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Surveillance and Targeted Action to Prevent HIV/AIDS

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ABSTRACT

Epidemiological surveillance has played a key role in the identification of AIDS and its modes of transmission. In India, laboratory-based surveillance of HIV was initiated among most at-risk populations in 1990s, which was later expanded to antenatal clinics. On the basis of surveillance, high risk geographic areas and high risk populations were identified; and preventive behaviour change interventions were targeted among high risk groups in mid1990s. In 2003, analysis of surveillance data revealed a declining trend in HIV. Further analysis, indicated that targeted sexual behaviour change interventions among high risk groups had been responsible for the decline. The targeted behaviour change strategy among high risk groups was also found to be cost-effective. In the era of anti-retroviral therapy (ART), HIV prevalence trends would no longer be useful for tracking the epidemic. Hence, new laboratory essays are needed for tracking HIV incidence. Verbal autopsy method can provide direct estimates of HIV mortality trends to evaluate the effectiveness of ART. Since the number of new HIV infections is showing plateauing trend, further intensification of HIV/AIDS prevention and control efforts is required to achieve the end of HIV transmission and deaths due to AIDS by 2030.

Keywords: Public health, epidemiology, public health surveillance, HIV/AIDS prevention, control of AIDS, high risk population, sexual behaviour, anti-retroviral therapy.

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Epidemiological surveillance has historically played a key role in not only identification of new diseases but in their prevention, control, and eventually eradication also. The strategy of epidemiological surveillance and containment finally helped in eradication of small pox in the 1970s; and the same strategy is working successfully for eradication of poliomyelitis. Surveillance and targeted action has also played a significant role in controlling HIV epidemic; and now it is possible to plan for achieving zero HIV transmission rate and the end of AIDS by 2030 can be a reality.

Since the early days of 1980s, when Acquired Immunodeficiency Syndrome (AIDS) was recognised among gay men in Los Angeles, epidemiologic methods have not only successfully unravelled modes of its transmission but also paved the way for identification of causative organism – the Human Immunodeficiency Virus (HIV) - leading to the development of rapid diagnostic tests and anti-retroviral treatments.

In India, HIV infection was first identified among female sex workers in 1986. Later, in the same year sex workers started having signs of the disease. By that time there were about 20,000 AIDS cases worldwide, and concerns were raised about the capacity of India in coping with HIV and AIDS. In 1986, Dr. T. K. Ghosh pronounced *"Unlike developed countries, India lacks the scientific laboratories, research facilities, equipment, and medical personnel to deal with an AIDS epidemic. In addition, factors such as cultural taboos against discussion of sexual practices, poor coordination between local health authorities and their communities, widespread poverty and malnutrition, and a lack of capacity to test and store blood would severely hinder the ability of the Government to control AIDS if the disease did become widespread" (1).*

Keeping in view the challenging situation, in 1987, Government established the National AIDS Committee. According to Kakkar *et al.*(2001) by the end of 1987, around 135 people were found to be HIV positive and 14 had AIDS (2). Most of these cases had occurred through heterosexual sex, but by the end of the 1980s a rapid spread of HIV was noticed among injecting drug users in some of the north-eastern states. In order to combat the epidemic, National AIDS Control Organization (NACO) was established and first National AIDS Control Programme (NACP) was initiated in 1992. Its activities covered surveillance, blood screening, and health education. However, doubts were expressed about the extent to which the epidemic had affected Indian population. Dr. L. M. Nath, a leading epidemiologist commented in 1998: *"HIV infection is now common in India; exactly what the prevalence is, is not really known, but it can be stated without any fear of being wrong that infection is widespread... it is spreading rapidly into those segments that society in India does not recognise as being at risk. AIDS is coming out of the closet"(3).*

Therefore, laboratory-based surveillance of HIV, which was initiated in high-risk groups in early 1990s, was expanded to low-risk women in antenatal care clinics in 1998 to monitor the progression of the epidemic in general population. On the basis of limited data available at that time, Rao *et al*.(2001) had predicted a rapidly rising trend in India *"Country level projections ...show adult HIV incidence of 3–4 per cent, which is quite alarming" (4).*

As major rise in HIV had been predicted, we investigated the trend of HIV prevalence in young people attending antenatal care clinics and sexually transmitted disease clinics. HIV surveillance data of women attending antenatal clinics and men attending STD clinics was re-analysed in 2003 in Southern and northern states separately (5). These surveillance data had been collected and analysed by National AIDS Control Organisation every year which had suggested an overall rising trend. However, we noticed that HIV prevalence in women aged 15-24 years in southern states had fallen from 1.7% in 2000 to 1.1% in 2004, but the prevalence did not fall significantly in women aged 25-34 years (6). Therefore, we concluded *"A reduction of more than a third in HIV-1 prevalence in 2000-04 in young women in south India seems realistic, and is not easily attributable to bias or to mortality. This fall is probably due to rising condom use by men and female sex workers in south India, and thus reduced transmission to wives".*

These observations were fiercely contested (7). However, our further analysis of data again in 2004 and 2007 corroborated the declining trend observed first time in Tamil Nadu in 2003 (8). On the basis of surveillance data, high risk geographic areas and key populations had been identified and preventive behaviour change interventions had been targeted more vigorously among high risk groups during the second phase of National AIDS Control Program. The observed decline in HIV was expected.

