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ORIGINAL ARTICLE

# Seroprevalence and Efficacy of Prevention of Parent to Child Transmission Program Over a Decade in a Tertiary Care Hospital in Mumbai, Maharashtra

**Deepali Swapnil Kapote[1] · Michelle N. Fonseca[1] · Arun Harishchandra Nayak[1] · Swathi H. Vishwabharati[1] · Apeksha Mohite[1]**

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## Abstract

**Background** Parent to child transmission is the major mode of spread of HIV. An effective national health program (PPTCT) has been designed under NACO which helps in reducing the spread of HIV by vertical transmission and improving the life of the women and her baby.

**Methods** A retrospective study was done at a tertiary care hospital, including pregnant women registered and delivered, and those who came directly in labour at the hospital during a period of 10 years from January 2010 to December 2019. Pretest counselling, HIV testing, Post-test counselling were done, and antiretroviral prophylaxis was given as per the NACP guidelines. Sociodemographic characteristics, obstetric outcome and efficacy of PPTCT services were analysed.

**Results** Out of the 63,947 antenatal mothers included, 61,061 (95.4%) accepted HIV testing. 177 of these tested positive (0.289%) with a significant reduction in the seroprevalence over the decade. Majority of seropositive women were primigravida; housewives from urban areas, from low income and educational background and with no history of any contraceptive use. Out of 718 live births, the MTCT rate was found to be 4.5% at 6 weeks over the whole decade and was noted to be 1.8 % at 18 months which is well within the goal of PPTCT program and hence elucidating the success. Seventy-four spouses of the 177 seropositive women tested positive, 55 tested negative and 49 did not undergo the HIV testing. Decline in the number of partners not undergoing testing was elicited. The discordant couple rate in the study was 31% and showed variable trend over the decade.

**Conclusions** Our study has observed an overall increase in efficacy of PPTCT in terms of increased utilization of PPTCT through the decade, decrease in the vertical transmission and seroprevalence rate, increase in the acceptance rates of HIV testing by partner almost conquering the goal of NACO.

**Keywords** Antenatal women · Human immunodeficiency virus · Triple drug ART · PPTCT · Seroprevalence · Vertical transmission rate

Deepali Swapnil Kapote is a Assisstant Professor, Department of Obstetrics and Gynaecology, Lokmanya Tilak Medical College, Mumbai, India. Michelle N. Fonseca is a Professor Addl. and HOU, Department of Obstetrics and Gynaecology, Lokmanya Tilak Medical College, Mumbai, India. Arun Harishchandra Nayak is a Professor and Head of Department, Department of Obstetrics and Gynaecology, Lokmanya Tilak Medical College, Mumbai, India. H. V. Swathi is a Senior Resident, Department of Obstetrics and Gynaecology, Lokamanya Tilak Municipal Medical College and General Hospital, Mumbai, India. Apeksha Mohite is a Post graduate student, Department of Obstetrics and Gynaecology, Lokamanya Tilak Municipal Medical College and General Hospital, Mumbai, India.

Extended author information available on the last page of the article

## Introduction

HIV is still one of the world's most serious public health challenges, and there is a global commitment to curbing new HIV infections and ensuring adequate access to treatment. Parent to child transmission is one of the significant modes of infection.

India has a large proportion of these cases, estimated to be around 21.40 lakh with more than 42% of the total estimated people living with HIV (PLHIV) being females [1].

According to NACO statistics, the adult (15–49 years) HIV prevalence in India is estimated at 0.22% (0.16–0.30%). Women living with HIV are 9,08,600 out

of which estimated pregnant women living with HIV are 22,677 and those who are receiving ARV from PMTCT are 13,716 (60%) [1].

State wise Prevention of Mother-to-child transmission (PMTCT) numbers was highest in Maharashtra (2.41 lakh) followed by Uttar Pradesh (2.29 lakh), Bihar, Andhra Pradesh, Karnataka, Telangana, West Bengal, Gujarat and Tamil Nadu, least being in Sikkim [1].

