Original article

HIV TREATMENT AND PREVENTION REPORT USING CASCADE ANALYSIS IN MAKWANPUR DISTRICT, NEPAL, DURING THE COVID-19 PANDEMIC: A RETROSPECTIVE COHORT STUDY

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ABSTRACT

Introduction: HIV remains a significant public health concern in Nepal, emphasizing the need for effective prevention and treatment strategies. This report provides an overview of HIV treatment and prevention efforts in Nepal, evaluated through cascade analysis.

Methodology: This study analysed HIV prevention and treatment activities implemented by General Welfare Pratisthan in Makwanpur district, Nepal, from January to December 2021. Hotspot mapping identified key locations for interventions targeting female sex workers (FSWs) and priority populations (PPs), including clients of FSWs and other high-risk individuals. Cascade analysis was used to assess the progression of HIV care, including outreach, HIV testing, diagnosis, antiretroviral therapy (ART) enrolment, and viral load suppression.

Results: A total of 333 FSWs and 230 PPs were reached, surpassing the annual targets of 274 by 121% and 228 by 101%, respectively. HIV testing and counselling services were provided to 107 FSWs and 109 PPs, achieving 56% and 68% of the annual targets of 192 and 160, respectively. Individuals who tested positive were promptly enrolled in ART, and the number of those receiving viral load testing and achieving viral suppression also surpassed the targets, demonstrating program effectiveness.

Conclusion: The findings highlight the successful implementation of HIV prevention and treatment activities in Makwanpur, despite the challenges posed by the COVID-19. Cascade analysis proved valuable for tracking progress through the HIV care continuum, offering insights into interventions effectiveness. The continued use of cascade analysis is recommended to strengthen HIV care and prevention efforts in similar settings.

Key words: HIV, HIV prevention, Covid-19, Cascade Analysis

INTRODUCTION

HIV prevalence in Nepal varies across different population groups, indicating a concentrated epidemic.[1] According to the National Centre for AIDS and STD Control, the HIV prevalence rate among adults in Nepal was 0.11% in 2023, with one new case reported daily.[2] HIV prevalence is higher among key populations, including people who inject drugs (0.2%), men who have sex with men (4.7%), female sex workers (2.5%), and clients of female sex workers (7.2%).[3] Due to the nature of their work, female sex workers (FSWs), are at particularly high risk for HIV transmission, making them a priority group for targeted HIV prevention and treatment efforts.

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Despite the implementation of various interventions aimed at promoting safer sexual practices, increasing HIV testing, and ensuring access to treatment for vulnerable populations, there remains a significant gap in evaluating their effectiveness. Prior studies have primarily focused on estimating HIV prevalence and identifying at-risk populations but have largely overlooked the operational success and gaps within the HIV care continuum particularly during the COVID-19 pandemic.[4,5]

Given that the COVID-19 pandemic persisted into 2021, people living with HIV were affected in various ways such as disruptions to healthcare access, interruptions in antiretroviral treatment (ART), changes in health-seeking behavior due to fear of COVID-19, increased mental health challenges, and heightened stigma and discrimination.[6] These factors exacerbated the vulnerabilities of people living with HIV. Despite these challenges, there is limited research evaluating how HIV care and prevention programs adapted to these disruptions, particularly in resource-limited settings like Nepal.

This report aims to address these gaps by evaluating the effectiveness of HIV interventions targeting FSWs in Makwanpur district during the COVID-19 pandemic. Utilizing cascade analysis, it examines key outcomes across the HIV care continuum, including HIV testing, ART enrollment, and viral load suppression. By highlighting operational challenges and successes, this research provides actionable insights to improve HIV prevention and treatment efforts in similar contexts.

METHODOLOGY

Study Design

This study employed a retrospective cohort design to evaluate HIV prevention and treatment activities in Makwanpur district, Nepal. A retrospective cohort design was chosen as it allows for the analysis of existing data to assess outcomes over time. The cohort consisted of high-risk individuals, participated in HIV interventions. This design enabled the evaluation of the effectiveness of HIV programs implemented during the COVID-19 pandemic, using historical data to track progress across the HIV care continuum without the need for new data collection.

