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Prevention of mother-to-child HIV transmission cascade in China: a systematic review and meta-analysis

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ABSTRACT

Introduction The Chinese government has invested US \$140 million annually on prevention of mother-to-child transmission (PMTCT) of HIV. This study evaluates the programme by examining the improvements in programme coverage HIV testing and provision of antiretroviral drugs along the PMTCT cascade.

Methods Data for PMTCT cascade indicators were collected through a comprehensive systematic review of published peer-reviewed English and Chinese literature during 2003–2011. Meta-analysis was conducted according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines.

Results This study included 113 publications. HIV prevalence among pregnant women in China who accessed antenatal care (ANC) remained below 0.1% during the past decade. HIV testing coverage in pregnant women attending ANC and in HIV-exposed infants at 18 months significantly increased from 62.4% (95% CI 4.7% to 98.2%) and 22.1% (16.3% to 32.3%) in 2003 to 90.3% (88.4% to 91.8%) and 82.8% (66.9% to 99.5%) in 2011 respectively, whereas antiretroviral (ARV) prophylaxis uptake increased from 35.2% (12.2% to 47.3%) and 26.9% (24.3% to 28.9%) to 86.2% (53.2% to 97.2%) and 90.3% (85.5% to 93.7%). HIV vertical transmission rate substantially decreased from 31.8% (25.7% to 38.6%) prior to the programme to 2.3% (1.4% to 3.8%) in 2011. During 2003–2011, among 25 312 (23 995–26 644) infants born to HIV-positive mothers who received ARV prophylaxis, 975 (564–1395) were diagnosed with HIV, corresponding to an average transmission rate of 3.9% (3.2% to 4.6%). However, while including transmissions among HIV-positive pregnant women who were lost along the cascade, the average transmission rate during 2003–2011 was 17.4% (15.8% to 19.0%).

Conclusions PMTCT programmes have reduced HIV mother-to-child transmission in China. Further improvements in the continuum of care remain essential in realising the full potential of the programme.

BACKGROUND

Effective prevention of mother-to-child transmission (PMTCT) of HIV can reduce the vertical transmission risk from 15%–45% to below 5% in breastfeeding populations and below 2% in non-breastfeeding populations.^{1–3} The 2013 WHO guidelines recommend that all HIV-positive pregnant and breastfeeding women start antiretroviral

therapy (ART) as early as during 14 weeks of pregnancy and continue lifelong treatment if resources are available particularly in generalised epidemics. In some countries, for women who are not eligible for ART according to national guidelines, stopping ART after cessation of mother-to-child transmission (MTCT) risk could be considered.⁴ These guidelines support the implementation of the Global Plan and Asia Pacific Frameworks towards the elimination of new HIV infections that may occur among children.^{3 5 6}

According to the official statistics, at the end of 2011, 780 000 people were living with HIV in China of which female patients accounted for 28.6%.⁷ About 10–13 million Chinese women gave birth annually during 2003–2011,⁸ and HIV infection among pregnant women is below 0.1%.⁹ Although infections attributed to MTCT accounted for less than 2% of the reported HIV cases in China in 2011,^{7 10} recent studies indicated that the proportion of women infected with HIV has doubled over the past decade and heterosexual exposure remains the main route of transmission.^{11 12} This suggests a continued risk of MTCT of HIV.¹³ In 2003, China initiated its first PMTCT programme in eight cities which provided free HIV testing and antiretroviral (ARV) prophylaxis as part of standard antenatal care. Prior to 2011, zidovudine (AZT) and nevirapine (NVP) were the recommended ARVs for HIV-positive pregnant women and newborns.^{14 15} Lamivudine was added later as a third drug.¹⁶ HIV testing was provided routinely and confirmed positive diagnoses were reported to the China Information System for Disease Control and Prevention through the antenatal care network. ARV prophylaxis was administered to HIV-positive pregnant women during pregnancy, delivery and postpartum as well as to their babies after delivery. All HIV-infected mothers received free infant formula. In 2010, the national PMTCT programme expanded to integrated PMTCT, which included universal syphilis and hepatitis B testing and treatment. The hypothesis was that integrated testing for several infections would increase the HIV testing uptake. This approach was feasible and successful.^{17 18} Government investment for integrated PMTCT has dramatically increased from US\$0.9 million in 2003 to US\$136.8 million in 2010.

WHO recommends monitoring the PMTCT cascade using a metric that defines key indicators along the continuum of care.¹⁹ The cascade



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visualises the continuum of HIV care from the estimated number of pregnant women, pregnant women attending antenatal care (ANC) tested for HIV and confirmed HIV-positive pregnant women receiving ARV prophylaxis. The PMTCT cascade also follows exposed infants. However, such an approach is difficult as it requires a defined set of data for each indicator along the cascade. Few publications on PMTCT cascade over time have been published from low HIV burden settings.^{20–21} In China, there is a large number of individual studies which reported isolated indicators related to PMTCT programmes and several previous studies have attempted to integrate some of these indicators.^{22–25} An integrated spectrum that comprehensively reflects the continuum of PMTCT services at the national and local level has not been published in China. Based on a comprehensive review and meta-analysis, this study aims to (1) describe the chronological trends of HIV disease burden among pregnant women, HIV vertical transmission rates and coverage of PMTCT and (2) map out a PMTCT cascade that reflects the continuum of service provision for both pregnant women and infants born to HIV-positive mothers since 2003 in China. This systematic review informs relevant health policies and best practices for future HIV prevention in China and other settings with concentrated HIV epidemics.

METHODS

Construction of China's PMTCT cascade

The PMTCT cascade in this study was established according to antenatal and postnatal PMTCT-related metrics reported in previous studies,^{26–28} but adjusted to the Chinese setting. The metrics included the percentage of pregnant women attending ANC who had an HIV test, tested positive and received ARV prophylaxis as well as the proportion of infants who received ARV prophylaxis and antibody testing at 18 months. The population size of pregnant women was calculated based on the number of live births during 2003–2011 reported by the National Bureau of Statistics of China and excluded pregnant women who underwent abortion or miscarriage.⁸ In China, over 90% of pregnant women attended at least one ANC visit under the free national ANC programme, but a small proportion (<10%) did not attend ANC. The percentage of pregnant women covered by ANC was obtained from the 2012 Health Statistical Abstract.²⁹ Free HIV testing was provided as an integrated part of ANC services. HIV-positive pregnant women could make voluntary choices to either continue pregnancy or terminate pregnancy. This percentage ranged from 52% to 75% during 2003–2011 in China.²³ Those who opted to continue pregnancy were recommended ARV prophylaxis for PMTCT (see online supplementary box S1), which was AZT plus a single dose of NVP prior to 2011 and a triple ARV regimen thereafter.^{14–16} At each step women could opt out. The women and infant who were linked to health facilities and received PMTCT-related services were assumed to be 'in care' in our study. In every 100 pregnancies, there were estimated 100.9 live births, which have accounted for stillbirths, perinatal mortality and multiple births at one time in China.^{30–33} Currently, early infant diagnosis (EID) of HIV infection among infants is not part of the standard PMTCT practices in China.¹⁶ Infants will have an HIV antibody test at 18 months.^{16–34–35} HIV-positive pregnant women who failed to enrol in ANC, HIV testing and ARV prophylaxis had a 31.8% (25.7%–38.6%) risk to transmit HIV to their infants.^{36–39} This transmission rate was used for calculating the number of cases of MTCT among HIV-positive mothers who missed ARV prophylaxis. We conducted a meta-analysis from published data to estimate key indicators at each step of the PMTCT cascade for each year

during 2003–2011. An overall 9-year cascade was then constructed by summing each indicator of the individual cascades (figure 4).

Search strategy and selection criteria

Peer reviewed articles were searched from the following English and Chinese databases: PubMed and ISI Web of Knowledge, Chinese Scientific Journals Full text Database, China National Knowledge Infrastructure and Wanfang Database from 1990 to 2012. The main search keywords included HIV, mother-to-child transmission, prevention, pregnant women, infant and China. We also conducted a manual search on the reference lists of published articles and a similar keyword search on Google Scholar and Baidu (figure 1). We included all types of quantitative studies, but review articles, modelling-based studies, case reports, news, conference abstracts and commentary were excluded in this review. Non-peer-reviewed publications, including official reports, were also excluded as their study quality cannot be systematically assessed. Studies were included if they: (1) were published in Chinese or English; (2) reported any of the following indicators with sample size: for pregnant women, HIV prevalence, HIV infection mode, HIV testing percentage, uptake of ARV prophylaxis and for infants born to HIV-positive mothers, HIV testing percentage, ARV uptake and vertical transmission rate; (3) reported study period, location and recruitment venues; (4) had sample size more than 30; (5) reported that HIV infection was confirmed by western blot in one of the laboratories designated by Chinese Center for Disease Control and Prevention. A checklist with seven items was used to assess the quality of the studies.

Data extraction

Two investigators (HZ and MT, LL and XT, YZ and XL) independently identified the eligible studies for this review. Any disagreement was resolved by the senior investigators (LZ and EPFC). Data were extracted and entered into an electronic form in Microsoft Access Database (V2007, Microsoft Corp., Redmond, Washington, USA) by HZ and were independently checked by a second investigator (EPFC). The following information was extracted from each eligible study: (1) publication details including author(s) and year of publication; (2) design of study, including type of study, study location and period, sampling method, recruitment venues, sample size and characteristics of the participants; (3) details of targeted indicators.

Statistical analyses

Meta-analyses were conducted by the Comprehensive Meta-Analysis software (V2.0, Biostat, Englewood, New Jersey). The pooled estimates and 95% CIs for each indicator were calculated by pooling the data from each study. The significance of heterogeneity across studies was measured by the Cochran Q-test and the extent of heterogeneity in the studies was measured by the I^2 statistic.⁴⁰ Random-effect model was selected when high and significant heterogeneity was observed across studies; otherwise, the fixed-effect model was used. Meta-regression was used to identify the significance of temporal trend and factors contributing to the high heterogeneities across the studies (see online supplementary table S2). If high heterogeneity was observed, subgroup analysis stratified by study year was performed. Potential publication bias was measured by the Begg and Mazumdar rank correlation. This study was conducted by according to PRISMA checklist (Supplementary checklist S1).

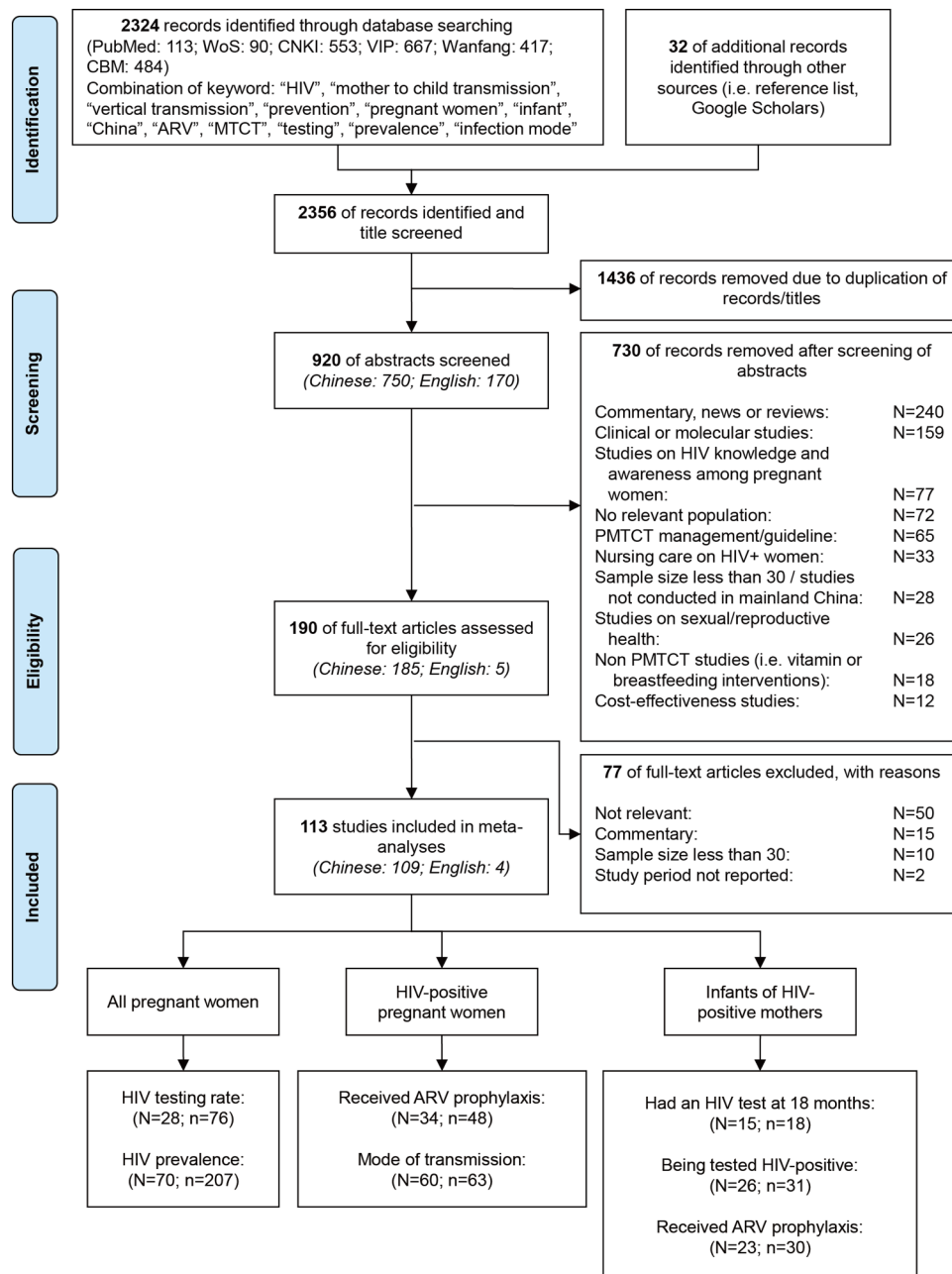


Figure 1 Flow chart showing the meta-analysis studies selection. ARV, antiretroviral; MTCT, mother-to-child transmission; N, the number of articles included in systematic review; n, the number of prevalence estimates included in meta-analysis; PMTCT, prevention of mother-to-child transmission.