The Government of India launched the National AIDS Control Program (NACP) way back in 1992 as a comprehensive program for the prevention and control of HIV/AIDS in India. The NACP instituted prevention of parent to child transmission (PPTCT) of HIV in 2001–2002 to provide HIV testing and treatment to all pregnant women registered for antenatal care (ANC) [2]. The vertical transmission rate was estimated to be 30–33% in the absence of any intervention, which dropped to around 3–5% with effective antenatal, intranatal and postnatal interventions for prevention of mother-to-child transmission of HIV (MTCT) interventions [2].

Antiretroviral (ARV) prophylaxis, which initially constituted a single dose of nevirapine given at the time of delivery, reduced the rate of transmission to 11% [3]. Later, it was changed to a more efficacious multi-drug ARV regimen, based on the new WHO guidelines of 2013. Triple drug regimen was initiated in all pregnant and breastfeeding women living with HIV regardless of their CD4 count or WHO clinical stage as early as possible in antenatal period, to prevent vertical transmission. These recommendations were a pivotal reform, reducing the risk of mother-to-child-transmission to less than 5% [4].

National strategic plan for HIV/AIDS and STI 2017–24 aimed to end HIV pandemic by 2030, adopting 90–90–90 strategy, i.e. 90% of PLHIV know their status, 90% of diagnosed PLHIV are on treatment and 90% of PLHIV on treatment achieve an undetectable viral load by 2020, with at least 75% reduction in new infections and elimination of stigma and discrimination [5].

NACO designed 4 prongs for PPTCT which included focus on primary prevention of HIV infection among men and women of the reproductive age, preventing unintended pregnancies among women living with HIV, integration of HIV testing in maternal child health units, early infant diagnosis, adequate counselling on the best feeding option for the baby, integration of HIV care, treatment and support for women found to be positive and their family [1, 2].

Our study aims to analyse the sociodemographic characteristics, determine the trend of seroprevalence of HIV in antenatal women, the testing rate and the utilization and efficacy of PPTCT services to minimize the risk of mother-to-child transmission at our centre which is one of the largest tertiary care hospitals in Mumbai.

## Methods

This was a retrospective observational study done at a tertiary care hospital attached with medical college in Mumbai. Study population comprised of all newly registered pregnant women attending antenatal care clinic and those presenting directly in labour during a period of 10 year from January 2010 to December 2019.

All these women who came for registration, underwent pretest counselling with 'opt out' technique, HIV testing, if they consented, using 3 different rapid antibody tests and post-test counselling, which was done by trained personnel as per the NACP guidelines. Those who delivered before 2013 were given prophylactic single dose Nevirapine therapy at the time of delivery and from 2013, they were started on triple dose ART (antiretroviral treatment) regimen (Tenofovir -300 mg + Lamivudine -300 mg + Efavirenz -600 mg) in a fixed dose combination as early as possible in the ANC period at ICTC centres attached to our college irrespective of CD4 count or clinical stage of the disease. For those who came in active labour and were found to be positive on finger prick testing in labour room, TLE regimen was initiated, blood was collected for CD4 count and ELISA testing was done for confirmation. Post-test counselling was done, and triple drug ART was continued after delivery.

All the babies were started on Syrup Nevirapine Prophylaxis (2 mg/kg) till 6 weeks. Infants were tested with dry blood spot collection at 6 weeks as per the new WHO 2013 guidelines. Early infant diagnosis was done in infants who were diagnosed as DBS positive. Confirmation was done by doing a whole blood sample test (WBS). If WBS was found to be positive, Paediatric ART was started irrespective of CD4 Count. The final confirmation of the HIV was done at 18 months in ICTCs, by doing all 3 rapid tests even if the first rapid antibody test was negative. Extended Nevirapine prophylaxis was given up to 12 weeks if mother had not received adequate duration of ART (i.e. 24 months) to suppress viral replication.

Simple statistical methods like mean, percentage and proportion were utilized to analyse results.