Study Setting

The study was conducted in Makwanpur district, Nepal, an area known for significant challenges related to human trafficking and high mobility. As one of the twenty-six districts in Nepal with high rates of girls trafficking, Makwanpur serves as a key transit point between Kathmandu and Bihar state in India. Hetauda, the district headquarters, is an industrial hub that attracts a transient population, increasing vulnerability to HIV-related risks such as trafficking, drug use, and sexual exploitation. As a part of EpiC Nepal Project (Meeting Targets and Maintaining Epidemic Control), General Welfare Pratisthan (GWP) is implementing HIV prevention care and treatment services in Makwanpur district. GWP is a non-governmental, non-profit organization dedicated to improving the well-being of marginalized communities in Nepal. Since its establishment in 1993, GWP has been actively engaged in social welfare initiatives, particularly those focused on vulnerable populations, including HIV prevention and treatment efforts.

Study Population

The study population included both key populations and priority populations. Key populations included female sex workers (FSWs), while priority populations (PPs) comprised clients of FSWs and other high-risk individuals. These groups were identified based on behaviours that increase the risk of HIV transmission, such as unprotected sexual contact, needle sharing, and frequent mobility. The study was conducted in identified “hotspots” within Makwanpur district, an area known for high-risk activities, including unprotected sex and drug use. HIV interventions were implemented throughout the year 2021, from January to December.

Variables

Independent Variables

- Risk Behaviours: Unprotected sexual intercourse, alcohol consumption, needle sharing, multiple sexual partners, HIV-positive partners, age under 25, lack of prior HIV testing, and history of sex work.
- Population Groups: FSWs and PPs, including clients of FSWs and other high-risk individuals.

- Interventions: Educational campaigns, condom distribution, comprehensive sex education, counselling services, and stigma reduction programs.

Dependent Variables

- HIV Testing: Number and proportion of FSWs and PPs tested compared to targets.
- HIV Diagnosis: Number of positive HIV tests.
- ART Enrolment: Number of HIV-positive individuals enrolled in antiretroviral therapy (ART).
- Viral Load Testing: Number of individuals tested and proportion achieving viral suppression (viral load <1000 copies/ml).
- PrEP Uptake: Number of high-risk individuals prescribed pre-exposure prophylaxis (PrEP).

Process/Operational Variables

- Hotspot Mapping: Identification of areas with high concentrations of HIV-related risk behaviours.
- Program Coverage: Number of FSWs and PPs reached by interventions, compared to targets.
- Cascade Analysis Indicators: Proportions at each stage of the HIV care continuum (e.g., HIV testing, ART enrolment, viral suppression).

Data Collection Procedure

Risk Behaviour Assessment: HIV testing was offered to individuals based on risk behaviours such as unprotected sex, lack of previous HIV testing, age under 25, history of sex work, multiple sexual partners, HIV-positive partners, alcohol use, and needle sharing.

Hotspot Mapping: Local informants or members of the target population identified areas with concentrated HIV risk behaviours (e.g., brothels, bars, drug-use areas) using mapping techniques. These locations were validated through triangulation from multiple sources.

HIV Testing and ART Enrolment: Individuals identified through hotspot mapping were offered voluntary HIV testing. Those testing positive were enrolled in ART according to national guidelines. Pre-exposure prophylaxis (PrEP) was also monitored for high-risk individuals.

Viral Load Testing: Individuals who initiated ART underwent viral load testing to monitor treatment efficacy. Viral load suppression (defined as <1000 copies/ml) was used as a marker for reduced HIV transmission risk.

Interventions: HIV prevention interventions included educational campaigns, sex education, condom distribution, condom negotiation skills training, counselling, and stigma reduction activities.

Data Entry and Analysis

Data was entered into a secure database by trained GWP personnel. Cascade analysis was employed to visualize the flow of individuals through various stages of HIV care, from initial contact and HIV testing to ART enrolment and viral load suppression. This method provides valuable insights into intervention effectiveness and tracks progress across key stages of HIV care.[7] By identifying gaps in the care continuum, cascade analysis helps measure the success of HIV prevention and treatment interventions, offering crucial data to strengthen on-going efforts in the field.

ETHICAL APPROVAL

This study used de-identified program data from the General Welfare Pratisthan (GWP), approved by the Social Welfare Council (Affln. 1366/049/050) through an agreement with Family Health International (FHI 360 Subaward ID#: 1297.0305). The data was collected for public health evaluation purposes, without any direct interventions or participant interactions, ensuring confidentiality. Since the study relied on de-identified, publicly available data, it followed ethical guidelines and was consistent with WHO recommendations, which indicate that studies using public information and posing no risk to individuals are not subject to review by a Research Ethics Committee (REC).[8]

RESULTS

Individual and/or small group level HIV prevention interventions were successfully delivered to 333

female sex workers (FSWs), surpassing the annual target of 274 by 121%, despite challenges posed by the COVID-19 pandemic. Similarly, standardized, evidence-based interventions, which are programs proven effective in improving outcomes based on research and formal studies, were provided to 230 priority populations (PPs), achieving 101% of the annual target of 228. These interventions focused on promoting HIV prevention behaviors and increasing service uptake. **Table 1 and 2** outline the service uptake and outcomes for FSWs and PPs, including HIV testing, positivity rates, ART enrollment, and viral load suppression. The cascade analyses, presented in **Figures 1 and 2,** further illustrate the flow of FSWs and PPs through each stage of the HIV care continuum.