RESULTS

Study characteristics

Among the initial 2356 records, we included 114 studies (4 in English and 110 in Chinese) for the meta-analysis (figure 1). The eligible articles covered 16 of the 31 Chinese provinces. The quality scores of the included studies are listed in online supplementary table S1, and 77.2% (88/114) of the studies scored four of eight or more. High heterogeneity was found in all investigated indicators (all p values <0.001 , I^2 ranged from 80.8 to 99.9), and subgroup analysis stratified by study year for each indicator was performed. No publication bias was observed (p values ranged from 0.061 to 0.273, p -value cut-off=0.05) across the studies in all indicators.

Low HIV prevalence among pregnant women in China

The pooled estimate of HIV prevalence among pregnant women attending ANC in China was 0.10% during 1991–2011 (figure 2). Subgroup analysis stratified by year indicated that prevalence peaked at 0.80% in 1999 then gradually decreased and stabilised at 0.07% in the next decade. However, the variation was not significant during this period (meta-regression, $p=0.104$, figure 2). Heterosexual transmission (51.9%, 50.6%–53.1%) was the dominant route of transmission, followed by plasma donation (25.5%, 20.5%–22.6%) and blood transfusion (5.9%, 5.4%–6.5%; see online supplementary figure S1).

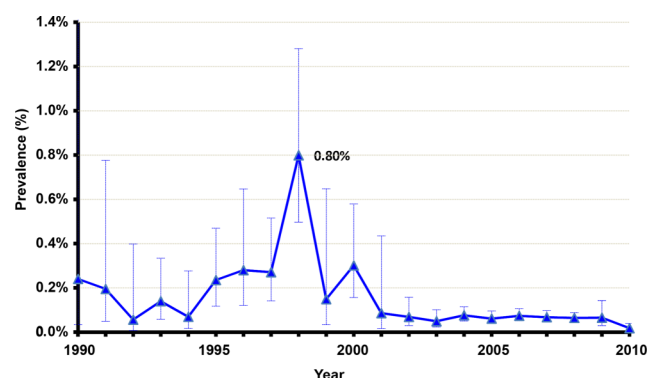


Figure 2 Temporal trend of HIV prevalence among pregnant women during 1991–2011 in China.

Coverage of ANC, HIV testing and PMTCT antiretrovirals

The 2012 Chinese Health Statistical Abstract reported that coverage of ANC (at least one ANC visit during pregnancy) among pregnant women increased from 88.9% in 2003 to 93.7% in 2011 (see online supplementary figure S2). Among those who attended ANC, the percentage of HIV testing uptake significantly increased from 62.4% (4.7%–98.2%) in 2003 to 90.3% (88.4%–91.8%) in 2011 (meta-regression, $p=0.002$, figure 3C). However, if pregnant women who did not attend ANC were included, the corresponding testing percentages were only 54.9% (27.9%–82.9%) in 2003 and 84.6% (77%–92.9%) in 2011 (meta-regression, $p<0.001$, figure 3D). Also, the proportion of diagnosed HIV-positive women who received ARV

prophylaxis during pregnancy or at delivery increased from 35.2% (12.2%–47.3%) to 86.2% (53.2%–97.2%) during 2003–2011 (meta-regression, $p=0.015$, figure 3A). In comparison, ARV coverage among all HIV-infected pregnant women was estimated to be as low as 67.7% (42.5%–99.5%) in 2011, despite a substantial increase from 16.0% (8.7%–27.9%) in 2003 (meta-regression, $p<0.001$, figure 3B).

Among HIV-exposed infants whose mothers were linked to and diagnosed with HIV in ANC, the proportion who received ARV prophylaxis significantly increased from 26.9% (24.3%–28.9%) to 90.3% (85.5%–93.7%) during 2003–2011 (meta-regression, $p=0.008$, figure 3A). However, while including infants born to HIV-positive mothers outside ANC, the corresponding ARV coverage was 4.3% (2.7%–7.0%) in 2003 and 61.4% (46.2%–80.5%) in 2011 (meta-regression, $p<0.001$, figure 3B). HIV testing percentages among infants retained in care at 18 months after birth significantly increased from 22.1% (16.3%–32.3%) to 82.8% (66.9%–100.0%) during 2003–2011 (meta-regression, $p=0.001$, figure 3C), while the corresponding rates were 3.5% (2.5%–5.4%) and 56.2% (46.7%–69.4%) among all infants born to HIV-positive mothers (meta-regression, $p<0.001$, figure 3D).

HIV vertical transmission

PMTCT programmes had an impact on mother-and-child pairs enrolled. The transmission rate decreased to 12.9% (7.5%–21.4%) in 2003 and then to 2.3% (1.4%–3.8%) in 2011, with an annual reduction of 1.7% (0.9%–2.5%, meta-regression, $p=0.001$, figure 3A). Nevertheless, while including mother-and-

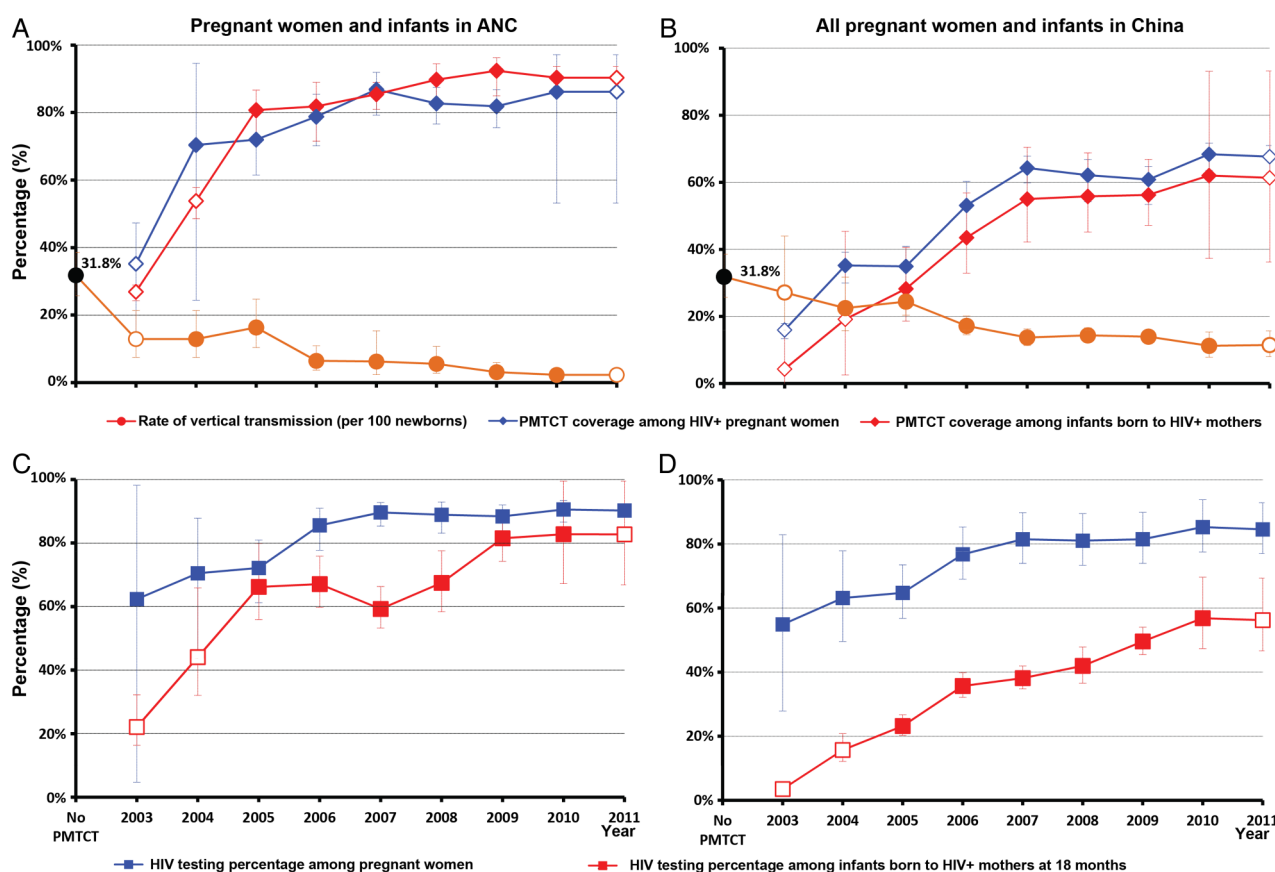


Figure 3 HIV testing and ARV prophylaxis coverage among pregnant women and infants who were born to HIV-positive mothers during 2003–2011 in China. The empty symbols represent interpolated values of the corresponding indicators in years where data are absent. The 95% CIs are included. ANC, antenatal care; ARV, antiretroviral; PMTCT, prevention of mother-to-child transmission.

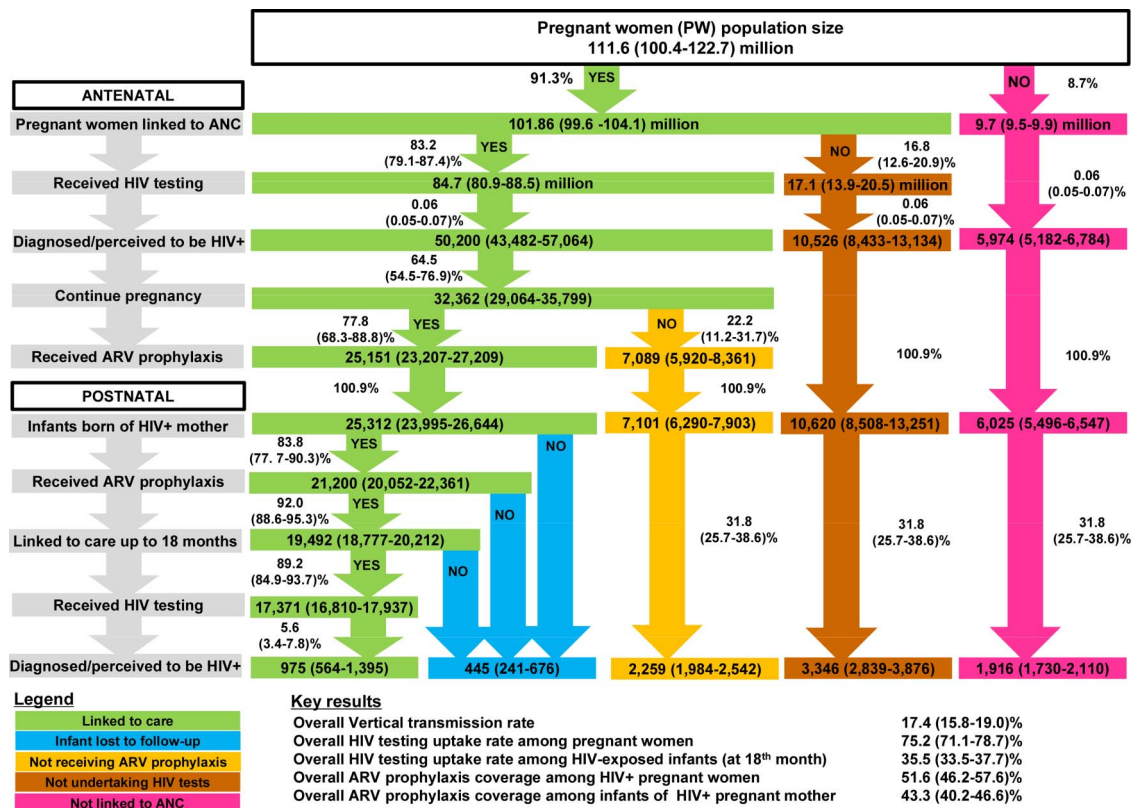


Figure 4 Continuum of care in the PMTCT cascade during 2003–2011 in China. ARV, antiretroviral; PMTCT, prevention of mother-to-child transmission.

child pairs not enrolled, the corresponding rates were 27.1% (17.4%–44.0%) in 2003 and 11.5% (8.0%–15.7%) in 2011 (meta-regression, $p < 0.001$, figure 3B).

