Health Policy and Planning, 2025, 40(5), 578–584
DOI: https://doi.org/10.1093/heapol/czaf006
Advance Access Publication date: 3 April 2025
Innovation and Practice Report

Delivering integrated and standardized services to eliminate mother-to-child transmission of sexually transmitted infections: experience of the E-Clinic model in a Chinese pilot district

Yali Luo[1], Shuang Gao[2], Jiahong Chen[1], Dingyan Lv[1], Weizhen Mai[1], Wei Wang[1,*], Yuanfang Zhu[3]

[1]Department of Health Care, Shenzhen Baoan Women's and Children's Hospital, No. 56 Yulv Road, Xin'an Street, Guangdong 518101, China
[2]Department of Maternal Health Care, Guangdong Women and Children's Hospital and Health Institute, 521 Xingnan Avenue, Panyu District, Guangzhou 511400, China
[3]Maternal-Fetal Medicine Institute, Shenzhen Baoan Women's and Children's Hospital, No. 56 Yulv Road, Xin'an Street, Guangdong 518101, China

*Corresponding authors. Wei Wang, Department of Health Care, Shenzhen Baoan Women's and Children's Hospital, No. 56 Yulv Road, Xin'an Street, Guangdong 518101, China. E-mail: wangwei-243243@163.com

Accepted 2 April 2025

Abstract

The elimination of mother-to-child transmission (EMTCT) of syphilis and hepatitis B virus (HBV) is a crucial strategy for preventing and reducing new pediatric infections. Timely and standardized EMTCT interventions for maternal infections have been demonstrated to be highly cost-effective and efficient. Regrettably, healthcare providers have encountered challenges in delivering these interventions due to the complexity of multidepartment referrals. Baoan district in Shenzhen, Guangdong Province, which serves as one of the six national pilot districts tasked with exploring effective EMTCT strategies, has pioneered the integration of infection management into antenatal care by establishing the E-Clinic (short for the Elimination of mother-to-child transmission Clinic) within the Obstetrics Department. The E-Clinic, through its provision of integrated services, has witnessed increased coverage of syphilis treatment for pregnant women living with syphilis, as well as increased coverage of antiviral treatment for high-risk pregnant women living with HBV. The E-Clinic has been recognized as a best practice for EMTCT by the World Health Organization and has been widely adopted and adapted in over 100 maternal and child healthcare institutions across Guangdong Province. The success of the E-Clinic underscores the importance of government leadership, innovation, and multilevel engagement in promoting standardized EMTCT services, providing insights for implementing EMTCT strategies in other regions worldwide.

Keywords: elimination of mother-to-child transmission; integrated; standardized; syphilis; hepatitis B virus; China

Introduction

The elimination of mother-to-child transmission (EMTCT) represents a crucial strategy in preventing and reducing new pediatric infections of syphilis and hepatitis B virus (HBV). In China, the incidence rate of congenital syphilis (CS) has experienced a concerning rise, rising from 0.01 cases per 100 000 live births in 1991 to 69.9 cases per 100 000 live births in 2013 (Gong et al. 2014, Qin et al. 2014). Additionally, ~6.17% of Chinese pregnant women are living with HBV (Liu et al. 2021), with mother-to-child transmission (MTCT) accounting for the majority of new HBV infections (Lamberth et al. 2015). This underscores the urgent need for effective prevention strategies.

Evidence shows that timely treatment of maternal syphilis has been effective in reducing the incidence rate of CS (Pascoal et al. 2023). Similarly, the provision of maternal antiviral prophylaxis has been recommended as an additional protective measure for infants born to mothers with high HBV DNA levels (Hyun et al. 2017). Despite the proven cost-effectiveness and efficiency of these interventions in reducing the rates of MTCT (Hawkes et al. 2011, Zhang et al. 2019, Liu et al. 2020), the implementation of maternal treatment in China has been suboptimal over the past decades.

