Assessment of Impact of Harm Reduction Interventions among People Who Inject Drugs (PWID) in Dhaka City

December 2014

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Assessment of Impact of Harm Reduction Interventions among People Who Inject Drugs (PWID) in Dhaka City

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December 2014
Dhaka, Bangladesh

This report was made possible with support from UNAIDS and Save the Children with funding support from The Global Fund to Fight AIDS, Tuberculosis and Malaria. The findings , interpretations and conclusions expressed in the report do not necessarily reflect the views of UNAIDS or Save the Children.

This document is available in printed or online versions. Online document can be located in the website at www.unaids.org.

ISBN: 978-984-33-8438-6

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Design & Printed by: Patwary Printing Press, Motijheel, Dhaka

Suggested citation: National AIDS/STD Programme (NASP) (2014). Assessment of impact of harm reduction interventions among people who inject drugs (PWID) in Dhaka city. Dhaka, Bangladesh: Ministry of Health and Family Welfare, Directorate General of Health Services, NASP.

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Foreword

Bangladesh responded early to HIV; even before the first case was reported in the country and a series of national plans has guided the response to HIV in Bangladesh. Consistent with the available data and strategic information, much of the response focus has been on preventing HIV in groups whose drug injecting and/or unprotected sex with multiple partners put them at most risk for HIV and other sexually transmitted infections. Though Bangladesh remains a low HIV prevalent country, the threat of a concentrated epidemic remains. HIV infection is increasing in some geographical areas among key populations (the transgender population, sex workers and people who inject drugs/PWID); and currently we maybe in a state of a latent epidemic. In Dhaka the HIV prevalence is at 5.3% among PWID (9th National Sero-Surveillance Report, 2011), implying the city as having a concentrated epidemic among PWID. A marker for unsafe injection practices is the prevalence of Hepatitis C and in Dhaka this declined significantly over the years. But high rates of HCV exist in four cities in northwest Bangladesh at upto 95.7%.

Since the late 1990s' a combination of HIV prevention, treatment, care and support approaches have been implemented in the country which have reinforced one another. There is a clear and urgent need to continue to accumulate more complementary credible evidence about what works and what does not work in HIV prevention in specific settings to further understand what is needed in which scenario to keep the low HIV prevalence among PWIDs or in general among the key populations in a cost-efficient manner. Donors and managers of HIV prevention programs need information on whether prevention activities, collectively, are doing enough to reduce HIV incidence.

Thus we are pleased to disseminate this joint report which helps us understand the various factors coming into play to influence the spread of HIV among the key and general population. Issues such as prevention interventions targeting risky behavior, high risk networks, client make-up, advocacy support, etc. have been considered using mathematical modeling and qualitative methods as well. The report describes the status of interventions and presents analyses of the trend of the epidemic and impact of the prevention programs among the PWID in terms of infections and deaths averted and return on investment. It is mentioned in the report that sustained interventions have contributed to low prevalence in Bangladesh, and interventions need to further sustain to continue this achievement towards reaching the global goal of getting to zero with the vision of "zero new HIV infections, zero discrimination, zero AIDS-related deaths." Though the return on investment is quite a long-term matter, it is well demonstrated that effective prevention efforts since the last 20 years has made an impact when we consider the epidemiological aspects of HIV in Bangladesh. We hope this report; jointly supported by the National AIDS/STD Programme on behalf of the Government of Bangladesh, UNAIDS, Save the Children, and icddr,b; will provide the basis to gradually undertake a similar analysis for the nation as a whole for critical insights into intervention and geographical prioritization to assist policy-makers and experts in decision making with regard to the national response to limit the spread of HIVAIDS.

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Acknowledgements

This study was carried out under the leadership and guidance of the National AIDS/STD Program (NASP) of the Ministry of Health and Family Welfare through a collaboration between Save the Children, the United Nations Joint Program on HIV and AIDS (UNAIDS) Bangladesh and the International Center for Diarrhoeal Disease Research, Bangladesh (icddr,b). The report presents the results of a study on the impact of harm reduction interventions among people who inject drugs (PWID) in Dhaka. The aim of the study is to assess the effectiveness of harm reduction interventions on reducing morbidity and mortality among PWID in Dhaka, and to examine what disparities exist in terms of program impact and outcomes. The authors acknowledge contributions of many national organizations and institutions that shared knowledge and data in support of this report including the NASP, Ministry of Health and Family Welfare, Government of Bangladesh. We are grateful to Dr. Wiwat Peerapatanapokin and Dr. Amala Reddy of UNAIDS Regional Support Team for Asia and the Pacific who provided invaluable technical support with data management, and were instrumental in finalizing the baseline workbook. Dr. Ali Mirzazadeh of University of California, San Francisco provided technical modeling support. The time and expertise of these contributors are gratefully acknowledged. We are very grateful to the Core Working Group of this study who worked with the research team throughout the study.

Appreciations are also extended to Dr. Abu Abdul Quadir, Global AIDS Program, Centers for Disease Control and Prevention (CDC), Atlanta and Dr. Tasnim Azim who shared with us the concept note and the ideas during the planning phases of this study. The comments from Dr. Anisur Rahman of NASP also helped us a great deal in the implementation of this study. Thanks are also due to Mr. Anup Kumar Bosu of Save the Children, Mr. A. B. M. Kamrul Ahsan of the United Nations Office on Drugs and Crime (UNODC) and Ms. Nadira Yasmin of FHI-360 who contributed to this assessment at different stages of its development. Many others gave important inputs and suggested valuable resources during the development of this report, including Dr. Mahmudur Rahman of the Institute of Epidemiology, Disease Control and Research (IEDCR), Dr. Simon Rasin and Dr. Lima Rahman of Save the Children, and Leo Kenny of UNAIDS Bangladesh.

Thanks are due to the team of field investigators who worked hard in the field for data collection. Many thanks are also due to those who participated in the key informant interviews. The study team must acknowledge the contributions of the PWID who participated in the focus group discussions and provided valuable information. They shared personal information about their lives for the purposes of this research and ultimately toward a better understanding of how harm reduction programs can prevent HIV transmission. Finally, we are grateful to Ms. Eva Hagström Frisell and Ms. Liza Marie Bakker for their editorial assistance.

This study was supported by UNAIDS Bangladesh and was funded by Save the Children from the Global Fund Grants under the terms of SCI/CA/2013/054. The opinions expressed herein are those of the authors and do not necessarily reflect the views of UNAIDS Bangladesh or Save the Children.

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Acronyms and Abbreviations

AEM	AIDS Epidemic Model
AIDS	Acquired Immune Deficiency Syndrome
ART	Anti-Retroviral Therapy
BDT	Bangladeshi Taka
BSS	Behavioral Surveillance Survey
CDC	Centers for Disease Control and Prevention
CEA	Cost-effectiveness Analysis
CMA	Cost-minimization Analysis
DALY	Disability Adjusted Life Year
DFID	Department for International Development
DGHS	Directorate General of Health Services
DIC	Drop-in-Center
FGD	Focus Group Discussion
FHI	Family Health International
FSW	Female Sex Workers
HBFSW	Hotel Based Female Sex Workers
HCV	Hepatitis C
HIV	Human Immunodeficiency Virus
icddr,b	International Center for Diarrhoeal Disease Research, Bangladesh
IDU	Injecting Drug User
IEC	Information, Education and Communication
IEDCR	Institute of Epidemiology, Disease Control and Research
ILWHA	Injecting Drug User Living with HIV/AIDS
KP	Key Populations
KII	Key Informant Interviews
MoHFW	Ministry of Health and Family Welfare
MSM	Men who have Sex with Men
MSW	Male Sex Workers
NASP	National AIDS/STD Program
NEP	Needle/syringe Exchange Program
OST	Opioid Substitution Therapy
PLHIV	People Living with HIV/AIDS
PV	Present value
PWID	People Who Inject Drugs
SBFSW	Street based Female Sex Workers
SCI	Save the Children International
STD	Sexually Transmitted Disease
STI	Sexually Transmitted Infection
TG	Transgender (Hijra)
UNAIDS	United Nations Joint Program on HIV and AIDS
UNGASS	United Nations General Assembly Special Session on HIV/AIDS
UNODC	United Nations Office on Drugs and Crime
USAID	United States Agency for International Development
WHO	World Health Organization

Executive Summary

Background

Although the commitment to prevent and control the HIV/AIDS epidemic in Bangladesh has increased significantly in recent years, the virus continues to spread with an alarming rate. In Bangladesh, like in other countries of the region, the epidemic is still concentrated in key populations (i.e. sex workers, men who have sex with men, people who inject drugs and hijra/trangender), particularly among people who inject drugs (PWID). The prevalence rate of HIV among PWID was more than 5 percent in Dhaka (all parts of the city) in 2011. Although it is estimated that less than 0.1 percent of the total population of 152 million is infected with HIV, the number of HIV cases is increasing rapidly.

This assessment was carried out to understand the dynamics of risk behavior and to provide a description of the current situation of the HIV epidemic in Bangladesh as well as its future projections. The study was supported by: the National AIDS/STD Program (NASP), IEDCR, Save the Children, UNAIDS Bangladesh, icddr,b and CDC Atlanta.

The aim of the study is to understand the HIV transmission dynamics and epidemiological trends in Dhaka city and to estimate the extent to which harm reduction interventions among PWID have contributed towards the epidemiological trends and reduced HIV transmission in the city. Cost efficiency of the existing harm reduction interventions is also examined.

Methods

The assessment used both quantitative and qualitative research methods. The AIDS Epidemic model (AEM) was used to assess the impact of harm reduction interventions among PWID in Dhaka city and to project the HIV epidemic based on detailed input of behavioral and biological information of key populations. The model aims to provide a more comprehensive picture of the current nature of the HIV epidemic and its development in the future. Scenarios are presented to illustrate multiple potential outcomes associated with different HIV prevention efforts. The study collects the relevant time series data from 2000 to 2012 to use as inputs to the AEM, and the AEM results presented focus on the period 2013-2020.

The study also uses AEM to analyse the costing by program activities which projected the intervention's impact in terms of cost per HIV infection averted. Apart from that, in-depth interviews with key informants and focus group discussions (FGDs) were conducted with male and female-PWID. A total of 8 FGDs were conducted among PWID in six drop in centers (DICs) in Dhaka to draw their perspective on risk behavior and to understand the nature of health and psychosocial challenges as well as insights and understandings of harm reduction programs. Data were also collected from key informants in order to gather information on the underlying contextual and programmatic factors that may have contributed to the relatively low HIV prevalence among PWID in Dhaka city. A total of 8 semi-structured interviews with key informants were held across a number of organizations.

Results

It is projected that the HIV prevalence will remain stable at around 6 percent among male-PWID in Dhaka city from 2013 to 2020 if the current scale of interventions continues. In contrast, the prevalence among female-PWID is projected to be at approximately 1.1 percent from 2012 and onwards. Although the number of current infections slightly dropped from 283 in 2007 to 266 in 2012 among male-PWID in Dhaka city, it will thereafter start to increase slightly. The model predicts that a significant proportion of HIV infections have been averted among PWID due to past prevention initiatives. The projection indicates that the current number of HIV infections among PWID in Dhaka city would be 315 in 2020 if current harm reduction interventions continue.

Recent trends indicate that the HIV prevalence levels may be stabilizing among PWID in Dhaka city. In 2000, the number of new HIV infections among PWID was estimated at 9, reaching a peak of 91 in 2005, which indicates a tenfold increase in just five years. The number of new infections among PWID fell back to 29 in 2011, probably indicating the success of current interventions. If current intervention programs continue, the number of new infections among PWID in Dhaka city is expected to be about 37 by 2020. Thus, interventions over the past decade have demonstrated a positive impact in reducing the spread of HIV among PWID.

Without the current harm reduction programs, HIV prevalence among PWID in Dhaka city could have reached as high as 24 percent in 2012, instead of the current 6 percent. Similarly, the HIV prevalence in the absence of any intervention among female-PWID in Dhaka city was projected to be nearly 3.8 percent in 2012 as compared to 1.1 percent with existing interventions. The AEM further projects a prevalence of 25.3 percent among male-PWID in Dhaka city in 2020, if no interventions continue among the group.

The general trend of HIV-related deaths for PWID was a gradual rise between 2000 and 2011 in Dhaka city if existing intervention scenarios was used and a similar trend is noted between 2015 and 2020. The projection shows that the number of deaths among PWID due to AIDS would be 24 in 2020 as compared to 23 in 2013, representing a 4.3 percent increase over the period. However, ***the trend shows that the proportion of deaths due to AIDS of PWID out of the total number of deaths is projected to drop to 23 percent in 2020 in Dhaka city if current interventions continue. The reduction in the proportion of deaths due to AIDS among PWID is probably the result of the country's continuous intervention program among the key populations.***

If the current interventions continue, the number of adults currently living with HIV in Dhaka will increase at a slower pace between 2013 and 2020 than earlier. It is projected that the total number of adults living with HIV will increase from 1,006 in 2013 to 1,437 in 2020 in Dhaka city. Past interventions targeting key populations have shown to be effective in reducing the transmission of HIV among the adult population.

The number of people living with HIV (PLHIV) in Dhaka city was estimated to be 973 in 2012. In the absence of any intervention program among the PWID since 1995, the number of PLHIVs was projected to be 2,073 by the year 2012. ***While PWID were found to constitute 28 percent of PLHIV in Dhaka city in 2012, this could have been as high as 50 percent, if no intervention had taken place targeting PWID.***

HIV estimates derived from the mathematical modeling are essential to the assessment of the HIV situation in different key populations, thereby keeping intervention activities focused on realities. In 2012, male-to-male sex accounted for 38 percent of new HIV infections in Dhaka city, followed by needle sharing at 28 percent, husband-to-wife at 22 percent, female sex work at 7 percent, while casual sex from wife to husband represent 2 percent of new infections, if current interventions took place. It is projected that needle sharing will be responsible for 21 percent of new infections by the year 2020, a decrease from 28 percent in 2012. The findings demonstrate that the HIV infection has spread to various key populations and highlight that intervention programs can potentially reduce HIV transmission even when the HIV incidence has spread over several key populations.

The results indicate that the number of adults on Anti-Retroviral Therapy (ART) is increasing over the years, and it is projected that the gap between the number of adults in need and number of adults currently on ART will increase in the upcoming years. In Dhaka, the number of adults in need of ART was estimated at 597 in 2013, as compared to 911 in 2020. The ART coverage was projected at 24.2 percent for adults in 2013, and 36.6 percent in 2020. Overall, it is evident that it will hardly cover a significant proportion of PWID in the coming years, if the current intensity of the program continues.

The PWID intervention program efforts had effects on reducing new infections and mortality both among the adult population and PWID. The study found that 99 lives (of which 76 were PWID) were saved in Dhaka city in 2012 due to life saving efforts of harm reduction. ***Further analysis shows that a total of 1,568 new infections among the adult population and 1,138 new infections among PWID have been averted since 1995 in Dhaka city because of interventions dedicated to PWID.*** Over a period of 18 years between 1995 and 2012, harm reduction programs were found to avert new HIV infections and to help prevent AIDS deaths both among adults and PWID.

The decrease in AIDS-related deaths has been reflected in the DIC-based record of Injecting Drug Users Living with HIV/AIDS (ILWHA). Records from the ILWHA database in DICs show that the number of deaths among ILWHAs in Dhaka city due to AIDS dropped down to only 1 in 2013. In total, 56 deaths were reported in Dhaka city from 2001 to 2013. Based on these reports a computer-modeled projection (besides AEM) further suggested that there would be no substantial increase in HIV-related deaths among PWID through to 2020.

Starting from the baseline, we can develop scenarios in AEM via changes in coverage or the number of key populations who receive different kinds of services. Projections toward 2020 indicate that both cumulative new HIV infections and AIDS related deaths would drop, if current intervention programs are scaled up among all key populations. It is projected that by scaling-up interventions targeting all key populations (scenario-4), maximum impact would be generated in terms of total HIV infections averted, total lives saved and total Disability Adjusted Life Years (DALYs) averted as compared to continuing existing intervention programs. Under scenario-4, current coverage of prevention interventions would be scaled up among key populations as follows: FSW (65 percent), MSM (35 percent), male-PWID (95 percent), female-PWID (55 percent), MSW (95 percent) and TG (90 percent), with OST targeting male (5 percent) and female (3 percent). It is projected that such a scaled-up intervention (scenario-4) will save 2,919 DALYs in 2020, as compared to 2,683 DALYs in the same year under scenario-5: also scaled up interventions, but with a higher ambition. Our

analysis suggests that ***scaling up focused prevention programs targeting a single at-risk group can be shown to have no effect even when other interventions continue at the current scale*** (Scenarios 1, 2 and 3).

We estimated the health impact and cost of intervention for the 7-year period (2014-2020) that development partners may support as an HIV prevention program. Implementation of the existing interventions in Dhaka city will require USD 20.3 million of which nearly 93.3 percent for prevention and the remaining 6.7 percent for treatment. However, with just an additional USD 2.7 million (for a total of USD 22.9 million), we can scale-up interventions across all key populations in Dhaka city (scenario-4) and prevent 633 HIV infections.

Furthermore, the benefit-cost ratio for the part of program efforts which was devoted to the PWID was still higher and, as such, the program interventions for the PWID were more effective than the general program. Comparison of the cost-effectiveness ratios for the alternative scenarios of implementing the future program reveals that scaling up all the interventions (Scenario-4) is the most cost-effective and should be in focus when formulating the next intervention programs for Dhaka.

Economic analysis also reinforces the mathematical modeling results: the benefit-cost ratio for the harm reduction program that has been implemented in Dhaka during the last 15-year period was 1.37 and, hence, the program satisfied the standard criterion of return on investment (ratio above 1 indicates return on investment) – the amount of return generated by the program is higher than the cost of investment.

This study also qualitatively evaluates the effectiveness of harm reduction programs and explores the structural and psychosocial challenges, including current dynamics of HIV transmission among PWID in Dhaka city. When asked about the causes of HIV infection among PWID, the FGD participants most frequently mentioned sharing of injecting equipment, with unprotected sex cited as the second most important mode of transmission among this group. A link has been found between police harassment for carrying used or unused syringes and the incidences of recent syringe sharing.

The present study shows that the mobility of some PWID and their networking were coupled with their unsafe injection practices. Some PWID moved between different places in and outside Dhaka, between cities and even across the national boundary to access drugs. The shortage of drug supply and high cost of drugs in the locale mostly led the PWID to desperately move everywhere for accessing drugs at a cheaper rate. For some PWID, the harm reduction program has a very positive impact on their lives, especially in decreasing mobility and high risk networks.

There is good evidence for the effectiveness of OST for PWID in Dhaka city. A range of behavioral and socio-economic benefits were observed among clients who are undergoing methadone treatment, and many of these benefits extended beyond the clients to their families and communities. Results of the key informant interviews show that drug users who entered treatment showed improvement on several outcomes, including abstained or reduced drug use and criminal behavior. Moreover, methadone prevented withdrawal and reduced the frequency of injecting drug use and sharing of syringes and needles – all factors which have contributed to prevent HIV infections.

Police harassment targeting drug users exists in some part of Dhaka city. The fear of encountering police while in possession of a syringe is particularly acute in Old Dhaka. The arbitrary police detention and incarceration, as reported by a number of FGD participants, may indirectly heighten HIV-related risks through the disruption of housing, income and social/sexual networks among PWID. Some FGD participants stated that the legal and social context in Bangladesh often make it difficult for harm reduction intervention programs to make contact with PWID in an effort to distribute needles and syringes.

Most key informants interviewed gave credit to law enforcement agencies, seeing their involvement in harm reduction interventions as vital in reaching PWID in Dhaka city. Over the last few years, police harassment has lessened and law enforcement agencies have supported many activities of harm reduction programs and allowed such programs to do their work without hindrance. The harm reduction programs should focus on strengthening advocacy to address harassment by law enforcement agencies in some localities, including some hot spots.

The gap between the supply and demand of syringes was cited as the main reason for the higher prevalence of needle sharing in hot spots. The FGD participants stated that PWID in hot spots are more likely to inject with others and share injecting equipment compared to the PWID living in normal spots. The harsh socioeconomic reality of life faced by the PWID in Old Dhaka force them to take an unusual path of living through stealing, hijacking or selling sex.

The study found that drug use and sex work is mutually reinforcing such that dependency on clients becomes more inevitable, which increases sex workers' vulnerability to HIV and violence. Needles and syringes were sometimes shared between sex workers and their PWID clients who pay for their services with drugs. Results from the FGDs suggest that sex workers are exposed to circumstances under which sex work often takes place in a coercible manner and condom use is found to be infrequent. The findings show that they did not have much control over who to refuse unwanted or unprotected sex. Many of the sex workers reported that they had been sexually coerced by clients who were unwilling to put on a condom.

Results from the KII suggest that peer education was found to be an effective method in reducing HIV-related risk behavior among PWID. Key informant participants stated that needles and syringes are being returned at a very successful rate, particularly in Old Dhaka, and they recognized the need for a needle and syringe program as well as peer education in reducing the risk attached to HIV/AIDS. For some FGD participants, the counseling services they received were useful and informative. A substantial reduction in the sharing of needles and syringes has also been reported by some participants as a concrete outcome of the peer support activities. There was general agreement among the participants that DICs provide opportunities to develop a more direct relationship with peer educators and outreach workers, including access to counseling and health services.

Conclusions

Although progress has been made in drawing attention to key populations, current infection levels may rise rapidly among these populations without urgent scale-up of interventions. As the epidemics in these populations continue to grow, infection will spread to the general population through complex behavioral interactions. HIV preventive measures in Bangladesh are still inadequate, mainly because of low healthcare budget, lack of regular surveillances and lack of evaluation of program effectiveness. The low HIV prevalence also adds to complacency. While successes have been achieved in controlling HIV/AIDS in Bangladesh, there are still challenges in achieving the goals set at national level.

The personal, social and economic costs associated with HIV and drug use can be devastating for individuals, families and the society as a whole. With the capital city, expecting to have more people living with HIV by the year 2020, there are related consequences of ineffective action. This enhanced understanding could strengthen the capacity to respond to HIV among PWID before the epidemic worsens. Continued and increased response to the problem now will be a much more cost-effective way of achieving sustainable program goals than waiting until the epidemic takes its full toll on communities and the country. In order to reach those most-at risk of HIV transmission, interventions need to be scaled up throughout the country. Considering the above messages, we should continue our efforts and enhance the quality of harm reduction programs to reach large numbers of PWID both in and out of Dhaka city to empower them to avoid HIV-related risk behavior. Finally, a ***lack of funding to undertake such interventions can have a negative effect on program delivery, including reducing the prevalence of HIV and other blood-borne viruses among key populations.*** This emphasizes the importance of ensuring continuous funding of intervention activities.

CHAPTER I: INTRODUCTION

1.1 Background

The state of the HIV epidemic in Bangladesh is characterized by low overall prevalence but there are several population groups who are at higher risk of becoming infected by the virus. The National AIDS/STD Programme (NASP) and UNAIDS estimated that approximately 9,548 adults and children were living with HIV in Bangladesh in 2013 - the adult prevalence rate is documented to be less than 0.1 percent.[1] Since the first case of HIV was detected in 1989, a cumulative total of 3,674 confirmed HIV cases have been reported by the NASP as of December 2014.[2] To date, the NASP also confirmed 433 new HIV infections and 91 deaths in 2014. [2] In Bangladesh, the epidemic is typically concentrated in major divisional cities and there is evidence that the epidemic is more rapidly diffusing into the general population: a total of 92 (21 percent) new HIV cases were reported in Dhaka city alone. [2]

While Bangladesh is a low prevalence country, several conditions increasingly contribute to high vulnerability and exposure to risks.[3] Low national HIV prevalence mask serious epidemics concentrated in some geographical areas and amongst high risk populations, such as PWID, male and female sex workers and their clients, MSM and hijras. The 9th round of the HIV Sentinel Surveillance conducted in 2011 found that national prevalence among these groups remains low: PWID 1 percent, FSW 0.3 percent, MSW 0 percent, MSM 0 percent and hijra 1 percent.[4] However, in certain geographical areas, key populations have high HIV prevalence - one neighbourhood of Dhaka city account for 7.3 percent of HIV prevalence among PWID. The most likely trigger for a more widespread HIV epidemic in the country is injecting drug use, because of the 'efficiency' of sharing contaminated needles and syringes as an HIV transmission route. The seroepidemiological and behavioral surveys carried out so far clearly indicate that HIV infection could become an epidemic in this country. This epidemic may be avoided if preventive measures are taken in the appropriate communities and in an appropriate time frame.

The HIV epidemic in Dhaka is believed to be largely associated with injecting drug use. However, the presence of several high-risk groups in Dhaka has resulted in a more complex local HIV epidemic among PWID than elsewhere in the country. Although HIV prevalence among PWID in Dhaka city has increased steadily over the years from 1.4 percent in 2000 to 7 percent in 2007, the rate declined to 5.3 percent in this population group in 2011.[4] Despite this, the high prevalence of HIV infections among the PWID in Dhaka city is considered to have the potential of causing an explosive epidemic among PWID, and this can spread into the general population.[5,6]

An HIV prevention intervention was introduced in Bangladesh in 1998 and some studies have shown that the intervention may have reduced HIV transmission substantially.[7] Over the years, some progress has been seen across the capital but there is need for greater focus on key geographical areas and key populations at high risk and more investment for greater impact. Studies have documented HIV cases among key populations in four out of eighteen cities surveyed in 2006.[8] Inadequate focus on key populations at high risk of HIV infection and geographical areas with higher HIV burden mean that some cities in the country are not progressing fast enough to reach global targets on HIV prevention, treatment, care and support.

HIV among PWID is a major public health concern in Bangladesh.[8,9] The PWID in the country are posing a serious risk to the country's healthcare system. There is an increased shift towards injecting drug use among drug users in the country. The problems associated with heroin use in Bangladesh are aggravated due to the country's widespread porous border with India, one of largest synthetic heroin producers.[10] However, fluctuations in heroin availability, purity and price have led many heroin users to change over to injecting drug use. Previous studies have also identified factors that have been associated with injecting synthetic drugs. In Dhaka, factors such as using drugs in groups or sharing needles/syringes were associated with recent onset of injections. Findings from the last Behavioral Surveillance Survey (BSS) conducted in 2006-07 reveal that 60 to 80 percent of PWID shared needles and syringes for their injection.[11]

Selling sex to procure drugs is quite common in many parts of Bangladesh. In the country, high numbers of PWID are buying sex and there is an overall low level of condom use in the encounters. The overlap between sex work and injecting drug use is considered to be among the most dangerous conditions for rapid spread of HIV and other Sexually Transmitted Infections (STIs) in the country. There is increasing evidence of overlapping risk and considerable crossover between injecting drug users, sex workers and their partners that can lead to wider spread of infection and more opportunities for transmission to the general population.[3,12] Women who are involved in commercial sex are very often largely dependent on their partners for the procurement and use of drugs. In this situation, the exchange of sex for drugs or drug money or under the influence of drugs is a high-risk encounter as it reduces appropriate judgment and ability to practice safer sex. As many women stay 'underground', they remain very hard to reach both in terms of service delivery and in terms of surveillance.

In Bangladesh, large scale harm reduction has been in place since 2008 with funding provided by the Global fund to fight AIDS, Tuberculosis and Malaria.[13] The project on 'Expanding HIV/AIDS Prevention in Bangladesh' is a collaborative project which has been implemented through a Public-Private partnership where the Economic Relations Division of the Government of Bangladesh worked as the principal recipient and Save the Children managed the grants as the management agency and later as the principal recipient in collaboration with the Ministry of Health and Family Welfare. The program is being implemented through technical packages by 13 consortiums: as a sub-recipient, CARE Bangladesh has been implementing two technical packages (GF-906 and 907) for the provision of essential harm reduction services for PWID. The goal of harm reduction is to create a situation that greatly reduces the risk that the PWID harms themselves or their environment. Within this concept, 'low threshold' methadone programs and large scale needle and syringe programs have been implemented. The needle/syringe exchange program (NEP) services in Dhaka are coordinated through a central field office and provided through 24 Drop-In Centres (DIC) which are located within or close to communities of PWID and outreach workers. The services provided are needle/syringe exchange and condom distribution mostly in the field; DIC-based clinical services for the management of abscesses and STIs, and OST. Moreover, the services include education and awareness on the harmful effects of drugs, safe injections, HIV/AIDS, STIs, other blood borne infections; legal support; and advocacy with relevant individuals and organizations. CARE Bangladesh started a NEP in Dhaka in 2008 with Round 6 (Phase I) Global Fund-financed HIV/AIDS program covering 13,461 PWID up to December 2013 in 68 DICs across Bangladesh. The assessment presented here is not only to assess risk factors for HIV but also to investigate whether the harm reduction approach has a protective effort on HIV

seroconversion among PWID and other related at-risk-populations. There are few studies that explicitly address the impact of NEP services in Bangladesh.[6,9,14] Although there is no evidence to date that NEP causes increases in drug use, it is important to understand the relationships between trends of HIV transmission and the use of NEP programs. Information on such relationships is needed to address the potential spread of HIV among PWID and the many other health and social problems associated with drug use. The present study is concentrated on building a picture of the impact of harm reduction program by analyzing the current dynamics of HIV transmission among PWID and aims to explain what disparities exist in terms of harm reduction program impact and outcomes. The study also aims to explore what efficient harm reduction interventions should consist of to reduce morbidity and mortality among PWID. Other areas for investigation include cost-benefit and cost effectiveness analysis of harm reduction.

1.2 The purpose of impact assessment

The AIDS epidemic could become a major public health concern for Bangladesh. UNAIDS now classifies the country as being in the first wave of the HIV/AIDS epidemic, especially so for PWID. Although the HIV infection rate is low, Bangladesh is highly vulnerable to the rapid spread of the virus because of the prevalence of high-risk behavioral patterns.[11,16] It is feared that the HIV epidemic in Bangladesh may emulate the situation in India with a rapidly increasing prevalence of HIV seropositivity in high-risk groups spreading to the general population. Reaching PWID early with effective harm reduction interventions is therefore vitally important in preventing the spread of HIV/AIDS in the country.

In Bangladesh the main routes of HIV transmission are through hetero-sexual unprotected sex, and sharing of used needles and syringes.[5,17] The 6th Round Behavioral Surveillance Survey data indicate an increase in risk behaviours, such as sharing of injecting equipment and a decline in consistent condom use in sexual encounters between PWID and female sex workers.[11] The 5th Round surveillance data also show that reported rates of condom use were 40 percent with sex workers, 28 percent with casual female partners and 9.8 percent with males/transgender.[18] Moreover, low levels of knowledge about HIV transmission and low perceptions of personal risk of contracting HIV have been documented. An earlier NASROB study showed that 9 percent of the heroin smokers and 12 percent of current PWID have had sex with their drug using partners and most interestingly only 4 percent of PWID and 9 percent of heroin smokers used a condom in those encounters.[12] As injecting drug users are often clients of sex workers, transmission of HIV infection from the former to the latter group is quite likely. Based on assumed sexual network dynamics, the eventual spread of the HIV infection to the general population is well predicted, and this may largely be triggered from within the infected PWID population like in many other countries of the world.

Previous behavioral surveys have found that injecting drug use is common in Bangladesh and PWID do share injecting equipment to a large extent.[11,18] Earlier research found high numbers of PWID throughout the twenty-four districts of Bangladesh surveyed and reveal that the proportion of PWID sharing injecting equipment during their last injecting episodes was significantly higher (67 percent) in non-intervention sites against intervention sites (19 percent).[12] It is note-worth that a substantial proportion of PWID do not have access to prevention activities. However, it is encouraging that the 1st program objective of the *National Strategic Plan for HIV/AIDS 2011-2015* has devoted a considerable thrust on providing

services to prevent new HIV infections ensuring universal access.[19] The strategy called for minimizing HIV and STI transmission among PWID, FSW, MSM and hijra through a comprehensive targeted intervention.

The HIV/AIDS situation in Bangladesh is considered to be a 'situation of low prevalence and high risk'. However, being a developing and highly populated country, it is under the pressure of a compounding threat of the HIV/AIDS epidemic. In the advent of AIDS in Bangladesh, information and education programs are under way, but other interventions on HIV/AIDS, such as harm reduction programs are yet to scale up significantly. Reaching PWID early with effective harm reduction intervention is therefore vitally important in preventing the growth and spread of HIV/AIDS in Bangladesh.

In AEM by varying the input behaviors and STI trends, we will be able to examine the impact of different prevention efforts on the future course of the epidemic. AEM offers opportunities to explore the effectiveness of harm reduction programs and policy alternatives, reflecting the primary groups and transmission modes driving HIV transmission in a country. Harm reduction programs are currently operating in 22 DICs across Dhaka city for over 4000 PWID. Learning more about the epidemiological trends of PWID, including other population groups' transmission modes and cost-effectiveness of programs is important to the design of effective programs to control HIV transmission.

This study aims to examine the impact of different prevention efforts on the future course of the HIV epidemic by varying the input behaviors and STI trends. The current impact assessment provides a useful tool for policy and program analysis in Bangladesh in order to improve high risk groups' awareness and risk behavior and to enhance efforts to prevent HIV/AIDS. The purpose is to improve the quality and coverage of sustainable HIV/AIDS programs nation-wide by implementing appropriate and affordable intervention programs for populations who are most vulnerable to HIV/AIDS. The overall goal of the intervention is to contribute towards an effective national HIV/AIDS control program. As resources for HIV interventions in the country are limited, it is also important to investigate the appropriate balance between investments in harm reduction programs and HIV in order to maximize benefits to public health.

