

**SCALING UP HIV/AIDS PREVENTION IN INDIA: AN  
ECONOMIC ANALYSIS OF AVAHAN INTERVENTIONS FOR  
HIGH RISK GROUPS IN FOUR SOUTHERN STATES**

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## ABSTRACT

**Background:** Many HIV prevention interventions have been implemented in India but there is very limited data on costs and effectiveness of large scale HIV prevention interventions targeting high risk groups over time. Most of the existing studies deal with service level resource needs. Moreover, none include the costs of supporting the scale-up above the service level, even though these programs may require substantial initial investment in capacity constrained environments.

**Objectives:** The present study in the southern Indian states looks at estimating the program costs at different organisational levels and specific project level costs and outcomes for different high risk groups and specific interventions like community mobilization and explore the HIV prevention costs by scale and typology over time.

**Methods:** Cost data was collected from 138 NGOs in 64 districts and detailed cost analysis for 23 districts in the four states based on the UNAIDS Costing Guidelines for HIV Prevention. Costs were collected using an ingredients-based costing methodology including both the financial and economic costs. The program data from four states (Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra) was analysed which is unique in the sense that none of the other studies are of this scale and from India.

**Results:** Unit costs per person reached fell over time, suggesting economies of scale. In addition, the variations found in unit costs between NGOs also suggest efficiency gains with program maturity. Costs structures change substantially over time as HIV prevention programs scale up. Above service level costs are considerable, but usually not measured in cost and efficiency analyses. These costs are essential to consider when scaling up HIV prevention.

**Conclusions:** This thesis would add to the limited evidence base on costs of large scale HIV prevention interventions globally and provide better estimates of cost-effectiveness of targeted programs for high risk groups.

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## TABLE OF CONTENTS

ACKNOWLEDGEMENTS.....	iii
LIST OF TABLES.....	ix
LIST OF FIGURES .....	x
ABSTRACT.....	xi
LIST OF ACRONYMS .....	xiii
SUMMARY AND STRUCTURE OF THE THESIS .....	xv
CHAPTER 1 INTRODUCTION AND BACKGROUND .....	1
1.1. Global and Regional Epidemic Update on HIV .....	1
1.2. Resource Needs Estimates Trends Over Time.....	4
1.3. HIV/AIDS Financing in India.....	7
CHAPTER 2 LITERATURE REVIEW .....	9
2.1. The Cost-Effectiveness of HIV Prevention for HRGs.....	9
2.2. Cost of HIV Prevention Intervention for Different High Risk Groups .....	13
2.3. Cost Drivers .....	21
2.3.1. Scale.....	21
2.3.2. Typology of Sex Work Matters .....	23
2.3.3. Program Maturity.....	27
2.3.4. Intervention Components.....	27
2.3.5. Contextual Factors .....	28
2.3.6. Program Management Costs.....	28

2.4. Conclusions.....	29
2.5. Hypothesis, Aim and Objectives of the Study .....	30
2.5.1. Hypothesis.....	30
2.5.2. Aim of the Thesis.....	30
2.5.3. Objectives .....	30
2.6. Application of This Study to Policy and Practice .....	31
CHAPTER 3 METHODOLOGY .....	33
3.1. Introduction and Definitions .....	33
3.2. Summary of Main Costing Methods.....	36
3.3. Justification for the Methods Used .....	38
3.4. Research Setting.....	41
3.4.1. Current HIV Estimates for India.....	41
3.4.2. Staging the Epidemic and the Need for Prioritizing the Target Populations ..	43
3.4.3. Avahan Program Description.....	44
3.5. Intervention Description and Project Activities.....	46
3.5.1. Start-up Activities .....	46
3.5.2. Outreach Education.....	46
3.5.3. Sexual Transmitted Infections Services.....	47
3.5.4. Capacity Building .....	48
3.5.5. Condom Promotion.....	49
3.5.6. Community Mobilization.....	49



3.5.7. Advocacy and Enabling Environment .....	49
3.6. Cost procedures.....	50
3.6.1. Data Collection .....	50
3.6.2. Field Visits .....	51
3.6.3. Criteria for District Selection for Detailed Sites.....	53
3.6.4. Cost Classification .....	54
3.6.5. Summary of Data Sources .....	58
3.7. Cost Allocations.....	59
3.7.1. Activity Based Analysis.....	59
CHAPTER 4 RESEARCH PAPER 1 .....	70
CHAPTER 5 RESEARCH PAPER 2 .....	72
CHAPTER 6 RESEARCH PAPER 3 .....	73
CHAPTER 7 RESEARCH PAPER 4 .....	74
CHAPTER 8 RESEARCH PAPER 5 .....	75
CHAPTER 9 DISCUSSION OF THE FINDINGS .....	76
9.1. Overview of the Findings.....	77
9.2. Policy Implications of the Various Research Papers of Our Study .....	84
9.3. Limitations of the Study.....	87
9.4. Future Work.....	89
9.4.1. On-going Further Analysis Based on This Costing Database .....	89
9.5. Conclusion .....	90

REFERENCES .....	91
ANNEXURES .....	117
Annexure 1: Life of Capital Inputs .....	117
Annexure 2: Records Review .....	118
Annexure 3: Weekly Time sheet for Project staff .....	122
Annexure 4: Activity Based Costing Description in Time Sheets.....	124
Annexure 5: Weekly Time Sheet for Doctors.....	125
Annexure 6: Guidelines for Peer Discussions .....	127
Annexure 7: Questionnaire for Key Project Staff on Community Mobilization.....	131
Annexure 8: Questionnaire for SLP Core Team Staff on Community Mobilization	134
Annexure 9: Ethical clearance .....	135
Annexure 10: Published article license.....	136
Annexure 11: Co-Authored Abstracts .....	145

## LIST OF TABLES

Table 1: Regional and global estimates of HIV epidemic 2013 .....	2
Table 2: Summary of cost studies in developing country context from India .....	16
Table 3: Epidemiological categories.....	43
Table 4: Annualization factors.....	57
Table 5: Data sources.....	58

## LIST OF FIGURES

<b><i>Figure1: AVAHAN INTERVENTION SITES INCLUDED IN DIFFERENT RESEARCH PAPERS</i></b>	<b>51</b>
Figure 2: Organizational levels of cost analysis .....	56

## ABSTRACT

**Background:** Many HIV prevention interventions have been implemented in India but there is very limited data on costs and effectiveness of large scale HIV prevention interventions targeting high risk groups over time. Most of the existing studies deal with service level resource needs. Moreover, none include the costs of supporting the scale-up above the service level, even though these programs may require substantial initial investment in capacity constrained environments.

**Objectives:** The present study in the southern Indian states looks at estimating the program costs at different organisational levels using specific project level costs, outcomes for different high risk groups, specific interventions like community mobilization and explores the HIV prevention costs by scale and typology over time.

**Methods:** Cost data was collected from 138 NGOs in 64 districts and detailed cost analysis was done for 23 districts in the four states based on the UNAIDS Costing Guidelines for HIV Prevention. Costs were collected using an ingredients-based costing methodology including both the financial and economic costs. The program data from four states (Karnataka, Andhra Pradesh, Tamil Nadu and Maharashtra) was analysed. This is unique in the sense that none of the other studies are of this scale and from India.

**Results:** Unit costs per person reached fell over time, suggesting economies of scale. In addition, the variations found in unit costs between NGOs also suggest efficiency gains with program maturity. Costs structures change substantially over time as HIV prevention programs scale up. Above service level costs are considerable, but usually



not measured in cost and efficiency analyses. These costs are essential to consider when scaling up HIV prevention.

**Conclusions:** This thesis would add to the limited evidence base on costs of large scale HIV prevention interventions globally and provide better estimates of cost-effectiveness of targeted programs for high risk groups.

## LIST OF ACRONYMS

AIDS	Acquired Immunodeficiency Syndrome
ANC	Antenatal clinic
ART	Anti-retroviral Therapy
ARV	Anti-retroviral
BCC	Behaviour Change Communication
BMGF	Bill and Melinda Gates foundation
CBO	Community Based Organization
CEA	Cost-effectiveness Analysis
CMIS	Computerized Management Information System
DALY	Disability Adjusted Life Year
DIC	Drop in Centre
FSW	Female Sex Workers
GDP	Gross Domestic Product
HIV	Human Immune-deficiency Virus
HRG	High Risk Group
IBBA	Integrated Biological and Behavioral Assessment
ICTC	Integrated Counselling and Testing Centre
IDU	Intravenous Drug Use
IP	Implementing Partner
KP	Key Population
MIS	Management Information System

MSM	Men who have Sex with Men
NACO	National AIDS Control Organization
NGO	Non-Governmental Organization
NHP	National Health Policy
ORW	Outreach Worker
PLWHA	People Living With HIV/AIDS
PPTCT	Prevention of parent to child transmission
PSA	Participatory Site Assessment
QALY	Quality Adjusted Life Year
RNTCP	Revised National Tuberculosis Control Program
SHG	Self-help Group
SLP	State Lead Partner
STI	Sexually Transmitted Infections
TG	Transgender
TI	Targeted Intervention
UNAIDS	United Nations Joint Program on HIV/AIDS
WHO	World Health Organization

## SUMMARY AND STRUCTURE OF THE THESIS

This thesis aims to explore how costs change over time during the scale up of HIV prevention interventions and to understand what factors drive the costs during scale up. The thesis assesses the effect of scale on costs, costs by typology of high risk groups and incremental costs of special activities like community mobilization and enabling environment in the HIV prevention services package. In addition, it also estimates the above service level costs and attempts to understand how different organizational structures influence the unit costs.

Chapter 1 provides a brief overview of the global and regional HIV epidemic, resource needs and the global response to address this major public health problem.

Chapter 2 summarises the available evidence on costs of HIV prevention programs for high risk groups from the literature in a developing countries context. The review includes studies focussed on different countries and the lessons learnt, innovations tried and challenges faced. The package of interventions that are assessed, the organizational levels considered and various factors that are driving the resource use in studies are discussed. This chapter also tries to understand why pilot projects might fail when they are scaled up and the important aspects to be considered while scaling up and replicating successful programs. A critical review of the methodologies of the studies is compiled along with the limitations of many studies which exclude above service level costs. A section also deals on the costs of the interventions and their effectiveness in different settings. Further, it discusses the available evidence on efficiency of health care programs and how it relates to HIV prevention interventions.

Chapter 3 describes the research methodology of this thesis. This section includes the study setting, HIV situation, the national governments response to the epidemic and the resource available. A detailed account of the methods used to meet each of the study objectives, including selection of sites, field visits, data sources both financial and programmatic and data collection instruments used, is provided. An account of the cost analysis considerations in the study including the type and classification of costs by activity and allocation issues of costs at different organizational levels is discussed. The research approvals and the ethical clearances taken are also provided. A dedicated section on the description of the *Avahan* Intervention program in India is also provided.

Chapter 4 includes **Research paper 1 (Published-STI BMJ)**: The effects of scale on the costs of targeted HIV Prevention interventions among female and male sex workers, MSM and transgender in India. This paper describes the costs during initial scale up of HIV prevention programme especially the start-up costs, and to what extent scale, an important variable can reduce costs.

Chapter 5 is based on **Research paper 2 (Published-PLOS One)**: Measuring costs of scaling up prevention program for high risk groups: lessons learned from the Avahan Program in four southern states of India. This paper presents the costs of Avahan intervention districts in four southern states over a period of 4 years, including cost at service level, above service level (state lead partner) and programme level (BMGF national office) and provides insights into the variation in costs across sites. Assessing costs over the life of the project helps to identify how costs vary with the changing needs and strategies of the programme.



Chapter 6 is based on **Research paper 3 (Submitted to BMC Health Services Research)**: Above service level costs of large scale HIV prevention program (Avahan) for high risk populations in four southern states of India. This chapter presents a descriptive analysis of the above service level costs of the intervention implemented by the State lead partners in the four states. It also discusses the organizational differences in the structure of program implementation. It further explores the variation of the costs of the programs implemented by different partners.

Chapter 7 is based on **Research paper 4 (Published BMC Public health)**: *The costs of HIV prevention for different target populations in Mumbai, Thane and Bangalore*. There is little information on the costs of reaching different typology of female sex workers (FSWs) and different high-risk groups like high risk men who have sex with men (MSM). This paper presents the costs involved in reaching and providing comprehensive HIV prevention services to different typology of sex workers and MSMs. Developing comprehensive sexual health promotion programmes require understanding of sex work typology in a particular area. The typology data has strategic implications for planning behavioral interventions for different types of high risk groups.

Chapter 8 presents the **Research paper 5 (Co-authored-published PLOS ONE)**: The incremental costs of community mobilization and empowerment interventions for female sex workers in two districts of Karnataka, Southern India. In this paper incremental costs of community mobilization which included drop-in Centre (DIC) activities, facilitating enabling environment, formation of collectives and self-help groups and strengthening them to form community-based organizations (CBOs) are analyzed. Recent evidence suggests inclusion of structural programmatic

components as part of FSW HIV programming may have important impacts on risk behavior. This paper gives insights into the costs of community mobilization activities which would be helpful for programme managers and policy makers for planning resource required to implement these activities. The cost data from this analysis has been used to estimate the cost-effectiveness of community mobilization and empowerment interventions. This co-authored paper is published in (PLOS ONE).

Finally, Chapter 9 provides an overview of the findings from this study and key results and how they compare with regional and international studies available on this topic. It also emphasizes the implications of this study to the national program and policy and provides priorities for future research work in this area.

## CHAPTER 1

### INTRODUCTION AND BACKGROUND

#### 1.1. Global and Regional Epidemic Update on HIV

It has been estimated globally that about 35 million (33.2-37.2 million) people are living with HIV/AIDS of which about 1.5 million (1.4 million -1.7 million) have succumbed to AIDS related deaths by end of 2013. About 4.8 million people live with HIV/AIDS in Asia. AIDS related deaths have shown a decrease by about 35%(UNAIDS 2014). The key statistics on HIV/AIDS of different regions are shown in Table-1. (UNAIDS 2013). Asia has 60% share of the world population and is second only to sub-Saharan Africa in terms of people affected with HIV/AIDS. India accounts for half of Asia's number with only Thailand accounting for adult HIV prevalence greater than 1%. India, one of the countries with largest number of HIV cases in this region has also seen a decline in the number of new infections by 56% from 2001-2011(NACO 2012). In China there has been a shift in HIV transmission from the Injecting drug route to heterosexual transmission(Zheng, et al., 2014). The epidemic setting in China is concentrated, about six provinces account for 53% of the people living with HIV(UNAIDS 2011; UNGASS 2012; Suguimoto; Techasrivichien et al., 2014).

The UNAIDS (2011) vision is to achieve its targets for 2015 so that the global community can move towards a world with "Zero new HIV infection, Zero discrimination and Zero AIDS related deaths".(UNAIDS 2010) The number of new infections globally has decreased by 33% over the last 13 years(UNAIDS 2013). The major reduction has been from the sub-Saharan countries but over half of the deaths

reported due to AIDS are still from this region. The greater availability of Anti-retroviral treatment at low cost has helped to reduce the number of deaths due to AIDS and more and more people diagnosed with HIV who need treatment have access to it.(UNAIDS 2013)In Eastern Europe and Central Asia, the number of people living with HIV has increased by 50% over the last decade from 970,000 to 1.4 million .(UNAIDS 2011).There is renewed commitment from all countries to halt and reverse the HIV epidemic by targeting at risk populations selectively with a package of proven cost-effective interventions at high coverage to have greater impact to work towards an AIDS free generation.

**Table 1:Regional and global estimates of HIV epidemic 2013**

<b>Region</b>	<b>No. of people living with HIV(15+)</b>	<b>No. of people newly infected withHIV (15+)</b>	<b>No. of AIDS related deaths</b>	<b>Adult HIV prevalence (%)</b>
Sub-Saharan Africa	22,100,000	1,400,000	1,200,000	4.7
Middle East and North Africa	250,000	29,000	17,000	0.1
South-East Asia	3,700,000	250,000	220,000	0.3
East Asia	880,000	80,000	41,000	0.1
Latin America	14,00,000	84,000	52,000	0.4
Caribbean	230,000	11,000	11,000	1.0
Eastern Europe and Central Asia	1,300,000	130,000	91,000	0.7
Western and Central Europe	860,000	29,000	7,600	0.2
North America	1,300,000	48,000	20,000	0.5
Oceania	48,000	1,800	1,200	0.2
Total	32,100,000	2,000,000	1,600,000	0.8

*Source:* UNAIDS report on the Global AIDS epidemic(UNAIDS 2013).

Globally, unprotected heterosexual transmission is still the major route of HIV transmission in many countries, whereas in many developed countries, higher risk of HIV is seen among men who have sex with men (UNAIDS 2012). The high risk groups like female sex workers (FSWs), men who have sex with men (MSM), transgender (TG) and Injecting drug users (IDU) are disproportionately affected by HIV compared to the general population (WHO/UNICEF/UNAIDS, 2011). HIV prevalence is higher by about 13.5% for FSWs, 19% for MSM and transgender, and 22% among Injecting drug users (IDUs) (Baral et al., 2007; Baral et al., 2012; Beyrer et al., 2012; Baral et al., 2013). This is especially due to lack of safe sex behavior like condom use in paid sex encounters among FSWs and MSMs. The broader transmission of HIV beyond these HRGs often occurs through their sexual partners, who also have lower-risk sexual partners in the “general” population (Alary et al., 2010; Gouws et al., 2012). The HIV transmission dynamics are such that unless effective targeted HIV prevention saturates the most at-risk HRGs of FSWs, MSM/TGs and IDUs, the epidemic will not be controlled. But the positive implication of this is that if HIV prevention is successful in these HRGs, the epidemic will be substantially curtailed (Vickerman et al., 2006; Boily et al., 2008; Luchters et al., 2008; Moses et al., 2008; Banandur et al., 2013, Behanzin Diabate et al., 2013, Boily et al., 2013).

The coverage and utilization of HIV prevention and treatment services are also lower among the high risk group, particularly due to fear of being identified or reported to law enforcement agencies (Shahmanesh et al., 2009). There is huge body of evidence to show the benefits of focusing on these groups to ensure the HIV prevention and treatment goals are met (Marseille et al., 2001; Nagelkerke et al., 2002; Burgos et al., 2010; Erausquin et al., 2012; Armstrong, et al., 2013; Behanzin, et



al. 2013;Pickles et al., 2013;Alary et al., 2014).In India declines in HIV prevalence have been recorded among Female Sex Workers at national level (5.06% in 2007 to 2.67% in 2011). Declines have been achieved among Men who have sex with Men (7.41% in 2007 to 4.43% in 2011)(NACO 2012). Though there are interventions being implemented in many countries, the scale of programs are quite small to be able to maximize the benefits of high risk group intervention(Stover, et al., 2002;Johns et al. 2005;Galarraga et al. 2009;Mangham et al., 2010;BMGF 2007).

In China the proportion of newly reported cases among Injecting drug users has decreased from 34.1% (2006) to 16.9%(2011) whereas cases due to sexual transmission has shown an upward trend rising from 33.1% (2006) to 76.3% in 2011(China 2012).Studies have shown prevention interventions for female sex workers have had promising results in China and other countries in Asia(UNAIDS 2001;Guo, et al. 2010, Morisky et al., 2010;Rou et al., 2010;UNGASS 2012;Shi et al., 2013).

Given this context the issues of costs and cost-effectiveness is important as it provides a basis to compare the pros and cons of various options for making a choice and gives an estimate of the costs involved and how best to allocate the resources so as to achieve the maximum desired benefit.

## **1.2. Resource Needs Estimates Trends Over Time**

The resource needs for HIV/AIDS programming for both prevention and treatment over the years are rising exponentially. Hence it is important to understand how resources are allocated across countries (Bautista-Arredondo, Gadsden et al., 2008). Further scarce resources in developing countries must be spent on interventions which provide maximum value for money. A review found that 30-50% of prevention

funds have been directed towards general population interventions when it should have been spent for high risk group interventions in concentrated epidemic settings(Craig et al., 2014).

The recent strategic investment framework proposed to support better management of national and international HIV/AIDS responses estimated US\$ 22 billion is required annually to provide universal access to HIV prevention, treatment, care and support by 2015 (Schwartlander et al., 2011). They proposed three categories of investment consisting of basic program activities like prevention of mother to child transmission (PMTCT), condom promotion and distribution, interventions with key populations(female sex workers, MSM, IDUs), treatment, care and support, male circumcision and behavior change programs. Second, interventions that create enabling environment to achieve maximum effectiveness and third, programmatic efforts in other health and development sectors related to HIV/AIDS. They projected that resource requirement for basic program activities will reach 12.9 billion dollars by 2015 of which 38% would be necessary for treatment, care and support. The critical enabler components would require \$ 3.4 billion and \$ 5.8 billion are required for synergies with development sectors. Currently this puts the resource need at, US\$ 3.2 billion annually to deliver HIV services to key populations globally. This amount of financing would avert an additional 12.2 million new infections between 2011-2020 of which 1.9 million would be among children, averting 7.4 million deaths and lead to 29.4 million additional life years gained(Schwartlander et al., 2011).

In 2003, the countries of Asia-Pacific required more than US\$1.5 billion to finance a comprehensive HIV/AIDS response but only US\$200 million was available from all sources combined, including the public sector(Commission 2008). From 2007 until 2010, US\$5.1 billion was required each year. Such sustained effort till

2020 was expected to achieve a reduction in cumulative infections by five million, reduction in number of people living with HIV in 2020 by 3.1 million, reduction in the number of AIDS related deaths by 40 per cent and a steady decline in HIV prevalence in the region(Commission 2008).An analysis by the Commission on ‘Redefining AIDS in Asia’ has also shown that US\$ 1 investment in appropriate prevention can save up to US\$ 8 in treatment costs for expanding epidemic countries. The analysis showed that even the peak resource need of US\$5.1 billion annually for the years 2007-2010 was just 4 per cent of the regional health expenditure and 0.2 per cent of regional gross national income (2001)(Commission 2008).

The two regions with the largest resource requirements are Asia, due to its large population and sub-Saharan Africa because of the high disease burden(aids2031 2010). It is estimated that in a rapid scale up scenario in Asia, the resources required would be US\$ 10.7 billion annually.The resource requirement if the intervention is continued at existing coverage would be US\$ 6.2 billion.If a structural change approach to address factors such as vulnerability to AIDS or strengthening the health system is added the resource need projected is US\$ 9.4 billion annually(aids2031 2010).

It is projected that future spending for AIDS in developing countries over the next two decades will be steadily increasing(Schwartlander et al., 2011). Unit cost information is available only from a handful of countries which are adjusted and extrapolated to obtain global estimates(aids2031 2010).

The Commission on ‘AIDS in Asia’ in their analysis found that the resource need for extensive coverage of high risk groups in Asia would be US\$ 1 billion a year for strong response and cost per infection averted would be US\$ 1800. Thus these

interventions targeting high risk groups are very cost-effective and need to be implemented urgently at optimal scale to obtain maximum value for money(Commission, 2008).It is important that resources are allocated based on available evidence and tools which can improve decision making(Forsythe et al., 2009). Further the design of interventions can also improve both impact and cost-effectiveness and is critical in optimising the resources available. (Panovska-Griffiths et al., 2014).

### **1.3. HIV/AIDS Financing in India**

Although the number of HIV infections and AIDS cases increase over time, resources for delivery of prevention and treatment services are necessarily finite. The National Health Policy (NHP) in India envisages that 2-3% of the total Gross Domestic Product (GDP) will be spent on health by 2010-2012. This amount has been static at 0.9% for almost 2 decades and whatever actual increase in money allocation has occurred is because of increase in GDP. The programs like National Rural health mission(NRHM) and RashtriyaSwasthyaBimaYojana (RSBY) has only contributed to a marginal increase in health care spending in India to 1.3% of GDP(Worldbank 2014). The total allocation for health sector in the financial year (2013) wasUS\$ 6billion. The total outlay for NACP III (2007-2012) is approximately US\$ 2574 million which includes support from the World Bank, UK's Department for International Development (DFID) and Government of India contributions (Pooled fund), Global Fund against AIDS, Tuberculosis(TB) and Malaria (GFATM), and the Bill and Melinda Gates Foundation (BMGF). NACP III had allocated 67.2% of funds for prevention activities, 17% for care and support, 8% for program management, 3% for strategic information and 5% for contingency(NACO 2008). The fund allocation

for NACP Phase IV (2012-2017) for targeted intervention has been allocated US\$ 3760 million(NACO 2012).

HIV leads to tremendous human suffering and has begun to put a stress on the Indian health system, this in turn, has had a significant economic impact at the household level (ILO 2004,Editorial Steering, Marlink et al., 2008;Bennett Singh et al., 2011). HIV/AIDS affects individuals in prime-working age groups and is expensive to treat. It is also found that households spend up to 30% of their monthly household income just on medications to treat their HIVpositive family members. The International LaborOrganization (ILO) study (2004) assessing the socio-economic Impact of HIV/AIDS on individuals and families in four Indian states among households affected by HIV found that incomes declined by as much as a third while average monthly expenditure on food and treatment increased substantially. Financial barrier to universal treatment access is that once people begin taking Anti-retroviral drugs (ARVs), they must continue taking them for life. Their productivity is also decreased and may lead to lower income levels or loss of job due to prolonged sickness. It also has a dent on the savings and immediate needs of the family like schooling of children and household purchases must also be compromised to care for the infected and support their medical expenses. HIV affects the most productive years of an individual and hence affects the economic status of the family. It is also found that investments on treatmentcan yieldhuge benefits(Resch et al., 2011). This could mean a commitment on the part of governments or international donors to guarantee treatment for many decades, for every person on ARVs(whiteside 2002;ILO 2004; Hontelez; de Vlas et al. 2011;Resch et al., 2011).

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **THE COSTS AND COST-EFFECTIVENESS OF HIV PREVENTION FOR HIGH RISK GROUPS**

Given the substantial resource requirements for HIV/AIDS, it is important to understand both the costs and efficiency of HIV prevention programmes (Holtgrave, et al., 1995; Zeng et al., 2012; Chersich et al. 2013).

In this chapter, effort has been made to review the available cost-effectiveness evidence and unit cost data from published literature in different settings. Region specific unit cost data helps decision makers to plan and estimate the resources required for expanding these interventions. It is also important to consider the methodologies adopted and the level of costs considered to ensure reasonable comparisons between studies. Review of cost studies of HIV prevention point out that many of the results of different studies are not comparable due to differences in methodology, lack of intervention description, missing data of costs especially the year, currency and details about the unit costs (Kumaranayake 2000; UNAIDS 2004; Kumaranayake 2008; Galarraga et al. 2009).

#### **2.1. The Cost-Effectiveness of HIV Prevention for HRGs**

Despite the widely acknowledged severity of the global HIV crisis, resources available to combat the epidemic are severely limited. It is essential that available funds be spent for interventions that are cost-effective, i.e., interventions that avert

high number of HIV infections compared with alternative uses of the funds. Cost and effectiveness data on HIV prevention interventions is increasing especially from developing countries (Marseille et al. 2001; Vickerman et al., 2006; Fung et al., 2007; Marseille et al., 2007; Galarraga et al., 2009; Burgos et al., 2010; Dandona 2010, Guo et al., 2010, Siapka et al., 2014; Vassall et al., 2014). Still there is need for more empirical data on long term costs of large scale programmes.

Cost-effectiveness analysis (CEA) is a comparison of two or more alternatives in terms of their costs and effectiveness through a Cost Effectiveness ratio. Mathematical and epidemiological models are often required to simulate final outcomes from available data on intermediate outcomes. To enable comparisons across different interventions and countries, CEA uses a summary measure of effectiveness such as the quality or disability adjusted life years (QALYs/DALYs) (Smith 2009). A recent systematic review of cost-effectiveness of HIV prevention interventions found that of the 21 studies, 16 of them were from sub-Saharan Africa and a handful from Asia, Latin America and Eastern Europe. Most of them analysed biomedical interventions, while few dealt with behavioural and structural interventions. A good number of them were small scale programs (Galarraga et al., 2009). Majority of the studies especially for injecting drug users are from developed countries and some evidence from developing countries (Guinness, et al., 2010).

There are increasing evidence obtained from developing countries that suggests interventions that are focused on high risk groups are cost-effective (Marseille et al., 2001; Vickerman et al., 2006; Fung et al., 2007; Burgos et al., 2010; Guo, et al., 2010; Vassall et al., 2014). Study by Hutton et al. in Chad of peer based programs for sex workers estimated a cost of US\$ 6-30 per HIV infection averted and about US\$2 per DALY saved. This study was based on published and local information sources

and estimates derived through modelling(Hutton et al., 2003). Another study from Cameroon for peer based programs found the cost per HIV infection averted to be US\$67-US\$137 and cost per DALY saved US\$3 to US\$7(Kumaranayake L 1998).

The recent studies from developing countries also have similar results(Marseille et al., 2001;Williams et al., 2006;Fung et al., 2007;Dandona 2010;Prinja et al., 2011) .Fung et al.study using mathematical modelling showed that over 51 months of interventions for commercial sex workers in Gujarat state, India, about 624 HIV infections among sex workers and 5131 infections among clients were averted.The cost per HIV infection averted in US\$ 2004 prices was US\$98(56-219) and cost per DALY saved was US\$6(3-12) which is very cost-effective. This is a very comprehensive work with all relevant costs considered at the service level while the modeling considered was conservative as the impact on commercial sex workers and clients was studied excluding the general population.

Dandona et al.(2010) study based on a sample of 16 FSW intervention sites in Andhra Pradesh found the cost per HIV infection averted was US\$ 984(605-2079).The cost per DALY saved was found to be US\$35(22-75). These estimates have very wide uncertainty ranges. Cost data used in this study has been retrospective and for only one year of intervention. But the cost-effectiveness estimates were also much lower compared to earlier studies as ART costs were much higher, especially of the drug Nevirapine which has since reduced considerably.The prevalence of HIV also had reduced. It shows that there is need for more concrete cost data(Dandona 2010).

Kumar et al. performed a cost-effectiveness analysis of targeted interventions for FSWs of the National AIDS Control organization (NACO) program which estimated US\$ 105 (2009)per HIV infection averted and US\$ 11(2009) per DALY



saved. They used a 20 year time horizon and considered all cases averted and not just among FSWs and clients. The cost data used were financial costs(Kumar et al., 2011).

There is a growing recognition among major global donors on providing comprehensive interventions to these groups and promoting co-operation from country level teams to identify the risk burden and relevant interventions to include in their national response plans. (Needle et al., 2012).

There are only few studies looking at effectiveness of HIV prevention interventions targeted at MSMs (Herbst et al., 2007;Lu et al., 2013;Subramanian et al., 2013;Ramanathan et al., 2014).Studies to estimate costs of MSM programs are plagued by challenges of incomplete and poor quality data not segregated by the target group and also the difficulty in defining what constitutes MSM HIV prevention expenditure(Commission 2008).This could lead to either under estimate or overestimate the MSM expenditure.MSM are a hidden group and it is difficult to track how many are reached by the services(Taegtmeyer et al., 2013). There have been recent reviews(Baral, et al., 2007;Herbst et al., 2007;Johnson et al., 2008) on the effectiveness of individual, group intervention on the high risk behaviour of MSM. The review found that such intervention reduces unprotected anal sex by 23-47% and increases condom use by 81%.

Some studies are based on single intervention components like counselling(Taegtmeyer et al., 2013) or behavior change interventions targeted to MSMs(Johnson et al., 2008). There is an ongoing study looking at comprehensive package of interventions and their impact(Prudden et al., 2011;Mitchell et al., 2014)for which our study provides the costs of interventions targeted towards this

group in southern India. Our cost analysis can be used for further studies to evaluate the cost-effectiveness of interventions for MSM in India.

The study by Dandona et al. in Andhra Pradesh, India found that the cost per HIV infection averted for MSM interventions to be US\$ 232(152-480) and cost per DALY saved US\$9 (6-19). The unit cost of reaching one key population member was US\$ 23.2 at 2006 prices. They also stressed on the need for increasing resource allocation to the MSM groups to avert higher number of HIV infections. In their study the number of HIV infections averted by the intervention was 611(6.3%) of the total interventions averted. Some of the limitations of their study was the lack of longitudinal cost data and the parameters used in the model which are mostly based on available secondary data and published literature(Dandona et al., 2005;Dandona 2010).The recent integrated biological and behavior assessment studies would provide more local real data in the states with *Avahan* interventions which would improve the estimates of effectiveness of interventions towards this group(Ramesh et al., 2010;Thilakavathi et al., 2011).

## **2.2. Cost of HIV Prevention Intervention for Different High Risk Groups**

The global crisis has brought to the forefront the resource crunch for HIV prevention activities. There is high interest in generating local cost data to aid adequate resource planning and their efficient utilisation. More and more donors are concerned about how their resources are spent and on the return of investment in terms of health gains(Holmes et al., 2011).

There is a growing recognition to ensure availability of local unit cost information especially in countries such as India which have stepped up their national response with a major rethinking of strategies based on recent epidemiological data

that has emphasized areas for resource allocation. In a situation where the costs are increasing while the funding is reducing, countries would definitely benefit from re-looking at how their resources are spent and plug the gaps leading to inefficiency and make informed choices to tackle the growing epidemic of HIV/AIDS.

In particular, there is lot of interest on the startup costs and the resources for program implementation and when pilot projects are either handed over to natural stakeholders or scaled up to other sites. Project maturity would seem to have an impact(Guinness et al., 2005).Many studies have programs which have been operating for several years – e.g. in Guinness et al (2005), the median age was 6 years (range 3-13).Shared costs between departments or other sectors need to be identified so that it can give realistic estimates of the resources required and what is already available.

There are only few studies in India which look at costs of comprehensive package of scaled up interventions over time(Dandona et al., 2005;Dandona; et al. 2005;Guinness et al., 2005;Fung et al., 2007;Kumar et al., 2009;Prinja et al., 2011).But some of the major issues with these are that they are retrospective, they include small sample of NGOs who agreed to participate and the time frame was short. The number of interventions covered was 17 in Guinness et al. study and 14 in Dandonastudy whileFung et al. analysis included one intervention site. It did not include STI services costs which were referred to government hospitals or private providers. It is important to consider the extent to which different studies have included the different organizational levels. The studies in India have included only the service level costs and not the support costs of the state or national level costs except two studies.Prinja et al. which mentions the amounts spent at state and NACO level but these are based on budgets and not actual expenditure and Guinness et al. which include an estimate of above service costs based on staff allocated to the

programme. It has been noted that many times there is under spending or overshooting of the exact budgeted amount, hence it is more reasonable to consider actual expenditure. Many a time costs above the service level are ignored, though they may be substantial and most of the studies fail to quantify them. This might actually lead to failure of successful pilot projects when they are scaled up. Since they were retrospective they also had issues of verifying data and obtaining clarifications. The type of costs considered would also need to be taken into account whether it is financial, economic or incremental as for example, financial costs are lower than economic. Guinness et al. used economic costs while Dandona et al. had a mix of financial and economic costs so methodologically these issues need to be considered (Guinness et al., 2005, Dandona et al., 2005).

The resource needs model by Stover et al. also provides unit costs of targeted interventions but these have been derived from a mix of sub-Saharan African and Indian studies which include both modelled and actual study estimates (Stover et al., 2006). It is important to identify the package of interventions and how the services were delivered in each of the sites before comparison of costs between studies are attempted. Some were based on only outreach education and condom distribution while many had service provision for STI also. The AIDS 2031 project estimated a global average unit cost for commercial sex worker outreach to be US\$ 51 and regional cost for south and Southeast Asia at US\$ 30 which in a scaled up scenario would reduce to US\$ 42 and US\$ 25 respectively. The global average unit costs for MSM outreach was US\$ 57 and when economies of scale are considered by 2015 it was estimated to be US\$ 42 (AIDS 2031 2010).

**Table 2: Summary of cost studies in developing country context from India**

Author (Year)	Country (Number of sites)	Intervention component	Scale	Costs	Cost results	Effectiveness results	Methodological aspects	Comment
Fung et al. (2007)	India (1)	Promotion and distribution of condoms, free STD treatment, counselling and behavior change	3050	Financial and economic (US\$ 2004)	Total costs- US\$ 2,02,042 Cost per commercial sex worker reached per month Fin US\$ 86 Econ US\$ 240	Total number of HIV infections averted- 5755 (2548-10,140) Cost effectiveness ratio per HIV infection averted Fin- US\$ 34-133 Economic -US\$ 56-219 Cost per DALY saved Fin-US\$ 1.9-7.5 Economic 3.1-12.3	Service level costs considered. Mathematical modelling for impact, limited to sex worker and client impact, not general population	Full costing with appropriate analysis and outputs considered

Author (Year)	Country (Number of sites)	Intervention component	Scale	Costs	Cost results	Effectiveness results	Methodological aspects	Comment
Dandona et al. (2008)	India, Voluntary counselling centers- 17 sites sex worker programs- 14 sites	Voluntary counselling and testing centers- Pre-test, Post-test counseling and HIV testing Sex worker programs -behavior change communication; sexually transmitted infections care; condom promotion; and creation of an enabling environment.	VCTC- 32,413 (2003) 66,445 (2006) Sex workers reached- 33,138 (2003) 32,500 (2006)	Financial and economic (US\$ 2003 and 2006)	VCTC unit costs- US\$ (2003) 5.5(2.92-17.1) US\$(2006) 3.3(1.9-5.2)	NA	Service level costs of government funded programs considered looking at cost change over 3 year period. Identified the factors for decreasing unit costs for VCTC interventions while the unit costs of sex worker interventions increased	One of the few longitudinal study on costs of HIV prevention intervention
Dandona et al. (2009)	India, 128 public funded programs 14 intervention types	Voluntary counselling and testing services, STI services, blood safety, truckers, migrant laborers, prison intervention, street children	NA	Economic costs(2005)	Sex worker program- US\$ 32.1, Blood bank- US\$ 1.6, MSM- US\$23.2, Truckers- US\$ 6.0,	Total number of HIV infections averted was 9688 (6624-16,898)	Costs by intervention type	Costs of public funded program and discusses the proportional allocation of resources to each

Author (Year)	Country (Number of sites)	Intervention component	Scale	Costs	Cost results	Effectiveness results	Methodological aspects	Comment
		Sex work programs, PPTCT, IEC and condom promotion			Migrants-US\$9.3, PPTCT-US\$2.2, VCT-US\$ 3.3, STI-US\$12.3, Workplace-US\$ 8.8, Street-US\$4.2, Prison-US\$ 2.5, IEC-US\$ 0.16, Condom-US\$ 1.4.			intervention type
Guinness et al (2005)	India, 17 interventions across two states in India	Peer education, Condom distribution, STI referral and two NGOs also provided treatment	250-2008	Economic costs(2003)	Median cost per sex worker reached-US\$19.21 (10-51)	Not considered	Interventions selected on willingness to participate. Costs were assessed for 2001-2002. Ingredients costing approach used. Looks at analysis of cost variation across	Retrospective, routine monitoring data, Data issues and lack of clarifications available

Author (Year)	Country (Number of sites)	Intervention component	Scale	Costs	Cost results	Effectiveness results	Methodological aspects	Comment
Prinja et al.(2010)	India, NACO program (1200 funded programs across India)	Peer-led counselling for behavior change towards safer sexual practices, condom promotion, quarterly referral for health check-up and sexually transmitted infection (STI) treatment, and referral and support for accessing antiretroviral therapy (ART)	Not mentioned, national level study	Financial costs (2009)	Cumulative cost of targeted intervention from 1995-2015 to be US\$1991 million	Cost per HIV infection averted- US\$ 104, Cost per DALY averted- 10.7	Discounting at 3%. Model based estimation. Costs based on budgets. ART coverage included and also costs of opportunistic infections, monitoring, drug costs and health staff	20 year time horizon considered, only national level cost-effectiveness analysis from India



Author (Year)	Country (Number of sites)	Intervention component	Scale	Costs	Cost results	Effectiveness results	Methodological aspects	Comment
Marseille et al (2007)	206 prevention programs across 5 countries	Voluntary counselling and testing, Sex worker programs, Information education and communication, risk reduction program for injecting drug users, Prevention of parent to child transmission, sexually transmitted infections treatment	Not mentioned	Economic costs (2004)	Doubling of scale resulted in reduction in unit costs by 34.2 % (2.4-56%). Efficiency increased with scale for each of the intervention type across all countries. Variation explained by scale ranged from 26% - 96%	Not assessed	Cross sectional cost data. Assess the efficiency versus scale for each intervention type	Change in unit costs over time not considered, no multivariate analysis, service quality not assessed

## **2.3. Cost Drivers**

### **2.3.1. Scale**

Scale is an important variable driving costs. Scale of a project can be measured in different ways like coverage (proportion of people reached by the intervention), volume of services provided (condoms distributed) and the level at which they are delivered (community, district, state or national)(Kumaranayake 2008). A recent paper by Mangham et al. discusses the different interpretation of the term scaling up which extends from increasing the coverage of health interventions or increasing financial, human or capital resources to expand coverage(Mangham and Hanson 2010).

Economies of scale are mainly seen when the long run average total costs fall as output increases. Greater specialization of both labor and capital is the main source of economies of scale. Theory suggests that economies of scale can be achieved through distribution of fixed costs, bulk purchasing of supplies, improving the efficiency of personnel, technological innovations and learning by doing(Parkin M 2012). If the average costs increase as output rises it means the presence of diseconomies of scale. Here the marginal cost, i.e., the cost to produce one more additional unit of the same output is higher than the average cost. This is due to increase in factor prices and decreasing returns to scale(Guinness L 2011). Theoretically it is assumed that the average and marginal cost curves are U-shaped, but recent studies show that based on the project cost structure or interventions, there could be economies or diseconomies of scale(Víctor Zurita, et al., 2001;Guinness; et al., 2007).

Economists use cost functions to explore the relationship between costs and outputs i.e., the efficiency of health services, to understand better what might influence this relationship. Cost function is a function of input prices and output quantity. Its value is the cost of making that output given those input prices. The cost functions are estimated

by a combination of statistical analysis and economic theory to health service data known as econometric analysis (Guinness et al. 2007). It is possible to estimate the marginal cost for different output levels by using a cost function. The presence of economies or diseconomies of scale can be assessed by comparing the estimates of marginal costs with average cost estimates from the same data set (Meyer-Rath and Over 2012).

The evidence available indicates that effective HIV prevention requires the scaling-up of multiple interventions that work synergistically to achieve maximum impact. There have been few attempts to define what is meant by scaling up (Kumaranayake 2008; Hanson et al., 2010; Mangham and Hanson 2010, Hirschhorn, et al., 2013). The term scaling up has been used to describe an increase in the coverage of health interventions that have been tested in pilot and experimental projects in order to benefit more people and support policy and program development at a large or national scale. It can also have a functional dimension in which the term describes an increase in the scale, scope or range of activities. In this thesis we use the definition of scaling up as explained by the Global HIV prevention working group convened by Bill and Melinda Gates foundation and Kaiser foundation in June (2007). "Scaling-up" HIV prevention means ensuring that the appropriate mix of evidence-based prevention strategies achieves a sufficient level of coverage, uptake, intensity, and duration to have optimal public health effect (BMGF June 2007). The four key issues which need to be considered for scaling up are mainly the costs constraints issues, equity, quality concerns and service delivery aspects.

Guinness et al, found that 50% of the variation in unit costs could be explained by scale. Dandona et al (2005) found similar results related to scale. Although they also found that the time spent with contacts had reduced significantly as the projects scaled up. In these studies unit costs were reduced both due to scale, but also quality reductions.

Dandona et al. (2008) in their study analyzed the changes in unit costs during scale up and also over 3 year time period of services of voluntary counselling and testing centers (VCTC) and sex worker programs(Dandona et al., 2005). They found significant reductions in unit costs for VCTC services mainly due to reduced HIV test kit costs and staff costs and rapid increase in the number of people accessing these services. In contrast the costs of providing services to sex workers increased 2.4 times over the same period without any change in the program scale which was attributed to improved quality of services offered to sex workers. This was due to increase in supply of condoms and costs of treatment of STIs and higher personnel costs of peer educators and outreach staff. In addition the training costs for staff also doubled.

Marseille et al. in a 5 country, six intervention type study found that 26-96% of variation in unit costs could be explained by scale. The unit costs decreased by 34.2% with doubling of scale of program implementation(Marseille et al. 2007).

Thus scale is an important variable to be considered which has significant impact on costs.

### **2.3.2. Typology of Sex Work Matters**

There have been about 25 types of sex work that are identified according to worksite, principal mode of soliciting clients, or sexual practices. These types of work are often grouped under the headings of "direct" and "indirect" prostitution, with the latter group less likely to be perceived or to perceive themselves as sex workers. Policing of sex work can change its typology and location but its prevalence is rarely affected (Harcourt and Donovan 2005;Buzdugan et al., 2009;Buzdugan et al., 2010).

The major typologies of FSW in India are described below.

- **Street-based** sex workers are those who solicit clients on the street or in public places such as parks, railway stations, bus stands, markets, cinema halls. They may live in a brothel and may entertain their clients in a lodge, car, truck, hotel room, at the client's home, in a cinema or in a public place.
- **Brothel-based** sex workers are those whose clients contact them in recognized brothels, that is buildings or residential homes where people from outside the sex trade know sex workers live and work. This includes sex workers in Kamathipura in Mumbai and Sonagachi in Kolkata, and also smaller scale brothels in districts such as Sangli, Bagalkot and Guntur. Typically, a brothel is a place where a small group of sex workers is managed by a 'madam' (gharwali) or an agent. Usually the sex worker pays a part of her earnings to the gharwali.
- **Lodge-based** sex workers are those who come and reside in what is known as a lodge (a small hotel) and their clients are contracted by the lodge owner, manager or any other employee of the lodge on the basis of sharing the profits. These sex workers do not publicly solicit for clients.
- **Dhaba-based sex workers** are those who are based at dhabas (roadside resting places for truckers and other long-distance motorists) or road-side country motels. Like lodge-based sex workers, these sex workers do not publicly solicit clients, but rather are accessed by clients who come to these locations. In some cases, dhaba-based sex workers are also contracted by the dhaba owners and could move from dhaba to dhaba based on their contracts.
- **Home-based** or "secret" sex workers operate usually from their homes, contacting their clients on the phone or through word of mouth or through middle-men (e.g., auto drivers). Generally, they are not known to be working

assex workers within their neighboring areas. In fact, they could have an entirely different “public” identity – e.g. housewife, student. While many sex workers operate “secretly” given the level of harassment, violence and stigmatization they experience from the police, the rowdies and the members of general public.

