



Promoting women's health in China



PROMOTING WOMEN'S HEALTH IN CHINA

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Women's health in China in the era of growing rights and falling fertility

A BMJ collection sets out the successes and challenges for the country

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“Women hold up half the sky.” This slogan, created in the 1960s in China to symbolise women's liberation in a rapidly industrialising country, is an apt vision of a world in which women are recognised to have equal rights and status to men. China's male dominated society historically confined women to the domestic sphere and carrying on the family line. Since the foundation of new China in 1949, ideas of women's roles have changed radically. Today, women in China participate and have rights and responsibilities in almost every aspect of life. They now account for 50% of those receiving university education and occupy senior roles in virtually every occupational sector.¹ These progressive demographic changes are commensurate with the improvements in women's health indicators: overall mortality in Chinese women has fallen by a remarkable 54% and maternal mortality by 81% between 1990 to 2019.^{2,3}

2024 marks an auspicious year for women's health in China—30 years since the landmark international conference on population and development,⁴ which led to the Beijing Platform for Action in 1995.⁵ The platform is considered the first global blueprint for women's rights and health, and was produced after the adoption of a UN resolution in Beijing at the end of the fourth world conference on women in 1995, codifying the equality of men and women. “Women's rights are human rights,” was the enduring Beijing refrain, and women's rights are the foundation for women's health.

New challenges

It is within this context that *The BMJ* publishes a collection examining women's health in China (<https://www.bmj.com/collections/womens-health-in-china>). Women are now healthier than ever in China, but there are also new challenges and changing social norms and expectations. In

nine articles spanning topics and conditions across women's life courses, experts from China analyse the current state of women's health; review achievements and remaining challenges in the contexts of women's empowerment and rights, labour force participation, and family and community dynamics; and make recommendations for promoting women's future health, with a focus on sexual and reproductive health.

Such a focus is necessary because of the immediate context of falling fertility.⁶ In 2022, the fertility rate in China dropped to 1.1% and for the first time in decades became lower than the country's overall mortality. In the meantime, the percentage of people aged 65 years or older reached its highest level (14.9%), setting a new challenge for health systems and delivery in the country.

As the economy grows and China's culture becomes more westernised, women have become sexually more active but less interested in marriage and parenthood. These changes, and importantly the social norms and freedoms that shape them, have become important determinants of women's health. Furthermore, delayed parenthood, decreased fecundity, and increased access to assisted reproductive technologies have health effects for both mothers and children. As a consequence, China faces great challenges in formulating its new population strategies and maternal and child care policies, argue Wang and colleagues.⁷

Historically, maternal health risks have been a serious threat to women's lives. China has made incredible strides in reducing maternal mortality,⁸ but at the same time, these successes also make it more difficult for future efforts to have an impact. The current low fertility may provide a window of opportunity, Shi and colleagues argue, for improving the quality and equity of maternal care, partly by setting up a learning system for quality management and regional networks that can provide integrated maternal care.⁸

Increased sexual activity, decreased fertility, and delayed parenthood all require a shift in focus for contraceptive services in China, Zeng and colleagues argue.⁹ The rising abortion:birth ratio, which reached a historical high of 0.75 in 2020, and the

resurging incidence of sexually transmitted diseases, they believe, point to the urgent need for more comprehensive and effective contraceptive services.

In addition to a focus on sexual and reproductive health and rights, other articles in the collection examine approaches to deal with the growing burdens of non-communicable disease in women. These include screening for cervical cancer and postpartum depression, and strategies for reducing cardiovascular diseases and type B hepatitis infections in women.¹⁰⁻¹³ Effects on mental health are discussed in relation to the growing capabilities of genomics to screen and prevent birth defects, which put considerable psychological burdens on mothers and families.¹⁴ Further still, challenges embedded in social, political, economic, and cultural contexts and their solutions require changes well beyond healthcare. For example, egg freezing for non-medical reasons is highly controversial and currently illegal in China. For women's rights and career aspirations, these restrictions should be lifted.⁷

Domestic violence is another serious concern for women in China. Domestic violence includes physical, sexual, and psychological harms and was estimated to affect at least 25% of women in 2023.¹⁵ The problem is, however, mostly hidden because in the Chinese culture it is often perceived as a family affair and deemed shameful by the family and woman experiencing abuse. Liu and colleagues suggest that mental health workers may have an important role in breaking the silence and helping those affected.¹⁵

A gender equal future

Promoting women's health in China, as elsewhere, demands that women's rights and status are not overlooked as broader social changes accelerate the wealth and development of a country as large and vital as China. Efforts must ensure that girls and women have access to education and leadership opportunities, new digital technologies are harnessed to empower girls and women while safeguarding their wellbeing, and the impacts of growing

challenges like climate change and migration are examined with a gender lens.