Table 1: The number of Female sex workers (FSWs) reached, tested for HIV, found HIV positive, enrolled for treatment and tested for viral load

Category	Indicator	n	%
Total Reach	Total FSWs reached	333	100
	Tested for HIV	107	32.04
HIV Testing	Tested for HIV	107	100
	Found HIV positive	3	2.8
HIV Treatment	Found HIV positive	3	100
	Enrolled in ART	3	100
VL Testing*	Tested for VL and received result	18	100
	Achieved VL suppression (of those tested for VL)	16	88.89

Viral Load (VL) Testing VL testing was conducted for 18 FSWs, which included individuals newly diagnosed with HIV during the reporting period as well as those who were previously diagnosed and already on ART or re-engaged in care.*

Table 2: The number of Priority Populations (PPs) reached, tested for HIV, found HIV positive, enrolled for treatment and tested for viral load

Category	Indicator	n	%
Total Reach	Total PPs reached	230	100
	Tested for HIV	109	47.39
HIV Testing	Tested for HIV	109	100
	Found HIV positive	14	12.84
HIV Treatment	Found HIV positive	14	100
	Enrolled in ART	35*	32.11
VL Testing*	Tested for VL and received result	132	100
	Achieved VL suppression (of those tested for VL)	125	94.7

35 PPs initiating antiretroviral therapy (ART) exceeded the number of newly diagnosed cases (14), due to the inclusion of previously diagnosed individuals who were not on ART or had been lost to follow-up before the intervention.*

Viral Load (VL) Testing VL testing was conducted for 132 PPs, which included individuals newly diagnosed with HIV during the reporting period as well as those who were previously diagnosed and already on ART or re-engaged in care.*

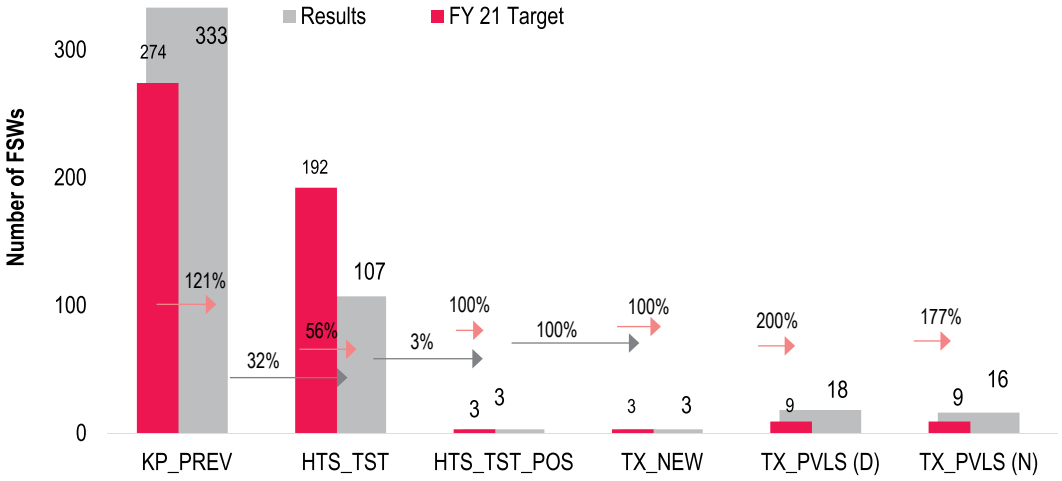

Figure 1: Cross-sectional HIV continuum of prevention, care, and treatment cascade for female sex workers in 2021.

Orange arrow shows the difference between achieved and target while blue arrow shows the difference within achieved populations.