- **Highway-based sex workers** are those who recruit their clients from highways, usually from among long distance truck drivers.
- There are other sex workers whose primary occupational identity may vary, but a large proportion of their occupation group, *but not all*, often engage in commercial sex regularly and in significant volumes. **Bar girls, Tamasha artistes, Mujra dancers**, come under this category.

There is some emerging evidence on the risk for HIV among different typology of sex workers **but there is no study on the costs of reaching different types of sex workers**. Different types of sex work have different degrees of health and safety risk. It is important to note that certain typologies (brothel- and lodge-/dhabha-based sex workers) tend to have higher client volumes than home-based sex workers, and they therefore have a higher risk profile, requiring special focus even within the category of female sex workers (Dandona et al., 2005; Chen et al., 2012; Chen et al., 2012; Emmanuel et al. 2013; Hao et al., 2013). New entrants into these categories also warrant special focus. In a study conducted in Karnataka (2006) they found that HIV prevalence varied by sex work type. The crude odds ratios for HIV infection was found to be 2.9 and 1.9 for brothel-based and street-based FSWs respectively, compared to the reference category of home-based FSWs. Logistic regression was used to study the association between sex work type and HIV infection, controlling for: age, marital status, literacy, residential status, whether worked outside enumeration area, age at first sexual intercourse, duration in sex work,

experience of condom breakage in the past one month, condom use with the last client, and client volume(Buzdugan et al., 2010).

Another study on the risk of HIV among non-brothel based female sex workers in Andhra Pradesh found that especially street-based sex workers were at a higher risk of HIV infection as compared with brothel-based FSWs in this study. Because of the stigma and discrimination against FSWs, not many of them acknowledge that they are sex workers. Only one-third of FSWs in this study reported that their families were aware of their sex work. FSWs with lower social support score were relatively less likely to use condom consistently. These women, for the most part, remain inaccessible to HIV prevention programs, thereby undermining the efforts of HIV prevention. Acknowledgment of being a sex worker is more of an issue with the non-brothel based FSWs as compared with the brothel-based FSWs because being in a brothel can be interpreted as an acknowledgment that she is a sex worker. They found that it makes it difficult for programs to organize non-brothel based FSWs as a group that could be empowered to protect themselves and participate in the HIV prevention efforts. (Dandona et al., 2005).

A model from India has been reported to be successful in empowering FSWs in Sonagachi, Kolkata (Jana et al., 2004;Swendeman et al., 2009). However, there are also examples of not so successful peer-based HIV interventions in brothel-based FSWs in India who were not interested in conducting education sessions for their peers after being trained, and their madams did not allow them to leave the brothels to conduct education programs(Shahmanesh and Wayal 2004).

Accessibility to and empowerment of non-brothel based FSWs is also very closely linked to the legal environment related to sex work in the country. A participatory

intervention program for HIV prevention among FSWs in Goa, India was put to an abrupt end because the Government of Goa demolished the red-light area of FSWs in its effort to eradicate prostitution and rehabilitate FSWs (Shahmanesh et al., 2009). The study found that women displaced from this area reported rape, increased violence, reduced ability to negotiate condom use, and multiple partners following this act.

Thus typologies also have certain implications on designing of HIV prevention interventions and their impact (Jain 2012; Kamazima 2012). There are currently no studies on the costs of reaching different high risk groups and our study would add to the evidence.

### **2.3.3. Program Maturity**

The costs of early years of intervention are normally higher than a mature program. This is mainly due to the high investment costs of early years in terms of infrastructure, training and low outputs due to lower scale of services. As programs mature they are able to improve their performance both due to increasing efficiency (learning by doing) and due to higher coverage rates which help to spread the fixed costs over larger number of units (Terris-Prestholt et al., 2006; Terris-Prestholt 2005). Hence it would be useful to understand how costs evolve as programs mature and are scaled up.

### **2.3.4. Intervention Components**

In cost studies it is very important to consider what are all the services delivered by the intervention, and the mode of delivery of intervention for e.g.: whether the STI services are provided by the project itself or the beneficiaries of the project are referred to government or private clinics. It is also important whether the peer educators are paid or not, from where the supplies are procured as it might be derived from government. This is



very useful in comparing the results from different studies as the cost differences may be purely due to the intervention strategies being different.

### **2.3.5. Contextual Factors**

The geographic location like urban/rural/difficult terrain/remote locations/political stability, the local stakeholders and general community support, distribution of the target population (dispersed/compact) can impact the cost of delivering the intervention. They mainly affect the input prices like higher staff or space costs as in urban locations, increased travel costs in regions with difficult access (Johns 2005) or by decreased uptake of services in case of resistance by local population.

### **2.3.6. Program Management Costs**

Most of the studies described in the literature review consider costs at the service level only. Though it is known that many of the costs are incurred at other levels like state or national level in large scale programs which are rarely quantified. There have been few studies undertaken as a part of tuberculosis control program (de Jonghe et al., 1994; Loevinsohn et al., 2005) and hospital administration which look at these costs. The nature of contracting of the agencies implementing the intervention also influences the costs. The organizational structures and the governance mechanisms like contracting may be different among the implementing agencies. This also has been found to influence costs (Guinness 2011). In many programs they just consider a fixed percentage as program management costs which may not reflect the actual resource use. The program management costs have a bearing on the unit costs and in the long term might be a source of economies or diseconomies of the intervention. Since resources are limited and most efficiency studies are done at the service level the program management level costs also offers opportunities to improve the efficiency and reduce wasteful spending. Especially in large scale programs they speed up the roll out and rapid scale up of interventions. The

*Avahan* interventions also were designed to have high coverage of high risk groups to ensure there would be measurable impact and good returns for their investment. They followed a management approach with tight monitoring of both inputs and outputs of the intervention partners and regularly reviewed the program and supported them through various capacity building activities(BMGF 2008).

#### **2.4. Conclusions**

It can be seen from the literature review that there is paucity of empirical data on costs of large scale HIV prevention program for high risk groups. Since most of the studies are short term or based on pilot interventions and extrapolated unit costs through modelling, there is an immediate need to understand what happens to costs when interventions are scaled up, what are the factors that drive these costs in real intervention setting and identify sources of program efficiency.

Accurate evidence on the costs of scaling-up HIV prevention in India can be used to inform both national and global HIV policy. However, to date there is very limited data on unit costs of HIV prevention interventions in India. Globally, there is almost no evidence on the determinants of variation in these costs across settings both across and within countries. This study is the largest study to date of HIV prevention costs covering four high HIV prevalence states in India. It is also the only study that collected data over time prospectively to assess the change in costs during scale up; and also addresses key evidence gaps relating to the impact of sex work typology on costs, the extent of above service level and the costs of community mobilization.

Thus based on the gaps in our existing knowledge this thesis tries to throw light on some of these areas by fulfilling the objectives as mentioned below.

## **2.5. Hypothesis, Aim and Objectives of the Study**

### **2.5.1. Hypothesis**

Our hypothesis is that costs are influenced by multiple factors like the scale, typology of sex workers and the high risk group considered for interventions, mix of interventions delivered and their efficiency and the organizational structures of the implementers and program maturity. We try to assess the extent to which these factors have a positive or negative impact on the costs by examining the intervention costs of *Avahan* program in real settings over time.

### **2.5.2. Aim of the Thesis**

The aim of the study is to carry out a descriptive cost analysis of *Avahan* interventions in four southern states in India to explore how costs change over time and during scale up.

### **2.5.3. Objectives**

- To describe the costs of the *Avahan* over the 4 years interventions by organizational level, activity and also quantify the above service level costs as programs are scaled up in four southern states of India'
- Explore the HIV prevention costs by typology of key populations over time in Karnataka and Maharashtra.
- Estimate the incremental costs of community mobilization activities in two districts of Karnataka.
- To provide the necessary costs for further cost-effectiveness analysis for interventions with both female sex workers and high risk men.

- To generate a cost database to support econometric work to assess the determinants of costs and efficiency of Avahan interventions.

## **2.6. Application of This Study to Policy and Practice**

Public resources are scarce, but the demand for health care is increasing steadily. Ethical, socio-political and economic imperatives make it necessary to use resources efficiently. Cost information is essential to improve the economic efficiency of health care in any state(Weatherly et al., 2009).

Therefore, appropriate costing methodology is vital to reduce the negative impact of ill-informed decisions(Drummond and Sculpher 2005). Cost, however, has several different meanings, and costs of any health services depend on the purpose for which they are to be used. For instance, the aim of costing in economic evaluation is to “maximise the benefit of resource utilisation according to the ethical value of the society, and not to save money”. However, there are several other approaches for costing such as costing for pricing decisions or cost of illness studies as part of a priority setting exercise. However, there is a consensus in the literature that costing exercises should preferably be undertaken within a decision-making framework (Hoffmann et al., 2002;Thurston et al., 2008; Sorenson et al., 2011) and the results can be used for different purposes like:

**Accountability:** Keeping track of spending. Program managers in developing countries need information on all levels of program performance, including cost data (Johns and Baltussen 2004).

**Efficiency:**A health program is more efficient when it provides more beneficial effects from given set of resources. Costing analyses can provide in-depth information on the efficiency and effectiveness of the use of these resources, as well as estimate the value of

additional efforts needed, often in terms of staff labour and inputs(Holmes et al., 2011;forum 2013).

***Assessing priorities:*** Costing analyses are useful tools when assessing financing options for national programs. In resource constrained countries, the additional costs of improvements into a country program are an important consideration in deciding whether or not to proceed with their use (Hutton et al., 2003).

***Making cost projections:***Costing analyses provide useful information about actual resource needs or inputs required to provide a service. They also allow program managers to evaluate different options for program improvements by estimating the resource requirements for each.

***Considering cost recovery:***Cost of health services/program is one of the pieces of information that must be known if a country is considering introducing user charges as one of the sources of financing.

***Sustainability of funding:***Using these data and analyses, program managers can work with local institutions, international donors and cooperating partners to develop financing plans for long term sustainability(Smith S 2009; Rudmik and Drummond 2013).

## **CHAPTER 3**

### **METHODOLOGY**

#### **3.1. Introduction and Definitions**

A costing analysis differs from an expenditure analysis in that it estimates the actual value of resources used. The quantity of resources used for the goods or service is estimated and its value calculated. Other ways in which costs differ from expenditures is that they also estimate the value of in-kind costs such as donated goods or volunteer time. In addition, the costs of capital goods, i.e. tangible assets that last more than one year such as equipment, are calculated differently than for expenditures and are annualized, to take into account the life expectancy of the goods. Cost analyses estimate the value of all resources used to produce a service, assuming that every resource has an opportunity cost and could have an alternative use(Guinness L 2011).

Total costing involves examining all costs of the provision of services, no matter who bears the costs. These costs include all kinds of costs -- fixed and variable costs, direct and indirect costs, and investment and recurrent costs. These include not only the costs of operating the program on a daily basis but also the costs of setting up the program or investment costs.

Incremental or additional costing analyses should be used by program managers when they want to estimate the cost of adding an activity to their program. This analysis provides information on the extra costs of changing program activities or adding additional activities to existing ones. Program managers may do incremental costing in order to make decisions about the benefits and costs of undertaking additional activities, such as introducing auto-destruct syringes or introducing Hepatitis B vaccine to

the existing program. This cost information can be used to make informed decisions about future costs to the program as a whole.

Marginal costing examines the additional cost incurred for the production of one additional unit of output. For example, the cost of increasing immunization coverage by one percentage point can be estimated. This information informs program managers or policymakers of how much it will cost to reach a goal of increasing coverage or reaching more children in harder-to-reach areas. In addition, it will provide information on whether average costs will increase, stay the same, or decrease as coverage increases. This relationship can change over time since average costs may decline as fixed costs are shared as more immunization services are provided, and then increase as more immunizations are provided in hard-to-reach areas.

The incremental ratio compares additional costs and additional consequences, starting from the current level of coverage or services. Using childhood immunizations as an example, the incremental cost of adding mobile vaccination teams might be lower than expanding fixed clinic services, particularly if the unvaccinated children are dispersed and hard to reach.

In general, costs are defined as the value of the resources used to produce or provide a good or service. “Cost” is different from “price,” in that the price is the amount charged to consumers, usually set by the producer of a good, and it may vary from the actual cost of production of the good. There are different costs for different decisions and it is important to know what costs are relevant to any decision. There are several classifications of cost, depending on the scope and breadth of the analyses. The different classifications of costs considered in our study are summarized in this section.

**Total costs** are the sum of the value of all resources used to produce a total output. To calculate total costs, the quantities of all program components used are determined and multiplied by their unit cost.

**Average costs** are the average value of inputs used per unit of output or total cost of output divided by the number of units of output. They are obtained through dividing total costs by number of outputs delivered.

**Incremental or additional costs** are the value of supplementary resources of adding components to a program or service.

### ***Fixed and Variable Costs***

Fixed costs are the costs that do not vary with the quantity of the good or service produced in the short term. Examples include building, utilities, administration salaries, and the depreciation of the physical plant or buildings.

Variable costs are the costs that vary with the quantity of the goods or services produced or provided in the short term. Examples include the costs of personnel for doctors, nurses and laboratory technicians, vaccines, needles and syringes, drugs, lab tests, and transportation.

### ***Financial and Economic costs***

Financial costs represent actual monetary flows on goods and services purchased. Economic costs include the estimated value of donated goods and services; Economic cost capture the cost of a good when the price does not reflect the cost of using it productively elsewhere; Economic costs are important when considering issues related to the sustainability or replication of projects as well as being a component of cost-effectiveness decision-making (Simth 2009 and Guinness L 2011).



### 3.2. Summary of Main Costing Methods

Many of the cost studies use cross-sectional data of provider costs in a few identified sites and estimate the average costs of the programs (Dandona; et al., 2005). Modelled provider cost estimates have been used based on regional expert estimations and logic/guess estimates (Johns and Baltussen 2004). In our study we use the approach of total costing and include the costs incurred at all levels for delivering the HIV prevention program for high risk groups over time.

Over the four year period of analysis (2004-2008), economic cost data was collected from 138 Non-governmental organization (NGO) projects functioning in the 64 districts providing intervention services for FSWs, MSM/TG. Cost data were collected from each district and from six Lead Partners (SLPs) in four states. Detailed costing was done in 23 districts and in the remaining districts a more general costing based on routine data was carried out. The detailed costing enabled a better understanding of economic costs, how costs and cost structures change with scaling up and provided information necessary for activity wise costing. The sites were selected in consultation with the SLPs to best represent the different level of activities across the NGOs. Costs of the external program evaluation and research studies are not included.

An ingredients top down approach was used to consider full financial and economic costs from the provider perspective based on the UNAIDS “*Costing Guidelines for HIV Prevention Strategies*” and as recommended by the Asian Development Bank (Kumaranayake 2000, UNAIDS 2004). Financial costs represent actual expenditure on goods and services purchased. Economic costs include the estimated value of all inputs including donated or subsidized goods and services.

Costs were classified as recurrent or capital. Additionally classifications by activity at the level of the local implementing NGO (i.e. capacity building, Behavior change communication (BCC), Sexually transmitted infection (STI) services, condom promotion, community mobilization, monitoring, planning and co-ordination, start-up activities, enabling environment and others) and organizational level (e.g. NGO, district, state) were carried out.

Cost data were obtained from the financial records used for routine financial and management reporting of the NGOs, SLPs and foundation office in Delhi, as well as staff records and interviews with staff. For the detailed costing sites, details of donated goods and services were collected from the project. The economic costs of these items were valued at market prices obtained from local shops and interviews with project staff. Process output and outcome data were extracted from the computerized management information system (CMIS) of the project and project reports. All data were entered into a specifically designed MS Excel workbook.

Economic costs were annualized using a discount rate of 3% (Walker and Kumaranayake 2002). Capital equipment was assumed to have a life of between 5-10 years depending on the item. Start-up and training costs were annualized over the lifetime of the project (assumed to be 5 years). The start up period was defined as from project inception until the start of services to the key population and project output reporting commenced. Recurrent costs in the start up period were treated as capital costs and annualised. Start up period capital costs were allocated to the start up period based on percentage months of start up.

The total costs of the *Avahan* program were calculated by summing up the total capital and recurrent costs at all levels of the intervention (NGO, LP and BMGF). Average

costs were obtained by dividing total costs by the relevant output indicators to obtain estimates of the cost per person reached and cost per contact.

The costs were adjusted for inflation using the average consumer price index for the year. All costs are presented in Indian currency and also converted to US dollars using corresponding exchange rate of the analysis period ([www.oanda.com](http://www.oanda.com)).

### **3.3. Justification for the Methods Used**

Cost data from economic perspective for consecutive years is scarce. Long term cost studies are costly and time consuming hence not routinely conducted.

The initial analysis was planned to be conducted in five districts and project costs for whole of *Avahan* but looking at the opportunity and wealth of data available to be mined, it was planned to include all the intervention sites. Since the data was being collected every year, it provided the opportunity to review and undertake special analysis which were novel and not been explored earlier, like typology costs for delivering services to different typology of sex workers.

Our full costing approach provided us data at all organizational levels over four years. It was interesting to note that a greater proportion of costs were being spent at above service level. Hence, an attempt is made to probe into factors leading to the variation among the state lead partners.

The data had a large number of observations as each NGO implementing *Avahan* intervention was included and they had up to 4 data points, one for each year (some NGOs had less data points due to later start as new sites were continuously added and scale up was phased). This allowed us to develop a costing database for econometric analysis to assess determinants and efficiency of the interventions.

Our longitudinal data provides more robust cost estimates for sex worker interventions than is currently available. This would help in better cost-effectiveness estimates with lower uncertainty ranges around cost per HIV infection averted and cost per DALY saved. It would also help to examine the several factors that can influence the cost-effectiveness like scale, intensity, efficiency of implementation and mix of interventions targeting different high risk groups.

We also used a standardized methodology for collecting cost data by a single team (though it meant more time was needed) which would limit subjective differences in our data. Participative methods used meant there was adequate discussion to clarify any data issues and sharing of preliminary results. The output indicator in the initial years had some limitations which were sorted out when the CMIS was set up and data was updated.

The time could have an impact on the cost of services in several different ways. For instance, during the learning curve phase costs could be significantly higher than after it. Many of the existing studies are short term and do not assess the change in costs over time. Furthermore, some institutions could adopt a very efficient delivery process and the cost of service delivery could decrease substantially, but the inter-organizational or regional variation in costs could increase. In addition, further change in strategy could also reduce the costs. The evidence-base currently does not allow us to estimate how costs might change as the project matures. Indeed one of the aims of the *Avahan* Economic Analysis is to generate this evidence. However, a cost analysis of an adolescent sexual health intervention suggests that costs can reduce by about 40% per year as a project matures (Terris-Prestholt; et al., 2006).

Therefore long run costs data helps to understand these changes with more clarity and hence in our study we have a time frame of 4-year data analysis for all districts. This

also provides the required number of observation and data points for econometrics analysis. The data was comprehensive and included all implementing agencies which gave us an opportunity to understand the cost variation. Our full costing approach including the costs of program management, capacity building and supervision of implementing agencies and their organizational structure gave us the insights into the resource needs and issues during rapid scale up. The typology analysis was planned when we looked at the way the NGOs were selected to implement the program in one state, which was unique. Target population of certain NGOs were from a specific typology like brothel based, bar based, street based, lodge based or a particular high risk group like MSMs and transgender. This gave us an opportunity to explore if costs differ by the key population reached. Due to the increasing interest in the added value of structural interventions to enhance the gains of HIV prevention especially for women, estimating the costs of such activities would be very relevant for future programming. The cost data generated were further used to measure the incremental cost-effectiveness of structural interventions for high risk groups in real-life community settings.

Instead of costing few sites for detailed analysis every year, we took a much wider approach to collect cost and program data from all the sites every year, using routine financial reports and program output data. For about a quarter of the districts, we also performed detailed cost data collection which helped us to gain insights into parameters from which we wanted additional information and further understand the actual program implementation and their challenges. This provided us with one of the largest HIV costing database derived from actual program data till date and permits us to perform econometric work and measure efficiency of the interventions implemented by different partners in a wide geographic area. In addition to providing us a much bigger picture, detailed district costs enabled us to evaluate the cost-effectiveness of number of districts.

India being a diverse country, such large analysis is required to achieve an adequate strength of the results.

### **3.4. Research Setting**

#### **3.4.1. Current HIV Estimates for India**

In 2006 UNAIDS estimated that there were 5.6 million people living with HIV in India, which indicated that there were more people with HIV in India than in any other country in the world (UNAIDS 2006). In 2007, following the first survey of HIV among the general population, UNAIDS and NACO released a revised estimate – between 2 million and 3.6 million people living with HIV in India. The 2010 estimates were about 2.4 million (1.93-3.04) which puts India behind South Africa and Nigeria in terms of numbers of people living with HIV. The total number of AIDS cases reported to NACO by August 2006 was 124,995 while the most recent estimates in 2010 puts this number at 120,000 new HIV infections in 2009 and about 172,000 deaths due to AIDS related causes. This shows about 54% reductions from the figures in 2000 which stood at 270,000 new infections. Of this number, 39% were women, and 4.4% of them were children under the age of 14 (NACO 2010).

The latest HIV Sentinel surveillance data for India (2012) found the adult HIV prevalence at 0.27%. The total number of people living with HIV has been estimated at 2 million people (1.7-2.5) and about 148,000 deaths were due to HIV/AIDS in 2011. The annual new infections among adults is 116,000 of which 31% are from the six high prevalence states of India (NACO 2012).

The primary driver of the HIV epidemic is unprotected paid sex with female sex workers (FSW) and high risk men who have sex with men (HR-MSM) and injecting drug

use. 88.2% of the HIV transmission in India is through heterosexual mode while mother to child transmission constitutes 5%, infected syringe and needle 1.7%, homosexual transmission 1.7% and transmission through contaminated blood and blood products 1%.

Overall, around 0.27% of India's population is living with HIV (2012). High HIV prevalence continues among high risk groups of IDUs (9.1%), MSM (7.3%), FSW (4.9%), sexually transmitted infections (STI) clinic attendees (2.4%) and antenatal clinic (ANC) attendees (0.4%). The national HIV prevalence rose dramatically in the early years of the epidemic, but a study released at the beginning of 2006 suggests that the HIV infection rate has recently fallen in southern India, the region that has been hit hardest by AIDS. In addition, NACO has released figures suggesting that the number of people living with HIV has declined. The six high prevalence states of South India account for 53% of all HIV infections in the country. Statistics indicate that Andhra Pradesh with adult HIV prevalence (0.7%) accounts for 419,000 cases, Maharashtra (0.4%) 316,000 cases, Karnataka (0.5%) 209,000 cases and Tamil Nadu (0.27%) accounts for 133,000 cases (NACO 2012). The high risk population estimates of HR-MSM and FSWs in these states are 18,682 and 85,962 in Andhra Pradesh, 24,926 and 118,610 in Karnataka, 49,235 and 79,712 in Tamil Nadu and 101,031 and 245,831 in Maharashtra respectively. Manipur and Nagaland contribute to 1% of all HIV infections. Focused intervention with groups of people such as female sex workers, truck drivers, injecting drug users and others have helped to a great extent in preventing the spread of diseases and keeping the overall prevalence low. The National AIDS control program has improved access to information, clean needles and condoms for vulnerable groups (NACO 2008, NACO 2012).

### 3.4.2. Staging the Epidemic and the Need for Prioritizing the Target Populations

In low prevalence countries the HIV epidemic is mostly limited to high-risk populations such as IDUs, FSWs and HR-MSM. These groups are often hard to reach and marginalized due to social stigma which add to their vulnerability. The interventions required and the complexities of reaching the groups differ as do the costs. As the epidemic advances, it spreads to bridge populations (clients of Sex workers, partners of IDUs, migrant/mobile populations etc.,) who continue its spread to the general population. As the virus spreads from one group to another, the size and the composition of the population to be targeted for prevention and care changes, increasing the resources needed to address the epidemic effectively.

Countries are classified into three epidemiological categories by the risk characteristics of predominantly affected population groups and their HIV prevalence. These categories describe the epidemiological status of HIV in a country and help planners and program managers to make strategic decisions.

**Table 3: Epidemiological categories**

Stage of epidemic	Affected population	Risk Level	Prevalence in affected groups
Low	IDUs, SWs and MSM	High risk	< 5%
Concentrated	IDUs, SWs and MSM, clients of Sex workers, partners of IDUs, migrant/mobile populations	High and medium risk (bridge populations)	>5% in high risk sub-populations
Generalized	General population	Low	> 1% in Antenatal women

*Source:UNAIDS Costing guidelines 2004.*



For the purpose of planning and implementation of National AIDS Control Program-III (NACP-III), all the districts in the country were classified into four categories based on HIV prevalence in the districts among different population groups for three consecutive years(NACO 2007). The definitions of the four categories are as follows:

**Category A:** More than 1% ANC prevalence in district in any of the sites in the last 3 years.

**Category B:** Less than 1% ANC prevalence in all the sites during last 3 years with more than 5% prevalence in any high risk group (HRG) site (STD/FSW/MSM/IDU).

**Category C:** Less than 1% ANC prevalence in all sites during last 3 years with less than 5% in all HRG sites, with known hot spots (Migrants, truckers, large aggregation of factory workers, tourists etc.).

**Category D:** Less than 1% ANC prevalence in all sites during last 3 years with less than 5% in all HRG sites with no known hot spots **OR** no or poor HIV data.

(ANC: Ante-natal Clinic; HRG: High Risk Group; STD: Sexually Transmitted Disease; FSW: Female Sex Worker; MSM: Men who have Sex with Men; IDU: Injecting Drug User).

### **3.4.3. Avahan Program Description**

The Bill and Melinda Gates foundation initiated a large scale HIV prevention program in India in mid-2003 to stem the growing epidemic of HIV in India. There were huge concerns at the national and global level that unless the epidemic in India was addressed immediately it can lead to increase in number of people affected by this disease.

Avahan which means “call to action” in Sanskrit – has three primary objectives:

- Build an HIV prevention model at scale in India
- Catalyze others to take over and replicate the model
- Foster and disseminate lessons learned within India and worldwide.

*Avahan* started in late 2003, early 2004 and is a focused prevention program, reaching the high-risk groups and bridge populations, in geographical locations most affected (BMGF 2008). The India AIDS Initiative (*Avahan*) project operates in six states in India, namely Tamil Nadu, Maharashtra, Karnataka, Andhra Pradesh, Manipur and Nagaland which have a combined population of 300 million people. Within these states, it provides prevention services to nearly 200,000 female sex workers, 60,000 high-risk men who have sex with men, and 20,000 injecting drug users, together with 5 million men at risk. The *Avahan* program is delivered by grassroots Non-Governmental Organizations (NGOs) supported by state level lead implementing partners (LPs) who are large Indian or international NGOs. Districts were chosen in consultation with national and state level authorities with the intent to avoid duplication and ensure programming complementarities, more importantly, to saturate the coverage of core groups in all the districts in which *Avahan* interventions were started. The package of prevention interventions address proximate determinants of risk through outreach, behavior change communication (BCC) on safe sex, free or socially marketed condom distribution, needle and syringe exchange, overdose management, oral substitution, referrals (for injecting drug use), and treatment of sexually transmitted Infections (STIs) as well as distal determinants (stigma, violence, the legal environment, medical infrastructure, mobility and migration, and gender) through structural interventions and community mobilization (BMGF 2010).

*Avahan's* mandate in the two North-East states of Manipur and Nagaland was two-fold: to build a model of high-quality HIV prevention programming with injecting drug users in selected locations; and strengthen local capacity to expand this model beyond *Avahan* intervention locations (BMGF 2009).

### **3.5. Intervention Description and Project Activities**

#### **3.5.1. Start-up Activities**

The startup activities included the selection of NGOs and their training on proposal writing, program management, strategic planning and working with various target groups. Validation of the mapping estimates and needs assessment was conducted and involved the collection of information with full involvement of the key population (vulnerable/ high risk groups in the district like FSWs, MSM, and IDUs). This yielded information to be used for planning HIV prevention programs like approximate number of key population residing in the district and the geographical characteristics of various sites. Participatory site assessment (PSA) activities include mapping the size, location and central 'hotspots' of key populations, as well as identifying patterns of high risk behavior, and factors that influence these. Analyzing this data helped in planning strategies for program implementation.

#### **3.5.2. Outreach Education**

Peer led outreach is designed to provide resources and support for safe sex as well as encouraging the key population members to attend clinics. Outreach by peers is done through behavior change communication, counseling, referrals and networking. The recommended peer educator ratio in the *Avahan* project is 1: 40 or 50 key population (KP) members. They are paid on an average Rupees 1500/month. Using their

knowledge of the sex work locations and geography, peer educators map the area, assess risk of each individual and make weekly work plans. They provide one-one and one-group behavior change communication sessions (1-1, 1-G), condom demonstrations, distribution of supplies to the key populations and support need assessment. The peers initially found identification of KP very difficult as they would deny their status as a drug user or sexworker. The KPs used to accept services in the field but were reluctant to come to Drop-in-centers (DIC). (*DICs are safe spaces for the key population to meet and share experiences and receive project services*). Peer linked approach to identify gaps in service delivery and support in formulating strategies for addressing them helped project outreach. The programme could reach out quickly to the vulnerable and marginalized community by having staff and peers from the community. Recreational materials provided in DICs helped to increase attendance at the DIC.

### **3.5.3. Sexual Transmitted Infections Services**

The strategy for providing STI services for urban sex workers had two main components:

***Program-run STI services*** – These are specific clinical services that are provided for sex workers in program areas where the program hires the doctor on a full-time or part-time basis. There are two main modalities of service provision. In some settings new clinics are set up in locations convenient for sex workers, often in a drop-in centre. This strategy is promoted in areas where there are large concentrations of female sex workers, particularly if they are street-based. In this case, doctors are hired by the program on a full-time or part-time basis to provide services.

***Outreach clinics:*** Where this above approach is not desirable or feasible for sex workers, an alternate strategy involves providing STI services on an intermittent basis at locations

that are convenient for sex workers. For example, sex workers based in brothels or dhabas who find travel to a program clinic inconvenient can be offered services at their work location on fixed days and at fixed times, or when there is a special need expressed.

***Referral-based STI services*** – This approach uses selected doctors within the program areas as referral doctors to provide clinical STI services for sex workers. Doctors are selected through consultation with the community and then recruited, trained and/or re-oriented with the assistance of regional STI managers. These referral doctors carry out syndromic case management according to the protocols developed by *Avahan*, and also keep records on all sex workers treated. Their fees are paid by the program, and all STI drugs are provided without charge by the NGO in syndrome-specific pre-packaged packets developed by the program.

#### **3.5.4. Capacity Building**

Training need assessments were done and refresher trainings, on the job training and experience sharing sessions across NGOs to share best practices and help to collectively address challenges were organized. Orientation about HIV/AIDS, skill building, self-help group(SHG) formation, account training, outreach worker(ORW) trainings included basic information on STI/HIV/AIDS, job description of ORW, peer management, counseling, motivating client for behavior change, conducting group discussion and focus group discussion, documentation and reporting were organized. For Nurses and programcounsellors the trainings consisted of STI management and case study writing and for KPs photography training was also conducted.

The Pan-*Avahan* capacity building partners and others also supported much training to build capacity of lead partners and implementing partners in all *Avahan* intervention states. Their support was mainly in the area of police advocacy,

media advocacy, interpersonal communication, community mobilization and quality monitoring of STI services.

#### **3.5.5. Condom Promotion**

The project considering the importance of preventing transmission by sexual route focuses on providing the key population access to free condoms and also skills for sex workers to successfully negotiate condom use with their clients. Condoms are distributed to the key population through peers, outreach workers, in DICs and condom outlets and also through stakeholders like pimps and brothel owners to ensure adequate supplies to FSWs.

#### **3.5.6. Community Mobilization**

At the grassroots level, programs have begun community mobilization activities across all districts. These activities differ from location to location, but include activities such as holding consultative meetings with sex workers about the program, having social gatherings for sex workers (including their families in some locations), and involving sex workers in outreach planning and program implementation (like enumeration, social network mapping and biological-behavioral surveys), participation in DIC events, peer conventions and formation of self-help groups.

#### **3.5.7. Advocacy and Enabling Environment**

This helps to promote better community mobilization and involves orienting taluk level officers, gram panchayat members about the program, sensitization for local leaders, youth organizations and secondary stake holders like pimps, auto drivers, brothel madams and police. Formation of District Advisory Committee (DAC) and building rapport with

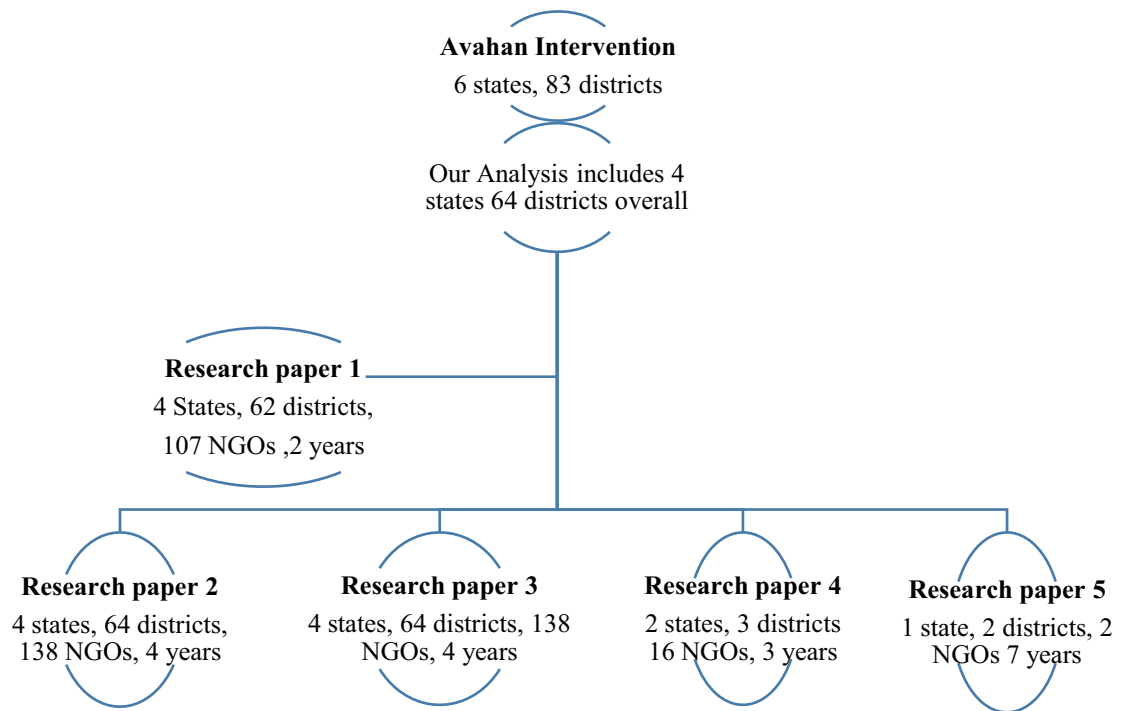
referral services like Integrated Counseling and Testing Centre(ICTC) and other NGOs in the districts. Friends club meeting with partners, clients, pimps etc.

### **3.6. Costprocedures**

#### **3.6.1. Data Collection**

**Study Sites:** All the 64 districts implementing *Avahan* interventions in the four southern states were included in our study. All NGOs implementing these interventions were considered for costing study. In some districts (23) we had detailed costing for two years and for two other years, the data was collected from the state lead partners through routine reporting. As the scale up happened over the years, new districts and NGOs were added into the study. The study sites specific to the research papers are shown in the flow diagram below.

Analysis of Avahan intervention and sites included in different research papers of this thesis as shown in Fig 1.



**Figure 1: Avahan intervention sites included in different research papers**

**Ethical Approval:** The study was approved by the Health monitoring and steering committee of Indian council of medical research and institutional review boards of St John’s Medical College in Bangalore, India(See Annexure 9 and 10).

### **3.6.2. Field Visits**

Cost data collection was based on the Costing Guidelines for HIV Prevention Strategies. UNAIDS provided the basis for standardizing the collection of cost data for HIV prevention strategies (including STI treatment, peer education and condom promotion), and guidance on methods to address common issues and problems in cost analyses. An ingredients-based costing methodology to consider both the financial and economic costs was used.



The study methods were shared with all the state lead partners. An initial visit to brief the program staff at the state level about this research work and discussions on selection of the detailed costing site was done. The background of the implementing NGOs, objectives of the project, the HIV situation in the district, the response to the epidemic, description of the *Avahan* intervention, and the target population as per mapping estimates were reviewed. The program description (project reports) and interview with the project staff gave insights to the strategies and innovations in service delivery, issues and concerns in project implementation. The discussions with the project staff at all levels from the project co-ordinator, field officers, doctors and peer educators during the field visit helped in understanding the intervention. The data was collected using a semi-structured, open ended questionnaire on the program evolution, implementation, their responsibilities and issues and constraints faced. Information on the local resources mobilised and any shared resources were elicited during the discussions.

The program output data was collected from the state lead partner's management information system (MIS) in the initial years and from the central computerised management information system (CMIS) from second year onwards. The data gives details on the number of key population estimated, contacted, registered and receiving various services like condoms, general clinical and STI services, capacity building activities and referrals done. The project details in terms of the towns and intervention sites and project related staff working is available in the CMIS.

Field visit was undertaken to the detailed costing site to explore issues in rolling out the project in the community, experiences of staff and the nature of delivery of services, various strategies and solutions used to solve the problems in service delivery and any innovative steps taken to improve services.

Detailed cost analyses were undertaken for selected sites from a provider perspective. It excludes the costs of clients for using the services. In each setting, the range and nature of activities were considered. The total provider costs were collected using ingredients cost analysis. Average costs per beneficiary reached yearly were calculated using the costs and program output data.

### **3.6.3. Criteria for District Selection for Detailed Sites**

There were 2 rationales for the selection of sites: Proof of concept and sites having diversity. Since the costing data would also be very crucial for impact assessment in terms of cost-effectiveness the sites chosen had to also be appropriate for modelling work at that site. Factors considered for proof of concept were that the sites should have pure *Avahan* interventions, higher sex worker numbers, high per capita sex workers and low migration/mobility of both core and bridge groups. Additionally, to reflect diversity, the factors considered were geographic spread, economic development in the region, mix of agricultural and industrial areas, high/low HIV prevalence, migration, rural/urban areas and large urban metros also were included.

#### ***Box 1: Criteria for district selection***

- Level of co-intervention should be minimized. Districts where there is relatively little non-*Avahan* activity are desirable to facilitate attribution and project impact. (This is important for both the modelling as well as the cost-effectiveness as no cost data was available from non-*Avahan* activities within districts).

- Sufficient data is available for future modelling work. At a minimum the selected districts should be a district where Integrated Behavioral and Biological Assessments (IBBA) have been conducted.
- The district should reflect the epidemiological and socio-political context of the state and is chosen after consultation with the lead implementing partner.

#### **3.6.4. Cost Classification**

Costs are classified according to three characteristics: phase of implementation of the intervention, organizational level where costs are incurred and type of costs. Firstly the time period between the decision to implement an intervention and beginning its delivery to the beneficiaries is regarded as the start-up costs. The start-up costs will be annualised to reflect its utility beyond the year in which it is incurred. All costs beyond the start-up period are included as implementation costs. Expenses prior to March 2004 were treated as start-up costs at the SLP and program level. The NGOs and SLPs were consulted on determining the exact duration of start-up period and the start of implementation during the field visits to the districts and time-sheets from a range of staff on how they allocate their time to different activities were also obtained to analyse costs by activity. For each NGO, startup time was estimated from two sources. We looked into the management information system to assess when the basic programme outputs like community contacts and condom supplies were started by the peer educators and also confirmed them through discussions undertaken through key informant interviews in the project.

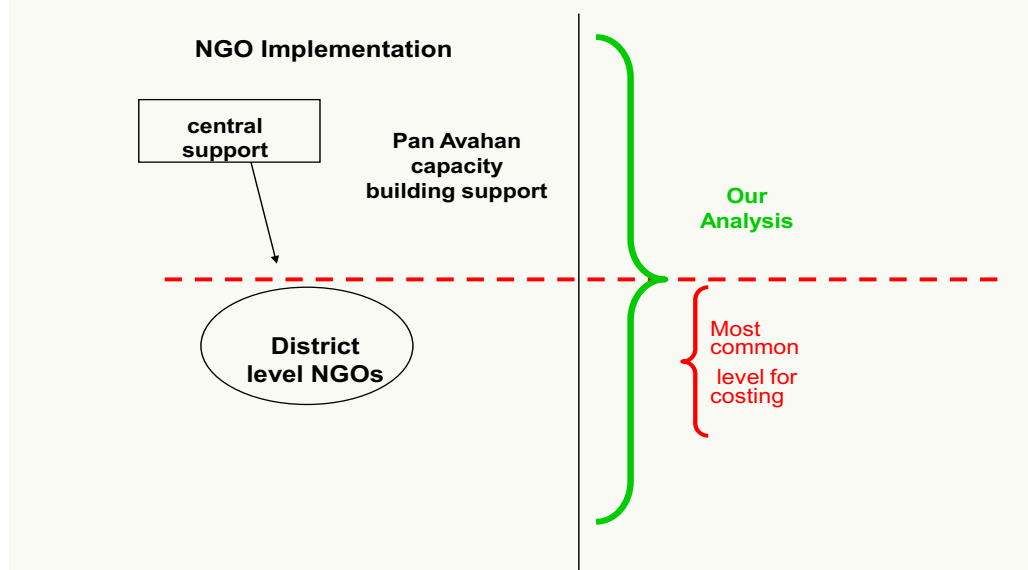
Secondly, costs are collected at the state level and at the implementing level of the NGO. In detailed costing districts (23) we also estimated activity costs and donated items at the service level. The additional data collection included field visits, key informant

interviews (district project in-charge, supervisors/ORW, peers), records review (proposals, programme annual/quarterly reports) and personnel time-sheets from a range of programme staff to better understand the programme implementation, extent of local resource mobilisation and allocation of costs across various activities.

The central financial costs at the *Avahan* level are also included. Finally, costs are categorised as capital costs which lasts for more than a year and the recurrent costs which are used up within the program year.

Most of the previous studies collect cost data only from the implementing NGO; our study covers the overall flow of funds and supporting partners for the project. Costs were collected retrospectively (where activities have already taken place) and considered both the financial and economic costs for the years 2004-2008. Discounting in our study is done using a 3% discount rate (Walker and Kumaranayake 2002). Discounting makes current costs and benefits worth more than those occurring in future because there is an opportunity cost to spending money now rather than in future and also the desire to enjoy benefits now. The reason why current spending incurs an opportunity cost relative to delayed spending is that a monetary investment yields a real rate of return and therefore there is a cost to spending money in the present. Hence this temporal dimension of preference should be incorporated in economic evaluation. When programmes have costs or benefits spread over time it is necessary to introduce adjustments based on time preference to make them comparable. In order to homogenise the magnitude that make up a flow of costs or benefits extending over successive periods we resort to discounting procedure. This expresses all future values in their equivalent values at its present moment in time. Discount rate of 3% is the widely used and recommended rate in economic studies. (Mahboub-Ahari et al., 2014; Permsuwan et al., 2014)

## Organizational levels for costing



**Figure 2: Organizational levels of cost analysis**

Total costs were estimated using a top down gross costing methodology from a provider perspective using expenditure records, donated supplies and additional resources mobilised locally for detailed costing sites. The recurrent costs that were included are personnel costs, travel, building operating and maintenance supplies, cost of condoms and needle and syringes, costs of clinical services for general complaints, STI services, program monitoring and evaluation, advocacy and enabling environment, capacity building, community mobilization and information, education and communication costs.

The capital costs include equipment, furniture and fixtures, vehicles, rental deposits and start-up costs. Capital costs were annualised to reflect the utility of their use during the course of the project. The annual financial cost of capital goods were calculated using straight-line depreciation, in which the total cost of the good is divided by the working life of that item. The annual economic costs of capital goods were calculated by taking the discount rate into account, which gives the opportunity cost of

the capital used. Capital equipment was assumed to have a life of between 5 and 10 years depending on the item (see Annex 1). The economic cost of capital items were calculated by dividing the cost of the item by the annualization factors for discount rate at 3%. Two types of cost analysis were undertaken: by input (e.g.: personnel, travel, supplies etc..) and by activity (e.g.: training, peer education). Table 4 presents the annualization factors used in this study.

**Table 4: Annualization factors**

Useful life of capital item	Annualization factor for discount rate 3%	Annualization factor for discount rate 10%
5 years	4.58	3.79
10 years	8.63	6.14

*Source: UNAIDS Costing guidelines 2001*

Costs are converted to constant values using prevailing inflation rates. Inflation is a term used to describe the process whereby the general price level is rising and money is losing value. This means that more money has to be paid to buy or provide the same quantity of goods and services. The Gross Domestic Product (GDP) implicit deflator reported by the Ministry of Finance that reflects price changes for all goods and services produced in a country was used which is the broadest measure of inflation.

Detailed cost analysis was done in selected districts (in consultation with SLP). Most of the data obtained at the central level, financial data from accounts, program reports and MIS data from respective units. The sources of data include financial records from project, interview with project staff, time-sheets to determine allocation of resources to different activities. Output data was derived from program Management information system (MIS) both monthly and from individual tracking data and mapping data. Cost and output data were entered and analyzed using Microsoft excel.

**Program output:** Data of the program outputs from the management information system of the project to assess the coverage, intensity and reach of the project.

**Qualitative data:** The information collected from proposals, report (secondary sources) discussions with project staff and time sheets to understand the program (Primary sources).

### 3.6.5. Summary of Data Sources

**Table 5: Data sources**

Data	
Financial data of NGOs Statement of expenditure (SOE) available by input and activity	2004-2008
Financial data of state lead partner(SLP)	2004-2008
Gates foundation(Delhi office)and capacity building partnercosts	2004-2008
Proposals	
Implementing NGOs	2004-2008
Annual report SLPs	
Output data	
Management information system (MIS)	2004-05
Computerized management Information system(CMIS) data	2005-2008
Data thatwas collected during field visits (Interviews,discussions, document review and time sheets	
Economic cost data	
Description of program implementation by interaction with field staff	
Narrative reports of the NGOs and event reports	
Time-Sheets from program staff and doctors	

### 3.7. Cost Allocations

#### 3.7.1. Activity Based Analysis

The main activities considered for the analysis by activity and organisational level with a description is provided.