PMTCT cascade in China during 2003–2011

Figure 4 summarises a national PMTCT care and treatment cascade for pregnant women and children in China during 2003–2011. A total of 111.6 million Chinese women gave birth during this period. On average, 91.3% were registered in ANC, and 83.2% (79.1%–87.4%) of those had had an HIV test. Approximately 50 200 (43 482–57 064) individuals of those tested were diagnosed HIV-positive; 64.5% (54.5%–76.9%) HIV-positive women continued pregnancy and 77.8% (68.3%–88.8%) of those received ARV prophylaxis prior to or at delivery. Of the 25 312 infants born to HIV-positive mothers who decided to continue their pregnancy, 83.8% (77.7%–90.3%) received ARV prophylaxis. Among infants who received ARV prophylaxis, 92.0% (88.6%–95.3%) were retained in care (up to 18 months), and 89.2% (84.9%–93.7%) of those retained were tested for HIV. About 975 (564–1395) infants who were followed in care, were found to be HIV infected at 18 months, corresponding to an average vertical transmission rate of 3.9% (3.2%–4.6%). However, an additional 445 (241–676) infections may have occurred among infants born of HIV-positive mothers but lost to follow-up, and 2259 (1984–2542) infections may have occurred among children born to HIV-positive pregnant women who did not receive ARVs and their infants did not take ARV prophylaxis either. Further, 3346 (2839–3876) additional cases and 1916 (1730–2110) additional cases due to pregnant women who were not HIV tested and did not attend ANC, respectively, were reported (figure 4). When including these additional cases, the overall rate of vertical transmission was

estimated to be 17.4% (15.8%–19.0%) during 2003–2011. Overall, only three quarters (75.2%, 71.2%–78.7%) of the pregnant women and less than half (41.5%, 39.2%–44.2%) of the HIV-exposed infants were tested for HIV. Only 51.6% (46.2%–57.6%) of the total estimated number of HIV-positive pregnant women and 43.3% (40.2%–46.6%) of their infants received ARVs for PMTCT. PMTCT cascade for each year during 2003–2011 were included in online supplementary figure S2a–S2i.

DISCUSSION

This is the first published systematic review analysing the PMTCT cascade in China. Along with the relatively low and stable HIV prevalence among pregnant women in China (<0.1% since 2002), remarkable reduction of HIV vertical transmission has been achieved through expanding PMTCT interventions following the improved national guidelines and remarkably high government investment.^{34–41} The overall trend of HIV prevalence is consistent with official reports.^{9–42} Transmission rates among mother and infants enrolled in PMTCT have decreased from 31.8% (25.7%–38.6%) prior to the roll-out of PMTCT to 12.9% (7.5%–21.4%) in 2003 and 2.3% (1.4%–3.8%) in 2011. However, when including pregnant women who did not attend ANC and hence not enrolled in PMTCT, the vertical transmission rate was 27.1% (17.4%–44.0%) in 2003 and 11.5% (8.0%–15.7%) in 2011, which is slightly higher than 7.4% reported by the 2012 progress report on PMTCT of HIV in China.¹⁷ This corresponds to similar findings published from other settings.²¹

Despite the marked improvements in China, gaps remain in achieving 90% coverage targets at each step of the PMTCT cascade towards reducing vertical transmission of HIV.⁴³ The

over 90% ANC coverage among pregnant women during 2003–2011 is high compared with other countries in Asia and other developing and emerging economies around the world.^{44–47} The low awareness of ANC and its associated benefits in isolated areas of rural China are incredible missed opportunities to improve both maternal and child health and in the prevention of paediatric HIV.^{48–49} During 2010–2011, the overall PMTCT coverage (67.7%) among all pregnant women falls short of the desired national goal of 90% in China⁴¹ and a similar global target of pregnant women receiving ARV by 2015.⁵⁰ Although HIV testing has been integrated as a standard service in China's ANC system, the fact that over one-fifth of pregnant women in care did opt-out of HIV testing is alarming. Low self-perceived risk and societal stigma against HIV seem to be the major causes for women opting-out despite provision of free HIV tests.^{22–51–52} The current HIV testing strategies requiring confirmatory western blot at a central level may further lead to delay in pregnant women receiving their test result.⁵³ Approximately one-quarter of the diagnosed pregnant women living with HIV either have not received any ARV prophylaxis during pregnancy or have started late during pregnancy. Similar to other resource-limited settings, loss to follow-up in antenatal care is also a major hindrance to the effectiveness of PMTCT programme.^{54–56}

The high percentages of pregnancy termination among HIV-positive pregnant women suggest that there is still high social stigma and limited confidence in the efficacy of PMTCT interventions.⁵⁷ Training of healthcare workers providing services to HIV-infected pregnant women should address factors influencing women's decisions with regard to pregnancy termination. The late start of ARV prophylaxis during pregnancy may explain the high rates of C-section for PMTCT. It is very likely that the widespread use of infant formula in China may have resulted in the high uptake of formula feeding in the PMTCT programme.⁵⁸

Provision of ARV prophylaxis to infants remains suboptimal. During 2003–2011, approximately 83.8% infants born to HIV-positive mothers in ANC received ARV prophylaxis, but this percentage falls to just 43.3% if infants born to women who did not attend ANC are included. Both percentages are comparable to those in the mothers, reflecting that care-seeking behaviours of the mothers determine their children's likelihood of receiving ARV. China's current national guidelines on PMTCT recommend HIV testing of infants born to HIV-positive mothers at 18 months after birth.⁴¹ As a result, our findings show that only around two-thirds (68.8%) of these infants eventually have an HIV test at their 18th month, whereas one-third died or were lost to follow-up. The concept of EID is recommended in the Chinese Handbook of Free ART since 2012.⁵⁹ Although early diagnosis using DNA PCR viral tests has been piloted in some parts of China, so far there are limited published studies reporting the implementation and impact of EID. The studies indicate that most health facilities in a number of provinces cannot implement EID due to financial constraints as well as structural and infrastructural limitations.⁶⁰

Several limitations should be noted. First, most published literature did not specify the timing of HIV testing for pregnant women; additionally, we were unable to differentiate the first time testers and re-testers, both of these would lead to an overestimate of HIV testing coverage. Second, geographical variations in the implementation of PMTCT are likely to be substantial across the country. As published data were only available in 16 of the 31 Chinese provinces, these biases were not investigated in our meta-analysis. Also, data unavailability prevents us

from differentiating between rural and urban areas. Third, most collected studies are cross-sectional with one single data point in a given year; the temporal trend provided in our findings was estimated by the pooled average of these studies in each year and may not reflect the actual trend. In particular, given the small number of PMTCT sites at an early stage of the programme, the national pooled estimates of HIV testing coverage based on limited available data may overestimate the actual percentages. Fourth, the variations in quality of reporting in selected papers may potentially affect our findings. Fifth, the included studies did not provide information on the percentage of mothers and infants who continue to receive life-long ART beyond the PMTCT programme. Also, other minor indicators, such as the percentages of women enrolled in ART voluntarily and retained in care, HIV-exposed infants who initiated cotrimoxazole by 6 weeks of age and HIV-infected infants who initiated ART were not included in our analyses. Sixth, our subgroup analysis could not fully explain the high heterogeneities in most indicators. These may be contributed by the variations in geographical locations and design of the studies and the demographic characteristics of the participants. These have not been investigated in the current scope of our study. We acknowledge that using national aggregate data could be a substantial limitation. Finally, as diagnosis of HIV-positive infants can only be confirmed at 18 months after birth, this inevitably represents substantial delay in the calculation of vertical transmission rates.

China is well poised to implement PMTCT cascade monitoring with the sophisticated electronic databases and unique health identifiers in place.⁶¹ Routine programme monitoring should be implemented at all levels for improving programme and service delivery. This systematic review shows that such cascade monitoring can be done in settings with low and concentrated HIV epidemics. The cascade promotes the use of population-based denominators to compare coverage across countries rather than using individuals registered into care as denominators. The PMTCT cascade monitoring as shown in this analysis helps in identifying bottlenecks in service delivery. There remains space for improvement for HIV testing coverage among pregnant women who are already linked to ANC, early ARV uptake among diagnosed pregnant women and early diagnosis in newborns. The exercise provides useful insights for future resource planning and allocation for PMTCT in China.

Improving PMTCT via increased integration of maternal and child health service delivery and enhancing performance of health system is perceived as a promising strategy, globally.^{62–63}

Key messages

- ▶ HIV prevalence among pregnant women in China has remained very low (<0.1%) during the past decade.
- ▶ Coverage of HIV testing among pregnant women attending antenatal care and ARV prophylaxis uptake among HIV-positive mothers and their babies have significantly increased during 2003–2011.
- ▶ During 2003–2011, an estimated 25 000 infants were born to HIV-positive mothers who were in care in China.
- ▶ During 2003–2011, HIV vertical transmission rate was 3.9% among mother–infant pairs registered in care, but was 17.4% when including transmissions occurred outside the continuum of prevention of mother-to-child transmission of HIV care.

Currently, a more innovative mechanism for PMTCT is taking shape in China, in which HIV prevention is integrated into maternal and children's healthcare services. PMTCT of multiple infectious diseases, including HIV, syphilis and HBV is integrated into a single mechanism under ANC services. In response to the new WHO 2013 ARV guidelines for treating and preventing HIV infection,⁴ China will need to substantially expand its PMTCT and ART programmes to provide life-long treatment to women of reproductive age and strengthen systems to maintain its high ANC coverage, increase uptake of HIV testing and improve retention in care. Reaching pregnant women who do not attend ANC, starting PMTCT interventions early during pregnancy and ensuring postpartum follow-up care determine the effectiveness of PMTCT.^{43–62} An integrated approach based on a cascade analysis would be important in improving provision of HIV care and treatment to pregnant women in China.

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Supplementary Materials

The 2004 PMTCT guidelines^a

- Antenatal period from 28 week of gestation: HIV-positive pregnant women to receive AZT (300mg) twice a day during pregnancy,
- During delivery:
 - Pregnant women receive AZT (300mg) every three hours and one dose of NVP (200 mg)
 - HIV-exposed infants within 72 hours after birth receive one dose of NVP (2mg/kg) and AZT(2mg/kg) every six hours up to six weeks post partum

The 2008 PMTCT guideline^b

- Antenatal period from 28 week of gestation: HIV-positive pregnant women to receive AZT (300mg) twice a day during pregnancy,
- During delivery:
 - Pregnant women receive AZT (300mg) every three hours, 3TC (150mg) two times per day and one dose NVP (200 mg)
 - HIV-exposed infants within 72 hours after birth receive one dose of NVP (2mg/kg) and AZT(2mg/kg) every six hours up to six weeks post partum

The 2011 PMTCT guidelines ^c

- Antenatal period from 14 weeks of gestation recommend AZT (300 mg) +3TC (150 mg) + LPV/EFV (400/100 mg) twice daily, or AZT (300 mg) + 3TC (150mg) twice daily, or EFV (600mg) once daily during pregnancy
- During delivery:
 - Pregnant women receive AZT (300mg) + 3TC (150mg) two times per day and one dose NVP (200 mg) until seven days post partum
 - HIV-exposed infants within 6-12 hours after birth receive one dose of NVP or AZT daily (15mg, 10mg and 2mg/kg for neonatal body weigh≥2500g, between 2000g and 2500g and <2000, respectively) up to six weeks post partum

^a Ministry of Health of the People's Republic of China. Implementatin plan for prevention of mother-to-child transmission of HIV (2004, trial). Beijing: Ministry of Health of the People's Republic of China; 2004.

^b Ministry of Health of the People's Republic of China. Implementatin plan for prevention of mother-to-child transmission of HIV (revised edition). Beijing: Ministry of Health of the People's Republic of China; 2008.

^c Ministry of Health of the People's Republic of China. Implementatin plan for prevention of mother-to-child transmission of HIV, syphilis and hepatitis. Beijing: Ministry of Health of the People's Republic of China; 2011.

Figure S1 Main HIV infection routes among pregnant women during 2003-2011 in China