## Results

A total of 78,739 antenatal mothers were included in the study, of which 63,947 (81.21%) underwent pretest counselling. Among these, 95.48% (61,061) patients accepted HIV testing. Reasons for refusing testing at our centre included testing done in the past elsewhere, fear of knowing that they were positive or the presence of a negative report. 177 of these tested positive for HIV.

The sero-prevalence rate in the antenatally registered patients dropped to 0.089% in 2019 as compared to 0.5% in 2010 (Table 1). In spite of the increasing number of patients being tested. Triple drug Ante-retroviral (ARV) prophylaxis including TLE was commenced in all of them, as per the new guidelines from 2013 onwards. Prior to that 96% were given nevirapine prophylaxis in labour.

From 2010 to 2019, the acceptance rate of HIV testing, i.e. the number of antenatal women accepting the HIV test out of the total antenatal women receiving pretest counselling, showed an overall increase, and the reduction in sero-prevalance rate as shown in Fig. 1. There is a significant increase in acceptance of pretest counselling in ANC registered women. It was observed in the last 3 years that almost 100% of them undergo pretest counselling, and 99% of them have accepted the HIV test reflecting effective counselling services.

**Table 1** Year wise seroprevalance rate among ANC patients undergoing HIV testing

| Year | ANC receiving pretest counselling | ANC accepted HIV testing | ANC tested positive for HIV | Sero-prevalance (%) |
|---|---|---|---|---|
| 2010 | 5992 | 5373 | 30 | 0.50 |
| 2011 | 5990 | 5888 | 30 | 0.50 |
| 2012 | 5880 | 5846 | 21 | 0.35 |
| 2013 | 6578 | 5451 | 16 | 0.24 |
| 2014 | 6738 | 5880 | 24 | 0.35 |
| 2015 | 6768 | 6665 | 14 | 0.20 |
| 2016 | 6969 | 6945 | 10 | 0.14 |
| 2017 | 6540 | 6534 | 15 | 0.22 |
| 2018 | 5750 | 5743 | 11 | 0.19 |
| 2019 | 6742 | 6736 | 6 | 0.089 |
| Total | 63,947 | 61,061 | 177 | 0.289 |

We observed that majority of seropositive women were housewives residing in urban areas (i.e. Mumbai), without any addictions, from low income class, with a very poor educational background and lack of knowledge about HIV and AIDS. Majority of them (60.11%) were in the 20–25 year age group, with 14.6% being under 20. About 44.9% were educated till primary school. Only 3.3 % of them were graduates (Table 2).

49.7% were primigravida and majority of them registered their pregnancy in their second (61.7%) or third trimester (48%), with only 11.7% coming for their first visit in the first trimester. 80.8% revealed that husbands had addictions to alcohol/tobacco/illicit drugs.

It was observed that a staggering 75.21% of the women who tested positive had not used any form of contraception (Table 2). Thus, it is imperative that knowledge about HIV and modes of spread be imparted from a younger age, even to the non-pregnant counterparts and male members of the society. Social media, awareness campaigns regarding sex education and safe sex practices, importance of dual contraception play a crucial role in reducing the seroprevalence of the disease.

## Pregnancy outcome

Out of the 718 deliveries over 10 years, 78% were normal vaginal deliveries and 20.5% underwent caesarean section.

It was also observed that the rate of caesarean section in these patients has increased over the years from 10% in 2010 to 39.5% in 2019 with curve showing a gradual increase over the decade. However, this is comparable to our overall institutional caesarean section rate of 38% for the year of 2019. The caesarean section was never intended as a procedure to prevent PPTCT. The rise in caesarean section rates can be