**Box 2: Description of main activities considered for the analysis**

Activity	Description
<i>Programme Level</i>	
Support to media advocacy	All activities and related costs to assist positive media representation of the issues of high risk groups and to create an enabling environment to reduce stigma and wider acceptance of HIV prevention programmes for eg: through Public Service Announcements and embedded messaging in mainstream television programming, training journalists in the states, tracking stories, and placing positive stories in the local media.
Support to policy advocacy	This included activities to sensitize the police to reduce harassment of sex workers.
Support to advocacy with societal leaders	These activities were for reducing the barriers for uptake of programme services by high risk groups by advocating with local government leaders and at state level, improving resource allocation and also involving business sectors to support some activities.
Support STI services	To maintain quality and ensure standardisation of services by regular monitoring, development of guidelines for STI syndromic management and clinic operation. Conducting operational research studies and also tracking the uptake of services.
Support to community mobilization	Activities like vision building, learning site demonstration projects for increasing community participation and engagement in programmes by the key populations appropriate for local conditions.
Support to inter-personal communication	Support to develop interpersonal communication methodologies to promote behaviour change skills for field staff in communicating with key populations.
Support to strengthening HIV positive networks	Raising capacity of PLHIV and supporting their networks, especially for demand generation and also as a resource persons for training and sharing their experiences.
Support to	Allocated expenses for Pan-Avahan capacity building partners who



programme management of expertise enhancement partner	were provided grants to support specific technical areas for the state lead partners.
Programme management general	General programme management activities of national office.
<b><i>State Level lead implementing Partner</i></b>	
Expertise enhancement including technical assistance and training	Includes induction training and re-orientation for staff, workshops/trainings on specific topics of project management, immersion visits and field visits for staff.
Information Education and communication	Development and printing of educational materials in English and local languages. Creating modules on specific topics. Improve awareness through mass media, wall writings, streetplays and celebration of days like World AIDS Day.
Programme management	General activities for grant management including office set up, recruitment, indirect expenses and maintenance costs
Management information	Mapping, validation and baseline studies . Setting up and maintenance of centralised management information data. Support to surveys and special studies.
Community mobilisation and enabling environment	Activities relate to establishment of safe spaces like Drop-in-centres, conduct of events for increasing key population participation, setting up of self help groups, supporting access to social entitlements, development of community based organisation(CBO) to increase ownership. Support to local advocacy to police, lawyers, local leaders, brothel madams and pimps. Supporting Peer convention and rallies. Setting up crisis response systems.
Support and supervision	Includes staff support in the form of regional managers or STI managers to oversee the programme implementations of the NGOs/CBOs. Set up procurement mechanisms for consumables like condoms and STI drugs. Link with state AIDS control societies and collaborate with other organisations working in their areas. Plan NGO level and partner meetings to share learnings.
<b><i>Service Level (NGO)</i></b>	
Outreach, condom promotion, behaviour change and communication	Includes peer outreach to provide programme services information and education on safe sexual practices, distribution of condoms and supplies.

STI Services	Referral to project STI services or referral doctors for STI treatment and follow-up. General medicines are also provided and referral for HIV counselling and testing. Syphilis screening and treatment.
Programme management	General activities like office set-up and maintenance, recruitment and project management related activities of NGO staff. Co-ordination with state lead partner. Reviews and meetings with field staff .
Community mobilisation and enabling environment	Conduct of DIC events, advocacy with local leaders, celebration of important days and festivals. Running crisis response systems. Setting up of self help groups and participation in programme committees and active engagement to form community based organisation.
Expertise enhancement including technical assistance and training	Trainings for peers, field level staff on programme implementation and workshops on skill development of project staff.

To obtain the activity based costs, time sheets were administered to get an estimate of the time spent by staff on the various project activities. The budget and expenditure statements were looked into in order to obtain the costs related to different activities. Directly allocable recurrent costs to the specific activity were allotted and for the non-allocable activities personnel cost percentage were used to allocate the costs across different activities. The capital costs were allocated based on the activity wise recurrent cost percentages. Thus the total costs was calculated for specific activities like outreach, enabling environment and advocacy, training, programme administration, clinical services and special events. If the NGOs handled the programme implementation in multiple districts then a percentage of the central programme management cost of the NGO was shared based on the total expenditure in each district.

The SLP Costs were allocated using the criteria mentioned below:

- Specific allocable costs to various activities were allocated to activities
- Capital costs/ administration costs were then allocated equally to districts

- Recurrent costs for the other activities were allocated based on the estimated population per district.
- Above service level costs were allocated to different support activities and between each district and NGO on the basis of actual resource usage (line item wise expenditure data analysed specific to the district), time sheets, interviews with staff and factors such as grant size and key population size where no alternative data was available.

The Bill and Melinda gates foundation office costs (New Delhi) and Pan *Avahan* capacity building costs were allocated using the following criteria.

- Program administration expenses allocated to all SLPs based on their grant size
- Capacity building grant expenses shared equally to all SLPs.
- Expenditures prior to March 2004 assumed to be start-up costs

To obtain the activity based costs the time spent by different staff as obtained from the filled and returned time sheets from detailed cost districts and discussions with staff were considered. Since most of the NGOs lacked sufficient experience in managing such large scale programs, capacity building was an important component. The budget and expenditure statements are looked into in order to obtain the costs related to capacity building, advocacy and enabling environment activities. Directly allocable recurrent costs to the specific activity were allocated and for the non-allocable activities, personnel cost percentage was used to allocate the costs across different activities. The capital costs were allocated equally to all activities. Thus the total costs were calculated for specific activities like outreach, enabling environment and advocacy, capacity building, program management, clinical services and special events.

***Summary:***

Methodologically this study presents one of the largest global samples of HIV prevention providers using prospective methods done concurrently with programme roll out. The time frame for the study is 4 years and for one sub-study is conducted over seven years. The data sources included a mix of both routine data and detailed costing for allocation to specific activities. To capture the costs of intervention in different phase of the implementation we collected data in both during the start-up phase and also during full-scale implementation.

This study demonstrates that large scale costing like this is feasible and informative. Key to the methodological approach was participative and involvement of the stakeholders from the beginning increased sharing and uptake of results. The study was able to provide empirical results in terms of unit costs year-wise which has provided robust estimates for the calculation of cost-effectiveness of the intervention. There have been few previous studies examining the incremental cost-effectiveness of involvement in community mobilization, and this study provides data on this for the first time. Additionally the unit costs by typology of reaching different types of female sex workers like street-based, brothel based, home-based, different target groups like female sex workers, men who have sex with men and transgenders, provides useful new data for those allocating resources across populations.

The study is one of the few studies that quantify the above service level support costs to the intervention, which were found to be substantial. The effect of scale on the costs was also studied in detail to understand the importance of scale as an important cost driver; this also highlighted the important of fixed above service level costs.

This section dealt with broad methods used in the research papers. The costing methods are quite uniform across the different research papers that are included in the thesis. The allocation criteria remain the same throughout. The main changes would be the duration of the study, number of sites involved, the focus of analysis like scale, typology, above service level costs and community mobilization. Each of the paper gives further detailed description of the methods, setting, outputs used, costing period and currency year.

The quality of the data were routinely checked in several ways. In the first year we had double data entry done by myself and one data entry operator to achieve consistency and to identify trouble shooters in the cost sheets that were being set up. The data in different sheets were linked for analysis, which limited manually copy paste errors. Any modifications to data made were done only with insert comment so that if we get back to the sheet after few days it is clear why the number is different.

There was no other data source to compare or validate our results with, so we adopted an approach of qualitative validation with key stakeholders. We held extensive methodology briefing meetings and then feedback meetings were held every year of analysis with the state lead partner where interim results were shared. At the end of the study dissemination meetings and workshops were held both state level and national level with BMGF and NACO. The results were also shared through Videoconference to the funders BMGF head office staff based in Seattle in the final year.

**Contribution of the candidate:**

The costing team was very small. It included senior health economist/Supervisor and two research assistants and myself. I have been involved from the start of the study and contributed to the development of design of the study, selection criteria for districts for detailed costing, developing the data collection tools, conducting the pilot, refining the tools, completed the data collection for one state (15 districts) independently including data entry and analysis in the first year and from the second year as we started other states data collection trained two more research assistants to assist as the data and travelling increased significantly. The first two years data were analyzed and I prepared the first draft of manuscript for STI-BMJ journal. Similarly each of the sub –studies was conceptualized as and when data collection progressed for which additional information were sourced and the analysis was undertaken. The community mobilization work was a result of my personal interaction with the NACO team during a feedback presentation and followed it up with funders for financial support. The typology paper was borne out during the analysis when we found the sub-grants to the implementing NGOs were given based on the high-risk population by typology provided services. Similarly during our final analysis high above service level costs was found and an attempt was made to explore based on the implementation models of different state lead partners. The first draft of all the research papers was prepared by me and incorporated inputs from my supervisor and co-authors and peer reviewers of journals where it was submitted.

All analysis was first presented to the state lead partners and I had opportunities to share during state partners meets, NACO conferences, BMGF meetings and WHO –evaluation advisory group forums and also LSHTM symposiums and seminars at the department level. I have been completely involved in all these as a presenter for both oral and poster presentations.

I have prepared abstracts and full presentations for AIDS conferences, IAEN symposiums, IHEA congress where I have had opportunity to present both early and final results. Academically I also supported two Master students who were involved in special analysis as local supervisor. One student worked on the peer educator payment systems in two districts of Karnataka. Another student worked on the economic analysis of providing STI services through different strategies for high-risk population in Karnataka. The final report and draft manuscript for both the studies were prepared. I reviewed both along with the senior health economist and provided my inputs.

Objective	Research question	Sub- study	Methods used	Sampling method	Sample size
<p>To describe the costs of the Avahan over the 4 years interventions by organizational level, activity and also quantify the above service level costs as programs are scaled up in four southern states of India</p>	<p>What are the costs of delivering HIV prevention services to high-risk groups?</p>	<p>1. The costs of scaling up prevention program for high-risk groups: lessons learned from the Avahan Program in India. (Research paper)</p> <p>2. Above service level costs of large scale HIV prevention program (Avahan) for high-risk populations in four southern states of India.</p> <p>3. The effects of scale on the costs of targeted HIV Prevention interventions among female and male sex workers, MSM and transgender in India.</p>	<p>Provider perspective: excludes costs of clients using services (e.g. travel time)</p> <ul style="list-style-type: none"> <li>• Top down expenditure costing including expenditures at all levels</li> <li>• Full costing: includes all costs of running program including administration, infrastructure etc.</li> <li>• Timeframe: start-up versus implementation. Start-up treated as a capital item</li> <li>• Multi-year costing: establish base year and adjust by inflation</li> <li>• Discount rate 3%</li> </ul> <p>Data Sources</p> <ul style="list-style-type: none"> <li>• Expenditure records from NGOs, SLPs, BMGF and Pan Avahan capacity building partners</li> <li>• Grant reporting sheet includes funding from other partners and overheads towards Avahan activities</li> <li>• Process and outcome data from Management Information System (MIS)</li> <li>• Record review (financial and programming data).</li> <li>• STI drugs where centrally purchased or sub-contracted – data collected and allocated to districts</li> </ul> <p>Time use data</p> <p>Self reported timesheets from 24 districts for each of the four years of the project Donated time valued at peer wage or NACO peer costs where not available</p> <p>Additional key informant interviews (in Karnataka and detailed sites)</p> <p>Project coordinators and outreach workers</p> <p>Key project staff to confirm allocations expenditure between different projects</p> <p>Detailed interviews to determine criteria to allocate SLP costs, multiple district NGO costs to districts (estimated population, expenditure, equally)</p> <p>Feedback</p> <p>Costs validated with programme staff on a yearly basis</p>	<p>All districts and NGOs data included for cost analysis. Purposive sampling in consultation with implementing partners for selection of detailed costing districts in line with pre-defined criteria for detailed district selection. All NGOs in the selected district included for field visit data collection</p>	<p>In total 64 districts (138 NGOs) were included for cost analysis over four years from 4 states</p> <p>Detailed costing was done for 23 districts (economic cost, and time sheets to allocate to different activities)</p> <p>4 states 62 districts, 107 NGOs, 2 years</p>
<p>Explore the HIV prevention costs by typology of key populations over time in Karnataka and Maharashtra.</p> <p>Estimate the incremental costs of community mobilization activities in two districts of Karnataka.</p>	<p>Do costs vary by the type of high-risk groups targeted for HIV prevention services?</p> <p>What are the additional costs of adding community mobilization interventions to basic HIV prevention services package for high risk groups?</p>	<p>The effects of scale on the costs of targeted HIV Prevention interventions among female and male sex workers, MSM and transgender in India.</p> <p>The incremental costs of community mobilization and empowerment interventions for female sex workers in two districts of Karnataka, Southern India.</p>	<p>Detailed interviews to determine criteria to allocate SLP costs, multiple district NGO costs to districts (estimated population, expenditure, equally)</p> <p>Feedback</p> <p>Costs validated with programme staff on a yearly basis</p>	<p>Districts were chosen based on availability of data specifically by typology. NGOs were chosen for extensive field work representing the range of typology of sex work interventions implemented, (brothel based; street-based, bar girls, home-based), high risk MSM, and transgenders)</p> <p>Districts were purposively chosen to represent the states socio-cultural regions, the size of the high-risk population and the availability of detailed behavioural, biological and costing data</p>	<p>2 states, 3 districts, 16 NGOs, 3 years data</p> <p>one state, 2 districts, 2 NGOs, 7 years data</p>



<p>To provide the necessary costs for further cost-effectiveness analysis for interventions with both female sex workers and high-risk men.</p>	<p>Are investments for large-scale HIV prevention programmes for high-risk groups cost-effective?</p>	<p>Cost-effectiveness of HIV prevention for high-risk groups at scale: an economic evaluation of the Avahan programme in south India evaluation of the Avahan programme in south India</p>	<p>UNAIDS Costing Guidelines for HIV Prevention Strategies as the basis for our costing method, and calculated effect estimates using a dynamic transmission model of HIV and sexually transmitted disease transmission that was parameterised and fitted to locally observed behavioural and prevalence trends. We calculated incremental cost-effective ratios (ICERs), comparing the incremental cost of Avahan per disability-adjusted life-year (DALY) averted versus a no-Avahan counterfactual scenario. We also estimated incremental cost per HIV infection averted and incremental cost per person reached.</p>	<p>Districts chosen were those where Integrated biological and behavioural surveillance surveys, General population surveys and special behavioural survey data were available along with costing data</p>	<p>4 states, 22 districts, 4 year data</p>
<p>To generate a cost database to support econometric work to assess the determinants of costs and efficiency of Avahan interventions.</p>	<p>What is driving costs beyond scale and is there an effect on costs due to typology, service mix, Setting/ environmental drivers of costs and Efficiency?</p>	<p>The determinants of technical efficiency of a large scale HIV prevention project: application of the DEA double bootstrap using panel data from the Indian Avahan.</p>	<p>Multivariate analysis on four year dataset (for all sites) , examining: Using a panel data set of the NGOs that implemented Avahan, we investigate the level of technical efficiency as well as the drivers of technical inefficiency by using the double bootstrap procedure developed by Simar &amp; Wilson (2007)</p>	<p>All districts and NGOs data included for cost analysis.</p>	<p>In total 64 districts (138 NGOs) were included for cost analysis over four years from 4 states</p>
		<p>Estimating unbiased economies of scale of HIV prevention projects: a case study of Avahan.</p>	<p>We costed the project in the first four years of its scale-up and linked the costs to surveillance data. Our empirical strategy allows us to quantify economies of scale in the very short run and in the longer run. System Generalized Method of Moments (GMM) and fixed-effects Instrumental Variable (IV) estimations are used in order to estimate unbiased economies of scale.</p>	<p>All districts and NGOs data included for cost analysis.</p>	<p>In total 64 districts (138 NGOs) were included for cost analysis over four years from 4 states</p>
		<p>“What determines HIV prevention costs at scale? Evidence from the Avahan programme in India”</p>	<p>We collected economic costs from the Indian Avahan Initiative, the largest HIV prevention project conducted globally, during the first 4 years of its implementation. We use a fixed effect panel estimator and a random-intercept model to investigate the determinants of average cost.</p>	<p>All districts and NGOs data included for cost analysis.</p>	<p>In total 64 districts (138 NGOs) were included for cost analysis over four years from 4 states</p>

**CHAPTER 4**  
**RESEARCH PAPER 1**

**The Effects of Scale on the Costs of Targeted HIV Prevention Interventions among  
Female and Male Sex Workers, MSM, and Transgender in India**

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Please be aware that one cover sheet must be completed for each 'Research Paper' included in a thesis.

**The effect of scale on the costs of targeted HIV prevention intervention among female and male sex workers and transgenders in India.**

1. For a 'research paper' already published

1.1. Where was the work published?

Sexually Transmitted Infections, British Medical Journal

1.2. When was the work published?

March 2010

1.2.1. If the work was published prior to registration for your research degree, give a brief rationale for its inclusion

.....

1.3. Was the work subject to academic peer review?

Yes

1.4. Have you retained the copyright for the work?

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Annexure 10.

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2.1. Where is the work intended to be published? .....

2.2. Please list the paper's authors in the intended authorship order

.....

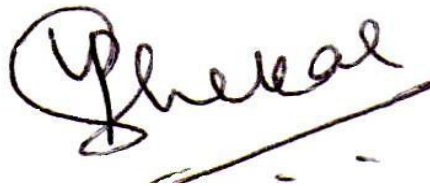
2.3. Stage of publication – Not yet submitted / Submitted / Undergoing revision from peer reviewers' comments / In press

3. For multi-authored work, give full details of your role in the research included in the paper and in the preparation of the paper. (Attach a further sheet if necessary)

I was involved in the study design, data collection, analysis, interpretation and wrote the first draft of the manuscript and incorporated suggestions from my co-authors and the journal peer reviewers. I also made all changes necessary in the post-acceptance of the article till the publication was completed.

NAME IN FULL (Block Capitals) .....Dr. Sudha Chandrashekar.....

STUDENT ID NO: .....222484.....



CANDIDATE'S SIGNATURE .....

Date .....19.12.14.....

SUPERVISOR/SENIOR AUTHOR'S SIGNATURE (3 above)





## The effects of scale on the costs of targeted HIV prevention interventions among female and male sex workers, men who have sex with men and transgenders in India

S Chandrashekar, L Guinness, L Kumaranayake, et al.

*Sex Transm Infect* 2010 86: i89-i94  
doi: 10.1136/sti.2009.038547

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# The effects of scale on the costs of targeted HIV prevention interventions among female and male sex workers, men who have sex with men and transgenders in India

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## ABSTRACT

**Background** The India AIDS Initiative (Avahan) project is involved in rapid scale-up of HIV-prevention interventions in high-risk populations. This study examines the cost variation of 107 non-governmental organisations (NGOs) implementing targeted interventions, over the start up (defined as period from project inception until services to the key population commenced) and first 2 years of intervention.

**Methods** The Avahan interventions for female and male sex workers and their clients, in 62 districts of four southern states were costed for the financial years 2004/2005 and 2005/2006 using standard costing techniques. Data sources include financial and economic costs from the lead implementing partners (LPs) and subcontracted local implementing NGOs retrospectively and prospectively collected from a provider perspective. Ingredients and step-down allocation processes were used. Outcomes were measured using routinely collected project data. The average costs were estimated and a regression analysis carried out to explore causes of cost variation. Costs were calculated in US\$ 2006.

**Results** The total number of registered people was 134 391 at the end of 2 years, and 124 669 had used STI services during that period. The median average cost of Avahan programme for this period was \$76 per person registered with the project. Sixty-one per cent of the cost variation could be explained by scale (positive association), number of NGOs per district (negative), number of LPs in the state (negative) and project maturity (positive) ( $p < 0.0001$ ).

**Conclusions** During rapid scale-up in the initial phase of the Avahan programme, a significant reduction in average costs was observed. As full scale-up had not yet been achieved, the average cost at scale is yet to be realised and the extent of the impact of scale on costs yet to be captured. Scale effects are important to quantify for planning resource requirements of large-scale interventions. The average cost after 2 years is within the range of global scale-up costs estimates and other studies in India.

ners (LPs) at the state level to deliver prevention activities for high-risk and bridge populations in India.<sup>1</sup> The programme is focused on four Southern States (Andhra Pradesh, Karnataka, Tamil Nadu, Maharashtra) and the two north-eastern states of Manipur and Nagaland. An integral part of the programme is its evaluation, designed to provide lessons on the roll-out of large-scale national programmes.<sup>2</sup> The multilevel analysis includes a cost-effectiveness analysis of the programme. This will provide new insight into the overall costs of large-scale national programme roll out, their cost structures, factors that influence costs and the cost-effectiveness of reaching high-risk and bridge populations.

Costs of HIV-prevention efforts are poorly understood, thus limiting the ability to plan and forecast costs for implementation.<sup>3–8</sup> Previous cost studies of India National AIDS Control Programme (NACP) NGO projects focus on the NGO level and have a 1-year time frame, excluding costs of funding partners<sup>9–15</sup> (and National AIDS Control Organisation's Revised Costing Guidelines for Targeted Interventions working with HRGs under NACPIII. 2009. [http://www.nacoonline.org/Divisions/Finance\\_Division/Revised\\_costing\\_guidelines\\_for\\_Targeted\\_Interventions\\_working\\_with\\_HRGs\\_under\\_NACP-III/](http://www.nacoonline.org/Divisions/Finance_Division/Revised_costing_guidelines_for_Targeted_Interventions_working_with_HRGs_under_NACP-III/)). Only two studies examine the causes of cost variation.<sup>14 16</sup> Factors that might influence costs include scale, the typology of the target population, the difference in LP, the age of the intervention, geographical location and other contextual factors.<sup>13 17 18</sup> A review of empirical and economic evidence of costs found that targeted prevention activities among sex workers demonstrated scale effects, with 38–88% of cost variation attributed to scale.<sup>5</sup>

There are a limited number of peer-reviewed studies on the costs of HIV prevention services in Asia. The Avahan programme provides a unique opportunity to fill this gap in the evidence by prospectively measuring the costs of a large-scale programme and incorporating all levels of the delivery system and the start up activities. This paper explores the cost of Avahan activities during the first 2 years of its activity (financial years 2004/2005 and 2005/2006) as it moves from start-up to rapid scale-up. It documents the costs of implementation of HIV prevention for female sex workers (FSWs), men who have sex with men (MSM) and transgenders (TGs) in 62 districts of the four Southern states where Avahan was



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## INTRODUCTION

The Avahan programme is a unique large-scale HIV prevention programme supported by the Bill and Melinda Gates Foundation. It works with local implementing non-governmental organisations (NGOs) supported through lead implementing part-

## Supplement

operational, calculates the cost per person registered and the cost per STI (sexually transmitted infection) clinic visit and analyses the causes of cost variation across the NGO projects.

### METHODS

#### Programme description

Avahan started in late 2003/early 2004 and is a focused prevention program, reaching the high-risk groups and bridge populations, in geographical locations most affected. The Avahan programme is delivered by grassroots NGOs supported by state-level LPs who are large Indian or international NGOs. The LPs subcontracted local implementing NGOs and provided technical and management support to the NGOs. The package of prevention interventions address proximate determinants of risk through outreach, behaviour-change communication on safe sex (BCC), free or socially marketed condom distribution, needle and syringe exchange (for injecting-drug use) and treatment of STIs as well as distal determinants (stigma, violence, the legal environment, medical infrastructure, mobility and migration, and gender) through structural interventions and community mobilisation.<sup>1</sup> Within 4 years, the programme had scaled up to reach 226 855 high-risk group individuals monthly.<sup>19</sup>

#### Sample

Over the 2-year period of analysis (2004/2005 and 2005/2006), 107 NGO projects were functioning in the 62 districts operational at the time (see table 1), providing intervention services for FSWs (38), MSM/TG (9) and mixed populations (60). Cost data were collected from each district and from six LPs in four states. Fifteen districts in the first year and 11 in the second, covering 38 NGO projects, were selected for detailed costing (see table 1). In the remaining districts, a more general costing based on routine data was carried out.<sup>2</sup> The detailed costing enabled a better understanding of economic costs, how costs and cost structures change with scaling up and an activitywise costing. The sites were selected in consultation with the LPs to best represent the different level of activities across the NGOs. Costs of the external programme evaluation and research studies are not included.

#### Methodological approach

An ingredients approach was used to consider full financial and economic costs from the provider perspective based on the UNAIDS 'Costing Guidelines for HIV Prevention Strategies' and as recommended by the Asian Development Bank.<sup>20 21</sup> Financial costs represent actual expenditure on goods and services purchased. Economic costs include the estimated value of all inputs including donated or subsidised goods and services. Costs

were classified as recurrent or capital. Additionally, classifications by activity at the level of the local implementing NGO (ie, capacity building, BCC, STI services, condom promotion, community mobilisation, monitoring, planning and coordination, start-up activities, enabling environment and others) and organisational level (eg, NGO, district, state) were carried out.

#### Data collection

Cost data were obtained from the financial records used for routine financial and management reporting of the NGOs, LPs and foundation office in Delhi, as well as staff records and interviews with staff. For the detailed costing sites, details of donated goods and services were collected from the project. The economic costs of these items were valued at market prices obtained from local shops and interviews with project staff. Process output and outcome data were extracted from the management information system (MIS) of the project and project reports. All data were entered into a specifically designed MS Excel workbook.

#### Recurrent costs

Personnel costs included salaries and expenses of all staff including peer educators, volunteers and shared resource personnel. The peer educator time was valued at the honorarium paid, except where peers were not paid. In the latter case and for other volunteers, their cost was valued based on time spent on the project and the value of their time, estimated as per their average earnings or, if unemployed, the corresponding payment to peers in NACP targeted interventions.

All expenses related to project building and operating expenses, travel and monitoring were obtained from project accounts. In three of the states, the cost of STI supplies was taken from expenditure records obtained from the LP or NGO where they were held. In one state, STI provision was contracted out to an agency, and so supply costs were obtained directly from the agency. Condom costs were calculated using the number of free condoms distributed (supplied by the primary health centre or government hospitals) and the price of the lowest cost alternative in the market, that is, subsidised socially marketed condoms. Indirect costs included project-management administration and overhead costs at the NGO and LP level, and were obtained from expenditure statements.

#### Capital costs

In the financial costing, capital costs (including training and start up inputs) were annualised using straight-line economic depreciation, in which the total cost of the good is divided by the working life of that item. Economic costs were annualised using a discount rate of 10%, reflecting the long-term interest rates in India. A standard discount rate of 3% was then used in a sensitivity analysis.<sup>22 23</sup> Capital equipment was assumed to have a life of between 5 and 10 years, depending on the item. Start-up and training costs were annualised over the lifetime of the project (assumed to be 5 years). The start-up period was defined as from project inception until the start of services to the key population and project output reporting commenced. Recurrent costs in the start-up period were treated as capital costs and annualised. Start-up period capital costs were allocated to the start-up period based on percentage months of start-up. Rent for project offices was included as a capital item.

#### Calculation of total and average costs

Both economic and financial costs were obtained from detailed costing sites. Where only financial cost data were available at the

**Table 1** Summary of districts included in the cost analysis of Avahan for first 2 years of activity

State lead partner	No of districts (number of non-governmental organisations) costed in year 1		No of districts (number of non-governmental organisations) costed in year 2	
	Full sample	Detailed costing	Full sample	Detailed costing
Tamil Nadu	12 (24)	—	12 (25)	2 (7)
Karnataka	15 (15)	15 (15)	16 (17)	3 (4)
Maharashtra 1	—	—	11 (12)	2 (2)
Maharashtra 2	—	—	2 (14)	1 (5)
Andhra Pradesh 1	8 (10)	—	8 (10)	1 (1)
Andhra Pradesh 2	9 (21)	—	13 (29)	2 (4)
All Avahan	44 (70)	15 (15)	62 (107)	11 (23)



general cost sites, these were inflated by the average percentage difference between financial and economic costs at the detailed sites to obtain estimates of economic costs. Unless directly allocable, the LP level costs were allocated to each NGO according to the percentage of the total LP target population the NGO covered. Only financial costs were available for the Bill & Melinda Gates Foundation India office and the capacity development partners. These costs were allocated equally to each of the LPs. Given this and to ensure comparability with other studies that do not include central costs, these costs are reported separately.

The total costs of the Avahan programme were calculated by summing up the total capital and recurrent costs at all levels of the intervention (NGO, LP). Average costs were obtained by dividing total costs by the relevant output indicators to obtain estimates of the cost per person registered and cost per person accessing STI services. Scale, in the economic sense, reflects the extent or level of activity at which an intervention is operating.<sup>15</sup> In the Avahan programme, this is defined as utilisation coverage.<sup>19</sup> As the MIS was not functioning in all NGOs until 2006, the LPs were consulted to select measures of utilisation. People were registered with a project only once they had developed a rapport with the project sufficient to obtain personal details, including client volume and sex-work history. This enables peer educators to actively pursue the provision of services to these individuals. As a result, this was used alongside people receiving STI services. However, due to the early stage of development of the MIS, average costs were therefore not available for all NGOs.

Costs were adjusted for inflation using the average consumer price index for the year.<sup>24</sup> All costs are presented in constant INR (2006) and converted to US dollars using (1 US \$=44.3) (<http://www.oanda.com>).

### Activity costing

In order to allocate the time between activities, the time that each individual spent on the project was assessed using time-sheets provided to the relevant staff at the detailed costing sites and completed over 1 week. The project specific personnel costs were allocated using the percentage of time spent on various activities. General staff time was allocated equally across all the activities. From these allocations, a total activitywise recurrent personnel cost was calculated. Directly allocable recurrent and capital costs such as training costs, STI services, BCC costs were allocated to the specific activity. Non-allocable costs such as rent, building operating and maintenance, and travel costs were allocated among activities using the personnel cost percentage. The average activitywise allocations obtained at the detailed costing sites were used to allocate costs at the general costing sites.

### Analysis of variation in average costs

Multivariate linear regression analysis was used to give an initial insight into the causes of the variation in average cost between local implementing NGOs. The analysis explored the relationship of cost per person registered with scale, high-risk group (MSM/TG or FSW), age of intervention, number of Avahan NGOs in the district, whether the NGO was in a metropolitan area, number of LPs in the state and by LPs by adding each variable progressively into the model. The regression was carried out using SPSS (SPSS, Chicago).

### RESULTS

At the end of the 2-year period, the Avahan interventions in the four Southern states were being implemented in 62 districts by

107 NGOs. The median start up time for the programme was 3 months (range 0–6 months). The programme had 134 391 people registered, and utilisation at the NGO level varied from 37 to 6315 people registered (n=93). The total cost of the programme was US\$16 759 189 (see table 2). Table 2 shows that personnel costs were 40.4%, and STI supply costs were 8.0% of total costs. Travel costs and training costs constituted 7.7% each and indirect expenses 3.4% of the total, respectively. The economic costs were 6% higher than the financial costs. When using a 3% discount rate, the total costs fall to US\$16.6 million. The analysis found that US\$8.7 million were incurred at the LP level and US\$12.9 million (financial costs) by the foundation office in Delhi and capacity development partners.

Table 3 shows the composition of the overall costs by activity. The major activities were STI service costs (27% of total costs), BCC costs (15%) and condom promotion costs (11%). These were followed by capacity building costs (9.3%) and enabling environment costs, constituting 8.9%. Start-up costs were 4.7% of the overall costs.

The median cost per person registered was US\$76 (see table 2). The cost per person registered ranged from US\$18 to US\$616 across the NGOs (see table 2, figure 1). The median cost per STI clinic visit was US\$117 with a mean cost of US\$134 (range US \$37–411). With a 3% discount rate, the median costs per person registered and per STI clinic visit were US\$75 and US\$112, respectively.

The regression of cost per person registered with scale showed that scale was significantly associated with decreasing average costs (adjusted  $R^2=-0.248$ ,  $p=0.0001$ ). When all variables were included in the model (adjusted  $R^2=0.605$ ,  $p<0.001$ ), the factors found to be significantly associated with average costs were scale ( $\beta=-0.604$ ,  $p<0.001$ ), age of the intervention (0.376,  $p<0.001$ ), number of Avahan NGOs in the district ( $-0.425$ ,  $p<0.001$ ) and number of LPs in the state (either one or two) ( $-0.227$ ,  $p=0.012$ ). The other variables did not have a significant effect, but their inclusion increased the explained variation.

### DISCUSSION

This paper presents the results of the cost analysis of the first 2 years of Avahan's implementation and examines causes of average cost variation over the sampled sites for this period. The total cost of the programme was US\$16.8 million, with personnel comprising nearly 40% of the total. Costs rose from US\$4.5 million to US\$12.2 million in year 2, an increase of US \$7.7 million, as NGOs started up and moved from start-up to focus on increasing the intensity and quality of coverage. The activities addressing proximate determinants of risk comprised 53% of total costs, whereas those addressing distal determinants of risk made up 14.6% of costs. The 8.6% of costs attributable to enabling environment activities is in the range recommended by the AIDS commission report 2008.<sup>25</sup> Capacity building and monitoring were also shown to be an important component of costs (9.3% and 8.1%, respectively). This activitywise analysis is unique in the costing of HIV prevention for high-risk groups in India and provides new insight into cost structures.<sup>10 12 13</sup>

A number of earlier studies have examined the costs of targeted interventions in India.<sup>10 12 13 26</sup> The district-level-only average costs of Avahan range from US\$11 to US\$95 (US \$10–124 with a 3% discount rate), and are closer in value to these studies (see table 4). They also coincide with the range of US \$16–50 used for global scale-up estimates for different regions.<sup>27</sup> LP level costs were found to be approximately half the total costs.



## Supplement

**Table 2** Total costs by input, outputs and average costs of the Avahan programme for the first 2 years of activity (2004/2005 and 2005/2006), US\$ 2006 prices

Total costs (NGO and LP levels) by input	Financial (US\$)	Economic (US\$)	Percentage of total economic cost
<b>Capital costs</b>			
Rent	710436	721443	4.3
Equipment	233911	327933	2.0
Furniture and fixtures	89731	137115	0.8
Vehicle	88008	131995	0.8
Training (start-up)	33821	40929	0.2
Insurance and deposits	28652	35521	0.2
Start up	626351	728065	4.3
<b>Subtotal</b>	<b>1810910</b>	<b>2123000</b>	<b>12.7</b>
<b>Recurrent costs</b>			
Personnel	6624189	6770706	40.4
Travel	1286108	1286141	7.7
Building operating and maintenance	952567	949977	5.7
STI supplies	1342251	1343331	8.0
Monitoring	931288	930936	5.6
Information education communication	867658	872300	5.2
Training recurrent	1283786	1290585	7.7
Condom supplies	120132	627755	3.7
Indirect expenses	560467	564456	3.4
<b>Subtotal</b>	<b>13968446</b>	<b>14636189</b>	<b>87.3</b>
<b>Total</b>	<b>15779356</b>	<b>16759189</b>	<b>100.0</b>
<b>Total costs by organisational level</b>		<b>US\$</b>	<b>Percentage of total</b>
NGO level		8030991	28.0
Lead implementing partner level		8728198	30.4
Avahan Delhi office costs*		3944959	13.7
Capacity building partner costs*		9006456	31.3
<b>All level costs*</b>		<b>28730771</b>	
<b>Outputs of the programme</b>			
Total number of people registered †			134391
Total number of people receiving STI services ‡			124669
<b>Average costs</b>	<b>Mean</b>	<b>Median</b>	<b>Range</b>
Total cost per NGO at the NGO level (US\$)	153646	128192	20287 to 532112
People registered at the NGO level †	1908	1930	37 to 6315
Cost per person registered (US\$) †	166	76	18 to 650
People receiving STI services at the NGO level ‡	1955	1950	7 to 8004
Cost per person receiving STI services (US\$) ‡	134	117	37 to 411
<b>Sensitivity analysis (discount rate = 3%)</b>			
Total economic cost US\$	16605094		
Total cost per NGO at the NGO level (US\$)	153650	124269	20008 to 541692
Cost per person registered (US\$) †	163	75	18 to 616
Cost per person receiving STI services (US\$) ‡	79	112	22 to 411

\*Financial costs only.

†No of non-governmental organisations (NGOs)=93.

‡No of NGOs=96.

These costs include both the technical and management support activities required in the early stages of the scale-up and supplies such as condoms, STI drugs and supply of educational materials. These project supplies distributed directly to the NGO level amount to 7% of total LP costs.

Further costs were incurred beyond the NGOs and LP organisational levels at the foundation office. These amounted to US \$12.9 million, 70% of which was spent on capacity development through pan-Avahan capacity development partners. Approximately 14% of total financial costs are foundation staff costs. These transaction costs inherent in the contracting out and subsequent management are rarely reported. One study of a large-scale nutrition programmes in Madagascar and Senegal found contracting costs to be between 13% and 17% of total costs.<sup>28</sup> Similarly, Guinness (2006) estimated that the costs incurred by the State AIDS Control Societies and other state-

level agencies responsible for management of NGO contracts in the delivery of HIV prevention services in India were between 11% and 17% of total costs.<sup>29</sup> In the case of the Avahan costs presented here, the relatively high portion of costs at the central and LP level need to be seen in the context of a large-scale programme in its first 2 years. These early years require a high level of technical and management inputs to ensure quality and consistency of services and supplies and to develop management systems while scaling up.

The cost per person registered varies across the NGOs. Economic theory on costs and empirical literature on costs of HIV prevention strategies show that scale is a major cause of this variation so that average cost falls as scale increases, at least in the short run.<sup>5 10 13 30</sup> Figure 1 supports this hypothesis, and the regression found scale to be responsible for 24% of the cost variation. The figure indicates that as each NGO intervention is scaled

**Table 3** Total cost by activity at the state level (non-governmental organisation and lead implementing partner costs), 2004/2005 and 2005/2006, US\$ 2006 prices

	Financial cost (US\$)	Economic cost (10%) (US\$)	Percentage of total economic cost
Capacity building	1484920	1558215	9.3
Behaviour-change communication*	2693357	2552033	15.2
STI services	4766458	4534406	27.1
Condom promotion†	1045264	1856335	11.1
Community mobilisation‡	938975	1003254	6.0
Monitoring	867696	1350681	8.1
Planning and coordination	1270790	1097431	6.5
Start-up activities§	817712	786120	4.7
Enabling environment¶	1328141	1498584	8.9
Others	566044	522130	3.1
Grand total	<b>15779356</b>	<b>16759189</b>	<b>100.0</b>

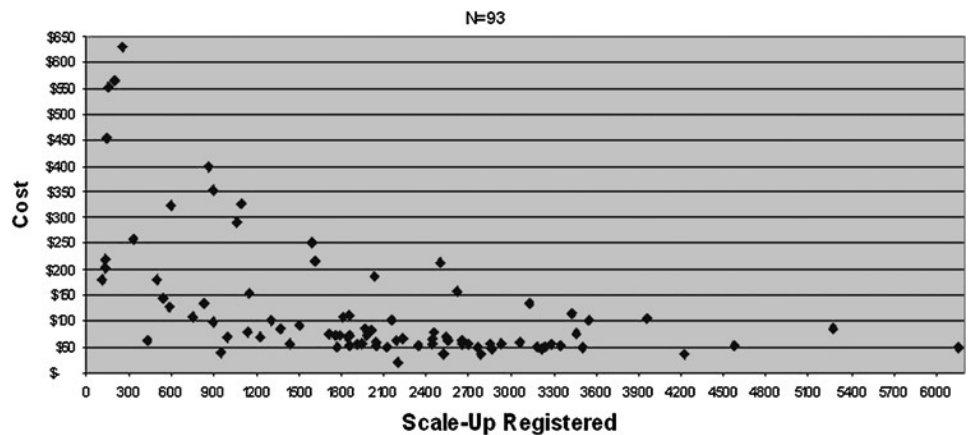
\*Behaviour-change communication includes outreach activities including peer educator remuneration.

†Condom promotion includes establishment of condom outlets, condom campaigns, condom demonstrations, condom supplies and lubricants.

‡Community mobilisation includes all drop in centre activities, special events, self-help group formation and welfare activities for the key population.

§Start-up activities includes recruitment, training, mapping, office set-up and all expenses until the start of implementation.

¶Enabling environment includes advocacy, sensitisation of stakeholders, crisis management and creation of mass awareness.

**Figure 1** Average costs by scale (cost per person registered), 2004–2006 (US \$ 2006 prices).

up, the average cost for that intervention will fall until about 2000 people are registered, above which there is less variation in the average cost. This implies that in moving to scale, total costs will initially increase rapidly, but as scale is reached the rate of increase in total costs will begin to fall. The regression also found that age, number of Avahan NGOs in the district and number of LPs in the state have an impact on costs. Age is positively associated with average cost, and the number of NGOs and number or LPs in the

state are negatively associated with average cost. As all implementation NGOs were local, it was not possible to test for the impact of an international NGO on average costs. However, without a random sample and the skewed nature of the data, econometric estimation of a cost function will be required to further explore the impact of these factors.

As with other studies of unit cost, the average cost per person registered cannot capture the quality of the intervention. In

**Table 4** Comparison of costs of HIV prevention for female sex workers in India

Cost study	Cost per sex worker reached	Cost per sex worker treated	No of interventions	Scale	Nature of costs
Avahan	53 (10 to 124)	78.7 (10 to 292)	107	37 to 6315	Full economic costing, implementation and support levels; 1st 2 years*
<sup>13</sup>	19.21 (10 to 51)	62.5 (13.9 to 141.2)	17	250 to 2008	Full economic costing, implementation level; mature NGO projects
<sup>10</sup>	31.65 (21.5 to 57.2)	16.6 (5.1 to 55.7)	14	1109 to 5721	Full economic costing, implementation level, mature NGO projects
<sup>12</sup>	56.5	NA	1	2342	Full economic costing, implementation level; first 51 months of project
<sup>26</sup>	13.66 (4.58 to 28.2)	NA	15	803 to 6379	Full economic costing, implementation level, mature NGO projects
NACO †	34.2 to 50.88	NA	NA	400 to 1000	Annual financial cost
<sup>15</sup>	31.02	NA	NA	1000	Annual financial cost

\*Lead implementing partner costs excluded, 3% discount rate.

†National AIDS Control Organisation's Revised Costing Guidelines for Targeted Interventions working with HRGs under NACPIII. 2009. [http://www.nacoonline.org/Divisions/Finance\\_Division/Revised\\_costing\\_guidelines\\_for\\_Targeted\\_Interventions\\_working\\_with\\_HRGs\\_under\\_NACP-III/](http://www.nacoonline.org/Divisions/Finance_Division/Revised_costing_guidelines_for_Targeted_Interventions_working_with_HRGs_under_NACP-III/) NGO, non-governmental organisation.

## Supplement

## Key messages

- ▶ Unique costing of a large-scale HIV prevention programme for vulnerable groups with multiple national and international implementing partners in South Asia.
- ▶ After 2 years, the total economic cost was 16.9 million; the cost per person registered was \$76, ranging from \$18 to \$650 across the NGO service delivery partners.
- ▶ The average cost variation was largely explained by scale, number of NGOs per district, number of LPs in the state and project age.

addition, although the person registered does capture only those target group members that have had repeated contact with the projects, this may be subject to some variation across the NGOs. However, the standardised MIS used and the uniform capacity development that staff undergo across the NGOs should minimise this variation. The use of registration data may also have underestimated utilisation. In the early years, there was reluctance by some outreach teams to collect registration data due to the concern of scaring the target group. In contrast, in a minority of cases, registration data were not available for the first year of analysis, and people contacted was used as a proxy, so that utilisation numbers have been inflated. A final limitation lies in the standard issues of bias in self-reporting for the timesheets. The extent of the bias is unknown but is believed to be limited.

Kumaranyake, in her review, observed that there are very few empirical cost data collected alongside programming as it expands.<sup>5</sup> In the Avahan evaluation, prospective data are being collected to monitor costs and document service delivery. This prospective data collection provides for greater reliability in the cost estimates than any of the previous studies in which costs have been collected retrospectively. At the end of this period of analysis, the Avahan programme had reached less than 50% of the estimated population through monthly outreach.<sup>19</sup> By December 2008, 75% of the estimated target population was being reached monthly.<sup>19</sup> Estimating the resource requirements for this further scaling up, and the implications for scaling up in the government programme, requires further modelling of the costs.

## CONCLUSION

In this paper, we have presented the early results of the cost analysis of the first 2 years of the Avahan project. Once the full 4 years of data have been collected, it will be possible to explore further how costs change as the programme scales up coverage, intensity, quality and scope of services. These first results from the programme show that during rapid scale-up of targeted HIV preventions, a significant reduction in average costs is apparent. These scale effects are therefore important to quantify for planning future resource requirements of large-scale interventions.

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**Conflict of interests** None.

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**CHAPTER 5**  
**RESEARCH PAPER 2**

**Measuring costs of scaling up prevention program for high risk groups:  
Lessons learned from the Avahan program in four southern states of India**

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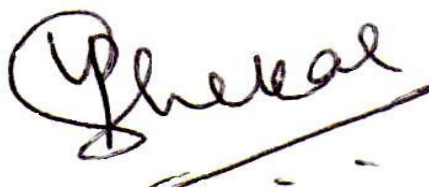
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I was involved in the study design, data collection, analysis, interpretation and wrote the first draft of the manuscript and incorporated suggestions from my co-authors and submitted to the journal. I also made all changes necessary in the post-acceptance of the article till the publication was completed.

NAME IN FULL (Block Capitals) .....Dr. Sudha Chandrashekar...

STUDENT ID NO: ...222484.....



CANDIDATE'S SIGNATURE .....

Date ...19.12.14.....



SUPERVISOR/SENIOR AUTHOR'S SIGNATURE (3 above) .....



# The Costs of Scaling Up HIV Prevention for High Risk Groups: Lessons Learned from the *Avahan* Programme in India

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## Abstract

**Objective:** The study objective is to measure, analyse costs of scaling up HIV prevention for high-risk groups in India, in order to assist the design of future HIV prevention programmes in South Asia and beyond.