The targeted intervention (TI) strategy among high risk groups was based on the hypothesis that prevention of HIV transmission from female sex workers to their male clients will result in lower rates of HIV transmission in males and subsequently it will lead to lower rates of HIV in their regular sexual contacts among women in general population. It was expected that this would lead to lower HIV prevalence among the antenatal women, particularly those in the younger age groups, who were more likely to have become sexually active recently. Prevalence of HIV infection in young antenatal women had been considered as a surrogate for the incidence of HIV. In 2003, our analysis of HIV sentinel surveillance data did reveal a declining trend in HIV in India, confirming the hypothesis (5).

Since the contribution of TI strategy in controlling HIV epidemic in program settings had not been formally evaluated, we conducted another analysis of HIV surveillance data to find out whether the trends of HIV decline are associated with

the implementation of targeted intervention programs. We conducted this study in southern states where prevalence of HIV was higher (Tamil Nadu, Karnataka, Andhra Pradesh and Maharashtra). Since targeted interventions had already been implemented, quasi-experimental approach was used to compare changes in HIV prevalence according to the intensity of targeted interventions.

The intensity of TI program implementation was measured by estimating the 'unmet need of condoms', i.e., the number of condoms required minus condoms supplied by TIs. Thus, districts in each southern state were ranked into quartiles based on the intensity of TI implementation. Among female sex workers (FSW), consistent condom use with last paying clients increased from 58.6% in 2001 to 83.7% in 2009. In high TI intensity quartile districts, on an average 186 condoms were distributed through TIs per FSW per year as compared to 45 condoms per FSW per year in the low TI intensity districts. Among young (15-24 years) antenatal clinic attendees, 58% decline was observed in HIV prevalence in high TI intensity districts whereas in low TI intensity districts there was no change in HIV prevalence. This indicated that Targeted Interventions were indeed associated with decline in HIV prevalence (9). We concluded that *"Targeted sexual behaviour change interventions among high risk groups, especially in female sex workers, had been responsible for the observed decline of HIV in India".*

Since large investments were needed to implement a wide range of prevention and treatment interventions, especially due to the need for scaling up of Anti-Retroviral Therapy (ART), the cost-effectiveness of various interventions was also required to refine HIV/AIDS control strategies. Therefore, we evaluated the cost-effectiveness of TI using a mathematical model over a 20-year time horizon, i.e., from 1995 to 2015, with a health system perspective. The incremental costs and effects of targeted interventions for female sex workers (FSW) were compared against the scenario of mass media education for the entire population of India.

Our model estimates indicated that targeted interventions for female sex workers would result in a reduction of 47% in the prevalent HIV cases by 2015. Adult HIV prevalence in India by 2015 would be 0.25% with FSW TIs but with only mass media campaigns the prevalence would be 0.48%. The estimated cost of targeted FSW TI was Rs. 4,748 per HIV infection averted and Rs. 490 per DALY averted (10). We had estimated *"At the current gross domestic product in India, targeted intervention is a cost-effective strategy for HIV prevention in India".*

Hence, HIV preventive programs were continued with vigour despite the resource crunch due to mounting expenditures for scaling up of anti-retroviral therapy (ART). Not only that the number of TIs were increased but the number of surveillance sites were also

increased in 2006, and new HIV epidemics among Men who have Sex with Men (MSM) and Injecting Drug Users (IDUs) were detected, which led to re-characterization of HIV epidemic in India as 'concentrated epidemic'.

As predicted in 2010, according to NACO estimates HIV prevalence among adults of reproductive age has indeed declined to 0.26% in 2015 (11). And now there is a well-established policy that at least 25% of HIV budget should be allocated to HIV prevention despite the need for expansion of the care and treatment programs which are also required to reduce mortality due to AIDS among HIV-infected people.

With widespread availability of ART, it is expected that by 2030 AIDS-related mortality can be totally prevented. Hence, there is need for monitoring cause-specific mortality. But considering the low rates of death registration and cause of death ascertainment in Indian Civil Registration System, it was difficult to monitor HIV/AIDS mortality trends. Hence, we have validated a verbal autopsy method – an interview-based inquiry for identification of probable causes of deaths from the description of symptoms and signs by the relatives of the diseased (12, 13). This field applicable tool proved invaluable in determining causes of death in a representative population. Thus, we could provide direct estimates of HIV-related mortality (about one lakh deaths in 2004) (14). Registrar General of India has incorporated verbal autopsy-based cause of death ascertainment method in the Sample Registration System which will provide HIV mortality trends over time.