**Fig. 1** Acceptance rate of HIV testing among antenatal women and seroprevalence

**Table 2** Sociodemographic characteristics of seropositive women antenatally registered at our hospital

| | No. of women | Percentage |
|---|---|---|
| Sociodemographic factors | | |
| Age | | |
| < 20 | 25 | 14.6 |
| 20–25 | 107 | 60.11 |
| > 25 | 45 | 25.2 |
| Occupation | | |
| Housewife | 154 | 87.07 |
| Labourer | 14 | 7.8 |
| Service | 9 | 3.9 |
| Religion | | |
| Hindu | 70 | 39.3 |
| Muslim | 91 | 51.6 |
| Others | 16 | 8.9 |
| Residence | | |
| Urban | 116 | 65.16 |
| Rural | 61 | 34.2 |
| Education | | |
| Illiterate | 61 | 34.2 |
| Primary | 81 | 44.9 |
| Secondary | 29 | 16.29 |
| Graduate | 6 | 3.3 |
| Gravida | | |
| Primigravida | 88 | 49.7 |
| Multigravida | 89 | 49.4 |
| Trimester of pregnancy registration | | |
| First | 18 | 11.7 |
| Second | 110 | 61.7 |
| Third | 49 | 26.9 |
| Contraceptive practice | | |
| None | 134 | 75.2 |
| Condoms | 30 | 16.8 |
| IUCD | 5 | 2.8 |
| OCP | 8 | 5.05 |
| *Addiction* | | |
| Wife | | |
| Yes | 21 | 12.3 |
| No | 156 | 88.13 |
| Husband | | |
| Yes | 144 | 80.8 |
| No | 33 | 19.10 |

attributed to varied indications, most common being, previous section, fetal distress, prolonged labour, breech presentation, multiple gestations, and other obstetric indications (Table 3).

All live babies born were given ARV prophylaxis (syrup nevirapine) after 2013 up to 6 weeks (Fig. 2). HIV testing using dried blood spot (DBS) was done in 82.07% babies at 6 weeks of birth, and about 61% of the babies were tested at 18 months. Rest of the babies were lost to follow-up for the tests. In the due course of time a total of 50 babies expired out of which only 2 babies tested positive for HIV.

**Table 3** Indication of caesarean section

| Indication | Number of caesarean section | % |
|---|---|---|
| Fetal distress | 251 | 35 |
| Previous LSCS | 272 | 38 |
| Twins | 15 | 2 |
| DTA | 28 | 4 |
| Breech presentation | 21 | 3 |
| Eclampsia | 72 | 10 |
| CPD | 22 | 3 |
| APH | 15 | 2 |
| Non progress of labour | 13 | 2 |
| Others | 7 | 1 |

Over the whole decade the overall transmission rate at 6 weeks was 4.5% and that at 18 months was 1.8% (Fig. 3).

However, this study shows there is a significantly decreasing trend after triple dose regimen was initiated in 2013. It was 1.5% in 2014, which reduced to 0 in 2019 at 18 months till date elucidating the success of the new treatment regimen and the PPTCT program (Table 4).

However, there is significant loss of follow-up of babies (39% of births) at 18 months which emphasises the need to increase the effectiveness of counselling and awareness.

All the mothers delivered in our hospital were counselled for exclusive breastfeeding for 6 months after assessing AFAAS criteria.

The husbands of seropositive patients were counselled and 72.3% agreed to undergo the HIV test. 74 spouses of the 177 seropositive women tested positive, 55 tested negative and 48 did not undergo the HIV test. There was a declining trend amongst the number of spouses not willing for testing, indicating increased efficacy of the PPTCT services in partner identification and testing.

The overall rate of discordant couples in our study, where the partner of an HIV positive woman was HIV negative, was 31%.

As shown in Fig. 4, the proportion of discordant couples has shown a variable trend through the years. The women could have acquired the virus through sources other than their husbands such as blood/blood products, other sexual partners, vertical transmission or IV drug users.

Increased awareness regarding importance of barrier protection, i.e. using condoms along with another method of contraception, access to ART and effective post-exposure prophylaxis to prevent the spread of the infection to their partners, plays a significant role in the same (Fig. 5).