**Design:** Prospective costing study.

**Methods:** This study is one of the most comprehensive studies of the costs of HIV prevention for high-risk groups to date in both its scope and size. HIV prevention included outreach, sexually transmitted infections (STI) services, condom provision, expertise enhancement, community mobilisation and enabling environment activities. Economic costs were collected from 138 non-government organisations (NGOs) in 64 districts, four state level lead implementing partners (SLPs), and the national programme level (Bill and Melinda Gates Foundation (BMGF)) office over four years using a top down costing approach, presented in US\$ 2011.

**Results:** Mean total unit costs (2004–08) per person reached at least once a year and per monthly contact were US\$ 235 (56–1864) and US\$ 82 (12–969) respectively. 35% of the cost was incurred by NGOs, 30% at the state level SLP and 35% at the national programme level. The proportion of total costs by activity were 34% for expertise enhancement, 37% for programme management (including support and supervision), 22% for core HIV prevention activities (outreach and STI services) and 7% for community mobilisation and enabling environment activities. Total unit cost per person reached fell sharply as the programme expanded due to declining unit costs above the service level (from US\$ 477 per person reached in 2004 to US\$ 145 per person reached in 2008). At the service level also unit costs decreased slightly over time from US\$ 68 to US\$ 64 per person reached.

**Conclusions:** Scaling up HIV prevention for high risk groups requires significant investment in expertise enhancement and programme administration. However, unit costs decreased with programme expansion in spite of an increase in the scope of activities.

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## Introduction

UNAIDS estimates that annually US\$ 22 billion is required to achieve universal access to HIV prevention, treatment, care and support services globally by year 2015 [1]. To ensure that global health targets for HIV can be achieved in the context of the economic crisis and the resulting flat-lining of development assistance for health, increased attention is focusing on the cost of HIV prevention. Evidence on the costs of HIV prevention can assist planners forecast the resource requirements, estimate the

cost-effectiveness of services, and identify potential areas of efficiency improvement. Empirical estimates of HIV prevention costs based on data collection during programme scale-up, are particularly useful in assisting those working in HIV prevention predict how costs may vary with scale and programme evolution.

Previous studies of HIV prevention provide some indication of the costs of HIV prevention for high risk groups [2–13] however, these studies are limited in that they either estimate costs from a very small number of providers or over a short time period. *Avahan*, the India AIDS Initiative of the Bill & Melinda Gates



Foundation, provides HIV prevention services to high-risk groups (HRGs) including female sex workers (FSWs) and high-risk men who have sex with men (HR-MSM) and transgender (TG) in six states in India. The goal of *Avahan* is to reduce HIV prevalence among HRGs and stabilize HIV infection rates among the general population [14]. Phase I of the *Avahan* programme aimed to scale up HIV prevention (2003–2008) and Phase II (2008–2013) to transition services to the National AIDS Control Organization (NACO), India. The scale of *Avahan* provides a unique opportunity to examine costs over a range of settings, over time and at different programmatic scales.

The study presented here is an update of previously published analysis of the costs of the first two years of *Avahan* scale up. This update includes additional data on the costs of HIV prevention for high risk groups at the national programmatic level. In addition, although all the *Avahan* interventions delivered a minimum package of interventions, as the programme evolved new elements were included such as the development of community mobilisation, building an enabling environment and vulnerability reduction. In summary, we present here a descriptive analysis of the costs of entire Phase I of the *Avahan* programme (2004–2008). In terms of both time frame and sample size this is the largest and the most comprehensive cost analysis of an HIV prevention programme globally to date.

**Methods**

**Study Setting**

We collected data from four of the six states served by *Avahan* (Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra). The two north-east states of Manipur and Nagaland are not included their epidemic is primarily driven by Injecting drug users. Details of HIV prevalence, incidence and the size of the key populations in each state are provided in Table 1. Our sampling was exhaustive: and within each state we costed all NGOs and supporting partners.

**Ethical Approval**

Ethics approval was provided by the centre hospitalier affilié universitaire de Québec, Canada; Health monitoring and screening committee (HMSC), India and Institutional ethical review board of St. John’s Medical college and Hospital, St. John’s Research Institute, Bangalore. Written informed consent was given by participants who participated in the study.

**Programme and services costed**

The package of HIV prevention services costed includes outreach through peers, behavior change communication, condom distribution, clinical services for sexually transmitted infections (STIs), community mobilization, advocacy and enabling environment activities, and is outlined in detail in Table S1. Peer educators provide services to about 25–50 people each, sharing prevention information, distributing supplies (condoms and lubricants) and providing referral for STI management. Referral clinics followed standard protocols for STI management<sup>15</sup>. Community mobilization, advocacy and enabling environment activities varied across the sites and included the formation of self-help groups, various drop-in center events, skills training, legal literacy workshops, police and stakeholder sensitization, crisis response teams and access to social entitlements [15]. Anti-retroviral therapy was not included in costs as it was not part of the package. There was active referral of individuals for HIV testing and positive key populations were referred to government anti-retroviral treatment (ART) centers for care and support.

**Table 1. Setting description.\***

States	Total Population (2011 census)		HIV Prevalence (2011–12)		People living with HIV (2011–12)		Annual New HIV infection (2011–12)		Estimated size of high risk population**		Avahan district high risk population estimates (2008)	Total (FSW & MSM included)
	Millions	(%)	Millions	(%)	Millions	MSM	FSW	MSM				
Karnataka	61	0.5	209,000		9,024	24,900	119,600		69,256			
Tamil Nadu	72	0.2	133,000		2,738	49,200	79,700		500,50			
Andhra Pradesh	84	0.7	419,000		16,603	18,700	86,000		81,615			
Maharashtra	112	0.4	316,000		5,893	101,000	245,800		53,874			

\*Source: NACO (2012). "Technical report India HIV estimates."  
 \*\*Includes both *Avahan* and Non-*Avahan* districts. Source: *Avahan*.  
 doi:10.1371/journal.pone.0106582.t001



HIV prevention across all four states was guided by a common minimum programme [15]. These included a set of implementation standards for technical and managerial areas, project milestones, a common management framework, and a common set of indicators. Beyond this there was flexibility to adapt services based on local context.

In the four study states, *Avahan* was implemented in 64 of the total 120 districts in the four southern states by 138 NGOs, supported by six state level lead Partners (SLPs) contracted by the Bill and Melinda Gates foundation, which also had a national level office at Delhi. In Karnataka and Tamil Nadu there was one SLP each, while NGOs in the states of Maharashtra and Andhra Pradesh were supported by two SLPs each. In 2003–4 SLPs identified NGOs for sub-granting, worked with these NGOs to conduct state wide mapping of high risk populations and co-ordinated closely with state AIDS control societies (SACS) to avoid the duplication of activities. This mapping was conducted by *Avahan* NGO partners or through contracted technical assistance agencies. All partners used variations of a non-mathematical method that involved a combination of geographic and social mapping combined with the iterative intensive use of Delphi techniques with different key informants. Most of the partners repeated the indirect non-mathematical size estimation exercise on an annual basis [16].

Thereafter SLPs provided technical assistance to develop key programme strategies, developed communication materials, enhanced the expertise of NGO staff, provided supportive supervision and consolidated the programme outputs through computerised management information system (CMIS), and supported the purchase and distribution of commodities. In their grant management role SLPs reviewed programme implementation and financial reporting of the NGOs.

At the national level, *Avahan* foundation office developed overarching programme strategies and organised annual partners meetings to share lessons learned and co-ordinate with the Indian authorities. They also co-ordinated with the agency sub-contracted for setting up and maintaining the centralised management information system, provided financial oversight and monitored programme evaluation. International NGOs and academic institutions were contracted in by the national office to provide pan-*Avahan* technical support. Technical assistance was primarily focused on enhancing the expertise to deliver STI services, provide advocacy, inter-personal communication and community mobilisation.

All NGOs were registered and operating prior to *Avahan* in sectors like education and poverty alleviation. A few NGOs had previous experience in HIV prevention. In some districts, *Avahan* funded NGOs were the sole provider of HIV prevention services in the district while in other districts provision was shared with NGOs funded by the National AIDS control organisation (NACO) with distinct catchment areas.

### Cost data collection

We collected cost data for each year of Phase 1 (2004–8) prospectively from a provider perspective. Further details can be found in our initial two year study, but are outlined in summary here [17]. We included all costs of HIV prevention for female sex workers (FSWs) and high risk men who have sex with men and transgendered persons (HR-MSM/TG) in four states. Excluded from the analysis were costs associated with evaluation and research-related activities, support to non-*Avahan* districts, condom social marketing, a separate male STI service delivery program, and client intervention and a trucker focused interven-

tion. These costs were excluded as they are not a part of core activities of NGO's interventions for the targeted high risk groups.

The costing approach used was primarily top-down – allocating out expenditures and economic costs to districts then NGOs and then to activities [17]. This was aided with comprehensive access to expenditure data, time sheets, the bottom up data collection of economic costs not included in financial records, and interviews with staff. Expenses prior to the first person being reached by the programme were treated as start-up costs and annuitized: costs are therefore reported from 2004.

Costs were also disaggregated and categorized by activities and input type. A full list of the inputs included are presented in Table S2 (and activities in Table S1). In 23 of the districts we conducted a detailed cost analysis of 37 NGOs including field visits and time sheets to estimate the share of costs allocated to different NGO sub-activities (outreach, community mobilization etc.). In non-detailed districts costs were estimated using expenditure records, commodity distribution records, financial records and narrative reports (for example to estimate the number of volunteer peer educators) submitted to the SLP. In some districts NGOs were replaced by new NGOs due to non-compliance of financial procedures. This led to temporary gap in service till another NGO was identified to take over the interventions. In this case, we included expenditures of both the NGOs for that district.

*Avahan* programme management costs (at the national level) were allocated among all grantees according to size of the expenditures for grant in year of analysis; and then from SLP's to districts and NGOs based on estimated population size. This allocation criteria was selected following extensive discussion with programme managers; who reported that estimated population size was the criteria they used to apportion their efforts. A more sophisticated method was used for allocating SLP level expenses to each NGO, first allocating out specific expenditures that could be clearly tracked to particular NGOs, then, for remaining expenditures, allocating to activities on the basis of SLP staff interviews, and thereafter allocating costs either equally or by persons reached to each NGO, depending on the activity. This procedure was determined following extensive interviews and discussions with SLP staff on how they spent their time and resource for different programme activities.

We report economic costs. Financial costs represent expenditure on goods and services purchased. Economic costs include items for which there were no financial transactions, for example volunteer time and/or donated goods. These goods were valued using market prices. Where peer educators were volunteers, we used the NACO peer honorarium as the market price. Economic capital costs were annualised using a discount rate of 3%.

Unit costs were estimated using output indicators obtained from the Computerised Management Information system (CMIS) [18]. We report two types of unit costs: cost per person reached at least once a year and per monthly contact made. Per person reached is defined as number of people reached at least once in the year being costed. Monthly contact made is defined the number of individuals contacted in any one month, summed over the year. If an individual is contacted more than once in a month, then this is still counted as one contact. Counting all contacts was not possible as this data was not reported to the CMIS. While this measure underestimates the true number of contacts, estimates from programme and NGO manager interviews suggest that less than 5% of high risk group persons contacted are likely to have been more than once a month in any particular month.

We followed a participatory approach during data collection. We utilised the common platforms during *Avahan* partners meetings and SLP meetings to brief participants about the study

methods, and receive feedback on preliminary results. Other key participants included NGO staff and SLP local partners. Extensive work was carried out to ensure the full involvement of participants in this study; and this was particularly helpful in terms of validating our results. Data were entered and analysed using Microsoft Excel. All costs are presented in using US dollars 2011 ([www.data.worldbank.org/indicator](http://www.data.worldbank.org/indicator)). The dataset on costs presented here is available from the corresponding author on request.

Ethics approval was provided by the centre hospitalier affilié universitaire de Québec, Canada, Health monitoring and screening committee (HMSC), India and St. John's Research Institute, Bangalore. Written informed consent was given by all participants who participated in the study.

## Results

The total economic cost of the Phase 1 scale-up of *Avahan* was US\$ 102,057,077 of which US\$ 35,890,683 was spent at the service level (NGO level)(35%) and US\$ 66,166,394 (65%) at above service level (**Table 2**). The total cost of the programme increased over the years, particularly between the first and second years of scale-up. After year 1, proportion of costs above the service level remained relatively constant, whereas both the proportional and total cost incurred at NGO level increased (from 24% in 2004 to 44% in 2008). Programme management (28%), advocacy (24%), interpersonal communication support (15%) community mobilisation (11%) and support to STI services (10%) were the largest costs items at the national level (**Table 2**). Proportional costs between these different areas of activities remained relatively stable over the period.

Programme management (46%), support and supervision (18%) and expertise enhancement (19%) were the activities that incurred costs by SLPs (**Table 2**). The proportional costs of both programme management and support to community mobilisation increased over the years, whereas the proportional costs of management information and information, education and communication fell. Different SLPs had markedly different cost patterns (**Figure 1**) – with some SLPs having higher costs for programme administration and others for expertise enhancement.

At the service level (**Table 2**), the proportional cost incurred for programme management fell over the years (from 28% to 17%), although the total programme management cost increased. Outreach costs and expertise enhancement stay constant as a proportion of cost throughout the period (around 23% and 8% respectively), although the total costs of both these activities increased. Both the proportional and total costs for areas such as STI services, community mobilisation increased (from 27% to 35%, and 10% to 16% respectively) – related to the expansion of clinics and clinical services including syphilis testing and TB verbal screening, the addition of new community mobilisation initiatives including organizational capacity building, advocacy and the expansion of enabling environment activities.

**Figure S1** shows the distribution of costs for all 64 districts across the period. There are substantial differences between districts on the proportion spent for each activity, particularly for STI services. Additional analysis of start-up costs (not shown) found that the mean start-up time for the 23 detailed costing districts was 4.8 months (ranging from 1 to 8 months). Start-up costs ranged from 2 to 8% of the total costs across all NGOs.

**Table 3** presents the cost profile by input for the NGOs and SLPs (this breakdown is not available for programme level costs). The largest area of cost was incurred by personnel at both levels (around 40%), with supplies costs being a major area of NGO level expenditures (27%). The total cost of supplies and commodities

increased substantially over time at the NGO level. However proportional input costs at both levels remained fairly constant over the years. **Figure S2** shows the variation in cost profiles of NGOs and SLPs by district. The items that show the highest degree of proportional variation are commodities and supplies, buildings and indirect expenses, and travel costs.

Programme outputs and unit costs are presented in **Table 4**. By year 4 the *Avahan* programme in the four districts was reaching over 300,000 target population members at least once a year, and the number of monthly contacts was over 2 million. The mean total unit costs (2004-08) per person reached at least once a year and per monthly contact were US\$ 235(56-1864) and US\$ 82(12-969) respectively. NGO level unit costs per person reached fell slightly over the period at the service level (US\$ 68 to US\$ 64), but total unit cost per person reached fell more substantially as the programme expanded due to sharply decreasing unit costs at the above service level (from US\$ 477 in 2004 to US\$ 145 in 2008). While the variation of unit cost per person reached at the service level narrowed over time, this narrowing was more distinct at the above service level. Median unit costs were considerably lower than the mean costs with a smaller inter quartile range values as a few very high values skew the distribution of unit costs.

## Discussion

This descriptive cost analysis of the *Avahan* programme presents the most comprehensive study to date on the changing cost structure of HIV prevention to high risk group during scale-up, updating our previous two year costing study [17]. Our previous analysis found a median cost per registered key population of US\$76 compared to our new estimate of US\$156. However, this increase in cost is primarily due to the fact that we are now able to take into account the full above service level cost that was not included earlier; an overall unit costs per person reached declined during scale-up. In the initial years of scale-up a high proportion of cost is incurred above the service level and then, as the programme expands and matures, a greater share of funds is channelled to NGOs. The proportion of cost for different activities also evolves during programme scale-up, with the initial focus being on outreach; and thereafter an expansion of funding for STI and community mobilisation. However, service level unit costs stay relatively constant over time, possibly as cost increases related to the expansion of programme scope are balanced out with cost reductions from scale.

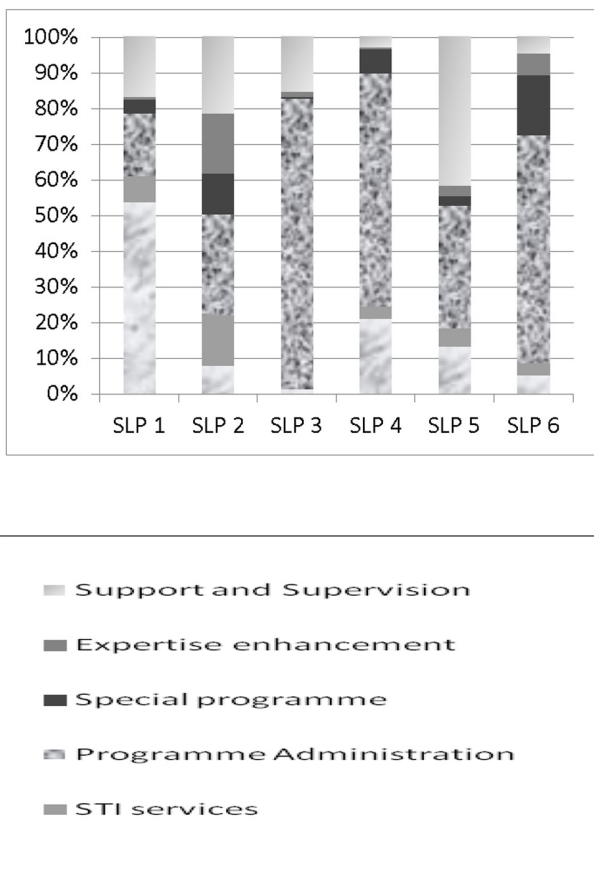
Our mean service level unit cost estimates (US\$64) are higher than those from other studies US\$ 32(22-57) [7], US\$ 57 [11], US\$ 19(10-51) [13] and US\$ 31(34-51) [19]. The range of services provided by *Avahan* is broader than that in the intervention package costed in many of these other studies<sup>21</sup>. In addition, cost differences may be due to the different estimation methods used. We primarily use a top down method, which may be less precise in terms of disaggregating costs at the activity level, but may better capture total cost. Previous studies only focus on small sample of NGOs who agreed to participate, and thus may suffer from selection bias. Finally, some of the previous studies did not include STI services costs which were referred to government hospitals or private providers.

One of the new and central findings of this update is that the greatest proportion of costs is incurred above the service level. Assessing the appropriate level of above service costs is complex. Aside from programme management, much of the above service cost was used to enhance the expertise of service providers. India has a robust NGO sector: and, in this sense, the degree of support

**Table 2.** Total economic costs by organizational level and activity 2004 to 2008 (US\$ 2011).

Activity	Economic costs (3%)						Total	%		
	2004-05.	%	2005-06.	%	2006-07	%			2007-08	%
<b>Programme Level</b>										
Programme management general	2,115,355	50	2,900,945	26	2,515,022	25	2,255,430	23	9,786,752	28
Support to inter-personal communication	558,398	13	2,056,492	18	1,427,460	14	1,410,729	15	5,453,080	15
Support to policy advocacy	0	-	1,191,432	11	1,748,137	17	1,437,190	15	4,376,759	12
Support to community mobilization	340,178	8	1,196,945	11	1,289,718	13	1,110,205	12	3,937,045	11
Support STI services	316,088	8	1,085,958	10	1,024,025	10	1,132,423	12	3,558,494	10
Support to advocacy with societal leaders	359,741	9	1,118,739	10	650,751	6	728,250	8	2,857,481	8
Support to programme management of expertise enhancement partner	334,743	8	988,674	9	846,411	8	822,101	9	2,991,928	8
Support to media advocacy	41,895	1	406,856	4	454,182	4	436,718	5	1,339,651	4
Support to strengthening HIV positive networks	138,900	3	274,641	2	305,042	3	290,985	3	1,009,568	3
<b>Sub-total (35% of total 2004-8)</b>	<b>4,205,299</b>	<b>100</b>	<b>11,220,682</b>	<b>100</b>	<b>10,260,748</b>	<b>100</b>	<b>9,624,030</b>	<b>100</b>	<b>35,310,758</b>	<b>100</b>
<b>State Level lead implementing Partner</b>										
Programme management	1,083,383	31	3,717,518	46	4,380,744	47	4,967,782	50	14,149,427	46
Expertise enhancement including technical assistance and training	834,561	24	1,543,047	19	1,762,620	19	1,759,232	18	5,899,460	19
Support and supervision	645,428	19	1,441,424	18	1,446,276	15	1,947,745	20	5,480,873	18
Management information	594,063	17	484,377	6	647,274	7	324,524	3	2,050,238	7
Information Education and communication	217,165	6	670,680	8	564,348	6	335,358	3	1,787,551	6
Community mobilization and enabling environment	101,946	3	251,942	3	604,009	6	530,191	5	1,488,087	5
<b>Sub -total (30% of total 2004-8)</b>	<b>3,476,546</b>	<b>100</b>	<b>8,108,987</b>	<b>100</b>	<b>9,405,271</b>	<b>100</b>	<b>9,864,832</b>	<b>100</b>	<b>30,855,636</b>	<b>100</b>
<b>Service Level (NGO*)</b>										
STI Services	635,724	27	2,636,754	36	4,011,918	36	5,239,684	35	12,524,080	35
Outreach, condom promotion behavior change and communication	643,064	27	1,598,516	22	2,536,109	23	3,456,964	23	8,234,653	23
Programme management	670,122	28	1,433,496	20	1,675,516	15	2,641,394	17	6,420,528	18
Community Mobilization and enabling environment	237,263	10	1,050,830	15	1,976,768	18	2,498,680	16	5,763,540	16
Expertise enhancement including technical assistance and training	207,783	9	520,819	7	907,921	8	1,311,359	9	2,947,882	8
<b>Sub-total (35% of total 2004-8)</b>	<b>2,393,957</b>	<b>100</b>	<b>7,240,415</b>	<b>100</b>	<b>11,108,232</b>	<b>100</b>	<b>15,148,080</b>	<b>100</b>	<b>35,890,683</b>	<b>100</b>
<b>Grand total</b>	<b>10,075,802</b>		<b>26,570,083</b>		<b>30,774,250</b>		<b>34,636,943</b>		<b>102,057,077</b>	

\* 2 NGOs excluded.  
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**Figure 1. Phase 1 (2004-8) SLP economic costs by activity (%).**  
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required to provide quality services quickly may be less than elsewhere. The scale-up of services was also rapid, reaching full coverage of FSWs in most sites by the second year of the programme: and slower scale up may require less support. The programme then continued to expand to include coverage of HR-MSM/TG during 3<sup>rd</sup> and 4<sup>th</sup> year. However, although total above service level costs did not escalate during scale-up, the variation between expenditures by different SLPs suggests that there may be room for efficiency gain – and further qualitative and quantitative work is required to better understand the causes of this variation and how different patterns of above service level costs may relate to NGO performance. At the very least, our findings highlight that other countries expanding HIV prevention to high risk groups need to critically examine and plan their above service support activities with the same level of scrutiny as they monitor costs of those directly providing services.

Our updated results add further support to our previous evidence on the economies of scale of HIV prevention to key populations [17]. Economies of scale are driven by the extent to which areas of costs remain constant (or fixed) as the level of service increases. Previous studies have focused primarily on service level costs and suggest that costs are lower for larger NGOs than smaller ones. Our descriptive analysis presented here also suggests further economies of scale may be derived from fixed above service level costs. The dataset presented here will also be analysed econometrically to assess the specific extent of any scale effect at the NGO level. However, the fixed nature of the above

service costs incurred indicates that economies of scale at a programmatic level may be substantially higher than our previous estimates considering service level costs alone.

We also find slight decline in unit costs at the service level as the programme scales up in spite of increase in the scope of services and difficulty of reaching more dispersed groups [20]. As *Avahan* evolved and the capacity of NGOs grew to deliver core activities, NGOs extended their services from prioritising the female sex worker programme to targeting high risk men also. Moreover, some activities such as STI service provision and community mobilisation were added to the core package of peer education. For example, community mobilisation started with relatively modest activities such as the provision of drop-in centres, but as more members of key populations were involved activities widened and intensified [21]. Syphilis testing was also difficult to implement initially because of quality assurance for tests but was instituted later, as was verbal screening for tuberculosis (although it is not commonly considered part of an HIV prevention intervention). For those countries planning services in the future, budgeting should therefore reflect an evolving change of scope over time.

We did not find a decrease in the variation of unit costs at the service level as scale-up progressed. This finding is somewhat surprising as learning effects are important to consider when examining the efficiency in the rapid scaling-up of HIV prevention activities [13], particularly when knowledge is transferred through the support activities of SLPs. While the computerised management information system took a year or so to establish, NGO activities were carefully monitored and progress fed back to them through the period. In principle these learning effects should lead to more standardised approaches and uniform costs. Moreover, the variation in unit cost should also have been minimised, as NGOs who did not comply with the financial procedures were dropped by a programme and replaced with new NGOs. Our findings therefore suggest that either the budgeting process was not sufficient attuned to promote efficiency, or that as the programme evolved the scope of services funded became increasingly heterogeneous across NGOs. Further work is being undertaken using econometric methods to better understand the main determinants of this cost variation.

When interpreting our results, care should be taken to consider the quality of our data. This study is the largest study to date of HIV prevention costs, it is also the only study that collects data over time. However, conducting a study at this scale, using primarily top down methods, means that the quality of any disaggregated findings by activity may be less robust than studies that employ more site intensive methods, such as comprehensive time in motion studies. Moreover, although every effort was made to include donated goods, it is likely some sites' data was under-reported (although where it was closely monitored the values were a very low proportion of total costs (<5%)). Another challenge also is the allocation of above service level costs and indirect costs generally. While our approach is based on interviews and detailed analysis of expenditure reports, due to the scale of the study we were not able to provide timesheets to all above service level staff. The most important limitation of the data however is on the output side and the use of routine data to measure the level of service utilisation. Programme indicators in the initial years lacked consistency across the states and different NGOs may have started reporting at different times. This may have impacted the estimation of unit costs in the first year of the programme, resulting in an over-estimation of unit costs in the first year. Moreover, routine data may be subject to various biases, including an incentive to demonstrate strong performance by NGO level managers.

**Table 3.** SLP and NGO economic costs by organisational level and input 2004 to 2008 (US\$ 2011).

SLP LEVEL	2004-05	%	2005-06	%	2006-07	%	2007-08	%	Total	%
<b>INPUT</b>										
Personnel	1,524,017	44	3,469,329	43	3,491,036	37	3,940,084	40	12,424,467	40
Commodities and supplies	328,734	9	968,044	12	1,186,760	13	1,174,455	12	3,657,992	12
Trainings	315,144	9	639,004	8	1,301,959	14	1,068,110	11	3,324,217	11
Capital cost	335,558	10	740,897	9	772,088	8	862,258	9	2,710,800	9
Building operating & maintenance	134,439	4	715,514	9	912,959	10	866,836	9	2,629,748	9
Travel	272,166	8	608,406	8	576,317	6	826,892	8	2,283,781	7
Monitoring & Evaluation	493,897	14	603,413	7	757,733	8	445,537	5	2,300,579	7
Indirect Expenses	72,592	2	364,381	4	406,418	4	680,660	7	1,524,051	5
<b>Grand Total</b>	<b>3,476,546</b>	<b>100</b>	<b>8,108,987</b>	<b>100</b>	<b>9,405,271</b>	<b>100</b>	<b>9,864,832</b>	<b>100</b>	<b>30,855,636</b>	<b>100</b>
<b>NGO LEVEL</b>										
<b>INPUT</b>	<b>2004-05</b>	<b>%</b>	<b>2005-06</b>	<b>%</b>	<b>2006-07</b>	<b>%</b>	<b>2007-08</b>	<b>%</b>	<b>Total</b>	<b>%</b>
Personnel	1,031,110	43	3,388,765	47	4,753,485	43	6,601,159	44	15,774,520	44
Commodities and supplies	448,652	19	1,799,082	25	3,405,363	31	4,104,490	27	9,757,587	27
Capital cost	349,802	15	805,142	11	1,029,404	9	1,293,651	9	3,477,999	10
Travel	154,713	6	476,113	7	726,209	7	1,015,032	7	2,372,066	7
Building operating & maintenance	168,664	7	402,760	6	537,197	5	1,155,525	8	2,264,145	6
Trainings	108,229	5	238,146	3	404,776	4	673,152	4	1,424,302	4
Monitoring & Evaluation	124,487	5	95,659	1	93,375	1	158,257	1	471,777	1
Indirect Expenses	8,300	0	34,748	0	158,422	1	146,816	1	348,286	1
<b>Grand Total</b>	<b>2,393,957</b>	<b>100</b>	<b>7,240,415</b>	<b>100</b>	<b>11,108,232</b>	<b>100</b>	<b>15,148,080</b>	<b>100</b>	<b>35,890,683</b>	<b>100</b>

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**Table 4.** Outputs and unit costs by service level 2004-08, US\$ 2011.

<b>Output Indicators</b>	<b>2004-05</b>	<b>2005-06</b>	<b>2006-7</b>	<b>2007-8</b>	
Persons reached at least once a year*	46,825	151,914	225,585	300,716	
Monthly contacts**	179,343	640,770	1,256,743	2,052,218	
Intensity of Contacts***	3.8	4.2	5.6	6.8	
<b>Unit cost in(US \$2011)</b>	<b>2004-05</b>	<b>2005-06</b>	<b>2006-07</b>	<b>2007-08</b>	<b>2004-08</b>
<b>Service level</b>					
<b>Per person reached</b>					
Mean (SD)	68 (89)	67 (54)	61 (44)	64 (57)	64 (47)
Range	11-425	19-412	10-285	13-459	13-268
Median (inter quartile Range)	38 (34)	54 (43)	53 (40)	47 (35)	51 (36)
<b>Per monthly contact</b>					
Mean (SD)	28 (42)	25 (39)	14 (16)	11 (14)	17 (20)
Range	3-224	3-249	3-116	2-124	3-131
Median (inter quartile Range)	10 (29)	13 (15)	8 (7)	7 (5)	10 (17)
<b>Above service level</b>					
<b>Per person reached</b>					
Mean (SD)	408 (960)	226 (376)	116 (141)	81 (65)	171 (232)
Range	45-5413	35-2923	13-1360	4-406	33-1650
Median (inter quartile Range)	116 (210)	120 (76)	90 (60)	65 (44)	100 (83)
<b>Per monthly contact</b>					
Mean (SD)	222 (534)	89 (219)	29 (47)	17 (28)	64 (122)
Range	5-2708	6-1720	2-380	1-244	6-838
Median (inter quartile Range)	34 (177)	33 (57)	14 (19)	9 (9)	30 (45)
<b>Total unit costs</b>					
<b>Per person reached</b>					
Mean (SD)	477 (1031)	292 (399)	178 (167)	145 (112)	235 (258)
Range	67-5838	56-3078	38-1506	41-866	56-1864
Median (inter quartile Range)	159 (260)	181 (103)	139 (94)	113 (84)	156 (95)
<b>Per monthly contact</b>					
Mean (SD)	251 (570)	112 (243)	42 (57)	27 (39)	82 (136)
Range	8-2932	3-1859	7-421	3-332	12-969
Median (inter quartile Range)	52 (215)	47 (67)	23 (26)	16 (16)	44 (61)

\*Persons reached includes individuals contacted at least once a year.

\*\* Sums the number of persons contacted at least once each month for all months in the year.

\*\*\*Intensity is the number of monthly contacts per person reached.

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Finally, during our study we learned several important practical and methodological lessons. Firstly, we were able to conduct our study within a reasonable cost, due to our reliance on the top down method; and our complete access to all expenditure data, CMIS data, programme staff and key resource data. While this approach is not always feasible or desirable, the extensive time taken and effort made at the beginning and throughout the study by local staff to involve participants was pivotal to the ability of the costing team the data required. Both the comprehensiveness and longitudinal nature of the dataset provide the potential for econometric analysis of cost determinants, and provide an evidence base for those interested in resource allocation across interventions at varying scales. Such extensive estimates also help validate previous estimates made in small scale pilot settings. However, pragmatically, such large scale costing studies may be considered expensive; and thus may be most appropriate to questions focused on technical efficiency; and early pragmatic

trials of the initial roll-out of new technologies and interventions. Even on these occasions it may be possible to take a more limited sampling approach and frequency of data collection. As part of our further econometric analysis of these results, we will explore whether collecting less cost data would substantially alter our policy recommendations; in order to inform and guide investment in HIV prevention costing methods going forward.

## Conclusion

This descriptive analysis of the costs of HIV prevention confirms that total costs, cost profiles and unit costs all evolve over time during the process of scale-up. In particular, policy makers and planners should note that above service costs can be considerable, that unit costs per person reached fall with scale, and that cost profiles by activity can change substantially over time. Further work exploring the optimal service package, how to reduce cost

variation over time, and the efficiency of different models of above service support are recommended to ensure that other programmes learn fully from the *Avahan* experience and are able to achieve value for money.

## Supporting Information

### Figure S1 NGO economic cost by district and by activity 2004 to 2008 (US\$ 2011).

(TIF)

### Figure S2 SLP and NGO economic cost by district by input 2004 to 2008 (US\$ 2011).

(TIF)

### Table S1 Description of the activity considered at different organisational levels.

(DOCX)

### Table S2 Costs considered for input categories.

(DOCX)

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## Author Contributions

Conceived and designed the experiments: SC AV. Performed the experiments: SC AV GS. Analyzed the data: SC AV GS LG. Contributed reagents/materials/analysis tools: SC AV GS LG PV. Wrote the paper: SC AV LG PV MP MA. Contributed to the design of the study: Charme Group authors.

**Supplementary Table S1: Description of the activity considered at different organisational levels**

Activity	Description*
<b><u>Programme Level</u></b>	
Support to media advocacy	All activities and related costs to assist positive media representation of the issues of high risk groups and to create an enabling environment to reduce stigma and wider acceptance of HIV prevention programmes for eg: through Public Service Announcements and embedded messaging in mainstream television programming, training journalists in the states, tracking stories, and placing positive stories in the local media
Support to policy advocacy	This included activities to sensitise the police to reduce harassment of sex workers
Support to advocacy with societal leaders	These activities were for reducing the barriers for uptake of programme services by high risk groups by advocating with local government leaders and at state level, improving resource allocation and also involving business sectors to support some activities
Support STI services	To maintain quality and ensure standardisation of services by regular monitoring, development of guidelines for STI syndromic management and clinic operation. Conducting operational research studies and also tracking the uptake of services
Support to community mobilization	Activities like vision building, learning site demonstration projects for increasing community participation and engagement in programmes by the key populations appropriate for local conditions.
Support to inter-personal communication	Support to develop interpersonal communication methodologies to promote behaviour change skills for field staff in communicating with key populations
Support to strengthening HIV positive networks	Raising capacity of PLHIV and supporting their networks. Especially for demand generation and also as a resource persons for training and sharing their experiences.
Support to programme management of expertise enhancement partner	Allocated expenses for Pan-Avahan capacity building partners who were provided grants to support specific technical areas for the state lead partners
Programme management general	General programme management activities of national office
<b><u>State Level lead implementing Partner</u></b>	
Expertise enhancement including technical assistance and training	Includes induction training and re-orientation for staff, workshops/trainings on specific topics of project management, immersion visits and field visits for staff
Information Education and communication	Development and printing of educational materials in English and local languages. Creating modules on specific topics. Improve awareness through mass media, wall writings, streetplays and celebration of days like World AIDS day
Programme management	General activities for grant management including office set up, recruitment, indirect expenses and maintenance costs
Management information	Mapping, validation and baseline studies . Setting up and maintenance of centralised management information data. Support to surveys and special studies
Community mobilisation and enabling environment	Activities relate to establishment of safe spaces like Drop-in- centres, conduct of events for increasing key population participation, setting up of self help groups, supporting access to social entitlements, development of Community based organisation to increase ownership. Support to local advocacy to police, lawyers, local leaders, brothel madams and pimps. Supporting Peer convention and rallies. Setting up crisis response systems



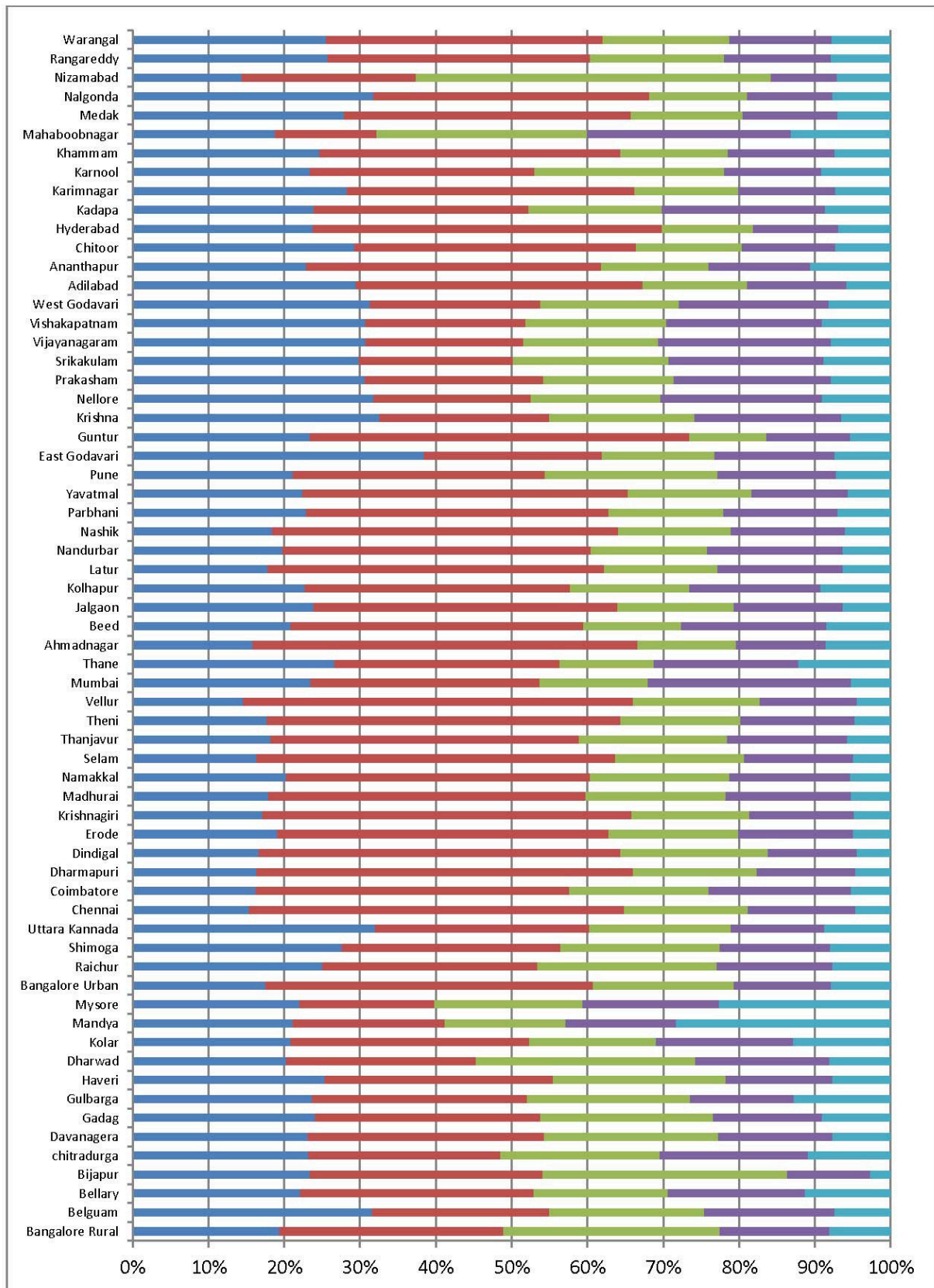
Support and supervision	Includes staff support in the form of regional managers or STI managers to oversee the programme implementations of the NGOs/CBOs. Set up procurement mechanisms for consumables like condoms and STI drugs. Link with state AIDS control societies and collaborate with other organisations working in their areas. Plan NGO level and partner meetings to share learnings.
<b>Service Level (NGO)</b>	
Outreach, condom promotion, behaviour change and communication	Includes peer outreach to provide programme services information and education on safe sexual practices, distribution of condoms and supplies.
STI Services	Referral to project STI services or referral doctors for STI treatment and follow-up. General medicines are also provided and referral for HIV counselling and testing. Syphills screening and treatment
Programme management	General activities like office set-up and maintenance, recruitment and project management related activities of NGO staff. Co-ordination with state lead partner .Reviews and meetings with field staff
Community mobilisation and enabling environment	Conduct of DIC events, advocacy with local leaders, celebration of important days and festivals. Running crisis response systems. Setting up of self help groups and participation in programme committes and active engagement to form community based organisation
Expertise enhancement including technical assistance and training	Trainings for peers, field level staff on programme implementation and workshops on skill development of project staff.

\* Costs considered for the activity include specific recurrent costs (like travel, consumables) and personnel, capital and general costs allocated for the activity

Supplementary Table S2: Costs considered for input categories

<b>INPUT</b>	Costs considered (indicative list only and may include other items depending on the NGO)
Personnel	Salaries of all categories of staff, consultants and resource persons
Commodities and supplies	Costs of drugs, condoms, IEC materials
Training	Costs of space, experts, travel, food and accomodation for participants
Capital cost	Rental deposits, equipment, furniture, vehicle costs
Building operating & maintenance	Office supplies, electricity, water, repairs and maintenance
Travel	Fuel, vehicle hiring tickets, accomodation expenses and perdiems
Monitoring & Evaluation	Mapping and setting up of the management information systems, conducting routine surveys and reviews
Indirect Expenses	Reported overhead expenses

**Figure S1: NGO economic cost by district and by activity 2004 to 2008 (US\$ 2011)**



\*No. of districts=64, No. of NGOs=136, 2 NGOs excluded as outliers

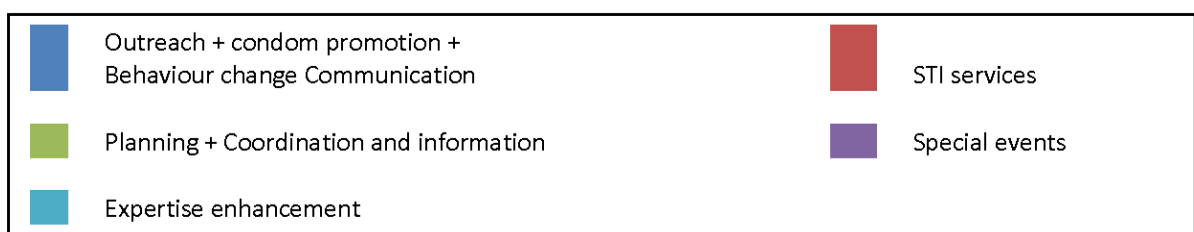
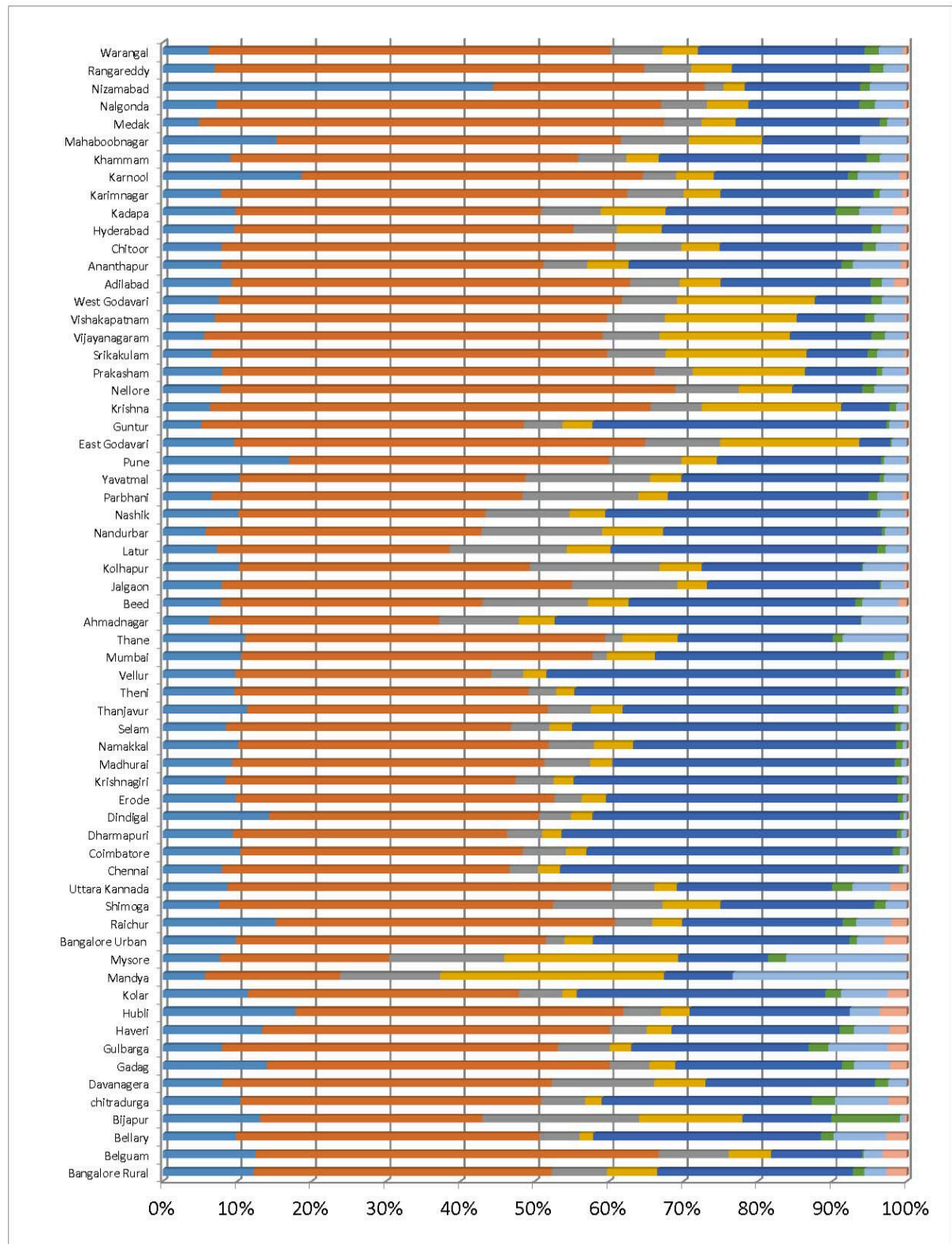
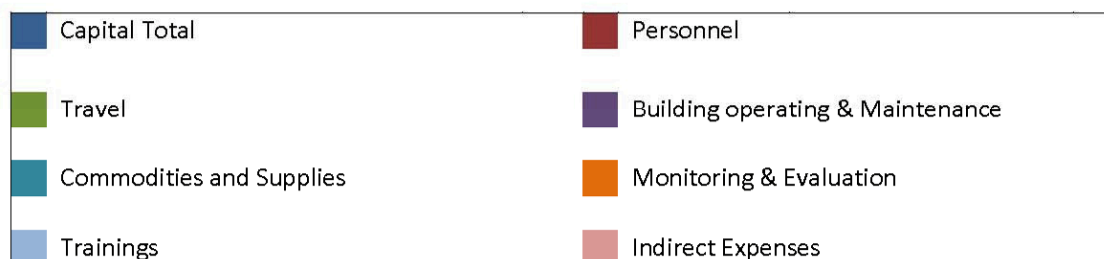


Figure S2: NGO economic cost by district and by input 2004 to 2008 (US\$ 2011)



\*No. of districts=64, No. of NGOs=136, 2 NGOs excluded as outliers



**CHAPTER 6**  
**RESEARCH PAPER 3**

**Above service level costs of large scale HIV prevention program (Avahan) for high risk populations in four southern states of India**

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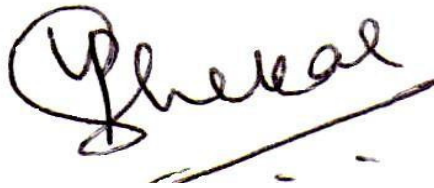
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## MAIN TEXT

**Title:** Above service level costs of large scale HIV prevention programme (Avahan) for high risk populations in four southern states of India

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## **Abstract**

**Title:** Above service level costs of large scale HIV prevention programme (Avahan) for high risk populations in four southern states of India

**Background:** Current resource constraints for HIV prevention programmes underline the importance of efficiency improvement in provision of services at all levels. Most previous cost studies only consider service level costs and little is known about the costs and efficiency of different models of above service level support. This study compares the different costs and organisational characteristics of the above service level organisations used to support the scale up of targeted HIV prevention across four states in India incurred by Avahan, the India AIDS Initiative, of the Bill and Melinda Gates foundation.