For instance, in 2013, 55.4% of pregnant women with syphilis infection received no treatment or initiated treatment after 37 gestational weeks (Dou et al. 2016). Data from the collaborative China–World Health Organization (WHO) pilot project conducted in eight counties across four provinces indicated that the HBV DNA test rate was <1% among mothers with HBV infection (Xv 2020). One of the significant barriers to treatment adherence is the disjointed healthcare system, where treatment is not offered within the same depart-

© The Author(s) 2025. Published by Oxford University Press in association with The London School of Hygiene and Tropical Medicine.
This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (https://creativecommons.org/licenses/by-nc/4.0/), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact reprints@oup.com for reprints and translation rights for reprints. All other permissions can be obtained through our RightsLink service via the Permissions link on the article page on our site–for further information please contact journals.permissions@oup.com.

Key messages

- To address the challenges in treatment adherence among pregnant women with syphilis or hepatitis B virus (HBV) undergoing maternal interventions across various departments, Baoan district has established the E-Clinic, which stands for the Elimination of mother-to-child transmission Clinic, within the Obstetrics Department of each maternal and child health hospital.
- The E-Clinic offers a comprehensive one-stop service for pregnant women diagnosed with syphilis or HBV infection. It provides integrated and standardized intervention services in conjunction with regular antenatal care and ensures continuous follow-up throughout the gestational period.
- The implementation of the E-Clinic has witnessed increased coverage of maternal treatments among pregnant women living with syphilis or HBV.
- Adhering to the construction framework and guidance provided by the E-Clinic, regions can readily replicate this model and adapt it to suit local circumstances, optimizing the approach as necessary.

ment that conducts the screening tests (Zhang et al. 2018). In many regions across China, pregnant women who tested positive were referred to dermatologists or hepatologists for treatment, while obstetricians focused exclusively on providing antenatal care (ANC) services. This division had a notable effect on treatment adherence and follow-up, as some diagnosed women either neglected to seek consultation upon referral or sought intervention only at a late stage.

In response, the Chinese government integrated a nationwide prevention program for MTCT of Human Immunodeficiency Virus, syphilis, and HBV into the existing maternal and child healthcare (MCH) system in 2010. Since 2015, a nationwide effort has been underway to prevent MTCT of these "triple diseases" (Qiao et al. 2019). In September 2017, the National Health Commission of China launched a pilot project in the provinces of Zhejiang, Guangdong, and Yunnan to explore effective strategies for EMTCT, with Baoan district in Shenzhen, Guangdong Province, selected as one of the six pilot districts (Baoan Daily 2024).

Baoan district, the largest in area and most populous among Shenzhen's 10 administrative divisions, also boasts the highest birth rate. In 2022, the total population of Baoan was 5.17 million, with ~81% being nonregistered residents. By 2023, the number of births in Baoan reached 36 000, representing nearly a quarter of Shenzhen's total births (see Supplementary Material 1). Annually, the district reports ~95 cases of syphilis and 3500 cases of HBV infection among pregnant women (see Supplementary Material 2), posing significant challenges in delivering EMTCT services due to its large catchment population, high mobility, and the elevated prevalence of maternal infections.

Confronted with challenges in providing EMTCT interventions, primarily stemming from the inconvenience of accessing various services in separate departments, Baoan district took a pioneering step by setting up the EMTCT clinic within the Obstetrics Department (Yin et al. 2024). This initiative marked the integration of maternal infection management with ANC services. To ensure confidentiality and reduce stigma, Baoan district opted to name the clinic "E-Clinic," using the English abbreviation for the EMTCT clinic.

Materials and methods

The E-Clinic provides one-stop services for all pregnant women affected by syphilis or HBV infection. Skilled obstetricians provide integrated intervention services free of charge, in addition to regular ANC services and continuous follow-up throughout the pregnancy.

Intervention package (Fig. 1)

Triage after screening

During the initial ANC visit at the Obstetrics Department, pregnant women will undergo screening for syphilis and HBV. If the results are positive, they will receive a text message within 30 min, reminding them to visit the E-Clinic for pregnancy interventions starting from their next ANC appointment until delivery. The message will provide appointment details while ensuring confidentiality.

Maternal treatment

Obstetricians at the E-Clinic will offer free treatment for these pregnant women following the EMTCT Guideline and Management Algorithm (National Health Commission, United Nations Children's Fund 2018, National Health Commission 2020, Liu et al. 2022), ensuring thorough communication and informed consent.