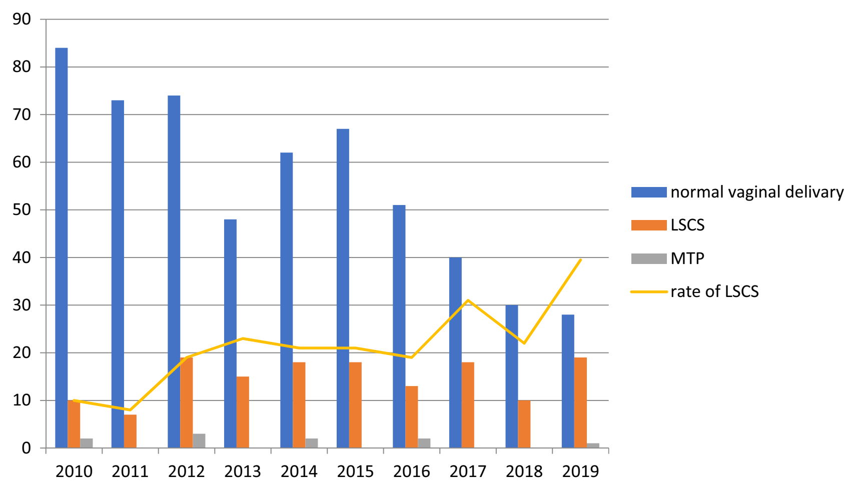


**Fig. 2** Mode of delivery in seropositive patients

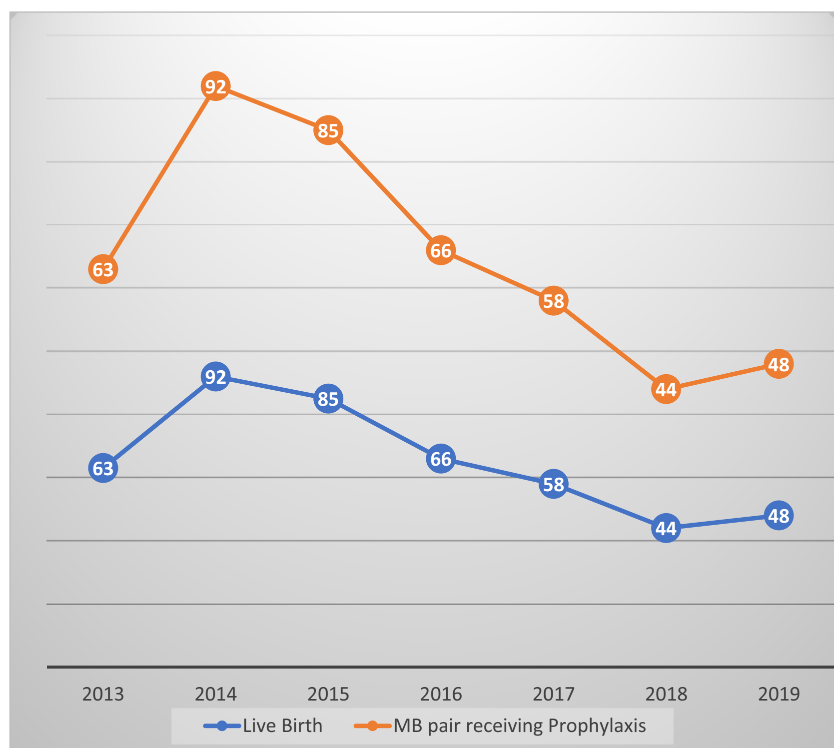


**Fig. 3** Trend of no. of live births to seropositive mother and mother baby pair receiving prophylaxis

## Discussion

In our study, the overall pretest counselling rate was 81.21% over a period of 10 years and 95.48% accepted HIV testing. The trend of increase in the acceptance of testing from 89.6% in 2010 to 99.9% in 2019 is observed in our study.

Similarly, Mohite et al. [6] also reported an increase in the HIV testing, from 88.9% to almost 100% over 10 years in rural Maharashtra. In the Study by Samuel et al. [7], 99.2% agreed to participate in the pretest counselling and 99.8% accepted HIV testing in rural parts of South India. Shiradkar et al. [8], Kwatra et al. [9], and Radhika et al. [10] reported an acceptance rate of 72.0%, 82.48% ,and 91% respectively of HIV testing.