**Methods:** We conducted a comparative analysis of the costs of different models of above service support to non-governmental organisations (NGOs) providing HIV prevention in India. Financial and economic cost data (2003-2008) from six State lead partners (SLP) (international or national NGOs/academic partners) implementing Avahan interventions supporting 64 districts and 138 NGOs in four southern states of India was collected using a top-down costing approach. The different organisational structures and approaches of SLPs in each state were documented through document review and staff interviews. All costs are presented in US\$ 2011 (3% discount rate).

**Results:** Mean above service level (ASL) SLP costs per person reached per year was US\$ 213, and ranged from US\$ 89 to US\$ 353. International SLPs had a higher cost per person reached than national SLPs (US\$ 301 vs. 174). The mean ASL costs per person reached over 4 years was 2.4 times higher in the SLPs primarily supporting NGOs who had no previous experience of HIV prevention (US\$ 408 vs. US\$168). Similarly SLPs working in large urban areas incurred 1.4 times the ASL cost (US\$ 288 vs. 208) per person reached than those in urban/rural mixed areas. Mean ASL costs per person reached were also three times higher for smaller SLPs, with a population reached less than 20,000 (US\$ 483 vs. 159) compared to the larger SLPs.

**Conclusions:** Above service level costs can be substantial and may be influenced by factors like geographic area, size of target population and prior programmatic exposure of local

service providers. Care should be taken to monitor the costs of above service level organisations; and ensure that funding is appropriately adjusted to take into account setting and population characteristics.

**Key words:** HIV prevention, Above service level costs, high risk groups

**Word Count:**5594 words, 3 tables and 3 figures included in this paper. 2 Supplementary tables

## **Introduction:**

UNAIDS estimates that US\$ 22 billion is required annually to provide universal access to HIV prevention, treatment, and care and support services globally<sup>1</sup>. However, global and domestic expenditures may be flat-lining and therefore increased emphasis is being placed on improving efficiency in provision of HIV services as part of the global effort to achieve HIV policy targets<sup>2,3,4</sup>. In concentrated epidemic settings targeted HIV prevention is likely to have an impact on the HIV prevalence<sup>5-7</sup> and interventions are now being scaled up in many countries.

Evidence on the costs of HIV prevention at scale is now emerging<sup>8-13</sup>. However, while much policy emphasis has been placed on improving efficiency at service provider level, efficiency at the programmatic level is often ignored<sup>14</sup>. The India AIDS initiative (Avahan) funded by Bill and Melinda Gates foundation (BMGF) is one of the largest HIV prevention programmes in the world.<sup>15</sup> Avahan used an approach whereby a management/capacity building agency at the state level provides grants to local NGOs to provide HIV prevention services to high risk population groups (HRGs), female sex workers (FSW) and their clients, high-risk men who have sex with men (HR-MSM), transgenders, and persons who inject drugs. A recent study into HIV prevention programme costs in India has shown that 30% of Avahan costs were incurred by this state lead partner (SLP) level and a further 35% of total cost was spent at the national programme level (for programme management and pan-Avahan capacity building / standard setting of SLPs and NGOs)<sup>9</sup>. However, although these costs are considerable and may signal inefficiency, a recent qualitative study into the management agency approach adopted by state AIDS control society in two states in India found overall that the management agency approach can reduce transaction costs and also improves quality of large scale HIV prevention programmes<sup>16</sup>. The study authors argue that funding substantial above service level support provided necessary NGO technical and programmatic guidance and capacity building.

Our previous econometric analysis of Avahan found that the specific supporting SLP and thus the characteristics of SLPs were a key determinant of NGO costs and technical efficiency<sup>17</sup>. We also found that an increase in the number of NGOs supported per SLP was a potential source of NGO inefficiency, particularly when the number of NGOs per SLP was above 27<sup>17</sup>. However, there is scarce evidence on which SLP characteristics may influence

costs and to date there is little understanding of the variation in cost structures of different models of above service level support for HIV prevention. To better inform programme managers in the design of above service support to HIV prevention globally we therefore present here a descriptive comparative cost analysis of six different supporting agencies in the context of the Avahan HIV prevention programme in India.

## **Methods**

### **Setting and Programme description**

Avahan was initiated with three primary goals (a) build an HIV prevention model at large scale in India (b) catalyse others to take over and replicate the model (c) foster and disseminate learnings within India and worldwide<sup>3, 15</sup> The HIV prevention strategy being scaled up included peer outreach and behavior change communication, treatment of sexually transmitted infections (STI) and referral services, condom promotion and free distribution, advocacy and enabling environment activities, expertise enhancement and community mobilisation<sup>18</sup>. Avahan is implemented in six states across India, and our study focuses on four of these states (Karnataka, Tamil Nadu, Andhra Pradesh and Maharashtra). Avahan is implemented through a national level head office, and then one lead grantee (SLP) per state in Karnataka and Tamil Nadu, and two grantees (SLPs) per state in each of the other two states of Andhra Pradesh and Maharashtra. This study therefore focuses on six SLPs across these four southern states providing prevention services to FSWs, HR-MSM and transgenders.

### **National level support**

Governance of the Avahan programme was supported by 23 members of the advisory board (for strategic inputs and portfolio review) and by BMGF. As part of this effort a technical advisory group consisting of experts in the field of HIV provided technical oversight to programme design, for grant selection, and ongoing monitoring and technical advice on implementation, scaling up and transition. The BMGF national office in Delhi was staffed mainly with programme officers who provide technical inputs and manage the day to day affairs of the Avahan initiative. The WHO-EAG (Evaluation Advisory Group) provided inputs for the evaluation design and monitored the progress of the evaluation partners on a yearly basis<sup>15</sup>.

The national level office contracted external organisations to support and assist SLPs in areas like monitoring and evaluation. These ‘Pan-Avahan capacity building partners’ (primarily international organisations) were funded to provide specific technical support for advocacy,

STI and other clinical services, communication, monitoring and community mobilisation skills, and to standardize where possible, the approaches. Workshops and training of trainers for each SLP were organised to strengthen their capacity in each of the areas identified. This process was supported by formal six monthly initially and then annually programme reviews which assessed the progress of the SLPs against plans. The Avahan national level office also helped to coordinate the activities of SLPs and capacity building partners. A coordination committee with representation from BMGF staff and State AIDS Control societies, project directors of the SLPs and other important stakeholders working in the area of HIV, was convened to share experiences and exchange ideas on an annual basis. The common minimum programme developed by Avahan sets out roles and responsibilities for the state lead partners and the minimum implementation standards to be followed<sup>18</sup>. This document was also revised thrice in five years to capture innovative approaches and practices and share the learning.<sup>19</sup>

### **State level support**

SLPs were national or international NGO/academic institutions with experience working in HIV and in India that were selected after inviting expressions of interest from them. They were selected following review by the technical panel of Avahan. The SLPs were staffed by a team with multidisciplinary backgrounds including programme management; management information systems / evaluation; specialist in medicine, community mobilization and communication; and finance management experts. The SLPs can be categorised as national and international NGOs/academic institutions each with their own governing structures including executive board of members, project directors, trustees and financial management systems.

The SLPs, both national and international, provided sub-grants to NGOs. Beyond granting to and managing NGOs, SLPs also had an additional capacity building and research function. Start-up capacity building activities at the SLP level included staff recruitment and multidisciplinary team building, mapping and site estimates of target population, close co-ordination with their respective State AIDS Committees, establishing level management information systems, training to their NGOs, ensuring supply of commodities like condoms, drugs, and developing locally relevant communication materials. All the SLPs supported the evaluation data collection activities of Avahan including the integrated biological and

behaviour assessment surveys, special behavioural surveys and general population surveys<sup>20-23, 24-26</sup>. They also conducted operation research in their respective intervention sites to assess their programmes, innovations and make suitable changes<sup>27</sup>. In addition, SLPs played an important role in strengthening the advocacy efforts and creating enabling environments both at local and state level. They also synthesized data from the outreach and made necessary changes to programme strategies like increased attention to HR-MSM and transgender, adding structural interventions to develop ownership among the key beneficiaries<sup>28</sup>.

SLPs in different states followed different contracting and support models largely influenced by state characteristics and NGOs reach and capacities (Table 1). Some SLPs (SLP3, SLP4, and SLP5) provided sub-grants predominantly to separate NGOs for each district, although there were a few NGOs that had infrastructure in more than one district. SLPs (SLP1, SLP2, and SLP6) provided sub-grants predominantly to multiple NGOs per district. Some SLPs also developed alternate programme strategies (creating learning sites and direct district intervention sites, where they directly provided services and piloted new approaches) (SLP3, SLP4). SLP2 took a programme management role and sub-granted to two main implementing partners (MIP) who further sub-granted to NGOs. SLP4 set up “district offices” to further decentralise support and supervision to implementing NGOs. SLP6 contracted with state-level private medical agencies to provide STI services (both medical personnel and supplies) at implementing NGO sites. (Figure-1)

### **Overview of descriptive analysis**

Unlike service costs, above service organisations are of insufficient numbers to conduct a statistical analysis to investigate the determinants of above service level (ASL) costs. We therefore conduct a descriptive analysis exploring of how costs vary by different SLP models and characteristics.

### **Costing methods**

We estimate the total ASL costs per SLP (defined as the costs spent at SLP and national level, management and pan-Avahan capacity building partner costs). The costing methods used in the study are reported in full in Chandrashekar et.al (2010, 2014)<sup>8,9</sup> and therefore we



provide a brief overview here. In addition, we provide a detailed description below of the specific methods used to estimate ASL costs. Broadly, cost data collection was based on UNAIDS Costing guidelines<sup>29</sup>. We report both financial and economic costs. Financial costs represent expenditure on goods and services purchased. Economic costs include items for which there were no financial transactions, for example volunteer time and/or donated goods. All cost data collected was for the period 2004-2009.

### **Allocation of national level costs to each SLP**

We used a top down approach to allocate costs to SLPs and to specific HIV prevention activities. The first step was to include any supporting expenditures from the national level in SLP costs. All national level grants given to various organizations in Avahan were reviewed with BMGF staff and grants relevant to the four southern states were considered for allocation. On the basis of these interviews most capacity building grants were allocated equally among all the SLPs. Avahan programme management costs were allocated among all grantees according to size of the grant to each SLP in year of analysis. Expenditures prior to Avahan start were categorized as startup costs and annualized over programme length of eight years using straight-line depreciation. Excluded from our analysis were national level costs associated with evaluation and research-related activities and support to non-Avahan districts, condom social marketing, a separate male STI service delivery programme, client intervention, harm reduction programme in north-east, trucker focused intervention.

### **Allocation of SLP costs within different activity areas**

SLP financial records were reviewed line by line and staff interviewed to estimate the activity based costs. Expenditures were allocated and shared to specific activities like expertise enhancement (like training and capacity building initiatives), support and supervision (support for programme implementation, reviews, meetings) and programme administration. If the description of the activity was clear and confirmed by staff, costs were allocated directly. The remaining non-allocable costs (primarily salaries costs, but also costs such as buildings overhead) were allocated to activities based on personnel job description and in some instances where tasks were shared using time sheets or interviews. All building and overhead costs were also allocated on this basis, as above service level room use was

primarily to house personnel. The discount rate used was 3% and all costs are presented in US\$ 2011.

### **Comparative analysis**

We first examined how different dimensions of costs differ by SLP. We firstly compared total costs, and the total cost breakdowns between activities and inputs. We also compared ASL mean unit costs per high-risk population reached per year between SLPs. These were estimated by dividing the ASL total costs described above with per person reached indicators obtained from the Computerised Management Information system (CMIS)<sup>28</sup>. Each SLP has different organisational characteristics (Table 1) that potentially may influence costs. We used a categorical analysis to compare between SLPs. We first examined the location in terms of urban/ rural split, as factors like input prices and geographical setting may influence the cost of travel. We classified the SLP location as predominately urban (if greater than 60% of the sites were in urban areas) or urban /rural mixed. We used the data from the CMIS on the intervention areas and narrative reports to classify the intervention areas as urban or mixed. We also compared the difference in cost between international SLP compared to a national SLP. Furthermore, we compared the mean ASL unit costs of each SLPs by scale of activity in terms of population covered, number of districts covered, the number of organisational levels (state/regional) and NGO capacity, classified as high if >60% of NGOs contracted by the SLP had prior experience in delivering HIV prevention intervention. A total of 2 SLPs had contracted NGOs with less than 40 percent of them with prior HIV prevention experience. In order to establish NGO prior experience, NGO proposals were reviewed to establish prior experience in providing HIV prevention services.

Finally we fed the main cost results back to each SLP for further interpretation and explanations of the differences found between NGOs. Data were entered and analysed using Microsoft Excel.

## Results

Table 1 presents the district and NGO characteristics of each SLP. The size of SLPs differed, and by 2007-8, the number of persons reached (unique individuals contacted that year) ranged from 20,255 to 69,256 per SLP. SLP1, SLP2, SLP4, SLP5 predominately operated in urban areas. SLPs also differed with regard to the capacity of NGOs, with two SLPs (SLP3 and SLP5) working with NGOs with less than 60% having prior experience in HIV. Districts in SLP1, SLP2 and SLP6 had higher exposure to previous large scale interventions (either government or donor-funded programmes) compared to the districts under SLP3, SLP4 and SLP5. The predominant high risk group for HIV prevention interventions also varied by SLP with some SLPs targeting predominantly FSWs (SLP2 and SLP5) and others having up to 33% of their estimated population in the districts being HR-MSM/transgender (SLP1, SLP3, SLP4 and SLP6).

Persons reached by each SLP over the years can be seen in Table 1. Most of the NGOs were operational by year 2 with the addition of new NGOs in some districts in years 3 and 4. Table 2 presents annual ASL costs. These increased from US\$ 7 million in 2004/5 to US\$ 19 million in year 2007/8. The ASL unit cost for SLP1, SLP3 and SLP5 were comparatively higher (US\$ 790, US\$1039, US\$ 1034) per person reached in their first year of implementation compared to the other SLPs (US\$ 215, US\$ 74). All the SLPs, except SLP5 (US\$ 175), showed reductions in unit costs over time, to a range of US\$ 60-80 by year 4 (Table 2).

Overall, the proportion of non-salary recurrent costs was about 51%, capital costs were about 9%, and personnel costs were about 40% (Supplementary Table 1) of total cost. The proportion of non-salary recurrent costs did not change substantially over time (slight change in most of the SLPs except SLP1). Capital costs were higher in the initial years, mainly due to start up training and mapping activities undertaken by the SLPs, and decreased over time. Proportional personnel costs in most SLPs increased over time which was necessary to support and supervise additional new intervention sites and NGOs under their care. Proportional personnel costs were lowest in SLP3 and SLP6. The SLPs who received support from overseas offices (SLP1, SLP2, SLP4 and SLP5) had higher personnel cost (44%)

compared to the SLPs(29%) whose operation was completely managed by National NGOs(SLP3, SLP6), (Figure 2).

Activity wise, costs show a 41-48% increase in ASL costs for expertise enhancement from years 1 to 4, and a reduction in costs both for programme administration (41-37%) and support and supervision (18-14%) over the same period (Supplementary Table 2). The proportion of costs due to expertise enhancement for each SLP did not seem to be related to the starting capacity of NGOs (Figure 3). The proportion of costs related to programme administration was clearly higher in SLP1, SLP2, SLP4 and SLP5, all of which had additional administration levels. The proportion of program administration was lower in SLP3 and SLP6 wherein they directly provided sub-grants to NGOs and also had no overseas support.

Above service level support cost on average US\$ 213 per person reached, with a variation between US\$ 89 and US\$ 353 over the years, Table 2. The mean ASL unit costs of SLPs with different characteristics are compared as seen in Table 3. The mean ASL unit costs per person reached over 4 years was 2.4 times higher for the SLPs (SLP3 and SLP5) working with more NGOs that lacked capacity (US\$ 408 vs. US\$168). In SLP5, an international SLP, this was due to a higher proportional cost related to capacity building; however in SLP3, this higher unit cost appears to be due to a relatively higher proportion of direct support and supervision costs. The unit costs of the four SLPs who had international support were 1.2 times higher (US\$ 252 vs. US\$ 208) than for those of SLPs handling operations without such support. Similarly SLPs working only in urban areas, and having multiple organisational levels, had 1.4 times higher costs (US\$ 288 vs. US\$ 208) than those operating in mixed locations with fewer organisational levels. ASL costs were US\$ 483 when the HRG population reached during year 4 was less than 20,000. The unit cost gradually decreased to US\$ 306 when the HRG population reached during year 4 was about 50,000, and was US\$ 159 when the SLPs reached more than 50,000 HRG individuals. SLPs covering more than 10 districts had 1.8 times lower unit costs (US\$ 167 vs. 308) than those working in fewer districts.

## **Discussion**

Our study found that ASL costs were substantial and varied considerably depending on the SLP characteristics. Comparing six SLP organisations, we found that those facing limited

local NGO capacity incurred substantially higher unit costs and those in urban areas faced moderately higher costs. Organisational factors may also play a role. We find that SLPs supporting large numbers of NGOs and providing services to large number of HRG incurred higher unit costs initially but lower unit costs overall. Likewise, we found that SLPs with multiple organisational levels, those working in large urban areas, and who were international organizations incurred higher costs. However, despite these differences we also found that over time, the variation between SLPs narrowed to a mean ASL cost per person reached of US\$ 89 (59-175) in Year 4.

It is common practice for health service delivery projects funded through international development assistance to allot about 10%-15% as management costs<sup>30</sup>. The ASL cost in this study was substantially higher at 65%; however, it included substantial technical costs such as capacity building, support and management, direct intervention sites and technical supervision and quality monitoring. Although these costs may seem high, it needs to be considered that the Avahan programme achieved rapid scale up of HIV prevention for hard-to-reach groups over a large population in a short period of time. As this was a rapid programme expansion, it was therefore necessary to work with many NGOs who had limited prior experience in working with HIV prevention programmes. As NGOs matured, much of the capacity building support initially directed towards basic services was then redirected towards creating enabling environment through advocacy and community mobilisation and project scope expansion<sup>19, 31, 32</sup>. The community mobilization efforts have been shown to be highly cost-effective investments in improving Avahan impact<sup>33, 34</sup>.

International support clearly increased costs. However, the one SLP who did not have the benefit of international technical assistance had a slower start-up and also had higher unit costs in the initial years (SLP3). SLPs working in states having prior large scale interventions (SLP1, SLP2 and SLP6) had more experienced NGO partners who had actual field experience in working with marginalised groups and were able to scale up rapidly at low costs and did not need international technical support.

Our previous analysis of programme costs (SLP and NGO) show that as the number of persons reached increased, the unit costs fell dramatically demonstrating economies of scale<sup>9</sup> and suggesting that SLP costs are major source of economies of scale. We also found economies of scale at the SLP level, with SLPs overseeing larger programme likely to have

lower costs and much of their costs being fixed. The level of capital costs is however low, suggesting that large proportions of both personnel and other recurrent expenditures (such as fuel, etc.) are fixed over the number of NGOs served irrespective of the numbers of persons reached by each NGO.

The convergence of costs over time may have been supported by the fact that SLPs had regular partner meetings facilitated by the foundation office in India which helped to rapidly disseminate field learnings, innovations, and good practices across SLPs which could be replicated. Further, the standardised nature of Avahan Common Minimum Programme for implementation, support from pan-Avahan capacity building partners, cross-partner immersion visits and exposure visits of field level staff were provided. This strengthened their capacity at the grass root level which could have contributed to the reduced variation over time across SLPs in spite of the differences in geographical and contextual factors.

Our study has limitations. The most important one is that we have very few organisations for analysis at the above service level reflecting the organizational pyramid. Hence statistical and econometric analysis was not possible. Nevertheless this remains a rare opportunity to compare above service level costs in one country. Secondly, our ASL is much dependent on the allocation of national costs to SLP which was based on grant size; however this was confirmed repeatedly as appropriate by all the stakeholders involved in the study. Likewise, allocations to different activities at the SLP level may be subject to the interpretation of stakeholders interviewed. However, great care was taken to be consistent between SLPs, and the allocations were checked by multiple study team members and different stakeholders.

## **Conclusion**

ASL costs are likely to be necessary and significant during the scaling up process and these costs are likely to be influenced by organisational decisions, different contexts and expertise level of the local implementing partners. It is therefore essential that policy makers consider different models of support and place as much attention on above service level organization design as they do on the design of services in order to ensure that programmes aimed at those most in need of HIV prevention services achieve the most benefit for the funds spent.

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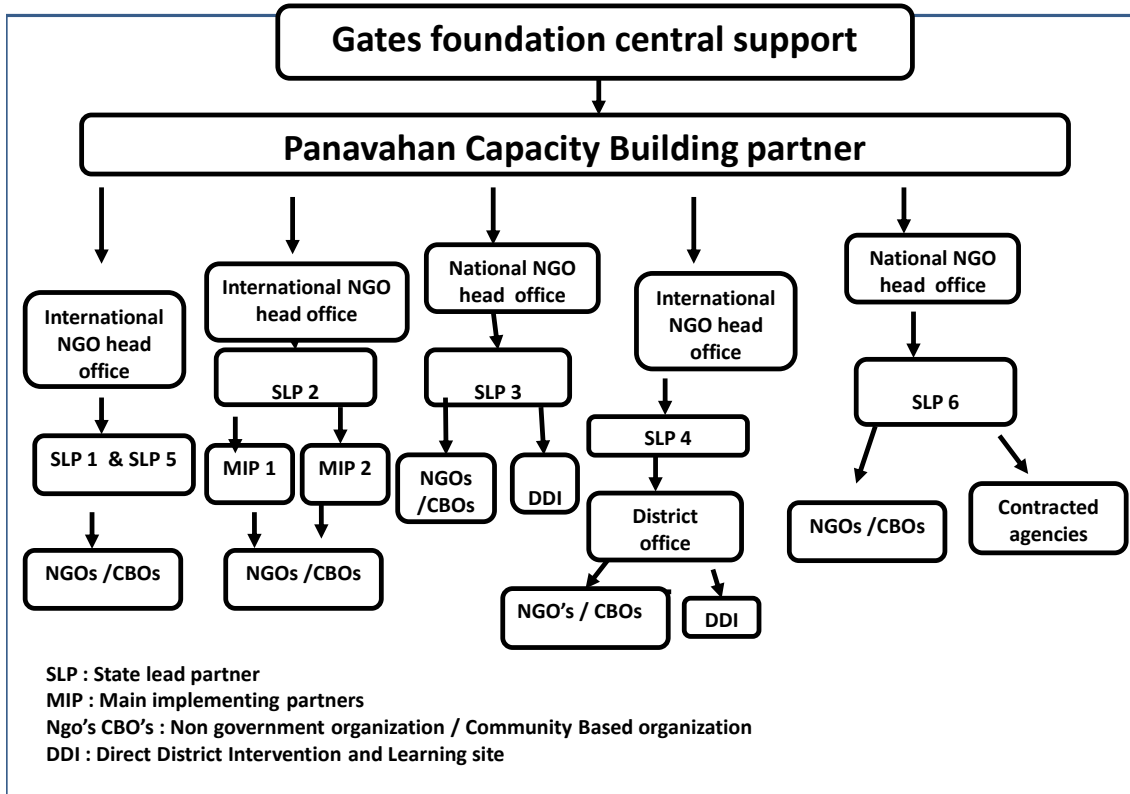


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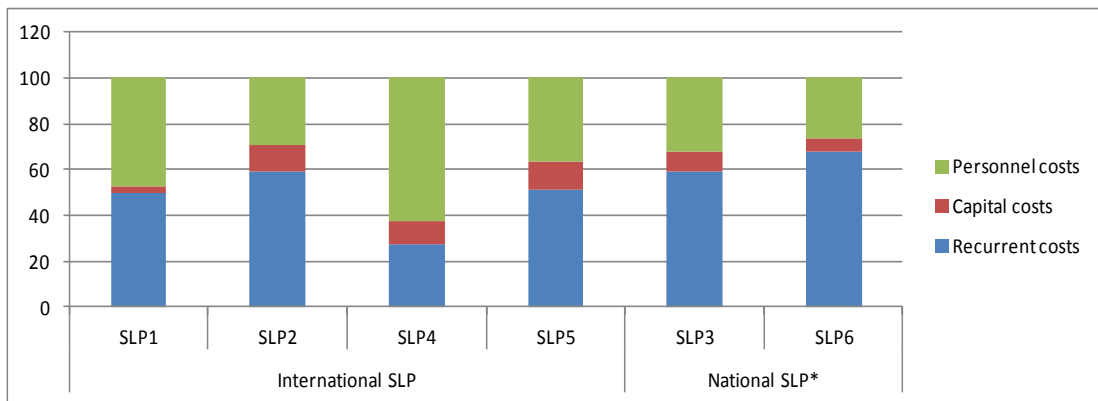
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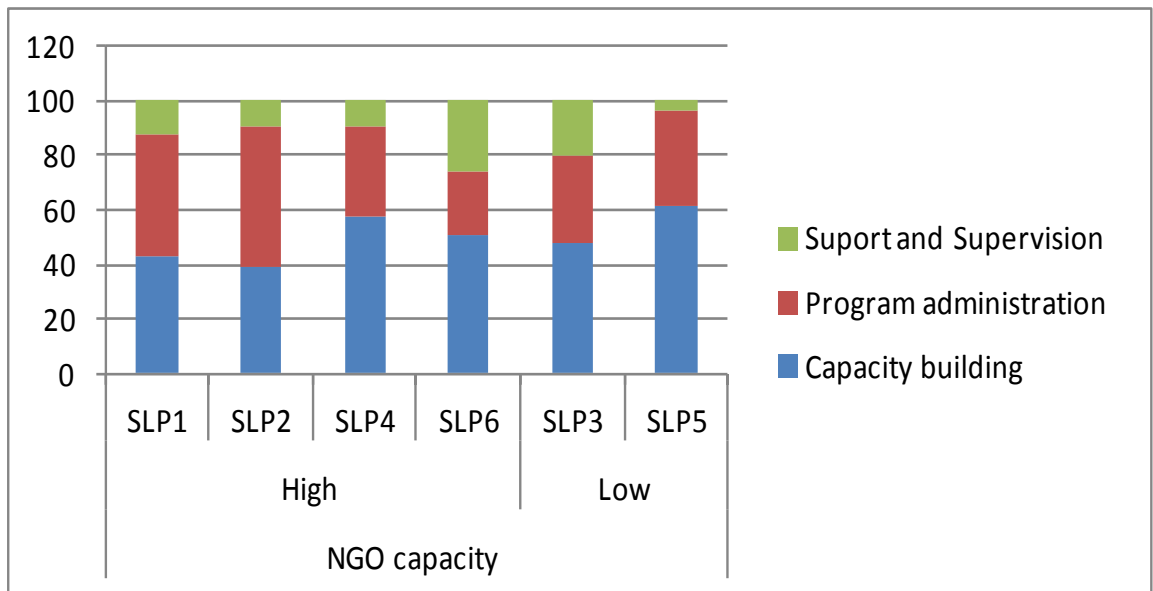
**Fig 1: Organizational structure of the state lead partners**



**Fig 2: Input costs (% of total costs) per state lead partner (SLP) by international/ national SLP**



**Fig 3: Activity costs by state lead partner (SLP) by NGO capacity**



\*NGO capacity High- If >60% of NGOs working under SLP have prior experience

**Table 1: Number of districts, non-governmental organizations (NGOs) and population reached by each state lead partner (SLP) and SLP characteristics**

SLP*	Number of districts (NGO)				Individuals reached by program monthly			
	2004-05	2005-06	2006-07	2007-08	2004-05	2005-06	2006-07	2007-08
SLP1	9 (19)	13(26)	13(27)	14(40)	6762	16497	21415	47108
SLP2		2(15)	2(16)	2(16)	0	26113	41399	50760
SLP3	8(10)	8(10)	9(18)	9(20)	4052	22092	49170	53444
SLP4	15(15)	16(17)	15(16)	17(20)	18411	47690	59598	80686
SLP5		10(11)	10(12)	10(14)	0	3245	8189	14918
SLP6	12(24)	12(24)	12(26)	12(28)	17600	36277	45814	53800
<b>Total</b>	<b>44(68)</b>	<b>61(103)</b>	<b>61(115)</b>	<b>64(138)</b>	46825	151914	225585	300716

SLP <sup>1</sup>	No districts Covered single NGO 2007-08	No dist. Covered Multiple NGO 2007-08	Previous exposure to large scale HIV prevention in most districts	Rural/urban intervention split <sup>4</sup> <small>(No. of NGOs urban of the total NGOs/SLP)</small>	NGO capacity to implement large scale program <sup>5</sup> <small>(No. of NGOs with capacity c the total NGOs))</small>	SLP with overseas support	Predominant high risk group as per estimated high risk group population(%) (2007-08) FSW <sup>2</sup> HR-MSM <sup>3</sup> / Transgender	
SLP1	5	9	Yes	Urban(30)	High(24)	Yes	67	33
SLP2	0	2	Yes	Urban(16)	High(10)	Yes	95	5
SLP3	7	2	No	Mixed(7)	Low(7)	No	71	29
SLP4	15	2	No	Urban(19)	High(15)	Yes	72	28
SLP5	9	1	No	Urban(10)	Low(5)	Yes	100	-
SLP6	3	9	Yes	Mixed(15)	High(17)	No	70	30
<b>Total</b>	<b>39</b>	<b>25</b>						

<sup>1</sup>SLP-State Lead Partner <sup>2</sup>FSW-Female sex worker <sup>3</sup>HR MSM-High-risk men who have sex with men<sup>4</sup>Urban- If >60% of intervention sites are urban; <sup>5</sup>NGO capacity High-

If >60% of NGOs working under SLP have prior experience in HIV prevention implementation

**Table 2: Above Service level total costs and unit costs per person reached by state lead partner (SLP) (US \$2011)**

	Above service level total costs per SLP					Above service mean cost per person reached (range)			
SLP	2004/05	2005/06	2006/07	2007/08	Total	2004/05	2005/06	2006/07	2007/08
SLP1	1,893,058	2,851,497	3,070,275	2,681,230	10,496,060	790(83-514)	188(39-767)	166 (13-1360)	79(4-406)
SLP2	-	3,894,865	3,657,753	3,393,312	10,945,930	0	154(94-258)	96(54-163)	71(30-115)
SLP3	1,632,341	2,612,540	2,842,980	3,391,278	10,479,140	1039(258-4934)	144(62-314)	73(28-178)	80(32-228)
SLP4	2,821,721	4,308,182	4,239,985	4,306,783	15,676,671	215(87-828)	96(50-137)	83(37-144)	59(26-91)
SLP5	-	2,791,856	2,450,799	2,736,754	7,979,410	0	1034(348-2923)	239(122-480)	175(94-402)
SLP6	1,334,725	2,870,729	3,404,226	2,979,504	10,589,184	74(45-145)	94(35-179)	90(30-196)	67(24-118)
<b>Total</b>	<b>7,681,845</b>	<b>19,329,669</b>	<b>19,666,018</b>	<b>19,488,863</b>	<b>66,166,395</b>	353	285	125	89

**Table 3: Above service level unit costs compared with state lead partner (SLP) characteristics (US\$ 2011)**

<u>SLP characteristics</u>	<u>2004/05</u>	<u>2005/06</u>	<u>2006/07</u>	<u>2007/08</u>	<u>Total</u>	<u>No. of SLPs (NGOs)</u>
<b><u>NGO capacity</u></b>						
High (>60% have prior experience)	360	133	109	69	168	4(78)
Low	1039	589	156	128	408	2(60)
<b><u>Location</u></b>						
Urban(>60% sites urban)	680	169	130	173	288	4 (94)
Mixed	557	119	81	74	208	2 (44)
<b><u>International assistance</u></b>						
Yes	680	169	130	173	252	4(90)
No	557	119	81	74	208	3(48)
<b><u>Organisational levels</u></b>						
Multiple	680	169	130	173	288	4(90)
Direct	557	119	81	74	208	2 (48)
<b><u>High risk population reached</u></b>						
< 20000		1034	239	175	483	1(14)
<50000	790	188	166	79	306	1(40)
>50000	443	122	85	69	159	4 (84)
<b><u>Districts covered</u></b>						
>10	360	126	113	69	167	3 (88)
<10	1039	444	136	109	308	3 (50)



**Table Supplementary 1: State lead partner (SLP) costs by input by year (US\$ 2011)**

	SLPs	SLP1	%	SLP2	%	SLP3	%	SLP4	%	SLP5	%	SLP6	%	Total (%)
<b>Recurrent cost</b>	2004-05	357,412	40	-	-	395,604	61	505,046	37	-	-	358,908	62	1,616,971 (47%)
	2005-06	573,214	49	979,603	56	467,628	50	520,441	24	335,147	50	1,022,729	72	3,898,761 (48%)
	2006-07	691,445	52	1,357,350	63	749,324	67	506,481	26	531,985	55	1,305,561	69	5,142,146 (55%)
	2007-08	666,051	57	1,182,223	58	1,067,488	58	429,543	24	680,910	49	1,036,276	64	5,062,491 (51%)
	<b>Total</b>	2,288,122		3,519,177		2,680,044		1,961,511		1,548,041		3,723,473		15,720,369(51%)
<b>Fixed cost</b>	2004-05	35,302	4	-	-	79,537	12	138,960	10	-	-	81,759	14	335,558 (10%)
	2005-06	28,596	2	229,905	13	114,219	12	161,313	7	111,638	17	95,225	7	740,897 (9%)
	2006-07	32,515	2	248,395	11	101,716	9	195,039	10	121,021	12	73,402	4	772,088 (8%)
	2007-08	37,665	3	242,091	12	121,316	7	245,152	14	144,503	10	71,531	4	862,258 (9%)
	<b>Total</b>	134,078	3	720,391	12	416,789	9	740,464	10	377,161	12	321,916	6	2,710,800 (9%)
<b>Salaries</b>	2004-05	505,504	56	-	-	174,431	27	703,263	52	-	-	140,819	24	1,524,017 (44%)
	2005-06	565,482	48	548,415	31	358,366	38	1,470,279	68	228,466	34	298,320	21	3,469,329 (43%)
	2006-07	614,404	46	562,683	26	271,627	24	1,213,309	63	318,800	33	510,213	27	3,491,036 (37%)
	2007-08	465,268	40	620,635	30	641,104	35	1,126,324	63	571,128	41	515,625	32	3,940,084 (40%)
	<b>Total</b>	2,150,659		1,731,733		1,445,529		4,513,176		1,118,393		1,464,977		12,424,467(40%)

Table Supplementary 2: SLP costs by activity by year (US\$ 2011)

SLPs	SLP1	%	SLP2	%	SLP3	%	SLP4	%	SLP5	%	SLP6	%	Total (%)
<b>Capacity building</b>													
2004-05	609,861	32	-		625,631	38	1,253,974	44	-		652,205	49	3,141,671 (41%)
2005-06	1,320,139	46	1,755,472	45	1,375,729	53	2,576,953	60	1,837,877	66	1,667,294	58	10,533,464 (54%)
2006-07	1,410,605	46	1,310,683	36	1,533,667	54	2,569,609	61	1,584,635	65	1,663,494	49	10,072,693 (51%)
2007-08	1,214,609	45	1,202,426	35	1,501,672	44	2,606,398	61	1,505,957	55	1,430,980	48	9,462,043 (49%)
<b>Total</b>	<b>4,555,214</b>		<b>4,268,581</b>		<b>5,036,700</b>		<b>9,006,933</b>		<b>4,928,470</b>		<b>5,413,974</b>		<b>33,209,871 (50%)</b>
<b>Program administration cost</b>													
2004-05	984,828	52	-		676,513	41	1,114,344	39	-		423,053	32	3,198,739 (42%)
2005-06	1,206,497	42	1,885,808	48	797,342	31	1,334,957	31	836,708	30	557,151	19	6,618,462 (34%)
2006-07	1,245,844	41	1,953,181	53	859,835	30	1,307,517	31	760,774	31	768,616	23	6,895,766 (35%)
2007-08	1,246,271	46	1,804,292	53	968,552	29	1,371,421	32	1,141,021	42	687,380	23	7,218,938 (37%)
<b>Total</b>	<b>4,683,439</b>		<b>5,643,281</b>		<b>3,302,243</b>		<b>5,128,239</b>		<b>2,738,503</b>		<b>2,436,200</b>		<b>23,931,90 (36%)</b>
<b>Support and Supervision</b>													
2004-05	298,370	16	-		330,197	20	453,403	16	-		259,468	19	1,341,437 (17%)
2005-06	324,861	11	253,584	7	439,469	17	396,272	9	117,272	4	646,283	23	2,177,742 (11%)
2006-07	413,826	13	393,889	11	449,477	16	362,860	9	105,390	4	972,116	29	2,697,559 (14%)
2007-08	220,350	8	386,594	11	921,054	27	328,964	8	89,775	3	861,143	29	2,807,880 (14%)
<b>Total</b>	<b>1,257,406</b>		<b>1,034,068</b>		<b>2,140,198</b>		<b>1,541,499</b>		<b>312,437</b>		<b>2,739,010</b>		<b>9,024,618 (14%)</b>

\*Above service level costs include SLP costs and programme level costs

**CHAPTER 7**  
**RESEARCH PAPER 4**

**The costs of HIV prevention for different target populations in Mumbai,  
Thane and Bangalore**

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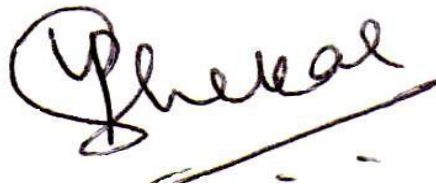
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NAME IN FULL (Block Capitals) Dr. Sudha Chandrashekar.....

STUDENT ID No. ....222484.....



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REVIEW

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# The costs of HIV prevention for different target populations in Mumbai, Thane and Bangalore

Sudha Chandrashekar<sup>1,2\*</sup>, Anna Vassall<sup>1</sup>, Bhaskar Reddy<sup>3</sup>, Govindraj Shetty<sup>3</sup>, Peter Vickerman<sup>1</sup>, Michel Alary<sup>4</sup>

## Abstract

**Background:** Avahan, the India AIDS Initiative, delivers HIV prevention services to high-risk populations at scale. Although the broad costs of such HIV interventions are known, to-date there has been little data available on the comparative costs of reaching different target groups, including female sex workers (FSWs), replace with "high risk men who have sex with men (HR-MSM) and trans-genders.

**Methods:** Costs are estimated for the first three years of Avahan scale up differentiated by typology of female sex workers (brothel, street, home, lodge based, bar based), HR-MSM and transgenders in urban districts in India: Mumbai and Thane in Maharashtra and Bangalore in Karnataka. Financial and economic costs were collected prospectively from a provider perspective. Outputs were measured using data collected by the Avahan programme. Costs are presented in US\$2008.

**Results:** Costs were found to vary substantially by target group. Non-governmental organisations (NGOs) working with transgender populations had a higher mean cost (US \$116) per person reached compared to those dealing primarily with FSWs (US \$75-96) and MSWs (US \$90) by the end of year three of the programme in Mumbai. The mean cost of delivering the intervention to HR-MSMs (US \$42) was higher than delivering it to FSWs (US \$37) in Bangalore. The package of services delivered to each target group was similar, and our results suggest that cost variation is related to the target population size, the intensity of the programme (in terms of number of contacts made per year) and a number of specific issues related to each target group.

**Conclusions:** Based on our data policy makers and program managers need to consider the ease of accessing high risk population when planning and budgeting for HIV prevention services for these populations and avoid funding programmes on the basis of target population size alone.

## Background

It is estimated that around 2.5 million people were living with HIV/AIDS in India in 2006 [1-3]. Much of the HIV transmission in India occurs within networks of individuals who have high levels of risk [4]. The India AIDS Initiative or Avahan Programme is a large scale 10-year HIV-prevention programme in the six Indian states most affected by the HIV epidemic - complementing programs by the Government of India. In its first five years, Avahan focused on core and bridging populations in order to reduce the spread of HIV in these populations as well as in the general population [5].

Avahan delivers HIV prevention services to a wide range of high risk populations. Female sex workers

(FSW) are the largest group, with Avahan targeting an estimated 310,000 FSWs. In India, FSWs are categorized into different typologies, based on where they recruit or solicit clients and not where they live or entertain the clients [6,7]. The major typologies are street based (SB), bar based (BG), brothel based (BB), lodge based (LB), home based (HB), dhaba based and highway based. These categories are often overlapping and fluid [4]. Avahan mapping in four southern states found that 60% of female sex work in India is street based, 9% brothel based, 12% are lodge based, 19% home based and others. Avahan also targets around 123,000 high risk "men who have sex with men" (HR-MSMs) and transgenders. Transgenders include hijras. While one sub-set of hijras is involved in blessing during births, marriages and ceremonies, another is involved in begging, and a third is involved in sex work.

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There are a limited number of peer reviewed studies on the costs of HIV prevention services in Asia [8-14]. These show that costs vary considerably by setting, finding that the cost of reaching a sex worker ranges from US\$10 to US\$124 (US\$2006) [14-17]. There are many reasons for these differences, foremost of which is scale [15]. However, other factors such as the type of the population reached, programme intensity, age of the programme may also impact costs. For example, a study by Dandona et al in 2008 found that costs of similar HIV prevention interventions fell as scale increased and over time [17].

As a part of the overall evaluation plan, Avahan was subject to an intensive costing effort and an economic evaluation in four southern states, Karnataka, Maharashtra, Andhra Pradesh and Tamil Nadu during 2005-2008. This evaluation covers over eighty districts, and thus provides an opportunity to understand the drivers of HIV prevention costs [18]. This paper presents the costs of delivering Avahan HIV prevention package in two urban settings where distinct typologies of high risk population were targeted in order to explore how the costs vary for different typologies in similar settings.

## Methods

### Study setting

This study presents the costs of HIV prevention in two large scale urban settings, Mumbai and Thane in

Maharashtra and Bangalore in Karnataka. In Mumbai and Thane, we measured the costs of delivering HIV prevention to different typologies of FSWs, HR-MSM and transgenders. A cross sectional behavioural and biological survey conducted in April 2006 in Maharashtra found an HIV prevalence of 28.1% (22.2-34.8) among brothel-based FSWs and 19.2%(13.7-26.2) among street-based FSWs [19]. In Bangalore, we measured the costs of HIV prevention services to FSWs and HR-MSMs. A study of HR-MSM in Bangalore in-2008 found an HIV prevalence of 18.9% [19]. HIV prevalence among the FSW population in Bangalore was estimated to be 12.6% from routine surveillance [20].

### Programme description

In Mumbai/Thane, Avahan funds 16 separate non-governmental organizations (NGOs) to deliver HIV prevention services. Each of these NGOs targets different high risk populations (Table 1). The estimated population targeted by Avahan in Mumbai and Thane was 34,919 persons. By the end of year three, a total of 51,885 individuals had been reached at least once. The number of individuals reached was higher than the population estimate due to the migration of individuals in and out of the target group. The breakdown of the population reached by Avahan in Mumbai and Thane consisted of: 51% bar-based FSWs, 13% brothel-based FSWs, 16% home-based FSWs, 12% street-based FSWs, 4% HR-

**Table 1 NGO site characteristics, estimated population, and population reached**

NGO/CBO	Typology*	Estimated population **	Total population reached by year 3
1	BB	2000	3381
2	BG	2200	2772
3	BB / BG	1700	2194
4	HB / BG	3000	4384
5	HR-MSM	1500	2411
6	BB / LB / SB / HB / BG	1500	1659
7	HIJRA	1500	1125
8	BB / HB/ BG	4057	5251
9	HB / BG /MSW	2800	3676
10	BB / BG	2671	3451
11	BB / SB / HB	1800	2751
12	BG / MSW	3052	5201
13	BB / LB / SB / HB / BG	2039	3646
14	HIJRA	1800	1668
15	BG / SB	2000	3482
16	BB / LB / SB / HB / BG	1300	4833
<b>Total Maharashtra</b>		<b>34919</b>	<b>51885</b>
<b>Bangalore, Karnataka</b>			
17	SB	12743	25124
18	HR-MSM	6226	11496
<b>Total Karnataka</b>		<b>18969</b>	<b>36620</b>

\* Street-based (SB), brothel-based (BB), lodge-based (LB), home-based (HB), bar girls (BG) and high risk men who have sex with men (HR-MSM).