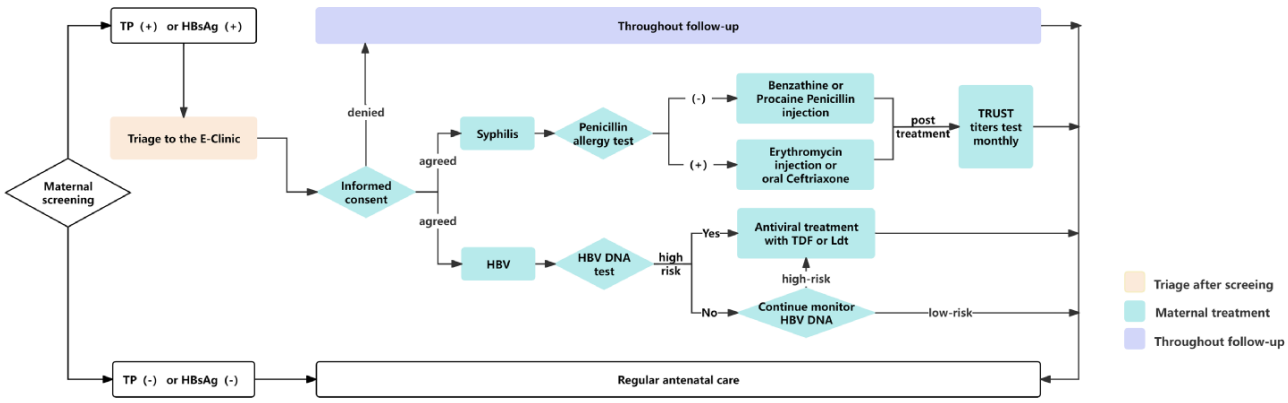

Figure 1. The intervention package of the E-Clinic in Baoan district.

For pregnant women with syphilis infection, the treatment options include Benzathine Penicillin injections (2.4 million units weekly for 3 weeks) or Procaine Penicillin injections (0.8 million units daily for 15 days). Alternatives such as erythromycin or ceftriaxone will be available for penicillin-allergic patients. Post-treatment, monthly monitoring using the tolulized red unheated serum test will be conducted to assess infection status. It is worth noting that due to the guideline update, there have been certain adjustments made to the requirements of standardized treatment. Between 2018 and 2020, adherence to standardized treatment necessitated fulfilling three conditions: (I) appropriate administration of penicillin, (II) undergoing two treatment courses during pregnancy spaced 2 weeks apart, and (iii) finishing the second course in late pregnancy. However, the criteria were updated in 2021 to include (I) receiving treatment with penicillin, (ii) undergoing a comprehensive treatment course, and (iii) completing treatment at least 1 month before delivery.

Pregnant women with HBV infection will undergo liver function tests and HBV DNA tests. Those with a high viral load of HBV are recognized as high risk for MTCT and are required to initiate antiviral treatment (ART) at either 24 or 28 weeks of pregnancy. Tenofovir disoproxil fumarate (TDF) is the preferred option, while telbivudine is recommended for individuals with kidney disease or severe osteoporosis. Additionally, due to guideline updates, the classification of high-risk individuals between 2018 and 2020 included those with a viral load of $\geq 2 \times 10^6$ IU/ml. However, starting from 2021, the threshold for high-risk individuals was lowered to 2×10^5 IU/ml.

Throughout follow-up

Obstetricians at the E-Clinic will provide consistent follow-up for each pregnant woman with an infection throughout their pregnancy. During the follow-up process, they will collect data on maternal intervention in accordance with project management requirements (see Supplementary Material 3).

Scaling up across the district

On 27 November 2018, Baoan Women's and Children's Hospital took the initiative to establish the E-Clinic. In December 2018, the Health Commission of Baoan district initiated a scale-up plan to introduce the E-Clinic model to cover the remaining 17 MCH hospitals in the district, including both private and public facilities. By March 2019, all MCH hospitals in Baoan district had integrated the E-Clinic model, ensuring standardized service delivery. This ensures that all pregnant women with syphilis or HBV infection receive high-quality care at the E-Clinic, guaranteeing equal access to quality healthcare.