Intensification of HIV prevention and treatment is required now more than ever before to stop HIV transmission, end stigma & discrimination, and to end deaths due to AIDS by the year 2030 (15). Newer strategies and resources for expansion of targeted preventive interventions, HIV testing and treatment services are required. HIV testing during pregnancy, as part of prevention of parent-to-child transmission (PPTCT), has expended in recent years, reducing infections in paediatric age-group. This initiative is providing country-wide large dataset for surveillance of HIV infections which is several times bigger than the data collected by HIV Sentinel Surveillance (HSS). However, biases in the PPTCT data need to be evaluated before switching on surveillance from HSS to PPTCT.

Hence, we carried out a systematic appraisal of routinely collected programme data for choosing a scientific, cost-effective, and ethical surveillance strategy. HIV prevalence estimates obtained from PPTCT programme and HSS were compared to find out the utility of PPTCT programme data for HIV surveillance. In 2007, HIV testing rate among pregnant women 76% in 372 ANC clinics where both PPTCT and HSS were carried out. Overall the correlation of HIV prevalence between PPTCT and HSS was 0.9 at state level but it was 0.6 at district or clinic level because the sample size tested at district level in HSS was very small compared to PPTCT (16). We concluded:

"Routinely collected PPTCT program data therefore has potential for providing reliable HIV time trends in various states of India".

These findings again indicating that PPTCT data can provide better estimates of HIV trends for general population even at local ANC clinic or district level. However, since HIV epidemic is now 'concentrated' in the high risk groups, integrated behavioural and biological surveillance (IBBS) assumes more importance. Hence, first IBBS was conducted in 2014 among female sex workers, injecting drug users, men who have sex with men, and transgender people, which provides invaluable insights for refining the program strategy (17).

IBBS has led to discovery of new hotspots among IDUs, MSM and transgender populations in northern India, whereas decline in HIV prevalence has been noted in areas where TI projects had been implemented earlier. However, due to widespread use of ART, HIV prevalence trends no longer would be useful in tracking the epidemic, though prevalence in younger age group (15-19 years) could be used as a surrogate for incident infections.

Incidence of HIV can only be monitored in cohorts, but this is expensive and time consuming. Hence, new laboratory essays are needed which can be used for epidemiological surveillance. We have recently used an avidity essay to indicate recent infections among high risk groups with promising results. Larger studies are required before these can be implemented in the HSS to have an estimate of the HIV incidence trends. In the era of ART, only incidence tracking will indicate at what rate HIV transmission is declining?

HIV surveillance should also employ molecular methods to track emergence of primary drug resistance. Genotyping methods using phylogenetic analysis can also reveal transmission patterns for better targeting of the resource to source population. In view of the current resource constraint scenario, this approach can help in increasing the efficiency of the targeted prevention strategy. Refinement of prevention and treatment strategies and a renewed intensification of HIV/AIDS prevention and control efforts are required now since the financial resource availability has stagnated and the number of new infections are also showing plateauing trend (18).

HIV thrives in key populations which are hard to reach as they face social exclusion due to social stigma and discrimination. Newer approaches are need to improve program coverage beyond 50%. Reaching the last mile with the interventions is much more difficult. It requires addressing other health and social problems faced by these populations such as depression, alcohol use and violence. IBBS should include surveillance for these conditions also, and future interventions would have to address these

problems so that access to prevention and treatment intervention goes up to beyond 90% and high coverage is sustained over long periods of time to achieve the zero HIV transmission and zero AIDS death by 2030 (15).

Only the biomedical approach may not end AIDS epidemic unless we address the social determinants that led to the emergence of HIV and fuelled the epidemic in the last century. A society which creates conditions for large scale unemployment and migration of single young males to industrial areas away from their homes and families, where rampant poverty in the absence of any means of livelihood indirectly promotes the option of selling sex for survival, and where same-sex couples are considered to be criminals, where extreme poverty leads people to forest in search of bush meat, is a fertile soil for emergence and sustenance of not only HIV but also for many other micro-organisms, and societies around the world will continue to pay the price of this social neglect. Emergence of several new infections in last 25 years, i.e., SARS, Ebola, H1N1 etc. are a testimony to this trend. Rapid urbanisation and globalisation would take the newly emerged organisms around the globe in short period of time.

A concerted global response is needed to address the social determinants of health and disease not only for HIV prevention and control but also for prevention and control of many other emerging and re-emerging infections and diseases. The systemic analysis and interpretation of routinely-collected surveillance data will continue to provide newer insights for preventive actions. The targeted public health approach of behaviour change, which led to the decline of HIV in India even before discovery of vaccine or drug for prevention, has once again underscored the importance of public health approach which needs to be nurtured and strengthened in India.

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