of proper menstrual hygiene for a menstruating person should be "using a clean menstrual management material to absorb or collect menstrual blood, that can be changed in privacy as often as necessary for the duration of a menstrual period, using soap and water for washing the body as required, and having access to safe and convenient facilities to dispose of used menstrual management materials. They understand the basic facts linked to the menstrual cycle and how to manage it with dignity and without discomfort or fear"[23]. Period poverty stems from a lack of access to suitable menstrual products, WASH facilities, privacy &dignity, and education & information on menstrual hygiene[21].
Reproductive Tract Infections:
In this study, reproductive tract infections primarily refer to the infections in the reproductive tract caused by introduction of pathogens or by overgrowth of the existing microorganisms of the vulva or vagina, or in the cervix. It is characterized by vaginal discharge, dyspareunia (persistent or recurrent genital pain that occurs just before, during or after intercourse), itching and burning feeling with urination, vaginal inflammation, or rash, genital sore/ulcer[20,8,9].
Beliefs: The religious or traditional beliefs of the participants.

Authority of decision making: The participant's ability to make the decisions about their life and family, healthcare, etc.

For this study, the following signs & symptoms will be used to level the Reproductive Tract Infections of the participants:
Yeast Infection/ Fungal Infections: Symptomatic definition would be presence of

- ✓ Itching and irritation in the vagina and vulva
- ✓ A burning sensation, especially during intercourse or while urinating
- ✓ Redness and swelling of the vulva.
- ✓ Vaginal pain and soreness
- ✓ Vaginal rash
- ✓ Thick, white, odor-free vaginal discharge with a cottage cheese appearance
- ✓ Watery vaginal discharge

Urinary Tract Infection: Symptomatic definition would be presence of

- ✓ Pain or burning while urinating.
- ✓ Frequent urination.
- ✓ Feeling the need to urinate despite having an empty bladder.
- ✓ Bloody urine.
- ✓ Pressure or cramping in the groin or lower abdomen.

Bacterial Vaginosis: Symptomatic definition would be presence of

- ✓ A thin white or gray vaginal discharge.
- ✓ Pain, itching, or burning in the vagina.
- ✓ A strong fish-like odor, especially after sex.
- ✓ Burning when peeing; and.
- ✓ Itching around the outside of the vagina.

2. Literature Review

Even though reproductive tract infections do not concern every individual of the world, it does affect a major proportion of the world's populating, specifically one eighth of the menstruating population suffer from RTI and ensuring prevention of RTI calls to be a priority issue.
Sexual and reproductive health and rights, is now on the Sustainable Development Goal agenda, are crucial for sustainable development. As Mao Zedong said: "Women hold up, half the sky;" their health is a significance matter. In developing countries, RTI is becoming a hidden epidemic with around one million women and children lost to complications resulting from RTI and untreated RTI giving way for other diseases such as cervical cancer, HIV AIDS, chronic abdominal pain, etc.
The prevalence of RTI in Bangladesh is increasing according to a survey-based study in 2021, going from 11.1% in 2007 to 13.4% in 2014, only based on self-reported symptoms[9].
The definition of 'Period poverty' by American Medical Women's Association is lack of proper and sufficient access to menstrual hygiene management which includes sanitary materials, washing facilities, and waste management, etc. It may be a fairly novel phrase, but the issue has been present in the communities forever, only hidden owing to the stigma, lack of awareness and patriarchal societies deprioritizing women's health issues.
In 2021, an estimated five hundred million females over the world shared that they do not have sufficient access to proper menstrual hygiene management. Even though menstrual equity is a matter of human rights as well as public health, inequalities based on race, socioeconomic conditions, and sex together increase the complexity of the structural barriers in access to proper menstrual hygiene management thus perpetuating period poverty. Furthermore, the limitation of data and research on this topic paired with the socio-cultural stigma is shoving it under the rug,

constantly away from those in the position of changing the gender as well as public health policies and interventions[17].

In our neighboring country India, which has a remarkably similar context as Bangladesh, only 12% of the menstruating populations have adequate access to proper menstrual hygiene management. Moreover, the non-binary and third gender menstruating population face adverse case of period poverty including access to proper information regarding their menstrual health and hygiene management[13].