KP_PREV = Number of key populations (female sex workers) reached with individual and / or small group level HIV prevention interventions designed for the target population

HTS_TST = Number of individuals who received HIV testing services and received their test results

HTS_TST_POS = Number of individuals newly identified HIV positive

TX_NEW = Number of individuals newly enrolled on antiretroviral therapy

TX_PVLS (D) = Total number of ART patients enrolled in the program with a viral load result documented in the medical or laboratory records/ LIS within the past 12 months

TX_PVLS (N) = Number of ART patients with suppressed viral load result documented in the medical or laboratory records within the past 12 months

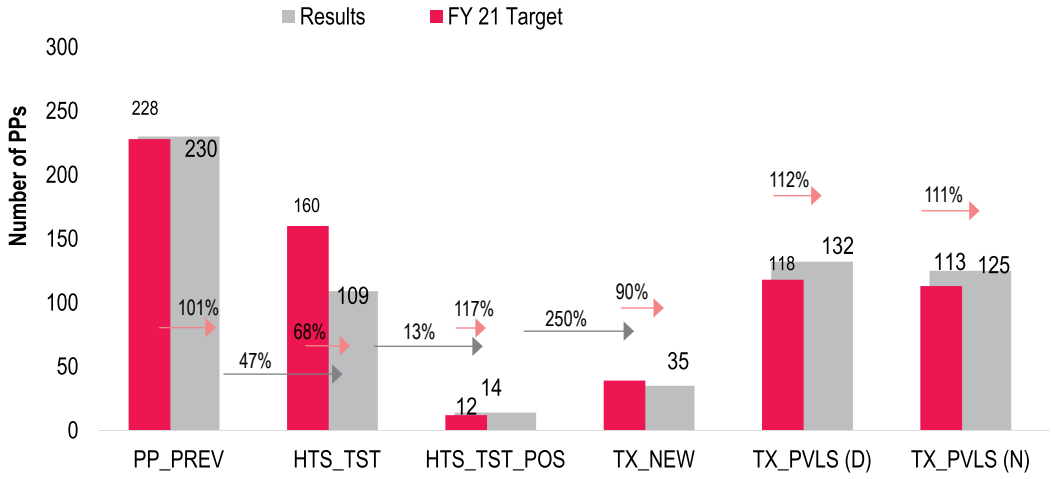

Figure 2: Cross-sectional HIV continuum of prevention, care, and treatment cascade for priority populations of Makwanpur district in 2021.

Orange arrow shows the difference between achieved and target while blue arrow shows the difference within achieved populations.

PP_PREV = Number of priority populations reached with individual and / or small group level HIV prevention interventions designed for the target population

HTS_TST = Number of individuals who received HIV testing services and received their test results

HTS_TST_POS = Number of individuals newly identified HIV positive

TX_NEW = Number of individuals newly enrolled on antiretroviral therapy

TX_PVLS (D) = Total number of ART patients enrolled in the program with a viral load result documented in the medical or laboratory records within the past 12 month

TX_PVLS (N) = Number of ART patients with suppressed viral load result documented in the medical or laboratory records within the past 12 month

Following the interventions, HIV testing and counseling services were provided to 107 FSWs (56% of the target of 192) and 109 PPs (68% of the target of 160). Among those tested, 3 FSWs and 14 PPs were newly diagnosed with HIV. All 3 FSWs diagnosed with HIV, along with 35 individuals from PPs initiated antiretroviral therapy (ART). Notably, the PPs initiating ART (35) exceeded the number of newly diagnosed cases (14), due to the inclusion of previously diagnosed individuals who were not on ART or had been lost to follow-up before the intervention. This reflects the program's success in addressing not only new diagnoses but also in re-engaging individuals with prior HIV diagnoses into care. Viral load testing was conducted for 18 FSWs and 132 PPs, exceeding the respective targets. This included individuals newly diagnosed with HIV during the reporting period as well as those who were previously diagnosed and PPs, exceeding the respective targets. This included individuals newly diagnosed with HIV during the reporting period as well as those who were previously diagnosed and already on ART or re-engaged in care. Viral suppression was achieved in 16 FSWs (exceeding the target of 9) and 125 PPs (surpassing the target of 113). These outcomes highlight the program's effectiveness in ensuring treatment adherence and achieving optimal health outcomes, even under the challenging circumstances of the pandemic.