No study has so far analyzed the cost effectiveness of harm reduction interventions in similar settings. Therefore, in order to provide insights into the appropriate public health investment in harm reduction programs as well as other interventions addressing key population groups in Bangladesh, the study assesses the cost effectiveness of different strategies for scaling up harm reduction programs. The need for continued implementation of effective interventions to combat the threat of the epidemic can hardly be exaggerated. Hence, the most crucial and urgent task is to identify the interventions which work best. At the same time, it is also necessary, given the growing scarcity of investible public resources, to know which interventions are economically most efficient, i.e. which produce the largest amount of outcome using a particular amount of resources. Added to this is the need to estimate the costs of the interventions and the resource requirements for successful implementation of the interventions.

1.3 Objectives

In the past, multiple rounds of cohort studies, surveillances and projection models have been carried out among most at risk groups including PWID in the country. But there has been no attempt to assess how many new infections have been averted. Nor have we fully understood the factors (e.g. programmatic, policy, epidemiological) which are possibly contributing to continued low HIV prevalence in Bangladesh. There are a number of reasons why: There is a lack of evidence upon which to formulate policies. We do not have adequate approaches or models to help policy-makers making good decisions about dealing with the transmission of HIV among PWID. When considering future investments, funding agencies and managers of HIV prevention programs need information on whether prevention activities, collectively, are working good enough to reduce HIV incidence among PWID. As a consequence, there is a clear and urgent need to reveal more complementary credible evidence about what works and what does not work in HIV prevention, particularly in specific settings. Further, the availability of HIV-related strategic information to guide effective decision making by stakeholders in the AIDS response is essential to achieving these targets and to reaching the UNAIDS vision of 'Zero new HIV infections, Zero discrimination, zero AIDS-related deaths'.

To this end, the aim of this assessment is to create valuable new policy insights, ideas and interventions that will allow Bangladesh to respond and underpin decision support tools in relation to prevention of HIV among PWID and the general population. The results of this analysis also characterize the dynamics of the HIV epidemic among PWID in Dhaka. In addition, the assessment conducts a cost-analysis by examining the costs of various components of the interventions currently being implemented in Dhaka.

The main purpose of the assessment is to analyze the effectiveness of existing harm reduction interventions among PWID in Dhaka city in terms of desired impact. The objectives of the study are:

- To explain what efficient harm reduction interventions should consist of to reduce morbidity and mortality among PWID in Dhaka city and what disparities exist in terms of program impact and outcomes;
- To conduct cost benefit and cost effectiveness analysis to assess the worthiness of investment in existing harm reduction interventions; and
- To analyze current dynamics of HIV transmission among PWID in Dhaka city.

CHAPTER II: CURRENT STATE OF HIV/AIDS IN KEY POPULATIONS

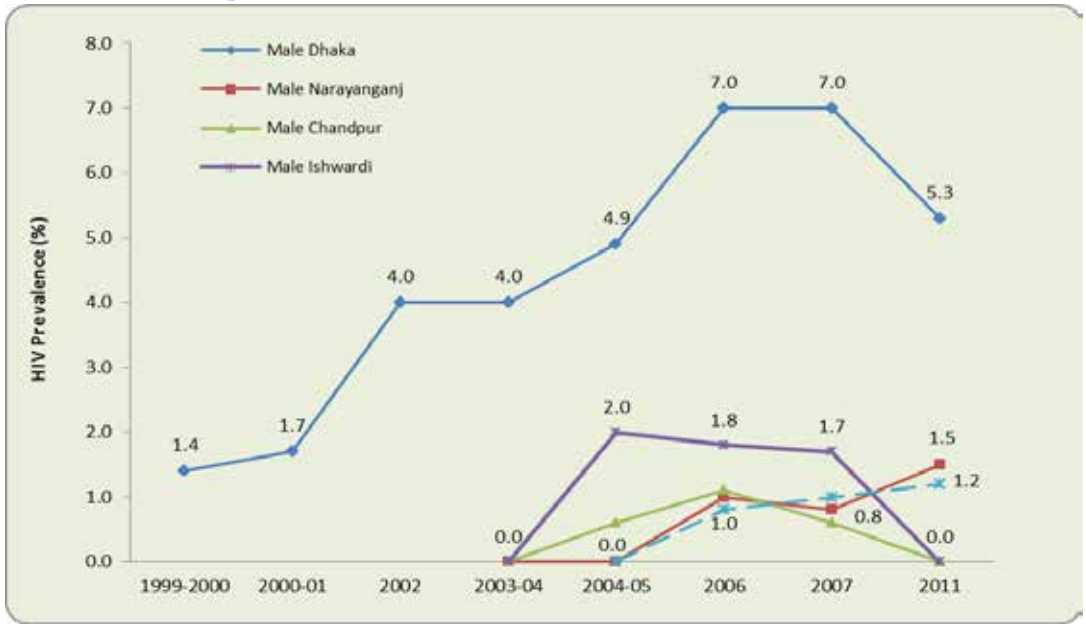
2.1 HIV risk and prevalence among key populations

Although Bangladesh continues to maintain a low HIV prevalence in the general population, the epidemic is concentrated among vulnerable population groups who are at high risk of being infected or affected by HIV. The persistence of infection within certain groups is due to their life-styles and professional characteristics, leading to an ever-greater possibility that the virus will spread to the general population. Despite the recent decline of HIV prevalence among PWID in Dhaka, the rate rose up to five times in an interval of seven years – from 1.4 percent in the 2nd serological surveillance (1999-2000) to 7 percent documented in the 8th serological surveillance (conducted in 2007).[15] In other cities however, the scenario is mixed with decline in HIV prevalence being documented in some cities and increase in others. The distribution of HIV among PWID over the rounds of surveillance is presented in Figure 2.1.

The prevalence of HIV in Bangladesh is less than 0.1 percent in the general population and has remained less than 1 percent among the most at risk population over the years.[3] According to the latest Serological Surveillance conducted in 2011, the HIV prevalence among PWID, FSW, MSW, MSM and transgender (hijras) was 0.7 percent.[3] In the same surveillance round, none of the MSM or MSW tested was positive for HIV. Among the hijras, the HIV prevalence was 1 percent in two sites (Dhaka and Manikganj – a peri-urban site adjacent to the capital). Although HIV prevalence was below 1 percent in most groups of female sex workers, the last data indicate that the prevalence was 1.6 percent among casual sex workers in Hilli - a small border town in the Northwestern part of Bangladesh bordering the Indian State of West Bengal.[3]

The 9th round surveillance documented hepatitis C (HCV) prevalence rates up to 95.7 percent among PWID in Kanshat, a locality in the Northwestern part of Bangladesh. Moreover, active syphilis rates were significant in female-PWID (including heroin smokers) – reported at 5.9 percent level in Dhaka, Tongi and Narayanganj. Active syphilis, like other STIs and HCV are major risk factors for HIV transmission.[4] The strategic focus on providing harm reduction services to PWID is considered to be effective as last sero-surveillance showed that the epidemic is still stable among PWID. The coverage of targeted harm reduction intervention for the PWID had been up scaled but is still to reach the optimum coverage levels needed to contain the epidemic.

Figure 2.1: HIV in PWID over the Rounds of Surveillance



2.2 Factors associated with HIV transmission in Bangladesh

The pattern of behaviors that favors the spread of the HIV infection is well established in the Bangladesh society.[22-24] Recent Behavioral Surveillance Survey data indicate risk behaviors, such as sharing of injecting equipment and a decline in consistent condom use in sexual encounters between PWID and female sex workers.[22] A substantial proportion of youth has multiple sex partners; drug users share and re-use their needles; sex workers have poor condom use and high STI prevalence; unscreened blood transfusion and increasing high-risk sexual behaviors are common.[11,23-25] These risk behaviors are sufficient for continued HIV transmission among groups at higher risk and to the general population (see Figure 2.2).

The frequency of pre-marital and extra-marital sex and the large number of sexual acts with sex workers are commonly known factors associated with the transmission of HIV in Bangladesh.[26-28] Among the general population, approximately 10 percent of the men reported having bought sex from female sex workers.[29] The previous national survey among youth conducted in 2008 also reports that almost 20 percent of unmarried males reported having had premarital sex and for 28 percent of these respondents, the last sex was with a sex worker. The reported consistent condom use with female sex workers among this group, however, has risen from 14 percent in 2005 to 48 percent in 2008. Almost one in three (28 percent) young people who have had sex reported one or more symptoms of an STI in the past 12 months, but only a quarter sought treatments from a trained provider.[22] A recent behavioral survey by icddr,b conducted in 2010 among hijras in Dhaka reported that most hijra (87.5 percent) had anal sex with male partners in the last month and only 19.4 percent used condom during the last sex act. The survey notes that no one injected drugs in the last

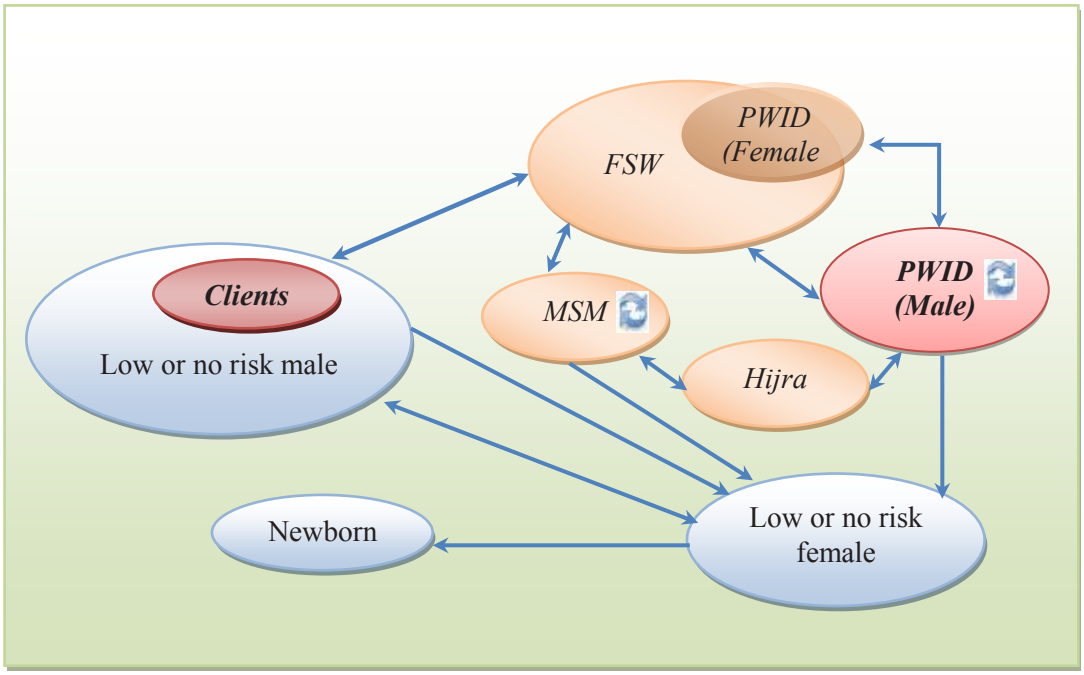
year but a small proportion claimed their regular partners (either commercial or non-commercial) injected drugs.[30]

There are well-documented reports of risk behaviors such as unprotected sex among MSM in Bangladesh. A behavioral survey conducted in a sample of MSM in Dhaka indicated that 71 percent of MSM reported having anal sex with commercial or non-commercial male partners within the month prior to the survey, and only 26 percent reported to have used condoms during their last anal sex.[28] Among those who had sex with commercial or non-commercial hijras, 58.2 percent had anal sex with hijras within a month. 30 percent of the respondents bought sex from female sex workers and another 46.7 percent purchased sex services from male sex workers in the last one month preceding the survey. More than 60 percent of MSM reported travelling to another city in the last year. Among those who travelled, 37.1 percent bought sex and 27.2 percent used a condom in the last commercial sex act. The survey also found that nearly 17.7 percent of MSM reported at least one symptom of STI in the past one year.[31]

Evidence shows that some female drug users in Bangladesh turn to sex work out of financial necessity to support their addiction.[24] Femal-PWID who also work as a sex workers are among those at the highest risk of and most vulnerable to HIV infection in the country today. Female injecting drug users who sell sex may be at higher risk for HIV than other groups because they are more likely to sell sex in exchange for drugs or money; are more likely to be economically dependent on their male partners and hence, maybe unable to negotiate condom use. They are more likely to have an injecting sexual partner than male injecting drug users and are more likely to use needles after their male partner has used them.[32] People who have sex with an injecting drug user also are at risk for infection through the sexual transmission of HIV, since PWID have the highest concentration of HIV.

The transmission of HIV due to drug injection is a major public health problem and is inextricably linked to the major socio-economic issues of the society.[33] Since the epidemic began, injection drug use has directly and indirectly accounted for a substantial proportion of AIDS cases in the country. Sharing needles and syringes for drug injection is a well-known route of HIV transmission in Bangladesh. A recent study undertaken by icddr,b in 2011 among male injecting drug users indicated that nearly 44.2 percent of the PWID share needles and syringes. The study also documents that the average number of injections per day was 2.4. The percent of male-PWID who visit female sex workers was estimated to 21.9 percent. Although a significant portion of the male injecting drug users reported to use condom during their last sex with sex workers, condom use with their regular partners or spouses was reported to 27.7 percent.[34]

Figure 2.2: HIV transmission dynamics



Migration is widely recognized as a potential factor in facilitating HIV transmission in Bangladesh– migrant workers are an important group identified as a priority in the Bangladesh National Strategic Plan for HIV and AIDS 2011-2015. Approximately 250,000 people leave Bangladesh for employment every year. The risk is that they will get infected during their stay abroad and upon their return to Bangladesh they may transmit the virus to others, particularly their wives who could, in turn, transmit the infection to their babies. Migrants, both international and cross border, have not been generally targeted by HIV prevention efforts in the past and there is little understanding as to how such targeted intervention could be implemented in the country. Improved understanding of the linkages between migration and HIV risk factors is critical to control further spread of AIDS at this moment. There are a multitude of conditions and factors that facilitate the spread of HIV/AIDS among mobile populations, indicating complex linkages between HIV and migration. Numerous sociocultural, economic and political factors in both origin and destination countries influence the risk of HIV infection of international labour migrants. These include separation from spouses, families and familiar social and cultural norms, language barriers, poverty, substandard living conditions, and exploitative working conditions, including sexual violence. The resulting isolation and stress may lead international labour migrants to engage in behaviors, such as unsafe casual or commercial sex, which potentially increase the risk of exposure to HIV. This risk is exacerbated by inadequate access to HIV prevention information services and voluntary counseling and testing and fear of being stigmatized for seeking such information or services.

There is no official data on overseas migrants living with HIV/AIDS in Bangladesh. However, the majority of passively reported HIV positive cases have been documented from returned international migrant workers and their families. A recent comprehensive mapping of children

infected and affected by HIV and AIDS in Bangladesh conducted by UNICEF provides an overview of the last reported regions where the HIV-positive parents lived.[35] The study was based on program data collected from community-based NGOs and self-help organizations in 2013. Out of 1497 People Living with HIV (PLHIV) currently living in Bangladesh, a large portion (38.5 percent) resided in the Middle-East followed by the South-East Asian region (4.4 percent), such as Singapore, Malaysia and Thailand. Previous analysis of existing data on PLHIV also indicated that of out 645 adult PLHIV who had been employed, 64.3 percent had previously worked abroad.[3] According to icddr,b, 47 of the 259 cases of PLHIV between 2002-2004 were linked to migration. Of these, 29 were males returning from abroad, seven were wives of migrant workers, and four were children of HIV- positive migrant workers. In 2004, data from NASP showed that 57 of the 102 newly reported HIV cases were among returning migrants.[36]

2.3 The national response to HIV/AIDS in Bangladesh

The national strategic frameworks, policies and guidelines cover almost all aspects of HIV prevention, control and implementation in Bangladesh. Strategic action plans for the National AIDS/STD Program set forth fundamental principles, with specific guidelines on a range of HIV issues including testing, care, safety, prevention among youth, women, migrant workers, sex workers, and prevention of STIs. Currently, the national response to HIV/AIDS is being guided by a number of well developed strategies and guidelines. Until now, through well documented collaboration between government departments, civil society, private sectors, and the development partners, the national response has been multi-dimensional to maintain a low prevalence status in the country. Bangladesh has strengthened its programs to improve its response gradually. The Government of Bangladesh also prepared the National Strategic Plan for HIV/AIDS for the period 2011-15 under the guidance of the National AIDS Committee (NAC) and with the involvement and support of different stakeholders.[19] The Strategic Plan includes international migrant workers, transport workers, especially vulnerable adolescents and prisoners within its framework and has set relevant indicators to track progress. Efforts to mainstream HIV/AIDS in public sectors outside the Ministry of Health and Family Welfare were initiated through designation and training of focal points on HIV/AIDS in 16 government ministries.

Bangladesh was the first country in the region to adopt a comprehensive national policy on HIV/AIDS and STDs.[13] In May 1997, long before the UNGASS Declaration, a national strategic plan, based on the policy, was developed for a five-year period from 1997 to 2002. The government, in collaboration with NGOs, development partners and self-help groups, has been instrumental in supporting various prevention, care, treatment and support activities. The national HIV program has been progressively scaled up in its quality and coverage in recent years and gender, equity, non-discrimination, human rights and fundamental freedoms were addressed as cross-cutting issues in all programs to comply with the UNGASS declaration of commitment.

Prevention efforts in Bangladesh had been initiated much before the first HIV case was detected in Bangladesh in 1989. Since the late 1980s, a combination of HIV prevention, treatment, care and support approaches has been implemented in the country, which have reinforced one another. Currently, there are five key prevention intervention programs being

implemented which include: the HIV/AIDS Intervention Services, Global Fund to Fight AIDS, Tuberculosis and Malaria supported national programs, Modhumita, and two Global Fund supported regional programs. These programs are designed to focus on prevention initiatives among PWID, FSW, MSM, MSW, transgender persons (hijras), and their intimate partners. Most programs are implemented through NGOs under the leadership of NASP. The three key contributors that support major prevention programs in the country are the World Bank, the Global Fund and the United States Agency for International Development (USAID). However, there have been relatively frequent funding gaps, often causing temporary discontinuation of services over the last few years. Currently, HIV prevention is under threat due to competition over limited resources.

2.4 Harm reduction interventions among PWID

A harm reduction program among PWID was initiated in Bangladesh by international and national NGOs since 1998. CARE-Bangladesh with support from DFID initiated the NEP in Dhaka. Gradually, the intervention expanded into other districts of Bangladesh. The National AIDS Policy recognizes harm reduction approaches and NASP has incorporated a greater programmatic role for drug users in its new Strategic Planning for 2011-2015.[19] Greater thrust and resources are allocated to a nationwide scale up of harm reduction services under the leadership of NASP. NASP is also coordinating different NGOs who are contributing significantly to harm reduction efforts. Bangladesh also has developed a Harm Reduction Strategy for Injecting Drug Users 2004-2010.[37] By 2004, the harm reduction intervention transited into WB/DFID funded GoB led HIV/AIDS Prevention Project. From 2008, The Global Fund Round 6 initiated harm reduction interventions for PWID.

Harm reduction interventions aim to reduce the dominant behavioral risk factors that facilitate transmission of HIV in Bangladesh, namely, sharing injecting equipment and engaging in unprotected sex. The main service components of harm reduction for this group include the distribution of free sterile needle-syringes and condoms and providing behavior change communication through peer educator-based outreach. Apart from that DICs offer abscess management, STI treatment, rest and recreation, organization of detoxification camps, local and national advocacy, and promoting self-help groups.

To achieve comprehensiveness in the program, a new component was included which includes OST, using methadone. The program was piloted in Dhaka in three service delivery sites.

The components of PWID interventions are:

- Outreach
- Drop-in-centers
- Abscess management and STI treatment
- Needle syringe exchange program
- Creating an enabling environment
- Established detoxification centers

CHAPTER III: METHODOLOGY AND KEY INPUTS

3.1 Study methods: Harm reduction impact assessment

This impact assessment study attempts to address a number of issues: (i) the number of AIDS related deaths among PWID in Dhaka city; (ii) the number of lives saved (deaths averted); and (iii) the number of new HIV infections averted amongst PWID. The study also examines the dynamics of risk behavior among PWID and explores the changes in their behavior, including changes in the socio-legal environment caused by continued interventions. Cost efficiency of the existing harm reduction interventions is also examined.

A holistic approach comprising both quantitative and qualitative methods is adopted in this study to assess the impact of harm reduction interventions among PWID in Dhaka city. The methods and models used include: 1) AIDS Epidemic Model (AEM); 2) In-depth interviews with key informants and focus group discussions conducted with male and female-PWID in Dhaka city; and 3) A model for cost-benefit analysis.

This impact assessment study aims to focus on the outcomes of harm reduction programs (e.g. infections averted, lives saved, cost efficiency) and socio-behavioral aspects. Information on trends and factors related to vulnerability, morbidity and mortality associated with the HIV epidemic and the national responses was collected and analyzed. The study collects relevant time series data on the AEM input indicators between 2000 and 2012 and presents the AEM output results for the period 2013-2020.

3.2 The AIDS Epidemic Model (AEM)

Modeling an HIV epidemic is commonly recognized as a complicated task. This is largely due to the absence of accurate data on the behaviors which drive and underpin the epidemic.[38] Despite its complexities, HIV epidemic projection is essential in determining the type of services that will be needed to prevent new infections and treat, care for, and support sufferers in the future. Without any modeling, it would be impossible to determine the impact and cost efficiency of the existing prevention programs as well as to know how much funding will be needed to control the spread of HIV, or what the future demand for programs and services is likely to be. The AIDS Epidemic Model (AEM) is one such process model.

The AEM is a semi-empirical process model that replicates the transmission dynamics of HIV in concentrated epidemic settings.[39] The AEM is constructed upon the observation that the primary driving forces for HIV epidemics in Asian countries are sex work and the sharing of needles by PWID.[20] Using trends in risk behaviors among the important key populations as inputs, the model determines the HIV transmission probabilities necessary to fit observed epidemiological patterns, as seen in surveillance data. It then calculates the number of new infections through key routes of transmission including marital sex, extra-marital (casual) sex, sex work, male-to-male sex, needle sharing, and mother-to-child transmission. Specific outputs of the model include: number of new, current and cumulative HIV infections and AIDS related deaths for each year, which can be combined with cost information to estimate and also the cost efficiency of the existing and proposed intervention scenarios.

3.2.1 Application of AEM in Bangladesh

The AEM was developed by the East-West Center with support from UNAIDS, USAID, Family Health International (FHI) 360, World Health Organization (WHO), and World Bank.[40-41] The first attempt of applying AEM was made in Bangladesh by Amala Reddy and Tim Brown to assess the history of the epidemic and the impacts of past and future behaviors on HIV prevalence, making long term projections among the key affected populations in Dhaka city. The exercise was conducted in 2007 as a part of the Analysis and Advocacy (The A^2 Project) in Bangladesh, which was jointly implemented by FHI 360, Futures Group and East West Centre.[20] The analysis was conducted by using AEM version 3. The current assessment uses the updated version of AEM (version 4), designed for collating the various forms of input data and outputs for policy and programming which is found to be useful for most low-level and concentrated epidemic countries, including those outside of Asia.

3.2.2 The AEM process

The AEM (version 4) allows the entire population to be divided into several subgroups according to their relevance to the socio-cultural setting and the nature of the local epidemic. It then mathematically replicates key processes driving HIV transmission among the defined subgroups. The current version is based on the epidemiological patterns commonly observed in concentrated epidemics, where the bulk of HIV transmission occurs among a number of key populations and their sexual partners. The populations include:

- Men who have sex with men (MSM) and male sex workers (MSW);
- Female sex workers (FSWs) and their clients;
- People who inject drugs (PWID) - both males and females;
- Transgender populations (TG); and
- Lower-risk members of the general population (both males and females).

Each of these populations and the primary behaviors which transmit HIV, including vaginal sex, anal sex, and sharing of injecting equipment are included in the model. AEM utilizes a number of equations to produce the model outputs by the specified transmission routes based on the following inputs:

- **The size of these key populations** - expressed as a percentage of adult males or females 15-49, and of the adult male and female population as a whole;
- **The average duration for which people remain in key populations** - expressed in years, used to calculate turnover and movement between key populations such as sex workers and PWID and the general population;
- **The frequency of risk behaviors** - e.g., the number of vaginal or anal intercourse acts per week or number of injections with shared equipment in the last year;
- **The levels of protective measures taken with different partner types** - e.g., condom use between sex workers and clients, reducing the fraction of injections shared or the prevalence of sharing;
- **HIV and STI prevalence** - accounted for in each key affected population.

AEM relates behavior and HIV prevalence through transmission probabilities and cofactors: AEM calculates the number of new infections in a year by multiplying the size of populations with a given risk behavior by the average frequency of that behavior and the probability of transmission for that behavior. The number of new infections is corrected for various cofactors such as STI enhancement of transmission, reduction of transmission for those on antiretroviral therapy (ART), and reduction of transmission to circumcised males. The effects of protective behaviors such as condom use are also incorporated directly into the calculations, allowing the model to incorporate the behavioral outcomes of prevention programs.

Epidemics can be tuned to the local context by adjusting model parameters: This interface allows the user to adjust these fitting parameters, i.e., start years, probabilities and cofactors, to obtain a model that is tuned to the actual epidemiological and behavioral situation in the country or province being modeled.

The AEM (version 4.0) includes the effects of ART on HIV transmission: People on ART or on pre-exposure prophylaxis have a lower probability of transmitting (or acquiring) HIV. The updated AEM gives those on ART a lower transmission probability. The actual reduction is controlled through five user-adjustable parameters:

- Heterosexual reduction factors (independent factors for M->F and F->M);
- Anal sex reduction factors (independent factors for insertive to receptive and receptive to insertive partners); and
- A needle sharing reduction factor.

In the current version of AEM (version 4), those in on-ART exhibit a lower level of infectivity with their partners based on these factors entered.

The AEM software is accompanied by a suite of four complementary workbooks implemented in Microsoft Excel 2010. The workbooks used in this assessment include:

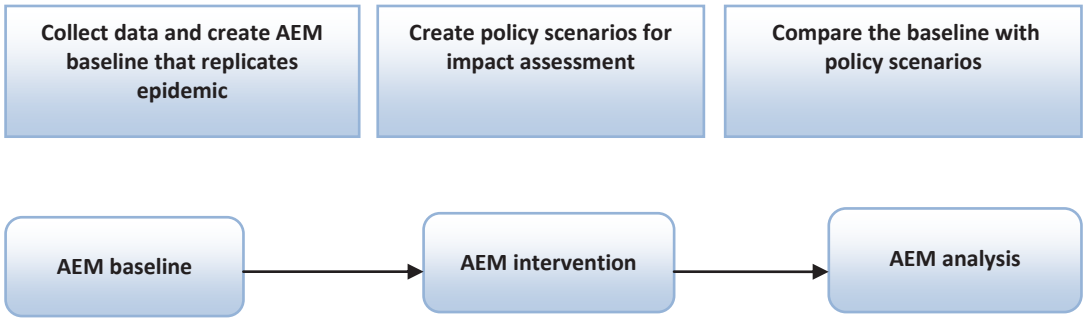
The AEM Baseline Workbook: The Baseline Workbook serves as a self-contained summary of a national or sub-national epidemic. It contains: 1) all of the epidemiological, behavioral and size inputs; 2) the transmission probabilities and cofactors chosen to fit observed historical trends in the epidemic; and 3) the numerical results of applying AEM to these inputs, including HIV incidence, prevalence, AIDS deaths, ART numbers and needs, transmission modes and other valuable information for planning and policymaking.

The AEM Intervention Workbook: The Intervention Workbook allows assessing the behavioral and epidemiological impacts and costs of a number of key population-specific programs that are relevant in low-level and concentrated epidemics. This workbook provides the behavioral impacts of the intervention programs and applies them to the original AEM inputs. The resulting projection includes the effects of the intervention chosen on the future of the HIV epidemic. Each intervention workbook containing a projection based on a different set of intervention programs is called a scenario.

The AEM Impact Analysis Workbook: The Impact Analysis Workbook permits to assess the impacts of alternative interventions by comparing the baseline projection with up to five scenarios prepared using separate Intervention Workbooks. The scenarios are compared in terms of key policy variables which include: resource needs, total and marginal prevention and treatment costs, HIV infections averted, lives saved, Disability Adjusted Life Years (DALYs) saved, and cost effectiveness measures, including cost per infection averted, cost per DALY saved, and treatment cost savings per prevention dollar. Both discounted and non-discounted estimates are provided.

The baseline serves as the starting point of analyses done with other workbooks. The AEM Intervention Workbook first reads in the AEM Baseline. The intervention workbook then requires relevant data on intervention effectiveness, coverage of specific programs, and unit costs of programs. Different scenarios will be developed for assessing impact and to design effective intervention programs for future implementation. Epidemiological, behavioral and intervention monitoring data will be used to parameterize the AEM, and to estimate the impact of the interventions on HIV transmission among PWID in Dhaka, which will subsequently translate into relevant decisions. The process is outlined in the following flow diagram (see Figure 3.1):

Figure 3.1: The AEM process: interpreting data into action



3.2.3 Key inputs and assumptions

The modeling process began with the input of data into the AEM workbooks. The Baseline workbook data consists of the following Microsoft Excel worksheets: population, heterosexual, PWID, MSM/MSW, TG, HIV prevalence, ART, validation data, epidemics. The Intervention Workbook data consist of the following Microsoft Excel worksheets: intervention effectiveness, program coverage, unit costs of programs. For the exact data input see Appendix 7.

Data sources

Multiple sources of data are used in this study to develop baseline data for each indicator. The assessment conducted by Reddy and Brown in 2007 serves as the basis for calculating values with regard to population characteristics as well as related indicators for the years preceding 2000. For some analysis of indicators, the AEM default values were considered.

Research studies conducted for different organizations are also used in this study as data source. These publications include technical and assessment reports of Save the Children, icddr,b and WHO. The data sources concerning the epidemiological profile and the behavioral aspects of key populations can be found in Appendix 7.

Assumptions

The results of the AEM for the projection years are based on the assumption that risk behaviors and STI rates remain unchanged from 2012 (the latest available data) onwards. If changes in levels of risk behaviors or STI occur, the number of new infections will increase or decrease accordingly. Moreover, in developing the model, the Working Group agreed on several assumptions to complete the prerequisite parameters of AEM. The assumptions include the following aspects:

- The number of key populations (FSW, PWID, MSM, MSW, transgender, clients of sex workers)
- The average number of years a person will be part of the key population for each at-risk group
- The distribution of age groups by STIs
- Calculation of STI prevalence among key populations using incidence data
- Percent of adult males who are circumcised
- Number of sexual contacts per week among general population with their spouse or regular partner
- Percent of PWID in high-risk networks, percent of all injections shared, and rate of sharing to non-sharing movement per year
- PWID mortality (crude mortality per year in percent)
- Shift from MSM to MSW
- Movement from Hotel Based Female Sex Workers (HBFSW) to Street Based Female Sex Workers (SBFSW) each year
- All transgender covered under Behavioral Surveillance Survey (BSS) are considered as TG sex workers. Therefore, the prevalence data for transgender are adjusted
- TG client make-up: Percent of TG clients who are classified as low-risk heterosexual males, MSM, PWID and also clients of FSW

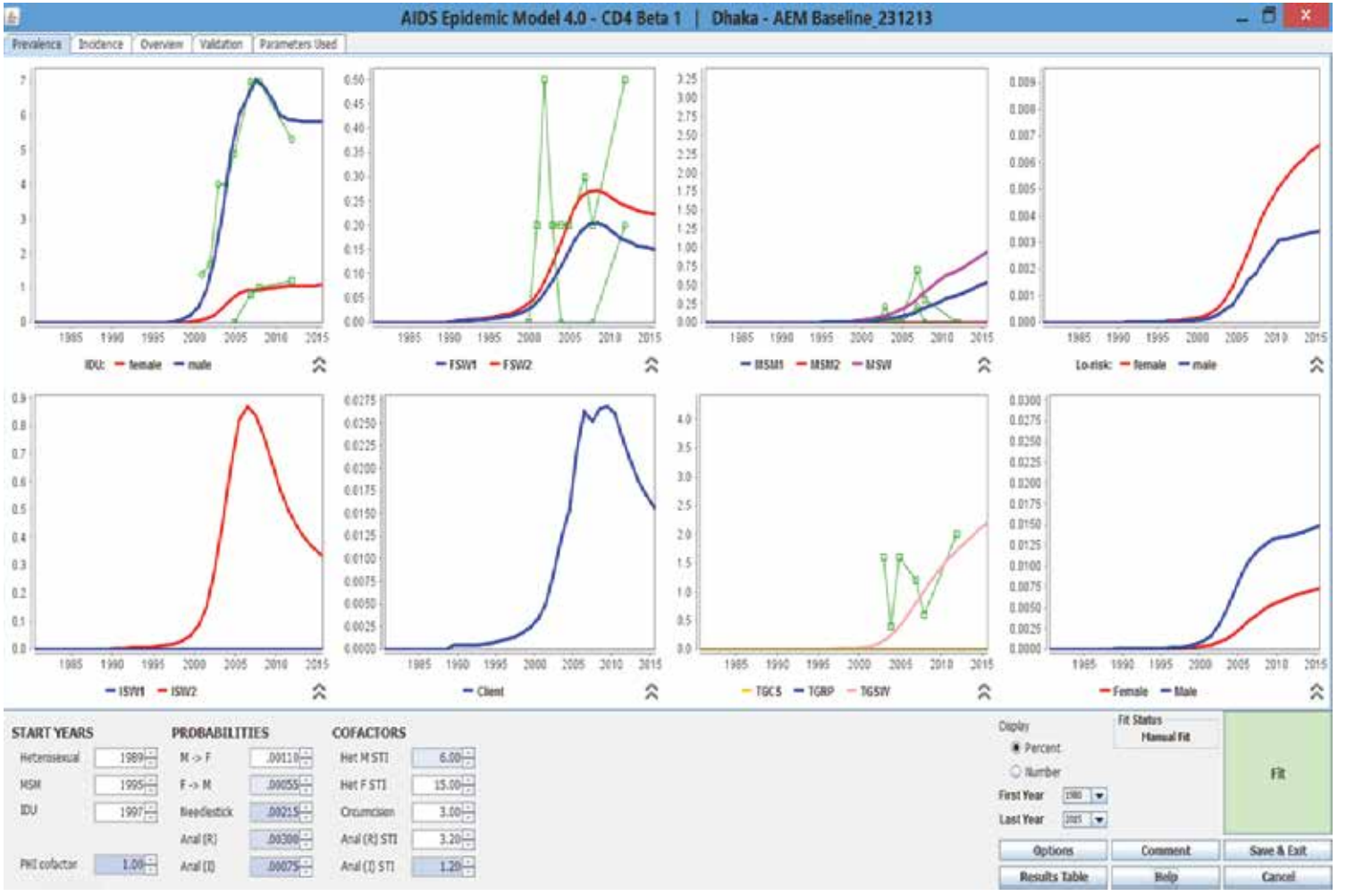
In addition, the Working Group consulted several references for accountability and further agreed on each parameter validation concerning the surveillance-derived modeling results.
These parameters include:

- The beginning year of the HIV epidemic among FSW, PWID and MSM
- The probability of new HIV infections among PWID, and the probability of infection through homosexual and heterosexual intercourse
- The new HIV infection co-factor due to STI and circumcision is also included
- The primary HIV cofactor

3.2.4 The validity of AEM

In order to validate the model outputs, the AEM estimates of prevalence among different key populations were compared with the observed prevalence data which are derived from national HIV serological surveys. The data shows that the AEM estimates are comparable to HIV prevalence curves and can therefore be validated (Figure 3.2).