In Bangladesh, there is very scarce data and research on the situation of period poverty, and there no information on the cases for third gender or other gender menstruation people. The concept itself is not well known amongst the policy makers and public health professionals, and the very few studies conducted on the association between menstrual hygiene and health do not cover all aspects of period poverty.

Reproductive tract infections are made up a considerable proportion of the public health concerns all over the world, especially associated with menstruating population, but the shame and stigma associated with the topic keeps in hidden while the lack of resources and awareness push it down the priority list of national health policy makers. Bangladesh is a country with limited resources and has been listed as one of the least developed countries by the UN and is at an elevated risk for reproductive health issues in women.

Urogenital schistosomiasis is a parasitic infection associated with poor menstrual hygiene which is a direct outcome of period poverty. It is not yet well researched and often misdiagnosed during examination at primary healthcare facilities. Insufficiency of guiding information and gender inequity results in menstruating adolescents not being able to manage their menstruation properly and using poor blood management materials predispose them to various bacterial, fungal, and helminthic infections as well as viral diseases[18].

The most recent study was conducted in 2021 based on Demographic and Health Survey data from 2007, 2011 and 2014 where women of reproductive age self-reported symptoms of RTI such as abnormal discharges or sore/ulcer experienced during the year prior to the survey. The aim of the study was to identify high-risk regions for RTI, through spatial-temporal analysis that can produce high resolution mapping of RTI critically useful in a resource-poor developing country like Bangladesh to guide public health strategies and interventions. Data was collected for 46,701 15-49 years old women who participated in the DHS demographics and health survey of whom 10,996 in 2007, 17,842 in 2011 and 17,863 in 2014.

The result of the study estimated higher prevalence in regions of high population density such as Dhaka and Chattogram, compared to other areas. The raw prevalence based on overall number of positive/total number of interviewed went from 10.99% in 2007 to 14.39% in 2011 to 13.94% in 2014, nationally. This study did not include the asymptomatic cases, and the included cases are not hospital diagnosed, and the study considered the symptomatic cases to be more severe than the asymptomatic cases which go undiagnosed. The study reconfirmed the negative relationship between socioeconomic status and the incidence of RTI amongst menstruating population, which is a factor contributing to period poverty[9].

Another study published in 2021, with data collected between 2016 to 2018 using a multi-stage cluster sampling design, from the Kinshasa (DRC), Ethiopia, Ghana, Kenya, Rajasthan (India), Indonesia, Nigeria and Uganda found that low-income household's females and lower education levels, have higher possibility of period poverty with lacking access to menstruation-friendly toilets, with soap and water, privacy and safety and sanitary pads. The inequality of menstrual hygiene management facility is particularly prominent in Rajasthan (India), Ethiopia and Nigeria. Based on the previous studies it is evident that the culture, economic vulnerability, and education plays key role in occurrence of period poverty, thus prevalence of RTIs. The sample population for this study was aged between 15 – 49 years, and the questionnaire was administered by female enumerators ensuring informed consent and complete privacy for the respondent[16].

A community-based cross-sectional study was conducted in 2019, for three months, in Dessie City of Ethiopia to investigate whether menstrual hygiene management and water, sanitation, and hygiene is associated with RTI. 602 15-49 years old females from urban areas in Ethiopia were systematically selected and data collected using observation checklist and questionnaires that asked about symptoms of RTI including abnormal vaginal discharge, rash/irritation, ulcers, or lesions around the vulva, dyspnoea, lower abdominal pain and lower back pain during one year before data collection. The prevalence of RTI based on self-reported symptoms was found to be 11% with were using unsanitary latrines, handwashing without soap and touching the genital area, infrequent replacement of sanitary napkins and infrequent washing of the genital area during the day. The study consisted of participants from all socioeconomic classes. The study deployed multivariate logistic regression analysis to identify associations between the independent variables and RTI, and the adjusted odds ratio was found to be 4.2 for use of unclean toilets, 3.94 for not washing hands with soap before touching the genitalia, 8.99 for changing absorbent material once per day during menstruation and 5.76 for washing the genital area only once per day during menstruation. This showed that the association between poor menstrual hygiene management such as use of unclean toilets, not washing hands with soap before touching the genitalia, changing absorbent material once per day during menstruation and washing the genital area only once per day during menstruation is significant. The study also mentioned that the prevalence of RTI in similar communities of different countries and cities were found to be higher by other studies such as 45% in Mohali, Punjab; 29.15% in Bangalore City; 55.5% in rural Tamil Nadu; 56.5% in rural Surendranagar; 36.1% in an urban slum in Bidar, Karnataka; 46.76% in Etawah District, Uttar Pradesh, and 43.9% in an urban slum of northeast Delhi, India[1].