\*\* Estimated using community mapping surveys.

MSMs and 3% transgenders. Programme interventions included community mobilisation, advocacy, crisis management, outreach, behavioural change and communication (including innovative strategies to reach out to the key population), sexually transmitted infections (STI) services, counselling and condom promotion and provision. These services are considered an essential package of services and are delivered for all target groups [21]. NGOs, however, are allowed to decide the intensity of (frequency of contact with the programme staff) and the way in which interventions are delivered.

In Bangalore, HIV prevention is implemented by two community based organizations, one targeting street-based FSW and the other HR-MSM. The estimated target population was 18,969 persons, and by year three, 36620 people had been reached at least once a year (Table 1). The intervention package was similar to that in Mumbai and Thane and comprised of outreach activities including peer led behaviour change communication, STI services and condom promotion [22]. Community mobilisation included drop-in centre activities, special events; welfare activities for the key population and enabling environment activities include advocacy, sensitization of stakeholders and crisis management.

#### Costing methods

Our methodology is based on the UNAIDS Costing Guidelines for HIV Prevention Strategies [23] as recommended by Asian development bank. An ingredients-based costing methodology was used to consider both financial and economic costs from the provider perspective - including both implementation and support costs. The ingredients approach identifies the inputs required to deliver the intervention, and then measures and values them.

Five NGO sites were chosen for extensive field work, representing the range of typology of sex work interventions implemented, (brothel based FSWs; street based FSWs, HR-MSM, bar girls and transgenders). For each NGO, data was collected on project activities, financial expenditure and outputs. Time-sheets were used to determine allocation of resources between different activities and population groups. For all the other NGOs studied, data was collected from their routine reports and no fieldwork was done. Expenditure data was obtained from routine financial and management reporting, staff records and interviews with staff. We estimate both financial and economic costs. Financial costs represent the money spent by the programme to deliver the intervention, whereas economic cost includes the value of all inputs (including the value of resources that may be donated). Therefore, for the detailed costing sites, data on donated goods and services were also collected

from the programme. The economic costs of these items were valued at market prices obtained from local shops and interviews with project staff.

Costs were classified according to three characteristics: the phase of implementation, organisational level where costs are incurred and type of cost. The time period between the decision to implement an intervention and starting its delivery to the beneficiaries was defined as the start up phase. All costs incurred in the start-up period were annualised to reflect utility beyond the start up period. All costs incurred after the start up period were defined as implementation costs. Costs were collected both from the state level (supporting the NGOs) and from each NGO. Costs are categorised as either recurrent or capital costs using a definition of capital cost to be an item with a useful life of more than one year. Capital costs include equipment, furniture and fixtures, vehicles, rental deposits and start up costs. Capital equipment was assumed to have a life of between 5 and 10 years, depending on the item. Capital costs were annualised to reflect the utility of their use during the course of the programme. A discount rate of 3% was used. Recurrent costs include all personnel costs, travel, building operating and maintenance supplies, cost of condoms, medical supplies and all other supplies costs.

At the start of an intervention in a district or sub-district, NGOs conducted a formal external mapping and size estimation exercise. Some state-level lead implementing partners updated these numbers on a regular basis (every 12 to 18 months) using programme data; others conducted formal size estimation exercises; others used programme data [24]. Programme output data was sourced from the programme Management Information System (MIS) which captures the number of individuals reached, those contacted monthly by outreach workers and number of individuals attending STI services [25]. Programmes were designed to cover high risk individuals in specific geographic area and as such did not follow the individuals when they left the area. All data were entered into a specifically designed MS Excel workbook.

Since the cost estimates cover more than one year of expenditure, where relevant, costs have been adjusted to US\$2008 using the Gross Domestic Product (GDP) deflator reported by the Indian Ministry of Finance [26]. Further details on the cost analysis methods are explained in Chandrashekar et al (2010) [15].

#### Results

The estimated target population, population reached, contacts made and clinic visits per year by typology of high-risk population are presented in Table 2. An examination of the number of contacts made per person reached shows that programme intensity differed by



**Table 2 Programme outputs for Mumbai/Thane and Bangalore, 2005-8**

Typology	Population estimation			Population reached at least once a year			Contacts per year, per person reached			Clinic visits per year, per person reached		
	Year	05-06	06-07	07-08	05-06	06-07	07-08	05-06	06-07	07-08	05-06	06-07
Brothel-based	3679	4044	4112	3489	4958	6818	8.1	4.9	4.8	0.5	1.0	1.0
Lodge-based	344	369	254	236	606	573	3.1	4.1	4.1	0.7	0.8	0.9
Street-based	3376	3754	3619	3356	4906	6622	7.9	5.1	4.2	0.5	1.0	1.0
Home-based	3079	4909	6027	2497	5670	8328	2.2	4.6	5.4	0.9	1.1	1.1
Bar girls	14373	16900	16092	12937	20060	24317	3.2	3.9	4.4	0.5	0.9	1.0
HR-MSM	1502	1503	1515	2314	2324	2434	3.1	6.4	5.9	0.1	0.9	1.1
Hijras*	1635	3440	1800	1284	2875	1668	16.1	6.6	3.8	0.5	0.7	0.8
<b>Total Mumbai/ Thane</b>	<b>27990</b>	<b>34919</b>	<b>33419</b>	<b>26,113</b>	<b>41399</b>	<b>50760</b>	<b>5.0</b>	<b>4.6</b>	<b>4.7</b>	<b>0.5</b>	<b>0.9</b>	<b>1.0</b>
<b>Bangalore, Karnataka</b>												
HR-MSM	6226	6226	6226	3591	9483	11496	3.7	4.1	4.9	0.3	0.3	0.5
FSW	12929	12743	12743	9241	22476	25124	1.7	4.0	4.4	0.5	0.4	0.6
<b>Total Bangalore</b>	<b>19155</b>	<b>18969</b>	<b>18969</b>	<b>12832</b>	<b>31959</b>	<b>36620</b>	<b>2.2</b>	<b>4.0</b>	<b>4.6</b>	<b>0.5</b>	<b>0.4</b>	<b>0.5</b>

\*one NGO closed

Female sex workers (FSW) and high-risk men who have sex with men (HR-MSM).

target population typology. For example, in Mumbai/Thane on average, by 2008, each brothel-based and bar-based FSW reached was contacted around 4.4-4.8 times per year. Street-based FSWs were contacted less frequently at around 4.2 times per year. In comparison, while intensity was low to begin with, by 2008 home based sex workers were contacted 5.4 times a year. Similarly HR-MSM intensity was low initially, but by 2008 was 5.9 times per year. In Bangalore, the number of contacts per year was found to be about 4.4 times a year for FSWs and 4.9 times a year for HR-MSMs in 2008. By 2008, in Mumbai/Thane, STI clinic visits a year did not vary substantially by population group and the mean was around 1 per year. For Bangalore, the mean frequency of clinic visits per year for HR-MSMs was around 0.47 in 2008. For FSWs it was slightly higher at 0.58 clinic visits per year.

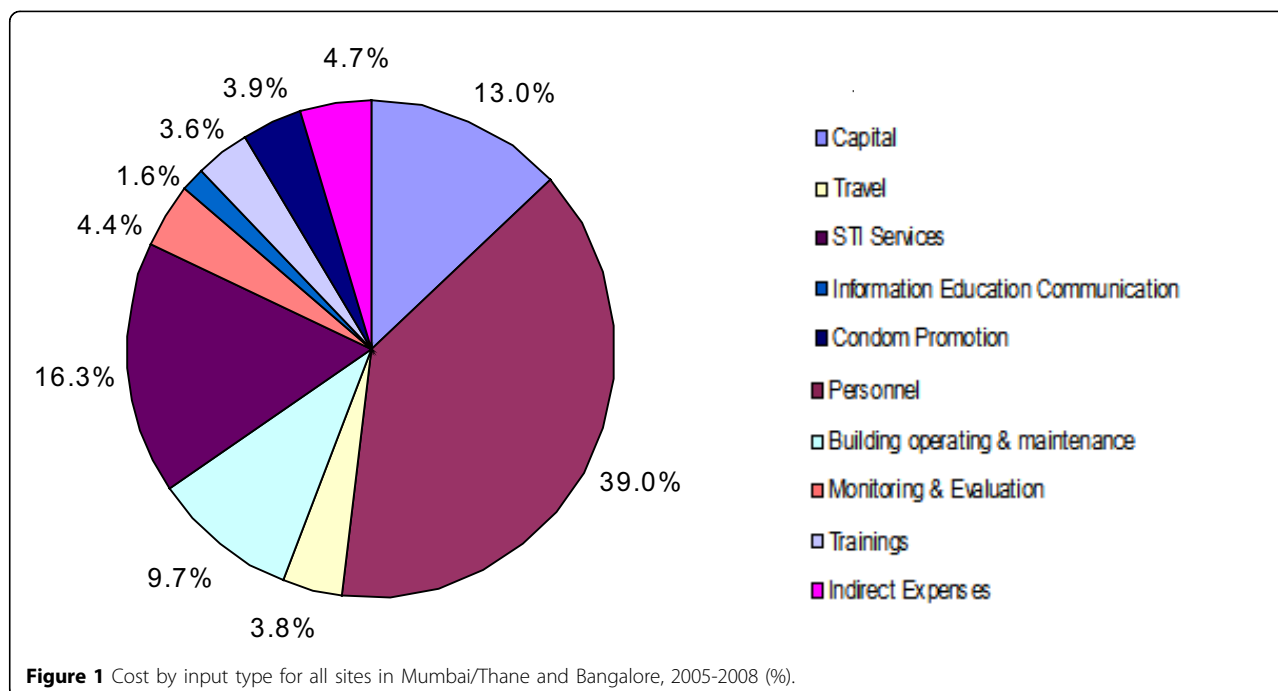
Table 3 presents total programme costs broken down by typology and risk group for all sites in Mumbai, Thane and Bangalore. Broadly, total costs of each programme increased over the years, with the most the increase occurring between years 1 and 2. The total economic cost is US\$9.2 million over the three years in Mumbai/Thane. 44% of this cost was spent on interventions focussed on bar based sex workers. The allocation to different target groups (as a proportion of total cost) remained much the same throughout the period, (aside from the cost of reaching home based workers that increased as the programme expanded). The total cost of the programme in Bangalore was around US\$3.1 million. The proportion cost related to HR-MSM, increased over time and reached around 34.4% of the total cost by 2008.

Figure 1 shows cost breakdown by input type across all areas studied. Capital costs account for around 13%

**Table 3 Programme implementation costs by Typology and high risk group (US \$ 2008) (Economic 3%)**

Typology	Costs by typology (discount rate 3%)								
	Year	05-06	%	06-07	%	07-08	%	Total	%
Brothel based		368936	15.1	435025	13.1	500151	14.3	1304112	14.1
Lodge based		32818	1.3	42390	1.3	32327	0.9	107535	1.2
Street based		318096	13.0	417830	12.6	440427	12.6	1176353	12.7
Home based		259848	10.6	445463	13.4	624896	17.8	1330207	14.4
Bar girls		1135975	46.5	1452101	43.7	1516250	43.3	4104326	44.3
HR-MSM		164067	6.7	194223	5.8	190603	5.4	548893	5.9
Hijras		162968	6.7	333946	10.1	196651	5.6	693565	7.5
<b>Total</b>		<b>2442708</b>	<b>100.0</b>	<b>3320978</b>	<b>100.0</b>	<b>3501305</b>	<b>100.0</b>	<b>9264991</b>	<b>100.0</b>
FSW site Bangalore		446228	73.6	739482	65.2	922722	65.6	2108432	67.0
HR-MSM site Bangalore		160181	26.4	394701	34.8	484476	34.4	1039358	33.0
<b>Total</b>		<b>606409</b>	<b>100.0</b>	<b>1134183</b>	<b>100.0</b>	<b>1407198</b>	<b>100.0</b>	<b>3147790</b>	<b>100.0</b>

FSW – female sex worker, HR-MSM – high-risk men who have sex with men.



of total cost. Personnel costs account for 39% of cost, followed by STI supplies costs at 16%. Figure 2 shows the breakdown in terms of activities. Programme administration costs (including mapping, programme monitoring and management information system, start-up activities, management staff, office expenses and overheads) account for around 37% of total costs, followed by outreach at 20%, STI services at 16% and, community mobilisation and advocacy activities at 13%. Start up activities contributed around 5% of the total costs.

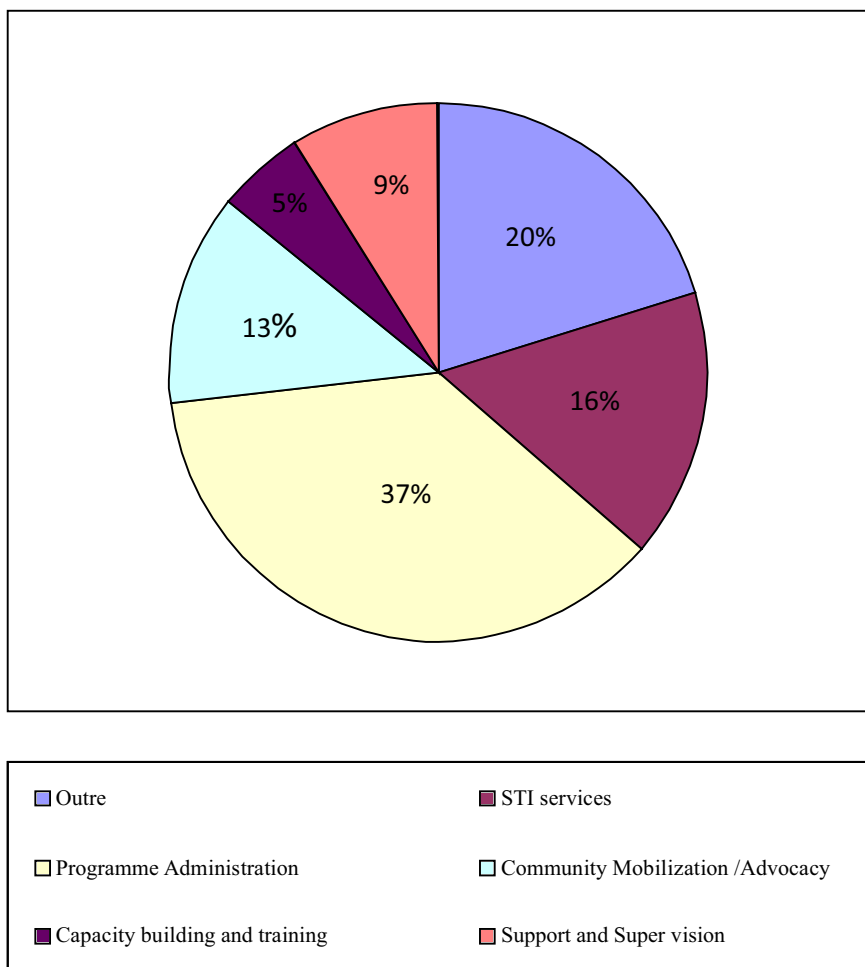
The unit costs by typology (estimates made from detailed costing sites/ or single target population sites only) are shown in Table 4. By year 3, the unit costs of reaching a member of the targeted population ranged from \$US 75 to \$US 116 in Mumbai and Thane and \$US 37 to US\$ 42 in Bangalore. Costs for non-fixed location groups (Hijras, street- based FSWs and HR-MSMs) tended to be higher than those for operating from a fixed setting (brothel and bar- based FSWs). Table 4 also shows that costs per person reached decline over time for brothel and bar based workers in Mumbai and Thane and in all target populations in Bangalore, but not for other groups. Figure 3 shows the cost breakdown for each typology by input type. For the most part, harder to reach groups (e.g. the non-fixed location groups) have higher capital (including building maintenance) and personal (including training) costs per person reached than groups operating from fixed settings. In terms of breakdowns by activity, harder to reach typologies show a similar proportional breakdown of

inputs as fixed location groups (Figure 4). We also analysed the relationship between the numbers of contacts per person reached per year (from Table 2) and the unit cost per person reached (Table 4). Some patterns were observed. For example in year 2 intensity and cost follow the same trends. However both in year 1 and 3 this association is weaker. Overall we found a correlation coefficient ( $r=0.32$ ), but this was not found to be statistically significant.

## Discussion

There is considerable interest by the Government of India, and other countries to sustain HIV prevention programmes, but their cost remains a concern. Improving the knowledge of factors that drive costs can assist programme budgeting and help in deciding the optimal resource allocation required to deliver these programmes. Previous resource estimates have tended to deal with financial costs only and assumed that they were linear across population typologies [26]. Many governments and programme also determine their budgets by allocating a standard cost for reaching a member of a target group, and multiplying this by target population size. Evidence to date has primarily focussed on establishing the extent of the relationship between costs and the scale and timing of programme implementation, and the characteristics of the (recipient) target group.

We find that the costs of reaching different populations with HIV prevention interventions in the similar settings vary substantially. The costs for all typologies



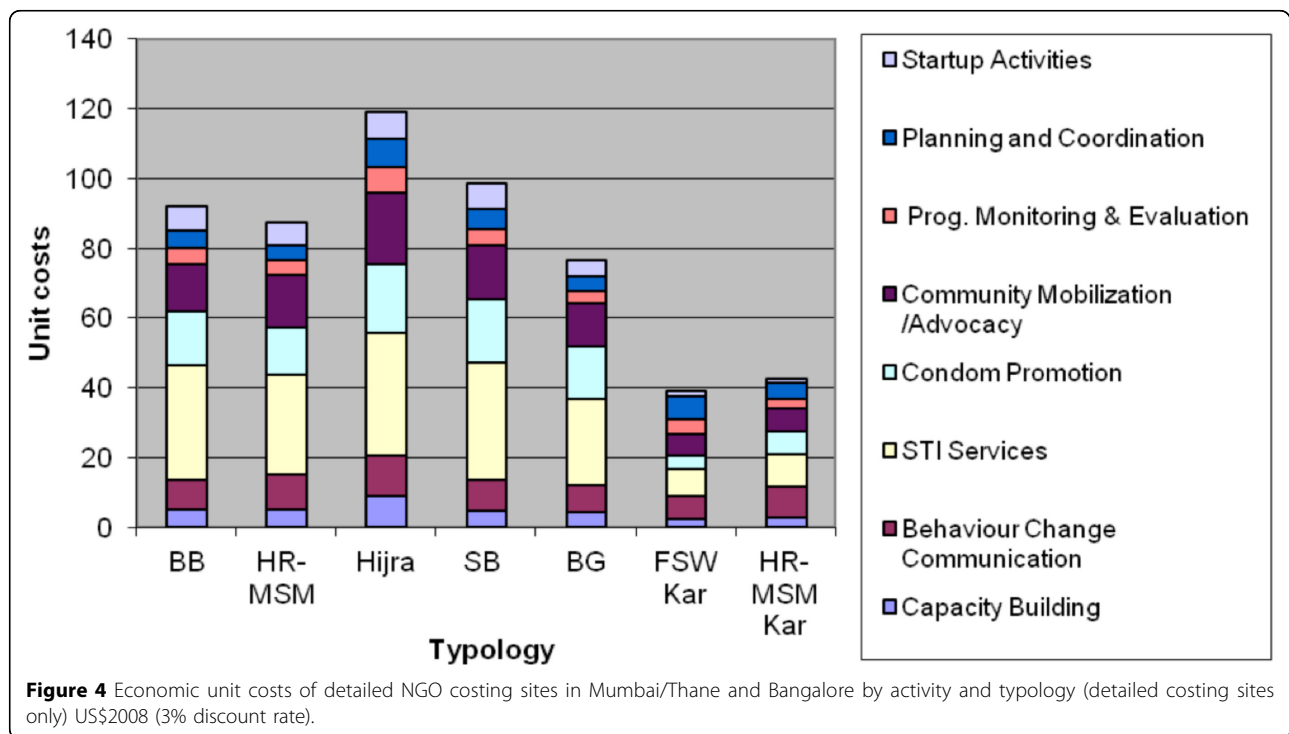
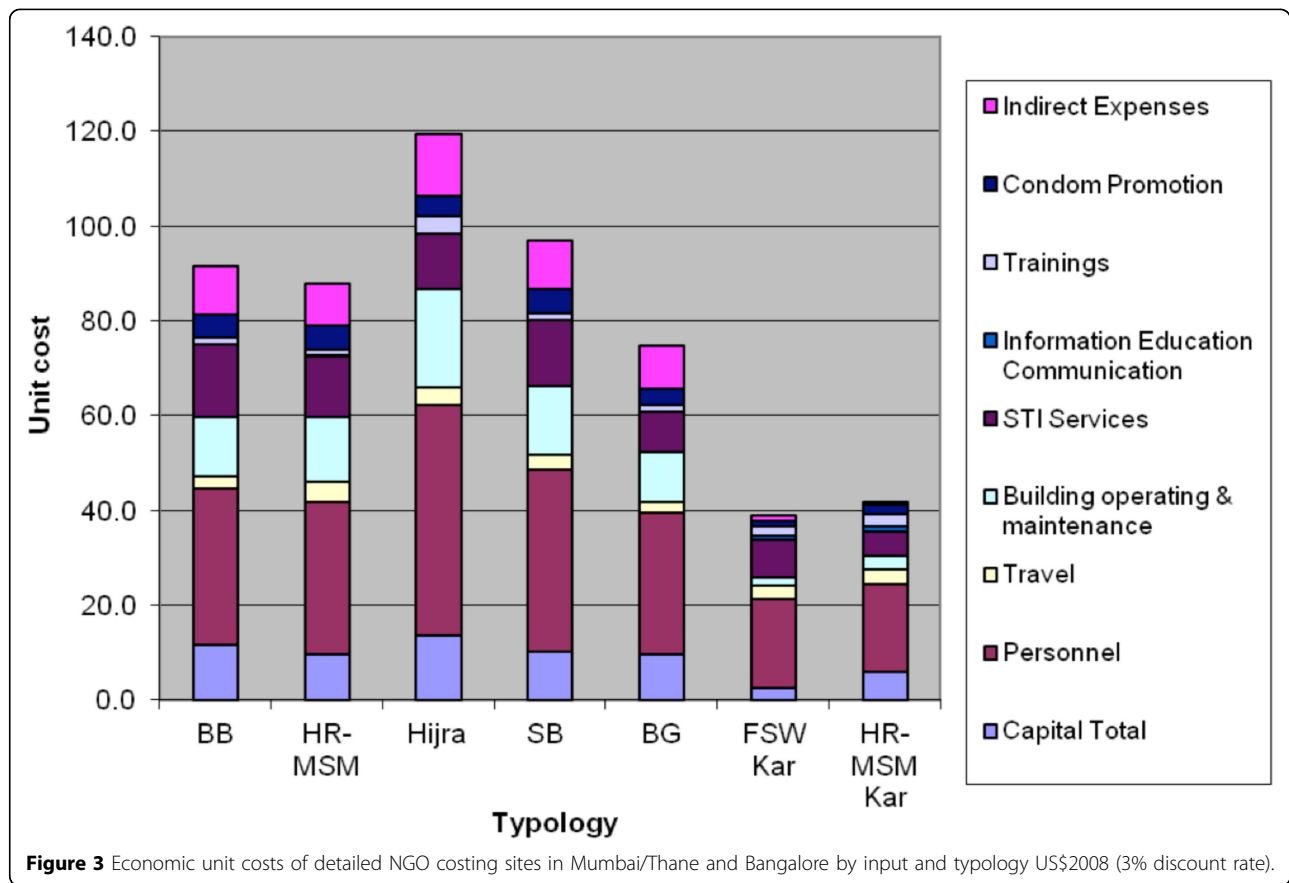
**Figure 2** Cost by activity for all NGO sites in Mumbai/Thane and Bangalore, 2005-2008 (%).

are at the higher end of those found in previous studies in India of both Avahan and HIV prevention delivered by others [11,14-17]. This is likely to be due to the package of services included and the fact that our costs also include expenditures beyond the NGO level, which most previous studies omit. However, broadly our findings suggest that sex worker populations who operate

from non-fixed locations are likely to cost more. For example, in Mumbai/ Thane, the cost of reaching hijras is approximately 1.5 times the cost of reaching the lowest cost group (bar girls). In Bangalore, we find that the cost of reaching HR-MSMs is with marginally higher than that of reaching FSWs. This is somewhat different than the findings of the one previous study from India

**Table 4** Unit costs of detailed NGOs by Typology (Economic costs 3%)

Typology	Population estimation			Cost per population reached			Cost per contact		
	05-06	06-07	07-08	05-06	06-07	07-08	05-06	06-07	07-08
Brothel-based	104	107	121	103	97	75	10	21	17
Street-based	100	123	124	93	102	96	7	15	18
Bar girls	98	86	97	92	86	75	25	18	10
HR-MSM	123	145	145	80	94	90	26	15	15
Hijras	-	101	107	-	123	116	-	43	30
HR-MSM site in Karnataka	26	63	78	45	42	42	12	10	9
FSW site in Karnataka	35	58	72	48	33	37	28	8	8



that reports on the costs of reaching these two groups in the same setting [11]. This found that the mean costs of the HR-MSM programme and reaching FSWs in Andhra Pradesh were, respectively, US\$7.8 and US\$32.1 (US\$2006) per person reached. The reasons for this difference are hard to ascertain without a detailed understanding of what was included in the HR-MSM cost in that study.

The factors that drive cost differences between high-risk population groups are complex. As with between settings, unit cost variation within similar settings is likely to be related to the size of the target group. This is demonstrated by the decreases in unit costs over time as the programme expanded (Table 4). Moreover, in any one year, larger populations groups, such as bar girls, have lower costs (Table 4). In the few instances where this pattern cannot be observed, the explanation was found to be due to site-specific issues. For example, NGOs changed condom supplier over the years, and this increased costs over time. This scale effect may also explain the difference in costs between reaching FSWs and HR-MSMs in Bangalore, given that the FSW population is more than twice the size of the MSM population. These finding mirrors those from earlier studies by Dandona et al (2008) [17] and Chandrashekar et al (2010) [17].

The scale effect within NGO sites for different target groups is also illustrated by our cost breakdowns. Our cost breakdowns show that the proportion of both capital and personnel related costs are substantially higher per person reached in smaller target groups whereas other costs such as those for STI supplies (as a proportion of unit costs) remain more uniform across different target groups. This is likely to be due, in part, to the fact that each NGO needs a certain level of fixed capacity in key areas, such as support and supervision for outreach workers. Planners and funders therefore need to consider whether it is worth encouraging NGOs targeting smaller groups to share these fixed costs between one another, and explore how their funding mechanisms can better encourage the more efficient use of fixed resources.

Our data also suggest that higher intensity of service, in terms of numbers of contacts made, is associated with higher unit cost per person reached, albeit in a very limited way. In Mumbai/ Thane the magnitude of the difference in intensity (ranging from 4.2 to 6.6 contacts per year) is aligned to magnitude of the cost differences observed, with the exception of street-based FSWs, particularly in year 2. In year three there were specific issues with the management of the Hirja programme that meant that costs remained high, despite a lower intensity of effort. In Bangalore however, this is much less the case, as differences in intensity are much

lower, and thus overall we found no statistically significant relationship between intensity and cost. More work needs to be done with large sample sizes to explore this relationship further.

We observe little variation in the proportion of activity costs between different population groups. This indicates that no group required a special mix of activities, but nevertheless, when asked to interpret our findings programme staff identified some specific issues when working with the non-fixed location groups, such as hijras. For example, it took longer for staff to orientate themselves regarding the nature of the hijra population. Moreover, it took time to build rapport with the hijra population; requiring a higher frequency of visits from the NGO staff compared than other groups. Programme staff also highlighted issues with keeping track of street-based FSWs repeatedly, due to the highly mobile nature of that population. In addition, street-based FSWs were considered more reluctant to participate in the project services, because of the time commitment and the corresponding loss of clients and income. Street-based FSWs were also worried that visiting drop-in centres would reveal their identity and lead to more stigma and harassment from police and the local community. The factors were thought by the NGOs to increase the level of outreach and thus cost of reaching these groups.

This study is limited by various factors, the most important of which is its small sample size. Ideally when exploring cost differences between different groups one would use statistical techniques, examining costs and cost drivers over a large number of sites. However, even in such large scale settings, it is difficult to capture the detailed cost data required from a sufficient number of NGOs to enable this analysis. We are planning a follow-up econometric of costs drivers' analysis of all Avahan sites, but as few sites target specific high risk sub-populations, there are an insufficient number of sites to explore the full impact of typology on cost statistically. We therefore needed to rely on the descriptive analysis presented above. An alternative method would be to measure costs at the client/ individual population level, and it is recommended that future studies explore opportunities to do this.

Furthermore, our costs are also likely to be impacted by a number of other factors beyond target population. While the settings were similar in terms of NGO characteristics and HIV prevalence, other factors related to implementation are likely to also have an impact on costs. For example the programme had some difficult phases in particular districts in Mumbai due to a major bomb blast in the metro and combing operations by the police. There was sudden closure of bars due to government instruction and the programme had to change the strategy to reach the sex workers in

the place of residence. The issue of frequent raids in brothels also affected programme services in certain areas. Again this limits the robustness of results, even though most of the above effects were temporary in nature.

Our findings suggest that policy makers, planners and analysts should consider the typology of the target population when conducting efficiency analyses and setting budgets across HIV prevention programmes. Analytically, care should be taken to judge costs and efficiency in the context of the populations they service. However, setting budgets using a fixed amount per person reached risks penalising those NGOs who are targeting more difficult to reach groups and may create a perverse incentive to focus on high risk groups that cost less to reach.

## Conclusion

Different HIV prevention target groups present multiple issues in delivery of services and interventions, reflected in the cost variation. Policy makers and programme managers are therefore recommended to examine the particular circumstances of the populations being reached when setting budgetary limits for HIV prevention services for high risk groups.

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## Authors' contributions

SC: contributed to the design, data collection, analysis, interpretation and prepared the first draft of the paper; AV: contributed to the analysis, interpretation of the data and the manuscript; PV: contributed to manuscript preparation; BR and GY: assisted in the data collection, data entry, preliminary data analysis and generation of tables; MA: Principal Investigator of the main study and contributed to the design of the study.

## Competing interests

The authors declare that they have no competing interests.

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**CHAPTER 8**  
**RESEARCH PAPER 5**

**The incremental costs of community mobilization and empowerment interventions  
for female sex workers in two districts of Karnataka, Southern India**



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## **Chapter 8: Research paper 5**

**Title: The incremental costs of community mobilisation and empowerment interventions for female sex workers in two districts of Karnataka, Southern India**

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Abstract

**Background:**

Recent evidence suggests inclusion of structural programmatic components as part of FSW HIV programming may have important impacts on risk behaviour. There is a general interest in costs of community mobilisation as part of HIV strategic investment discussions. This study explores the incremental costs of the community mobilisation and empowerment (CME) of the AVAHAN Programme involved in scale up of HIV prevention interventions among high-risk groups (HRGs) in two districts in southern India.

**Methods:**

Financial and economic costs collected from Non-Governmental organisations (NGOs) and supporting costs at the state and national level for 2 districts over seven years (2004-2011) are presented in US\$ 2011 (3% discount rate). The community mobilisation activities included setting up drop-in centre (DIC) and conducting events; creating an enabling environment (advocacy, crisis intervention, access to social entitlements) and the formation of FSW collectives and self-help groups and strengthening them to form community-based organisations (CBOs).

**Results:**

The incremental costs of CME were US\$307,711 in Belgaum and US\$ 592,903 in Bellary over seven years (2004-2011). The average district cost per year for Belgaum was US\$ 43,959 (31,690-64,304) and Bellary US\$ 84704 (53,349- 135,572). The

incremental costs contribute between 4.2% to 17.8% in Belgaum and 13.6% to 22.4% in Bellary of total annual programme costs in the district. Personnel costs also accounted for a high proportion of the total costs of community mobilisation and empowerment (44% in Belgaum and 32% in Bellary).

Average district level costs(including state and national level support costs) for low exposure to community mobilisation activities was US \$ 76,998(56,414-97,582), medium exposure US\$ 398,482(276,940-520,025) and high exposure US\$ 450,307(307,711-592,903). Total CME costs broken down by sub-activity were advocacy and enabling environment 17%, events 49%,training 23% and CBO formation 12%. The unit cost per FSW reached ranges from US\$11 to US\$39 for Belgaum and US\$11 to US\$37 in Bellary

**Conclusions:** There is variation in the proportion of costs of community mobilisation by district indicating different levels of activity. Costs seen are consistent to the mix of activities required during different phases. Costs incurred beyond the district level both at the State and national level was vital to strengthen this process. Majority of the activities were found to have fixed costs which requires that while allocating resources to district for community mobilisation it would be better to allocate fixed funds per district with little extra for districts which are larger or have specific contextual issues than allocating per estimated population.

## **Introduction**

### **Costs and effectiveness of structural interventions**

There are emerging evidence from studies on the value additions of integrating structural interventions like community mobilisation, advocacy, and sensitisation of

stakeholders to decrease vulnerability with the essential HIV prevention package.(Reza-Paul, Beattie et al. 2008, Beattie, Bhattacharjee et al. 2010, Campbell and Cornish 2010, Tsai 2012). There is increased interest in evaluating these efforts to generate credible evidence to support their impact on improved programme outcomes(Chakravarthy, Joseph et al. 2012, Gaikwad, Bhende et al. 2012, Galavotti, Wheeler et al. 2012, Narayanan, Moulasha et al. 2012, Wheeler, Kiran et al. 2012). It is found that these interventions have a sustainable impact, reinforce behaviour change, address contextual issues, increase community engagement which is beneficial for HIV prevention efforts (Blankenship, Burroway et al. 2010, Erasquin, Biradavolu et al. 2012, Riehman, Kakietek et al. 2013).

There have been real reductions in vulnerability in demonstration projects especially India where community have been placed as the central focus and their empowerment has been well supported (Jana, Basu et al. 2004, Swendeman, Basu et al. 2009). But it is interesting to note that there is very little in terms of quantifying the resources needed for structural interventions. This kind of information if available would help the policy makers to have an idea of how much they need to invest and what would be the value for money. There have been some indication of the resource need estimates but lack of empirical evidence in real study settings (Schwartlander, Stover et al. 2011). Our study provides such cost estimates needed by governments to consider inclusion of these activities as a part of their national response.

## **Methods**

### ***Study setting and population studied***

It is estimated that 2.27 million people are living with HIV in India(National AIDS Control Organisation 2010). The epidemic is concentrated, and predominately driven by marginalised groups, particularly FSWs, men who have sex with men (MSM), and

in some contexts injecting drug users (Chandrasekaran, Dallabetta et al. 2008, Vickerman, Foss et al. 2010). The *Avahan* programme, the India AIDS Initiative of the Bill & Melinda Gates Foundation (BMGF), is one of the largest HIV prevention programmes targeted at high-risk groups in the world. The programme operates across six Indian states and had a funding commitment of US \$258 million between 2004 and 2009 (Bill and Melinda Gates Foundation 2008), and thereafter was transitioned to national ownership. *Avahan* is implemented through contracted state lead partners (SLPs), who in turn contract a plethora of local non-governmental organisations (NGOs) at the district level.

The state of Karnataka is one of the four southern states in India supported by *Avahan*, with an estimated HIV adult prevalence of 0.9% (2008), and it contributes 11% of the HIV burden in the country (National AIDS Control Organisation 2010). Unprotected heterosexual sex is a key factor in the spread of the epidemic, with overall prevalence among FSWs in the state being 16.4% (Vickerman, Foss et al. 2010). The *Avahan* SLP in HIV prevention efforts is the Karnataka Health Promotion Trust (KHPT), supported by the University of Manitoba - and has worked with 17 NGOs across 19 districts since 2004. Our cost-effectiveness analysis focuses on two districts in Karnataka, Belgaum and Bellary. These two districts were chosen purposively, based on Karnataka's socio-cultural regions, the size of the high-risk population and the availability of detailed behavioural, biological and costing data. Table 1 shows the number of FSWs reached at least once a year. For Belgaum this ranges from 806 in 2004 to 3072 in 2011; and in Bellary from 2741 in 2004 to 5743 in 2011.

### ***Intervention description***

Figure 1 depicts the community mobilization process adopted in Bellary and Belgaum. Full details of the intervention are also publically available (Foundation. 2013, Foundation. 2013). In the initial stages, activities concentrated on drop-in centres (DICs) as a focal point for community mobilization (2004-6). DICs provided a platform to motivate FSWs to use HIV prevention, but also drew in FSWs by holding special events. In rural areas, at the village level, self-help groups (SHGs) were established as a platform for FSWs to share and discuss issues and develop income generation activities (2006-07). SHGs aimed to create awareness on HIV/AIDS, but also address non-health needs such as helping to access ration cards and government schemes, education for the children of FSWs, etc. From 2008 onwards, SHGs were strengthened through the formation of district-level collectives; and over time these provided the basis to form community-based organizations that could take on an active role in programme implementation and management. Similarly, building on the connections made in the DICs, FSWs were further encouraged to be involved in the planning of HIV prevention services through the formation of various programme committees.

In addition to the formation of communal structures, broader efforts were taken to improve the FSWs' interaction with the wider community. This included conventions to encourage community members to interact with other FSWs in different villages and the provision of legal empowerment sessions (Gurnani, Beattie et al. 2011). There were also sensitization sessions for local leaders, youth organizations and secondary stakeholders like pimps, brothel owners, police and others – particularly focused on violence reduction (Beattie, Bhattacharjee et al. 2010). All the activities were supported through capacity building from the SLP and its supporting partners. Table 1 shows the numbers of DICs, SHGs and FSW membership and attendances to



committee meetings in each district. We developed a three-point scale to try to capture the levels of exposure more accurately in this study ('high' exposure to CME activities: member of sex worker collective and / or peer group; 'medium' exposure to CME activities: attended a drop-in centre meeting and/or NGO organised meeting; and 'low' exposure to CME activities: none of the above).

### ***Incremental cost estimation***

An ingredients approach was used to estimate incremental economic costs prospectively from the perspective of the HIV programme. The UNAIDS 'Costing Guidelines for HIV Prevention Strategies' were taken as the basis for the costing methodology (UNAIDS 2000). Costs were collected from every organizational level that was involved in the provision of services: NGO, SLP, the BMGF office in Delhi (including pan-Avahan capacity building costs).

Cost data were obtained from routine financial and management reporting, as well as from staff records and interviews with staff. Details of donated goods and services were collected from each district. The economic costs of donated items were valued at market prices. Capital costs were annualised using a standard discount rate of 3% (Drummond, Stoddart et al. 1997, Reserve Bank of India 2009). Start-up and training costs were annualised over the first five years. The start-up period was defined as district-level inception until the start of service delivery to the target population.

Personnel costs covered the salaries and expenses of all staff, including peer educators, volunteers and shared resource personnel. Peer educator time was valued at the honorarium paid, except when not paid. In the latter case, and for other volunteers, time costs were valued using self-reported average earnings or, if unemployed, the payment made to peers in interventions undertaken by the National

Aids Control Organisation (NACO), Government of India. Condom costs were estimated using the lowest-priced market alternative.

All costs that were not spent on a specific use were allocated to different programme activities on the basis of time sheets (personnel-related costs) or interviews with staff (use of capital items), supported by programme activity reports. BMGF and pan-Avahan capacity building costs were allocated to SLPs according to the size of the grant during the year of analysis. SLP costs that could not be allocated for a specific use were broadly allocated according to either interview with staff, on an equal basis for costs associated with programme management, or using estimated population for activities directly related to service provision.

Incremental costs for CME activities were calculated for the numbers of FSWs reached per year. The number of people contacted at least once in a year reflects programme reach and was measured using programme management information system (MIS) data Table -2. We also estimated the costs by the level of intensity of the activities. All data were entered into a specifically designed MS Excel workbook and converted to US\$ 2011 prices using the GDP deflator index (Fund 2011) and the mid-year exchange rate for 2011 (Reserve Bank of India 2009).

## **Results**

Community mobilisation and empowerment activities cost between US\$31,690-US\$64,304 in Belgaum and US\$ 53,349-US\$135,572 in Bellary per year (Table 2). The average district cost per year for Belgaum was US\$ 43,959 (31,690-64,304) and Bellary US\$ 84704 (53,349- 135,572). Total costs rise initially then fall after the first four to five years of the intervention, broadly in line with the pattern of total HIV prevention costs. Total costs increase from the first to second year mainly due to the

increased ability of NGOs to expand CME once the rapport with the community was built. In the later years, post 2008, costs start to decrease due to preparation for transition in funding to local state HIV programmes. Reductions in costs may also reflect improvements in efficiency with programme maturity and scale

Community mobilisation and empowerment costs contribute between 4.2% to 17.8% in Belgaum and 13.6% to 22.4% in Bellary of total annual programme costs. Bellary shows a more sustained resource commitment for this overall compared to Belgaum; this in parts reflects NGO priorities and also the larger target population of brothel-based workers, which meant that it was feasible to achieve a high attendance at community mobilisation events. In addition Belgaum expanded its more general activities to new areas during the period, which also meant that less attention could be placed on supporting community mobilisation. As with the basic HIV prevention package of services, most cost was incurred above the NGO service level for activities such as capacity building, programme management, and support and supervision (Chandrashekar, Vassall et al. 2011).

The allocation of costs between different activities (Table 3) shows that the majority of the cost was allocated to DICs and events, although this decreased over time. Activities that did not require fixed centres (advocacy and & enabling environment, self-help groups and capacity building for FSWs) required relatively low proportions of total cost, compared to funding for the DICs. The relatively high costs of DICs, was not due to expenditure on buildings, but was due to the costs of holding events in the early years of community mobilisation and empowerment activities. Personnel costs also accounted for a high proportion of the total costs of community mobilisation and empowerment (44% in Belgaum and 32% in Bellary) (Supplementary appendix Table S1).

Average district level costs (including state and national level support costs) for low exposure to community mobilisation activities was US \$ 76,998(56,414-97,582), medium exposure US\$ 398,482(276,940-520,025) and high exposure US\$ 450,307(307,711-592,903). Total CME costs broken down by sub-activity were advocacy and enabling environment 17%, events 49%,training 23% and CBO formation 12%. The unit cost per FSW reached ranges from US\$11 to US\$39 for Belgaum and US\$11 to US\$37 in Bellary. As with total costs, the highest costs are observed in the first 2-4 years of the intervention – and thereafter costs stabilise at lower levels Table-4. The costs by the intensity of community mobilisation in the districts are shown in Table-5. The resource needs are higher as the intervention becomes more intensive.

## **Discussion**

This is the first study looking at costs of enabling environment and community mobilisation of sex workers over time. The study findings show that resources are required for this component in the later years of programme once good rapport with the key population is established. The resource need peaks by year 3 and gradually shows reduction in the later years. This is mainly due to the initial push needed and later attending community mobilisation events become a routine activity. Strong participation in these activities also increase uptake of other HIV prevention services as seen from programme output data. It is also seen that spending resources for parallel advocacy and enabling environment activities among stakeholders and general community can enhance community mobilisation activities. This would reduce the stigma and other barriers for key population to take active part in the programme. The training and capacity building costs rise over the years, which help in equipping the key population with the necessary skills to involve in programme

management and take ownership. Bellary spent a higher proportion (25.2%) compared to Belgaum for this activity. The mean total unit costs (including costs at service and above service level) of US\$ 19(Belgaum) and US\$ 21(Bellary) are very small compared to the value addition this community mobilisation process can add to HIV prevention for high-risk groups. The recent emerging evidence from studies in Avahan learning sites in Guntur (Andhra Pradesh) and Karnataka(Tara Beattie 2014) strengthen the need for these interventions to be an essential component of HIV prevention interventions for high risk groups(Chakravarthy, Joseph et al. 2012, Erausquin, Biradavolu et al. 2012).

One of the limitations of our study is the data analysed is from only two sites. There is scope to extend the analysis for additional sites across the different states to look at the variation and the factors influencing the cost and the extent to which the community mobilisation has an effect on programme uptake. Further cost-effectiveness analysis can also be undertaken in more sites. Secondly we used the cost data collected from these sites for programme cost analysis rather than specifically designed to capture resource use for this activity. We did take additional efforts to discuss with programme staff and reviewed the cost data line item wise to ensure allocation specific to the activity but it may not have been very comprehensive. The results from the study would be more specific to the intervention in those districts and would be limited in its generalizability due to the small sample of districts analysed.

Nevertheless the study does provide the first cost estimates for this specific component of HIV Prevention. Especially with Avahan programmes being transitioned to government there is discussion on to what extent the government would be willing to take up this additional investment in National AIDS control

programme IV. Our initial results do suggest that policy makers should view the costs as investment to have better programme outcome of HIV prevention especially to ensure behaviour change and sustain it through peer groups' reinforcements.

## **Conclusion**

There is variation in the proportion of costs of community mobilisation by district indicating different levels of activity. Costs seen are consistent to the mix of activities required during different phases. Costs incurred beyond the district level both at the State and national level was vital to strengthen this process. Majority of the activities were found to have fixed costs which requires that while allocation resources to district for community mobilisation it would be better to allocate fixed funds per district with little extra for districts which are larger or have specific contextual issues than allocating per estimated population. Resources for this activity are reasonable and would improve programme uptake among high-risk groups like female sex workers.