Figure 3.2: Comparison of AEM outputs with HIV prevalence curves



3.3 Approaches to qualitative analysis

3.3.1 Focus group discussion

To assess the effectiveness of harm reduction programs and to explore the reality of assumptions associated with the transmission of HIV and related risk behavior, FGDs were conducted with PWID. Both HIV-positive and HIV-negative PWID were selected for FGDs by the outreach workers of Care Bangladesh (under GF-906 & 907 intervention). Emphasis was given to recruit long term drug users in order to understand the effect of harm reduction programs among them. A total of 8 FGDs were conducted in six drop in centres (DICs) in Dhaka to draw their perspective on risk behavior and to understand the nature of health and psychosocial challenges as well as insights and understandings of harm reduction programs. Specific emphasis was given on gender specific views on the challenges and vulnerabilities of PWID. Two FGDs were conducted with female-PWID in the area of intervention in Old Dhaka (Noya Bazar and City Polli).

The focus group consisted of on average 6 to 7 PWID. The homogeneity of focus groups including HIV-positive participants allowed for free flow of discussion as members were not afraid of disclosure. Each FGD was moderated by a research assistant with the help of a staff member of Care Bangladesh and notes were taken by interviewers. A field-test of the FGD tool was conducted among male-PWID in Old Dhaka to check for glitches in wording of questions or anything that could impede the tool's ability to collect data in a systematic fashion. Discussions during the FGDs were taped using audiotapes. The testimonial narratives of PWID constituted the core data of this assessment.

FGDs were conducted with PWID who were recruited by purposive sampling across the DICs in Dhaka city. Hot spots (defined in terms of HIV/STI prevalence among PWID, their number and injecting profile) and normal spots were identified after discussions with DIC managers/outreach workers. A comparative analysis was made to understand the disparity between the clients (perception about program effect) in two areas (hot spot vs. normal spot). For one FGD, the scope of the study was limited to those PWID who had direct experience with OST. The FGDs were carried out in the rest room of DIC conducive to informal discussion. After the completion of the discussion, respondents were compensated monetarily for travel expenses.

3.3.2 Key informant interviews

Data collection also relied on a participatory methodology involving extensive consultations with service providers, policy makers and stakeholders. These experts provided insight on the effects of harm reduction programs over the past decade and the nature of problems among PWID, and gave recommendations for solutions. More particularly, data were collected from key informants in order to gather information on the underlying contextual and programmatic factors that may have contributed to the relatively low HIV prevalence among PWID in Dhaka city. A total of 8 semi-structured interviews with key informants were held across a number of organizations: Save the Children, Care Bangladesh and NASP. More particularly, data were collected from key informants in order to gather information on the underlying contextual and programmatic factors that may have contributed to the relatively low HIV prevalence among PWID in Dhaka city.

3.3.3 Interpretation of data

The analyses of focus group and key informant interview data were performed in line with the study objectives and the purpose for which the data were collected. The study required an understanding of HIV/AIDS-related risk behavior among PWID as well as their insights and understandings of harm reduction programs. For such exploratory research, a simple descriptive narrative is quite appropriate. The analytical process involved a number of distinct and highly interconnected stages, such as familiarization, identifying a thematic framework, indexing and interpretation.[42] The distinctive aspect of the framework analysis performed in this study allowed themes to develop both from the research objectives and from the narratives of research participants. During the analysis, descriptive statements were formed and an analysis was carried out on the data under the questioning route. The aim of this analysis was to see the relationship between the quotes, and the links between the data as a whole.

3.4 Method of economic analysis

3.4.1 Data for economic analysis

The economic analysis for the present study required data on three groups of variables: cost by inputs, outputs (amount of services provided) and impact of interventions on harm reduction. All these data had to be gathered for different groups of clients (of the program services) under the interventions being undertaken by several non- government organizations, and for several years so as to ascertain the trend of average cost.

The client groups are: HBFSW, SBFSW, injecting HBFSW, injecting SBFSW, PWID (male and female), MSM, MSW, TG, and males and females receiving ART. These categories of the clientele population were based on the requirements in the AEM model. These are also the categories for which the harm reduction services are being provided in the country by a number of NGOs. Besides, data were collected for another category, residence-based sex workers, who are also getting services from one NGO.

Data were collected from the NGOs providing the services. The NGOs include: CARE-Bangladesh, FHI 360, icddr,b, Ashar Alo Society, Bangladesh Women's Health Coalition (BWHC), and Durjoy Nari Sangha. A prescribed format was used to collect the information. The format required information on the total fixed cost, total variable cost and total cost of all services (viz. distribution of condoms, distribution of needles/syringes, supply of lubricant, distribution of drugs for STI management, and ART), coverage of people under each category, and number of contacts for each service in each year. Information was available for the following years: the initial year 1998, 2008, 2009, 2010, 2011, and 2012.

Total cost has two components: total fixed cost and total variable cost. The inputs whose amounts remain fixed at all levels of output are the fixed inputs, while the inputs whose amounts vary as the volume of output changes are the variable inputs. For the interventions under study, the category of variable cost includes the following components: cost of drugs, supplies (condoms, syringes, etc.), logistics, food, transport, hospital bed, and of other recurrent items. The components of the fixed cost are: cost of manpower, land/building,

maintenance of building, furniture, vehicle, IEC materials, equipment, training, and other capital inputs. The total expenditures on capital items including equipment and furniture were properly annualized before they were included in the total cost. For an extensive description of the basic concepts and theories underlying the economic analysis, and the economic efficiency and economic evaluation, see Appendix 7.

Detailed discussions were held with the managers and account officers of the NGOs about the requirements of data for the study and on the methods of computation of cost under each type. In addition, the research team had regular interactions with the NGO personnel during the entire process of data compilation.

The NGOs furnished the prescribed forms of data on the expenditures already incurred by them. The research team compared the expenditures with that on the same or similar items and activities existing in the competitive market. It appeared that the data collected from the organizations were highly consistent with the market data and, hence, the expenditure data were assumed as the equivalent of cost data. The expenditures incurred by different NGOs on the major items were found to have striking similarity (varying within a very narrow range), which is also an indication of the expenditures reflecting market costs.

One of the limitations was that data on expenditure were available only for the past 5 to 6 years. It was difficult to trace the trend of cost and analyze the behavior of the cost function, only using data for such a small period.

3.4.2 Method of computation

A mathematical model, fitted to epidemiologic data, projected the intervention's impact. The cost per HIV infection averted for different intervention scenarios was estimated. The specific methods of computing cost, outcome, and resource requirement, and conducting economic evaluation are discussed in the relevant parts of the chapter on economic analysis (Chapter 7) and the methods of computations are provided in Appendix 7 (Section 7.4).

CHAPTER IV: STATE OF HIV/AIDS IN DHAKA CITY

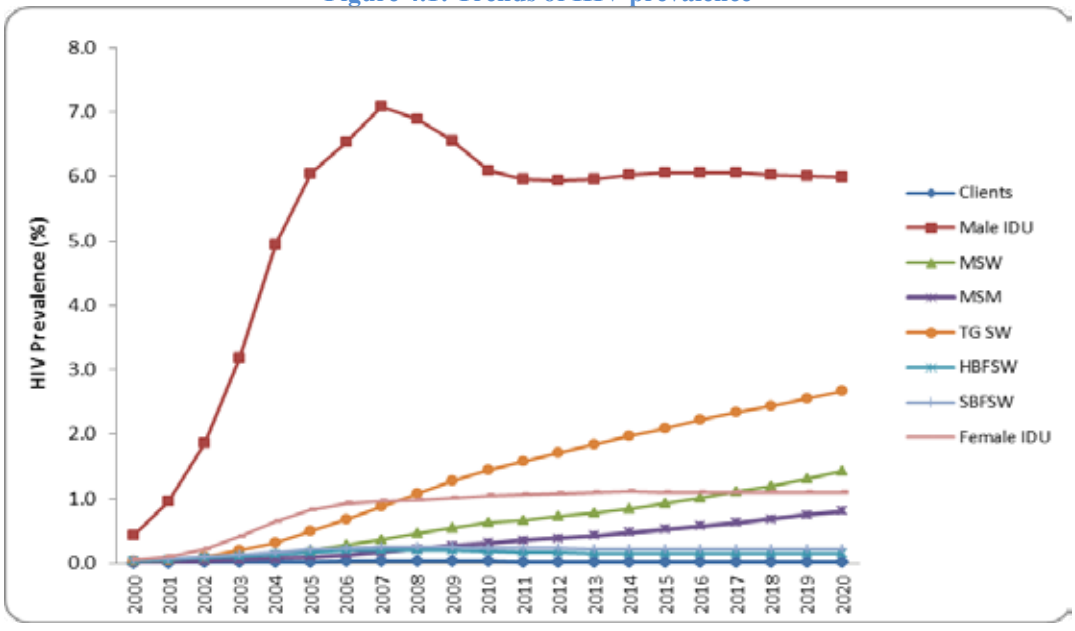
4.1 Results of the AEM baseline workbook

In this chapter the results of the data analysis, obtained from the AEM Baseline workbook, are presented. The chapter provides information about outputs based on the assumption that impact will occur if the current intensity of interventions targeting PWID and other risk population continues for the coming years. The selected indicators (e.g. number of current HIV infections, number of new infections and AIDS related deaths) are analyzed in the subsequent sections by different population groups and gender. The findings in this section are based on the presentation of model results from 2000 to 2020.

4.2 HIV prevalence among PWID and other key populations

The HIV prevalence among male-PWID in Dhaka city showed an upward trend from 2000 to 2007 (Figure 4.1). The prevalence was estimated at less than 1 percent in 2000 and the peak estimated prevalence was 7.1 percent, reached in 2007. Thereafter, there was a decline in the prevalence rate to around 5.9 percent in 2012. It is projected that the prevalence will remain fairly stable at 6.0 percent among male-PWID in Dhaka city from 2013 to 2020. The general trend for female-PWID was a rise in the prevalence of HIV to 1 percent in 2008. From 2012 and onwards, the prevalence among female-PWID is projected to reach approximately 1.1 percent. The distribution of HIV prevalence among other risk populations is also presented in the graph.

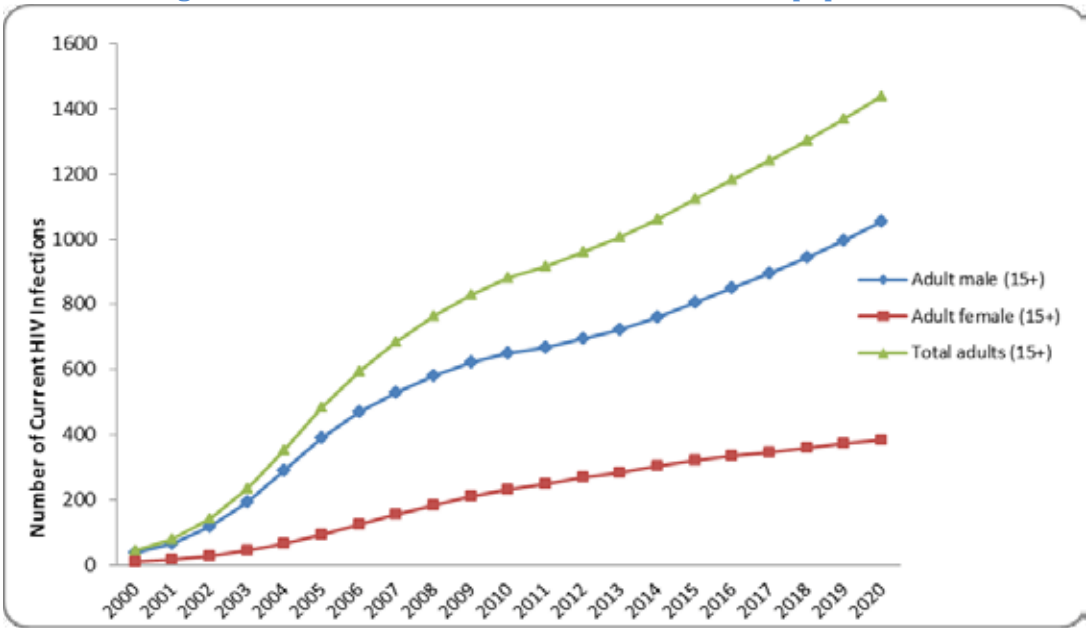
Figure 4.1: Trends of HIV prevalence



4.3 People currently living with HIV

The number of people currently living with HIV has been increasing over the projection period. In 2000, the number of current infections in the adult population was estimated at 45 and in 2012 the number of current HIV infections was estimated to 961 cases, which represents nearly a 21-fold increase over the 12-year period (Figure 4.2). The number of adults currently living with HIV is projected to increase at a slower pace between 2013 and 2020. It is projected that the total number of adults living with HIV will increase by 42 percent - from 1,006 in 2013 to 1,437 in 2020.

Figure 4.2: Trends in current HIV infections in adult population



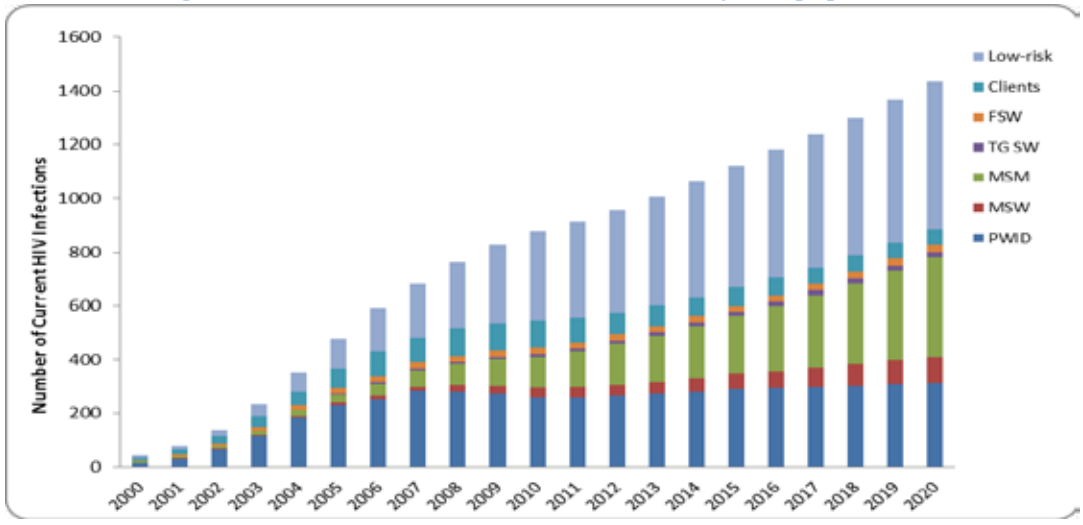
The current male-female HIV infection ratio is presented in Table 4.1. The table shows that the number of adult males living with HIV was 3.5 times higher in 2000 as compared with their female counterparts. The male-female ratio has declined to 2.6 in 2012. In 2020, the male-female ratio would be 2.7, which indicates that the number of adult females living with HIV will gradually increase over the period.

Table 4.1: Number of current HIV infections in adult population

Year	Adult male (15+)	Adult female (15+)	Total adults (15+)	Male-female ratio
2000	35	10	45	3.5
2001	64	16	80	4.0
2002	116	26	142	4.4
2003	194	42	235	4.6
2004	289	64	353	4.5
2005	389	93	482	4.2
2006	469	124	593	3.8
2007	529	155	684	3.4
2008	581	184	764	3.2
2009	622	208	830	3.0
2010	650	230	880	2.8
2011	667	249	916	2.7
2012	693	268	961	2.6
2013	723	283	1006	2.6
2014	761	302	1062	2.5
2015	805	319	1124	2.5
2016	850	333	1183	2.6
2017	895	346	1241	2.6
2018	944	359	1302	2.6
2019	996	371	1367	2.7
2020	1054	384	1437	2.7

The number of people living with HIV by different risk population groups is presented in Figure 4.3. The figure shows that the number of current HIV infections among PWID in Dhaka city has increased from 14 in 2000 to 280 in 2007. Between 2008 and 2012, the number of current infections slightly dropped from 278 in 2008 to 262 in 2012. The number of HIV-infected individuals will then start to increase slightly. In 2020, it is estimated that the current estimated number of HIV infections among PWID would be 310. It should be mentioned that the number of infections is also linked to the population turnover of PWID.

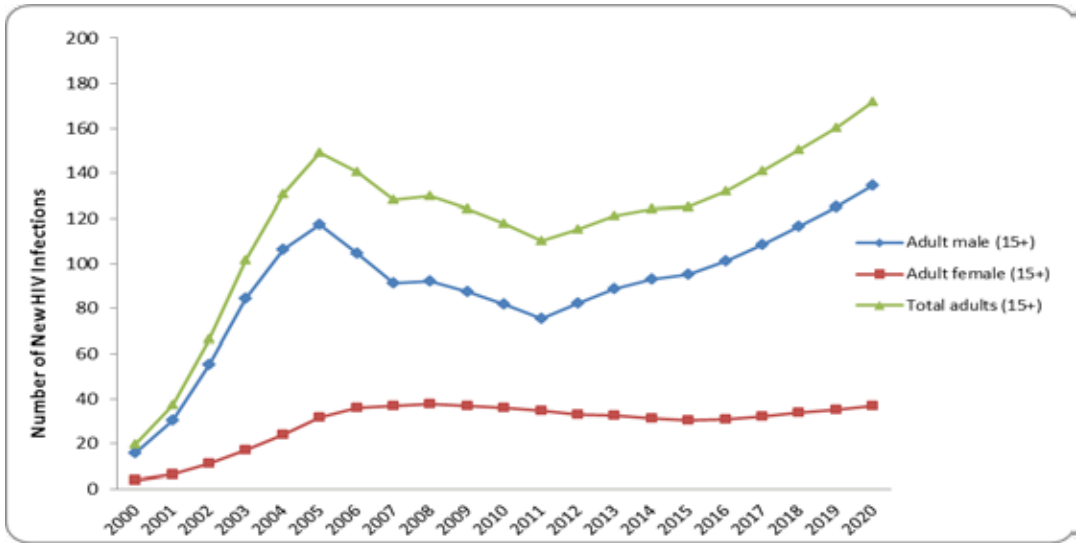
Figure 4.3: Number of current HIV infections by sub-population



4.4 Number of new HIV infections

Figure 4.4 shows the number of new HIV infections among the adult population (15+ years) by year. The figure shows that the number of new infections among adults in Dhaka city has sharply increased from 20 in 2000 to 149 in 2005, representing more than a seven-fold increase in only five years. The number then started to decrease slightly – falling to 115 in 2012. The graph indicates that the number of new HIV infections in Dhaka city will eventually start to increase in the coming years.

Figure 4.4: Trends in new HIV infections in adult population



The distribution of new HIV cases by sex is presented in Table 4.2. The table shows that more male adults in Dhaka city are getting infected with HIV each year as compared to their female counterparts (Table 4.2). In 2000, the male-female ratio of new HIV infection was estimated at 4.1. This indicates that the number of new infections among men is 4.1 times higher than their female counterparts. From 2000 to 2011 the male-female ratio decreased substantially. In 2011, the male-female ratio was estiamted at 2.2 as compared to 4.1 in 2000. In other words more female adults have become infected by HIV in recent years as compared to males. After 2011, the male-female ratio shows a gradual rise from 2.5 in 2012 to 3.6 in 2020.

Table 4.2: Number of new HIV infections in adult population

Year	Adult male (15+)	Adult female (15+)	Total adults (15+)	Male-female ratio
2000	16	4	20	4.1
2001	31	6	37	4.7
2002	55	11	66	5.1
2003	85	17	102	4.9
2004	106	24	131	4.4
2005	117	32	149	3.7
2006	105	36	141	2.9
2007	91	37	128	2.5
2008	92	37	130	2.5
2009	87	37	124	2.4
2010	82	36	118	2.3
2011	76	35	110	2.2
2012	82	33	115	2.5
2013	89	32	121	2.7
2014	93	31	124	3.0
2015	95	30	125	3.2
2016	101	31	132	3.3
2017	109	32	141	3.4
2018	117	34	150	3.5
2019	125	35	161	3.6
2020	135	37	172	3.6

The line graph below shows the number of new HIV infections by sub-population during the period 2000-2020 in Dhaka city (Figure 4.5). Overall it can be seen that the number of new HIV infections among PWID sharply increased between 2000 and 2005. In 2000, the new HIV infections among PWID was estimated at 9, reaching a peak of 91 in 2005, which indicates a ten-fold increase in just five years. The new infections among PWID fell back to 29 in 2011, indicating the success of current interventions. If current intervention programs continue, the new infections among PWID in Dhaka city is expected to rise to nearly 37 by 2020.

Figure 4.5: Number of new HIV infections by sub-population

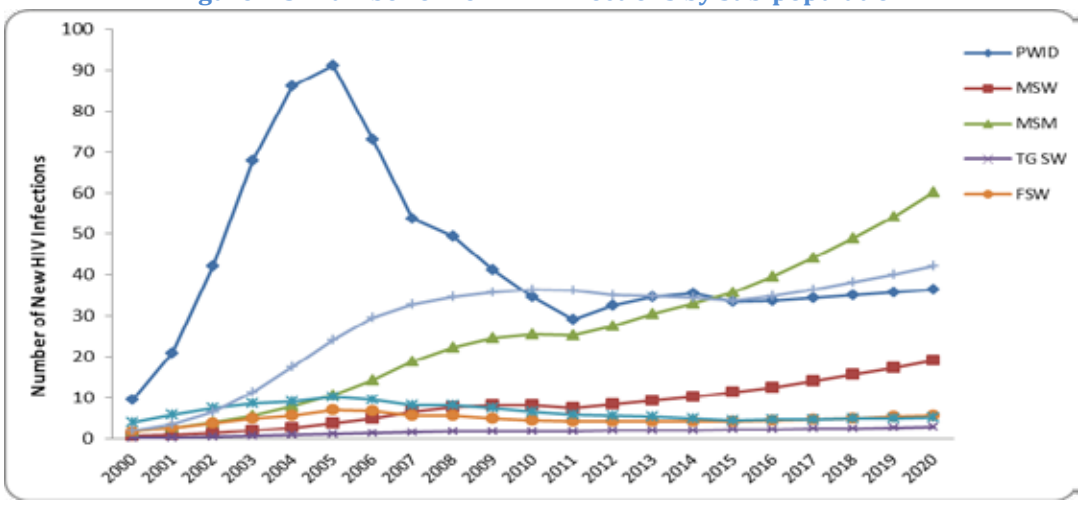
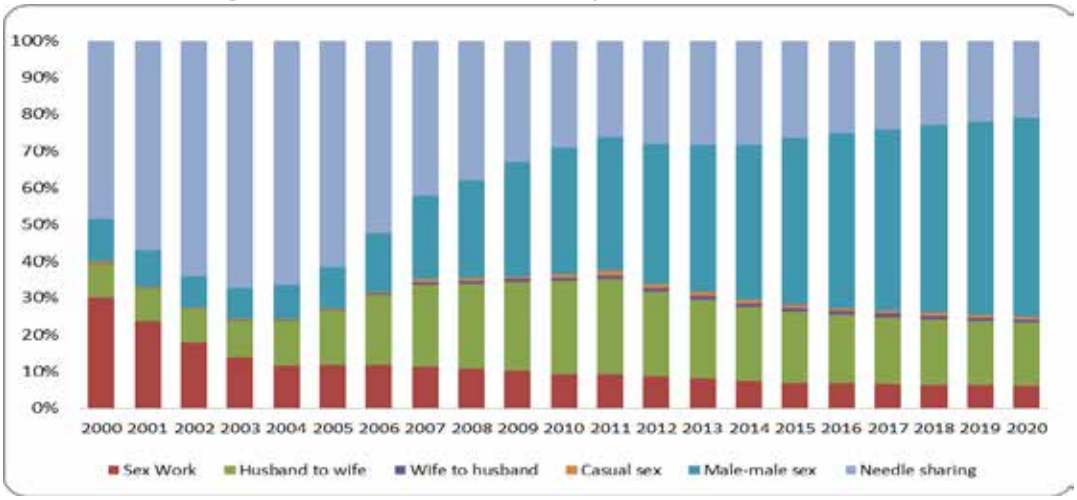


Figure 4.6 shows the distribution of new HIV infections by mode of transmission. It is evident that in 2000 needle sharing was the major source of HIV infection (48 percent) among the adult population in Dhaka city, followed by female sex work (30 percent), male-to-male sex (12 percent), husband to wife (9 percent) and other sources (1 percent). The source of HIV infections followed a different pattern in 2012, with a sharp drop to 28 percent through needle sharing. In the same year, male-to-male sex accounted for 38 percent of new HIV infections, followed by husband-to-wife at 22 percent, female sex work at 7 percent, while casual sex from wife to husband represent 2 percent of new infections. It is projected that needle sharing will be responsible for only 21 percent of new infections by the year 2020. The graph demonstrates that new HIV infection has spread through various at-risk populations, which demonstrates that increased national prevention efforts are needed in curbing the spread of the epidemic.

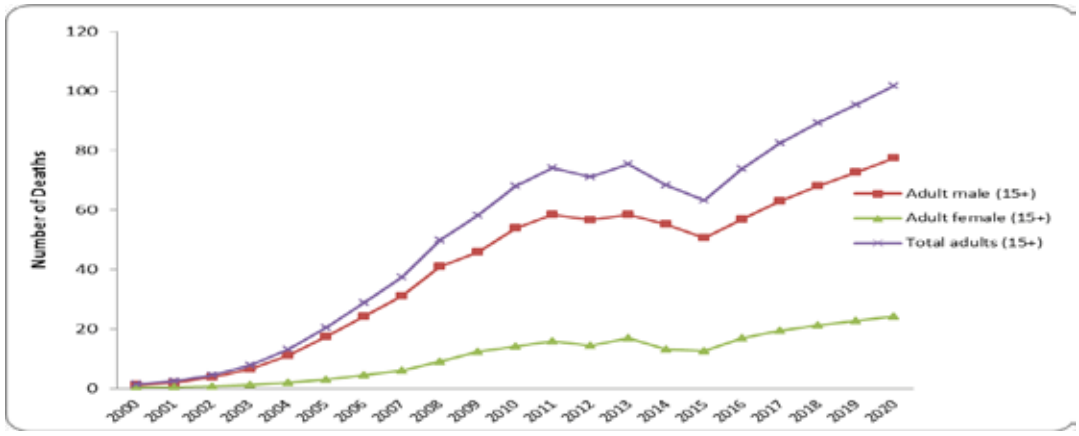
Figure 4.6: New HIV infections by mode of transmission



4.5 AIDS-related deaths

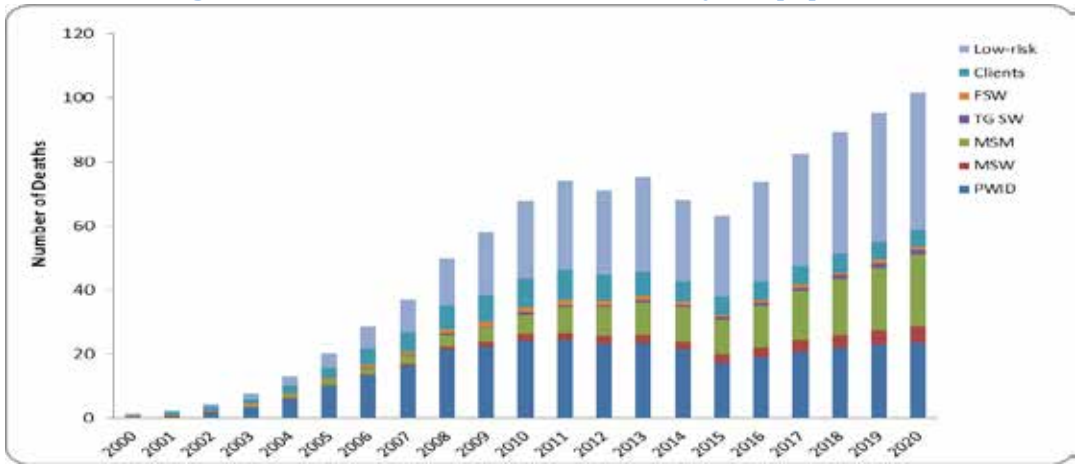
The total number of deaths due to HIV/AIDS among the adult population (15+ years) in Dhaka city is presented in Figure 4.7. Overall the number of deaths for each year among the adult population sharply increased from 2 in 2000 to 74 in 2011. The number of deaths due to AIDS was 75 in 2013 and is predicted to stand at 102 by the year 2020. In the coming years, the rate of increase in deaths would be significantly higher among female adults (85.8 percent) between 2014 and 2020 as compared to 40.3 percent among the adult male population.

Figure 4.7: Trend in AIDS related deaths among adult population



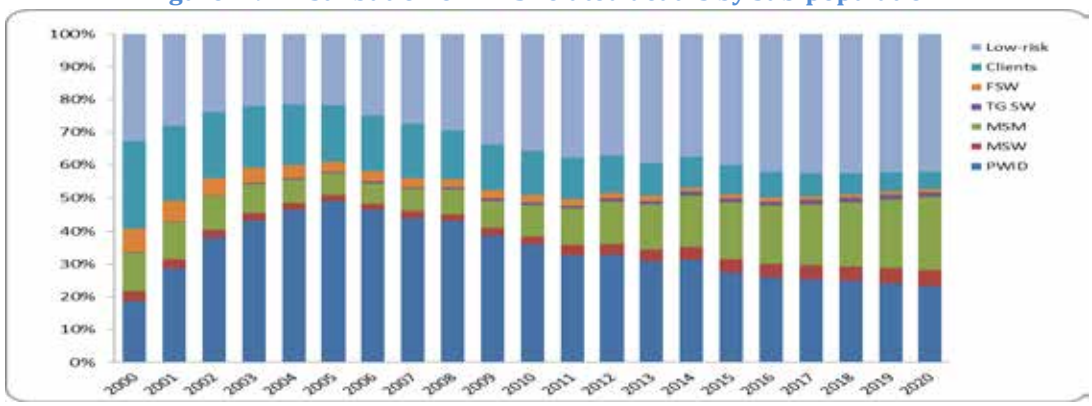
The graph below shows the distribution of AIDS-related deaths by sub-population (Figure 4.8). The general trend for PWID was a gradual rise between 2000 and 2011 and a similar trend is seen between 2015 and 2020. The graph shows that the estimated number of deaths among PWID due to AIDS would be 24 in 2020 as compared to 17 in 2015, representing a 37.0 percent increase over the period.

Figure 4.8: Number of AIDS related deaths by sub-population



The following graph provides data on AIDS-related deaths among PWID (Figure 4.9). In 2005, nearly half (49 percent) of the AIDS-related deaths occurred among PWID with an HIV infection, it then dropped to 33 percent in 2012. Deaths due to AIDS among PWID are projected to drop to 23 percent of the total number of deaths in 2020. The reduction in the proportion of deaths due to AIDS among PWID and FSWs, including their clients, has been stimulated by the country's effective intervention program among these sub-populations.