A similar study was proposed in the metropolis of Barcelona, Spain, using a mixed method study to menstrual health and period poverty among their young menstruating population. Quantitative transversal study was used to identify period poverty amongst 11-16 years old people who menstruate using a questionnaire, and qualitative study was used to explore experiences of menstruating and non-menstruating people of 11-16 years age as well as primary healthcare professionals, educators, and policymakers.

For the quantitative study questionnaire the variables were: use of menstrual products, economic challenges in access to menstrual products, hormonal contraception consumption, menstrual pain and disorders, mental health, provision of menstrual health consultation, school absence related to period, disruption of performance in school due to periods, stigma and discrimination towards periods, information and awareness regarding menstrual health and hygiene management as well as age, school, primary healthcare center, household composition. The qualitative data collection was to be conducted through Key Informant Interviews and Focus Group Discussions.

Based on the interim report of the study, it is evident that period poverty is strongly associated with socioeconomic condition of the household. 37.1% of the study participants who had financial challenges have no other choice but to access cheaper menstrual supplies and 71.4% of the total participants shared that the menstrual products are pricey for them. Furthermore, 11.6% of the participants reported using toilet paper, 4.3% resorted to used diapers, and 4.6% used nothing. Alarmingly, 94.3% of the total participants reported using the menstrual product for longer or more frequently than recommended. 20% of the participant did not access health services for their menstrual health, and 7.9% assumed extreme menstrual pain is normal while 3.8% had the belief that menstrual pain is not something that may need medical consultations. These are lack of information and education regarding menstrual health and hygiene, as well as societal barriers, which together bring about the silent epidemic of RTI through period poverty[15].

A frequently cited study in Odisha, India is based on a hospital-based cross-sectional study which investigated the association between Bacterial vaginosis, (BV), Candida, and Trichomonas vaginalis (TV) and poor menstrual hygiene, amongst patients from varying socioeconomic status. The sample population was 18-45 years old non-pregnant female patients visiting the outpatient

department of the Obstetrics and Gynecology department of the two hospitals. After being identified by the respective doctors and signing the informed consent form, the participants received tests for the three RTI, and responded to survey questionnaire for risk factors including socio-economic indicators, menstrual hygiene tools and management, and WASH access variables. The questionnaire included inquiries on age, marital status, religion, educational level, profession, family size, income, material to manage blood, whether it is disposable or reusable and of what material it is made of, their usual hygiene habit, how often they change pads, menstrual waste disposal, WASH facilities at home, and symptoms of RTI such as unusual vaginal discharge, burning/itching in the genital area, ulcers/rash in the genital area, etc. Clinical examination and sample collection from the genital area was conducted by a relevant professional to further confirm the presence of RTI. Hierarchical analysis was conducted with age and education as potential confounders, to identify association of each group of independent variables with RTI.

The results showed that 50.5% of the participants had at least one symptom of RTI and 29% of them repeatedly visited the hospital for those symptoms. The total prevalence of RTI was 62.4% with abnormal vaginal discharge being the most common self-reported symptom and the most prevalent RTI was Bacterial vaginosis at 41%. The results of the study affirmed the association of specific menstrual hygiene management issues such as reusing menstrual pad, frequency of washing the genital area, frequency of changing the menstrual pad as well as level of education, with risk of RTI[20].