Results

Comparisons and trends in the indicators

Data on maternal interventions, extracted from the Case Report and Monthly Report (see Supplementary Material 3), were used to create a database with EpiData 3.0. Indicators relevant to the intervention process, as detailed in Supplementary Material 4, were evaluated following the National Guidance Manual (National Health Commission 2022) and aligned with the global EMTCT validation criteria (World Health Organization 2021).

The year 2018 was defined as the prepractice period as it served as the preparatory phase for the E-Clinic, while the period from 2019 onward was defined as the postpractice period. This is because it was not until March 2019 that all 18 MCH hospitals in Baoan district fully implemented the E-Clinic model, thereby ensuring the standardized provision of services. The study first utilized "Pearson's chi-squared" test to compare the indicators between the pre- (2018) and post- (2019–2023) practice periods. In addition, the Joinpoint Regression Program (Version 5.0.1) was employed to analyze annual trends from 2018 to 2023. This analysis involved calculating the annual percentage change (APC) and its 95% confidence interval (CI), with a two-tailed *P*-value of <.05 considered statistically significant.

For maternal syphilis interventions, the postpractice period showed significantly higher coverage for overall treatment (Fig. 2a), adequate treatment (Fig. 2b), and standardized treatment (Fig. 2c) compared to the prepractice period. As shown in Table 1 and Supplementary Material 5a, trend analysis revealed a significant annual percentage increase in both adequate treatment (APC = 3.630, 95% CI 0.107–7.278, $P = .046$) and standardized treatment (APC = 5.426, 95% CI 0.645–10.435, $P = .034$).

Regarding maternal HBV interventions, there was a significant increase in the coverage for HBV DNA tests (Fig. 2d) and ART in high-risk women (Fig. 2e) compared to the period prior to practice. As detailed in Table 2 and Supplementary Material 5b, trend analysis indicated a significant annual rise of 23.542% in ART coverage among high-risk women (APC = 23.542, 95% CI 0.871–51.309, $P = .044$).

Recognition and promotion

In 2021, the WHO recognized the E-Clinic as a best practice for EMTCT. From 2022 to 2024, it was incorporated into international training programs, including the MCH training hub for Belt and Road Initiative Countries, EMTCT training for developing nations, and the China–Association of Southeast Asian Nations EMTCT training initiative. In 2023, the Health Commission of Guangdong Province included the E-Clinic model in the "Guangdong Province EMTCT Action Plan (2023–2025)" (Health Commission of Guangdong Province 2023) and promoted it extensively across the province. This plan offers guidance to all MCH institutions on the essential elements of the E-Clinic model, covering facility requirements, medication supply, training programs, standard operating procedure files, promotion strategies, and data collection protocols. With this clear and effective framework, the E-Clinic can be readily implemented in regions with limited resources, tailored to local conditions. By December 2024, over 100 MCH institutions have established the E-Clinic, showcasing the widespread adoption and impact of this innovative model in improving maternal health delivery.

Discussion

Challenges

The E-Clinic was implemented and promoted despite facing challenges. The prevalence of HBV infection among pregnant women in Baoan district has been on a decreasing trend in recent years, as shown in Table 1, and aligns with national data (Liu et al. 2021). This decrease has resulted in resource inefficiencies, including those related to facilities, personnel,