The seroprevalence rate in our study was low compared to other studies, and there has been an overall decrease in the seroprevalence rate of HIV positive antenatal women in India, from 0.48% (52,806) in 2007 to 0.21% (22,677) in 2017, with Maharashtra having the highest number of HIV positive ANC women all over India [1]. Our study also shows that the overall seroprevalence is 0.28% over a decade and has diminished through the years, from 0.58 in 2010 to

**Table 4** Year wise distribution of Neonatal outcome and HIV status by DBS and testing at 18 months among the total live births

| Year | Live birth | DBS done | DBS positive | Repeat WBS positive | Put on ART | Infant diagnosis done at 18 months | No. of positives at 18 months (newly detected) | |
|---|---|---|---|---|---|---|---|---|
| 2010 | 96 | 89 | 2 | 2 | 1* | 50 | 0 | *1 expired |
| 2011 | 80 | 65 | 3 | 3 | 2* | 58 | 1 | *1 not willing |
| 2012 | 96 | 79 | 10 | 8 | 8* | 65 | 0 | *1 went to Faziabad |
| 2013 | 63 | 35 | 9 | 2 | 10* | 36 | 3 | *1 Baby put on ART on basis of symptoms |
| 2014 | 82 | 77 | 2 | 1 | 1 | 65 | 1 | *1 baby went to native place in Karnataka |
| 2015 | 85 | 71 | 0 | 0 | 0 | 64 | 1 | |
| 2016 | 66 | 60 | 0 | 0 | 0 | 52 | 1 | |
| 2017 | 58 | 51 | 0 | 0 | 0 | 20 | 1 | |
| 2018 | 44 | 25 | 1* | 0 | 0 | 26 | 0 | Expired* |
| 2019 | 48 | 40 | 0 | 0 | 0 | 1 | 0 (till now) | |
| Total | 718 | 592 | 27 | 16 | 15 | 438 | 8 | |