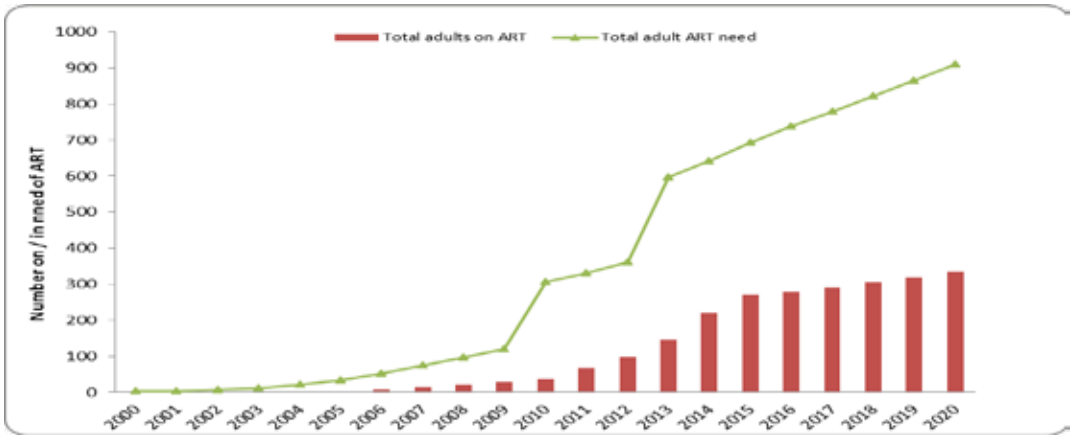
Figure 4.9: Distribution of AIDS related deaths by sub-population



4.6 Coverage and adults in need of ART

The distribution of adults on ART based on current interventions is presented in Figure 4.10 by year. The adults in need of ART include those who meet the asymptomatic criterion based on CD4 cell count (CD4 cells are a type of white blood cell that fights infection and in known as the T-helper cells. Along with other tests, the CD4 count helps tell how strong the immune system is and may indicate the stage of HIV) and the adults under coverage include those who are currently on ART and continuously receiving ART. The graph shows that the number of adults on ART is increasing over the years, and it is projected that the gap between the number of adults in need and number of adults currently on ART will increase between 2013 and 2020.

Figure 4.10: Total adult ART coverage and need: 2000-2020



The coverage of ART among adults and PWID is presented in Table 4.3. In 2005, the adults who were in need of ART were covered by 7.4 percent. The ART coverage among adults has increased to 27.1 percent in 2012. Further, the ART coverage was projected at 36.6 percent in 2020. In contrast, only 5.6 percent of the PWID who were in need of ART were covered in 2005. The ART coverage significantly increased over the years from 2005 to 2012. In 2012, the ART coverage for PWID was estimated at 23.9 percent and in 2020 it is estimated to fall to 20.4 percent. Overall, it is evident that it will hardly cover a significant proportion of PWID in the coming years (up to 2020) if the current program does not incorporate stronger case detection.

Table 4.3: ART coverage among total adults and PWID

Year	Total adults (15+)			Total PWID (15+)		
	Number on ART	Number ART need	Coverage (%)	Number on ART	Number ART need	Coverage (%)
2005	3	34	7.4	1	13	5.6
2006	9	52	17.1	3	19	15.4
2007	14	76	18.8	4	29	15.6
2008	21	97	21.1	6	35	18.4
2009	29	120	24.5	10	40	24.0
2010	38	307	12.2	10	93	11.3
2011	69	332	20.7	17	96	18.1
2012	98	362	27.1	24	100	23.9
2013	145	597	24.2	34	160	21.1
2014	221	641	34.5	39	167	23.5
2015	270	692	39.1	38	176	21.5
2016	278	738	37.7	38	182	21.0
2017	291	780	37.3	39	187	20.7
2018	305	822	37.0	39	192	20.5
2019	319	866	36.8	40	195	20.4
2020	334	911	36.6	41	199	20.4

CHAPTER V: IMPACT OF PWID INTERVENTIONS IN DHAKA CITY

5.1 The assumptions of impact in Dhaka city

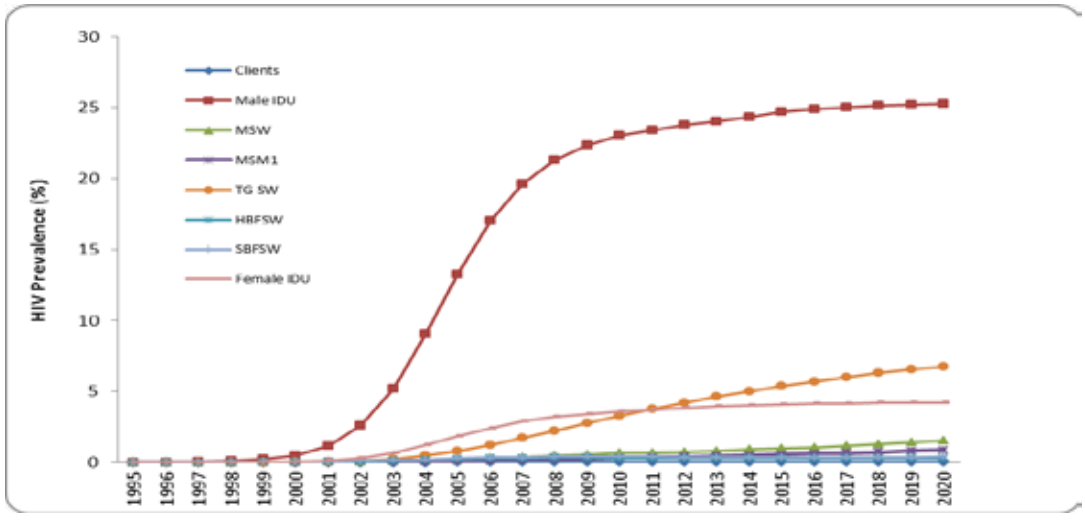
The impact of existing harm reduction programs among PWID in Dhaka city is assessed by comparing the estimations and projections between the scenarios of: a) current interventions in place and; b) no interventions in place since 1995.

The results of the AEM for the "no intervention scenario" is based on the assumption that risk behaviors and STI rates remain unchanged for PWID from 1995 onwards.

5.2 Impact of interventions on HIV prevalence among PWID

What would have happened if no intervention existed for PWID in Dhaka city since 1995?
The graph shows that the prevalence of HIV among male-PWID in Dhaka city in 2012 was projected to be 23.8 percent if there was no harm reduction intervention (Figure 5.1). In contrast, the prevalence among the same group was projected to be 5.9 percent if existing intervention scenarios are considered. Similarly, the HIV prevalence in the absence of any intervention among female-PWID in Dhaka city was projected to be nearly 3.8 percent in 2012 as compared to 1.1 percent with existing interventions. The scenario projects a prevalence of 25.3 percent among male-PWID in 2020 if existing interventions do not continue among the group.

Figure 5.1: HIV prevalence among key populations without harm reduction intervention in Dhaka

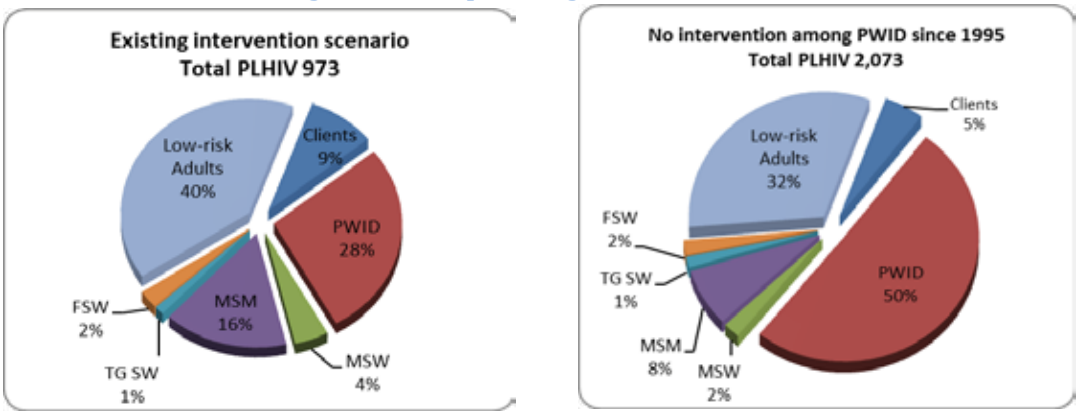


5.3 Interventions may impact the number of PLHIV

Number of PLHIV would increase in the absence of PWID interventions in Dhaka city since 1995

The number of (PLHIV) in Dhaka city was estimated to be 973 in 2012. In the absence of any intervention program among the PWID (since 1995), the number of PLHIVs was projected to be 2,073 by the year 2012 (Figure 5.2). While PWID were found to constitute 28 percent of PLHIV in Dhaka city in 2012, this could have been 50 percent if no intervention had taken place targeting PWID in Dhaka city.

Figure 5.2: People living with HIV in 2012



5.4 Gains achieved so far towards reducing new HIV infections

What we have achieved so far through existing harm reduction programs among PWID in Dhaka city?

The existing harm reduction programs among PWID in Dhaka city was instrumental in bringing about a decline in HIV infections: as an outcome, 184 new infections among adult population and 117 new infections among PWID have been averted in 2012 (Figure 5.3). It is worth noting that reducing the rate of new infections is clearly linked with changes in risk behavior. The PWID intervention program efforts had effects on reducing mortality among the adult population and PWID: 99 lives of adults and 76 lives of PWID were saved in Dhaka city in 2012 due to life saving efforts of harm reduction. Over a period of 18 years between 1995 and 2012, harm reduction programs were found to avert new HIV infections and the program increasingly helped prevent deaths both among adults and PWID.

Figure 5.3: New infections averted and lives saved per year in Dhaka city: 1995-2012

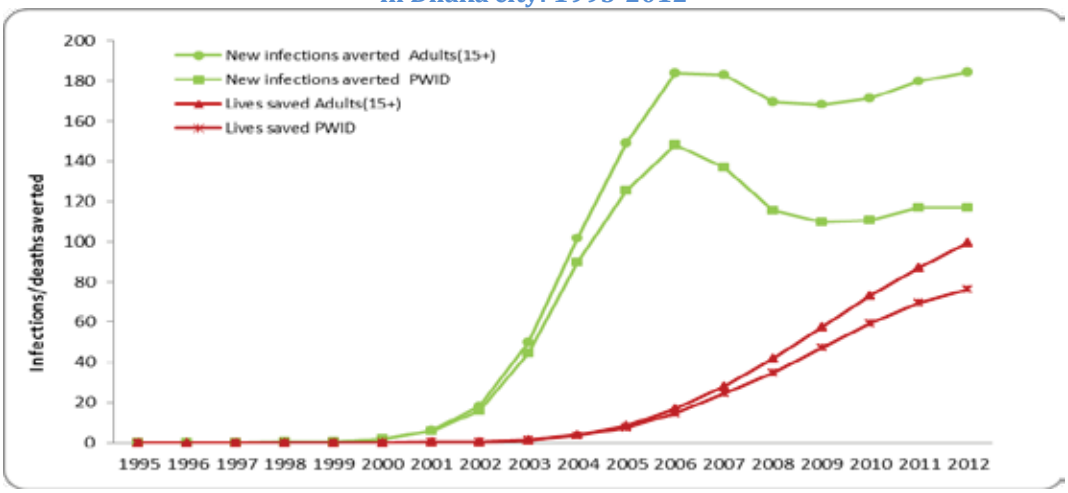
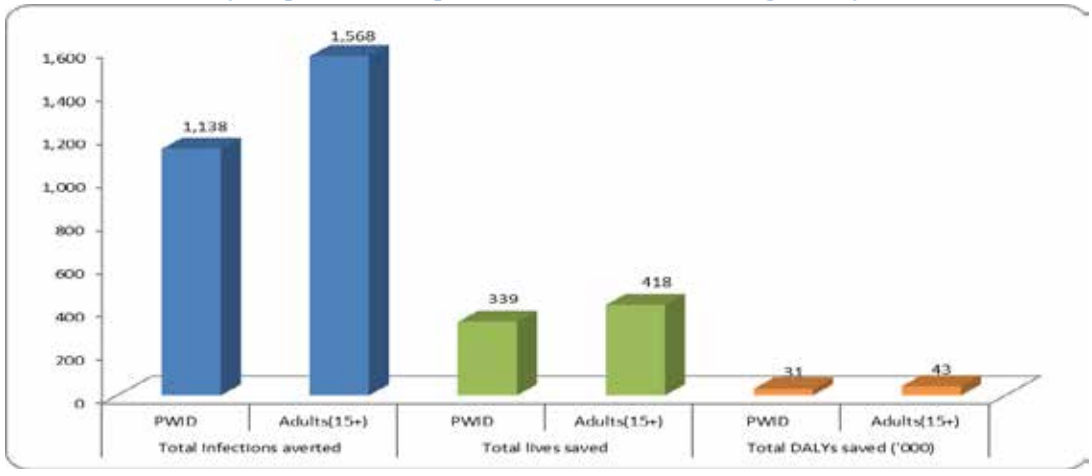


Figure 5.4 shows that a total of 1,568 new infections among the adult population and 1,138 new infections among PWID have been averted since 1995 in Dhaka city because of harm reduction program efforts dedicated to PWID (Figure 5.4). The graph also shows that a total of 418 cumulative lives have been saved so far. From 1995 to 2012, 339 lives were saved among PWID. During the same time period, a total of 31,000 DALYs were saved among PWID in Dhaka city, when harm reduction interventions are in place.

Figure 5.4: Total infections averted, and lives and DALYs saved: 1995-2012 (as a probable impact of interventions among PWID)



Note: For further understating the impact of all prevention interventions with key populations in Dhaka, refer to Appendix 2.

CHAPTER VI: EFFECTIVE INTERVENTION SCENARIOS AND SCALE-UP

6.1 Assumptions of intervention scenarios

In order to identify the effectiveness of harm reduction interventions to reduce the risk of morbidity and mortality among PWID and other key populations in Dhaka city, a number of intervention scenarios have been developed. The scenarios are briefly described below:

Scenarios	Description	
Baseline	Existing interventions maintained	Current coverage of interventions to be maintained among all key populations (KPs)
Scenario 1	PWID scaled up	Current coverage to be scaled up among male-PWID (100 percent) and female-PWID (65 percent) with OST targeting male (5 percent) and female (3 percent) and HTC (HIV testing and counseling) scale up. Maintained among the other groups
Scenario 2	MSM scaled up	Current coverage to be scaled up among MSM (50 percent) with HTC scale up and maintained among the other groups
Scenario 3	FSW scaled up	Current coverage to be scaled up among FSW (65 percent) with HTC scale up and maintained among the other groups
Scenario 4	All intervention programs scaled up-1	Current coverage to be scaled up among male-PWID (95 percent), female-PWID (55 percent), FSW (65 percent) and MSM (35 percent), MSW (95 percent), TG (90 percent) with OST targeting male (5 percent) and female (3 percent) and HTC scale up among all KPs
Scenario 5	All intervention programs scaled up-2	Current coverage to be scaled up among FSW (80 percent), MSM (50 percent), male-PWID (95 percent), female-PWID (80 percent), MSW (95 percent) and TG (95 percent) with OST targeting male (10 percent) and female (5 percent) and HTC scale up among all KPs

Note: HTC scale up among different key populations are set as per the targets set in the national strategic plan.

The relative efficiency of these scenarios are assessed by comparing the epidemiological outputs (e.g. new HIV infections and AIDS related deaths) produced by the scenarios and by evaluating their relative impacts in terms of infections averted and lives saved between 2014 and 2020.

6.2 Epidemiological outputs

The table compares the epidemiological outputs relating to different scenarios in the period 2014 to 2020. It is projected that new HIV infections for this period (baseline scenario) will be 1,005 if existing harm reduction interventions continue (Table 6.1). Projections toward 2020 indicate that both cumulative new HIV infections and AIDS related deaths would drop significantly if current intervention programs are scaled up among all key populations (see scenario 4 and scenario 5). Our analysis suggests overall, that scaling up prevention interventions for all key populations would have a better effect than focused prevention programs targeting a single at-risk group.

Table 6.1: Epidemiological outcomes: 2014-2020

Indicators	Intervention Scenarios					
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Cumulative new HIV infections	1,005	788	960	995	633	628
Cumulative AIDS-related deaths	575	538	590	589	543	545

6.3 Epidemiological impact

Table 6.2 compares the epidemiological impacts of HIV and AIDS with regard to different scenarios estimated from 2014 to 2020. It is projected that scenario-5, which proposes intensified coverage scale-up across all risk groups, would generate maximum impact in terms of total HIV infections averted and total DALYs saved as compared to existing intervention programs. Of the other scenarios, if PWID intervention (scenario-1) can be scaled up, it will save more lives as compared to scenario-4. But total HIV infections would be relatively lower if scenario-4 (scaling up programs among all key populations) is taken into account.

Table 6.2: Epidemiological impacts: 2014-2020

Indicators	Intervention scenarios					
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Total HIV infections averted	-	217	45	10	372	378
Total lives saved (deaths averted)	-	37	(15)	(14)	31	30
Total DALY saved	-	5,914	1,233	274	10,124	10,278

Figure 6.1 shows the comparative picture by different scenarios in relation to HIV infection probability. A total of five scenarios have been simulated in which a mathematical relationship between scaling-up intervention programs and transmission probability are used to estimate the number of HIV infections averted per year. The analysis of the findings reveals that scenario 5 will be able to generate immediate impact in terms of infections averted, while scenario 4 would avert more infections after 2018.

Figure 6.1: Total infections averted per year

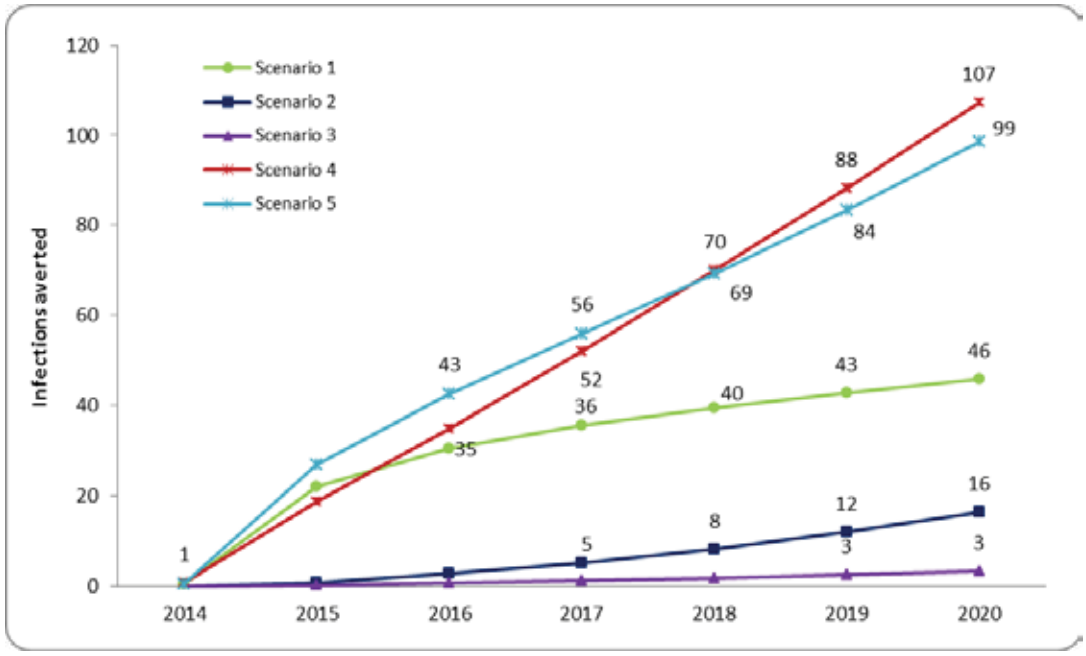
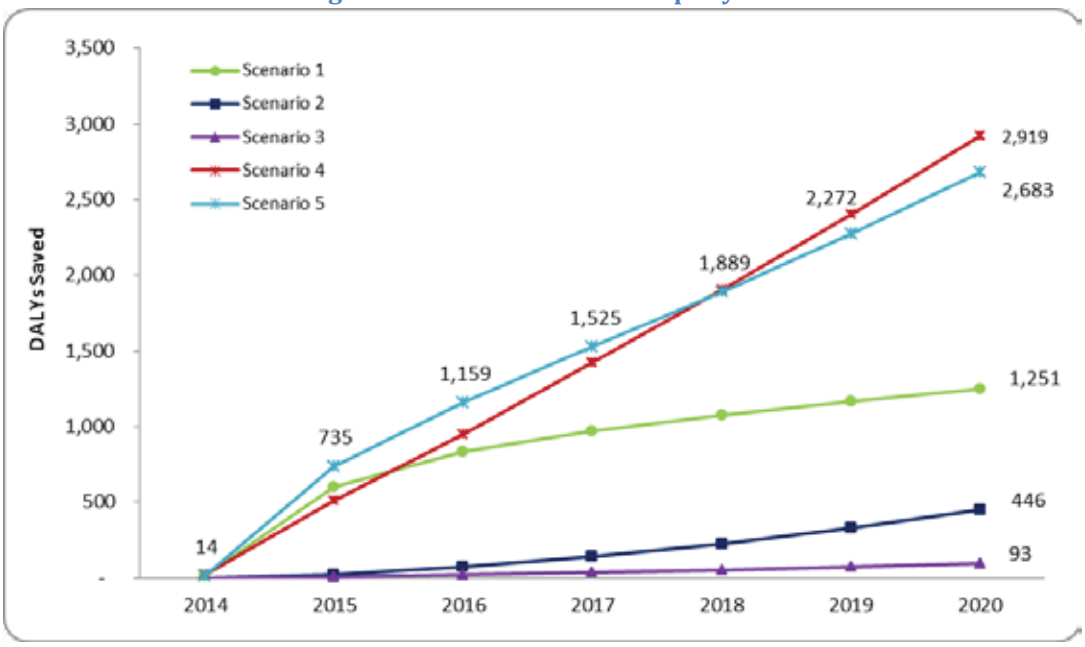


Figure 6.2 shows the comparative picture by different scenarios based on DALYs saved per year. It is predicted that scenario-4 will save maximum number of DALYs between 2014 and 2020; i.e. 2,919 DALYs in 2020, as compared to 2,683 DALYs in the same year under scenario-5. In contrast, scenario-1 is expected to save 1,251 DALYs. We estimated that if efforts to scale up the HIV intervention coverage targeting only MSM or FSW are achieved, it will not generate any potential impact in terms of DALYs saved.

Figure 6.2: Total DALYs saved per year



This projection model provides an overall assessment of the impact of different scenarios on key populations to produce better epidemiological impact. Using scenario analysis, we examined the potential effects of intervention options. We compared the scenarios developed to understand the potential impact on new HIV infections as well as DALYs saved. Scenario analysis is a helpful tool for making policy decisions about the design and planning of HIV outbreak control management on a national, regional, and local level. The model predicts that scaling up certain interventions (e.g. scenario 4 and scenario 5) could produce significant epidemiological impact as compared to intervention scenarios that particularly focus on a single key population at risk. If government and development partners want to scale up existing HIV intervention programs, it would be more effective if they focus on universal coverage with intervention efforts for all populations at risk. This could be done by considering scenario 4 or scenario 5 which includes universal coverage initiatives and policies. However, the choice between the two scenarios should be made after making a cost-effectiveness analysis.

CHAPTER VII: RESOURCE NEED AND COST-EFFECTIVENESS ANALYSIS

7.1 Resource cost analysis for the specific time frame

This chapter discusses the unit costs of the interventions and the resource requirements to undertake the interventions in the period 2014-2020. The chapter also estimates the total benefit to accrue from the interventions and calculates the costs of the interventions in order to conduct a cost-benefit analysis to assess the worthiness of investment in interventions as well as to identify the most effective interventions.

7.2 Program coverage and unit cost

Unit cost is considered here in three senses: i) average total cost per client (service user), ii) average total cost per contact, and iii) average total cost of distributing condom and other materials. Knowledge about the level and trend of average total cost per client is crucial for estimating the cost to be incurred by the program in future years as well as for assessing the level of economic efficiency. Estimation of the cost per contact is needed to compute the program cost when the number of contact varies by the client type and by the commodity distributed. It is particularly useful to assess the implications of increasing the number of contacts, if needed, on the program costs. The planners and program managers need to know the amount of the average costs of distributing each commodity in order to plan procurement and ensure adequate supply throughout the year. For each category of clients the computed unit cost is the average of the amounts obtained from all NGOs. The same is also true for the other two types of unit cost– both are the average amounts. It may be noted that the amount of variation of the cost by NGOs was nil or negligible.

Table 7.1: Program coverage and unit cost

Risk Groups		Coverage (%)		Unit Cost (USD)
		2012	2020	
FSW1	**HBFSW**	43	43	88
FSW2	**SBFSW**	54	54	82
PWID (Male)	**NEP**	92	92	157
	OST	3	3	340
PWID (Female)	**NEP**	41	41	157
	OST	1	1	340
MSM	**MSM**	24	24	75
	MSW	89	89	85
TG	**TG-SW**	82	82	140
ART	Male	24	32	670
	Female	28	47	670

Table 7.1 shows the average cost per client in 2012 for different risk groups (clients). The average cost per client is highest for ART (US$ 670), followed by that of OST for male and female-PWID (US$

340). The average total cost for the PWID is high because four types of commodities – condom, needle/syringe, STI drug and lubricant – are distributed to this client group, while the other client groups are supplied mostly with the lowest-cost commodity and, in some cases, with the STI drug too.

7.3 Resource need analysis

The resources required for implementing different scenarios between 2014 and 2020 are presented in Table 7.2. To continue implementing the existing interventions (baseline) in Dhaka city will require USD 20.3 million of which nearly 93.3 percent would be the prevention cost and the rest 6.7 percent would be the cost of treatment. However, scaling up all the interventions (scenario 4) will require USD 22.9 million between 2014 and 2020. The additional cost for implementing scenario 4 would be USD 2.7 million representing an increase of nearly 14.3 percent over the cost required for implementing the existing interventions.

Table 7.2: Resource required: 2014-2020

Indicators	Intervention Scenarios					
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Resource Required (in million USD)						
Prevention Cost	18.9	19.4	22.3	19.7	21.6	25.0
Treatment Cost	1.35	1.41	1.25	1.27	1.34	1.30
Total Cost	20.3	20.8	23.6	21.0	22.9	26.3
Marginal Resources Required						
Additional Prevention Cost (in million USD)		0.46	3.42	0.80	2.70	6.13
Additional Treatment Cost (in thousand UD$)		53.40	(103.60)	(82.80)	(7.77)	(52.72)

Note: The detailed breakdown of the resource requirement is presented in Appendix 1, Tables A1 and A2.

7.4 Economic analysis

7.4.1 Behavior of cost function

Total cost was divided into the different components to obtain the estimates of average fixed cost and average variable cost, as well as recurrent cost and capital cost. The average total cost shows an increasing trend if we take into account the trend of inflation in the recent years. However, the rate of increase over time is low, and much lower than the inflation rate, indicating increasing economies of scale in the use of resources by the organizations. Total cost has also been increasing, albeit at a slow pace. The main reason for the increasing trend of total cost is the increasing trend of coverage and not the increase in the unit cost, because the rate of rise in the unit cost is much lower than that in the total cost. If the total cost is calculated at constant prices, the average total cost will show a decreasing trend, indicating that as coverage increases it is moving toward the lowest point of the average cost curve.

Based on analysis of program data, the average fixed cost constitutes a low proportion of the average total cost (less than 30 percent) for all client groups except for MSM and male sex workers. It needs to be investigated why the fixed cost is so high for these two groups. The average fixed cost shows a declining trend while the average variable cost demonstrates an increasing trend. At present the recurrent cost accounts for more than 90 percent of the total cost, and salary and allowances of manpower is the overwhelmingly dominant component of the recurrent cost (about 60 percent). The cost of capital is very low. The cost of manpower demonstrates an increasing trend, which may not be a good indicator of performances of the program if it means a declining trend of the procurement of commodities. Nevertheless, no major change in the cost components is observed.

Table 7.3: Components of total cost of service provision by NGOs

Component of cost	Proportion in 2009	Proportion in 2012
Salary and allowances	0.58	0.60
Commodities	0.18	0.17
Total recurrent cost	0.93	0.94
Total capital cost	0.07	0.06
Total cost	1.00	1.00

7.4.2 Cost-benefit analysis

In order to calculate the benefit and cost of the programs that have been implemented from 1998 to 2012, the number of HIV infections averted and the value of DALYs saved due to the programs, and the costs of the programs incurred during the same period are estimated and used.

A comparison between the areas under harm reduction interventions and the areas without such interventions shows the impact of the interventions in the form of the number of people saved from becoming infected with HIV. Table 7.4 shows the number of new infections averted in different population groups.

Table 7.4: Number of people saved from HIV infection, 1998-2012

Client group	Number of HIV infections when no intervention	Number of HIV infections when intervention	Number saved from HIV infection
Clients	138	101	36
PWID	1,776	637	1,138
MSM	202	193	9
MSW	66	63	2
TG-SW	36	15	21
FSW	111	71	40
Low risk adults	627	307	320
Total	**2,955**	**1,388**	**1,568**

During the period of 1998-2012, a total of 1,568 new infections were averted among all key populations by the harm reduction program. One averted HIV infection is assumed in the AEM model as equal to approximately 27.2 DALYs. To multiply the number of DALYs by per capita

GDP is one of way of converting DALYs into the money value of program benefits. Since the amount of program cost of each year was converted into the amount at the prices of 2012, the per capita GDP of 2012, US $1044, has been used as the multiplier. In 2012 the rate of exchange was $1= Tk. 80 approximately. The monetary value of benefit yielded by the programs during the 15-year period was, therefore:

The number of cases averted * No. of DALYs * per capita GDP in 2012 * exchange rate = 1568* 27.2*1044*80 = Tk. 356.1 crore[1].

Data on cost was available only for a few years – from 2008 to 2012. We have estimated the cost in the earlier years by conducting backward projection based on some assumptions. The entire 15- year period has been divided into three 5-year plan periods: 1998-2002, 2003-2007, and 2008-2012. Then, first, the costs in the latest plan years were converted from the cost at current prices into the cost at the 2012 prices by using the escalation formula:

*C(T) = Ca (1+e)t

Where, value of t is the number of years between 2012 and the year in question, Ca is the cost at the current market price in the given year, T is the year in question, and e is the escalator. During the 15-year period, the annual rate of inflation considerably varied by year, ranging from 1.94 percent in 2000 to 10.62 percent in 2011. The average of all years' inflation rate is computed at 6.44 percent. This rate has been used as the escalator e. To proffer an example: total program cost was Tk. 19.64 crore in 2010 at the prices of that year. Using the prices of 2012 the amount becomes C (2010) = 19.64 (1+0.0644)2 = 22.25 crore. The total cost during 2008-2012 at the prices of 2012 is estimated at Tk. 111.80 crore. Moreover, it has been assumed that the amount of cost in a 5-year program period is 33 percent higher than that in the earlier 5-year program period, so that the total cost during the 2003-2007 period is equal to (cost during 2008-2012 period) divided by (1/ 1.33) and that during the 1998-2002 period is to (cost during 2003-2007 period) divided by (1/ 1.33). The average rate of annual increase in cost at the constant prices is 2.62 percent during the last program period and it has been assumed that the rate was same in the earlier program years too. The estimated total cost during the entire 15-year period at the prices of 2012 is estimated as Tk. 259. 06 crore (see Table A3 in Appendix 1). The benefit-cost ratio is 1.37 – which means that the benefit of the programs are higher than the cost, demonstrating that the programs were cost-effective.

A part of the program efforts was devoted to the PWID. The benefit- cost ratio for that part was also estimated. Among the PWID, a total of 1,138 infections were averted during the period. The number of DALYS averted was 1,138 * 27.2 = 30953.6 years. The value of the averted DALYs was 30953.6*1044*80 = 258.52 crore Taka. The cost of implementing the program for the PWID was approximately Tk. 113.96 crore (about 44 percent). Hence, the benefit-cost ratio is 2.27. It is evident that the program interventions for the PWID were very effective and much more effective than the general program.

It may be pointed out that the cost-utility approach usually underestimates the benefits since it does not take into account all the components of loss caused by the disease/condition. The consumer-theoretic approach more appropriately captures all types of damages caused by a disease, including effects on health (or disability) and economic loss, and one measure shows the combined monetary value of both effects.

[1] BDT 1 crore = BDT 10 million

7.4.3 Cost effectiveness analysis

Five alternative scenarios have been described earlier to show the varying proportion of coverage of the client population under the program in the years 2014-2020. The benefit-cost ratios as well as the cost per DALY averted have been computed for all scenarios under consideration. Table 7.5 presents the ratios.

In computing the benefit of the future programs US$ 1407 was used as the multiplier. Since the program will be implemented during 2014-2020, it is not reasonable to use the per capita GDP as in 2012 as the multiplier to convert the DALYs into money value; the per capita GDP will grow during this period. The assumption was made that it will grow at 6 per cent per annum and then estimated the per capita income for all years from 2013 using that in 2012 as the base value. The sum-total of the per capita GDP's in the years from 2014 to 2020 has been divided by the number of program years (7) to obtain the average of the annual per capita GDP (US$ 1,407).

Table 7.5: Estimated benefit-cost ratios of program in future years

Scenarios	No. of HIV cases averted	No. of cases averted * 27.2 years (DALYs)	Program cost in crore BDT	Cost per DALY averted (thousand BDT)
Scenario 1	217	5,914	166.1	280.9
Scenario 2	45	1,233	188.6	1529.7
Scenario 3	10	274	167.7	6126.0
Scenario 4	372	10,124	183.6	181.3
Scenario 5	378	10,278	210.6	205.0

The World Health Organization argues that interventions that cost less than three times the per capita GDP per DALY averted is cost-effective.[43,44]
The comparator used here is m = GDP per capita * 3 = US$ 1407 * 80*3 = Tk. 337,680.

It is found that cost per DALY is less than 'm' for Scenarios 1, 4 and 5, and all are cost-effective. Scenario 4 emerges as the most cost-effective. Scenario 1 is marginally cost-effective.

However, as already mentioned, the benefits are underestimated in the cost-utility approach. The use of the consumer-theoretic approach shows that all scenarios are worthwhile and the 4th scenario is the best.