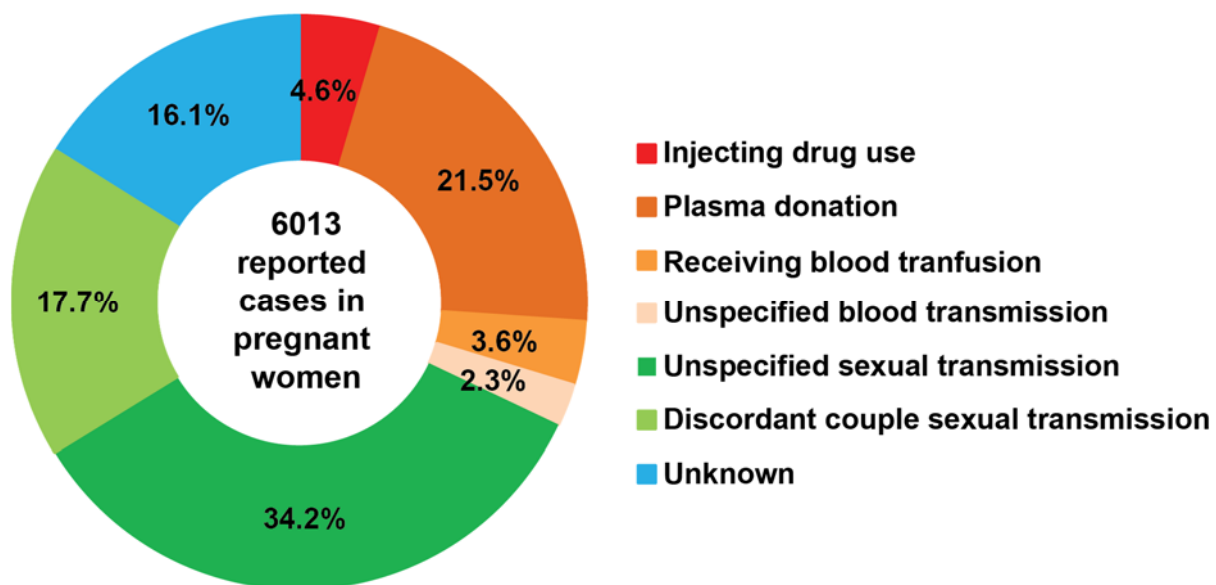


Figure S2. Continuum of care of PMTCT program from 2003 to 2011 in China

Figure S2a. Continuum of care of PMTCT program in 2003 in China

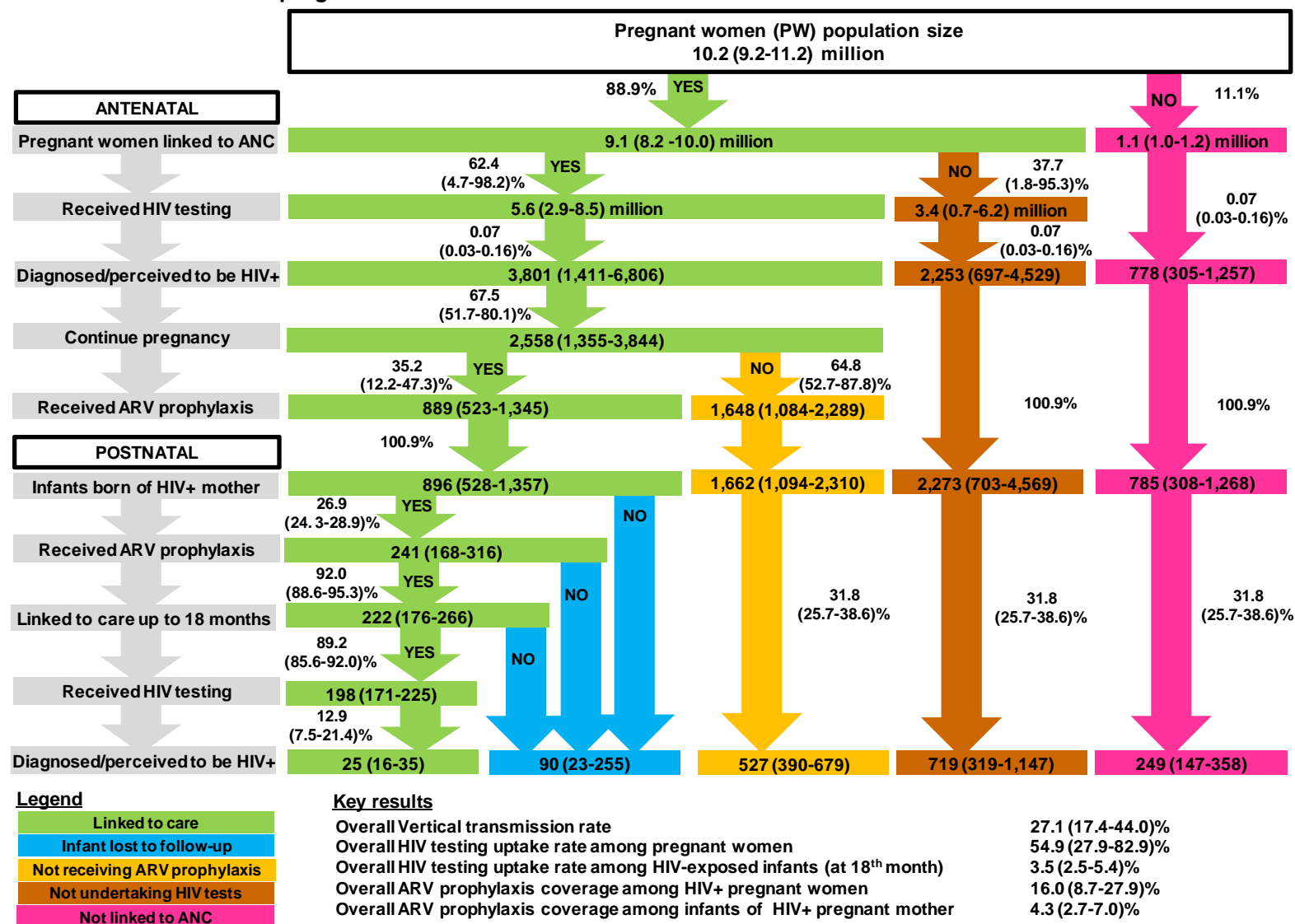


Figure S2b. Continuum of care of PMTCT program in 2004 in China

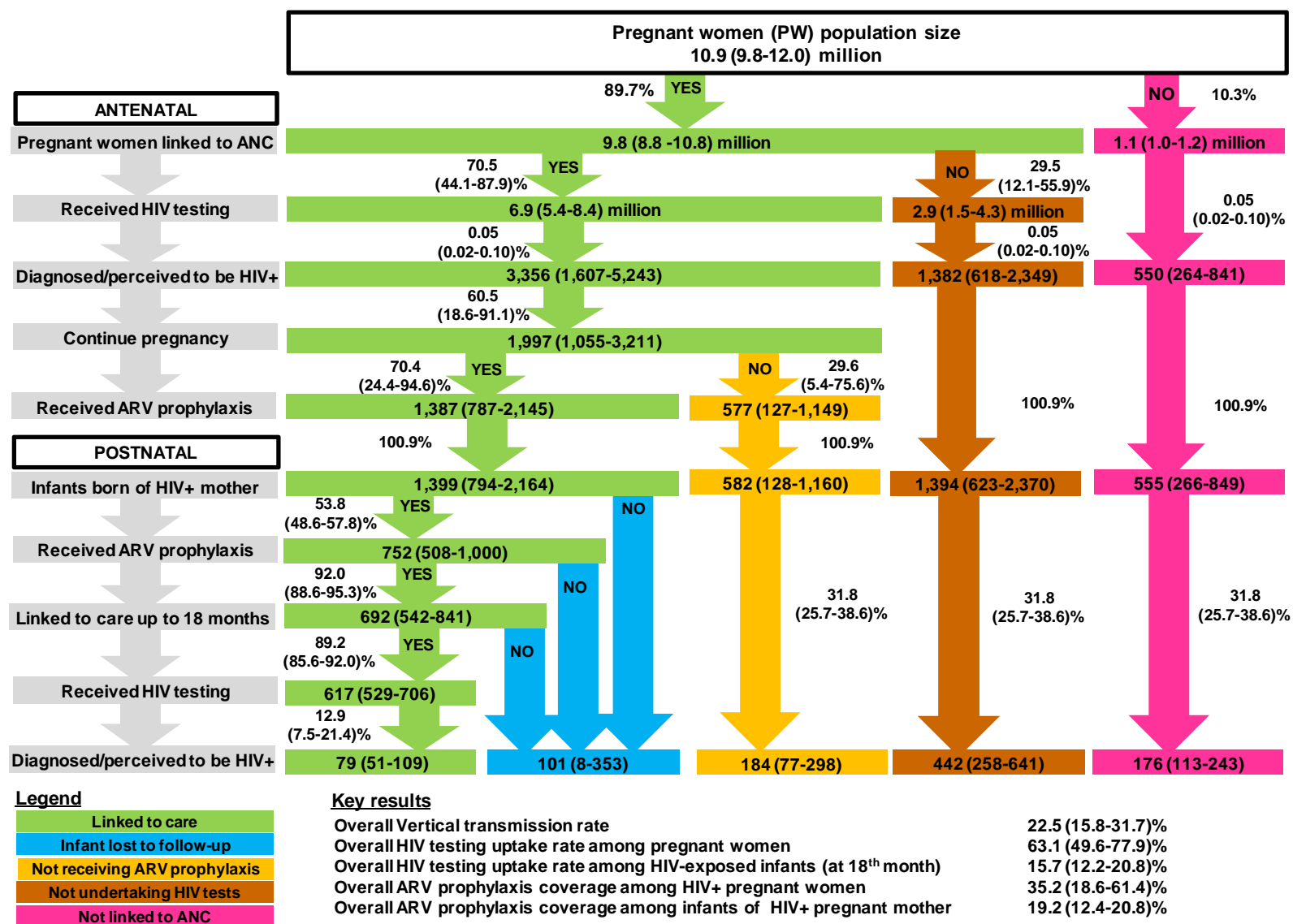


Figure S2c. Continuum of care of PMTCT program in 2005 in China

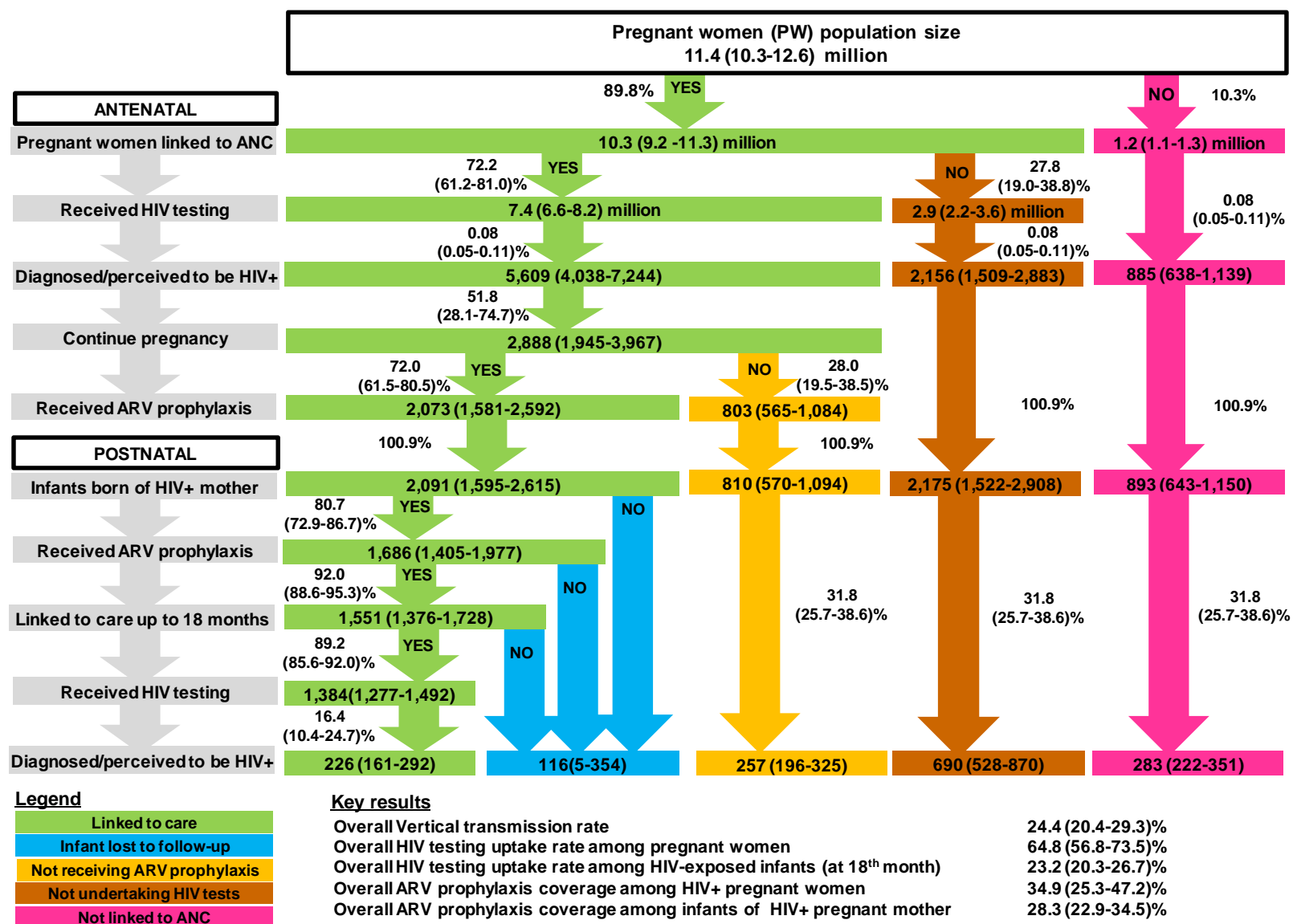


Figure S2d. Continuum of care of PMTCT program in 2006 in China

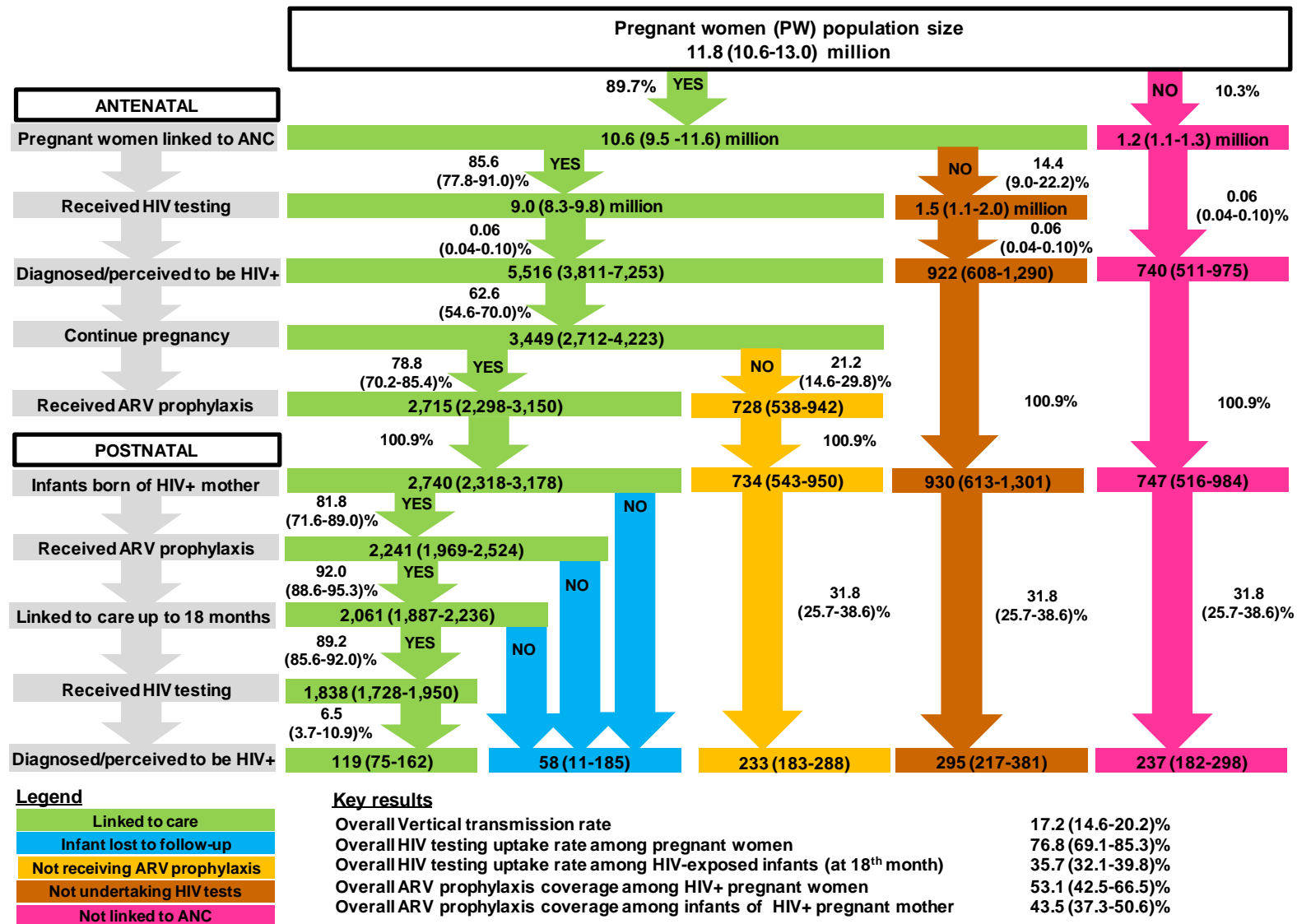


Figure S2e. Continuum of care of PMTCT program in 2007 in China

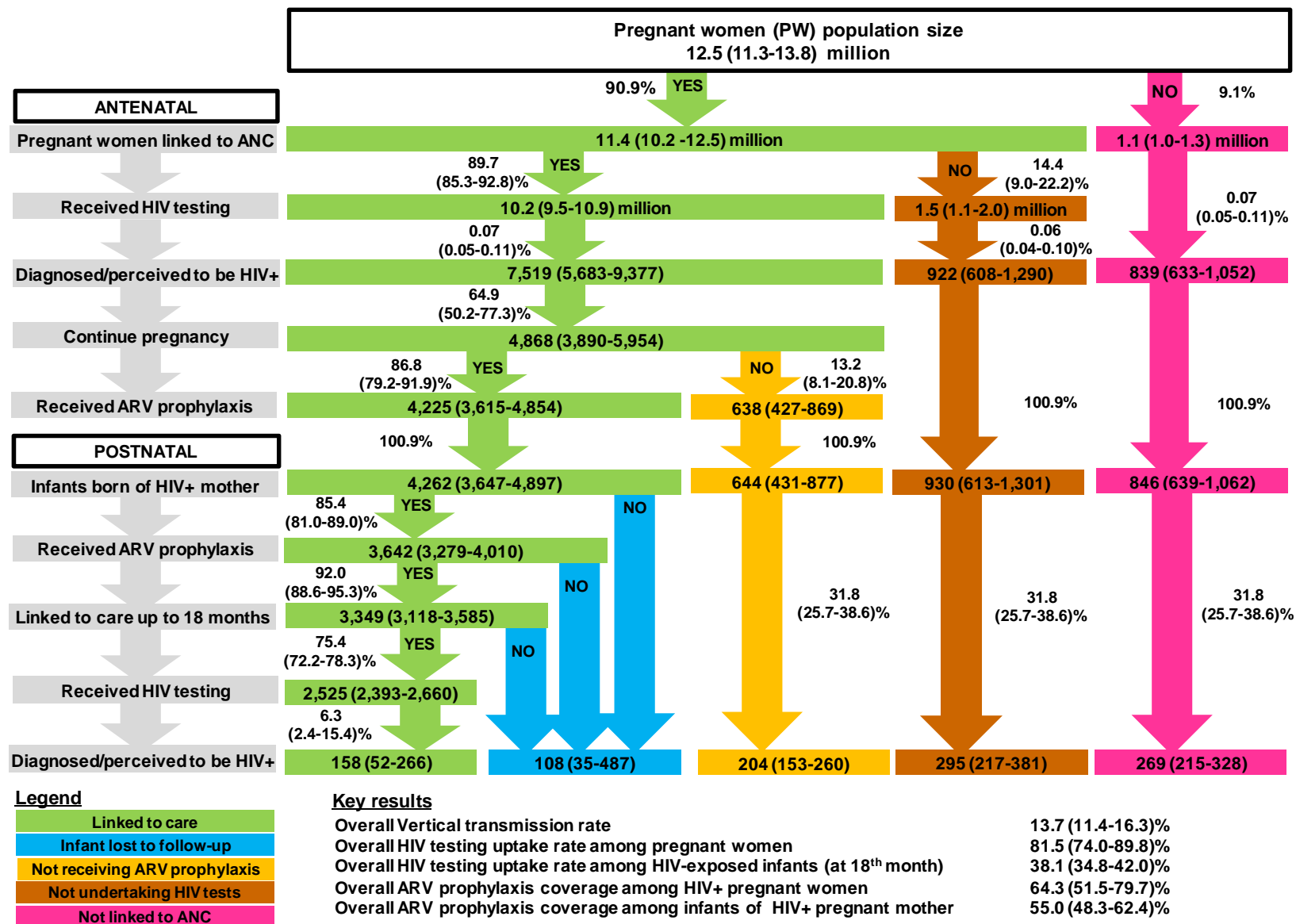


Figure S2f. Continuum of care of PMTCT program in 2008 in China

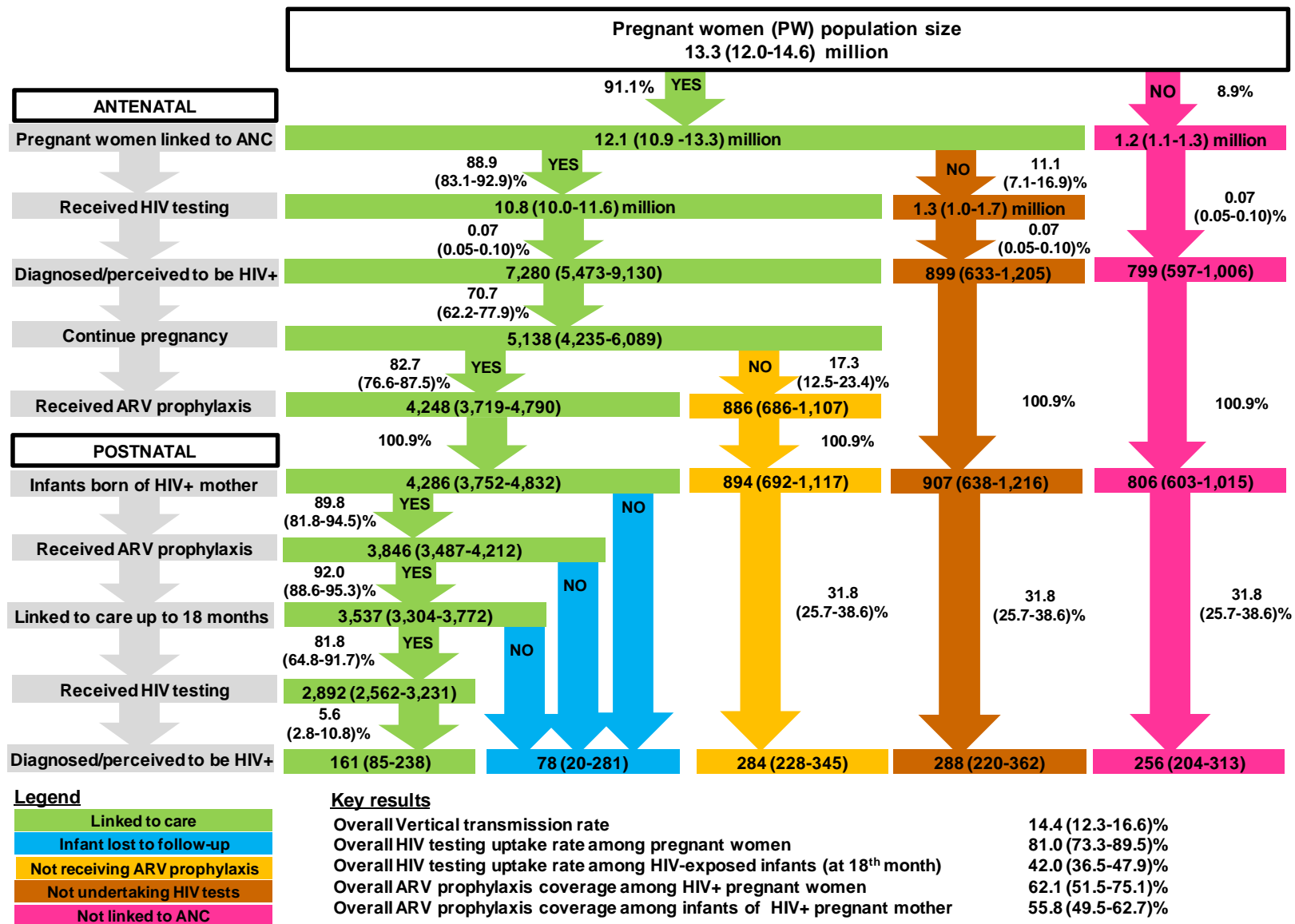


Figure S2g. Continuum of care of PMTCT program in 2009 in China

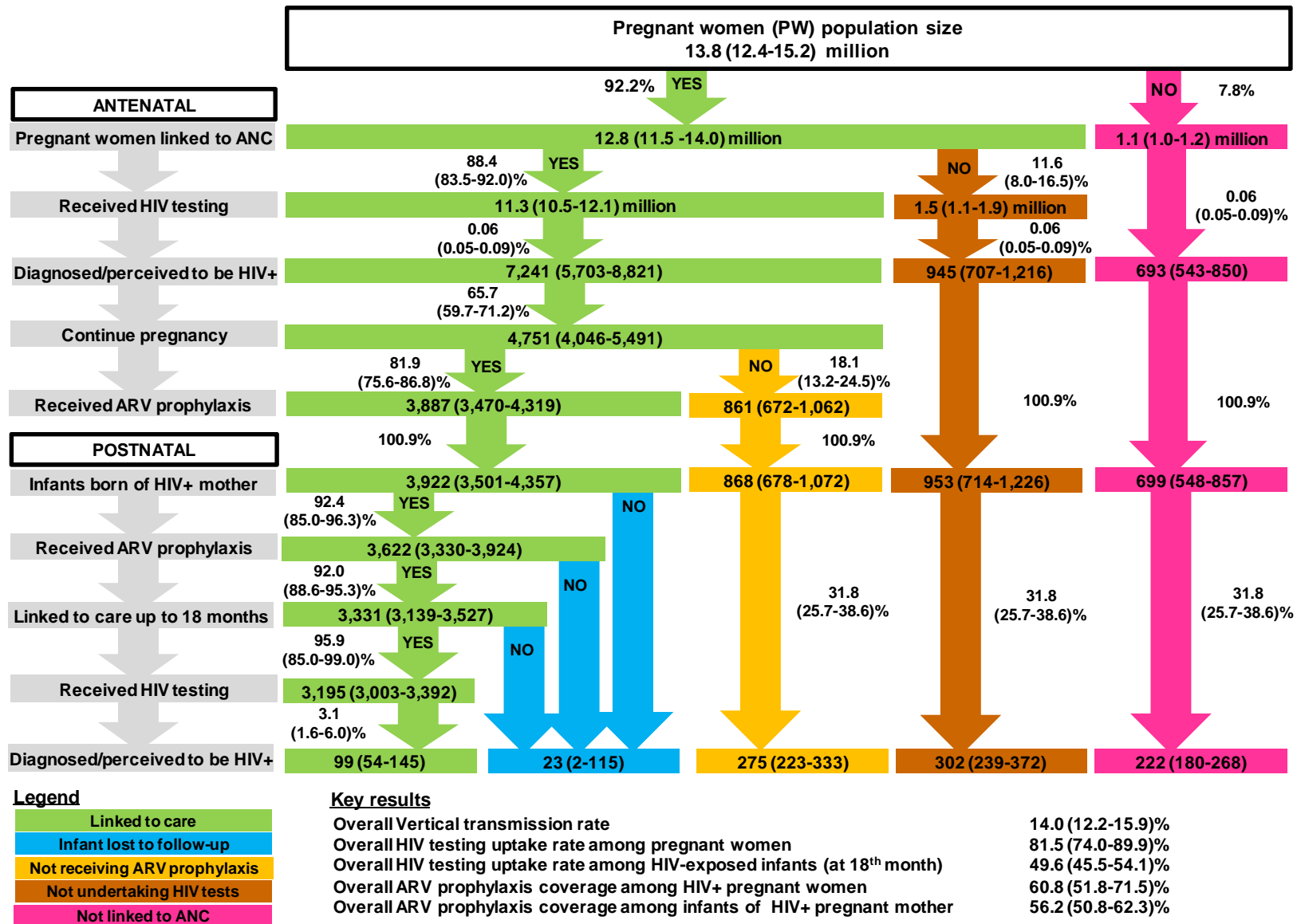


Figure S2h. Continuum of care of PMTCT program in 2010 in China

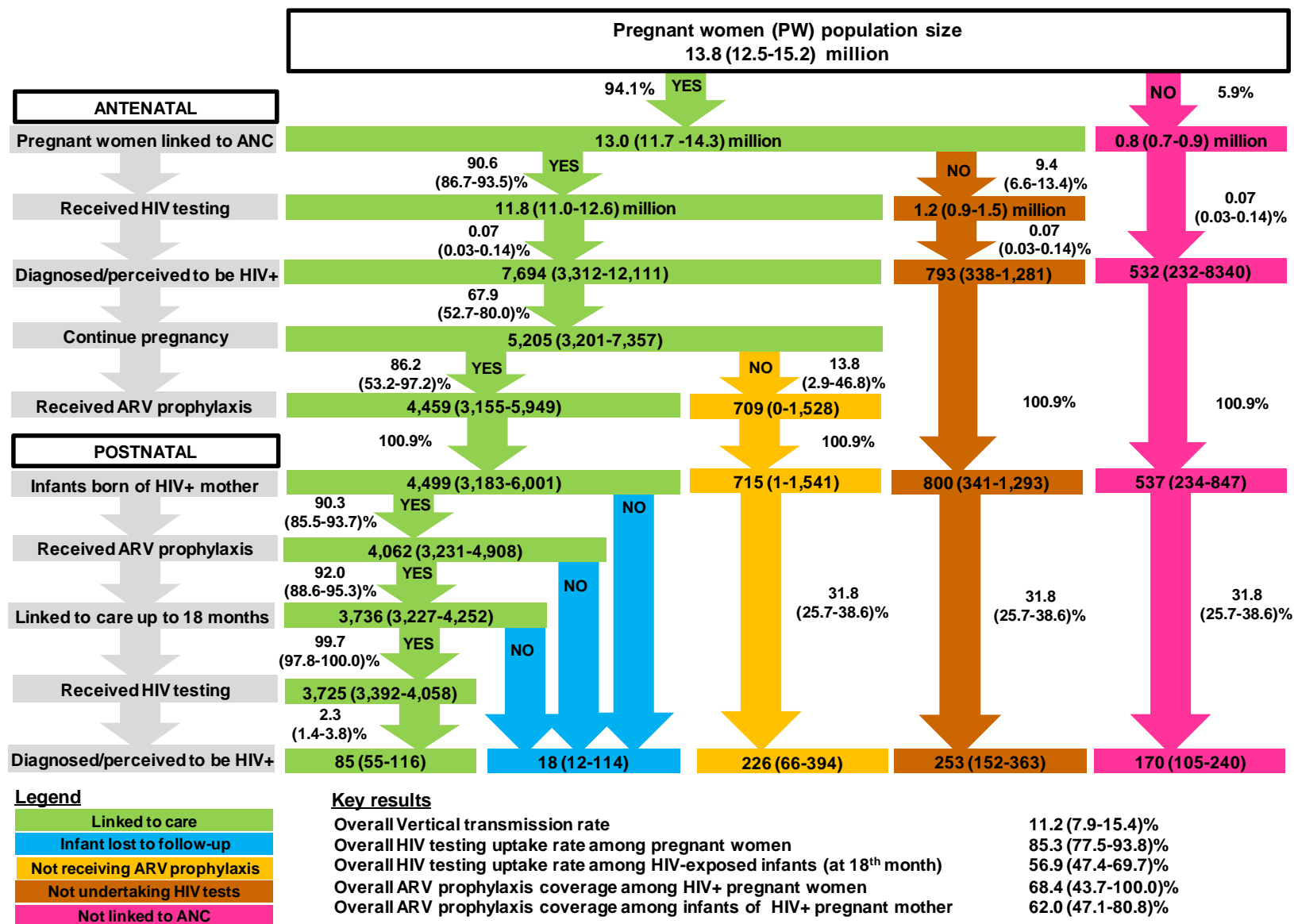


Figure S2i. Continuum of care of PMTCT program in 2011 in China

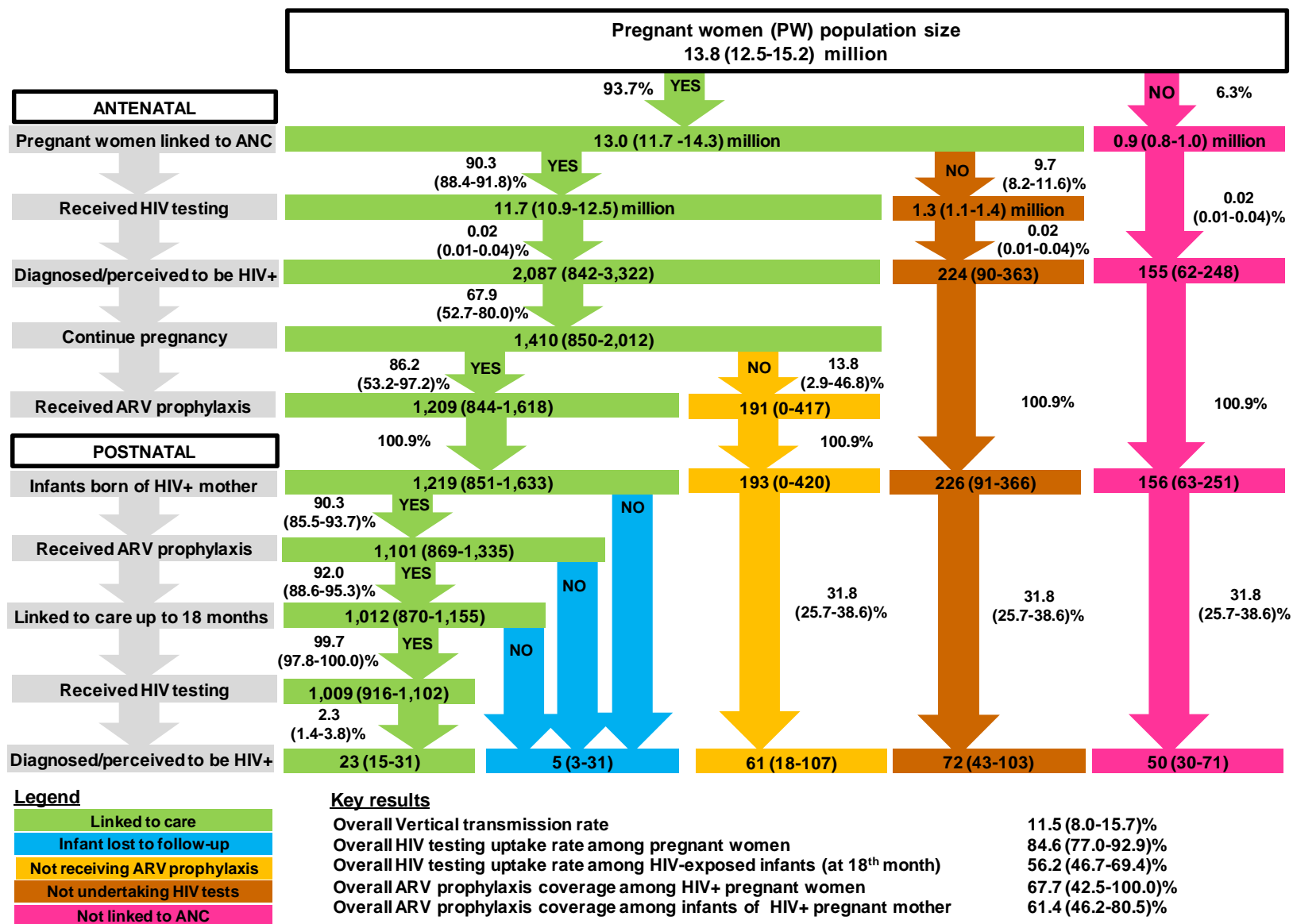


Table S1. Summery table of the 113 included studies (NSS: national surveillance sites; MCH: maternal and child health center)

First author, published year	Province	Recruitment venue	HIV prevalence among pregnant women	HIV testing rate among pregnant women in antenatal care	Percentage of uptake of ARV prophylaxis among HIV-positive pregnant women	Percentage of infants who received ARV prophylaxis	HIV testing rate among infants remained in care until age of 18-month	Percentage of infants tested HIV-positive at 18th month	Quality score