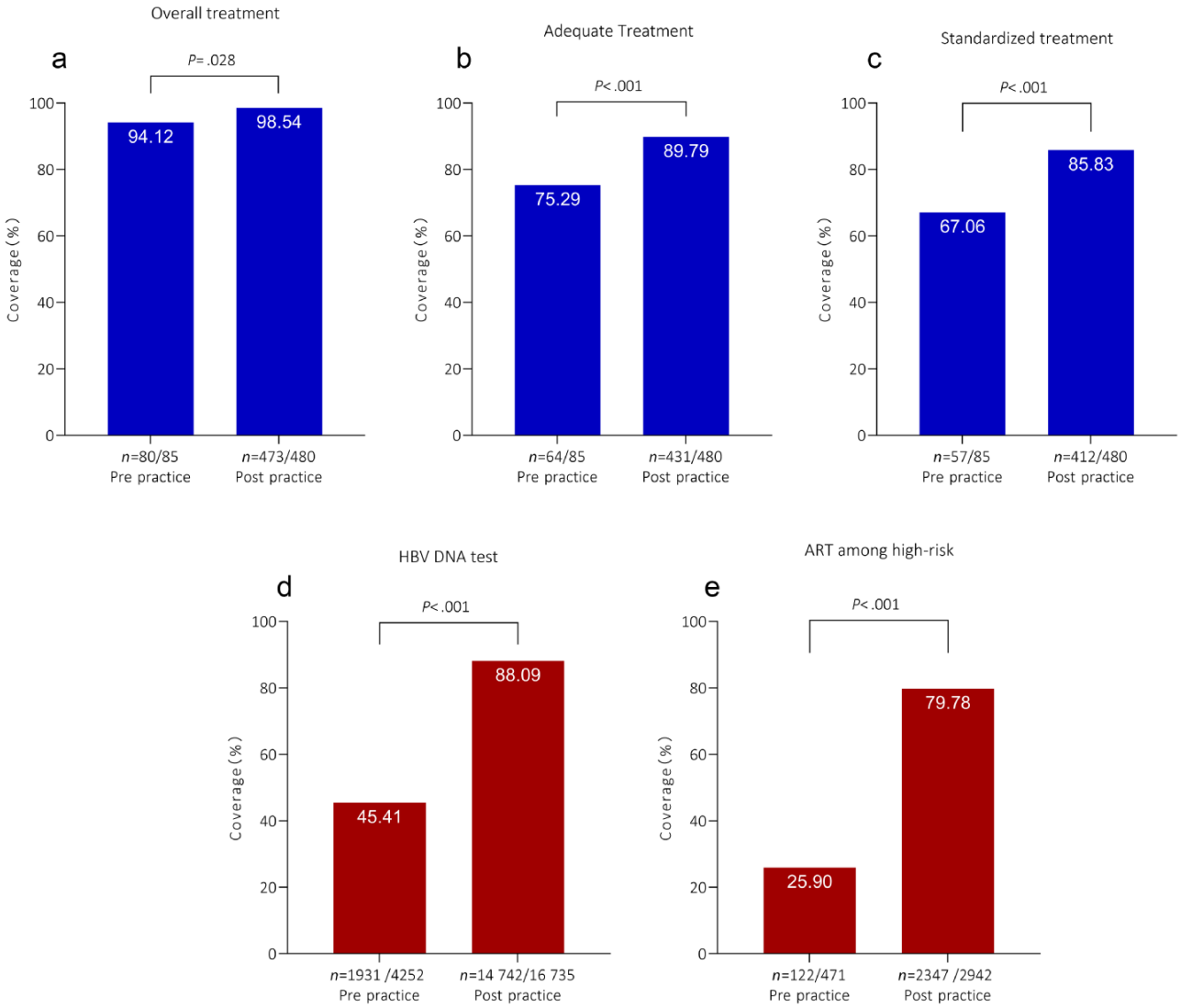

Figure 2. (a) Overall treatment coverage in pregnant women with syphilis: pre- vs. postpractice groups. (b) Adequate treatment coverage in pregnant women with syphilis: pre- vs. postpractice groups. (c) Standardized treatment coverage in pregnant women with syphilis: pre- vs. postpractice groups. (d) HBV DNA test in pregnant women with HBV: pre- vs. postpractice groups. **(**e) ART coverage in high-risk pregnant women with HBV: pre- vs. postpractice groups.

and pharmaceuticals, in certain MCH hospitals, especially those with lower service volumes. As a result, strategic adjustments have been implemented, such as intermittent obstetrician consultations at the E-Clinic, and enhanced medication procurement oversight.

Another challenge is the promotion of E-Clinic in underdeveloped areas of Guangdong Province, which lack the robust financial support that Baoan district enjoys and, therefore, cannot offer all free treatment services as in Baoan. However, as antiviral medication prices have decreased, making treatments more affordable and accessible (Razavi-Shearer et al. 2023), and given that these drugs do not necessitate cold chain storage, coupled with the expansion of medical insurance to both rural and urban populations, it is conceivable that certain services, such as penicillin treatment for syphilis and TDF treatment for HBV, could transition to a fee-based model without significantly increasing the financial burden on patients.