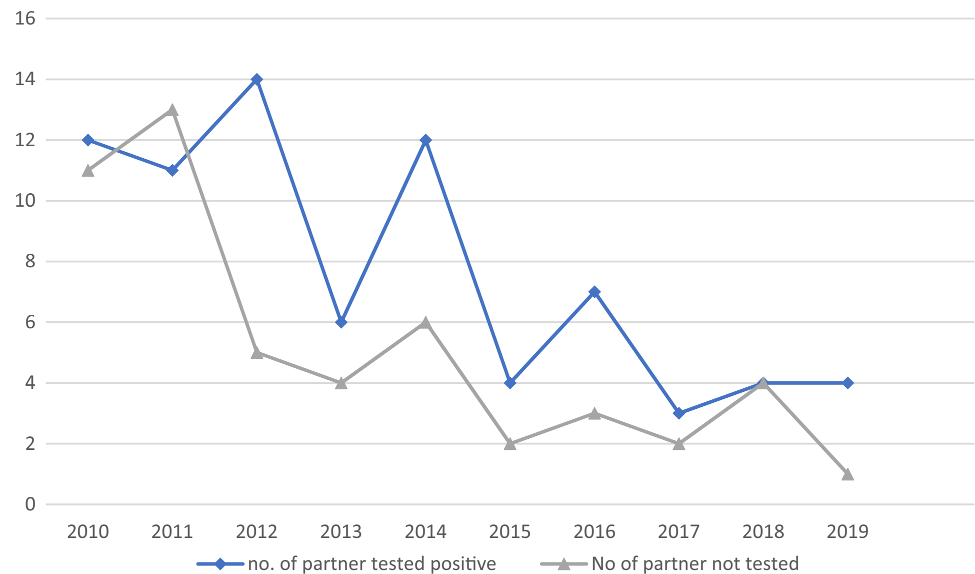


**Fig. 4** Testing among partners of seropositive women

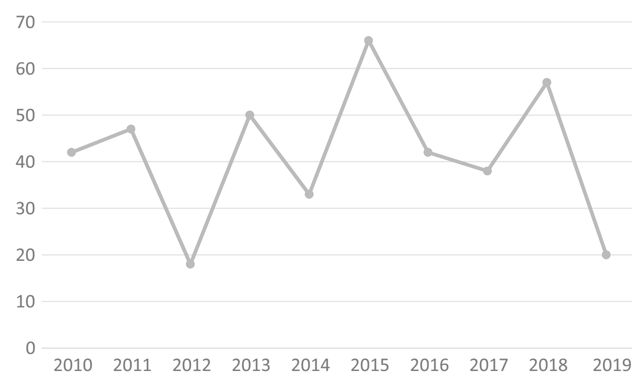


**Fig. 5** Trend of discordant couple over the decade

0.089 in 2019. Table 5 demonstrates different studies and comparable seroprevalence in various parts of India.

In our study, 50.5% of the antenatal seropositive mothers were primigravidas, with majority being from low income classes, with a very poor educational background and housewives. Most lived in an urban area, since our study was conducted in a tertiary hospital in Mumbai, the largest metropolitan of India. Most of the women themselves denied any addictions, but 81.29% revealed that husbands had addictions to alcohol/tobacco/illicit drugs. More than 75% of the women who tested positive did not use any form of contraception.

In a study done by Kwatra et al. [9], 95.86% were married, most of them were primigravidas (43.44%) with low

**Table 5** Seroprevalence in pregnant women in various studies from India

| Study | Location | Seroprevalance | Period of study |
|---|---|---|---|
| Our study | Mumbai | 0.289 | 2010–2019 |
| Nayak et al. [11] | Cuttak | 0.5% | 2014 |
| Radhika et al. [10] | Delhi | 0.1–0.25% | 2002–2015 |
| Mohite al. [6] | Rural Maharashtra | 0.8% | 2002–2015 |
| Shah et al. [12] | Mumbai | 1.4% | 1993–2004 |
| Sameul et al. [7] | Rural Tamil Nadu | 0.8% | 2006–2011 |

socioeconomic status (77.93%), housewife by occupation (67.58%), having no addictions (86.20%) and with no contraceptive use (72.41%), which complied with our study. The study population in their study were women from rural Maharashtra; hence, majority were Hindu (79.31%) rural (81.37%) women. Potty et al. [13] found that majority of seropositive women were uneducated housewives. The general trend observed is that most seropositive women are from a low socioeconomic class with a lack of knowledge about HIV. Thus, widespread education to the masses in a language they understand and using a method that they will accept and comply with the information given is the need of the hour, such as group counselling with husbands, in-laws and other family members [14]. This facilitates the elimination of stigma regarding the disease and facilitates early and effective treatment of the mothers.

In our study, about 78% of the patients delivered vaginally, and 20.5% underwent caesarean section over a decade. It was observed that there is a gradual increase in caesarean section rates over the decade. However, in spite of a significant number of vaginal deliveries, the rate of MTCT is 1.8% at the age of 18 months indicating that role of adequate treatment with ART is more than mode of delivery in preventing mother-to-child transmission.

Caesarean section is not recommended for prevention of mother-to-child-transmission and is to be performed only if there is an obstetric indication as per NACO PPTCT guideline, 2013 [2]. The rise in caesarean section rates in our study over the decade can be attributed to overall increase in the rate of caesarean section in obstetrics.

The mother–baby pair (100%) who delivered after 2013 in our study were given nevirapine prophylaxis. According to the study done by Kwatra et al. [9], 86% of women and 80% of newborns received Nevirapine prophylaxis. Mohite et al. [6] reported that 86.1% of mother–baby pairs received nevirapine prophylaxis.

Study conducted in Ananthapur district, where all HIV-infected pregnant women were given triple drug antiretroviral therapy (ART) regardless of the CD4 lymphocyte count, the MTCT rate reported was 3.7% in 2013–2014 [15].