Furthermore, HIV self-test kits were distributed to 230/333 (69%) FSWs and 126/230 (54.8%) PPs, enhancing accessibility and convenience for HIV testing. 21/333 (6.3%) FSWs and 192/230 (83.5%) PPs participated in community support retention services, reflecting the program's comprehensive approach to HIV care beyond just testing and treatment. Sexually transmitted infection (STI) screening was performed on 82/333 (24.6%) FSWs and 49/230 (21.3%) PPs, resulting in 17/82 (20.7%) FSWs and 13/49 (26.5%) PPs being diagnosed with STIs. Treatment was provided to 15/17 (88.2%) FSWs and 13/13 (100%) PPs, demonstrating a proactive approach to STI management, which is critical in preventing HIV transmission. Additionally, 53/333 (15.9%) FSWs were enrolled in pre-exposure prophylaxis (PrEP) for HIV prevention, an important strategy to reduce the risk of HIV transmission among high-risk populations. A total of 78,026 condoms were distributed, with 54,312 allocated to FSWs and 23,714 to PPs, reinforcing the program's commitment to safe sexual practices.

DISCUSSION

The COVID-19 pandemic significantly impacted HIV programs worldwide, causing substantial disruptions to access to HIV services. A study conducted in South Africa highlighted the adverse effects of the pandemic, particularly the sharp decline in HIV screening, diagnosis, and ART initiation.[9] In contrast, our findings indicate that HIV service access in Nepal remained stable and uninterrupted throughout the pandemic. Specifically, 121% of the annual HIV testing target for female sex workers (FSWs) was achieved, primarily due to the promotion of self-testing and the strong support from community-based staff and peer navigators. Similarly, the annual target for priority populations (PPs) was met, achieving 101%, underscoring the effectiveness of these community-centered models during a crisis. ART enrolment was also successfully maintained, with 100% enrolment among FSWs and 90% among PPs, highlighting the potential of these approaches for maintaining long-term treatment adherence.

Our findings suggest that the community-centered HIV service delivery model is sustainable and adaptable, especially in low-resource settings. A key strength of this study was the application of a cascade analysis tool, which identifies critical intervention points and optimizes resource allocation to improve health outcomes.[10] By identifying specific intervention points, the cascade tool helps streamline complex health systems and maximizes the impact of limited resources[11]. Initially developed to address mother-to-child HIV transmission, this tool has since been extended to other health conditions, including hypertension, cervical cancer, tuberculosis, diabetes, cardiovascular risk management, hepatitis, sexually transmitted diseases, addiction care, and mental health[7]. While previous research focused on viral load monitoring[12] and online service delivery[13] during COVID-19, our study emphasizes the critical role of community-led strategies and self-testing in sustaining healthcare access in times of crisis.

Although broader literature documents numerous barriers to HIV service delivery during the pandemic, our results demonstrate that community-cantered models can effectively overcome these challenges. Integrating self-

testing and community support into national HIV policies could enhance testing coverage, improve enrolment rates, and build resilience against future health system disruptions.[14] These models are particularly viable in low-resource settings, as they require minimal investment in training and self-testing kits.[15] Community involvement also strengthens the acceptance and effectiveness of these interventions, promoting local ownership and active engagement in healthcare delivery.

The public health impact of these models is profound, as they increase access to services and ensure the continuity of ART enrolment, which is essential for managing HIV. Future research should explore the scalability of these approaches in non-crisis settings and assess the sustainability of ART adherence among populations using self-testing. Additionally, studies should investigate how these models can be applied to other health conditions to broaden their impact. Studies from China and Ethiopia highlight severe disruptions to HIV service delivery during COVID-19, including declines in viral load tests and ART initiations.[16,17] In contrast, our study demonstrates the resilience of HIV programs in Nepal, which maintained service access and achieved or exceeded targets for HIV testing and ART enrolment, even during the pandemic.

Despite the successes, there are several limitations to the study. First, the study was conducted in Makwanpur district, which may not represent the national HIV situation. Results could differ in other parts of Nepal with varying healthcare resources or community engagement. Second, self-reported data for interventions such as community support participation and self-testing could introduce bias, like over reporting or recall issues. Additionally, while the cascade analysis tool proved effective for tracking HIV care continuum stages, its application is resource-intensive, making it less feasible in low-resource settings. Lastly, the rapid implementation of interventions during the pandemic may have led to limited follow-up with participants, which could impact long-term ART adherence and the sustainability of the results.

CONCLUSION

This study demonstrates the effective continuation of HIV prevention and treatment efforts in Makwanpur during the COVID-19 pandemic, surpassing targets for reaching, testing, and treating female sex workers and priority populations. Cascade analysis offered critical insights into the HIV care continuum, providing a clear evaluation of intervention effectiveness. These results underscore the importance of resilience in HIV programs and the necessity of on-going monitoring and adaptation to ensure optimal HIV service delivery. Based on these findings, we recommend further integration of cascade analysis to improve HIV care in resource-constrained settings.

CONFLICT OF INTEREST

There is no any financial interest or any conflict of interest related to this paper.

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