Enablers

The success of this practice is credited to three main enablers. First, government leadership has provided the necessary support for the design and implementation of the E-Clinic. Secondly, innovation has played an important role in integrating infection management into regular ANC services. Lastly, the active and meaningful engagement of multiple institutions at all levels is crucial, with all MCH hospitals now included in the network and strengthened to deliver standardized services.

Conclusion

The E-Clinic in Baoan district, which serves as a pioneering integrated service model for pregnant women with syphilis or HBV infections, has witnessed improved maternal interventions and has showcased its potential for broader dissemination. Government leadership, innovation, and collaboration

Table 1. Trends in the prevalence of maternal syphilis infection and maternal treatments in Baoan district, 2018–23

Year of delivery	Number of pregnant women (*a*)	Number of pregnant women living with syphilis (*b*)	Prevalence of maternal syphilis infection (*b*/*a*, %, 95% CI)	Number of overall treatment (*c*)	Coverage of overall treatment (*c*/*b*, %)	Number of adequate treatment (*d*)	Coverage of adequate treatment (*d*/*b*, %)	Number of standardized treatment (*e*)	Coverage of standardized treatment (*e*/*b*, %)
2018	48 553	85	0.18 (0.14–0.21)	80	94.12	64	75.29	57	67.06
2019	49 838	131	0.26 (0.22–0.31)	130	99.24	113	86.26	104	79.39
2020	41 589	113	0.27 (0.22–0.32)	112	99.12	99	87.61	95	84.07
2021	39 939	93	0.23 (0.19–0.28)	91	97.85	88	94.62	86	92.47
2022	38 788	66	0.17 (0.13–0.21)	64	96.97	60	90.91	58	87.88
2023	36 199	77	0.21 (0.17–0.26)	76	98.70	71	92.21	69	89.61
APC			−1.880		0.445		3.630		5.426
95% CI			−14.534, 12.648		−0.905, 1.813		0.107, 7.278		0.645, 10.435
t-value			−0.382		0.910		2.862		3.161
P-value			.7222		.414		.046		.034

Table 2. Trends in the prevalence of maternal HBV infection and maternal ART in Baoan district, 2018–23

Year of delivery	Number of pregnant women (*a*)	Number of pregnant women living with HBV (*b*)	Prevalence of maternal HBV infection (*b*/*a*, %, 95% CI)	Number of HBV DNA test (*c*)	Coverage of HBV DNA test (*c*/*b*, %)	Number of high-risk women living with HBV (*d*)	Proportion of high-risk women living with HBV (*d*/*c*, %)	Number of ART among high-risk women (*e*)	Coverage of ART among high-risk women (*e*/*d*, %)
2018	48 553	4252	8.76 (8.51–9.01)	1931	45.41	471	24.39	122	25.90
2019	49 838	4238	8.50 (8.26–8.75)	3452	81.45	736	21.32	468	63.59
2020	41 589	3599	8.65 (8.28–8.92)	3171	88.11	552	17.41	426	77.17
2021	39 939	3152	7.89 (7.63–8.16)	2803	88.93	632	22.55	529	83.70
2022	38 788	2953	7.61 (7.35–7.88)	2676	90.62	552	20.63	497	90.04
2023	36 199	2793	7.72 (7.44–7.99)	2640	94.52	470	17.80	427	90.85
APC			−2.971		12.090		−3.962		23.542
95% CI			−4.785, −1.123		−1.697, 27.811		−11.392, 4.091		0.871, 51.309
t-value			−4.438		2.414		−1.394		2.895
P-value			.011		.073		.236		.044

have played pivotal roles in the triumph of this framework. By following the construction framework and guidance of the E-Clinic, regions can readily replicate this practice, and adjust or optimize according to local circumstances. Continued support and expansion of such initiatives are crucial for enhancing maternal interventions and promoting standardized healthcare services for pregnant women with infectious diseases.