A study conducted earlier in 2011 by Rajaram et al. [13] in Belgaum district showed that nearly, 7.8% of the exposed babies were infected with HIV by age of 24 months through vertical transmission. The rate of transmission was 24%, for babies when neither the baby nor the mother was administered Nevirapine.

Comparing these with our study, there is rapid decline in the number of infected babies at 18 months over a decade after the newer triple dose ART regimen and the overall rate being 1.8%.

75.14% of partners of the HIV positive antenatal women underwent HIV testing in our study, and 43.5% of those tested were HIV positive with an overall increase in partner testing over the decade. It was also evident that there was a decline in the prevalence of discordant couple in our study.

In study done by Shiradkar et al. [8], and Dadhwal et al. [16], 76.95% and 80% partners tested positive, respectively. Mohite et al. reported a partner testing rate of 54.9%, with an increasing trend of acceptance over the years, as stated in our study.

Study done by Salvaraj et al. [17] in Gujrat, India, in 2015 analysed that the rate of partner testing was 31% and sero-discordance rate was 39%, which is higher compared to our study.

Identification of patients living in serodiscordant relationships depends upon disclosure of HIV status to the partner and having the partner tested for HIV. As HIV is a disease driven by behavioural factors entangled within complex sociocultural and legal contexts, there are numerous challenges involved in partner disclosure and testing which needs to be tackled by increasing awareness.

## Conclusion

As depicted by our study, the seroprevalence rate in antenatal women has decreased over the decade, and utilization of PPTCT services has increased with > 95% testing and treatment rate, reflecting the success of the national PPTCT programme and the PPTCT centre at our institute. We have achieved the goal of 90–90–90 strategic plan by National AIDS control program well before hand.

The rate of MTCT has almost touched 4.5% at 6 weeks and 1.8% by the age of 18 months with effective triple ART regimen conquering the goal of NACP.

It is still an uphill task to strive towards elimination of mother-to-child transmission of HIV, and certain areas and sociodemographic groups need special attention. Educating and empowering women and creating awareness about HIV in the general public to overcome the social stigma attached to this disease, increasing the acceptance of HIV

testing, especially among spouses and specialized antenatal and postnatal care are some measures that can help. Good coordination and team work between obstetricians, ART team and pediatricians have increased the efficacy of the program and complete elimination of MTCT in India can be achieved soon with the constant efforts.

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## Compliance with ethical standards

**Conflict of interest** Nil.

**Research involving human participants/animals** The study was approved by the institutional research ethics committee-LTMMC and LTMGH , Mumbai and the study was performed in accordance with the ethical standards as laid down in the1964 Declaration of Helsinki and its later amendments.

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## About the Author

**Dr. Deepali Swapnil Kapote** is Assistant Professor, LTMMC, Sion, Mumbai, India. She is Consultant Gynaecologist, Obstetrician and Laparoscopic Surgeon attached to LTM General Hospital, Currra, and Jupiter hospital Thane, and MUHS recognised undergraduate and postgraduate teacher. Her main area of interest is Gynec endoscopic surgeries and high risk obstetrics. She is awarded postgraduate diploma in ART and reproductive medicine from prestigious Keli school of Fertility, Germany . She has various publications in national and international journals in her name. She has also been awarded with several Prestigious Prizes and awards like "V H Mazumdar Memorial prize" for the academic excellence in MS OBG postgraduate exams from KEM hospital, Young Scientist award for the year 2020 in annual TOGS conference.

## Authors and Affiliations

**Deepali Swapnil Kapote**[1] · **Michelle N. Fonseca**[1] · **Arun Harishchandra Nayak**[1] · **Swathi H. Vishwabharati**[1] · **Apeksha Mohite**[1]

✉ Swathi H. Vishwabharati
swathi.vishwa@gmail.com

1 Department of Obstetrics and Gynaecology, Lokmanya Tilak Medical College, Mumbai, India