CHAPTER VIII: EFFECTIVENESS OF HARM REDUCTION PROGRAMS: QUALITATIVE ANALYSIS

8.1 Injecting drug use and HIV transmission

Injecting drug use is considered to be one of the major routes for HIV transmission. FGD findings suggest that PWID are not only at risk of acquiring and transmitting HIV through sharing needles and syringes, but also through high-risk sexual practices, including engaging in sexual practices in exchange for drugs or money. When asked about the causes of HIV infection among PWID, the FGD participants most frequently mentioned sharing of injecting equipment. Additionally, unprotected sex was cited as the second most important mode of transmission among this group. As the FGD participants have revealed:

> *It* [HIV transmission among PWID] *is because of sharing the same syringe. Moreover, HIV positive sex workers are also responsible for that. Some of the clients like us have sexual relationship with them* [sex workers] *in exchange for money or love either secretly or publicly.* (40-year-old male-PWID under OST program at Moulovi Bazar DIC).

> *PWID get involved in sexual intercourse with both PWID and non-PWID sex workers* [female] *in this locality. Many sex workers suffer from STIs and are more likely to have sex without condom, with clients' pressure being a major risk factor for unprotected sex. This is one of the causes. Secondly, sharing needles and syringes among the PWIDs is the main route of transmission of HIV/AIDS in this locality*. (39-year-old male-PWID under OST program at Moulovi Bazar DIC).

> *Sharing* [needle] *and unprotected sex are the most important ways to spread HIV. Sometimes sex workers do not carry condom. When I started sex work in a hotel, no condom was available there. I have been doing sex for a long time and have started taking injection. I used to do sharing with my sister. I am HIV positive, my sister is not. But when my sister went to village, I did sharing in Doyagonj for one month.* (35-year-old female-PWID of City Polli).

Unsafe Sexual Behavior

The harm reduction interventions, which provided information and skills (through outreach and peer education) for reducing sexual and injecting risk associated with HIV infection produced a substantial reduction across injecting risk behaviors. The participants claimed that injecting risk behaviors as well as the frequency of unprotected sexual risk behaviors declined as a result of these interventions. According to a 26-year-old male-PWID of Shahzadpur DIC,

> *Peer education is definitely working, otherwise we would have been affected by AIDS by this time. Peer educators and outreach workers regularly provide us with information on how to keep ourselves safe and that is why we've become successful to avoid risk and transmission* [HIV].

However, the social context under which PWID engage in risk behaviors is also important. To some extent, high-risk injecting behaviors including needle-sharing and unsafe sex still have an impact on HIV incidence. This is evident when needle sharing and unprotected sex remain common practices among PWID even after harm reduction services (e.g. free distribution of condoms, needles and syringes) become available. Although PWID constitute a risk group in

themselves, there is also an overlap between drug dependence and those involved in sex work. Individuals who fall into both categories are therefore particularly vulnerable to HIV. The study findings reveal that the FSWs with drug dependence need more customers to secure their drug habit, and often they forgo using condoms if their clients offer more money for unprotected sex. They stated that most clients preferred not to use condoms, and that even if they insist on the client using a condom, it does not always work out. Many FSWs at some stage find themselves in a situation with a client in which they have little or no control over the nature of the sexual transaction. Some spoke of being threatened and forced to have sex without condom. Some of them have even experienced physical and sexual violence by their clients:

> *We have sex with many people. Many of them don't like using condoms. So we become compelled to do sex without condom for money. I badly need money because I have to take TD* [Tidigesic injection]. (27-year-old female-PWID, City Polli).

> *Although sexual contact is an effective transmission route for HIV, we are less vulnerable to the transmission of the virus. In fact, HIV transmission is substantially associated with needle sharing. However, if our client carries HIV and we do sex without condom, then we both are vulnerable. The real clients* [who come from outside area], *use condom, whereas our local leaders and mastans do not want to use it. They intimidate, and sometimes force us to do sex without condom. Some clients offer 20-50 taka more for unprotected sex. We avoid those clients.* (35-year-old female-PWID, Noya Bazar).

> *We sometimes are tortured by the local leaders and mastans. They beat us and force us into having unprotected sex. Nothing can motivate them to use condom while having sex. We are bound to do sex with them without it.* (28-year-old female-PWID, Noya Bazar).

Unsafe injection practices

Evidence from the FGDs conducted with PWID strongly indicate that outreach-based interventions have been effective in reaching PWID, providing the means for behavior changes in the desired direction. The findings provide sound evidence that participation in outreach-based prevention programs can lead to lower needle sharing rates among program participants. This evidence has been substantiated by the comment of a female-PWID:

> *We get them* [outreach workers] *by our side whenever we want them to be. We are getting lot of supports which were simply unthinkable in the past. Outreach workers educate us in a way that we still stay healthy. We learn a lot from them. We used to share our needles and syringes before this distribution program of 'CARE' started, but now we share less as we get as many needles and condoms as we need.* (24-year old female-PWID, Noya Bazar DIC).

While identifying the success of NEP and outreach programs in reducing risk behaviors is important, it is also crucial to explore the contextual factors that interact with and shape individual risk behaviours, such as needle sharing. When asked what prompted them to share needles despite the free supply of needles and syringes, most of the FGD participants reported that it is due to the intense withdrawal syndrome associated with drug use. According to a PWID, "We understand that it [drug use] is harmful, but we can not keep aloof from it." Another male-PWID who is under the OST program commented: "If PWID don't have their needle-syringe with them during the time of their withdrawal syndrome, they share with their

friends' syringe instead of buying a new one even though it cost only Tk. 5. It is because they don't have any sense then - whether it is HIV or something else."

Some PWID stated that an expanded NEP program is important within the context of harm reduction programs. They stated that current coverage seldom reach the required number of needles and syringes. The demand of clean injecting paraphernalia has increased significantly over the years, which they attributed to the mobility of drug users:

> *Sometimes there is scarcity in other zones due to excessive increased pressure of PWID. PWID from other areas come to our locality. Once I had one ampoule which I preserved to use later. I offered another PWID to take this at a low price, but he could afford only half of the cost. Then I shared this with him and became his friend. (*29-year-old male-PWID of Noya Bazar DIC).

There may be some link between police harassment and the carrying of used or unused syringes (to prevent needle-syringe sharing). One 28-year-old PWID from Bokshi Bazar of Dhaka described the fear of the police in this way, "They [DIC] often ask us to bring the old syringe, but it is risky to carry this since police stop and search the suspected drug users moving on the way."

8.2 Patterns of current drug use

While OST has apparently reduced the number of existing hardcore PWID in some localities, the number of new drug users continues to rise. A variation has also been found in the preference of the drug substance among the drug users. Tidigesic is the most commonly injected drug among older users, while yaba is mostly favored among younger people. Some PWID have described the low quality and scarcity of heroin as the primary reason for switching from inhaling to injecting.

> *The heroin which we took earlier was great. But the heroin which is available now can't give us the expected feeling. Now we are getting the desired feeling from injection. In the past, out of 100 addicted* [PWID]*, 90 used to take heroin. On the other hand, out of 100 addicted* [PWID]*, 90 usually take injection now.* (35-year-old FSW of City Polli).

> *The young generation takes yaba instead of injection. At the same time, new PWID are on the rise. I can see one or two new PWID every month.* (PWID of Moulovi Bazar DIC).

> *If you investigate the drug spots and the DICs for days or months, you can easily discover the new faces coming and becoming addicted* [PWID]. (48-year-old PWID of Bokshi Bazar DIC).

> *There were around 400-500 PWID in this area, but now it has reduced to almost half as most of the PWID are taking OST. On the other hand, new PWID are increasing in number.* (OST client of Moulovi Bazar DIC).

Relation between HIV and duration of injecting

In this study, we found that a strong awareness about the routes of HIV transmission prevailed among PWID. They were asked whether persons taking drugs for a long time has greater

possibility of being infected by HIV than younger drug users. The overwhelming majority of participants stated that younger drug users are more likely to be affected by HIV, because they are more likely to be unaware of the disease and more likely to frequently engage in unsafe sexual practices or sharing needles. With regard to their claim, a participant states:

> *We* [the older PWID] *are more careful than younger ones. We know how this disease spreads. It spreads by sharing syringe and sex. There are many addicted guys* [PWID] *who are taking drugs for a long period of time, but have not got any disease* [HIV]. *It is because older addicts* [PWID] *who have been taking drugs for many years do not try to share the syringe with anyone.* (39-year old PWID of Shahzadpur DIC).

8.3 Geographical mobility and injection sharing

PWID are a relatively mobile group who engage in risky behavior not only in their places of residence but also in other areas. The mobility serves as a potential risk factor in transmitting HIV to the PWID themselves, their sex partners, and hence to the general population. The present study shows that some PWID had mobility networking coupled with their unsafe injection practices; ie. their networks were broader as they are a mobile population. However, the majority denied sharing injecting equipment while travelling and reported that they did not run the risk of HIV. According to them, "the networking mobility for PWID in Dhaka city is less in recent times." This, in turn, has positive implications for the effects of current harm reduction interventions.

Some PWID moved between different places in and outside Dhaka, between cities and even across the national boundary to access drugs. The shortage of drug supply and high cost of drugs in their regular locale mostly led the PWID to desperately move far and wide to accessing drugs at a cheaper rate. Most of the PWID were revealing the history of their spatial mobility in the following way:

> *I went to Pubail to take heroin. For injecting drugs, I visited quite a number of places such as Chunkuthia, Keraniganj, Sweeper Potti at Doyaganj, BNP Potti and shared injection with both males and females. I also shared injection with my clients.* (35-year-old female-PWID, Noya Bazar).

> *Three to four months ago, there was a crisis of drugs. Injections were being sold at Tk. 600 per piece. I came to know from a friend that injection was available in Comilla. So I went there and bought 20 pieces of injection at the cost of Tk. 5000.* (27-year-old female-PWID, City Polli).

> *I went to India several times. I used to inject drugs at Kolkata New Market, Chandnichawk. At the parking site of Chandnichawk, I bought syringes at 16 rupee. Sometimes I smoked cannabis and heroin in India and shared syringes as well. I often make travel to India through the borders. I can speak Hindi, so the border guards don't verify.* (38-year-old male-PWID, Moulovi Bazar).

> *I went to Fulbari of Dinazpur; TD cost only 70 to 80 taka there. It is a border area; my grandmother's house is situated there. Because of shortage of money, I took TD by sharing with a partner* [friend]. *I also visited Tongi, Chobrapotti, and Doyagonj, but did not share there*. (42-year-old HIV-positive male-PWID, Bokshi Bazar).

8.4 Sex work, drug use and violence

Injection drug use is inextricably connected to commercial sex work. The overlap between sex work and injecting drug use is considered to be among the most dangerous conditions for rapid spread of HIV. Among the study participants, drug use and sex work was mutually reinforcing which has increased their vulnerability to HIV-related risk behavior. The study findings highlight the double jeopardy faced by the PWID who engage in both risky injecting and sexual practices. In general, PWID (Female) participating in this study were found to be sex workers. The study has found that needles and syringes are sometimes shared between sex workers and their PWID clients who pay for their services with drugs. It is also revealed from FGDs that drug use appear to facilitate high-risk sexual behavior. This amplifies not only their own risks of HIV infection but also the likelihood of HIV transmission to their injecting and sexual partners.

> *If I like any of them* [sex workers], *I go to her and ask whether she injects drug or not. If she does, I offer her to share, as she also needs drugs.* (28-year-old male-PWID, Moulovi Bazar).

> *There are a huge number of sex workers in this area* [Moulovi Bazar]. *Hotel and residence based sex workers are greater in number than the street based sex workers. Hotel based sex workers are to be paid minimum 100 taka per sexual act. It varies from Tk. 100 to 500, depending on the clients' ability to pay and the sex worker's demand. Street based sex workers have no specific rate. It ranges between 20 to 200 taka.* (39-year-old male-PWID under OST program).

> *There are few female drug users who are working as sex workers and become HIV positive. They need money to take drugs. The drug users go to sex workers, as do the non-drug users. Guys from the surrounding homes also go to them. Once I went to a sex worker. When I was going to start* [having sex], *I noticed an infection in her secret organ and then stopped immediately.* (28-year old HIV-positive PWID, Bokshi Bazar).

> *I went once* [to have sex with a sex worker]. *She was HIV positive and a member of Self-help Organization, but I was not a member since I was not positive then. I did not know her HIV status, neither did she ever tell me anything about her disease. I came to know about her disease once I got involved in an open relationship with her. After some days, I went for blood test and came to know that I had become positive* [HIV]*…. It was through sex that I became positive.* (42 year old HIV-positive PWID, Bokshi Bazar.

> *Once I was lying in a park. Three guards came to me and offered me to have unprotected sex. When I refused them, they intimidated me with a knife, as if, they would kill me. As I remained strict with my decision not to have sex without condom, they beat me too. I didn't know if they had HIV or such other diseases, but it seemed to me that it was better to be killed by them than to have sex with them.* **(**30-year-old female-PWID, Noya Bazar).

The use of drugs by clients, including injecting drugs, can contribute to difficulty with sexual functioning as the sex workers mentioned. Drugs can increase the time it takes for a male client to ejaculate, thereby lengthening the time spent providing a physical sexual service and increasing the potential risk of infection. According to a 26-year old female sex worker of Noya Bazar DIC, "Most of the drug users are our local people. They waste a lot of time while having sex. Instead of having sex with one of them, we can meet 3 to 4 clients and earn more. Drug users are unable to give sexual pleasure and often refuse to pay us." Some sex workers never got paid for their sexual services, as they mentioned. A 30-year old FSW made her remark in

this way, "Drug users remain in fantasies while coming for sex. They agree to pay Tk.100 for each sexual encounter, but make a lot out of it, and finally refuse to pay."

Some sex workers mentioned an association between drug use by their clients and unprotected sex. The intersection between sex work and injecting drug use makes it difficult for the FSWs to negotiate safe sex with their clients. The study findings indicate that sex workers often negotiate with their clients to practice safe sex. However, negotiating safe sex with an intoxicated client increases the possibility of a client reacting violently. A few FSWs are also at increased risk of experiencing violence from their clients. A 30-year old FSW from Noya Bazar mentioned her experiences in this way: "We try to avoid PWID as our sex clients. They force us to do unprotected sex with them. Sometimes they beat us too. We become victims then. We don't want to have sex with the drug users even though they offer 1000 *taka*."

Gender inequality and unsafe sex

Risk behaviors among PWID (Female) who also engage in sex work are potential drivers of HIV infections in Bangladesh, especially transmission between high-risk and low-risk groups. Available evidence indicates that women who inject drugs are more likely to engage in sex work than men who inject drugs and are also more likely than their male counterparts to acquire HIV through sexual transmission. PWID (Female) have substantially different needs and they face higher risks of infection and violence than do men PWID. Female-PWID who also engage in sex work have fewer economic options, have to cope with an imbalance in responsibilities for childcare, are stigmatized by the community and are often subject to greater financial pressures resulting in unsafe sex. Sex work often takes place in a coercible manner and condom use is found to be sporadic.[45]

Most participants reported that they turned to sex work out of financial necessity to supplement income for drug.

PWID (Male) admitted offering larger fees in return for sex without a condom. As one PWID (Male) from Chowdhury Para said:

> *To some extent, sex workers have to perform sex without a condom. In that case the rate increases…Sometimes I don't want to wear condom. I request her* [sex worker] *to have sexual intercourse without condom assuring to pay extra 200 taka and she readily accepts the offer.*

A 27-year-old female drug injector was more forthright arguing that the lure of drug or money was enough for her to forget about condom use. According to her:

> *If someone comes to me at the time of a withdrawal symptom and offers me drugs, I will instantly agree to have sex with him, without bothering about using condom…I will obviously do sex without condom because I need money.*

The exchange of sex for drugs or drug money or under the influence of drugs is a high-risk encounter as it reduces appropriate judgment and the ability to practice safe sex. They may

even not be paid the amount they are supposed to get from the clients. The following quotes substantiate this point:

> *Clients call us, have sex forcefully without condoms and don't pay or pay less than the set price. Nothing can be done!* (24-year old female-PWID, Noya Bazar DIC).

> *Once five people had sex with me forcefully without condoms and went away paying nothing. Even they tore my cloths too.* (30-year old female-PWID, Noya Bazar DIC).

> *It happened with me many times. They made contract for one but five had sex at a time. They may give money if they wish to or may not pay at all. We become very helpless then.* (28-year old female-PWID of Noya Bazar DIC).

In many instances, sex workers did not have control to refuse unwanted or unprotected sex. Miscreants and clients perpetrated intimidation, harassment, physical and sexual violence and other forms of coercion against sex workers. Many of the sex workers who are also injecting drug users reported that clients who were unwilling to put on a condom had sexually coerced them. This reflects the underlying power imbalance between sex workers and their clients.

8.5 Impact of OST on HIV risk behaviors

There is good evidence for the effectiveness of OST for PWID in Dhaka city. In this study, perceived benefits as well as negative side-effects of taking OST were explored. A range of behavioral and socio-economic benefits were evident as early as four months into the treatment, and many of these benefits extended beyond the OST clients to their families and communities. According to a client of Moulovi Bazar DIC (who had been under OST program for 4 months), "As I am not a PWID anymore, everyone now respects me and my family is quite happy with me." Methadone treatment helped PWID to take control over their drug dependence and allowed them to lead a productive life. They mentioned having confidence in the treatment and feeling at ease, and were satisfied with the DIC providing OST services. For example, one OST client noted,

> *My drug addiction has decreased now. I believe I can be totally drug-free, if I keep taking OST properly. And I feel inspired to see those who are already drug-free for the OST program.* (53-year-old male-PWID, Moulovi Bazar DIC).

It has been found that PWID who entered treatment showed improvement in several areas, including abstention from drugs, criminal behavior and HIV risk behavior such as unsafe injecting practices. The study participants stated that methadone prevented withdrawal, reduced frequency of injecting drug use and sharing of syringes and needles among them – all of these factors have contributed to the prevention of HIV infections. Some of the quotes of the PWID are as follows:

> *It is impossible to prevent the withdrawal with any other drug but methadone is successful to do that. We are now injection drug free thanks to this methadone. I think 10 drug injections is equivalent to 1 methadone.* (39-year-old male-PWID, Moulovi Bazar DIC).

Before taking methadone, I used to run out for money for buying drugs. But now we are getting methadone for free and doing no crimes. We have now managed to get rid of the habit of injecting drug. (53-year-old male-PWID, Moulovi Bazar DIC).

After having methadone, I don't need to take other drugs. I am now drug free. That's why my family is happy now…As I am no longer a drug injector, I don't have to share needles and syringes anymore. (28-year-old male-PWID, Moulovi Bazar DIC).

Although the PWID receiving treatment (average duration of taking OST is 4.4 months) had an overall positive perception of the OST services, some negative health effects such as loss of libido have been reported. The other perceived side-effects associated with the use of methadone include physical weakness, feeling drowsy and tiredness. Some of the comments from the FGD participants include: "I don't have physical strength as I had before because of taking OST. I feel sleepy all the time."

One of the primary concerns expressed by the clients is the length of treatment OST involves, as one client stated, "Methadone needs to be taken every day…and we are not informed as to how long we need to take it." Since good outcomes from OST are dependent on adequate length of treatment, this illustrates the challenge of retention with the possibility that the patients may drop out and relapse to opioid use.

8.6 The role of peer education in AIDS prevention

Preventive interventions that provide information about HIV/AIDS through peer education have proved to be effective in changing risky behavior in Dhaka city. The findings support the view that behavioral interventions that focus on changing attitudes, in addition to information, may be more effective in modifying HIV-related risk behavior. Most of the participants who attended the FGDs mentioned peer education as an effective method in reducing HIV-related risk behavior among PWID. For some participants, the counseling services they received were useful and informative. A substantial reduction in the sharing of needles and syringes was also reported by some as a concrete outcome of the peer support activities. As the following illustrations suggest:

Peer educators teach us how HIV/AIDS and STDs transmit and suggest not to share needles and syringes. They inform us about hepatitis B and C as well. If we don't get them [peer workers] *in the field, then we are sure to find them in the office. 'CARE' is doing a lot for us. We are satisfied with their support.* (36-year old female-PWID, Noya Bazar DIC).

What they are doing for us is not done even by our family. CARE Bangladesh is giving us shelter, food, fan, TV, doctors, syringes and what not. (35-year old female-PWID, City Polli DIC).

Key informant participants recognized the need for peer education programs in Dhaka city to address HIV/AIDS transmission. In the words of a key informant, "Peer-led activities are at the heart of any intervention program around the world." During the consultation, key informants also discussed the need to establish HIV/AIDS education as the foundation of PWID community mobilization and empowerment initiatives. Their opinion was that peer networks

can increase the credibility and effectiveness of the message. It is a good approach for conveying information in natural settings where a peer can work as a catalyst and is likely to appear credible. According to a key informant, "Actually an ex-PWID can truly read the mind of a current PWID. That is why the peer volunteers can effectively reach the PWID. Except for some problems, the peer workers serve as the main catalysts to the success of harm reduction programs."

According to a key informant, as a pathfinder, the peer knows almost all information about the PWID. The PWID openly share their risk behaviors and problems like STIs with the peers. The peers provide them with suggestions, condoms, clean needles and syringes, including information about reducing risk behaviors. A non-peer does not usually have knowledge of the changed location of drugs, drug availability or the changed location of sex spots, whereas peers do. Drug and sex networks can be recognized perfectly by the information provided to peers. Peers are being employed as outreach workers through training, so they work as a bridge. Outreach workers and peer groups have a well communicated relationship. In the DICs of Dhaka city, a strategy has been adopted over the years to put pressure on the PWID to return the used syringe in order to improve the exchange rate. A key informant mentioned that needles and syringes are being returned at a very high rate. If there is no pressure on the PWID to return syringes, the exchange rate would be drastically low and HIV prevalence could be higher.

Needle and Syringe Distribution: Experience from the Field

At the consultation, Md. Shakawat Alam (Senior Project Manager, Direct Implementation, Save the Children) presented examples of how a 'one shot one syringe' strategy was integrated in the peer-led intervention and minimized HIV transmission in Dhaka city.

I have been working for 17 years since 1999. I observed the activities of outreach workers. In the beginning they refuse to give new syringes if anyone could not return the old one. But ultimately they would give him and tell it's for the last time. I observe the direct implementation of 'one shot one syringe' strategy taken by Save the Children in Dhaka, Sylhet, Barisal, Chuadanga, and Meherpur, which are non-hot spots. We check in the weekly meeting whether the required number of syringes is supplied or not. We observe their behavior in the track sheet. So, in the hot spots they get 100 percent coverage. It helped reducing the transmission of HIV in Dhaka city, maintaining a certain prevalence level.

Finding and Keeping Peer Educators: Experience from the Field

During the consultation, Md. Omar Faruque (Senior Manager QA/QI) from Save the Children in Bangladesh reported on the effectiveness of the peer-led program.

When someone like peers talks with these marginalized people, they feel prioritized and get hope to live. Almost 80-90 percent of the peer education component is working properly in Dhaka city. Petty crimes by the outreach workers and peer educators are part of their drug dependency. Still, peer-led activities are giving a tremendous outcome to the intervention program resulting in reduced needle/syringe sharing and HIV prevalence in Dhaka city.

The performance of peer educators was sometimes criticized by the PWID. The narratives of PWID from Moulovi Bazar and Bokshi Bazar DICs emphasized requirements of a more positive role of peer support workers while disseminating prevention information regarding HIV/AIDS. Findings suggest a more strictly supervised delivery system of syringes by the DICs. Some of the relevant comments included: "They [peer workers] don't treat us well and do not give enough attention to us".

8.7 Legal environment and effect on criminal behavior

Results from the consultations suggest that harm reduction in Bangladesh is considered as an approach that welcomes drug users into a supportive environment and allows them to set their own short- and long-term goals. In harm reduction interventions, a myriad of outcomes, not just abstinence is considered to be helpful. It addresses any and all of the issues that bring a user to therapy: emotional pain, work issues and social problems. For example, counseling is given within the DICs across Dhaka city and the counselors not only listen to drug users' HIV related stories but also listen to their personal matters, family situation, emotional crisis and the like. This kind of services enhances self-esteem to the users and creates self-motivation and awareness.

Harm reduction strategies are directed towards reducing harm, in many cases by altering drug using behaviors and effects, such as acquisition and withdrawal– including from exposure or conducting criminal acts (eg. drug dealing and theft). Harm reduction in the form of substitution therapy (e.g. OST) has been shown to decrease criminal activities by PWID in old Dhaka as informed by program implementers. It improved public safety by reducing drug dependence that can lead to theft and other crimes.

Harm Reduction and Criminal Activity: Experience from the Field

During the consultation, the Senior Manager-PWID and the Manager-PWID from Save the Children in Bangladesh of GF 906 & 907 Project draws attention to the effect of harm reduction strategies, commenting:

If OST program could be launched outside the DIC-based intervention framework, there would be no criminal offences by the PWID in the future, and society will ultimately accept them. (Anup Kumar Bosu, Senior Manager-PWID)

We run the OST program in Moulvibazar DIC, the progress includes about 8-10 persons who left methadone - they don't need any types of drugs. The present OST clients are going back to their families and are now engaged in work. They no longer sleep on the street, and do not involve themselves in various types of criminal offences such as hijacking and stealing. (Moshfaqus Salehin, Manager- PWID)

In Dhaka city, the interventions are aimed at fostering an environment supportive of harm reduction for all people who use drugs and it was found to be effective at influencing law enforcement policy and practice. Under the current intervention program, DIC staff regularly conduct advocacy – meeting with the law enforcement agencies and community members to make them understand the perspective of a PWID. According to a key informant, "Police harassment comes from stigma and the harassment has been reduced a lot compared to the

situation 14 years ago - when this intervention program was started. Police is not thwarting the implementation of harm reduction policies in recent times. They have been systematically included in advocacy to support harm reduction interventions."

Responding to the issue of police harassment, a key informant commented:

> *I am telling it confidently as I am with this program from the very beginning and it is all for our advocacy program. Yes, I must acknowledge that there is some unnecessary harassment of the PWID, but my point is that it has lessened significantly compared to the past situation.* (Md. Omar Faruque, Senior Manager QAQI, Save the Children).

Advocacy and Law Enforcement Practice: Experience from the Field

During the consultation, Tajul Islam (Program Development Officer) from CARE- Bangladesh of GF 906 & 907 Project reported on the effectiveness of the harm reduction program on advocay.

Now the police do not harass the PWID much. They go after people who are involved in drug business. Previously when they got ampoule from someone, they arrested and beat him or her, something which has become rare now. This is because we are keeping contact with the police regularly through advocacy. And also the behavior of PWID has changed due to intervention.

On the other hand, police harassment targeting drug users still remains a concern. The fear of encountering police while in possession of a syringe is particularly acute in this country. The arbitrary police detention and incarceration, as reported by the FGD participants, may indirectly heighten HIV-related risks through the disruption of housing, income and social/sexual networks among PWID.

The present study documents that harm reduction measures such as access to clean needles and drug treatment with methadone have been effective in reducing HIV risk behaviors among the PWID. In terms of drug users' involvement in criminal activities, study findings indicate a substantial reduction among the OST clients while the PWID under the intervention programs other than the OST continue to engage in crimes like hijacking, stealing and the like. At the same time, mistreatment of people who use drugs by police is widespread in the study sites. The study reveals that law enforcement officials harass drug users at needle exchange points, and/or arrest them for possession of syringes. In many instances, police use the threat of incarceration to extort money from people who use drugs or sell drugs in the drug spots. The following quotes illustrate this point:

> *If drug spot businessmen don't bribe the police regularly, they harass all the addicts* [PWID] *randomly. Drug spot owners must give at least Tk. 200 to the police officer, Tk.200 to the police station, Tk. 200 to mastans* [hooligans] *and so on. If this money isn't paid to them timely, the police picks us up, beats us, and harasses us randomly.* (36-year old female-PWID, Noya Bazar DIC).

> *It* [police harassment] *is increasing day by day. When the police catch me, they demand 10 thousand or 20 thousand taka. If I refuse to pay, they threaten to arrest me. I live on selling drugs. If I don't give them the money demanded, they might detain me. Then I will have to pay the lawyers to get bail.* (40-year old female-PWID, City Polli DIC).

Police harassment has seen an increase recently. Most of the time, they pick up innocent people to fulfill their target. (24-year old female-PWID, Noya Bazar DIC).

It has [police harassment] *increased. Police officers charge 400-500 taka for carrying 1 syringe. Besides, they sometimes punish us by beating.* (28-year old PWID, Chowdhury Para DIC).

The drug sellers give information to police. If they want to do business, they have to provide customers to the police. The police tell the drug sellers that you people do business without tension but give us at least two criminals. (35-year old HIV positive PWID, Bokshi Bazar DIC).

8.8 Why HIV prevalence is high in hot spots

Studies reveal that the dynamics of the epidemic is quite varied within the capital city of Dhaka. The last round of national surveillance (2011) demonstrates that HIV has alarmingly spread to the hot spots (e.g. Noyabazar, Bokshibazar) located in old Dhaka while the prevalence is relatively low in the rest of the city (e.g. Shahzadpur, Badda, Chowdhuripara, Malibag and Rampura areas). In this study, an attempt was made to explain this variation of HIV prevalence from PWID's perspective. The FGD participants reported that PWID in hot spots were more likely to inject with others and share injecting equipment compared to the PWID living in regular spots. The gap between the supply and demand of syringes was cited as the main reason for the higher prevalence of needle sharing in those sites. To quote a 39-year-old PWID of Shahzadpur DIC:

We are getting it [syringes] *adequately and according to our demand. CARE even gives us two syringes instead of one for encouraging us not to share.*

Inadequate syringe supply was the most commonly reported factor for the concomitant rise of PWID who share injection, underpinning this is a lack of education and the environment of poverty within which they live. The harsh socioeconomic reality of life faced by the PWID in old Dhaka force them to take an unusual path of living through stealing, hijacking or selling sex. They even sell the syringes provided by the DIC staff and share with others, without caring about the danger (eg. transmitting of HIV) that might accompany it. A respondent noted his experience in this way:

Usually they [PWID in hot spots] *do hijacking or steal to earn money for buying drugs. Sometimes they are caught by the police. People usually beat them when they are caught. This make them stop hijacking for the time being, making them completely broke. In this condition, they become compelled to share with someone ... Actually they sell the syringe provided by CARE and buy ampoule... I went there and saw them selling syringes. They use old syringe by cleaning it. They don't bother about the disease. However, in our area, we utilize the services provided by CARE.* (26-year old PWID, Shahzadpur DIC).

8.9 Expanding specific services for female-PWID

Participants were probed for their feelings and thoughts regarding the need of a separate DIC for female-PWID. For most sex workers there was some positive sense that a separate DIC offers a range of services, such as free condoms and syringes as well as behavior change training sessions which equipped them to make decisions and take action to improve their own health. According to a female-PWID, "We females get as many condoms, needles, and syringes as we need, but the males don't get these to larger extent."

There was general agreement among the participants that female-specific DICs provide opportunities to develop a more free relationship with peer educators and outreach workers as well as more acceptable and accessible advice and access to health services. In justifying the establishment of a separate female DIC, the female drug users highly spoke of the benefits they were enjoying from these DICs. A 31 year-old PWID (female) of City Polli DIC shared her awkward experience: "Earlier, the injection was shared in the toilet. The males used to mix chili powder with water to tease us. They tried to disturb us in various means - now we can relax here more comfortably than ever before."

Some PWID (female) also pointed out the likelihood of increased injection sharing in the event of a joint DIC for both the sexes. One participant commented, "If there was no separate DIC for PWID (female), we would have faced lots of problems with PWID (male). For instance, we would have shared needles and syringes with males more often."

For many of these female-PWID who are mostly street-based sex workers, the current arrangement of a separate DIC has mediated the homeless experience and enabled them to cope with their homelessness situation better than they might otherwise have done. Many necessary products and services, such as fresh water, showers, hygiene products and condoms, which are currently made available through the DICs, would simply be unavailable to them. The situation of many sex workers is characterised by the fact that they lack the necessary means to earn their living. Homelessness and drug consumption reinforce this situation. The inability to find shelter during the day time would leave them on the street, and at increased vulnerability to sexual violence. The narrative below illustrates the positive role played by a female DIC and its importance in the lives of street-based sex workers who inject drugs:

> *We do sex with our clients all through the night on the streets and come to the DIC office in the morning. Here in the DIC, we take bathe, sleep, watch TV, drink tea, cook food, and play ludo. If the DIC were for both male and PWID* [female]*, these would be impossible for us to avail. We would have died on the street unless we had a separate DIC for us.* (24-year old female-PWID, Noya Bazar DIC).

8.10 Vulnerability: Male-PWID vs. Female-PWID

Responding to the question about which PWID are more vulnerable to HIV – male or female, a striking difference in opinions among female-PWID was observed between the two DICs under investigation. While the female clients of Noya Bazar DIC mentioned that they were more exposed to HIV-related high-risk practices, the clients of City Polli DIC held the opposite view. Many PWID (female) were of the opinion that they are more susceptible to drug dependency and are more likely to contract HIV. According to a participant,

> *Sometimes PWID-clients visit me at our area and have sex with me. When they inject drugs in front of me, it yields temptation to inject with them, sharing the same needle. Sometimes, clients do not use condom properly. In this way, we females become more vulnerable than males.* (28-year old female-PWID of Noya Bazar DIC).

Unprotected sex with clients during withdrawal symptom is quite common among the PWID sex workers. Being under the influence of injecting drugs can reduce the ability to protect themselves. The remark of a sex worker substantiates this:

> *When we have withdrawal syndrome, we inject drugs and remain in delusion. We usually do not have sense then. Where the clients take us or make us unrobe and how they have sex with us, with or without condom – we can discover almost nothing during that time. And this is a common incidence faced by all PWID sex workers.* (24-year old female-PWID).