Acknowledgements

The authors would like to express their deep gratitude to all the medical staff and participants who took part in the EMTCT Project in Baoan district.

Supplementary data

Supplementary data is available at *Health Policy and Planning* online.

Author contributions

Conceptualization: Y.Z., W.W., Y.L.; Data curation: Y.L., J.C., D.L.; Formal analysis: Y.L., D.L., W.M.; Writing—original draft: Y.L., S.G.; Writing—review & editing: Y.L., S.G., J.C.; all authors read and approved the final manuscript.

Reflexivity Statement

The author group of this research is inclusive, with four identified as women and three as men, and one from Guangdong Women and Children's Hospital and Health Institute and six from Shenzhen Baoan Women's and Children's Hospital. S.G., from Guangdong Women and Children's Hospital and Health Institute, assumes the pivotal role of project leader for the Guangdong Province EMTCT Project, offering national-level expertise in guiding and supervising EMTCT initiatives. Her leadership is instrumental in spearheading the province-wide implementation and advancement of the E-Clinic. Y.L., J.C., D.L., and W.M. are integral members of the EMTCT Project Office in Baoan district. Y.L., J.C., and W.M. hold Master's degrees in Public Health, while D.L. possesses a Master's degree in Management. Their responsibilities span across project management, service delivery, information dissemination, laboratory operations, and human rights considerations, collectively contributing to the multifaceted success of the project. Y.L., in particular, leverages >10 years of experience as a senior statistician specializing in epidemiology and health statistics. W.W. assumes the dual roles of project leader for the EMTCT Project in Baoan district and Director of the Health Care Department at Shenzhen Baoan Women's and Children's Hospital. With a wealth of experience exceeding 15 years in managing MCH projects, he oversees a portfolio of 27 initiatives within Baoan district, managing substantial project funds exceeding 100 million RMB annually. Y.Z., a Doctor of Obstetrics and doctoral supervisor, brings >20 years of clinical expertise in Obstetrics. Currently serving as the Director of Shenzhen Baoan Women's and Children's Hospital, Y.Z. has been instrumental in providing invaluable insights and comprehensive support for the establishment of the E-Clinic in Baoan district, further enriching the project's impact and outcomes.

Ethical approval

This research has received ethics approval from the Ethics Committee of Baoan Women's and Children's Hospital [No. LLSC-2023-02-06-02-KS (approval on 20 June 2023, on the study protocol for 'Progress of eliminating mother-to-child transmission of hepatitis B virus in Baoan district') and No. LLSCHY-2023-03-11-03 (approval on 15 November 2023, on the study protocol for 'Progress of eliminating mother-to-child transmission of syphilis in Baoan district')].

Conflict of interest

None declared.

Funding

This work was supported by the China Sexually Transmitted Disease and AIDS Prevention and Control Association-AbbVie Maternal and Child Care and PMTCT Fund (2020PMTCT-S3) and the Fundamental Research Foundation of Shenzhen (No. JCYJ20190809181805708).

Data availability

The data underlying this article will be shared upon reasonable request to the corresponding author.

References

Baoan Daily. *Baoan District Becomes a Pilot Area for the National Project to Eliminate Mother-to-Child Transmission*. http://barb.sznews.com/MB/content/201709/22/c183569.html (9 June 2024, date last accessed).

Dou L, Wang X, Wang F *et al*. Epidemic profile of maternal syphilis in China in 2013. *Biomed Res Int* 2016;**2016**:9194805.

Gong XD, Yue XL, Teng F *et al*. Syphilis in China from 2000 to 2013: epidemiological trends and characteristics. *Zhonghua Pi Fu Ke Za Zhi* 2014;**47**:310–15.

Hawkes S, Matin N, Broutet N *et al*. Effectiveness of interventions to improve screening for syphilis in pregnancy: a systematic review and meta-analysis. *Lancet Infect Dis* 2011;**11**:684–91.

Health Commission of Guangdong Province. *Action Plan for Eliminating Mother-to-Child Transmission of HIV, Syphilis, and Hepatitis B in Guangdong Province (2023-2025)*. 2023. https://wsjkw.gd.gov.cn/zwyw_bmwj/content/post_4097111.html (9 June 2024, date last accessed).