<2003									
A SY, 2003 ¹	Xinjiang	NSS	24 / 6012						6
Chen L, 2006 ²	Guangdong	MCH	12 / 77997						6
He Y, 2003 ³	Guangdong	NSS	1 / 3310						5
Li H, 2001 ⁴	Yunnan	NSS	38 / 25345						5
Liu YM, 2004 ⁵	Guangdong	MCH	1 / 49341						5
Peng X, 2003 ⁶	Yunnan	NSS	29 / 4202						5
Ren JH, 2002 ⁷	Guangdong	Hospital	2 / 11701						5
Sun DY, 2008 ⁸	Henan	MCH	49 / 9412						4
Wu ZJ, 2007 ⁹	Guangdong	MCH	0 / 3873	3873 / 4489					5
Yang L, 2008 ¹⁰	Yunnan	NSS	42 / 17135						7
Zhang M, 2004 ¹¹	Xinjiang	MCH	12 / 1634						4
Pooled estimates from meta-analysis (95%CI)			0.09% (0.02-0.43%)	86.28% (85.24-87.25%)					
Test of heterogeneity			$I^2=96.35\%$, $p<0.001$	$I^2=0\%$, $p=1.00$					
Test of overall effect			$Z=-8.50$, $p<0.001$	$Z=42.39$, $p<0.001$					
2003									
An FL, 2009 ¹²	Henan	NSS	3 / 1985						4
Chen JX, 2005 ¹³	Guangdong	Hospital	1 / 4365						4
Chen L, 2006 ²	Guangdong	MCH	10 / 124975						6
Cheng WM, 2006 ¹⁴	Hunan	NSS	15 / 38211						5
Fang L, 2007 ¹⁵	Guangdong	NSS	10 / 116851						6
Liu YM, 2004 ⁵	Guangdong	MCH	3 / 45396						5
Qiu X, 2009 ¹⁶	4 counties	NSS	14 / 2746	2746 / 12703					4

Sun DY, 2008 ⁸	Henan	MCH	106 / 117405				4
Wu ZJ, 2007 ⁹	Guangdong	MCH	2 / 8860	8860 / 9751			5
Xu MY, 2011 ¹⁷	Guangxi	NSS	3 / 882				6
Yang L, 2008 ¹⁰	Yunnan	NSS	85 / 22876				7