Another cross-sectional study based in rural Uganda's Kamuli district utilized secondary data, to estimate the prevalence of poor MHM in school-going girls, and the impact on them. Total 205 school-going females of age 10 to 19 years from eight sites participated in this study. Written consent was procured from the participants as well as their parents. The study cited genital irritation and urogenital symptoms, as results of poor menstrual hygiene management and the result of the study show that 90.5% of the participant did not follow proper menstrual health and hygiene, exposing them to risk of RTI.

The study defined Menstrual Hygiene Management as availability of clean absorbents, adequate changing frequency of absorbent, ability to wash with soap and water, adequate waste disposal and adequate privacy MHM and was captured through self-reported practices of the participants. Univariate logistic regression was used to evaluate the association between MHM practices and impact on health. It was found that only 9.5% of the participants had appropriate MHM based on the relaxed minimal criteria. About half of the study participants shared that they felt some kind of physical discomfort such as genital irritation and unusual discharge, which could potentially be due to RTI[11].

A study in 2013 in India investigated the association between MHM and RTI or abnormal vaginal discharge, with a sample size of 577,758 ever married women aged 15 to 49 years, from twenty-eight states through interview. The results were analyzed in two stages, starting with prevalence of proper menstrual hygiene management followed by testing the hypothesis that those who do not follow proper MHM would more likely report RTI symptoms and abnormal vaginal discharge against those who used proper MHM. The participants were asked about their backgrounds such as age, education, age at marriage, marital status, marital duration, place of residence (rural and urban), religion, wealth index, caste group of the women and type of toilet used (flush, pit/dry toilet, no facility/used, open space, other), awareness about personal hygiene, and gynaecological factors. They were also asked regarding MHM and RTI through blood soaking material use— hygienic or unhygienic, (clothes or other method) simultaneously, any itching or irritation over vulva, boils/ulcers/warts around vulva, pain during urination/defecation, swelling in the groin and painful blister like lesions in and around vulva, abnormal vaginal discharge. Association between socio-economic and demographic factors, and proper or improper MHM was analyzed using bivariate analysis in SPSS. Logistic regression estimated the

effects of socioeconomic, demographic, and gynaecological factors on RTI and abnormal vaginal discharge. Multivariate logistic regression predicted the symptomatic prevalence of RTI and abnormal vaginal discharge[3].

Only 15% of the sample population reported using used sanitary pads or some locally prepared napkins and RTI and abnormal vaginal discharge were found to be positively related with non-use of hygienic methods. Women who did not follow proper MHM, having symptoms of RTI was 1.046 times more and having vaginal discharge was 1.303 times more than women who did follow proper MHM[3].

Another hospital-based case-control study in India, based off Odisha investigated Menstrual hygiene practices, WASH access and the risk of urogenital infections in 486 women with syndromic approach. Vaginal swabs, urine samples, questions on socioeconomic status, clinical symptoms, and reproductive history, and MHM and water and sanitation practices were collected. The results showed that reusable pad users were 2.3 times more likely to contract urogenital infections than disposable pad users, 'Wealth and space for personal hygiene inthe household were protective for BV,' and education was found to be the only factor related with UTI, when confounders were adjusted for[7].

Prevalence of RTI was also investigated through descriptive cross-sectional study in 2007, at the Gynae OPD of an urban clinic in Dhaka, with 176 women of age 15-49 years visiting the department. The sample was selected through systematic purposive sampling, and participation was voluntary with informed consent.

Based of clinical symptoms RTI was identified in 18.19% of the sample, based on clinical examination 22.16% and based on laboratory tests 23.9% were reported as RTI. Among thirty-nine provisionally diagnosed RTI cases 13 (33.33% of the provisionally diagnosed cases were pelvic inflammatory disease, 25.64% were mixed infection and 12.82% were vulvovaginitis; and 38.09% of the confirmed cases were confirmed as bacterial vaginosis, 9.52% were trichomoniasis, 16.66% were candidiasis, 14.28% were mucopurulent cervicitis and 2.38% were syphilis. Apart from these, the study also noted that additional to acute infections some cases result in long term impairment of reproductive system such as ectopic pregnancy[12].