Hyun MH, Lee Y-S, Kim JH *et al*. Systematic review with meta-analysis: the efficacy and safety of tenofovir to prevent mother-to-child transmission of hepatitis B virus. *Aliment Pharmacol Ther* 2017;**45**:1493–505.

Lamberth JR, Reddy SC, Pan JJ *et al*. Chronic hepatitis B infection in pregnancy. *World J Hepatol* 2015;**7**:1233–37.

Liu J, Wang X, Wang Q *et al*. Hepatitis B virus infection among 90 million pregnant women in 2853 Chinese counties, 2015-2020: a national observational study. *Lancet Reg Health West Pac* 2021;**16**:100267.

Liu J, Zhang S, Wang Q *et al*. Elimination of mother-to-child transmission of hepatitis B in China: progress and challenges. *Front Med* 2020;**14**:209–20.

Liu Z, Chen Z, Cui F *et al*. Management algorithm for prevention of mother-to-child transmission of hepatitis B virus. *J Clin Transl Hepatol* 2022;**10**:1004–10.

National Health Commission. *Prevention Guidelines for Mother-to-Child Transmission of HIV, Syphilis, and Hepatitis B (2020 Edition)*. 2020. http://www.nhc.gov.cn/cms-search/xxgk/getManuscr

iptXxgk.htm?id=fc7b46b2b48b45a69bd390ae3a62d065 (9 June 2024, date last accessed).

National Health Commission. *Action Plan for Eliminating Mother-to-Child Transmission of HIV, Syphilis and Hepatitis B (2022-2025)*. 2022. http://www.nhc.gov.cn/fys/s3581/202212/afe6bc9626be45a0b25bee93f01fef10.shtml (9 June 2024, date last accessed).

National Health Commission, United Nations Children's Fund. *Implementation Guidelines for Pilot Projects on Eliminating Mother-to-Child Transmission of HIV/AIDS, Syphilis, and Hepatitis B (Trial Edition)*. 2018.

Pascoal LB, Carellos EVM, Tarabai BHM *et al*. Maternal and perinatal risk factors associated with congenital syphilis. *Trop Med Int Health* 2023;**28**:442–53.

Qiao Y, Su M, Song Y *et al*. Outcomes of the national programme on prevention of mother-to-child transmission of hepatitis B virus in China, 2016-2017. *Infect Dis Poverty* 2019;**8**:65.

Qin JB, Feng TJ, Yang TB *et al*. Synthesized prevention and control of one decade for mother-to-child transmission of syphilis and determinants associated with congenital syphilis and adverse pregnancy outcomes in Shenzhen, South China. *Eur J Clin Microbiol Infect Dis* 2014;**33**:2183–98.

Razavi-Shearer D, Gamkrelidze I, Pan C, Polaris Observatory Collaborators. Global prevalence, cascade of care, and prophylaxis coverage of hepatitis B in 2022: a modelling study. *Lancet Gastroenterol Hepatol* 2023;**8**:879–907.

World Health Organization. 2022. *Global Guideline on Criteria and Processes for Validation: Elimination of Mother-to-child Transmission of HIV, Syphilis and Hepatitis B virus*. 2021. https://www.who.int/publications/i/item/9789240039360 (21 July 2023, date last accessed).

Xv LL. *Investigation on the Willingness of HBsAg Positive Mothers for Their Children Participating in PVST and Analysis of the PVST Results in Six Provinces in China*. Beijing: Chinese Center for Disease Control and Prevention, 2020.

Yin X, Wang W, Chen H *et al*. Real-world implementation of a multilevel interventions program to prevent mother-to-child transmission of HBV in China. *Nat Med* 2024;**30**:455–62.

Zhang L, Tao Y, Woodring J *et al*. Integrated approach for triple elimination of mother-to-child transmission of HIV, hepatitis B and syphilis is highly effective and cost-effective: an economic evaluation. *Int J Epidemiol* 2019;**48**:1327–39.

Zhang X, Yu Y, Yang H *et al*. Surveillance of maternal syphilis in China: pregnancy outcomes and determinants of congenital syphilis. *Med Sci Monit* 2018;**24**:7727–35.