Further strengthening the above fact, a sex worker was talking about a similar experience of her own life:

> *It also happened to me. Once I had delusion after injecting drugs, then some people had sex with me and went away. I could realize all these when they had already gone, but I could barely remember if they used condom or not.* (30-year-old female-PWID).

In contrast, most respondents of the City Polli DIC held the view that male-PWID have greater vulnerability than female ones. They believe that males were affected by HIV in larger numbers than females and males were exposed to more heterosexual behavior, as they believe. The following comments identify the key message of a male-PWID's vulnerability.

> *Males are more vulnerable. For example, my husband is a PWID. He may not like the same tamarind* [wife] *every day. He may see other girls. Though he behaves well with me, he has the possibility of seeing other girls to get a taste of variety.* (27-year old female-PWID).

Another explanation came from a 31-year old female-PWID who remarked: “Males are more risky because the females don’t engage themselves in anal sex but the males do. Condom is not used in such sexual practices. Since AIDS spreads through injection as well as anal sex, males are more likely to acquire the disease.”

8.11 Challenges of child rearing among female-PWID engaged in sex work

Female drug users’ children potentially face vulnerabilities unique to their family situation. Most of the participants stated that they are not in a position to look after their children, given the nature of their sex work. As a result, children are being deprived of parental love and care which are essential for their smooth cognitive development. Some of the sex workers were of the opinion that they somehow cope with the imbalance in responsibilities for childcare and sex work by keeping themselves aloof from their children for a while but they were later taken care of. In the words of a 27-year old female-PWID of City Polli: “When I feel the withdrawal symptom, I just keep my child apart from me. Later, I take him with me when the effect of the drug goes away from my body.” Most other women were also able to avail the support of relatives to help alleviate the difficulties of childrearing in which cases, the sex workers themselves bear the cost of food, clothes, etc.

My elder sister looks after my daughters and I bear the cost of them. (28-year old female-PWID of Noya Bazar DIC).

I don't keep my daughter with me as both me and my husband are drug users. There is no one to take care of her. That's why we sent her to my relatives who live in Bagerhat. (35-year old female-PWID of Noya Bazar DIC).

I left my son with my sister when I came to Dhaka. The age of my son was 3 years then. I am unable to keep my son in my touch. He is deprived of my love. (31-year old female-PWID of City Polli DIC).

I actually had five children but gave all of them to people after their birth. No one lives with me. So, now I don't have any child at all. (30-year old female-PWID of Noya Bazar DIC).

Female-PWID in the FGD mentioned that their children are left with their relatives as they sometimes fear that their children might end up as sex workers and/or drug users too. As one sex worker stated, "If my children were with me, they could have learned my ill-job [sex-work, drug use]. That's why I kept them with my relatives". While such separation might improve the well-being or at least reduce the immediate risks faced by a neglected child, it can also lead to depression and self-blame on the part of the parent and thwart child-parent attachment. This dilemma must be taken into account by future intervention programs. On the one hand, the environment in which these PWID sex workers live can increase their children's vulnerability. On the other hand, removing them from this environment may also mean separating them from their parents.

8.12 Male to male sexual risk behavior

Relation between HIV and duration of injecting that MSM face a significantly higher risk of HIV infection than the general population. Several countries have witnessed resurgence in the incidence of HIV infection and other STIs among MSM. Despite the relevance of the interrelationship between injecting drug use and male-to-male sex, research on the issue is nonexistent in Bangladesh. In our study, one of the study participants admitted having experienced any sexual encounters of this kind. According to the participant, "The practice [MSM] is present inside the jail. Males live together as though they were each other's husband or wife". When asked whether male to male sex inside the jail occurs in exchange of money or drug, one FGD participant said that such sexual practices do not usually involve any monetary or drug exchange. In his words:

… there is no injection available in jails; they [PWID prisoners] *smoke cannabis and yaba instead...It* [male to male sex] *usually occurs without any exchange of money and drug. Once I had been in jail; I had to do this* [sex] *for good food and clothes. Inside the jail, prisoners served food and did sex with the males. They provided us with food, clothes, soaps, etc. They maintained the male sex workers as they were like their wives.* (30-year-old HIV positive PWID of Bokshi Bazar DIC).

8.13 Needs and challenges of HIV-positive PWID

Responding to the question concerning the program needs and challenges they were facing in receiving services, almost all the HIV-positive users stated that they need free food, snacks, milk and medicine that were once provided from DICs on a regular basis. According a male HIV-positive user,

> *Earlier, they used to entertain us with tea, but rarely do they entertain us now. In the past, they used to provide us with blankets, but there is no blanket now. We used to be fed by fish or meat once in a day. Some 20-40 packets of biscuits were provided to the HIV-positive users who were taking ARV, but now we don't get it anymore. Similarly, three packets of milk were provided every month, but now we get one packet of milk every three months.*

Due to interruption of ARV supply once, there was also a concern of the PWID about maintaining regular drug schedule.

8.14 Challenges of harm reduction intervention

With respect to harm reduction interventions, the following challenges have been identified by the key informant participants.

Discontinuation of the intervention program: The Global Fund funded harm reduction intervention program has a funding target till 2015. Discontinuation of the program due to lack of funding or project handover to another agency is a major challenge for the success of the program. Lack of funding to undertake such interventions can have negative effect on program delivery, including reducing the prevalence of HIV and other blood-borne virus among key populations.

Lack of policy and legal support: The legal and social context of the country can make it difficult for a harm reduction intervention or NGO to make contact with at-risk PWID in an effort to distribute needles and syringes and to educate them about HIV and its prevention. The social and legal situations around drug use can drive drug users underground and make it difficult to reach them. The current legislative situation and law enforcing practices often make it difficult for community based needle/syringe exchange programs (NEP) to prevent HIV among PWID. The Ministry of Health and Family Welfare of the Government of Bangladesh has approved the NEP but there is no written document available in the Ministry of Home Affairs. The Department of Narcotics Control also does not have any document, outlining the Act or the provision of NEP in the country.

Undercoverage of PWID: Out of a total of 23,800 PWID (Male), about 20,000 are being covered in the country. The rest are not included in any ongoing intervention program. Currently, services are being provided to street-based, marginalized and targeted population groups. PWID who belong to upper social classes remain excluded from the intervention programs. They also need preventive interventions, as they are engaged in high risk behavior.

Police harassment: The police often harasses and arrests drug users attempting to access clean syringes. In Bangladesh, PWID are often subject to prolonged incarceration. Due to frequent job transfer, police officers are often unaware of the public health benefits and legal

status of harm reduction programs and continue to treat the possession of injection equipment as illegal and program participation as a marker of illegal behavior.

Human rights of PWID: Promotion of respect for fundamental human rights is needed while empowering PWID to focus on the 'enabling environment,' particularly the underlying conditions that make them vulnerable to HIV/AIDS.

Drug-related stigma: Most PWID under the OST program continue to experience drug-related stigma after their return. Some internalize drug-related stigma and limit their interactions with family members, neighbors and other community people. There is a need to bring this issue under national mainstreaming coverage in order to eliminate stigma and facilitate social acceptance.

Mobility of PWID: Mobility and injecting drugs are closely associated. Drug use also occurs along border regions and transport routes, where drug trafficking, commercial sex and other HIV risk factors have been well documented in Bangladesh. It has been found that DIC-based harm reduction interventions face particular challenges in retaining PWID.

Employee turnover: Employee turnover constitutes a great challenge for NGOs implementing harm reduction interventions. The transition period of replacing a skilled employee within an organization is very costly.

Policy dialogue: More policy dialogue is essential to building sustainable interventions among PWID: government-led initiatives require political commitment and leadership. Implementation of HIV/AIDS activities among PWID, particularly prevention is a complex, dynamic and time intensive process, which must be addressed in the context of broader development policies of the country.

Coordination and technical assistance: Good governance is needed to ensure an effective multi-sectoral HIV response based on the operationalization and coordination of main committees, including the National Advisory Committee on AIDS and the National Technical Steering Committee on AIDS. Moreover, technical assistance and capacity-building are essential to expand the ability of national HIV programs to plan, implement, monitor and sustain collaborative activities targeting PWID.

8.15 Lessons learned for Bangladesh and the region

The suggestions and recommendations emerging from the discussion with regard to Bangladesh and the region are summarized below:

- The national HIV and AIDS response should be an essential component of the country's national development strategy. To achieve agreed upon joint outcomes, all key stakeholders need to work collaboratively to define strategies and priorities for implementation. The NASP should take the leading role in expanding, scaling up and implementing multisectoral responses to HIV and AIDS. The health sector remains key, but non-health sectors are also to take action on HIV and AIDS based on the National HIV/AIDS Strategy. Therefore, enhanced policy dialogue is recommended,

which will provide a forum for stakeholders from governments, non-governmental and multilateral organizations to explore the issues and evidence related to HIV and AIDS, and to chart a way forward in terms of policy and program development.

- A high degree of dependence on donors for aid may create vulnerability. Bangladesh has its own resources, capacity and skilled man power to run intervention programs by its own. The Government needs to generate its own budget for the PWID intervention program and funding needs to be derived from the revenue budget.

- Within the context of the concentrated HIV epidemic among PWID in Bangladesh and the high levels of their risk behavior, the country needs to take action to improve young drug users' coverage. Currently, PWID below 18 years of age are not covered under the harm reduction program. In order to control the spread of HIV, young drug users' coverage should be improved.

- The government of Bangladesh should run the HIV prevention program nationwide, taking into account the experience from TB prevention. The government should be aiming to bring harm reduction and HIV/AIDS prevention under program and strategy mainstreaming. Due to growth in the prevalence of heroin use, it is equally important for policy makers to consider how the future composition of the heroin using population should be covered. Treatment needs of young heroin users at an early stage may require a different response to those of older and more established drug users.

- In order to scale up harm reduction interventions, there is a need to introduce and scale up OST programs nationwide. Flexibility should be enhanced to introduce more OST, and efforts should be made to bring a maximum number of PWID under OST program.

- Message guides, advocacy material and other culturally sensitive media material need to be developed targeting women, young people and other vulnerable groups in order to provide appropriate sexual and reproductive health information.

- More training is needed to better respond to the needs of the government and NGOs, contributing to increasing their capacities in harm reduction program prevention. Particularly, training in specialized counseling is needed to support harm reduction.

- With the ongoing and expanding transmission of hepatitis C (HCV) among PWID, strong advocacy and resources are needed to overcome challenges in providing multiple and comprehensive programs that could reduce HCV transmission and the associated burden of the disease among PWID.

- Outreach interventions, which have been found to be more effective in eliciting behavioral change and in disseminating information for HIV/AIDS interventions, need to be scaled up for PWID throughout the country. Opting to start a DIC for PWID will be more costly than running an outreach program. Therefore, there is a need to

extend the outreach program to ensure decentralization of DIC staffs so that they have an active presence in the spots where vulnerable PWID are concentrated.

- Adequate HIV testing and counseling services should be enhanced in all key populations including PWID. And this can be scaled up through existing DICs. Simultaneously, facility for ART eligibility, adequate amount of ARV drugs supply should be ensured to minimize the gap between demand and supply. Otherwise, it would be difficult to halt the HIV spread among the key populations and their potential partners. Treatment as prevention may also be initiated to ensure that all ILWHA receive ART, with mechanisms in place to monitor adherence.

- There is a need to increase awareness and sensitize the general public, including governmental bodies which are important for the success of intervention programs. From discussions with DIC personnel and the PWID, it is clear that government departments (including those beyond the MOHFW), such as the law enforcement authorities, need to ensure more support towards harm reduction interventions.

- HIV responses need to ensure that human rights of PWID and other key populations are protected and promoted. Those populations most vulnerable and at risk of HIV are often the same populations prone to human rights violations. The government's policies and programs in the health sector must promote human rights and empower vulnerable populations to exercise their rights. NGOs engaged in serving the key populations must ensure mechanisms to uphold their human rights.

- Serological and behavioral surveillance on HIV/AIDS play a fundamental role in monitoring the magnitude and trends in the prevalence of infection and risk behavior. Over the years, data from HIV surveillance systems have been used for evidence-based program planning. Therefore the government of Bangladesh should conduct regular surveillance which will provide an overview of the HIV epidemic and detail the understanding of risk behavior among key populations.

CHAPTER IX: SUMMARY AND CONCLUSIONS

In this study, the AEM has been used to estimate the impact on HIV transmission among PWID in relation to harm reduction interventions in Dhaka city. The study also examined the cost efficiency of the existing interventions. The model uses intervention, behavioral, and epidemiological data to estimate the number of HIV infections averted among PWID and non-PWID sub-populations in Dhaka city. The model was designed by using input data to estimate the extent and form of behavior change, and how this affects the transmission of HIV amongst PWID and the non-PWID population. In this study, we have illustrated how the AEM can be used to simulate HIV transmission among PWID and to estimate the impact of HIV prevention activities focusing on PWID and other key populations. From 2000-2012, the model predicts that the harm reduction interventions averted 1,138 new infections among PWID in Dhaka city, and resulted in the reduction of deaths among this population.

Recent trends indicate that HIV prevalence levels among PWID may stabile or increase at a more gradual rate due to current ongoing interventions. Projections predict that without any intervention, the prevalence of HIV in Dhaka city among male-PWID would have been 23.8 percent, which is significantly higher than the prevalence rate in 2012 (5.9 percent). HIV-related deaths for PWID reported a gradual rise between 2000 and 2012, but the rate is projected to rise more gradually between 2013 and 2020 due to current ongoing interventions. Based on the current trends, the country's effective program intervention among the at-risk population is projected to bring about a large drop in the prevalence of HIV by 2020.

The participants of the FGD stated that one of the main reasons for sharing needles is the gaps between the supply and demand of syringes in hot spots. Police harassment for carrying used/unused syringes also exacerbates the problem. High correlation has been found between injecting drugs and getting involved in the commercial sex business, and it has also been found that coerced sex increases the likelihood of unsafe sex.

The OST has produced effective results in reducing the frequency of injecting drug use and the sharing of needles and syringes. There are also positive impacts of this therapy in terms of behavioral and socio-economic benefits and reduced criminal behavior. Peer education and counseling have been found to be effective methods in reducing HIV-related risk behavior. DICs provide good opportunities for this and they also increase access to health services. However, DICs need to be better monitored, to ensure that individual PWID get the services they are entitled to.

There is also an increasing gap between the number of adults in need and the number of adults currently on ART. Findings suggest that the current program has to be expanded to be able to meet this gap. Scaling up current programs will reduce both cumulative new HIV infections and AIDS related deaths, especially with the help of interventions targeting all at-risk populations.

The qualitative data also provides insight into the potential travel-related risk behavior of PWID across several areas. Although PWID most commonly decide to travel in order to escape legal problems or social pressures in their local environment, to enter a drug treatment program, or to conduct illegal activities related to the selling of drugs, in this study the reasons reported for mobility were related to the procurement of drugs. The FGD findings show that PWID of Dhaka city had mobility networking to some extent coupled with their unsafe injection practices. The

movement of PWID between various regions may serve as an important mechanism for the spread of HIV among PWID. For some PWID, the networking mobility for Dhaka city is less in recent times, which has positive implications for the effects of harm reduction interventions (e.g. OST) as well as the safe disposal of injecting equipment. Discussions also revealed that the PWID are motivated to travel apparently long distances to collect clean injecting equipment when required. With this success, our findings support the importance of harm reduction or other initiatives for PWID in Dhaka city. Further research is needed to understand the factors involved in individual risk behaviors, including the context of injecting and sharing during travelling.

The most important achievement of the Global Fund funding has been its contribution to the continued low-prevalence rate of HIV in Bangladesh. Many countries experienced an explosive increase of HIV as a result from the epidemic of PWID. Due to the activities supported by the Global Fund this did not occur in this country.

Bangladesh has introduced needle and syringe exchange and developed methadone treatment programs (e.g. OST) and these policies have been successful in averting or reversing the epidemic spread of HIV. The goal of the policy package is to limit the spread and impact of HIV in the country through preventing HIV/AIDS/STIs and reducing risks among the PWID and other key populations. The main objectives of the Global Fund projects (GF-906 and GF-907) are to increase the coverage and ensure quality and comprehensiveness of the intervention among PWID relating to the spread of HIV in Bangladesh.

The effectiveness of harm reduction programs in Bangladesh in limiting the spread of HIV among PWID has been well documented.[6,9,14,41] Although the needle and syringe exchange program has been less successful in curbing the transmission of HCV among PWID, with prevalence rates for HCV at about 39.6 percent compared to less than 5.3 percent for HIV in Dhaka, there is evidence that HCV incidence in Dhaka has been declining in recent years.[4] Such a decline in Dhaka city can, in part, be attributed to the preventative and educative role of NEPs. NEPs are widely acknowledged as providing a vital service in the delivery of information and education about the risks for transmission of blood-borne viruses, including the supply of free condoms and syringes.[46]

The research findings have demonstrated the role of the police as an important stakeholder to support or operationalize harm reduction interventions in Dhaka city. Key informants mentioned that the role of the police within the law enforcement sector was consistent, with good communication about harm reduction programs. Most key informants interviewed gave credit to the law enforcement agency, seeing its involvement in harm reduction interventions as vital in reaching PWID in Dhaka city. Over the last few years, police harassment has lessened and the law enforcement agency has supported many activities of harm reduction programs and allowed such programs to do their work without hindrance.

On the other hand, drug law enforcement remains the major barrier to increased adoption of harm reduction in the country.[9] The implementation of harm reduction programs in community settings is often a struggle in the country due to social and policy barriers.[47] Key harm reduction interventions that hold a strong promise of reducing risky behaviors related to transmission and acquisition of HIV are not being scaled up adequately in affected areas of Bangladesh. In addition to policy barriers which limit the use of available approaches for PWID, a range of other contextual realities, including human rights abuses, abusive police

practices, and the widespread use of arrest, detention and incarceration impact the health, wellbeing, and lives of PWID. The harm reduction programs should focus on strengthening advocacy to address harassment by law enforcement agencies in some localities, including some hot spots.

The findings show that opioid substitution therapy in the DIC setting lags far behind. The available choices for OST are limited to PWID in the capital city and it is often a struggle for them to enroll in the program. The first harm reduction program was initiated in Dhaka in 1998 by CARE Bangladesh and later at least two more non-governmental organizations (MAB and Light House) started to provide services in this mega city of over 15 million people. In addition, Save the Children in Bangladesh has been providing harm reduction services in three DICs across Dhaka city through a direct delivery system. Over the years, NGO program coverage remained low and did not reach more than 40 percent of the total target estimated population of PWID in Bangladesh. Currently, there are only three OST programs being run in Dhaka city (located at Moulovibazar, SK Dash and CTC Tejgaon) for treatment of drug dependency, funded by the Global Fund and the Government. Inadequate availability of OST in Dhaka to a wider extent means that the majority of PWID in the city do not have access to an integral component of evidence-based HIV prevention. There is a dearth of data on actual relapse rates but the program managers of the current harm reduction program stated a relapse rate of 90 percent among PWID who are in detoxification programs.

Findings from focus group discussions and key informant interviews show that there is strong and consistent evidence across Dhaka city for the effect of needle and syringe programs on risky injecting behaviors: sharing of injecting equipment, unsafe injection, and higher frequency of injection. Key informants believe that cumulative effect in this context should reduce the total number of risky injecting episodes, thereby reducing the risk of HIV acquisition in the city. HIV transmission dynamics can be significantly reduced among PWID and in most cases among the general population, by a well-targeted scale-up of harm reductions as well as a proportionate access in ART scale-up. The scale-up of well-targeted PWID interventions should occur within the existing context of allocations to the HIV/AIDS response in Bangladesh.

The sustained high prevalence of blood-borne diseases such as HCV among PWID in Dhaka signals a clear need for a range of evidence-based interventions that will help prevent HIV transmission through shared injection equipment and help ensure access to care, treatment and support for people who are living with HIV. Policy makers in Bangladesh may consider these interventions when approaching a stepwise scale-up across the country. In order to attain the greatest effect from these interventions, structural issues must be addressed, especially the removal of punitive policies targeting PWID in many districts. How the law treats illegal drug use and people who use drugs, and how the law is enforced, will affect how successful such efforts will be in Bangladesh.

The results of this study demonstrate some key realities for the future of the national response to HIV and AIDS. The findings presented here make it clear that an 'AIDS free society' will not be possible in Bangladesh unless HIV prevention, treatment, and care are scaled up for PWID and other key populations. In this light, HIV prevention initiatives targeting PWID requires a 'combination intervention' approach tailored to the local setting, including a balance of needle and syringe distribution programs, OST, ART, peer education and outreach, HIV testing and

counseling services, and the promotion of public policies and other structural changes conducive to public health approaches. The government of Bangladesh needs to ensure that its national drug policy includes harm reduction as a key component, and that harm reduction is implemented through a range of evidence-based services and programs to protect and promote the health of people who use drugs.

The decrease in AIDS-related death has been reflected in the DIC-based record of ILWHA. During the field investigation, the study team analyzed records from ILWHAs in DICs and found that the number of deaths among ILWHAs due to AIDS was only 5 in Dhaka city in 2003. The number dropped down to only 1 in 2013. In total, 56 deaths were reported in Dhaka city from 2001 to 2013. A computer-modeled projection based on previous data further suggests that there would be no substantial increase in HIV-related deaths among PWID through to 2020. The estimated number of deaths among PWID due to AIDS would be 24 in 2020 and 23 in 2013.

In Dhaka city, the increasing trends of the number of current HIV infections, new infections and deaths among PWID have been controlled in the past years and will be stable in the projection years from 2013 to 2020. This confirms the success of the existing harm reduction program among the PWID in the city.[48] Albeit, a substantial HIV epidemic is anticipated among other risk groups as the number of new infections and deaths among the adult population still show an increasing trend with the current intensity of the intervention programs. More importantly, in the absence of existing prevention efforts, HIV infections will rise in all the at-risk populations in the city and affect the general population as well. As a result, Bangladesh critically needs effective prevention interventions. The findings have implications for other cities and regions in Bangladesh as well, illustrating the importance of PWID interventions both to avert further HIV transmission among PWID, and to prevent HIV transmission between PWID and their non-PWID sexual partners. Given that this is an important means by which HIV infection may enter the general population, it is imperative that prevention initiatives build upon and replicate interventions implemented in the whole country. Lack of funding to undertake such interventions can have negative effects on program delivery, including reducing the prevalence of HIV among key populations.

Considerable resources and long term commitment are required to continuously promote and maintain sufficient behavior changes to control the HIV epidemic. The projections also show a substantial and growing number of people needing ART. While sufficient resources need to be secured for the development and expansion of these programs, sharing resources by integrating these programs into the other existing health or social programs when appropriate will possibly help. Improving adherence to and keeping ART at a low cost are key factors to ensure the sustainability of treatment programs.

In this study, the behavior of the cost function is found appropriate. The unit cost estimated at constant prices shows a declining trend. The cost function has the tendency to move toward the optimum capacity level – the lowest point of the average cost curve. But the cost of manpower demonstrates an increasing trend, which may not be a good indicator of performances if it implies a declining trend of procurement of commodities. It is strongly recommended that the program ensures procurement of the necessary amount of commodities; otherwise the program will suffer from an inappropriate input mix which will cause economic inefficiency.

The benefit-cost ratio for the program that has been implemented during the last 15-year period was 1.37 and, hence, the program fully satisfied the standard criterion of investment – the amount of return generated by the program was much higher than the cost of investment. Furthermore, the benefit-cost ratio for the part of program efforts which was devoted to PWID was still higher and, as such, the program interventions for PWID were more effective than the general program. Therefore, it is recommended that the interventions for the PWID should be expanded and reinforced so as to make the entire program more effective by way of raising the benefit-cost ratio.

Comparison of the cost-effectiveness ratios for the alternative scenarios of implementing the future program reveals that Scenario-4 is the most cost-effective one, followed by Scenario-5. Scenario-1 is marginally cost-effective and Scenarios-2 and 3 are not cost- effective at all. Hence, it is recommended that Scenario-4 be chosen in formulating the next program.

The specific recommendations of the study include:

- Prevention programs should be continued and consist of interventions that have proved to generate significant effects in reducing HIV/STI risk behaviors or increasing HIV/STI-protective behaviors.
- In order to generate optimum outputs in terms of infections averted and lives saved, all interventions should be scaled up in Dhaka. The most cost effective scenario should consist of scaling up of current coverage among: PWID (male) to 95 percent, PWID (female) to 55 percent, FSW to 65 percent, and MSM to 35 percent, MSW to 95 percent and TG to 90 percent. In addition to this, OST targeting PWID (male) and PWID (female) should be scaled up to 5 percent and 3 percent respectively; and HTC should be scaled up among all key populations.
- The key populations driving the HIV epidemic need to have increased access to more user-friendly HIV prevention, Voluntary Counseling and Testing and STI services that are designed to meet their needs and are adapted to the context.
- Focus needs to be strengthened to ensure that demand-based services are provided to the clients and that their satisfaction is enhanced.
- STI control is critically important for HIV prevention as the risk of HIV transmission is higher with concurrent STIs.
- Efforts should be made to bring a maximum number of PWID under OST program
- HIV testing and counseling services need to be increased in all key populations including PWID and treatment as prevention may be initiated to ensure that all ILWHA receive ART. Mechanisms to ensure ART adherence need to be strengthened.
- All prevention programs should involve the community and aim at reducing stigma and discrimination.

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APPENDIX 1: TABLES ON COST-BENEFIT ANALYSIS

Table A1: Resource required (in thousand US$)

Cost in thousand USD	2014	2015	2016	2017	2018	2019	2020	Total
Existing interventions maintained								
Prevention Cost	2,542	2,594	2,647	2,700	2,753	2,806	2,858	18,900
Treatment Cost	148	181	187	195	204	214	223	1,352
Total Cost	2,690	2,776	2,834	2,895	2,957	3,019	3,081	20,252
PWID scaled up								
Prevention Cost	2,557	2,625	2,695	2,765	2,835	2,906	2,977	19,360
Treatment Cost	153	190	198	207	214	219	224	1,406
Total Cost	2,710	2,816	2,893	2,971	3,049	3,125	3,201	20,765
MSM scaled up								
Prevention Cost	2,655	2,825	3,000	3,180	3,365	3,554	3,747	22,325
Treatment Cost	139	165	174	181	189	196	204	1,249
Total Cost	2,794	2,990	3,174	3,361	3,553	3,750	3,951	23,574
FSW scaled up								
Prevention Cost	2,568	2,648	2,730	2,812	2,896	2,980	3,065	19,698
Treatment Cost	141	168	176	184	192	200	208	1,269
Total Cost	2,709	2,816	2,906	2,996	3,087	3,180	3,273	20,968
All interventions scaled up 1								
Prevention Cost	2,631	2,776	2,926	3,079	3,235	3,395	3,559	21,600
Treatment Cost	145	179	191	201	207	210	211	1,344
Total Cost	2,776	2,955	3,116	3,279	3,442	3,606	3,770	22,945
All interventions scaled up 2								
Prevention Cost	2,744	3,007	3,279	3,559	3,848	4,145	4,449	25,032
Treatment Cost	144	175	186	194	199	201	201	1,299
Total Cost	2,888	3,182	3,465	3,753	4,047	4,346	4,650	26,331

Table A2: Resource required (in thousand US$) by area: 2014-2020

Category	Intervention Scenarios					
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Female Sex Workers	3,790	3,790	3,790	4,564	4,564	5,252
Injecting Female Sex Workers	213	213	213	238	247	289
Injecting Drug Users (Male/Female)	5,490	5,949	5,490	5,490	5,767	6,339
Men who Have Sex with Men	8,787	8,787	12,212	8,787	10,368	12,454
Transgender Sex Workers	619	619	619	619	655	699
Antiretroviral Treatment (ART)	1,352	1,406	1,249	1,269	1,344	1,299
Total Resource Needs	20,252	20,765	23,574	20,968	22,945	26,331

Table A3. Annual cost of harm reduction program in Bangladesh

Year	Rate of inflation	Program cost at 2012 Prices	Program cost at current prices
2012	7.70	22.91	22.91
2011	10.62	25.46	23.92
2010	8.80	22.25	19.64
2009	7.31	20.92	17.35
2008	6.66	20.26	15.78
2007	9.94	17.23	12.61
2006	7.20	19.14	12.36
2005	7.16	16.73	10.80
2004	6.48	15.72	9.54
2003	5.83	15.23	8.68
2002	4.38	12.95	6.94
2001	2.79	14.39	7.24
2000	1.94	12.58	5.94
1999	2.79	11.81	5.25
1998	7.06	11.45	4.78
	6.44	259.06	183.74

Escalator = e = 1.0644.

Table A4: Cost-effectiveness of different intervention scenarios: 2014-2022

Scenario	Impact (No. of cases averted)	DALYs averted	Value of DALYs averted (Crore BDT)	Program cost (Crore BDT)	Benefit – Cost ratio	Cost per DALY averted (Thousand BDT)
Baseline	1,568	42,637	356.1	259.06	1.37	60.8
Scenario 1	217	5,914	49.4	166.1	0.30	280.9
Scenario 2	45	1,233	10.3	188.6	0.05	1529.7
Scenario 3	10	274	2.3	167.7	0.01	6126.0
Scenario 4	372	10,124	84.6	183.6	0.46	181.3
Scenario 5	378	10,278	85.8	210.6	0.41	205.0

- GDP per capita for baseline : US $ 1044; GDP per capita for Scenario 1 through Scenario 5 : US $ 1407 and Conversion rate (as in 2012) : US $ = BDT 80

APPENDIX 2: IMPACT OF INTERVENTIONS AMONG KEY POPULATIONS

Figure B1: HIV prevalence among Key Populations without interventions in Dhaka since 1995

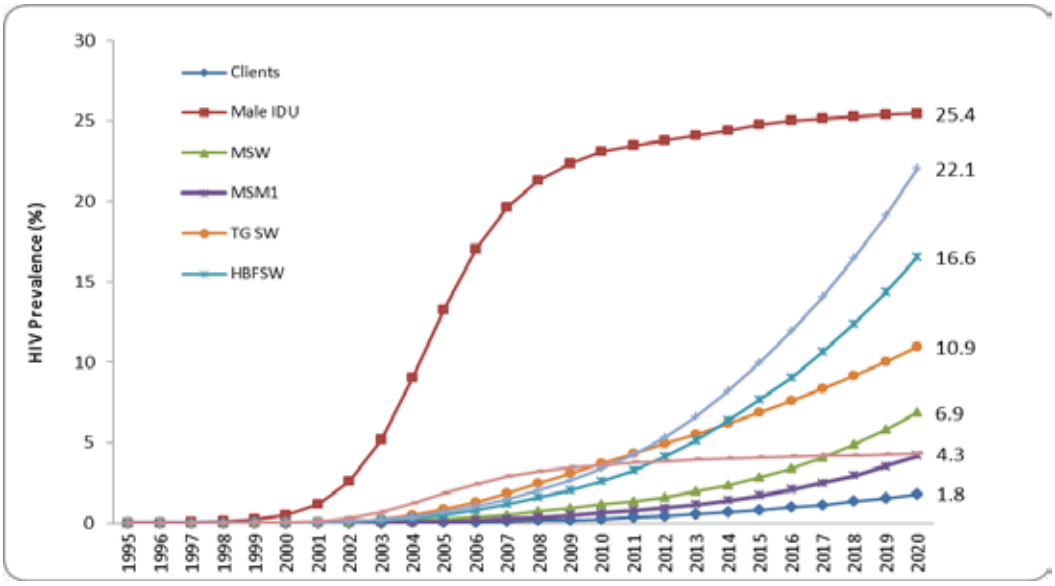


Figure B2: New infections averted and lives saved per year in Dhaka city: 1995-2012

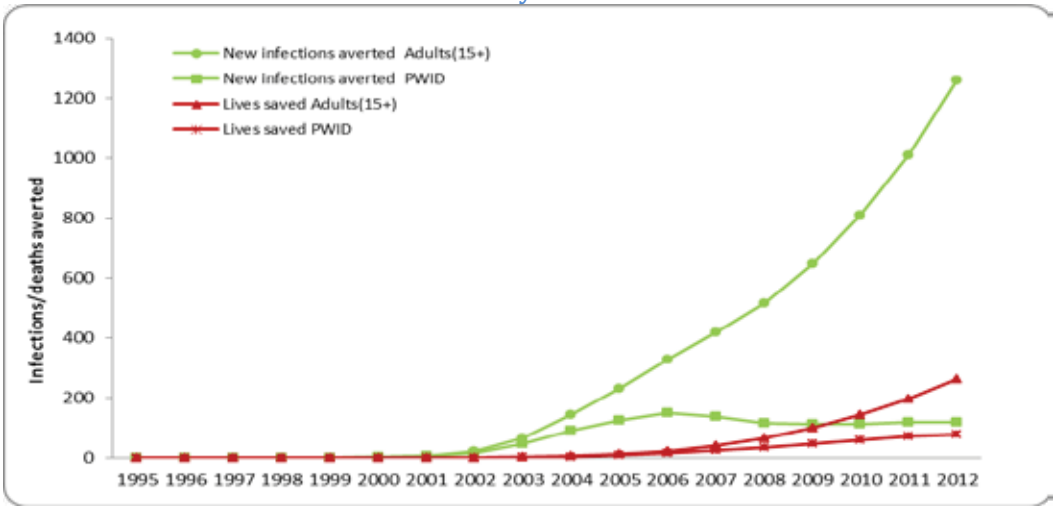
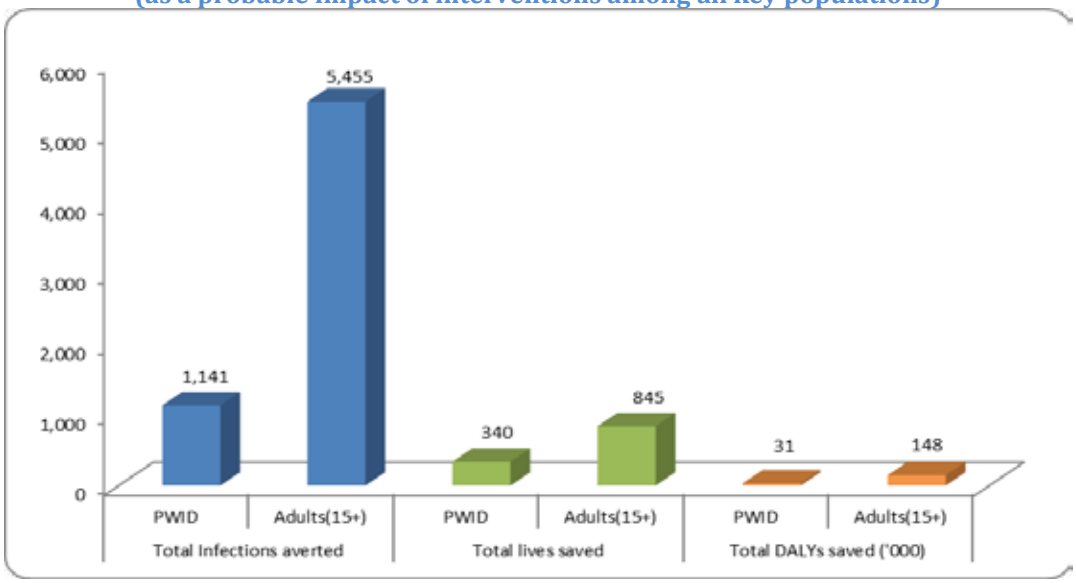