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## Tables and Figures

**Table 1 – HIV prevention core and community mobilisation and empowerment services provided by year (US\$ 2011)**

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
<b>Belgaum</b>							
FSW population contacted at least once a year	806	2,776	3,143	4,237	2,294	2,679	3,072
Drop-in Centres	1	8	15	17	17	16	16
Self help groups (SHG)			18	186	233	163	117
FSW members of SHG			250	2,328	2,609	2,155	1,607
FSWs attendances to committee meetings			582	4,597	19,481	20,712	13,697
<b>Bellary</b>							
FSW population contacted at least once a year	2,741	3,066	4,464	4,157	4,341	5,055	5,743
Drop-in Centres	0	7	14	14	13	14	14
Self help groups (SHG)				158	168	168	168
FSW members of SHG				2,364	2,568	2,568	2,568
FSWs attendances to committee meetings				25,529	25,264	34,541	38,450

*Data from routine management data sources (Avahan Comprehensive Management Information System)*

**Table 2 – Incremental community mobilisation and empowerment (CME) costs by organisational level and year (US\$ 2011) and CME as a percentage of total HIV prevention costs**

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	Total	%
<b>Belgaum</b>									
NGO Level	16,309	23,053	35,518	20,296	17,508	10,584	8,071	131,339	42.7
SLP Level	-	19,081	4,218	1,895	10,008	12,078	9,595	56,874	18.5
Programme Level	15,381	22,169	17,857	32,860	4,427	10,482	16,321	119,498	38.8
<b>Total CME costs</b>	<b>31,690</b>	<b>64,304</b>	<b>57,593</b>	<b>55,051</b>	<b>31,942</b>	<b>33,144</b>	<b>33,986</b>	<b>307,711</b>	<b>100.0</b>
Total HIV Prevention costs	256,407	361,204	530,550	1,015,644	763,946	619,066	562,240	4,109,056	
<b>CME costs / HIV prevention costs (%)</b>	<b>12.4%</b>	<b>17.8%</b>	<b>10.9%</b>	<b>5.4%</b>	<b>4.2%</b>	<b>5.4%</b>	<b>6.0%</b>	<b>8.9%</b>	
<b>Bellary</b>									
NGO Level	8,188	21,807	66,240	51,380	41,548	26,818	22,085	238,065	40.2
SLP Level	-	27,263	5,877	8,960	3,929	6,343	6,071	58,416	9.9
Programme Level	48,397	63,640	63,455	57,239	8,526	20,188	34,975	296,422	50.0
<b>Total CME costs</b>	<b>56,585</b>	<b>112,711</b>	<b>135,572</b>	<b>117,578</b>	<b>54,004</b>	<b>53,349</b>	<b>63,131</b>	<b>592,903</b>	<b>100.0</b>
Total HIV Prevention costs	415,796	502,869	635,771	628,652	297,274	298,942	302,835	3,082,140	
<b>CME costs / HIV prevention costs (%)</b>	<b>13.6%</b>	<b>22.4%</b>	<b>21.3%</b>	<b>18.7%</b>	<b>18.2%</b>	<b>17.8%</b>	<b>20.8%</b>	<b>19.0%</b>	

**Table 3 - Community mobilisation and empowerment costs by activity and year****(US\$ 2011)**

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	Total	%
<b><i>Belgaum</i></b>									
Advocacy & Enabling Environment	5,810	11,789	10,559	10,093	5,856	6,076	6,231	56,414	18.3
Drop-in centres and events	17,165	34,831	31,196	29,819	17,302	17,953	18,409	166,677	54.2
Self-help groups and community based organisations	3,169	6,430	5,759	5,505	3,194	3,314	3,399	30,771	10.0
Capacity building and training for FSWs	5,546	11,253	10,079	9,634	5,590	5,800	5,948	53,849	17.5
<b>Total</b>	<b>31,690</b>	<b>64,304</b>	<b>57,593</b>	<b>55,051</b>	<b>31,942</b>	<b>33,144</b>	<b>33,986</b>	<b>307,711</b>	<b>100.0</b>
<b><i>Bellary</i></b>									
Advocacy & Enabling Environment	9,313	18,550	22,313	19,347	8,888	8,780	10,390	97,582	16.5
Drop-in centres and events	26,053	51,894	62,420	54,123	24,864	24,563	29,067	272,982	46.0
Self-help groups and community based organisations	6,955	13,854	16,664	14,449	6,638	6,557	7,760	72,878	12.3
Capacity building and training for FSWs	14,264	28,412	34,175	29,633	13,613	13,448	15,914	149,461	25.2
<b>Total</b>	<b>56,585</b>	<b>112,711</b>	<b>135,572</b>	<b>117,552</b>	<b>54,004</b>	<b>53,349</b>	<b>63,131</b>	<b>592,903</b>	<b>100.0</b>

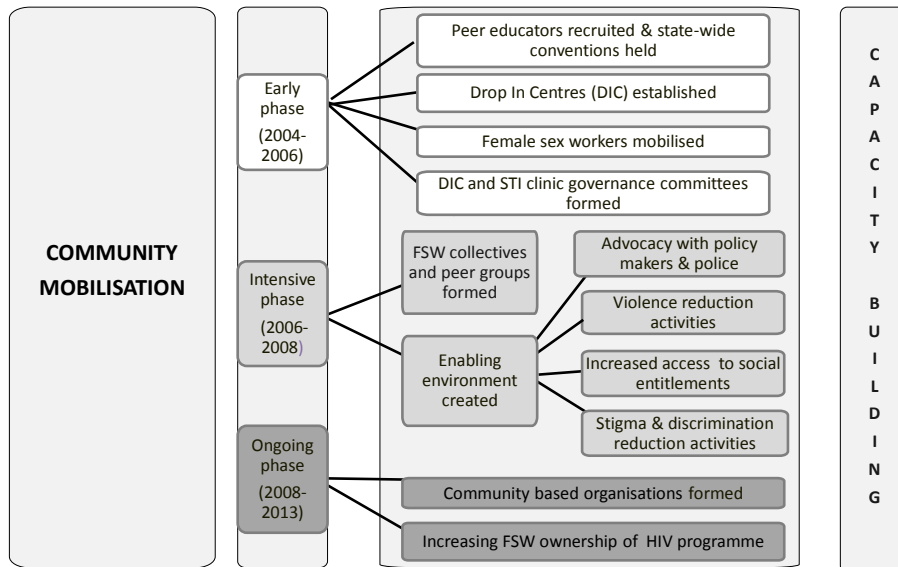
**Table 4: Unit costs of community mobilisation per person reached by district and year (US\$2011 )**

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	Mean 2004/11
<b><i>Belgaum</i></b>								
Total CME costs	31,690	64,304	57,593	55,051	31,942	33,144	33,986	
NGO CME costs	16,309	23,053	35,518	20,296	17,508	10,584	8,071	
Number of persons reached at least once a year	806	2,776	3,143	4,237	2,294	2,679	3,072	
Unit cost per person reached at least once a year	39	23	18	13	14	12	11	19
NGO level unit cost per person reached at least once a year	20	8	11	5	8	4	3	8
<b><i>Bellary</i></b>								
Total CME costs	56,585	1,12,711	1,35,572	1,17,552	54,004	53,349	63,131	
NGO CME costs	8,188	21,807	66,240	51,380	41,548	26,818	22,085	
Number of persons reached at least once a year	2,741	3,066	4,464	4,157	4,341	5,055	5,743	
Unit costs per person reached at least once a year	21	37	30	28	12	11	11	21
NGO level costs per person reached at least once a year	3	7	15	12.4	10	5	4	8

**Table: 5 Breakdown of costs by intensity of community mobilisation activities**

<b>Belgaum</b>	<b>Y1</b>	<b>Y2</b>	<b>Y3</b>	<b>Y4</b>	<b>Y5</b>	<b>Y6</b>	<b>Y7</b>	<b>Total</b>
<b><u>NGO Level</u></b>								
NO /Low Exposure	2,990	4,226	6,512	3,721	3,210	1,940	1,480	24,079
Medium Exposure	14,678	20,748	31,966	18,267	15,757	9,526	7,264	1,18,205
High Exposure	16,309	23,053	35,518	20,296	17,508	10,584	8,071	1,31,339
<b><u>Total Cost</u></b>								
NO /Low Exposure	5,810	11,789	10,559	10,093	5,856	6,076	6,231	56,414
Medium Exposure	28,521	57,874	51,834	49,546	28,748	29,830	30,588	2,76,940
High Exposure	31,690	64,304	57,593	55,051	31,942	33,144	33,986	3,07,711
<b><u>Bellary</u></b>								
<b><u>NGO level</u></b>								
NO /Low Exposure	1,348	3,589	10,902	8,456	6,838	4,414	3,635	39,182
Medium Exposure	7,181	19,127	58,098	45,064	36,441	23,521	19,370	2,08,803
High Exposure	8,188	21,807	66,240	51,380	41,548	26,818	22,085	2,38,065
<b><u>Total Cost</u></b>								
NO /Low Exposure	9,313	18,550	22,313	19,347	8,888	8,780	10,390	97,582
Medium Exposure	49,630	98,857	1,18,908	1,03,102	47,366	46,791	55,371	5,20,025
High Exposure	56,585	1,12,711	1,35,572	1,17,552	54,004	53,349	63,131	5,92,903

**Figure 1: Community mobilisation intervention**





## Supplementary Appendix

### Costing

**Table S1: NGO\* and SLP\*\* community mobilisation economic costs by input and year (US\$ 2011)**

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	Total	%
<i><b>Belgaum</b></i>									
<b>Total capital costs</b>	<b>817</b>	<b>1,710</b>	<b>1,448</b>	<b>1,130</b>	<b>1,280</b>	<b>1,594</b>	<b>1,841</b>	<b>9,820</b>	<b>5</b>
Personnel	8,224	11,993	14,452	8,738	15,775	14,330	9,135	82,646	44
Travel	936	2,133	2,369	1,656	2,299	1,833	1,578	12,803	7
Building operating & maintenance	4,605	3,629	2,938	1,080	930	721	1,117	15,019	8
Materials and supplies/ event costs	1,450	22,515	17,307	8,987	6,465	3,840	3,648	64,212	34
Other overheads	277	156	1,224	601	766	344	347	3,715	2
<b>Total recurrent costs</b>	<b>15,492</b>	<b>40,425</b>	<b>38,288</b>	<b>21,062</b>	<b>26,235</b>	<b>21,068</b>	<b>15,825</b>	<b>178,395</b>	<b>95</b>
<b>Grand Total</b>	<b>16,309</b>	<b>42,135</b>	<b>39,736</b>	<b>22,191</b>	<b>27,515</b>	<b>22,662</b>	<b>17,666</b>	<b>188,213</b>	<b>100</b>
<i><b>Bellary</b></i>									
<b>Total capital costs</b>	<b>1,034</b>	<b>1,975</b>	<b>4,218</b>	<b>2,899</b>	<b>1,844</b>	<b>2,243</b>	<b>2,375</b>	<b>16,588</b>	<b>6</b>
Personnel	2,820	11,431	18,512	14,308	16,312	19,407	13,233	96,023	32
Travel	256	1,561	2,006	2,429	1,660	2,774	2,065	12,751	4
Building operating & maintenance	213	1,061	345	524	1,517	1,497	1,596	6,753	2
Information Education Communication supplies	3,866	1,661	3,467	2,722	430	1,233	588	13,968	5
Materials and supplies/ event costs	0	31,110	41,701	36,312	22,877	5,419	7,739	145,157	49
Other overheads	0	271	1,866	1,119	837	586	560	5,239	2
<b>Total recurrent costs</b>	<b>7,154</b>	<b>47,095</b>	<b>67,898</b>	<b>57,415</b>	<b>43,633</b>	<b>30,917</b>	<b>25,781</b>	<b>279,893</b>	<b>94</b>
<b>Grand Total</b>	<b>8,188</b>	<b>49,070</b>	<b>72,117</b>	<b>60,313</b>	<b>45,477</b>	<b>33,160</b>	<b>28,156</b>	<b>296,481</b>	<b>100</b>

\*Non-governmental organisation , \*\*State Lead Partner





# Community Mobilisation and Empowerment Interventions as Part of HIV Prevention for Female Sex Workers in Southern India: A Cost-Effectiveness Analysis

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## Abstract

**Background:** Most HIV prevention for female sex workers (FSWs) focuses on individual behaviour change involving peer educators, condom promotion and the provision of sexual health services. However, there is a growing recognition of the need to address broader societal, contextual and structural factors contributing to FSW risk behaviour. We assess the cost-effectiveness of adding community mobilisation (CM) and empowerment interventions (eg. community mobilisation, community involvement in programme management and services, violence reduction, and addressing legal policies and police practices), to core HIV prevention services delivered as part of *Avahan* in two districts (Bellary and Belgaum) of Karnataka state, Southern India.

**Methods:** An ingredients approach was used to estimate economic costs in US\$ 2011 from an HIV programme perspective of CM and empowerment interventions over a seven year period (2004–2011). Incremental impact, in terms of HIV infections averted, was estimated using a two-stage process. An 'exposure analysis' explored whether exposure to CM was associated with FSW's empowerment, risk behaviours and HIV/STI prevalence. Pathway analyses were then used to estimate the extent to which behaviour change may be attributable to CM and to inform a dynamic HIV transmission model.

**Findings:** The incremental costs of CM and empowerment were US\$ 307,711 in Belgaum and US\$ 592,903 in Bellary over seven years (2004–2011). Over a 7-year period (2004–2011) the mean (standard deviation, sd.) number of HIV infections averted through CM and empowerment is estimated to be 1257 (308) in Belgaum and 2775 (1260) in Bellary. This translates in a mean (sd.) incremental cost per disability adjusted life year (DALY) averted of US\$ 14.12 (3.68) in Belgaum and US\$ 13.48 (6.80) for Bellary - well below the World Health Organisation recommended willingness to pay threshold for India. When savings from ART are taken into account, investments in CM and empowerment are cost saving.

**Conclusions:** Our findings suggest that CM and empowerment is, at worst, highly cost-effective and, at best, a cost-saving investment from an HIV programme perspective. CM and empowerment interventions should therefore be considered as core components of HIV prevention programmes for FSWs.

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## Introduction

The UNAIDS strategic investment approach for an effective response to HIV/AIDS proposes a package of basic programme interventions, including HIV prevention for key populations [1,2]. Traditionally, core HIV prevention interventions for female sex workers (FSWs) are individual behaviour change involving peer educators, condom promotion and the provision of sexual health services [3,4]. However, there is a growing recognition that wider

social and community level factors influence an individual's ability to adopt safer sexual behaviours [5]. As a result, many actors working in HIV prevention argue it is necessary to simultaneously address the broader societal and contextual factors that may contribute to HIV-related risk behaviour [6–12] as an essential element in achieving and sustaining the impact and efficiency of HIV prevention services targeted at FSWs [2].

Within the UNAIDS investment framework, 'critical enablers' are defined as activities that are necessary to support the

effectiveness and efficiency of basic programme activities [13]. For FSW-targeted HIV prevention these community mobilisation (CM) and empowerment interventions may include: community mobilisation, community involvement in programme management and services, violence reduction, and addressing legal policies and police practices. These interventions are argued to improve programme effectiveness through the ‘empowerment’ of FSWs, with empowerment defined as ‘the *process* by which those who have been denied the ability to make choices (the disempowered) acquire such an ability’ [14] - in this case the aim being to empower individual FSWs to negotiate safer sex and access services, as well as address other issues affecting their lives (such as violence or poverty), supported by the social solidarity of the broader community of FSWs [15].

There are a number of studies on the cost-effectiveness of HIV prevention targeted at FSWs [16–18]. For example, a recent study, modelling the potential cost-effectiveness of FSW-targeted HIV prevention in India (including impact on the general population), found an incremental cost per disability adjusted life year (DALY) averted of US\$ 10 [19] for a basic package of services. Several further studies also suggest that cost-effectiveness can be achieved in practice and at a scale [20–22]. However, despite this clear evidence that investment in HIV prevention for FSWs is highly cost-effective in concentrated epidemic settings, the ‘added value’ of investing in the mobilisation and empowerment of FSWs as part of the HIV prevention package for key populations remains unclear. This lack of evidence can provide a substantial constraint to those seeking funding to implement comprehensive approaches to supporting FSWs, when funders are seeking ‘value for money’ and are scrutinising any cost that may be seen as ‘non-essential’. Given the growing evidence that CM and empowerment improve programme impact [23–27], without sound evidence of cost-effectiveness there is a risk that the gains that have been made to date by more comprehensive HIV prevention programmes for FSWs [28,29] will be jeopardised.

We therefore present here a cost-effectiveness analysis of CM and empowerment interventions, when added to the core package of HIV prevention for FSWs, as part of the *Avahan* Programme in two districts of Karnataka state, South India, in order to inform funders, policy makers and programme managers designing HIV prevention for FSWs globally.

## Methods

### Study setting and population studied

It is estimated that 2.27 million people are living with HIV in India [30]. The epidemic is concentrated, and predominately driven by marginalised groups, particularly FSWs, men who have sex with men (MSM), and in some contexts injecting drug users [31,32]. The *Avahan* programme, the India AIDS Initiative of the Bill & Melinda Gates Foundation (BMGF), is one of the largest HIV prevention programmes targeted at high risk groups in the world. The programme operates across six Indian states and had a funding commitment of US\$ 258 million between 2004 and 2009 [33], and thereafter was transitioned to national ownership. *Avahan* is implemented through contracted state lead partners (SLPs), who in turn contract a plethora of local non-governmental organisations (NGOs) at the district level.

The state of Karnataka is one of the four southern states in India supported by *Avahan*, with an estimated HIV adult prevalence of 0.9% (2008), and it contributes 11% of the HIV burden in the country [30]. Unprotected heterosexual sex is a key factor in the spread of the epidemic, with overall prevalence among FSWs in the state being 16.4% [32]. The *Avahan* SLP in

HIV prevention efforts is the Karnataka Health Promotion Trust (KHPT), supported by the University of Manitoba - and has worked with 17 NGOs across 19 districts since 2004. Our cost-effectiveness analysis focuses on two districts in Karnataka, Belgaum and Bellary. These two districts were chosen purposively, based on Karnataka’s socio-cultural regions, the size of the high-risk population and the availability of detailed behavioural, biological and costing data. Table 1 shows the number of FSWs reached at least once a year. For Belgaum this ranges from 806 in 2004 to 3072 in 2011; and in Bellary from 2741 in 2004 to 5743 in 2011.

### Intervention description

The package of core HIV prevention services provided by the Avahan NGOs in both districts includes outreach through peers, behaviour change communication, condom distribution, and clinical services for sexually transmitted infections (STIs). Peer educators provided services to about 25–50 people each, sharing prevention information, distributing supplies (condoms and lubricants) and providing referral for STI management. Referral clinics followed standard protocols for STI management. There was active referral of individuals for HIV testing and positive key populations were referred to government anti-retroviral treatment (ART) centres for care and support. This core package has been demonstrated as cost-effective [34].

CM services and actions to create an ‘enabling environment’ were added to these core services in order to empower FSWs. Full details of the intervention are also publically available [35,36]. In the initial stages, activities concentrated on drop-in centres (DICs) as a focal point for community mobilization (2004–6). DICs provided a platform to motivate FSWs to use HIV prevention, but also drew in FSWs by holding special events. In rural areas, at the village level, FSW peer groups were established as a platform for FSWs to share and discuss issues and develop income generation activities (2006–07). FSW peer groups aimed to create awareness on HIV/AIDS, but also address non-health needs such as helping to access government welfare schemes including ration cards, education for the children of FSWs, etc. From 2008 onwards, FSW peer groups were strengthened through the formation of district-level collectives; and over time these provided the basis to form community-based organizations that could take on an active role in programme implementation and management. Similarly, building on the connections made in the DICs, FSWs were further encouraged to be involved in the planning of HIV prevention services through the formation of various programme committees.

In addition to the formation of communal structures, broader efforts to create an ‘enabling environment’ were taken to improve the FSWs’ interaction with the wider community, further contributing towards their empowerment. This included conventions to encourage community members to interact with other FSWs in different villages and the provision of legal empowerment sessions [12]. There were also sensitization sessions for local leaders, youth organizations and secondary stakeholders like pimps, brothel owners, police and others – particularly focused on violence reduction [11]. All the activities were supported through capacity building from the SLP and its supporting partners. Table 1 shows the numbers of DICs, FSW peer groups and FSW membership and attendances to committee meetings in each district.

### Intervention effectiveness

We have recently conducted a study [37,38] examining the impact of CM on FSW empowerment, risk behaviours and HIV/STI prevalence in four districts in Karnataka. This study used data from serial cross-sectional bio-behavioural surveys, termed inte-

**Table 1.** HIV prevention core and community mobilisation and empowerment services provided by year (US\$ 2011).

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11
<i>Belgaum</i>							
FSW population contacted at least once a year	806	2,776	3,143	4,237	2,294	2,679	3,072
Drop-in Centres	1	8	15	17	17	16	16
FSW peer groups			18	186	233	163	117
FSW members of peer groups			250	2,328	2,609	2,155	1,607
FSWs attendances to committee meetings			582	4,597	19,481	20,712	13,697
<i>Bellary</i>							
FSW population contacted at least once a year	2,741	3,066	4,464	4,157	4,341	5,055	5,743
Drop-in Centres	0	7	14	14	13	14	14
FSW peer groups				158	168	168	168
FSW members of peer groups				2,364	2,568	2,568	2,568
FSWs attendances to committee meetings				25,529	25,264	34,541	38,450

Data from routine management data sources (Avahan Comprehensive Management Information System). doi:10.1371/journal.pone.0110562.t001

grated behavioural and biological assessments (IBBAs), that were carried out amongst FSWs and clients in districts in Karnataka state in 2008 (3 years after programme initiation) and in 2011 (further details below). Detailed results of this exposure analysis are presented elsewhere [37,38], and a summary of the methods and results used can be found in Appendix S1 (Tables S1 and S2).

We used a conceptual hierarchical framework of protective factors for HIV and STI infection to explore the possible pathways through which CM may impact key HIV related outcomes, over and above peer education activities alone [37]. By 2011, for all measures of power, HIV/STI service uptake and condom use, adjusting for CM, caused the adjusted odds ratio (AOR) (for peer education and these HIV related outcome variables) to shift substantially closer to 1.0, suggesting CM was having a key mediating effect on the pathway between peer education and these HIV related outcomes (Table S2 in Appendix S1). When peer education was significantly associated with an outcome variable, we then calculated the proportion difference in the adjusted ORs between peer education and the HIV related outcome variable, and the adjusted ORs with the adjustment for CM (OR adjusted for confounders – OR adjusted for confounders and CM)/OR adjusted for confounders) (last column of tables S1–S2). In particular, and for the purposes of this study, the AOR for peer education and reported condom use at last sex with occasional clients changed from 10.96 (5.00, 24.01) ( $p < 0.001$ ), to 6.78 (1.96, 23.44) ( $p = 0.003$ ), when we included CM in the model, representing a proportional reduction in the AOR of 38.1% in 2010/11. Similar results were also seen in baseline (Table S1 in Appendix S1), where the proportional reduction in the AOR was found to be 46.2%.

**Framework for cost-effectiveness analysis**

Drawing upon these findings, we estimate the incremental (additional) costs and impact of CM and empowerment activities described above compared to a base case of providing just the core HIV prevention activities for FSWs from an HIV programme [39] (provider) perspective for a seven year period (2004–2011). We estimate two measures of incremental cost-effectiveness, incremental cost per HIV infection averted (within the seven year period), and incremental cost per DALY averted, (DALYs averted from HIV infections averted within the seven year period over the potential lifetime of FSWs). The latter is compared to a World Health Organisation (WHO) defined willingness to pay (WTP) threshold of Gross National Income (GNI) per capita (US\$ 1410) for India in 2011 [40,41] to assess cost-effectiveness. A discount rate of 3% is used in our primary estimates for both costs and DALYS.

**Incremental cost estimation.** An ingredients approach was used to estimate incremental economic costs prospectively from the perspective of the HIV programme. The UNAIDS ‘Costing Guidelines for HIV Prevention Strategies’ were taken as the basis for the costing methodology [42]. Costs were collected from every organizational level that was involved in the provision of services: NGO, SLP, the BMGF office in Delhi (including pan-Avahan capacity building costs).

Cost data were obtained from routine financial and management reporting, as well as from staff records and interviews with staff. Details of donated goods and services were collected from each district. The economic costs of donated items were valued at market prices. Capital costs were annualised using a standard discount rate of 3% [43,44]. Start-up and training costs were annualised over the first five years. The start-up period was defined as district-level inception until the start of service delivery to the target population.

Personnel costs covered the salaries and expenses of all staff, including peer educators, volunteers and shared resource personnel. Peer educator time was valued at the honorarium paid, except when not paid. In the latter case, and for other volunteers, time costs were valued using self-reported average earnings or, if unemployed, the payment made to peers in interventions undertaken by the National Aids Control Organisation (NACO), Government of India. Condom costs were estimated using the lowest-priced market alternative.

All costs that were not spent on a specific use were allocated to different programme activities on the basis of time sheets (personnel-related costs) or interviews with staff (use of capital items), supported by programme activity reports. BMGF and pan-*Avahan* capacity building costs were allocated to SLPs according to the size of the grant during the year of analysis. SLP costs that could not be allocated for a specific use were broadly allocated according to either interviews with staff, on an equal basis for costs associated with programme management, or using estimated population for activities directly related to service provision.

Incremental costs for CM and empowerment activities were calculated for the numbers of FSWs reached per year. The number of people contacted at least once in a year reflects programme reach and was measured using programme management information system (MIS) data. All data were entered into a specifically designed MS Excel workbook and converted to US\$ 2011 prices using the GDP deflator index [45] and the mid-year exchange rate for 2011 [43].

**Incremental impact estimation.** Incremental impact, in terms of HIV infections averted, was estimated using a two-stage process drawing on the exposure analysis. The exposure analysis, described above was used to estimate the incremental changes in HIV-related sexual risk behaviour related to exposure to the CM and empowerment intervention in Bellary and Belgaum. In the second stage, the results of this exposure analysis were then inputted into a dynamic transmission model that estimated the number of HIV infections averted from the incremental changes in HIV-related sexual risk behaviour relative to a simulated control scenario where no CM and empowerment activities were present.

### Survey data used

As part of the evaluation of *Avahan*, IBBA surveys were carried out amongst FSWs and clients in districts in Karnataka state. Programmes were initiated between April 2004 and July 2005, with the IBBA surveys in FSWs conducted in 2005/6, 2008 and 2011. Client IBBA surveys were carried out in October 2007 in Belgaum and Bellary. Sample size calculations and the sampling methodology have been described in detail previously [46], with approximately 400 respondents randomly sampled at each round in most districts, using a probability-based sampling method. Appropriate weights were used to account for the differential non-response rates and differential probabilities of selection across districts, as well as the differential recruitment of FSW by typology within districts.

In addition to questions on sexual behaviour and risk factors for HIV, blood samples were taken to test for HIV, HSV-2 and syphilis [47]. IBBA survey data were subsequently used in the exposure analysis and to calibrate the dynamic HIV transmission model.

### Exposure analysis

Following discussions with project staff, we used the following data from the IBBA as proxy measures to define exposure to CM activities: “high” if a woman reported being a member of a FSW

peer group or FSW collective; “medium” if she had ever attended a drop-in center or a nongovernmental organization (NGO) meeting; and “low” if she had not done any of the preceding. Measures of collective power (power with) were explored using the following questions: “I feel a strong sense of unity with FSWs I do not know”; “In the last 1 year, have you negotiated with or stood up against a powerbroker to help a fellow FSW?”; and “In the last 6 months, have you attended any public events, such as a rally or a gathering of sex workers, where you could be identified as a sex worker?”. A measure of individual power (power to) was developed by looking at whether respondents had answered “no” to “In the past 1 month, was there a time when you wanted to use a condom during sexual intercourse but did not use it?” or “In the past 1 month, was there a time when you wanted to use a condom during sexual intercourse with a client but did not use it?”

For the exposure analysis, we used the results from this analysis [37] derived from data from the 2005/6 and 2011 IBBA surveys for FSWs pooled across four districts (Bangalore and Shimoga in addition to Belgaum and Bellary) and applied them to Belgaum and Bellary. This was justified because the implementation of CM and empowerment was standardized across *Avahan* districts, and the district-pooled analysis was necessary to have sufficient unexposed individuals to CM and empowerment activities (incremental to the broad HIV programme). The effect size (proportional AOR) derived from the exposure analysis was assumed to vary over time, starting at the 2005/6 value (46.2%) and then increasing linearly over time to the value at 2011 (38.1%), after which it was taken to be constant. This effect size was then incorporated in the dynamic HIV transmission model described below.

It should be noted that the examination of effect did include controls for socio-demographic variables. District, duration in sex work, sex work typology (place where solicit clients or place where have sex with clients), relationship status (marital status or regular partner), and socio-economic status (literacy or additional income to sex work) were added a priori. The adjusted Wald test was used to test for effect modification for the following socio-demographic variables: age, duration in sex work, place where solicit clients, place where have sex with clients, charge per sex act, and regular partner.

### Impact model

A purpose-built dynamic compartmental model of HIV/STI transmission was then used to calculate HIV infections averted in FSWs and their clients, as well as their partners in the general population, over the first seven years of the *Avahan* programme [48]. Further details of the model are publically available [29,49]. Within the model, the basic package of services is assumed to have two effects: increasing FSW condom use with clients, and enhancing STI treatment in clinics. Other intervention components such as structural interventions, and CM and empowerment, are considered to act indirectly on HIV transmission through increasing condom use. The effect estimates from the causal pathway model for condom use at last sex with occasional clients (see Tables S1 and S2 in Appendix S1) were used to parameterise the fraction of increases in FSW condom use with clients associated with the CM and empowerment component of the intervention, and thus explore the impact of CM and empowerment activities on HIV infections averted using the simulated matched control groups described below. Unlike most previous exercises in modelling impact for cost-effectiveness analyses at scale in India [19,21,22], the model used is dynamic (incorporating indirect population-level effects not captured in cohort models)

and is employed within a Bayesian framework [1,29] to allow a better quantification of uncertainty.

Each district was parameterized separately, using behavioural parameters derived from the relevant district FSW and client IBBA surveys. For each parameter a range was defined using the 95% confidence interval of the survey data. Ranges for biological parameters such as per-act HIV transmission probabilities were obtained from extensive reviews of published literature, and the same parameter ranges were used for both districts (see Table S3 in Appendix S1 which summarises the key model parameter ranges and references). A full list of parameters, along with a detailed description of the model equations and structure, is also publically available [29,49]. All parameter ranges were sampled extensively through Latin hypercube sampling (LHS) to generate combinations of parameters for each district. Enough combinations of parameters were generated through LHS to fully account for parametric uncertainty in each district, with one million and 100,000 parameter sets sampled for Belgaum and Bellary districts respectively.

In a previous evaluation of the overall HIV impact of *Avahan* [29,49] the *intervention* scenario in which condom use increased as given by trends in IBBA survey data was compared against a control scenario describing how condom use might have changed without the intervention (i.e. a first matched simulated control group). For the intervention scenario, condom use over time in each district was estimated using a historical cohort method [50]. Condom use increased at a slower rate before *Avahan*, and then increased sequentially up to the level of each FSW IBBA survey, remaining constant after the last round. The model was then run under the *intervention* scenario with each parameter set as an input to obtain “fits” to the confidence intervals of the first round of local HIV/STI prevalence derived from IBBA survey data for FSWs and clients, as well as the FSW HIV prevalence ratio between Round 1 and subsequent rounds.

In the *control* scenario, condom use was assumed to have increased during *Avahan* at the pre-intervention rate, while STI treatment was assumed to continue at pre-intervention levels. The difference between the *intervention* scenario and evaluation *control* scenario thus gives the increase in condom use due to *Avahan* over time. This incremental effect is used to generate our primary estimates for the impact and cost-effectiveness analysis of the entire *Avahan* package of services.

The effect size of CM and empowerment on FSW condom use, which was taken to be the same in both districts, was used in a similar way to define a second simulated control group. This second simulated control group, with no exposure to CM and empowerment activities, was created by assuming that a fraction of the total increase in condom use due to *Avahan*, as defined above, was due to CM and empowerment activities, as estimated through the exposure analysis. Removing this fraction created a *no-CM and empowerment (no-CME) control* group scenario. The multiple parameter combinations which were found to be “fits” to survey prevalence data under the intervention scenario were re-run for the *no-CME control scenario* to obtain the number of new HIV infections without the CM and empowerment component of the intervention. By comparison with the number of HIV infections occurring in each of the corresponding original “fits” from the intervention scenario, estimates for the incremental infections averted over 7 years by CM and empowerment were obtained, with the multiple “fits” producing an uncertainty range. DALYs averted were estimated from incremental infections averted generated by the impact model, using standard formulae and disability weights [41], a 3% discount rate and no age weighting. Table S4 also includes the parameters used to estimate DALYS.

## Sensitivity Analyses

We conducted a probabilistic sensitivity analysis randomly sampling cost parameters with 5,000 iterations to estimate mean incremental costs per DALY averted. The parameters sampled at this stage were annual NGO, SLP and BMGF costs, age at HIV infection (based on IBBA data), and DALY weights (see Table S4 in Appendix S1 for details). In addition, the impact model “fits” were also sampled uniformly at the same time, corresponding to different impacts of CM and empowerment.

We also conducted a one-way analysis to examine how our results may change if antiretroviral therapy (ART) was available. We did not include prevention effects from ART, as ART was not provided in a widespread manner during the time of intervention, but rather explored the likely impact in terms of the future cost savings associated with reductions in the need for ART from infections averted. This was done using the dynamic HIV transmission model to predict the number of individuals who would have started ART by 2011 assuming future coverage rates of 21–40% of people meeting the eligibility criterion  $CD4 < 350$  cells/mm<sup>3</sup>. For the sensitivity analysis, coverage of ART, the incremental increase in life expectancy from ART, and the annual unit cost of ART were all sampled as well. We also conducted a further sensitivity analysis using discount rates of 0%, 5% and examined the probability that any incremental cost-effectiveness ratios were below the WTP threshold using an acceptability curve, which shows the probability of the incremental cost effectiveness being below the WTP taking into account the parameter uncertainty.

## Ethical approval

The estimates of the effect of CM and empowerment come from the secondary analysis of IBBA data in Karnataka. Participation in the IBBAs was by witnessed, verbal, informed consent. Only women aged 18 years or more were recruited in the study. The surveys were conducted anonymously, with no names or personal identifiers recorded. A detailed and standardized consent process was implemented for each respondent, and consent was obtained separately for the interview and for giving biological samples. Participants’ consent was provided in writing, either by themselves, or for illiterate participants, by an independent witness who confirmed that verbal consent was provided. Statutory approval for the conduct of the IBBAs and their protocols was obtained from the Government of India’s Health Ministry Screening Committee (HMSC). The study was approved by the Institutional Ethical Review Board of St. John’s Medical College, Bangalore, India, and the Health Research Ethics Board of the University of Manitoba, Winnipeg, Canada.

## Results

### Costs

Community mobilisation and empowerment activities cost between US\$ 31,690–US\$ 64,304 in Belgaum and US\$ 53,349–US\$ 135,572 in Bellary per year (Table 2). Total costs rise initially then fall after the first four to five years of the intervention, broadly in line with the pattern of total HIV prevention costs. Overall HIV prevention costs increased until 2007/8 as the programme reached out to more people (also see Table 3). In 2008 the programme began to transition to national ownership and fell back dramatically. Total CM and empowerment costs increased from the first to second year, due to the increased ability of NGOs to expand CM and empowerment once the rapport with the community was built. In the later years, post 2008, as with overall prevention costs, CM and empowerment costs start to decrease

**Table 2.** Incremental community mobilisation (CM) and empowerment costs by organisational level and year (US\$ 2011) and CM and empowerment as a percentage of total HIV prevention costs.

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	Total	%
<b>Belgaum</b>									
NGO Level	16,309	23,053	35,518	20,296	17,508	10,584	8,071	131,339	42.7
SLP Level	0	19,081	4,218	1,895	10,008	12,078	9,595	56,874	18.5
Programme Level	15,381	22,169	17,857	32,860	4,427	10,482	16,321	119,498	38.8
<b>Total CM &amp; empowerment costs</b>	<b>31,690</b>	<b>64,304</b>	<b>57,593</b>	<b>55,051</b>	<b>31,942</b>	<b>33,144</b>	<b>33,986</b>	<b>307,711</b>	100.0
Total HIV prevention costs	256,407	361,204	530,550	1,015,644	763,946	619,066	562,240	4,109,056	
<b>CM &amp; empowerment costs/HIV prevention costs (%)</b>	<b>12.4%</b>	<b>17.8%</b>	<b>10.9%</b>	<b>5.4%</b>	<b>4.2%</b>	<b>5.4%</b>	<b>6.0%</b>	<b>8.9%</b>	
<b>Bellary</b>									
NGO Level	8,188	21,807	66,240	51,380	41,548	26,818	22,085	238,065	40.2
SLP Level	-	27,263	5,877	8,960	3,929	6,343	6,071	58,416	9.9
Programme Level	48,397	63,640	63,455	57,239	8,526	20,188	34,975	296,422	50.0
<b>Total CM &amp; empowerment costs</b>	<b>56,585</b>	<b>112,711</b>	<b>135,572</b>	<b>117,578</b>	<b>54,004</b>	<b>53,349</b>	<b>63,131</b>	<b>592,903</b>	100.0
Total HIV prevention costs	415,796	502,869	635,771	628,652	297,274	298,942	302,835	3,082,140	
<b>CM &amp; empowerment costs/HIV prevention costs (%)</b>	<b>13.6%</b>	<b>22.4%</b>	<b>21.3%</b>	<b>18.7%</b>	<b>18.2%</b>	<b>17.8%</b>	<b>20.8%</b>	<b>19.0%</b>	

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due to preparation for transition in funding to local state HIV programmes. Reductions in costs may also reflect improvements in efficiency with programme maturity and scale [51].

Community mobilisation and empowerment costs contribute between 4.2% to 17.8% in Belgaum and 13.6% to 22.4% in Bellary of total annual programme costs. Bellary shows a more sustained resource commitment for this overall compared to Belgaum; this in parts reflects NGO priorities and also the larger target population of brothel-based workers, which meant that it was feasible to achieve a high attendance at community mobilisation events. In addition Belgaum expanded its more general activities to new areas during the period, which also meant that less attention was able to be placed on supporting community mobilisation. As with the basic HIV prevention package of services, most cost was incurred above the NGO service level for activities such as capacity building, programme management, and support and supervision [52].

The allocation of costs between different activities (Table 4) shows that the majority of the cost was allocated to DICs and events, although this decreased over time. Activities that did not require fixed centres (advocacy and enabling environment, self-help groups and capacity building for FSWs) required relatively low proportions of total cost, compared to funding for the DICs. The relatively high costs of DICs, was not due to expenditure on buildings, but was due to the costs of holding events in the early years of community mobilisation and empowerment activities. Personnel costs also accounted for a high proportion of the total costs of community mobilisation and empowerment (44% in Belgaum and 32% in Bellary) (Table S4 in Appendix S1).

The numbers of persons reached at least once a year increases between 2004 and 2011. However in Belgaum it falls in 2008 when the programme is taken over by national authorities in 2008, and also at a time when the programme was beginning to expand to new key populations (high risk men who have sex with men/transgenders); thereafter the numbers of FSWs increases again, but does not rebound to the levels achieved in 2008. The unit cost per

FSW reached ranges from US\$ 11 to US\$ 39 for Belgaum and US\$ 11 to US\$ 37 in Bellary (Table 4). As with total costs, the highest costs are observed in the first 2–4 years of the intervention – and thereafter costs stabilise at lower levels.

### HIV impact and cost-effectiveness

We estimate that the incremental mean (standard deviation, sd.) impact of community mobilisation and empowerment is 1,256 (308) infections averted in Belgaum, and 2,775 (1,260) infections averted in Bellary in the first seven years of the intervention (Table 5) compared to a situation where no CM and empowerment activities were present. This represents 31% and 39% respectively of the total impact of *Avahan* over this period [29]. Assuming no ART is available to prolong the lives of those in these groups with HIV, we estimate a mean of 20,837 DALYs averted in Belgaum and 46,932 DALYs averted in Bellary as a consequence of the HIV infections averted during the seven year period. In the univariate sensitivity analysis, where ART is available (at a coverage rate of 21–40%) [53], we predict that CM and empowerment would prevent around 383 persons in Belgaum starting treatment and 846 persons in Bellary during this period.

Bringing together this incremental impact with incremental cost we estimate a mean (sd.) incremental cost per infection averted of US\$ 234 (61) in Belgaum and US\$ 228 (114) in Bellary. Assuming no ART this results in a mean (sd.) incremental cost per DALY averted of US\$ 14.12 (3.68) in Belgaum and US\$ 13.48 (6.80) in Bellary. Exploring the inclusion of ART in a sensitivity analysis we find that if ART cost savings are included, the intervention becomes cost saving. The sensitivity analysis around discount rates did not increase the incremental cost per DALY above the WTP threshold (Figure S1 in Appendix S1).

### Discussion

Our findings suggest that investment in CM and empowerment, as a critical enabler of basic HIV prevention services aimed at



**Table 3.** Unit costs of community mobilisation per person reached by district and year (US\$ 2011).

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	Mean 2004/11
<b>Belgaum</b>								
Total CM & empowerment costs	31,690	64,304	57,593	55,051	31,942	33,144	33,986	
NGO CM & empowerment costs	16,309	23,053	35,518	20,296	17,508	10,584	8,071	
Number of persons reached at least once a year	806	2,776	3,143	4,237	2,294	2,679	3,072	
Unit cost per person reached at least once a year	<b>39</b>	<b>23</b>	<b>18</b>	<b>13</b>	<b>14</b>	<b>12</b>	<b>11</b>	<b>19</b>
NGO level unit cost per person reached at least once a year	<b>20</b>	<b>8</b>	<b>11</b>	<b>5</b>	<b>8</b>	<b>4</b>	<b>3</b>	<b>8</b>
<b>Bellary</b>								
Total CM & empowerment costs	56,585	1,12,711	1,35,572	1,17,552	54,004	53,349	63,131	
NGO CM & empowerment costs	8,188	21,807	66,240	51,380	41,548	26,818	22,085	
Number of persons reached at least once a year	2,741	3,066	4,464	4,157	4,341	5,055	5,743	
Unit costs per person reached at least once a year	<b>21</b>	<b>37</b>	<b>30</b>	<b>28</b>	<b>12</b>	<b>11</b>	<b>11</b>	<b>21</b>
NGO level costs per person reached at least once a year	<b>3</b>	<b>7</b>	<b>15</b>	<b>12.4</b>	<b>10</b>	<b>5</b>	<b>4</b>	<b>8</b>

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FSWs, is cost-effective; may even be cost saving if future ART savings are taken into account and therefore are good ‘value for money’. While some may be concerned that additional expenditure on CM and empowerment has an opportunity cost in terms of other HIV prevention and treatment activities forgone (given current resource constraints on HIV programmes), the very low incremental cost-effectiveness ratio of CM and empowerment suggests that this is unlikely - and that CM and empowerment should be considered as an integral component of HIV prevention programming for FSWs [16,18]. In this sense, CM and empowerment can be argued to be as much of an essential HIV prevention activity for FSWs as many other HIV interventions labeled as ‘core’ HIV prevention services.

Moreover our findings are likely to be conservative from a broader economic welfare perspective as our analysis focuses on outcomes in terms of the HIV prevention benefits alone. We have excluded other health benefits that may arise from this type of intervention, such as reductions in violence and alcohol use [11]. We have also not examined possible impact on ART uptake or adherence. Beyond these health benefits, there may be broader benefits derived in terms of economic welfare (access to income generation schemes) and poverty reduction objectives (access of this very vulnerable group to social entitlements and education for their children) [12]. Therefore, while our results suggest that investment in community mobilization and empowerment is justifiable from the HIV perspective alone, exploring wider economic and health benefits further may also justify funding from those with a broader development perspective – at a time when HIV funding is increasingly required to find its place in the broader post-Millennium Development Goals context.

For those interested in broader social welfare as their primary funding objective, it is important to consider the added value of making the most efficient use of the infrastructure developed by HIV prevention programmes such as *Avahan* to reach many vulnerable population groups who may not have previously been reached at this scale by other development efforts. From a poverty reduction perspective, the potential of incurring relatively low incremental costs to expand development efforts to improve the welfare of FSWs more generally may be an opportunity not to be missed – and thus greater synergies between traditional HIV funders and development funders need to be explored.

The high cost-effectiveness of community mobilization and empowerment found is likely to be primarily due to the underlying cost-effectiveness of HIV prevention in India [20,22,54]. The low cost of HIV prevention in India [55], together with a sizeable impact on the HIV epidemic [29], means that community mobilization and empowerment, as an intertwined intervention that enhances the effectiveness of the HIV prevention, has a sound basis on which to yield substantial returns from an HIV perspective. However, in environments where HIV prevention targeted at key populations is less cost-effective, it remains to be seen whether the same results as we find here could be achieved. In India the costs of CM and empowerment range between 10–20% of the total HIV prevention cost; and the incremental unit cost per person reached a year is around US\$ 11, which may be considered affordable within the current National Aids Control Organisation expenditures of around US\$ 50 per person reached. But this may not be the case in other settings. There are a number of key contextual factors that are likely to impact on the likely transferability of our findings to other settings. These include the legal context of sex work – for example, where sex work is highly criminalised, it may be far more difficult to implement sex worker mobilisation interventions, or they may require a different combination of intervention inputs. Other contextual issues

**Table 4.** Community mobilisation and empowerment costs by activity and year (US\$ 2011).

	2004/5	2005/6	2006/7	2007/8	2008/9	2009/10	2010/11	Total	%
<b>Belgium</b>									
Advocacy & Enabling Environment	5,810	11,789	10,559	10,093	55,856	6,076	6,231	56,414	18.3
Drop-in centres and events	17,165	34,831	31,196	29,819	17,302	17,953	18,409	166,677	54.2
Self-help groups and community based organisations	3,169	6,430	5,759	5,505	3,194	3,314	3,399	30,771	10.0
Capacity building and training for FSWs	5,546	11,253	10,079	9,634	5,590	5,800	5,948	53,849	17.5
<b>Total</b>	<b>31,690</b>	<b>64,304</b>	<b>57,593</b>	<b>55,051</b>	<b>31,942</b>	<b>33,144</b>	<b>33,986</b>	<b>307,711</b>	<b>100.0</b>
<b>Bellary</b>									
Advocacy & Enabling Environment	9,313	18,550	22,313	19,347	8,888	8,780	10,390	97,582	16.5
Drop-in centres and events	26,053	51,894	62,420	54,123	24,864	24,563	29,067	272,982	46.0
Self-help groups and community based organisations	6,955	13,854	16,664	14,449	6,638	6,557	7,760	72,878	12.3
Capacity building and training for FSWs	14,264	28,412	34,175	29,633	13,613	13,448	15,914	149,461	25.2
<b>Total</b>	<b>56,585</b>	<b>112,711</b>	<b>135,572</b>	<b>117,552</b>	<b>54,004</b>	<b>53,349</b>	<b>63,131</b>	<b>592,903</b>	<b>100.0</b>

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**Table 5.** Mean and standard deviation (sd.)infections averted, cost per infection, DALYs averted, Cost per DALY averted, persons on ART and ART savings, by district and year (US\$2011).