Zhang M, 2004 ¹¹	Xinjiang	MCH	3 / 308				4
Pooled estimates from meta-analysis (95%CI)			0.07% (0.03-0.06%)	62.35% (4.70-98.23%)			
Test of heterogeneity			$I^2=96.93\%$, $p<0.001$	$I^2=99.99\%$, $p<0.001$			
Test of overall effect			$Z=-8.50$, $p<0.001$	$Z=0.28$, $p=0.778$			

2004

Wu ZJ, 2007 ⁹	Guangdong	MCH	0 / 10553	10553 / 10726			5
Fang L, 2007 ¹⁵	Guangdong	NSS	14 / 141259				6
Zhou XK, 2009 ¹⁸	Hubei	MCH	1 / 10012	10012 / 11150			3
Chen L, 2006 ²	Guangdong	MCH	14 / 135680				6
Zhao J, 2010 ¹⁹	Hubei	NSS	1 / 4469	4469 / 7428			5
Cheng WM, 2006 ¹⁴	Hunan	NSS	9 / 35936	35936 / 46375			5
Dai GH, 2010 ²⁰	Hubei	NSS	6 / 21550				5
An FL, 2009 ¹²	Henan	NSS	4 / 12041				4
Wu M, 2011 ²¹	Hunan	NSS	0 / 1163	1163 / 35771			3
Sun DY, 2008 ⁸	Henan	MCH	163 / 125128				4
Xu MY, 2011 ¹⁷	Guangxi	NSS	5 / 1896				6
Sun DY, 2006 ²²	Henan	NSS	232 / 57215				6
Qiu X, 2009 ¹⁶	4 counties	NSS	119 / 22891	22891 / 34294	44 / 94	12 / 93	4
Wang LH, 2006 ²³	Multi provinces	NSS			54 / 62		3
Pooled estimates from meta-analysis (95%CI)			0.05% (0.02-0.10%)	70.51% (44.13-87.86%)	70.39% (24.42-94.59%)	12.90% (7.48-21.36%)	
Test of heterogeneity			$I^2=97.97\%$, $p<0.001$	$I^2=99.98\%$, $p<0.001$	$I^2=95.51\%$, $p<0.001$	$I^2=0\%$, $p<0.001$	
Test of overall effect			$Z=-20.51$, $p<0.001$	$Z=1.54$, $p=0.123$	$Z=0.85$, $p=0.395$	$Z=-6.17$, $p<0.001$	

2005

Tang GZ, 2008 ²⁴	Hubei	NSS	0 / 23728				7
Zhou XK, 2009 ¹⁸	Hubei	MCH	0 / 23553	23553 / 25182			3