Based on a study in Khulna, Bangladesh, amongst 300 married slum women aged 15 to 49 years, the prevalence of RTI in women living in slums was found to be 72.6% as per one or more self-reported symptoms. Chi-squared test was used to evaluate the bivariate relationships between respondents' age, education level, age at marriage, religion, family type, house type, menstrual hygiene, contraception usage, age at first pregnancy, place of delivery, non-live birth, knowledge, and awareness of RTIs and treatment seeking behavior—independent and dependent variables. The study found a negative relationship between education of the women and symptoms of RTI, also a negative relationship between awareness about RTI and symptoms of RTI. The authors attributed the higher incidence of RTI in the married women in slums to their lack of education, lack of proper hygiene management, age of marriage and lack of awareness and information regarding RTI. The study also suggested the contribution of social stigma and cultural barriers to improper management of hygiene and RTI[8].

A research was published by World Health Organization in 2002, on the prevalence of and risk factors for reproductive tract infections among men and women in Matlab, Cumilla, a rural community in Bangladesh. The study included 804 married women of age 15-50 years who were not pregnant at the time, through systematic sampling, and collected survey data on sociodemographic and reproductive history, current and past clinical symptoms affecting the reproductive tract, treatment-seeking history, and sexual behaviour as well as cervical, vaginal, urinary, and serological samples. Informed consent had been collected from all the participants and their close family members were also explained about the study and method.

Cross-tabulations and Fisher's exact test were used to examine the risk factors associated with vaginal and cervical infections. Sociodemographic and hygiene-related factors were examined

through bivariate logistic regression analysis. The results of the study suggested that endogenous infections had higher incidence in Hindu females (28%) while it was comparatively lower in Muslim females (14%) and did not find any association between MHM and endogenous vaginal infection. However, the study also found that the frequency of changing sanitary pad was more than three times in 31% females who are Muslim, and 15% females who are Hindu. The overall finding of the study suggested low to moderate prevalence of RTI, including moderate prevalence of endogenous infection amongst married women of rural Matlab[10].

Despite these studies, there is no nationally representative data on RTI, and the concept of period poverty is still unknown to maximum of the general population, medical practitioners, policy makers as well as public health specialists. There are only few studies in Bangladesh, and those are on very specific geographical area and population; none of them recent. It is well understood that poor menstrual hygiene is strongly associated with socioeconomic poverty, however it is not realized how far the impact of period poverty is. Period poverty does not care about the lack of data or policies, and it is of urgent need to assess the scenario of RTI owing to period poverty in Bangladesh, before the number of cases rise beyond control as we know prevention is better than cure.

3. Methodology

3.1. Study design

A Community Based Cross Sectional Study will be conducted Study place and population:

3.2. Study place and study population

Lower income settlements in Rampura Banasree, Dhaka

3.3. Study period

June 2023 – July 2023

3.4. Sampling technique& Sample size

In Bangladesh, there is no national prevalence data on RTIs or STIs. However, the limited numbers of prevalence studies showed high number of women have confirmed infections. According to a 2014 study, the symptomatic prevalence of RTI is 18.19% and 23.09% actually had RTI regardless of symptoms. Another internal study by Square Toiletries Limited (STL) showed that almost 97% women suffer from vaginitis due to unhygienic menstrual practices, in Bangladesh. An earlier study on 3000 women in Matlab Thana showed that 22% women had symptoms of RTIs.

According to few other older studies only about 14-23% menstruating women have access to sanitary napkins. Therefore, a 75% prevalence for period poverty is considered for calculating sample size using the following formula. The total low-income population of the selected areas was estimated to be 165539 based on latest census data.

$$n = \frac{z^2 \, x \, p(1-p)}{d^2}$$

d=.05, (1-α)=0.95,z = 1.96 for 95% confidence level

Using this formula, the required sample size is estimated to 288 which is rounded to 300 sample for this study.

One Mohalla with the majority of low-income population will be purposively selected from Rampura Banasree slum. First, one household from the approximate center of the area will be chosen. Following that, subsequent household will be chosen with anti-clockwise manner. One eligible participant will be considered from each household.

3.5. Selection criteria

- ✓ Female and transgender (Hijra) population residing in the slums of Rampura Banasree of Dhaka district.

3.5.1. Inclusion criteria

- ✓ 15 – 49 years of age
- ✓ Have menstruated in the last 3 months.