Figure B3: Total infections averted, lives saved and DALYs saved: 1995-2012 2012 (as a probable impact of interventions among all key populations)



APPENDIX 3: AEM INPUT INDICATORS

Table C1: Data inputs of AEM population worksheet

Population 15 years and above in in Dhaka city

Year	Males				Females			
	Males 15+	Males 15-49	Males 15 y/o	Males 15-24	Females 15+	Females 15-49	Females 15 y/o	Females 15-24
1975	1,779,341	1,451,409	46,263	517,788	1,479,183	1,206,569	31,371	351,232
1976	1,811,371	1,477,536	47,096	527,109	1,508,534	1,230,511	31,993	358,202
1977	1,853,548	1,511,939	48,192	539,382	1,545,468	1,260,638	32,777	366,972
1978	1,904,752	1,553,706	49,524	554,283	1,588,029	1,295,356	33,679	377,078
1979	1,960,276	1,598,997	50,967	570,440	1,632,370	1,331,524	34,620	387,607
1980	2,224,878	1,814,833	57,847	647,440	1,677,839	1,368,614	35,584	398,403
1981	2,283,922	1,862,995	59,382	664,621	1,724,184	1,406,417	36,567	409,408
1982	2,344,726	1,912,593	60,963	682,315	1,771,480	1,444,996	37,570	420,638
1983	2,407,339	1,963,666	62,591	700,536	1,821,382	1,485,701	38,628	432,488
1984	2,471,837	2,016,277	64,268	719,304	1,875,454	1,529,808	39,775	445,327
1985	2,538,260	2,070,458	65,995	738,634	1,933,719	1,577,335	41,011	459,162
1986	2,606,731	2,126,311	67,775	758,559	1,994,905	1,627,244	42,308	473,691
1987	2,677,214	2,183,803	69,608	779,069	2,058,324	1,678,975	43,653	488,750
1988	2,749,397	2,242,683	71,484	800,075	2,122,814	1,731,580	45,021	504,063
1989	2,822,859	2,302,606	73,394	821,452	2,187,383	1,784,248	46,390	519,395
1990	2,897,355	2,363,373	75,331	843,130	2,253,210	1,837,944	47,787	535,025
1991	2,972,625	2,424,770	77,288	865,034	2,326,592	1,897,801	49,343	552,450
1992	3,048,906	2,486,993	79,272	887,232	2,402,518	1,959,734	50,953	570,479
1993	3,127,058	2,550,741	81,304	909,974	2,480,426	2,023,283	52,605	588,978
1994	3,208,261	2,616,978	83,415	933,604	2,560,121	2,088,291	54,296	607,902
1995	3,293,303	2,686,347	85,626	958,351	2,641,777	2,154,898	56,027	627,291
1996	3,382,588	2,759,177	87,947	984,333	2,725,535	2,223,219	57,804	647,179
1997	3,475,713	2,835,139	90,369	1,011,432	2,811,527	2,293,363	59,627	667,598
1998	3,571,671	2,913,412	92,863	1,039,356	2,899,063	2,364,766	61,484	688,383
1999	3,669,021	2,992,820	95,395	1,067,685	2,987,394	2,436,817	63,357	709,357
2000	3,766,732	3,072,523	97,935	1,096,119	3,076,542	2,509,535	65,248	730,526
2001	3,864,289	3,152,101	100,472	1,124,508	3,166,386	2,582,821	67,153	751,859
2002	3,962,012	3,231,813	103,012	1,152,945	3,256,696	2,656,487	69,069	773,303
2003	4,060,689	3,312,304	105,578	1,181,661	3,347,223	2,730,330	70,989	794,799
2004	4,161,520	3,394,552	108,200	1,211,002	3,437,664	2,804,103	72,907	816,274
2005	4,265,279	3,479,188	110,897	1,241,196	3,527,646	2,877,501	74,815	837,640
2006	4,372,250	3,566,444	113,679	1,272,325	3,616,937	2,950,336	76,709	858,843
2007	4,481,872	3,655,863	116,529	1,304,225	3,705,290	3,022,405	78,583	879,822
2008	4,593,054	3,746,554	119,419	1,336,579	3,793,849	3,094,643	80,461	900,850
2009	4,704,279	3,837,280	122,311	1,368,945	3,883,846	3,168,053	82,369	922,220
2010	4,814,449	3,917,998	125,176	1,401,005	3,975,026	3,234,877	84,107	941,673
2011	4,923,118	4,006,434	128,001	1,432,627	4,067,242	3,309,922	86,058	963,518
2012	5,030,576	4,093,883	130,795	1,463,898	4,160,349	3,385,692	88,028	985,575

Year	Males				Females			
	Males 15+	Males 15-49	Males 15 y/o	Males 15-24	Females 15+	Females 15-49	Females 15 y/o	Females 15-24
2013	5,137,352	4,180,777	133,571	1,494,970	4,253,874	3,461,802	90,007	1,007,731
2014	5,244,306	4,267,817	136,352	1,526,093	4,347,263	3,537,803	91,983	1,029,854
2015	5,352,046	4,355,495	139,153	1,557,446	4,440,119	3,613,369	93,948	1,051,852
2016	5,460,658	4,443,883	141,977	1,589,051	4,532,022	3,688,160	95,892	1,073,623
2017	5,569,850	4,532,744	144,816	1,620,826	4,622,572	3,761,849	97,808	1,095,074
2018	5,679,411	4,621,905	147,665	1,652,709	4,711,491	3,834,212	99,690	1,116,139
2019	5,789,010	4,711,096	150,514	1,684,602	4,798,541	3,905,052	101,531	1,136,761
2020	5,898,385	4,800,106	153,358	1,716,430	4,883,396	3,974,107	103,327	1,156,863
2021	5,972,099	4,860,094	155,275	1,737,881	4,965,667	4,041,059	105,068	1,176,352
2022	6,045,812	4,920,082	157,191	1,759,331	5,044,972	4,105,598	106,746	1,195,140
2023	6,119,526	4,980,070	159,108	1,780,782	5,122,340	4,168,560	108,383	1,213,468
2024	6,193,239	5,040,058	161,024	1,802,233	5,198,936	4,230,894	110,003	1,231,613
2025	6,266,953	5,100,046	162,941	1,823,683	5,274,652	4,292,511	111,605	1,249,550
2026	6,340,666	5,160,034	164,857	1,845,134	5,349,302	4,353,262	113,185	1,267,235
2027	6,414,380	5,220,022	166,774	1,866,584	5,422,678	4,412,975	114,737	1,284,617
2028	6,488,093	5,280,010	168,690	1,888,035	5,494,796	4,471,665	116,263	1,301,702
2029	6,561,807	5,339,998	170,607	1,909,486	5,565,703	4,529,369	117,764	1,318,499
2030	6,635,520	5,399,986	172,524	1,930,936	5,635,257	4,585,972	119,235	1,334,976
2031	6,709,233	5,459,974	174,440	1,952,387	5,703,250	4,641,305	120,674	1,351,084
2032	6,782,668	5,519,736	176,349	1,973,756	5,769,451	4,695,179	122,075	1,366,767
2033	6,853,585	5,577,448	178,193	1,994,393	5,833,819	4,747,562	123,437	1,382,015
2034	6,921,975	5,633,103	179,971	2,014,295	5,896,325	4,798,429	124,759	1,396,823
2035	6,987,613	5,686,519	181,678	2,033,395	5,956,764	4,847,615	126,038	1,411,141
2036	7,050,270	5,737,509	183,307	2,051,628	6,014,922	4,894,944	127,269	1,424,918
2037	7,109,720	5,785,890	184,853	2,068,928	6,070,581	4,940,239	128,446	1,438,104
2038	7,165,994	5,831,686	186,316	2,085,304	6,123,721	4,983,484	129,571	1,450,692
2039	7,219,140	5,874,936	187,698	2,100,770	6,174,343	5,024,680	130,642	1,462,684
2040	7,268,986	5,915,501	188,994	2,115,275	6,222,270	5,063,683	131,656	1,474,038
2041	7,315,362	5,953,241	190,199	2,128,770	6,267,324	5,100,349	132,609	1,484,711
2042	7,358,095	5,988,018	191,310	2,141,206	6,309,336	5,134,538	133,498	1,494,664
2043	7,397,164	6,019,812	192,326	2,152,575	6,348,253	5,166,208	134,321	1,503,883
2044	7,432,621	6,048,667	193,248	2,162,893	6,384,100	5,195,380	135,080	1,512,375
2045	7,464,466	6,074,582	194,076	2,172,160	6,416,886	5,222,062	135,774	1,520,142
2046	7,492,721	6,097,576	194,811	2,180,382	6,446,648	5,246,282	136,403	1,527,193
2047	7,517,410	6,117,668	195,453	2,187,566	6,473,425	5,268,073	136,970	1,533,536
2048	7,538,228	6,134,610	195,994	2,193,624	6,497,158	5,287,387	137,472	1,539,158
2049	7,555,725	6,148,849	196,449	2,198,716	6,518,127	5,304,452	137,916	1,544,126
2050	7,569,910	6,160,393	196,818	2,202,844	6,536,323	5,319,260	138,301	1,548,437

Table C2: Behavioral inputs to AEM for heterosexual population in Dhaka city

Indicators	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Female Sex Workers - General													
Percent of females aged 15-49 who sell sex	0.36%	0.36%	0.36%	0.36%	0.36%	0.36%	0.36%	0.36%	0.36%	0.36%	0.36%	0.36%	0.36%
Percent of female sex workers in group 1	25.0%	25.0%	25.0%	25.0%	29.2%	33.5%	37.7%	41.9%	46.2%	50.4%	50.4%	50.4%	50.4%
Movement from group 1 to group 2 each year	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Female Sex Workers group 1 (FSW1)													
Number of clients per day - female sex worker group 1	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7	4.7
Days worked per week - female sex workers group 1	4.0	4.0	4.0	4.1	4.1	4.1	4.3	4.3	4.3	4.3	4.3	4.3	4.3
Percent condom use with clients - FSW group 1	21.0%	21.0%	24.3%	29.7%	29.7%	34.6%	39.9%	48.0%	56.0%	64.1%	65.6%	65.6%	65.6%
Average duration selling sex in group 1 (years)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
STI prevalence among female sex worker group 1	30.0%	23.8%	17.6%	11.4%	11.4%	9.0%	6.6%	6.5%	6.3%	6.2%	6.0%	6.0%	6.0%
Female Sex Workers group 2 (FSW2)													
Number of clients per day - female sex worker group 2	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9
Days worked per week - female sex workers group 2	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8	4.8
Percent condom use with clients - FSW group 2	29.0%	29.0%	35.6%	37.7%	49.4%	61.1%	72.8%	72.8%	72.8%	72.8%	72.8%	72.8%	72.8%
Average duration selling sex in group 2 (years)	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4	8.4
STI prevalence among female sex worker group 2	50.0%	39.7%	29.3%	19.0%	19.0%	15.0%	11.0%	10.8%	10.5%	10.3%	10.0%	10.0%	10.0%
Clients of Female Sex Workers													
Percent of males aged 15-49 who visited FSW in last year	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%	9.9%
Average duration buying sex (years)	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4	7.4
Percent of adult males who are circumcised	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%	90.0%
Population engaging in Casual Sex													
Percent of males engaging in casual sex in the last year	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Percent of females engaging in casual sex in the last year	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%
Percent condom use in casual sex	27.6%	28.3%	28.9%	29.6%	30.3%	30.9%	31.6%	31.6%	31.6%	31.6%	31.6%	31.6%	31.6%
Average number of sex contacts in the last year (male)	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Sex with spouses or regular partners (RP)													
Number of sexual contacts with spouse or RP (per week)	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Percent condom use with spouses or regular partners	4.3%	4.3%	4.3%	4.2%	4.2%	4.3%	4.4%	4.5%	4.8%	5.0%	5.3%	5.5%	5.5%
STI prevalence in adult population	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%	0.7%

Table C3: Behavioral inputs to AEM for injecting drug users in Dhaka city

Indicators	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Male IDU - Injecting Behaviors / population													
Percent of males age 15-49 who inject drugs	0.11%	0.11%	0.11%	0.11%	0.11%	0.11%	0.11%	0.11%	0.11%	0.11%	0.11%	0.11%	0.11%
Percent of male IDUs in high-risk networks	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%
IDU mortality (crude mortality per year in %)	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Percent of male IDUs who share needles	88.0%	88.0%	82.6%	77.2%	77.2%	69.0%	60.7%	60.7%	54.7%	48.7%	42.7%	42.7%	42.7%
Percent of all injections shared (among those who share)	58.0%	58.0%	58.0%	58.0%	58.0%	58.0%	58.0%	58.0%	55.3%	52.7%	50.0%	50.0%	50.0%
Number of injections per day	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Average duration of injecting behavior (in years)	8.0	8.0	8.0	8.0	8.0	9.0	10.0	10.4	10.8	11.2	11.6	12.0	12.0
Sharing to non-sharing movement per year	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%	7.5%
Male Injecting Drug Users - Sexual Behaviors													
Percent of male IDUs visiting female sex workers	28.1%	30.3%	32.4%	34.5%	34.5%	32.4%	30.3%	28.2%	26.1%	24.0%	21.9%	21.9%	21.9%
Percent condom use with female sex worker group 1	26.7%	26.7%	29.3%	32.3%	35.2%	38.2%	41.1%	41.1%	50.1%	59.0%	68.0%	68.0%	68.0%
Percent condom use with female sex worker group 2	26.7%	26.7%	29.3%	32.3%	35.2%	38.2%	41.1%	41.1%	50.1%	59.0%	68.0%	68.0%	68.0%
Percent condom use with spouse or regular partner	14.3%	14.3%	16.5%	17.9%	19.3%	20.7%	22.1%	23.5%	24.9%	26.3%	27.7%	27.7%	27.7%
Number of contacts with regular partners (per week)	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56	1.56
Female IDU - Injecting Behaviors													
Percent of females age 15-49 who inject drugs	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Percent of female IDUs in high-risk networks	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%	2.0%
Percent of female IDUs who share needles	74.8%	74.8%	74.8%	74.8%	74.8%	67.7%	59.9%	52.1%	52.1%	52.1%	52.1%	52.1%	52.1%
Percent of all injections shared (among those who share)	60.3%	60.3%	60.3%	60.3%	60.3%	55.7%	54.1%	52.4%	52.4%	52.4%	52.4%	52.4%	52.4%
Number of injections per day	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Average duration of injection (in years)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Sharing to non-sharing movement per year	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%	9.0%
Female Injecting Drug Users - Sexual Behaviors													
Percent whose regular partners also inject drugs	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%	60.0%
Percent condom use with spouse or regular partner	14.3%	14.3%	16.5%	17.9%	19.3%	20.7%	22.1%	23.5%	24.9%	26.3%	27.7%	27.7%	27.7%
Number of contacts with regular partners (per week)	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Table C4: Behavioral inputs to AEM for men having sex with men in Dhaka city

Indicators	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Men who have Sex with Men - General													
Percent of males aged 15-49 engaging in same-sex behavior	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Percent of MSM in risk group 1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Shift from MSM group 1 to group 2	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Men who have Sex with Men group 1 (MSM1) / population													
Percent engaging in anal sex in the last year - MSM1	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Number of anal sex contacts last week (among those having anal sex) - MSM1	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Average duration of same-sex behavior (years) - MSM1	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0
Percent of MSM1 with female partners	50.3%	50.3%	50.3%	50.3%	50.3%	50.3%	50.3%	50.3%	50.3%	50.3%	50.3%	50.3%	50.3%
Percent condom use in anal sex with MSM1	12.0%	12.0%	17.2%	18.2%	19.3%	20.3%	21.3%	21.3%	21.3%	21.3%	21.3%	21.3%	21.3%
STI prevalence among MSM1	5.6%	5.2%	4.8%	4.4%	4.1%	3.7%	3.3%	3.2%	3.1%	3.0%	3.0%	3.0%	3.0%
MSM visiting (male and female) sex workers													
Percent of MSM1 visiting male sex workers	91.1%	91.1%	88.0%	71.9%	71.9%	71.9%	62.0%	62.0%	56.9%	51.8%	46.7%	46.7%	46.7%
Percent of MSM2 visiting male sex workers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Ratio of frequency of visiting MSW (group 2 / group 1)	0	0	0	0	0	0	0	0	0	0	0	0	0
Percent of MSM1 visiting female sex workers	34.1%	34.1%	28.2%	27.3%	26.5%	25.6%	24.8%	24.8%	24.8%	24.8%	29.5%	29.5%	29.5%
Percent of MSM2 visiting female sex workers	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Percent condom use in anal sex with male sex workers	16.0%	16.0%	17.4%	18.7%	20.1%	21.4%	22.8%	22.8%	23.1%	23.4%	23.7%	23.7%	23.7%
Percent condom use with Female sex worker group 1 (FSW1)	16.0%	16.0%	16.7%	17.5%	18.2%	18.9%	19.7%	20.4%	21.1%	21.9%	22.6%	22.6%	22.6%
Percent condom use with female sex worker group 2 (FSW2)	16.0%	16.0%	16.7%	17.5%	18.2%	18.9%	19.7%	20.4%	21.1%	21.9%	22.6%	22.6%	22.6%
Male Sex Workers													
Percent of males aged 15-49 who sell sex	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%	0.14%
Average duration selling sex (in years)	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2	13.2
Shift from MSM1 to MSW	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%
Percent of MSW reporting anal sex with clients in the last year	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Number of anal sex contacts last week (for MSW with anal sex)	10.05	10.05	9.98	9.90	9.90	9.90	9.80	8.63	7.45	6.28	5.10	5.10	5.10
STI prevalence among male sex workers	16.5%	16.5%	16.5%	15.1%	13.7%	12.3%	10.9%	9.5%	8.1%	6.7%	5.3%	5.3%	5.3%
Percent MSW visiting female sex workers in the last year	1.0%	1.0%	1.4%	1.5%	1.5%	1.6%	1.7%	1.7%	1.8%	1.8%	1.9%	1.9%	1.9%
Percent MSW with female regular partners in the last year	16.50%	16.55%	16.60%	16.65%	16.70%	16.75%	16.80%	16.85%	16.90%	16.95%	17.00%	17.00%	17.00%

Table C5: Behavioral inputs to AEM for transgenders in Dhaka city

Indicators	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Transgender population - General													
Percent of males aged 15-49 who are transgender	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%	0.02%
Percent of Transgenders who sell sex	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Percent of Transgenders who engage in casual sex but not sex work	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Percent of Transgenders who have regular partners only	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Transgender Sex Workers - Sexual Behaviors													
Percent of transgender sex workers engaging in anal sex with clients	95.2%	95.2%	95.2%	95.2%	95.2%	95.2%	95.2%	95.2%	95.2%	95.2%	95.2%	95.2%	95.2%
Number of anal sex contacts last week with clients (for those having anal sex)	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4
Percent of anal sex contacts with clients which are receptive	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Average duration selling sex (in years)	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6	19.6
Percent condom use in anal sex with clients	16.0%	16.0%	16.0%	21.7%	21.7%	21.7%	21.2%	20.8%	20.3%	19.9%	19.4%	19.4%	19.4%
Anal STIs (%) among transgenders who sell sex	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%	12.0%
Transgender Sex Workers - Client Make-up (sums to 100%)													
Percent of TG clients who are low-risk heterosexual males	91.0%	91.0%	91.0%	91.0%	91.0%	91.0%	91.0%	91.0%	91.0%	91.0%	91.0%	91.0%	91.0%
Percent of TG clients who are also clients of female sex workers	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Percent of TG clients who are MSM	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%	4.0%
Percent of TG clients who are male IDU	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%	1.0%

Table C6: HIV Prevalence by population group in Dhaka city

Surveillance/observed data on HIV prevalence used for curve-fitting and validation of AEM model

Month-year	% HIV +						
	Female Sex Workers (1)	Female Sex Workers (2)	Male Injecting Drug Users	Female Injecting Drug Users	Men who have Sex with Men	Male Sex Worker	Transgender Sex Workers*
01-12-99	-	0.00%	-	-	-	-	-
01-12-00	-	0.20%	1.40%	-	-	-	-
01-12-01	-	0.50%	1.70%	-	0.00%	0.00%	-
01-12-02	0.20%	0.20%	4.00%	-	0.20%	0.00%	1.60%
01-12-03	0.00%	0.20%	4.00%	-	0.00%	0.00%	0.40%
01-12-04	-	0.20%	4.90%	0.00%	0.00%	0.00%	1.60%
01-12-06	-	0.30%	7.00%	0.80%	0.20%	0.70%	1.20%
01-12-07	0.00%	0.20%	7.00%	1.00%	0.00%	0.30%	0.60%
01-12-11	0.20%	0.50%	5.30%	1.20%	0.00%	0.00%	2.00%

* The observed prevalence among Transgender is multiplied by 2 considering that half of the denominators are sex workers and only that half is considered in the input sheets

Table C7: HTC inputs to AEM intervention worksheets and estimated ART coverage in Dhaka city

	Scaled HTC as per National Strategic Plan	ART Coverage (%)	
		Current coverage (2012)	Increased coverage with HTC by 2020
Clients of FSW	5	26.8	38.0
FSW-H&R	40	32.0	51.7
FSW-Street	40	34.6	52.9
MWID	50	23.2	64.1
FWID	50	29.3	54.2
MSM	10	22.3	31.3
MSW	40	22.1	49.3
TG	50	22.4	57.5
Low risk male	1	27.4	39.9
Low risk female	1	34.2	40.9

APPENDIX 4: FGD GUIDELINE FOR PWID

ASSESSMENT OF IMPACT OF HARM REDUCTION INTERVENTIONS AMONG PEOPLE WHO INJECT DRUGS (PWID) IN DHAKA

The following tools have been developed in order to assess the effectiveness of harm reduction program and to explore the reality of assumptions associated with the transmission of HIV and related risk behavior among PWID. The following questions and prompts will be used to guide the discussion to bring out insights and understandings of risk behavior that cannot be discerned from the AEM mathematical modeling.

PART I: FOR ALL PWID

1. What is your age and marital status? (*Ask all the participants*)

2. What is your education? (Level of education; when discontinued, why discontinued)

3. Are you or were you in any job? What job; what is/was your salary; when did you discontinue and why (if relevant)?

4. Household economy: what is the economic status of your household (probe); how many earning members are there; what do the other members of the household feel about the effects of drug use of one member?

5. What do you think is the cause of HIV transmission among injecting drug users in your locality/DIC?

6. How many people initiated drug injecting last year in your locality and what would be the major route of HIV (sharing of injecting equipment, unsafe sex, geographical mobility)?

7. In your view, to what extent have injecting drug users been closely associated with risky sexual practices? (Social and sexual networks among drug users and commercial and non-commercial partners including *hijra*)

8. In your observation, what proportion of drug users have had same sex sexual intercourse in the past years (explore whether due to same sex orientation, exchanging sex for money or drug)?

9. How crucial is the role of peer led activities in the various intervention component outcomes?

10. Is there a changed socio-behavioral and legal environment due to continued interventions? Effect on harm reduction, criminal behavior, incarceration history, etc?

PART II: INJECTING DRUG USERS LIVING WITH HIV/AIDS (ILWHA)

11. Is there any variation in incidence of HIV among drug users by age, duration of injecting, needle sharing and condom use over time?

12. What are the main challenges HIV-positive drug users are facing in Bangladesh? (*Focus on pattern of morbidity and mortality*)

13. What is the HIV-positive drug users' perception of their greatest needs (needles/syringes, OST, focus on whether they are currently taking ARV)?

14. What is the effect of HIV incidence / AIDS death on the family of the PWID?

15. What is not working well or not understood well? (challenges of harm reduction intervention)

PART III: PWID WHO ARE UNDER OST INTERVENTION

16. What according to you are the benefits of taking OST?

PART IV: PWID (FEMALE)

17. What are the benefits of establishing a separate DIC for PWID (Female)? Do you think PWID (Female) are more vulnerable to drug dependency or to be at higher risk of contracting HIV? (Explore gender inequalities, economic and social dependency upon men, women's power to refuse unsafe sex, breakdown of family, challenges of child rearing, reproductive health issues etc.)

APPENDIX 5: KII GUIDELINE FOR PROGAM MANAGER/ DEVELOPMENT PARTNERS

1. Why is there a variation of HIV prevalence among PWID in Old and rest of Dhaka city? (What factors might led to stable HIV prevalence and incidence among drug users in Dhaka city over the years – e.g. service seeking behavior, sexual behavior, number of sex partners etc.)

2. What measures have been taken in Old Dhaka area over the years to control the spread of HIV/HCV diseases (internal and external agencies)?

3. In your view, how many new HIV infections averted through the harm reduction program in Dhaka city? What way?

4. To what extent OST has reduced injecting drug use and decreased incidence of HIV/HCV through reduced needle sharing, mortality and criminal activity?

5. What factors do you think have contributed to the containment of the concentrated epidemic? (Probe after a while):
    i. Early and effective interventions
    ii. Circumcision
    iii. Low geographical mobility
    iv. Nature of sharing behavior and networks of sharing (e.g. shooting galleries, use of same syringe, etc.)
    v. Nature of networks (e.g. MSM and FSW behavior, etc.) and small vs. large networks

6. To what extent do you think PWID interventions helped prevent a larger epidemic (e.g. transmission among FSW, general population, etc.)?

7. How crucial is the role of peer led activities in the various intervention component outcomes?

8. Is there a changed socio-behavioral and legal environment due to continued interventions? Effect on criminal behavior, incarceration costs, etc?

9. What is not working well or not understood well? (challenges of harm reduction intervention)

10. What are the lessons for Bangladesh and the region?

APPENDIX 6: KII GUIDELINE FOR PROGRAM COORDINAOTR/DIC MANAGER

1. In your view, to what extent injecting drug users are covered under the Global Fund intervention program in your DIC area and Dhaka city?
2. In your observation, how is the supply of needles/syringes and condoms in your DIC? (How many syringes distributed last month, return rate, supply of ARV etc.)
3. What is the retention of injecting drug users into the harm reduction intervention program? (Coverage and drop-out of drug users with service intervention)
4. In your opinion how might AIDS affect people in our community now and in the future?
5. What measures are to be taken in future if someone is infected with HIV or hepatitis C? (What changes you would like to suggest, to improve the harm reduction services among drug users in Dhaka city)?
6. To what extent OST has reduced injecting drug use and decreased incidence of HIV/HCV through reduced needle sharing, mortality and criminal activity? (*focus on the supply of OST*)
7. Do you think HIV epidemiology is contained among PWID in recent time? What factors do you think have contributed to the containment of the concentrated epidemic? (Probe after a while:
    i. Early and effective interventions
    ii. Circumcision
    iii. Low geographical mobility
    iv. Nature of sharing behavior and networks of sharing (e.g. shooting galleries, use of same syringe, etc.)
    v. Nature of networks (e.g. MSM and FSW behavior, etc.) and small vs. large networks)
8. Have harm reduction interventions helped in preventing HIV transmission (e.g. transmission among FSW, general population etc.)? If so, how?
9. What are the main challenges HIV-positive drug users are facing in Bangladesh? (Focus on pattern of morbidity and mortality)
10. How crucial is the role of peer led activities in the various intervention component outcomes?
11. Is there a changed socio-behavioral and legal environment due to continued interventions? Effect on criminal behavior, incarceration history, etc?
12. What is not working well or not understood well? (challenges of harm reduction intervention)
13. What is the effect of HIV incidence / AIDS death on the family of the PWID?
14. What are the lessons for Bangladesh and the region?

APPENDIX 7: METHOD OF ANALYSIS

7.1 The input of data into the AEM workbooks

- ***Worksheet on population data***: This worksheet requires information on the population aged 15 years and above, divided according to sex (male and female) from 1975 – 2050.
- ***Worksheet on heterosexual data***: It requires information on the proportion of FSW within the general female population aged 15-49, and the proportion of their clients amongst the male population aged 15-49. This worksheet also included information on the length of time engaged in sex work, sexual behavior, the use of condoms in sexual intercourse with FSW as well as with permanent partners, STI prevalence, and the number of males who had been circumcised.
- ***Worksheet on IDU data***: This worksheet requires information on the proportion of PWID within the male population aged 15-49, history of needle sharing, condom use and at-risk sex.
- ***Worksheet on MSM/MSW***: Information is needed on the proportion of MSM and MSW within the male population aged 15-49, at-risk sexual behavior, including anal sex, condom use and STI prevalence.
- ***Worksheet on transgender***: It requires information on the proportion of TG within the male population aged 15-49, at-risk sexual behavior, including history of anal sex, condom use with their client make-up and STI prevalence.
- ***Worksheet on HIV prevalence***: The worksheet requires information about the trends of HIV prevalence among FSW, IDU, MSM, transgender and general populations in Dhaka city.
- ***Worksheet on ART***: It includes information on the number of adult males and females receiving ART as well as adult ART parameters and the proportion of new infections by CD4 level.
- ***Worksheet on validation data***: It requires information on the number of annual AIDS cases reported by gender and transmission route as well as annual HIV infections by gender.
- ***Worksheet on epidemics***: The worksheet requires information on the fertility rate and number of STI cases found among males and females based on age group.

In addition, the data input requires information for the Intervention Workbook which includes:

- ***Intervention effectiveness data***: It requires information on different key populations from best practice intervention packages in terms of condom use, injection sharing and number of injections per day, including STI prevalence.
- ***Program coverage data***: The workbook requires data on program coverage (between 2012 and 2020) for each sub populations.
- ***Unit costs of programs***: It requires information on the unit cost of interventions and ART between 2012 and 2020 for each sub populations.

7.2 Data source

The following data sources concerning the epidemiological profile and the behavioral aspects of key populations were used:

- NASP/DGHS/MoHFW. National HIV Serological and Behavioral Surveillance (2000-01, 2002, 2004-05, 2011)
- NASP/DGHS/MoHFW. Behavioral Surveillance Survey (BSS: 2003-04, 2006-07)
- NASP/DGHS/MoHFW. HIV/AIDS case reporting data (2007-2012)
- NASP/ DGHS/MoHFW. Population Size Estimates for Most at Risk Populations for HIV in Bangladesh
- National Syndromic Management Guidelines 1998-2004
- NIPORT, Mitra and Associates, and ICF International. Bangladesh Demographic and Health Survey (1999-2000, 2004, 2007, 2011)
- Program data on intervention coverage and ART recipients by gender
- Save the Children 2012. HIV prevention services for female sex workers (FSWs): effects of changes in STI management and condom promotion strategies. Unpublished.
- icddr,b 2006. Assessment of Sexual Behavior of Men in Bangladesh: A Methodological Experiment
- icddr,b 2011. Assessing the effectiveness and quality of harm reduction services for injecting drug users delivered through their peers in Dhaka and identifying gaps and barriers to effective service provision. Report Submitted to Save the Children, USA, December 2011.
- icddr,b 2012. Counting the Numbers of Males Who Have Sex with Males, Male Sex Workers and Hijra In Bangladesh to Provide HIV Prevention Services.
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7.3 Basic concepts and theories underlying economic analysis

Economic cost, as distinguished from financial cost, refers to the value of the optimum amount of inputs used for producing an output. The economic cost depends on both the cost of the alternative chosen and the benefit that the best alternative would have provided if chosen. Economic cost includes opportunity cost. Defined in this way, economic efficiency remains inbuilt in the cost. Economic efficiency as a concept is related to the value of money obtained from the use of resources. Highest efficiency is achieved at the level where the highest value of money is ensured, i.e., where a particular amount of resources produces the maximum possible output or where a particular amount of output is produced at the minimum level of cost. Cost is estimated only for the output levels that yield the highest economic efficiency. Thus, cost greatly differs from expenditure, since expenditure denotes any amount of money spent, regardless of whether the money produces maximum output (or whether it produces any output at all) or not. A project may not have to incur any expenditure for some inputs (e.g. donated land) but the value of the input is a part of its cost. Conversely, if a provider does not work in a facility but gets salary from it, there is expenditure but no cost. However, for operational purposes, an expenditure can be considered cost if the expenditure estimates are obtained after a proper Cost Minimization Analysis (CMA).