Dai GH, 2010 ²⁰	Hubei	NSS	14 / 277876					5
Fang L, 2007 ¹⁵	Guangdong	NSS	21 / 159519					6
Chen WX, 2010 ²⁵	Guizhou	NSS	0 / 3795	3795 / 8782				5
Cheng WM, 2006 ¹⁴	Hunan	NSS	7 / 45935	45935 / 46742				5
Wu ZJ, 2007 ⁹	Guangdong	MCH	2 / 11770	11770 / 11886				5
Tian ZW, 2011 ²⁶	Henan	NSS	2 / 9453					5
Wu M, 2011 ²¹	Hunan	NSS	2 / 9078	9078 / 38582				3
Wang HN, 2006 ²⁷	Guangdong	Hospital	1 / 3691	3691 / 4031				5
An FL, 2009 ¹²	Henan	NSS	3 / 10258					4
Zhao J, 2010 ¹⁹	Hubei	NSS	2 / 5207	5207 / 8912				5
Ma JQ, 2007 ²⁸	Guangdong	NSS	3 / 5441	5441 / 22028				7
Wang LQ, 2011 ²⁹	Yunnan	MCH	0 / 755					3
Liu JR, 2011 ³⁰	Hubei	NSS	3 / 3651					7
Chen ZY, 2010 ³¹	Henan	NSS	228 / 219320		100 / 119			4
Sun DY, 2008 ⁸	Henan	MCH	234 / 204384					4
Ma Q, 2012 ³²	Yunnan	NSS	34 / 13659	13659 / 35248				7
Huang WT, 2011 ³³	Yunnan	NSS	4 / 1476					3
Fang LW, 2010 ³⁴	National	NSS	914 / 336459	336459 / 581975	362 / 560	409 / 530		7
Xu MY, 2011 ¹⁷	Guangxi	NSS	8 / 1956					6
Lan Z, 2009 ³⁵	Guangxi	MCH	9 / 2160					5
Yang L, 2008 ¹⁰	Yunnan	NSS	101 / 23890					7
Qiu X, 2009 ¹⁶	4 counties	NSS	143 / 24387	24387 / 35366	63 / 106		17 / 104	4
Fang LW, 2008 ³⁶	Multi provinces	NSS		227 / 774				4
Zhou XC, 2012 ³⁷	Shanxi	MCH		24807 / 32578				3
Wang Q, 2012 ³⁸	Multi provinces	NSS			263 / 341	287 / 341		3
Pooled estimates from meta-analysis (95%CI)			0.08% (0.05-0.11%)	72.18% (61.22-81.00%)	71.99% (61.49-80.54%)	80.72% (72.89-86.70%)	16.35% (10.41-24.73)	
Test of heterogeneity			$I^2=97.52\%, p<0.001$	$I^2=99.98\%, p<0.001$	$I^2=90.50\%, p<0.001$	$I^2=84.03\%, p=0.012$	$I^2=0\%, p<0.001$	
Test of overall effect			$Z=-34.31, p<0.001$	$Z=3.76, p<0.001$	$Z=3.89, p<0.001$	$Z=6.34, p<0.001$	$Z=-6.16, p<0.001$	

2006

Tang GZ, 2008 ²⁴	Hubei	NSS	1 / 29249					7
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Ma JQ, 2007 ²⁸	Guangdong	NSS	1 / 19660	19660 / 21208					7
Hu J, 2010 ³⁹	Hubei	NSS	4 / 62051						6
Wu M, 2011 ²¹	Hunan	NSS	1 / 14202	14202 / 34786					3
Dai GH, 2010 ²⁰	Hubei	NSS	40 / 399301						5
Zhou XK, 2009 ¹⁸	Hubei	MCH	3 / 27566	27566 / 28447					3
Wu ZJ, 2007 ⁹	Guangdong	MCH	1 / 6451	6451 / 6458					5
Fang L, 2007 ¹⁵	Guangdong	NSS	31 / 192949		18 / 35	18 / 35	29 / 30		6
Zhao J, 2010 ¹⁹	Hubei	NSS	1 / 6105	6105 / 9607					5
Chen WX, 2010 ²⁵	Guizhou	NSS	1 / 6097	6097 / 10562					5
Tian ZW, 2011 ²⁶	Henan	NSS	5 / 24358						5
Lin H, 2006 ⁴⁰	Jiangxi	MCH	0 / 1437						4
An FL, 2009 ¹²	Henan	NSS	6 / 11997						4
Sun DY, 2008 ⁸	Henan	MCH	190 / 307185		376 / 436	410 / 431	167 / 192	9 / 167	4
Chen ZY, 2010 ³¹	Henan	NSS	221 / 349305		101 / 111				4
Liu JR, 2011 ³⁰	Hubei	NSS	4 / 3855						7
Lan Z, 2009 ³⁵	Guangxi	MCH	7 / 5423						5
Li Y, 2007 ⁴¹	Yunnan	NSS	3 / 2256						3
Wang LQ, 2011 ²⁹	Yunnan	MCH	3 / 2243						3
Xu MY, 2011 ¹⁷	Guangxi	NSS	3 / 1944						6
Liu CX, 2012 ⁴²	Yunnan	MCH	12 / 7723						7
Chen YQ, 2007 ⁴³	Guangdong	MCH	9 / 3886						6
Ma Q, 2012 ³²	Yunnan	NSS	74 / 22857	22857 / 33842					7
Shi X, 2007 ⁴⁴	Yunnan	NSS	6 / 1816						7
Huang WT, 2011 ³³	Yunnan	NSS	18 / 2720						3
Qiu X, 2009 ¹⁶	4 counties	NSS	209 / 25773	25773 / 36537	104 / 155			21 / 154	4
Zhou XC, 2012 ³⁷	Shanxi	MCH		29452 / 37316					3
Meng XN, 2008 ¹⁴⁵	Guangxi	NSS		12049 / 15211					5
Fang LW, 2010 ³⁴	National	NSS	1453 / 1287812	1287812 / 1594579	623 / 931	720 / 899	297 / 345		7
Du M, 2006 ⁴⁶	Yunnan	MCH		7726 / 9145					3
Zhu ML, 2008 ⁴⁷	Guangxi	MCH		22591 / 26391					3
Peng YE, 2003 ⁴⁸	Henan	NSS		766806 / 801538			229 / 254	9 / 229	5

Zhang CF, 2011 ⁴⁹	Yunnan	MCH		41 / 59			0 / 35	7
Wang Q, 2012 ³⁸	Multi provinces	NSS		178 / 233	198 / 233			3
Gong SY, 2007 ⁵⁰	Multi provinces	NSS		303 / 346		75 / 80		3
Gao LP, 2006 ⁵¹	Yunnan	NSS		45 / 47				4
Shi JC, 2007 ⁵²	Henan	NSS			25 / 35			3
Chen ZY, 2007 ⁵³	Henan	NSS			145 / 171		9 / 171	3
Huang Q, 2009 ⁵⁴	Guangdong	NSS				32 / 32	3 / 32	4
Pooled estimates from meta-analysis (95%CI)			0.06% (0.04-0.10%)	85.60% (77.77-90.99%)	78.79% (70.19-85.43%)	81.84% (71.55-88.98%)	89.22% (85.56-92.04)	6.45% (3.73-10.93)
Test of heterogeneity			$I^2=98.34\%, p<0.001$	$I^2=99.99\%, p<0.001$	$I^2=93.53\%, p<0.001$	$I^2=92.64\%, p<0.001$	$I^2=44.67\%, p=0.108$	$I^2=68.85\%, p=0.007$
Test of overall effect			$Z=-31.93, p<0.001$	$Z=6.59, p<0.001$	$Z=5.64, p<0.001$	$Z=5.06, p<0.001$	$Z=12.39, p<0.001$	$Z=-9.10, p<0.001$

2007

Hu J, 2010 ³⁹	Hubei	NSS	5 / 66579					6
Dai GH, 2010 ²⁰	Hubei	NSS	50 / 509461					5
Zhou XK, 2009 ¹⁸	Hubei	MCH	3 / 28830	28830 / 29172				3
Guo YL, 2008 ⁵⁵	Guangdong	MCH	0 / 4593					5
Tian ZW, 2011 ²⁶	Henan	NSS	3 / 26249					5
Tang GZ, 2008 ²⁴	Hubei	NSS	5 / 32321					7
Shi XY, 2009 ⁵⁶	Shandong	NSS	7 / 43504					5
Chen WX, 2010 ²⁵	Guizhou	NSS	2 / 8040	8040 / 11114				5
Wu M, 2011 ²¹	Hunan	NSS	6 / 21005	21005 / 31938				3
Zhao J, 2010 ¹⁹	Hubei	NSS	2 / 6766	6766 / 10210				5
An FL, 2009 ¹²	Henan	NSS	4 / 12292					4
Ma JQ, 2007 ²⁸	Guangdong	NSS	2 / 5571	5571 / 5571				7
Du WJ, 2010 ⁵⁷	Zhejiang	Hospital	2 / 4031					4
Wang YX, 2011 ⁵⁸	Guangdong	NSS	25 / 42425					3
Chen ZY, 2010 ³¹	Henan	NSS	92 / 151980	720605 / 773929	49 / 54			4
Wang LQ, 2011 ²⁹	Yunnan	MCH	2 / 2672					3
Liu JR, 2011 ³⁰	Hubei	NSS	4 / 5133					7
Liu CX, 2012 ⁴²	Yunnan	MCH	8 / 7061					7
Wang FK, 2009 ⁵⁹	Henan	NSS	78 / 53056					6

Lan Z, 2009 ³⁵	Guangxi	MCH	6 / 3114						5
Tan XL, 2010 ⁶⁰	Chongqing	Hospital	1 / 454						3
Ma Q, 2012 ³²	Yunnan	NSS	71 / 27414	27414 / 33893					7
Gui XZ, 2012 ⁶¹	Guangxi	NSS	19 / 6885	6885 / 7019					6
Song LP, 2012 ⁶²	Guangxi	NSS	251 / 86552						7
Gui XZ, 2008 ⁶³	Guangxi	NSS	14 / 4639						3
Wang SW, 2008 ⁶⁴	Henan	NSS	276 / 73702		121 / 121			2 / 82	3
Yang L, 2008 ¹⁰	Yunnan	NSS	113 / 23317						7
Xu MY, 2011 ¹⁷	Guangxi	NSS	11 / 1874						6
Zhou XC, 2012 ³⁷	Shanxi	MCH		36424 / 42760					3
Fang LW, 2010 ³⁴	National	NSS	1739 / 1524595	1524595 / 1753191	857 / 1284	1053 / 1257	570 / 756		7
Chen WM, 2009 ⁶⁵	Henan	NSS			27 / 37	33 / 38			6
Wang Q, 2012 ³⁸	Multi provinces	NSS			306 / 395	338 / 395			3
Wang CJ, 2009 ⁶⁶	Henan	MCH			62 / 69	71 / 71		1 / 51	3
Pan LH, 2008 ⁶⁷	Guangxi	Hospital			50 / 55	53 / 56			6
Zhang CF, 2011 ⁴⁹	Yunnan	MCH			50 / 53			3 / 34	7
Pang J, 2008 ⁶⁸	Guangxi	Hospital			73 / 73				6
Li MH, 2009 ⁶⁹	Henan	NSS				47 / 60			4
Wang LH, 2008 ⁷⁰	Multi provinces	NSS						38 / 287	5
Pooled estimates from meta-analysis (95%CI)			0.07% (0.05-0.11%)	89.67% (85.34-92.82%)	86.84% (79.24-91.94%)	85.43% (80.99-88.97%)	75.40% (72.20-78.34%)	6.25% (2.39-15.36%)	
Test of heterogeneity			$I^2=97.91\%, p<0.001$	$I^2=99.98\%, p<0.001$	$I^2=89.56\%, p<0.001$	$I^2=57.99\%, p=0.036$	$I^2=0\%, p=1.00$	$I^2=69.44\%, p=0.020$	
Test of overall effect			$Z=-39.11, p<0.001$	$Z=10.62, p<0.001$	$Z=6.76, p<0.001$	$Z=10.86, p<0.001$	$Z=13.26, p<0.001$	$Z=-5.30, p<0.001$	
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2008									
Wu M, 2011 ²¹	Hunan	NSS	2 / 25434	25434 / 34608					3
Dai GH, 2010 ²⁰	Hubei	NSS	47 / 546946						5
Hu J, 2010 ³⁹	Hubei	NSS	7 / 73319						6
Cao YZ, 2011 ⁷¹	Guangdong	Hospital	15 / 126373	126373 / 140414					3
An FL, 2009 ¹²	Henan	NSS	2 / 13455						4
Tian ZW, 2011 ²⁶	Henan	NSS	5 / 32457						5
Zhao J, 2010 ¹⁹	Hubei	NSS	2 / 7751	7751 / 10872					5

Chen WX, 2010 ²⁵	Guizhou	NSS	3 / 9500	9500 / 11647					5
Wang YX, 2011 ⁵⁸	Guangdong	NSS	23 / 44852						3
Liu JR, 2011 ³⁰	Hubei	NSS	4 / 5441						7
Huang XN, 2009 ⁷²	Guangdong	Hospital	1 / 1187						7
Wang LQ, 2011 ²⁹	Yunnan	MCH	3 / 2954						3
Wang FK, 2009 ⁵⁹	Henan	NSS	86 / 73343						6
Liu CX, 2012 ⁴²	Yunnan	MCH	10 / 7788						7
Weng YQ, 2010 ⁷³	Guangxi	NSS	47 / 29023						5
He BC, 2012 ⁷⁴	Yunnan	NSS	5 / 2931	2931 / 3191					7
Ma Q, 2012 ³²	Yunnan	NSS	64 / 32342	32342 / 33054					7
Xu MY, 2011 ¹⁷	Guangxi	NSS	4 / 1892						6
Song LP, 2012 ⁶²	Guangxi	NSS	337 / 134800						7
Gui XZ, 2012 ⁶¹	Guangxi	NSS	15 / 5672	5672 / 5770					6
Li L, 2008 ⁷⁵	Shanxi	Hospital	3 / 468						6
Zhou FR, 2010 ⁷⁶	Shandong	NSS		57064 / 83370					4
Fang LW, 2010 ³⁴	National	NSS	2355 / 1833246	1833246 / 2055232	977 / 1316	1116 / 1249	871 / 1177		7
Zhang N, 2008 ⁷⁷	Multi provinces	Hospital			20 / 40	20 / 37			4
Meng XN, 2008II ⁷⁸	Guangxi	NSS			22 / 35	32 / 35			3
Wang LH, 2010 ⁷⁹	Multi provinces	NSS			856 / 1072		31 / 1072		6
Pang J, 2009 ⁸⁰	Guangxi	Hospital			76 / 92				6
Wang Q, 2012 ³⁸	Multi provinces	NSS			373 / 445	414 / 445			3
Wang LH, 2009I ⁸¹	Multi provinces	NSS			278 / 312		40 / 312		5
Zhang CF, 2011 ⁴⁹	Yunnan	MCH			69 / 76		3 / 46		7
Sun GQ, 2009 ⁸²	Henan	NSS			332 / 352	339 / 362	31 / 1072		5
Fan EJ, 2010 ⁸³	Henan	NSS			141 / 141	142 / 142	107 / 107	7 / 107	3
Dou YY, 2010 ⁸⁴	Guangxi	Hospital				42 / 54	0 / 42		3
Pooled estimates from meta-analysis (95%CI)			0.07% (0.05-0.10%)	88.93% (83.11-92.92%)	82.71% (76.62-87.48%)	89.75% (81.82-94.45%)	81.79% (64.77-91.65%)	5.56% (2.79-10.76%)	
Test of heterogeneity			$I^2=97.15\%, p<0.001$	$I^2=99.98\%, p<0.001$	$I^2=92.68\%, p<0.001$	$I^2=90.80\%, p<0.001$	$I^2=79.24\%, p=0.008$	$I^2=88.60\%, p<0.001$	
Test of overall effect			$Z=-38.69, p<0.001$	$Z=8.33, p<0.001$	$Z=8.11, p<0.001$	$Z=10.86, p<0.001$	$Z=3.30, p=0.001$	$Z=-7.74, p<0.001$	