	Infections averted		Cost per infection averted (no ART)		DALYs averted (no ART)		Cost per DALY averted (no ART)		NGO cost per DALY averted (no ART)		Persons on ART averted		ART savings		Cost per DALY averted (including ART savings)	
	Over first 4 years	Over first 7 years	Over first 4 years	Over first 7 years	Over first 4 years	Over first 7 years	Over first 4 years	Over first 7 years	Over first 4 years	Over first 7 years	Over first 4 years	Over first 7 years	Over first 4 years	Over first 7 years	Over first 4 years	Over first 7 years
<b>Belgium</b>																
Mean	719	1257	273	234	11916	20837	16.48	14.12	8.44	6.70	219	383	424249	741989	Cost Saving	Cost Saving
mean-1.96sd	391	653	137	114	6333	10557	8.28	6.90	4.51	3.44	92	153	29781	41046	Cost Saving	Cost Saving
mean+1.96sd	1046	1860	408	353	17499	31118	24.67	21.33	12.38	9.96	346	613	818718	1442933	9.42	Cost Saving
<b>Bellary</b>																
Mean	1332	2775	323	228	22533	46932	19.12	13.48	7.80	6.22	406	846	787793	1642173	Cost Saving	Cost Saving
mean-1.96sd	247	305	27	3	4035	4843	1.53	0.15	0.87	0.21	43	28	-163829	-449356	Cost Saving	Cost Saving
mean+1.96sd	2417	5246	619	452	41031	89021	36.71	26.82	14.73	12.22	769	1664	1739414	3733701	18.88	10.97

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include the acceptability to the community of the specific intervention models evaluated here, existing levels of sex worker empowerment and organisation, socio-cultural norms and the characteristics of sex work in different settings.

Our results may also be viewed by some as limited, even with the setting studied, as the analysis of the causal pathway relies on a conceptual framework, observational data and model-based evidence of effectiveness, rather than on experimental evidence. This approach provides plausible evidence of effect [29]; and is feasible in settings where experimental designs are not appropriate [56]. However, while we adjusted for socio-demographic confounders in our exposure analysis, and carefully constructed our control group in the modelling, our results may still be limited by some selection bias, in that we may not have entirely removed endogeneity in the relationship between FSW behaviour related to HIV prevention and their involvement in community mobilisation. In addition, our approach allows estimation of the impact of CM and empowerment activities including reduced onwards transmission from FSWs who were infected prior to engaging with CM and empowerment. Through the combination of Bayesian methods and a probabilistic sensitivity analysis around the incremental cost-effectiveness ratio we also attempt to provide a realistic and transparent presentation of the uncertainty inherent in this type of analysis. In particular, our estimates of infections averted have high standard deviations, primarily due to uncertainty around the estimated population size studied [29]. But nevertheless we find our results to be robust.

As an economic evaluation, our study is also limited in that the strength of much of our evidence is based on data from costs and effects which are derived from a single study setting. We chose this approach due to the dearth of data on costs and effects of community mobilisation and empowerment (from the same setting) globally. However, our findings on effects are supported by a recent meta-analysis of CM and empowerment interventions [57]. Finally, our study is limited in the fact that it takes a provider rather than a societal perspective, and thus excludes the costs that FSWs and other providers may incur and contribute towards any intervention effect. This may mean we over-estimate cost-effectiveness. However, given the very low incremental cost-effectiveness ratio, this is highly unlikely to impact our main findings and inference above. Nevertheless, given the local nature of our study, and these limitations, we strongly suggest that further research across a number of settings is conducted to bring added precision and confirmation to our findings.

Overall, our findings provide strong evidence of the value of investment in sex worker community mobilization, and lead us to recommend the sustained funding of community mobilisation and empowerment activities as part of HIV prevention for FSWs in India, and the consideration of funding for scaling up similar interventions in other contexts, (accompanied with a careful evaluation of impact and cost-effectiveness during scale-up). The potential for multiple HIV, development and poverty reduction benefits for a low cost are an important element of such investments, meriting further research, as part of a broader, developmental perspective on future investments. Finally, our findings suggest that community mobilisation for especially at risk and vulnerable populations play a central role in the HIV response, and merit consideration by HIV programme managers

## References

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and their funders, as central components of the core package of HIV prevention for FSWs.

## Supporting Information

**Appendix S1 Text S1**, Summary of Exposure Analysis. **Table S1**, Peer education and service uptake, risk and HIV/STI prevalence, adjusted for socio-demographic characteristics and community mobilisation (IBBA Round 1 (2005), pooled data from 4 districts). **Table S2**, Peer education and power, service uptake, risk and HIV/STI prevalence, adjusted for socio-demographic characteristics and community mobilisation (IBBA 2011 and STI data 2008, pooled data from 4 districts). **Table S3**, Impact and cost-effectiveness model parameters. **Table S4**, NGO\* and SLP\*\* community mobilisation economic costs by input and year (US\$ 2011). **Figure S1**, Acceptability Curves. **Figure S2**, FSW HIV prevalence (%) by year in four districts used in the exposure analysis. **Figure S3**, Condom use by year in four districts used in the exposure analysis. (DOCX)

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## CHAPTER 9

### DISCUSSION OF THE FINDINGS

This thesis is one of the largest cost analysis studies looking at costs of scaling up a large HIV prevention program for high risk group over time through concurrent evaluation, along with the roll out of the interventions in four southern states of India. The Avahan interventions were designed to target the most at risk group to ensure high coverage and maximum impact in a very short period of time. The approach was to provide an appropriate mix of evidence based HIV prevention strategies to achieve high coverage, intensity and duration to achieve optimal impact(BMGF 2010). There have been successful examples of scaled up measures in three countries that have reversed their respective epidemics like in Thailand, Senegal and Uganda(UNAIDS 2001). Many other countries along with India(Steen, Mogasale et al. 2006, Blanchard, Bhattacharjee et al. 2008) like Cambodia(Saphonn et al., 2004;Srikantiah et al., 2010), Haiti(Koenig et al., 2004), Iran(Farnia et al., 2010), Zambia(Nsutebu et al., 2001;Stringer et al., 2003;Gormley et al., 2011) etc., have stepped up efforts to scale up their current prevention interventions and are progressing significantly to reduce HIV prevalence at the national level(UNAIDS 2013, BMGF June 2007).

Some of the critical factors identified for success of scaled up programs were strong political commitment and leadership(Kanki et al., 2012), good monitoring(Beck et al., 2008), adequate financing(Hecht, Bollinger et al. 2009, Hecht, Stover et al. 2010) and local innovations(Braitstein et al., 2009).

One of the major constraints identified for scaling up was high costs(Hanson et al. 2010;Mangham and Hanson 2010), staff shortages(Laurent 2011), stigma(Posse, et al.,

2008;Solomon et al., 2008;Taegtmeyer et al., 2013), misallocation of resources and inadequate financing(Commission 2008). There is very little empirical evidence to identify the costs of scaling up and expanding service delivery. This rapid scale up in India through *Avahan* gives great learning opportunity to study how HIV prevention costs change as interventions are scaled up in varied program settings.What are the factors driving these costs?The study also provides the required data to further analyze efficiency of HIV services using econometrics.This is of interest for other countries planning to replicate these large scalefocused interventions to achieve maximum value for their money spent. The various research papers which form the part of the thesis try to address each of the different objectives of the study.

### **9.1. Overview of the Findings**

The research paper 1 demonstrates the effect scale has on costs and shows the changes in unit costs across different implementing organizations in real settings, in the initial two years of programming. There are very few studies providing the costs of programs during scale up and most of them are based on pilot intervention data and projected costs. There is scarce real program cost data as scaling up happens. Early programdata which has been analyzed is particularly beneficial as it also provides anunderstanding ofstart-up costs.This study also gave insights into the proportion of start-up costs (4.7%) which in many cost studies of established program cannot be assessed. The start-up costs are an investment to generate in-depth understanding of community profiles through mapping and needs assessment and also to assess the baseline knowledge and attitude towards HIV/AIDS among the target population to design effective programs.

It also explores the early effect of scale on costs variation across the different implementing NGOs. Guinness et al. in their study explored some of the factors of

variation in total costs of mature NGOs, wherein the median age was 6 years into the intervention and found that input prices and nature of target group contributed to variation in total costs. Scale variable could explain 50% of the variation in unit costs (Guinness, et al., 2005). In our study on the effect of scale the unit costs fell till about 2100 key population were reached and later there was much less variation signifying constant returns to scale. In addition to scale which explained 24% of the unit cost variation in our study, we also explored other factors like age of intervention (positive association), number of NGOs implementing in the district, the number of state lead implementing partners in the state (negative association). We were also able to quantify the costs by activity and estimate the major cost components.

Resource mobilization at the local level was also found to be low (2-6%) which needs to be promoted as it is an indication of the local commitment/ownership of the program by the key population and stakeholders and enhances the prospects of a sustained response. The more detailed impact of these factors needs to be further explored through more sophisticated econometric methods. But it is very clear that scaled up interventions are necessary in order to have the expected effect on the prevalence of HIV but it would have implications on the costs (Watts and Kumaranayake 1999; Dandona et al., 2008; Chatterjee and Sharma 2010).

Research paper 2 clearly tracks the costs as interventions evolve over the years. It is the first and the largest study analyzing longitudinal costs of over 4 years of HIV prevention interventions of 138 NGOs in 64 districts of the four southern states of India. Kumaranayake et al. (2008) in her review discussed the importance of prospective cost data which helps to arrive at robust unit cost estimates (Kumaranayake 2008). Moreover the other small scale costing studies which have been conducted in India and

elsewhere have mainly estimated the costs at the service level and over a small time frame(Creese et al., 2002).

Understanding the full intervention costs helps program managers planning scale up of large programs in other settings reflect on the resources that might be needed for such rapid scale up. Our study was planned to ensure good costing data over longer time period to actually monitor the changes in costs as interventions evolve. Methodologically a standardized approach was adopted to collect the cost data from all the implementing NGOs and state lead partners and the central level support costs to ensure we capture the full costs of implementation. The reasons for unit cost variations over time at different organizational levels have not been explored in detail. However, our results show that unit costs do not remain constant over the years and since many global resource estimates have been based on such constant costs, it adds new evidence in benchmarking costs of HIV prevention. We found that the unit costs at above service level (from US\$ 477 in 2004 to US\$ 145 in 2008) fell more sharply as programs expanded than the unit costs at the service NGO level(US\$ 68 to US\$ 64). This was seen in spite of increasing scope of activities to empower the communities to take ownership and get involved in program management at the service level. Maximum gains in efficiency can be achieved by focusing on how the services are designed at the state lead partner level.

Districts are geographically confined areas and have administrative mechanisms in place for delivery of programs. Districts vary in overall HIV prevalence and vulnerability which is different in each district. Districts are also quite large in India. Our analysis found large variations in unit costs across districts. These are mainly due to specific contextual factors in the key population in districts. In many costing studies the implementing agencies are the unit of analysis. District based approach and data provide the best opportunity for scaling up prevention efforts (Green et al., 2001; Emmanuel et al.,



2013) and in Africa (Japheth Ng'weshemi). Even within the district the resources can be directed to areas with high risk to increase their impact than spread the resources thinly with low intensity interventions to cover the whole district(Weir et al., 2003;Blanchard, et al., 2008). The scaling up strategy involved key steps which included determination of size and distribution of key population; macro level establishment of program and services in those urban locations containing at least 90% of the estimated key populations; micro level planning and implementation of outreach and services to deliver to cover a high proportion of the key population in each location(Tran et al., 2013). In the *Avahan* program, clinics were set up in locations only where the number of key populations in target areas was greater than 200. Referral clinics were the approach used in situations with low concentration of key population.

These cost estimates are also the building blocks for future cost-effectiveness analysis to study the impact of interventions on high risk groups using a district level approach.

Research paper 3 presents costs by typology of female sex workers and high risk groups like MSMs and transgender. There have been some good evidence available on the higher risk for HIV among Non-brothel based sex workers (Dandona et al., 2005) and Men who have sex with men compared to female sex workers(Dandona et al., 2005). But none have looked into the difference in costs of reaching this varied group of female sex workers and high risk groups. This paper provides the first ever such cost estimates. The costs of delivering HIV prevention interventions to transgender (US\$ 116) were much higher than for FSWS or MSMs (US\$ 90) in one setting in Maharashtra. The costs of reaching FSWs working in non-fixed locations (US\$ 96) were much higher than those in fixed settings like brothels or bars (US\$ 75) at the end of three years of intervention. The costs to reach high risk groups in fixed setting was higher in the first year

among brothel based (US\$ 103) and then reduced once the rapport was built with the stakeholders like pimps. In the non-fixed locations (street-based) , unit costs are lower (US\$ 93) initially but to ensure their participation and continued association with the project was much more difficult due to mobility which increase the costs of reaching out to them repeatedly. Similar results were also seen in another setting in Bangalore with MSM unit costs (US\$ 47) being higher than reaching FSWs (US\$ 37).

This paper suggests that program managers need to think of the typology of high risk groups they would be working with to design interventions suited to them and plan for the costs associated with targeting different type of sex workers and high risk groups. Until now unit costs for various high risk groups were assumed to be similar but our study shows that for better resource planning the typology information would be crucial. It would also help in revising the national costing guidelines for targeted interventions for high risk groups to ensure adequate resources for partners working with different high risk groups and based on the predominant typology in their intervention area.

Research paper 4 discusses the above service level costs which are normally not considered or quantified in economic evaluations. Above service level costs include costs incurred at an administrative level of district, state or central level i.e. costs incurred at a level other than the delivery point of intervention. The component may include administration, training, strategy development etc., In a study on cost effectiveness of TB treatment strategies, only one out of the 9 studies had incorporated above service level costs into their analysis (Adam et al., 2003). The approach of complete ambulatory short course chemotherapy with daily supervision the program costs accounted for 33%, 16% and 34% of the total costs in Mozambique, Malawi and Tanzania (de Jonghe et al., 1994). The WHO choice project does provide the methods and tools to calculate the program costs for different health interventions in different regions of the world. They

found that these costs vary substantially across interventions and different regions (Johns et al., 2003).

Our own analysis of the *Avahan* costs showed that above service level costs form a significant proportion of the total costs (35%) (Research paper 2). There has been recent evidence on the efficiency gains that can be achieved by understanding the organizational structure and the design of service delivery of the state lead partners for HIV Prevention (Palmer and Mills 2005, Guinness 2011). Efficiency in HIV prevention programs has become key mainly due to the limited resources available and policy makers and funders are quite interested to understand how it can be improved in the response to the HIV/AIDS epidemic (Holtgrave et al., 1995; Marseille et al., 2004; Dandona et al., 2005; Dandona et al., 2005; Bautista-Arredondo et al., 2008; Brandeau and Zaric 2009, Holmes et al., 2011; Zeng et al., 2012; Bowser et al., 2013). In our study we have described the different organizational structures adopted by the state lead partners to deliver the interventions by classifying them into five implementation models. We also try to understand the variation in unit costs of different models and certain contextual factors which drive these cost variations.

This study showed that the intervention model with multiple organizational levels (international technical inputs), lead partners working with NGOs who lacked capacity in districts with no prior large scale HIV prevention interventions had higher unit costs. The results also clearly underline and quantify the importance of above service level costs. This is also the first time that such an effort and opportunity has been available to include these costs. Many pilot programs fail when scaled up due to lack of adequate resource commitment, especially the above service level costs which would have provided support for successful implementation of pilot projects in terms of oversight and technical assistance (Potts and Walsh 2003).

**Research paper 5** on community mobilization costs provides for the first time incremental cost estimates of community mobilization and enabling environment interventions among female sex workers which has been generating quite a lot of interest among national planners. As the program was dynamic and evolved over time it was possible to identify the components which were additional to the NACO standard package in India, like community mobilization and enabling environment efforts. Interaction with policy makers also helped in prioritizing this special analysis which was of interest to them. The results from our study would help in their decision making on the allocation of resources to this activity. Though the need has been recognized, the impact of including this component and resource requirement for this activity has not been studied in detail. There have been emerging evidence from the *Avahan* learning sites in Andhra Pradesh (Blankenship et al., 2010; Chakravarthy et al., 2012) and Karnataka (Tara Beattie 2014) on the additional benefits of this component to improve engagement of key population in HIV prevention activities. But cost data regarding these activities is not available.

Our analysis provides the first estimates of such costs in two settings over 7 years of programming and provides the necessary data needed to assess impact and cost-effectiveness of this intervention component. The mean total unit costs (including costs at service and above service level) of US\$ 19 (Belgaum) and US\$ 21 (Bellary) are very small compared to the additional benefits in terms of increased uptake of services and ownership of the program by the key population. The results would be useful for those considering these interventions in future HIV prevention programs.

## **9.2. Policy Implications of the Various Research Papers of Our Study**

The analysis involving cost data collected over time helps in identifying how costs change over time and scope of the program. Thus, tracking of HIV expenditure for prevention intervention for marginalized groups and outputs of implementation can help in understanding the utilization of the resources instead of looking at allocated budgets to ensure accountability of implementing agencies. In the Indian context district level cost data on a routine basis is more useful for planning, designing and implementing the HIV/AIDS prevention program because of the large size of each districts and local administrative set up.

The cost drivers like scale on costs, the intervention population, their typology and the mix of activities should be considered during resource allocation to service providers as they do influence costs. The study showed significant amount of resources for capacity building and technical expertise enhancement at local, state and national level. This surely helps in long term sustained implementation through transfer of skills to sufficient number of people. Hence, facilitating capacity development should be continued on a routine basis especially in such large scale programs. The current study has been able to quantify the resources needed for such large scale capacity building activities and this would help in better planning for the required resources.

Community mobilization is a key component of essential HIV Prevention package but the incremental cost associated with this is quite small. Early results from its impact on increased service uptake and HIV prevalence is positive. Hence these emerging evidences should be looked into and sufficient resources committed for community mobilization as a cost-effective component of HIV prevention programs.

Costs at the above service level can be significant. Efficiency at the above service level should be improved to ensure lower unit costs. It is also important to ensure specific organizational structure for delivery of interventions in situations where implementers lack experience or there is absence of prior exposure to such interventions among the key populations.

The Avahan programme has been long seen as a ‘cadillac’ programme, and to that extent some may argue that its costs are not generalizable in India and beyond. However, costs fell considerable as the programme scaled-up and with experience. There have been very few comparative global efforts to scale up services at this scale so rapidly; and early costs may not be typical or appropriate for other settings. Costs in the later years are however now similar to more recent costs of the theAvahanprogramme, now under the stewardship of NACO- Phase IV 2012-2017. The diversity and variation of costs across Avahan remain substantial, and suggest that costs may be highly dependent on setting. Therefore care has to be taken before taking the mean Avahan costs as representative. However, the costs here can inform may be generalizable to other states in India. Indeed this study has provided data for econometric analyses of costs that may be used to predict costs based on setting characteristics.

In India HIV is still considered a concentrated epidemic and the targeted intervention resource use may also be used to inform countries with similar epidemiological conditions with price adjustments. Even if not in terms of absolute quantities of resources, this work has highlighted that broadly the costs of community mobilization, population characteristics and above service costs may be important in determining overall costs and cost-effectiveness. The activity component estimates can

help other countries pick and choose the package of intervention and adjust the resources required.

The robust epidemiological impact of the modelling study and cost information generated from this study has emphasized the cost-effectiveness of focused HIV prevention for high risk groups in concentrated epidemic settings; adding to the growing evidence base. Our estimates of cost-effectiveness were conservative and at a stage when ART uptake was low and our analysis showed that if ART was included the intervention is cost saving. While, as with all behavior change interventions, generalisability cannot always be assumed, our study results suggest that these interventions should at least be considered in other settings.’

Priority setting, as reported in official policy documents, in the context of HIV prevention in India has been largely evidence based and India has been state support for the uptake proven cost-effective interventions. However, in reality, there has been a major limitation as to the scale at which these interventions were funded and implemented. The additional resources, which were brought in by the BMGF, were directed to fill such major geographical intervention gaps and to improve the effectiveness of HIV prevention coverage through extensive community involvement.

Policy makers were regularly updated regarding the progress, early and final results of this study. They were well represented in the WHO-Evaluation advisory group meetings and we were also given opportunities and special sessions during NACO annual conferences. Our results provide extensive data to facilitate the resource requirements estimation based on the type and size of high-risk group rather than use a fixed unit cost per person. For example, NACO now recognizes the need for separate intervention budgets for MSM interventions. NACO needs to move away from funding fixed budget

based on estimated number of key population per targeted intervention which is still in the process at the national level for NACP-Phase- IV targeted intervention implementation.

In a separate meeting with NACO to discuss specific priorities for analysis the community mobilization costs assessment and cost-effectiveness was requested. The study findings suggest that NACO should continue to include the funding for this aspect of the HIV prevention intervention. The importance of this intervention component has been well received both nationally and globally and there is increasing emphasis towards such structural interventions as a part of the national package. In India this component has been included as part of the NACP- IV, although funding is still supported by BMGF.

### **9.3. Limitations of the Study**

Some of the limitations of our study are that detailed costing was done only in 23 districts due to constraints of time and resources. Time sheets were collected only from detailed sites and were used to estimate the costs for different activities among the routine reporting sites. We could include only two sites for the incremental cost work on structural interventions but we included an extended time frame of 7 years. Our intention was to get maximum data from few sites instead of limited data from many sites.

The breakdown of costs by sub-activities was not very comprehensive at the state lead partner level. We have discussed this with the state lead partners. Since the staff often did multiple tasks, it was difficult for them to give an accurate breakup of the time spent on various activities.



There were some data reporting issues on the output data till the CMIS was standardized at the central level and the training was completed for all the states and implementing partners. In the early years till *Avahan* established the CMIS, each state was following their own management systems and the definitions of the indicators were not standardized across states. This gave us a very small pool of indicators to use which was comparable. Once the CMIS was established in January 2005 all the data was back entered and a revised set of indicators was used in our analysis which caused us to redo our work. But for year 2004 we had to rely on the state management information systems.

The indicators are mainly quantitative in terms of number of people reached, supplies distributed and clinical visits. The quality of the service could not be determined and was beyond the scope of our study.

In our analysis of costs by typology the information on different typology of key population in the study sites were based on the data available in the year when the mapping and validation was done. Since typology of sex workers is fluid, this data refers to the period when it was collected. In our analysis we have considered the costs and corresponding typology data for that year though this may not be possible in all future studies.

The state lead partners were big NGOs and hence shared costs could not be fully estimated from state lead partners running multiple projects. There were some resources and personnel we could clearly identify to be working in multiple projects and we allocated only proportion of their costs. There were some grey areas wherein we could not estimate the proportion of shared costs exactly. This was addressed by estimating the proportion of input from other donors and corresponding outputs were reduced in that year.

In our analysis we have mainly focused on the costs of implementing agencies to deliver the program, hence the costs incurred by the key population to access these services like transport costs or loss of wages have not been considered. Since the provider perspective was chosen for the analysis, this had minimal impact on our results. Estimating the full societal costs was beyond the scope of this study.

Even though this was a well funded intervention the implementation site level costs were kept in line with the NACO requirements. However the Avahan intervention had an addition structural component of community mobilization and advocacy. In addition, the above service level costs were substantially higher than may be accepted funded by the Government of India. Funding for areas such as monitoring and evaluation activities, expertise enhancement, research work, mass media advocacy etc., have not been typically funded by NACO, but these were captured and reported separately.

#### **9.4. Future Work**

##### **9.4.1. On-going Further Analysis Based on This Costing Database**

Based on this cost database developed there have been opportunities to further explore program efficiency. This work has been now completed. (See Annexure 11 for co-authored research paper abstracts).

The learning's from the *Avahan* project would also help to contribute to the planning of National AIDS Control Program (NACP IV) in India and more globally in benchmarking costs. Our study also provides unit cost which can form the basis for calculating better impact estimates of the donor funded programs. It also provides information for resource need estimates for large scale interventions for those developing

countries planning to replicate such programs. The robust cost estimates from detailed costing sites of this study has been provided to further estimate the cost-effectiveness and impact of *Avahan* interventions (Published in Lancet Global Health, 2014). In addition, the incremental costs of community mobilization estimated from this study have provided inputs for evaluating the cost-effectiveness of community mobilization activities (Published 2014 in Plos One).

Finally, the typology based cost estimates for MSM interventions would be used to estimate the cost-effectiveness of MSM interventions (for the first time) through mathematical modelling (Manuscript under preparation).

## **9.5. Conclusion**

The main finding of this thesis is that scale is an important variable influencing unit costs and need to be considered while planning resources for scaling up HIV prevention interventions. The other key finding to note is that typology and high risk groups targeted by the intervention may impact cost, and therefore should also be considered in resource allocation decisions. In addition above service level costs need to be carefully scrutinized as they are substantial and could potential be a source of efficiency gains. The community mobilization analysis showed that this is an important component which can be included in the basic HIV prevention package at a low cost, and could lead to improvements in the uptake of services and is also cost-effective.

Overall, this report presents the results of a unique opportunity to explore the costs of a large scale HIV prevention program like *Avahan*. This has provided valuable insights on costs of the implementation of complex HIV prevention interventions in real life

settings. The thesis has explored in detail costs associated with rapid scaling up has identified the key lessons learned from this program in specific research papers. The results provide useful inputs in planning resource use both within India and for those wishing to scale-up these services in other settings. This thesis therefore adds to the limited evidence base on costs of large scale HIV prevention interventions globally and has contributed to providing better estimates of cost-effectiveness of targeted programs for high risk groups.

It has provided an excellent cost database for others to work on various efficiency analyses to understand the delivery of HIV prevention programs in developing country context. The results would provide useful inputs in planning resource use and the extent of above service level support that would be required. The emphasis is also on inclusion of low cost intervention activities like community mobilization as a part of core HIV prevention programming. It is felt that this thesis would add to the limited evidence base on costs of large scale HIV prevention interventions globally and help in providing better estimates of cost-effectiveness of targeted programs for high risk groups.

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## ANNEXURES

### Annexure 1: Life of Capital Inputs

<b>Capital inputs</b>	<b>Life</b>
Training and start-up	5 years
Equipment (Computers & electrical)	5 years
Vehicle	10 years
Furnitureand Fixtures	10 years

## Annexure 2: Records Review

Costing Period: From start of project to March 31, 2008

Discussion with the Project coordinators, NGO staff, including Accountant and Documentation Officer

- NGO background and project details and timelines
- Project intervention areas
- Startup activities and capacity development
- Background of the district profile, HIV prevalence, HIV Prevention and care programmes ongoing, other NGO working on HIV/AIDS and the target population they cater to, any overlap of programmes or geographically where they work.
- Other Avahan partners working like, other NGOs, TCIF, PSI-Truckers intervention,
- Availability of VCTC, PPTCT and care and support facilities for HIV positive referrals and networks in the district
- Areas of intervention and scale in the district
- Monitoring, evaluation and technical assistance
- Co-ordination with state lead partner
- Personnel-A list of the **staff, peer educators and volunteers** working on the project from the beginning of the project until March 2008. (Designation,

District coordinator, peer educator, taluka coordinator, volunteer)Peers-How many? Peer education strategy any rotating peers, difference in payment system, amount paid, any problems with peers. Roles of different staff in outreach

- A list of the health care providers (project-linked clinic doctors/ referral doctors) working with the project to provide clinical services:

Name, clinic name, qualification, date of starting referral services, location (Pvt., NGO Government), training duration, location and related expenses of training provided to them in relation to the STI services provided under the project. Activities involved intrainingfor treatment guidelines, who provided training, advocacy, STI services, general clinical services-consultation, tests, drugs. Payment details, consultation fee, treatment guidelines, standard course of treatment, no. of consultations, follow-up, Time spent/pt, Rapport, counseling, clinical examination, follow-up % , HIV positive rate, referrals, opportunistic infections, drugs, Government mobilizations, free samples, camps, clinic set up support, up-gradation, field referral, -other health problems common among Key population

- Supplies- STI, condoms and IEC material supplies
- Buildings used for the project- A list of all the buildings that are used for this project at each of the project sites including outreach offices set up, whenestablished, any sharing, any free space utilisedeither government buildings or others and operating costs
- Capital items –equipment, vehicle, furniture (i.e. those items whose expected life is greater than 1 year) used by the project
- Travel expenses



- Training expense

### ***Intervention Details***

All the start -up activities that were required to implement the project (project proposal development, contract issue date, needs assessment, mapping and validation of sex workers, identification of peer educators, development of reporting systems)

- Time frame of activities-Month-wise
- Start -up activities till which month
- Outreach services started-month and year
- STI services started-month and year
- DIC services when started

A brief description of outreach, STI, condom distribution, community mobilization and sensitization, advocacy and other events held by your organization in the time period

### ***Resource Mobilization***

- Space mobilized free- purpose how many days, cost/day-market value, if different from what paid
- Personnel Support-, doctors, another NGO, local leaders etc., Any project staff working in other projects, proportion of time spent in this project
- Supplies\_ Any camp support like medicines, IEC materials,
- Any combined activity with another organization who contributed funds like for World AIDS day,

- Any other funded project same NGO is working in same population. What are its activities
- Linkages with other services
- Any donations, cross funding support
- Problems of implementation as per the original proposal
- Any innovation tried
- Is service delivery any different from other partner NGO of same SLP
- Any special activities undertaken different from partner NGO
- Programme challenges and how they were

### ***Reports***

**Financial:** Monthly/quarterly for the costing period

**Narrative programme reports:** Proposals, quarterly reports, annual reports submitted to the SLP

**MIS reports:** for output indicators

### Annexure 3: Weekly Time sheet for Project staff

District: \_\_\_\_\_

Project: \_\_\_\_\_

Personnel Name and Grade: \_\_\_\_\_

Date from Week Beginning: \_\_\_\_\_

<b>Time/Day/ Activity</b>	<b>8:00 A.M.</b>	<b>9:00</b>	<b>10:00</b>	<b>11:00</b>	<b>12:00 P.M.</b>	<b>1:00</b>	<b>2:00</b>	<b>3:00</b>	<b>4:00</b>	<b>5:00</b>	<b>6:00 P.M.</b>
Monday											
Tuesday											
Wednesday											
Thursday											
Friday											
Saturday											

#### *Instructions for filling the time sheets*

Thank you for participating in this economic evaluation. Your assistance will help us determine the costs of Avahan interventions in India.

In the Activities column, indicate leave and public holidays.

In the Time Started and Ended column in the AM write the time you arrive to the time you start lunch (e.g., 7:30-13:00) and in the PM write the time you start lunch to the time you leave (e.g., 13:00-16:30).

In each one-hour slot, kindly enter the name of each activity and the amount of time spent on that activity. You can use the following activity headings, and then add the

specific activities that were done. (E.g. for meetings, you can write “Meeting with peers”, “meeting with local leaders”). You can add more detail on a separate sheet and attach to this form if you need more space.

- Field visit: outreach activities including peer education, needle and syring supplies
- Clinic – (referral, etc.)
- IEC
- Training
- Meeting
- Monitoring and Evaluation
- Report writing
- Non-avahan work ,any other project or activities, personal etc.,
- Others

Time spent filling forms or doing translation for each activity should be included in the estimate of time for that activity.

Remember to update this form as soon as possible after each time block (i.e., after lunch and at the end of the day before you leave) every day for 1 week and complete 1 form/week for 4 weeks.

#### Annexure 4: Activity Based Costing Description in Time Sheets

Activities	Code	III year
Capacity building- includes trainings conducted and attended	A	
Outreach: -Behaviour change communication (1-1,1-G), Support to Peer education	B	
STI services	C	
Condom promotion-Distribution, demos, condom negotiation skills, outlets replenishment	D	
Community led structural interventions (CLSI) - collectivisation, community mobilization, group events	E	
Advocacy and enabling environment	F	
Support to central M & E, includes mapping, surveys like IBBA, MIS	G	
Documentation	H	
Essential AIDS care includes Positive support group formation and meetings, opportunistic infections treatment, psychosocial counselling, referrals	I	
Planning and co-ordination includes staff planning ,meeting, co-ordination with local agencies and linkages	J	
Start-up activities for MSM/ new areas of project expansion	K	
Special events	L	
Programme monitoring and evaluation includes monitoring of field staff, annual reviews	M	
MSM programming	N	
Others (specify)	O	
Non-projector personal work	P	

### Annexure 5: Weekly Time Sheet for Doctors

District: \_\_\_\_\_

Project: \_\_\_\_\_

Personnel Name and Grade: \_\_\_\_\_

Date from Week Beginning: \_\_\_\_\_

Time/Day/ Activity	8:00 A.M.	9:00	10:00	11:00	12:00 P.M.	1:00	2:00	3:00	4:00	5:00	6:00 P.M.
Monday											
Tuesday											
Wednesday											
Thursday											
Friday											
Saturday											

#### ***Instructions for filling the time sheets***

- Thank you for participating in this economic evaluation. Your assistance will help us determine the cost-effectiveness of Avahan interventions in India.
- In the Activities column, indicate leave and public holidays.

In the Time Started and Ended column in the AM write the time you arrive to the time you start lunch (e.g., 7:30-13:00) and in the PM write the time you start lunch to the time you leave (e.g., 13:00-16:30).

In each one-hour slot, kindly enter the name of each activity and the amount of time spent on that activity for each patient. You can use the following activity headings, and then add the specific activities that were done. (E.g. if between 9-12, you saw 3

patients for follow up, you could put “follow-up 3 patients, (15 min each)” in the 9-12PM time slot). We would like to know the amount of time you spend with a patient for these different activities.

- General health check
- Follow-up
- STI, general health treatment
- Counselling
- Training
- Meeting
- others

Time spent filling forms or doing translation for each activity should be included in the estimate of time for that activity. Remember to update this form as soon as possible after each time block (i.e., after lunch and at the end of the day before you leave) every day for 1 week and complete 1 form/week for 4 weeks.

## **Annexure 6: Guidelines for Peer Discussions**

Namaskar! My name is Dr. Sudha Chandrashekar And I am from London School of Hygiene and Tropical medicine. I am here to understand your perception on the various aspects of your work as peer educators like your job responsibilities , the activities you do, the problems you face on the work front and also about your total earnings and earnings from sex work and project ,your clients and the amount of time you spend for the project and the benefits you gain from being a peer educator in this project. The information that you share will help us to estimate the cost of HIV prevention services.

First and foremost I would like to thank you for all for your valuable time to take part in this group discussion. In today's discussion we are interested to know about your work in the project and also about the financial aspects of your work .The discussion will be facilitated topic by topic by one of our team members and it will take approximately 30-40 minutes. I would request each one of you to express your ideas and feeling and also feel free to express if you differ in opinion to others. The information provided by each one of you will be valuable and it will not be shared/ discussed with anyone outside this group and we assure that you will not be judged on the vies that you hold with respect to the topics. Please feel free to seek clarification to your doubts if any.

Well, if you all are ready we can start the discussion

### ***Topics and the discussion points***

#### ***Work related***

- From when are you working as Peer educators? (Start of project / when?)
- How many are newly joined as peer educators?



- What made you join the project?

### ***Roles and Responsibilities***

- Can you describe your roles and responsibilities as a peer educator?
- What are the activities you carry out?
- Did you have any problems when you started working for this project(PROMPT: in your family, among other sex workers, in your community)
- Would you be able to describe a typical week/day?
- Before you joined as peer educator how would you spend your time? Were you involved in any part time or full time work?
- How many hours each day do you spend for various activities on the project?
  - Peer education
  - STI follow-up
  - Condom promotion
  - Health information and other activities(refer for time sheets and fill it in the form of a sample)

### ***Sex work related***

- Do you work part time or full time in sex work?
- Get a sense of the typologies of the participants in the form of predominantly street, brothel, home, dhaba, public places or mixed.
- How many hours do you work per day for sex work?

- How many paying clients do you have per day?
- How do you get paid? Is the payment always in cash or kind also?
- What are your charges?
- Do you get paid more if you agree to have sex without a condom? How much more do you get paid? How many of such clients you have in a week/month you agree to have sex without a condom?
- Any problems you face with clients?
- What is your average monthly earnings from sex work?
- Probe to find out variations in payment based on typology and the amount paid as commission find out amount finally received.
- Do you lose any income because of working as a peer educator?
- Has the number of clients/day changed since you joined the project? What are the possible reasons any of it related to working as peer educators in the project?

***Project Honorarium***

- Do you receive any payment form the project?What do you get?How much?(PROMPT:salary/honorarium, travel expenses (separate out for peer education, versus anything to do with STI, trainings, and other meetings).
- Describe the peer educators payment whether on a daily basis, monthly fixed or piece rate, unpaid, incentive based any difference in payment of senior peers and new peers?

- Do you spend any of your own money on project activities?How much?On what activities?

***Other sources of income***

- What are the other jobs you do and the income from them?
- What is your average monthly earnings from other sources/work?
- How much would you expect to be paid to do some other work for an hour other than sex work?

***Benefits of working in the project***

- What are the benefits you gain from being a peer educator?
- What are the reasons for you to continue working as a peer educator?

Thank you for all the responses and your time.

## **Annexure 7: Questionnaire for Key Project Staff on Community**

### **Mobilization**

Personnel and Grade: District level NGO staff

Planned activity: Telephonic interview after taking prior appointment

Name:

Age:

Designation:

Duration of working on this project:

#### ***District and NGO in charge:***

- What are the main job responsibilities of your position? Specify your tasks related to community mobilization activities?
- Can you list the key activities related to community mobilization conducted in your district in the year 2011-2012? (Prompt: like DIC events, capacity building etc.,)
- Think back to the last time you conducted this event. What were the main steps in carrying out each activity, use this to fill in table below?

- Please list all resources used and help fill in the table below

Activity	Sub-activity	Staff type	No.	Hours per person spent	Room (list room type)	Hours used	Costs rental paid per hour	Equipment (list any equipment)	Hours used	Other supplies and costs
Drop in event	Planning									
	Designing Materials									
	Conducting									

- How many times did you conduct these activities every year since 2004 – (please also refer to any reports/ records)?

Year	Activity	Sub-activity	Number of times per year
2004			
2005			
2006			
2007			
2008			
2009			
2010			
2011			

### *Advocacy*

- What was the amount of time each core staff spent on these activities last year? (Express in percentage)

Staff type	Number of staff	% Time

- Have the sub-activities for each activity been the same over the years from 2009-2012 or any new components added or removed over time?

## **Annexure 8: Questionnaire for SLP Core Team Staff on Community Mobilization**

Planned Activity: Face to Face interview

Name

Designation:

Duration of working in this project:

### ***Key roles and job responsibilities***

- What has been the community mobilization strategy in Phase I and Phase II of Avahan?
- Are they same in all districts. If different what are the main areas how they vary from district to district.
- Could you list the salient activities, and describe sub-activities related to community mobilization in Phase II of Avahan?
- Who are the main staff at SLP level involved in supporting these activities at the district?
- What is the proportion of time of all staff spent for different activities last year?
- Are they responsible for specific districts or all the districts, how much time do they allocate to each district?

## **Annexure9: Ethical clearance**



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## Annexure 11:Co-Authored Abstracts

*Abstract 1:Published SocSci Med. 2015 Apr;131:164-72. doi: 10.1016/j.socscimed.2015.03.007. Epub 2015 Mar 5*

**Estimating unbiased economies of scale of HIV prevention projects: a case study of Avahan.**

[Lépine A1](#), [Vassall A2](#), [Chandrashekar S3](#), [Blanc E4](#), [Le Nestour A5](#).

### **Abstract**

Governments and donors are investing considerable resources on HIV prevention in order to scale up these services rapidly. Given the current economic climate, providers of HIV prevention services increasingly need to demonstrate that these investments offer good 'value for money'. One of the primary routes to achieve efficiency is to take advantage of economies of scale (a reduction in the average cost of a health service as provision scales-up), yet empirical evidence on economies of scale is scarce. Methodologically, the estimation of economies of scale is hampered by several statistical issues preventing causal inference and thus making the estimation of economies of scale complex. In order to estimate unbiased economies of scale when scaling up HIV prevention services, we apply our analysis to one of the few HIV prevention programmes globally delivered at a large scale: the Indian Avahan initiative. We costed the project by collecting data from the 138 Avahan NGOs and the supporting partners in the first four years of its scale-up, between 2004 and 2007. We develop a parsimonious empirical model and apply a system Generalized Method of Moments (GMM) and fixed-effects Instrumental Variable (IV) estimators to estimate unbiased economies of scale. At the programme level, we find that, after controlling for the endogeneity of scale, the scale-up of Avahan has generated high

economies of scale. Our findings suggest that average cost reductions per person reached are achievable when scaling-up HIV prevention in low and middle income countries.

**Abstract 2-** Submitted to Health economics journal

“What determines HIV prevention costs at scale? Evidence from the Avahan programme in India”

Aurelia LEPINE<sup>1</sup> \*, Sudhashree CHANDRASHEKAR<sup>1,2</sup>, Govindraj SHETTY<sup>3</sup>, Peter VICKERMAN<sup>1</sup> , Janet BRADLEY<sup>4</sup>, Michel ALARY<sup>4,5</sup>, Stephen MOSES<sup>3,7</sup> , CHARME India Group<sup>\*\*</sup>, Anna VASSALL<sup>1</sup>

**Abstract:** Expanding essential health services through non-government organizations (NGOs) is a central strategy for achieving universal health coverage in many low and middle income countries. HIV prevention services for key populations are commonly delivered through NGOs and have been demonstrated to be cost-effective and of substantial global public health importance. However, funding for HIV prevention remains scarce, and there are growing calls internationally to improve the efficiency of HIV prevention programmes as a key strategy to reach global HIV targets. To date, there is limited evidence on the determinants of costs of HIV prevention delivered through NGOs; and thus policy makers have little guidance in how best to design programmes that are both effective and efficient. We collected economic costs from the Indian Avahan Initiative, the largest HIV prevention project conducted globally, during the first 4 years of its implementation. We use a fixed effect panel estimator and a random-intercept model to investigate the determinants of average cost. We find that programme design choices such as NGO scale, the extent of community involvement, the way in which support is offered to NGOs, and how clinical services are organised substantially impacts average cost in a grant based payment setting.

*Abstract 3-* Published, Cost EffResourAlloc. 2015 Mar 29;13:5. doi: 10.1186/s12962-015-0031-2. eCollection 2015

**The determinants of technical efficiency of a large scale HIV prevention project: application of the DEA double bootstrap using panel data from the Indian Avahan.**

[Lépine A1](#), [Vassall A1](#), [Chandrashekar S2](#)

### **Abstract**

#### **BACKGROUND:**

In 2004, the largest HIV prevention project (Avahan) conducted globally was implemented in India. Avahan was implemented by NGOs supported by state lead partners in order to provide HIV prevention services to high-risk population groups. In 2007, most of the NGOs reached full coverage.

#### **METHODS:**

Using a panel data set of the NGOs that implemented Avahan, we investigate the level of technical efficiency as well as the drivers of technical inefficiency by using the double bootstrap procedure developed by Simar & Wilson (2007). Unlike the two-stage traditional method, this method allows valid inference in the presence of measurement error and serial correlation.

#### **RESULTS:**

We find that over the 4 years, Avahan NGOs could have reduced the level of inputs by 43% given the level of outputs reached. We find that efficiency of the project has

increased over time. Results indicate that main drivers of inefficiency come from the characteristics of the state lead partner, the NGOs and the catchment area.

## **CONCLUSION:**

These organisational factors are important to explicitly consider and assess when designing and implementing HIV prevention programmes and in setting benchmarks in order to optimise the use and allocation of resources

*Abstract 4-* Lancet Glob Health. 2014 Sep;2(9):e531-40. doi: 10.1016/S2214-109X(14)70277-3. Epub 2014 Aug 27.

Cost-effectiveness of HIV prevention for high-risk groups at scale: an economic evaluation of the Avahan programme in south India

Vassall A, Pickles M, Chandrashekar S, Boily MC, Shetty G, Guinness L, Lowndes CM, Bradley J, Moses S, Alary M; Charme India Group, Vickerman P.

## Summary

**Background:** Avahan is a large-scale, HIV preventive intervention, targeting high-risk populations in south India. We assessed the cost-effectiveness of Avahan to inform global and national funding institutions who are considering investing in worldwide HIV prevention in concentrated epidemics.

**Methods:** We estimated cost effectiveness from a programme perspective in 22 districts in four high-prevalence states. We used the UNAIDS Costing Guidelines for HIV Prevention Strategies as the basis for our costing method, and calculated effect estimates using a dynamic transmission model of HIV and sexually transmitted disease transmission that was parameterised and fitted to locally observed behavioural and prevalence trends. We calculated incremental cost-effective ratios (ICERs), comparing the incremental cost of Avahan per disability-adjusted life-year (DALY) averted versus a no-Avahan counterfactual scenario. We also estimated incremental cost per HIV infection averted and incremental cost per person reached.

**Findings:** Avahan reached roughly 150 000 high-risk individuals between 2004 and 2008 in the 22 districts studied, at a mean cost per person reached of US\$327 during the 4 years. This reach resulted in an estimated 61 000 HIV infections averted, with roughly 11 000 HIV infections averted in the general population, at a mean incremental cost per HIV infection averted of \$785 (SD 166). We estimate that roughly 1 million DALYs were averted across the 22 districts, at a mean incremental cost per DALY averted of \$46 (SD 10). Future antiretroviral treatment (ART) cost savings during the lifetime of the cohort exposed to HIV prevention were estimated to be more than \$77 million (compared with the slightly more than \$50 million spent on Avahan in the 22 districts during the 4 years of the study).

***Interpretation:*** This study provides evidence that the investment in targeted HIV prevention programmes in south India has been cost effective, and is likely to be cost saving if a commitment is made to provide ART to all that can benefit from it. Policy makers should consider funding and sustaining large-scale targeted HIV prevention programmes in India and beyond.