The cost function is derived from the economic theory of production. A production function is customarily assumed to specify the maximum output obtainable from a given set of inputs. The producer has also a linear budget line (or iso-cost line) determined by the input prices and the desired amount of investment, which shows that the total amount of input expenditure is the same at all of its points. Given the production function and the iso-cost line, a producer's equilibrium is achieved at the point where the iso-cost line is tangent to the production function. The necessary condition to be fulfilled for obtaining this equilibrium is that the ratio of marginal productivities is equal to the ratio of input prices, and the condition is fulfilled if each input produces the maximum possible output , the input-mix is most appropriate, and inputs are purchased at the minimum possible prices (or in competitive markets).

The cost function is derived from the comparative statics of production equilibrium. If the iso-cost line shifts upward (i.e., producer-desired expenditure for production increases), equilibrium points also move upward. The curve that joins the equilibrium is called the expansion path. The total cost curve is derived from the expansion path. Since the production equilibriums show the highest production efficiency at various levels of production expenditure, the points along the expansion path also show the highest level of production efficiency. Hence, the total cost curve also shows the costs at the highest levels of production efficiency.

Total cost has two components: total fixed cost and total variable cost. In a production process, two types of inputs are used: fixed inputs and variable inputs. The inputs whose amounts remain fixed at all levels of output are the fixed inputs, while the inputs whose amounts vary as the volume of output changes are the variable inputs. Examples of fixed cost are land, building, furniture, durable equipment, salary of managers whereas drugs, contraceptives, micronutrients, etc. are examples of variable costs. Sometimes another type of input is used as well, which can be called quasi-fixed (or quasi-variable) inputs. The amount of this type of inputs changes at certain interval of outputs: It remains constant for some amount of output, but changes if the quantity exceeds that amount. Chairs in the reception room of the facility, vials of child immunization vaccine and field-level health workers fall into this type.

The average cost curve can be derived from the total cost curve. The average cost curve in the short run will be U-shaped. The shape of the short-run average cost curve is a result of the fact that the total cost function is cubic. Economic efficiency is directly related to the location of cost along the average cost curve (or curves). The economic efficiency of a production process is highest if output is produced at the lowest level of the short-run average cost curve. Sometimes a producer has several methods for producing the same level of the same output. In that case, the producer faces several short-run average cost curves, all having a highest level of production efficiency (under different production methods).

For the managers, cost has to be divided into two other categories: capital cost and recurrent cost. Capital cost refers to the costs for the inputs that produce output over a period of more than one year. The recurrent cost is to be incurred every year. Costs for land, building, and equipment are capital costs, and costs for manpower, drugs and travel are recurrent costs. The distinction between fixed and variable costs is related to the behaviors of costs with respect to change in output, while that between capital and recurrent costs is related to the behavior of costs with respect to change in time (year). The program managers need to know the amounts of capital and recurrent costs in order to judge the expediency (feasibility) of the program as well the amounts to be incurred every year. The efficaciousness of the cost estimates should be judged using the following criteria:

- The estimates are obtained at the maximum level of production efficiency, i.e., cost is the minimum for each level of output.
- In the short run, the average cost has the tendency to move toward the lowest point of the average cost curve as output increases in the short run (optimality).
- The average cost declines in the long run (showing returns to scale).
- If several methods can be applied to produce the output of the program and average cost curves corresponding to the methods intersect, then the curve that shows lower average costs at the higher level of output should be chosen.
- Capital cost is low and recurrent cost is high, so that the investment requirement in the initial years is low.
- Fixed cost is low and variable cost is higher. Fixed cost represents the public good character and externality of inputs; the fixed inputs are more susceptible to misuse and wastage. Moreover, fixed cost does not change as output increases and, hence, its amount is higher in the earlier years of the program. The variable cost represents the pure private good character of inputs and it is visible and divisible. These variable inputs are used more efficiently than are the fixed inputs.
- Average cost and marginal cost are low, so that the financial sustainability of the program is high.

7.4 Economic efficiency and economic evaluation

Economic theory deals with three types of efficiency: technical efficiency, production efficiency, and allocative efficiency. In production, technical efficiency is highest when the production function exists, i.e. when each input produces its maximum possible output. Production efficiency is highest when the iso-cost line is tangent to the production function, i.e. when a particular amount of output is produced at minimum possible cost. The cost curve embodies highest production efficiency. These two types of efficiency have already been reflected upon in the earlier subsection when analyzing the behavior of the costs. The remaining type of efficiency is the allocative efficiency. There are two sides in any economic activity: supply/production and demand. Unlike production efficiency, allocative efficiency addresses both sides: it is highest when the cost of production is minimal and consumers/clients obtain maximal satisfaction from the output. Microeconomics deals mainly with how to maximize allocative efficiency. In a competitive market situation, the highest level of allocative efficiency is achieved at the point of intersection of demand and supply curves.

For a project which generates a flow of output over a period of several years, the supply and demand curves are not visible (although they exist) even in a competitive market situation and, hence, the point of intersection of the supply and demand curves, or the level of allocative efficiency, cannot be identified. In such a case, the level of production efficiency is assessed using the theory of capital budgeting of economics. According to this theory, there are two criteria for judging the efficiency of investment: the present value (PV) criterion and the marginal efficiency of investment criterion - the last one is also called the internal rate of return (IRR) criterion.

In the PV criterion the discounted present value of outputs of all years of a project is computed using the following formula:

$$PV = R_0 + \frac{R_1}{1+r} + \frac{R_2}{(1+r)^2} + \ldots\ldots\ldots\ldots\ldots + \frac{R_n}{(1+r)^n}$$

Where R = the return of the project and r = the market rate of interest, and the subscripts show the years. Similarly, the discounted present value of cost incurred in different years by the project is also estimated, as

$$C = C_0 + \frac{C_1}{1+r} + \frac{C_2}{(1+r)^2} + \ldots\ldots\ldots\ldots\ldots + \frac{C_n}{(1+\sigma)^n}$$

Then the ratio PV/Cost (C) is computed for the project. If the ratio is greater than 1, or the inverse of the ratio (C/PV or unit cost) is less than 1, the project is economically worthwhile. If the PV/C ratio of the project is greater than that of other projects, the economic efficiency of the project is highest.

In recent years, the use of the PV criterion has been increasing in many social sectors, especially in the sectors of health and education.

The social/public sectors produce many outputs for which a market does not exist or does not properly work and, hence, the government or the NGOs, instead of the private producers, have to produce these outputs. Although the market does not exist and the demand and supply curves are not visible for these outputs, the objective of the government and the NGOs still remains the same: the maximization of allocation efficiency or at least of production efficiency. Nevertheless, many of the outputs of the social sectors cannot be directly measured in terms of money. However, sometimes the money value of the outputs can be estimated indirectly. In such cases the cost-benefit analysis (CBA) is used to determine the level of economic efficiency of the project. The CBA is just an operational variant of the PV criterion. The main prerequisites for applying the cost benefit analysis technique is that the money values of the benefits of the project under study and of comparable projects can be estimated at least indirectly.

In the social sector the outputs of many projects can not at all be converted into money values. In those cases, cost-effectiveness analysis (CEA) is used to assess the level of economic efficiency of the project. In CEA, the unit costs of outputs or effects of several (at least two) projects are computed and compared. The main preconditions for applying the CEA technique are: the outputs produced by the projects being compared are the same in nature (but not in amount), and each project produces a single outcome.

There are many cases in the social sector where the projects to be compared do not produce the same type of output. In those cases, CEA is not applicable. In the health sector, cost-utility analysis (DALY or Quality Adjusted Life Years) is used for those cases.

The worst possible case emerges when only one project exists to produce a particular output. If the comparable projects are not there, then, whether or not the outputs or outcomes of the projects can be measured in terms of money, none of the above techniques of project appraisal is applicable. The only technique to be used is the cost-minimization analysis (CMA). The costs of the project are examined by line item and an assessment is made as to whether costs can be reduced in any line item and cost center without affecting the volume of output/outcome of the project.

APPENDIX 8: Key AEM Findings from Assessment

Key Findings from

Assessment of Impact of Harm Reduction Interventions among People Who Inject Drugs (PWID) in Dhaka

DECEMBER, 2014

Save the Children icddr,b UNAIDS

Background

- In the past, several studies have been carried out among key populations including PWID in the country. But there is little empirical evidences on:
  - How many infections are being averted amongst PWID and amongst general population?
  - How many PWID died due to AIDS in Bangladesh?
  - How many deaths are being averted amongst PWID in the country?
  - Was it worth investing among PWID?
  - To what extent can we scale up efficiently?
- The study used qualitative and quantitative approaches including FGDs, modeling (AIDS Epidemic Model), and economics analyses

2

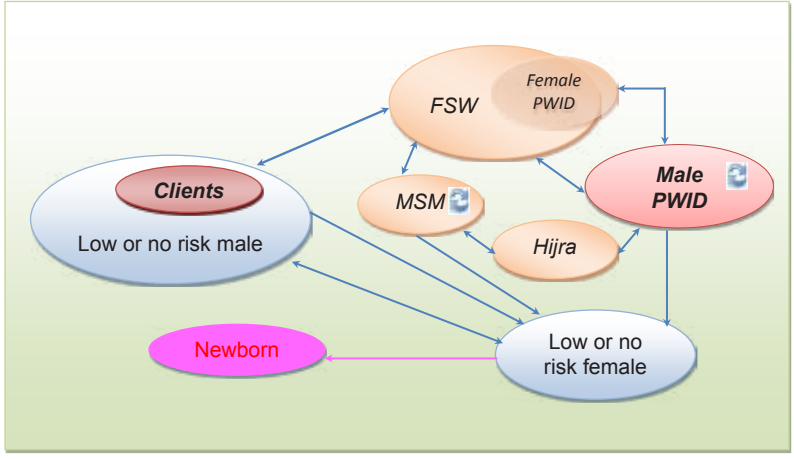
Data Analysis through AEM

- AEM is the tested policy and planning tool successfully adopted recently in many countries including Thailand, Indonesia, Myanmar, Vietnam, Pakistan, Uzbekistan, etc.
- The study collects relevant time series data on AEM input indicators between 2000 and 2012 and presents the AEM output results for the period 2013-2020
- It interprets the dynamics of HIV transmissions among different KP groups
- It also provides the projections of risk population groups for any specified years, trends in new infections, death averted (life saved) and infections averted
- It analyses returns on investments

3

HIV Transmission Dynamics

The AEM is a semi-empirical process model that replicates the transmission dynamics of HIV in Asian settings

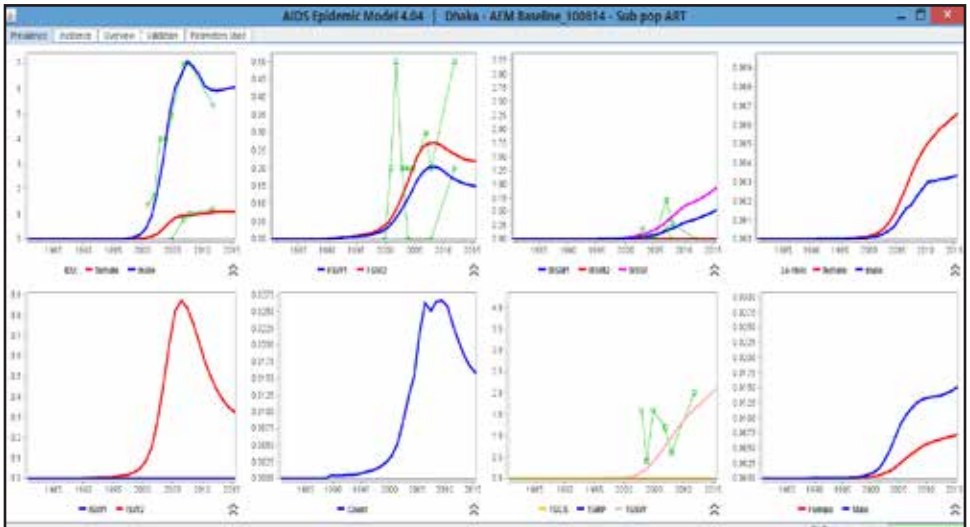


4

AEM Inputs

- Each of these populations and the primary behaviors which transmit HIV, including vaginal sex, anal sex, and sharing of injecting equipment are included in the model
- AEM utilizes a number of equations to produce the model outputs by the specified transmission routes based on the following inputs:
  - *Size of these key populations*
  - *Average duration, for which people remain in key populations (to calculate turnover and movement)*
  - *Frequency of risk behaviors, e.g., number of vaginal or anal sex acts per week, number of injections shared in the last year*
  - *Levels of protective measures taken with different partner types, e.g., condom use, etc.*
  - *HIV and STI prevalence in each key affected population*

5



6

State of HIV/AIDS in Dhaka City with and without early interventions

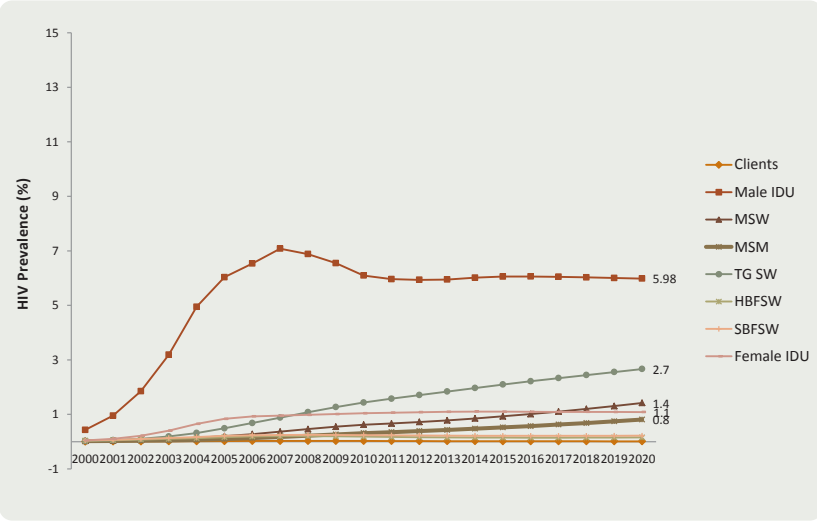
Comparison of two scenarios with current baseline interventions:
- without PWID interventions since 1995 in Dhaka city
- without key populations interventions since 1995 in Dhaka city

AEM provides the relevant outputs based on the assumption that the current scale of interventions among the PWID and other Key Populations continues

AEM also provides outputs by assuming no intervention among PWID and / or other Key Populations in Dhaka city since 1995

7

Trends of HIV Prevalence, 2000-2020 (Dhaka)
(current interventions ongoing)



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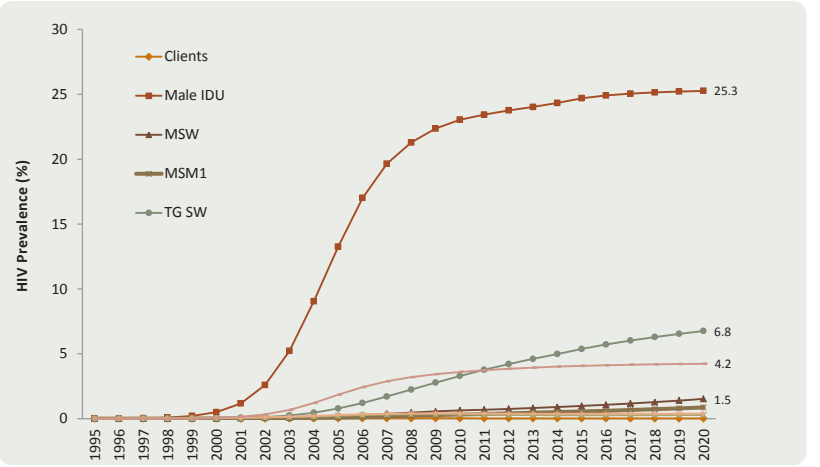
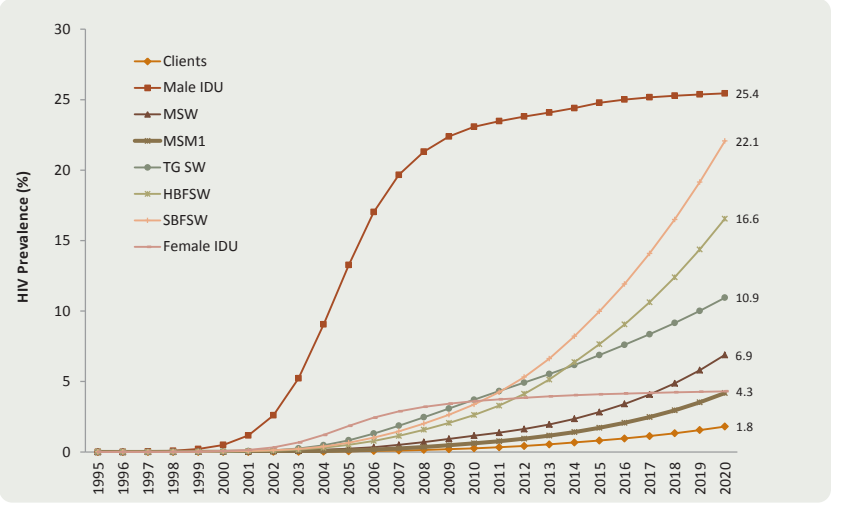
Trends of HIV Prevalence, 2000-2020 (Dhaka)

(No PWID intervention since 1995)



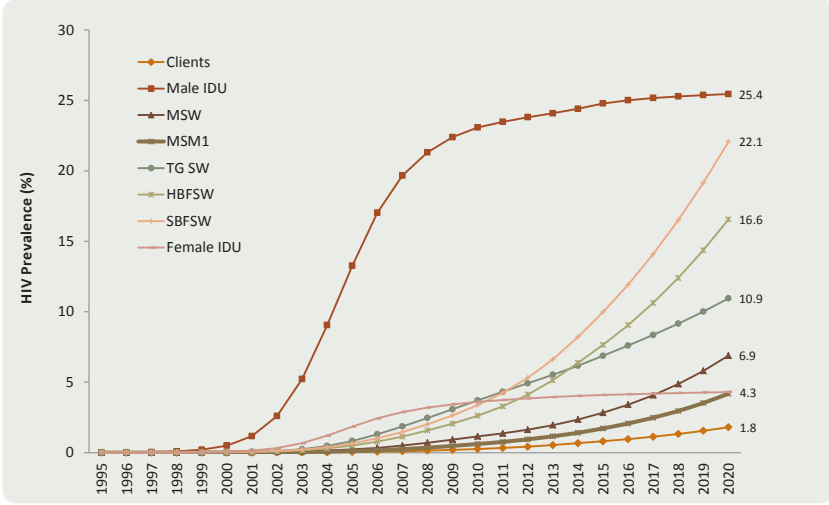
Trends of HIV Prevalence, 2000-2020 (Dhaka)

(No KP intervention since 1995)



Trends of HIV Prevalence, 2000-2020 (Dhaka)

(No KP intervention since 1995)



AEM Output Summary for Dhaka

Indicators	Current coverage maintained		No PWID interventions since 1995				No KP interventions since 1995			
	2012	2020	2012	2020	Diff: 2012	Diff: 2020	2012	2020	Diff: 2012	Diff: 2020
New HIV infections:	115	172	300	386	185	214	1,375	4,967	1,260	4,795
Current PLHIVs:	961	1,437	2,110	3,211	1,149	1,774	5,571	24,614	4,610	23,177
Annual AIDS death:	71	102	170	248	99	146	333	1,216	262	1,114
Annual ART needs:	362	911	731	1,978	369	1,067	1,579	14,283	1,217	13,372
Number on ART:	98	334	98	573	-	239	98	4,245	-	3,911
Male-Female Inc Ratio:	2.50	3.65	2.64	3.08	-	-	2.11	2.00	-	-
Cumulative infections:	**1,401**	**2,527**	**2,968**	**5,683**	**1,567**	**3,156**	**6,855**	**31,390**	**5,454**	**28,863**
Cumulative deaths:	**440**	**1,090**	**858**	**2,472**	**418**	**1,382**	**1,285**	**6,777**	**845**	**5,687**
Cumulative M/F Ratio:	2.97	3.10	3.26	3.09	-	-	2.46	2.09	-	-

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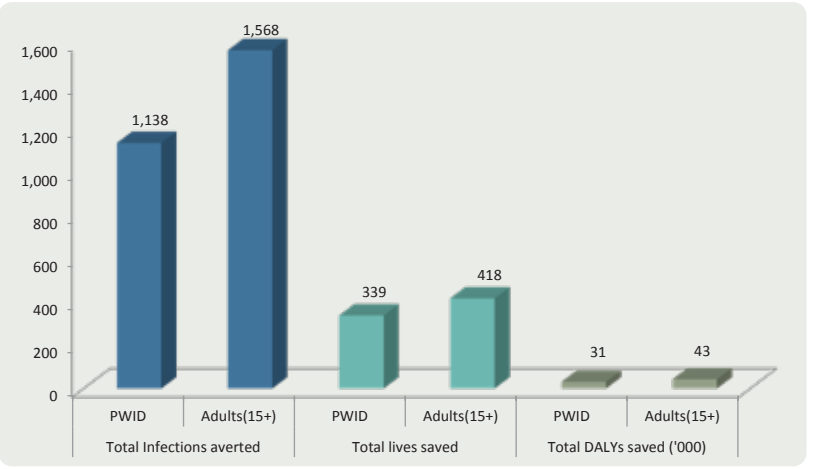
Total Infections Averted, Lives and DALYs Saved in 2012 due to PWID interventions in Dhaka



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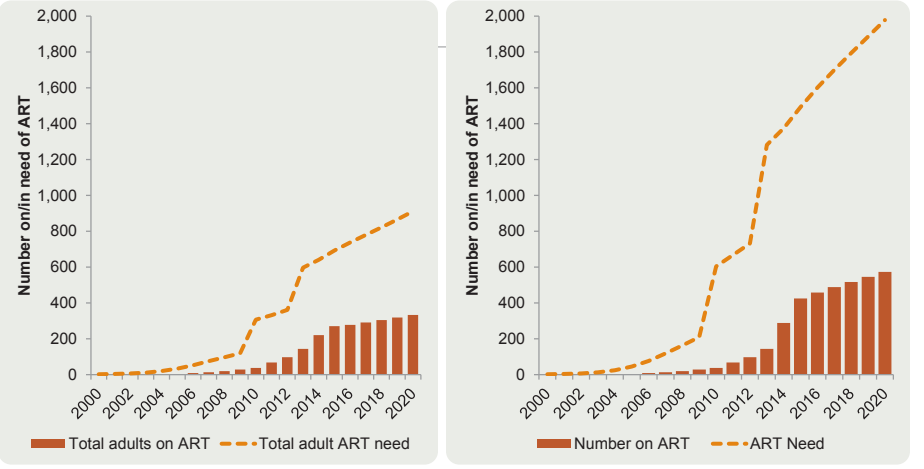
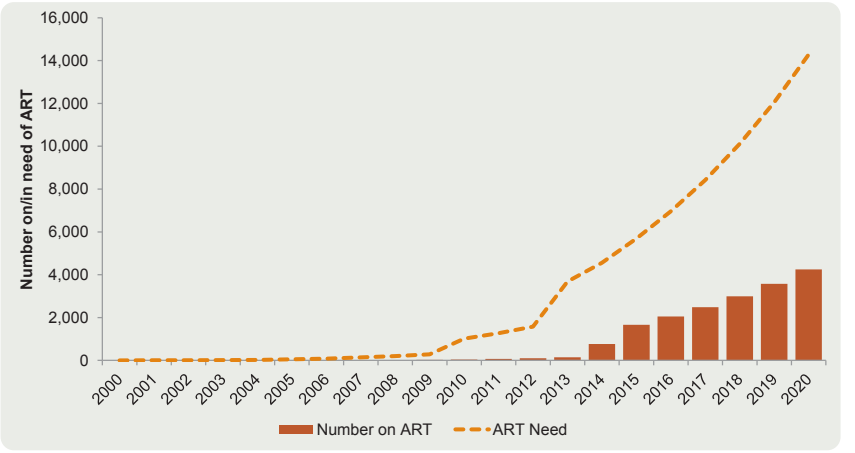
Total Adult ART Coverage and Need, Dhaka: 2000-2020

(current interventions ongoing) (no PWID Interventions)



Treatment costs increase 2 folds

Total Adult ART Coverage and Need, Dhaka: 2000-2020
(No KP Interventions)



Treatment costs increase >10 folds

Policy Scenarios for the Future of the Epidemic in Dhaka city

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Effective Intervention Scenarios and Scale-up in Dhaka

Scenarios	Description	
Baseline	Existing interventions maintained	Current coverage of interventions to be maintained: PWID-Male (92%), PWID-Female (41%), FSW (43%) and MSM (24%), MSW (89%), TG (82%) with OST: Male (3%) and Female (1%)
Scenario 1	PWID scaled up	Current coverage to be scaled up among PWID-Male (100%) and PWID-Female (65%) with OST: Male (5%) and Female (3%). Maintained among the other groups
Scenario 2	MSM scaled up	Current coverage to be scaled up among MSM (50%) and maintained among the other groups
Scenario 3	FSW scaled up	Current coverage to be scaled up among FSW (65%) and maintained among the other groups
Scenario 4	All interventions programs scaled up 1	Current coverage to be scaled up among PWID-Male (95%), PWID-Female (55%), FSW (65%) and MSM (35%), MSW (95%), TG (90%) with OST: Male (5%) and Female (3%)
Scenario 5	All interventions programs scaled up 2	Current coverage to be scaled up among FSW (80%), MSM (50%), PWID-Male (95%), PWID-Female (80%), MSW (95%) and TG (95%) with OST: Male (10%) and Female (5%)

…. and HTC scale up as per National Strategic Plan

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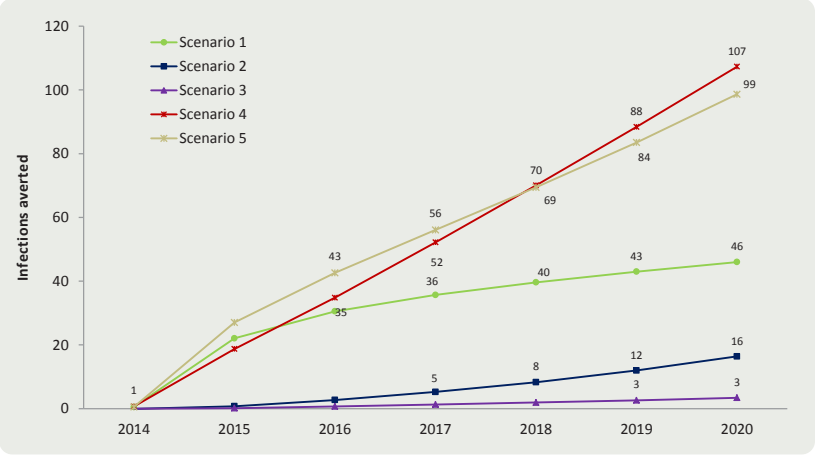
Total Infections Averted per Year in Dhaka



Total additional infections averted over 7 years in Dhaka on scale up (Scenario 4): 372

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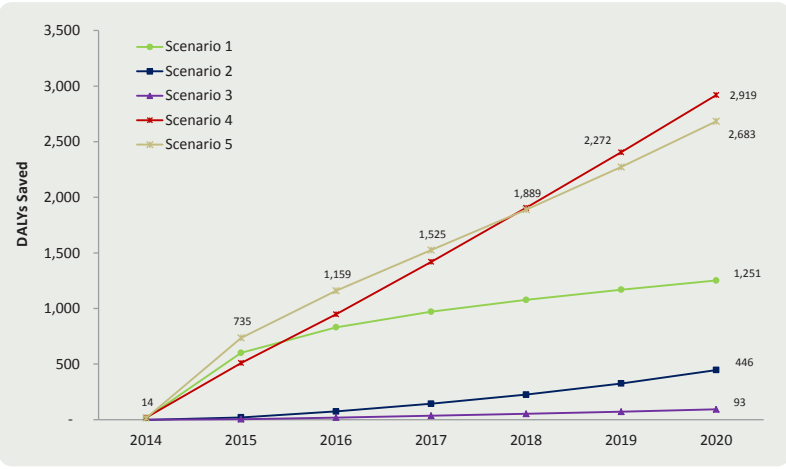
Total DALYs saved per year (in Dhaka)



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Resource Need and Cost Effectiveness Analysis

This analysis provides resource required for each of the intervention scenarios and also compares the cost effectiveness of the scenarios to identify the most effective intervention scenario

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Program Coverage and Unit Cost, 2012

Risk Groups		Coverage (%)	Unit cost (UD$)
FSW1	HBFSW	43	88
FSW2	SBFSW	54	82
Male-IDU	NSE	92	157
	OST	3	340
Female-IDU	NSE	41	157
	OST	1	340
MSM	MSM	24	75
	MSW	89	85
TG	TG-SW	82	140
ART	Male	24	670
	Female	28	670

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Resource Required (in thousand UD$), 2014-2020 over 7 years

Indicators	Intervention Scenarios					
	Baseline	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
Resource Required:						
Prevention Cost	18,900	19,360	22,325	19,698	**21,600**	25,032
Treatment Cost	1,352	1,406	1,249	1,269	**1,344**	1,299
Total Cost	20,252	20,765	23,574	20,968	**22,945**	26,331
Marginal Resources Required:						
Additional Prevention Cost		459	3,425	798	**2,700**	6,132
Additional Treatment Cost		53	(104)	(83)	(8)	(53)

Under Scenario 4:

Approx. USD 2,700,000 additional needed to avert 372 infections over 7 years

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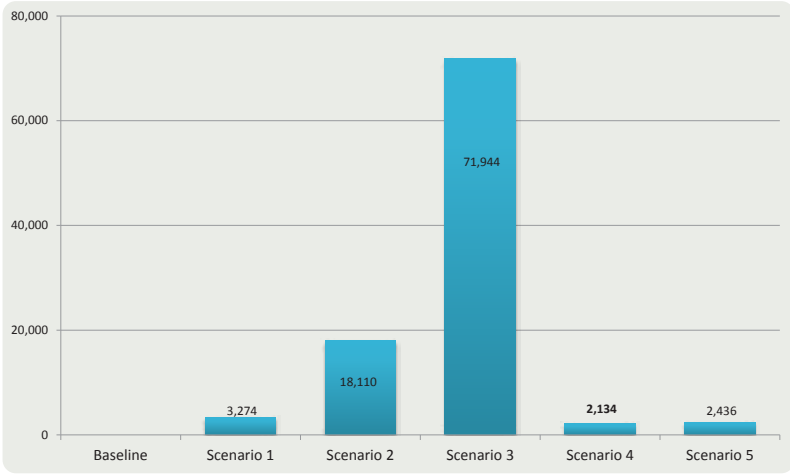
Cost per DALY saved (US$)



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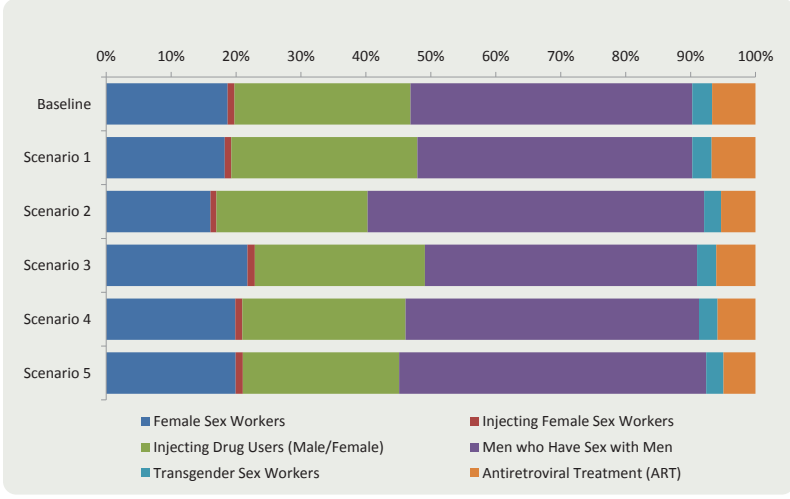
Proportion of Resource Needs by Area, 2014-2020



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Key Messages and Recommendations

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Key Messages

- HIV prevalence will remain stable among male PWID at around 6 percent in Dhaka city from 2013 to 2020 if current scale of interventions continues; but new HIV infections will continue to increase
- If no harm reduction interventions were in place, HIV prevalence among PWID in Dhaka city in 2012 was projected to be about 23 percent
- Deaths due to AIDS among PWID are projected to drop to 23 percent in 2020 in Dhaka city if current interventions continue. The reduction in the number of AIDS deaths among PWID is probably the result of the country's continuous intervention program among the key populations

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Key Messages contd…

- A total of 1,568 new infections among adult population and 1,138 new infections among PWID have been averted since 1995 in Dhaka city because of interventions dedicated to PWID
- Scaling up focused prevention programs targeting a single at-risk group may have marginal effect even when other interventions continue at current scale
- The benefit-cost ratio for the Harm Reduction program that has been implemented in Dhaka during the last 15-year period was 1.37 till date and, hence, the program satisfied the standard criterion of return on investment
- Lack of funding to undertake such interventions can have a negative effect on program delivery, including reducing the prevalence of HIV and other blood-borne viruses among key populations

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Recommendations

- Prevention programs should be continued and consist of interventions that have proved to have significant effects in reducing HIV/STI risk behaviors or increasing HIV/STI-protective behaviors
- The key populations driving the HIV epidemic need continued access to user-friendly HIV prevention, VCT and STI services that are designed to meet their needs and are adapted to the context
- STI control is critically important for HIV prevention as the risk of HIV transmission is higher with concurrent STIs

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