Dai GH, 2010 ²⁰	Hubei	NSS	50 / 533799		43 / 101	50 / 98	25 / 30		5
Zhang SW, 2012 ⁸⁵	Anhui	NSS	13 / 132362	132362 / 178105					7
Li YL, 2011 ⁸⁶	Shanxi	MCH	2 / 18398	18398 / 45969					3
Cao YZ, 2011 ⁷¹	Guangdong	Hospital	14 / 121606	121606 / 135115					3
Li Y, 2012 ⁸⁷	Guizhou	MCH	12 / 98956						5
Tian ZW, 2011 ²⁶	Henan	NSS	5 / 34381						5
Wang LQ, 2011 ²⁹	Yunnan	MCH	1 / 2829						3
Li Y, 2011 ⁸⁸	Guangxi	MCH	2 / 5593						4
Zhao F, 2010 ⁸⁹	Shaanxi	Hospital	1 / 1706						6
Wang YX, 2011 ⁵⁸	Guangdong	NSS	34 / 41195						3
Chen WX, 2010 ²⁵	Guizhou	NSS	8 / 9323	9323 / 11168					5
Song LP, 2012 ⁶²	Guangxi	NSS	373 / 373000						7
Wang FK, 2009 ⁵⁹	Henan	NSS	43 / 34122			298 / 326	221 / 224	7 / 221	6
Zhu FY, 2010 ⁹⁰	Guangdong	NSS	63 / 41783	41783 / 45081	30 / 30	30 / 30			5
Liu CX, 2012 ⁴²	Yunnan	MCH	20 / 13047						7
Wu M, 2011 ²¹	Hunan	NSS	38 / 24549	24549 / 39540					3
Xu MY, 2011 ¹⁷	Guangxi	NSS	3 / 1904						6
He BC, 2012 ⁷⁴	Yunnan	NSS	8 / 3399	3399 / 3640					7
Ma Q, 2012 ³²	Yunnan	NSS	94 / 38239						7
Gui XZ, 2012 ⁶¹	Guangxi	NSS	19 / 5988	5988 / 6037					6
Zhou FR, 2010 ⁷⁶	Shandong	NSS		104002 / 141505					4
Fang LW, 2010 ³⁴	National	NSS	3662 / 3741337	3741337 / 4375678	1554 / 2065	1701 / 2059	652 / 895		7
Zhou XC, 2012 ³⁷	Shanxi	MCH		46460 / 51388					3
Mao XM, 2012 ⁹¹	Yunnan	NSS		23771 / 25298	69 / 88	81 / 90	55 / 60	0 / 55	6
Fang FM, 2011 ⁹²	Zhejiang	MCH		16996 / 16996					7
Yu L, 2012 ⁹³	Guangxi	NSS			139 / 194			13 / 194	6
Wang F, 2010 ⁹⁴	Multi provinces	NSS			3046 / 3808				5
Zhang CF, 2011 ⁴⁹	Yunnan	MCH			116 / 122			1 / 87	7
Peng RY, 2010 ⁹⁵	Yunnan	Hospital			92 / 94	92 / 94			5
Liao FL, 2010 ⁹⁶	Guangxi	Hospital			31 / 31	32 / 32			3
Gao LP, 2009 ⁹⁷	Yunnan	MCH			90 / 90	90 / 92		3 / 92	4

Meng CL, 2011 ⁹⁸	Guangxi	Hospital		129 / 129	129 / 129		0 / 129	6
Han BY, 2010 ⁹⁹	Henan	MCH				85 / 85	2 / 85	4
Wang LH, 2009II ¹⁰⁰	Multi provinces	NSS				554 / 554	57 / 554	7
Zhou ZQ, 2010 ¹⁰¹	Yunnan	NSS					2 / 193	6
Pooled estimates from meta-analysis (95%CI)			0.06% (0.05-0.09%)	88.42% (83.53-91.99%)	81.85% (75.55-86.80%)	92.39% (84.97-96.31%)	95.92% (84.99-98.98%)	3.10% (1.59-5.97%)
Test of heterogeneity			$I^2=96.84\%, p<0.001$	$I^2=99.99\%, p<0.001$	$I^2=92.69\%, p<0.001$	$I^2=92.78\%, p<0.001$	$I^2=92.53\%, p<0.001$	$I^2=77.72\%, p<0.001$
Test of overall effect			$Z=-45.33, p<0.001$	$Z=9.75, p<0.001$	$Z=7.82, p<0.001$	$Z=6.40, p<0.001$	$Z=4.35, p<0.001$	$Z=-9.86, p<0.001$

2010

Tian ZW, 2011 ²⁶	Henan	NSS	1 / 53616					5
Zhang SW, 2012 ⁸⁵	Anhui	NSS	4 / 138485	138485 / 197582				7
Li Y, 2012 ⁸⁷	Guizhou	MCH	9 / 124587					5
Pang CH, 2012 ¹⁰²	Guangxi	NSS	10 / 118119					6
Cao YZ, 2011 ⁷¹	Guangdong	Hospital	18 / 126036	126036 / 136996				3
Wu M, 2011 ²¹	Hunan	NSS	106 / 591000	591000 / 803640				3
Li Y, 2011 ⁸⁸	Guangxi	MCH	2 / 7312					4
Wu HY, 2012 ¹⁰³	Guangxi	NSS	11 / 32734	32734 / 44672				5
Sun YP, 2011 ¹⁰⁴	Xinjiang	NSS	0 / 890					5
Song LP, 2012 ⁶²	Guangxi	NSS	460 / 766232					7
Hang H, 2011 ¹⁰⁵	Zhejiang	MCH	0 / 800					3
Wang LQ, 2011 ²⁹	Yunnan	MCH	2 / 2888					3
Wang YX, 2011 ⁵⁸	Guangdong	NSS	34 / 44197	25 / 49				3
Liu CX, 2012 ⁴²	Yunnan	MCH	12 / 9934					7
Ma Q, 2012 ³²	Yunnan	NSS	79 / 35840			347 / 347	8 / 347	7
Zhou Y, 2012 ¹⁰⁶	Guangxi	MCH	1 / 400					6
He BC, 2012 ⁷⁴	Yunnan	NSS	9 / 3575	3575 / 3682				7
Gui XZ, 2012 ⁶¹	Guangxi	NSS	16 / 5684	5684 / 5718	177 / 208	187 / 207		6
Xu MY, 2011 ¹⁷	Guangxi	NSS	8 / 2037					6
Fan LP, 2011 ¹⁰⁷	Xinjiang	Hospital	33 / 3008					6
Su GY, 2011 ¹⁰⁸	Sichuan	NSS	94 / 3491					3
Pang J, 2011 ¹⁰⁹	Guangxi	Hospital		136 / 136				5

Huang NY, 2012 ¹¹⁰	Guangxi	MCH				73 / 73	3 / 73	7
Jiang CQ, 2011 ¹¹¹	Yunnan	MCH					1 / 105	4
Shang YL, 2010 ¹¹²	Henan	MCH					2 / 138	4
Pooled estimates from meta-analysis (95%CI)			0.07% (0.03-0.14%)	90.59% (86.65-93.45%)	86.16% (53.20-97.15%)	90.34% (85.50-93.68%)	99.69% (97.82-99.96%)	2.29% (1.36-3.83%)
Test of heterogeneity			$I^2=99.00\%, p<0.001$	$I^2=99.98\%, p<0.001$	$I^2=94.08\%, p<0.001$	$I^2=0\%, p=1.00$	$I^2=0\%, p=0.438$	$I^2=0\%, p=0.520$
Test of overall effect			$Z=-18.27, p<0.001$	$Z=11.27, p<0.001$	$Z=2.11, p=0.035$	$Z=9.50, p<0.001$	$Z=5.78, p<0.001$	$Z=-13.87, p<0.001$
<hr/>								
2011								
Zhang SW, 2012 ⁸⁵	Anhui	NSS	11 / 200164	200164 / 223985				7
Li Y, 2012 ⁸⁷	Guizhou	MCH	19 / 102345					5
Wu HY, 2012 ¹⁰³	Guangxi	NSS	16 / 49250	49250 / 54063				5
Wu JH, 2012 ¹¹³	Guangdong	MCH	3 / 8442					6
Pooled estimates from meta-analysis (95%CI)			0.02% (0.01-0.04%)	90.26% (88.43-91.83%)				
Test of heterogeneity			$I^2=86.64\%, p=0.469$	$I^2=99.29\%, p<0.001$				
Test of overall effect			$Z=-20.70, p<0.001$	$Z=22.60, p<0.001$				

Table S2. Result of individual variable meta-regression models for meta-analysis.

Study characteristics	Study factors		
	Sample size	Recruitment venue*	Study year
HIV prevalence among pregnant women	$\beta = 0.000$ $p = 0.075$	$\beta = -0.085$ $p = 0.266$	$\beta = -0.104$ $p = 0.000$
HIV testing rate among pregnant women	$\beta = 0.000$ $p = 0.823$	$\beta = 0.948$ $p = 0.000$	$\beta = 0.218$ $p = 0.000$
HIV-positive pregnant women received ARV prophylaxis	$\beta = -0.001$ $p = 0.307$	$\beta = 0.473$ $p = 0.000$	$\beta = 0.113$ $p = 0.404$
ARV prophylaxis among infants who born to diagnosed HIV-positive mother	$\beta = 0.000$ $p = 0.732$	$\beta = 0.604$ $p = 0.001$	$\beta = 0.200$ $p = 0.026$
HIV testing among infants remained in care until age of 18-month	$\beta = -0.002$ $p = 0.000$	$\beta = 0.429$ $p = 0.086$	$\beta = 0.170$ $p = 0.212$
Infants tested HIV-positive at 18 th month	$\beta = 0.000$ $p = 0.946$	$\beta = -0.322$ $p = 0.063$	$\beta = -0.302$ $p = 0.001$

* 1: national surveillance sites; 2: hospital; 3: maternal and child health center. Table showing the meta-regression coefficient (β) and significance of β (p -value). p -values in bold print represent significant associations ($p < 0.10$).

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Abstract in Chinese

目的 中国政府 2010 年用于艾滋病母婴传播的经费已近 1.4 亿美元。本研究旨在评价中国在艾滋病母婴传播阻断工作中取得的进步及面临的挑战。

方法 全面系统检索与中国艾滋病母婴传播相关的中英文文献,获得 2003 至 2011 年相关指标的数据。本研究严格遵照“系统综述和 meta 分析报告规范(PRISMA checklist)”。

结果 本研究共纳入113篇文献。1991至2011年,在接受产检的中国孕妇中HIV感染率低于0.1%。从2003年到2011年,在接受产检的中国孕妇中,HIV检测率从62.4%(95% CI: 4.7%~98.2%)上升至90.3% (95% CI: 88.4%~91.8%)。HIV阳性孕产妇所生孩子在18个月的HIV检测率从22.1% (95% CI: 16.3%~32.3%)上升至82.8% (95% CI: 66.9%~99.5%)。HIV阳性孕产妇中接受艾滋病母婴阻断药物的比例从35.2% (95% CI: 12.2% ~47.3%)提高至86.2% (95% CI: 53.2%~97.2%),其孩子接受艾滋病母婴阻断药物的比例从26.9% (95% CI: 24.3%~ 28.9%)提高至90.3% (95% CI: 85.5%~93.7%)。HIV母婴传播率从2003年的31.8% (95% CI: 25.7%~38.6%)下降至2011年的2.3% (95% CI: 1.4%~3.8%)。根据本研究估算,2003-2011年间在接受艾滋病母婴阻断药物的中国孕产妇所生的25312 (95% CI: 23995~26644) 名孩子中,975 (95% CI: 564~1395) 名孩子诊断HIV阳性,HIV母婴传播率为3.9% (95% CI: 3.2%~4.6%)。然而,如果考虑那些未接受产前检查,未接受HIV检测及未应用艾滋病母婴阻断药物的孕产妇,2003-2011年间中国总的HIV母婴传播率达17.4% (95% CI: 15.8%~to 19.0%)。

结论 虽然中国的艾滋病母婴阻断工作取得一定成绩,但艾滋病母婴阻断工作的各个环节仍需进一步加强。

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