Existing inequities between rural and urban women, those in different cultural and ethnic groups, and those across regions and groups of different economic levels must be addressed before they widen alongside the country's overall wealth and economic gains. Our aim with this collection is to contribute to the conversations and analysis of gender equality in China, and to stimulate more discussion to ensure evidence based interventions are developed and implemented fairly so that women can hold up half the sky.

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How can China tackle its declining fertility rate?

Jie Qiao and colleagues highlight the challenges and priorities for pronatalist policies and the health system amid declining fertility rates in China

Fertility rates have been falling in both more developed and less developed regions for several decades (fig 1).¹ China has also seen steep falls in fertility rates, which have not reversed despite a gradual relaxation of population policies in China over the past decade. In 2022, China began to experience negative population growth.² We consider the reasons behind for the current falls in fertility intention and fecundity in China, analyse their implications for health and other areas of society, and identify policy priorities for health services and pronatalist measures.

Declining fertility intention and the realities of parenthood

Over 30 years after the implementation of the one child policy in the early 1980s, China began to relax its population control measures. It introduced a selective two child policy in November 2013, followed by the universal two child policy in October 2015, and the universal three child policy in May 2021. However, the fertility intentions of Chinese couples were not stimulated as expected. The number of births per year fluctuated slightly between 2013 and 2016, and then sharply reduced from 18.83 million in 2016 to 9.02 million in 2023 (fig 2).² The traditional notions mandating

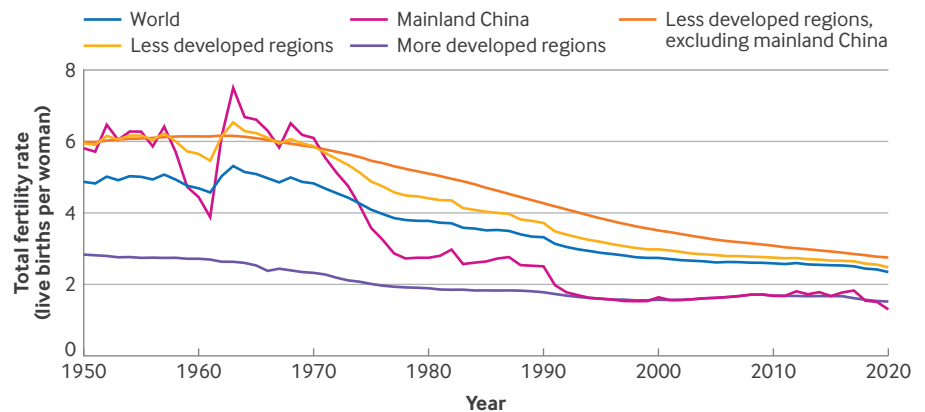


Fig 1 | Global trends in fertility rate¹

marriage and childbearing as indispensable components of life are changing radically, especially among the younger generations. In a national sample survey of marriage and fertility intentions among 14 418 college students conducted in 2021, only 49% of female respondents and 74% of male respondents reported a strong intention for marriage in their life plans, and the planned number of children was only 1.19 among women and 1.55 among men.³ Compared with their male peers, highly educated young women have lower intentions for marriage and childbearing. The 2019 national population and household dynamic monitoring survey data, including 58 538 women aged 20-49 years old (10 101 aged 20-29) reported that 59.8% of Chinese women aged 20-29 years believed that childbearing would lower their quality of life, while 52.7% considered that childbearing would affect career development.⁴

Besides concerns about the potential effects on quality of life and career development, prospective parents encounter several major barriers to childbearing. In a national cross-sectional online survey of 4406 parents aged 18-49 conducted in 2021, 94.7% of Chinese parents reported encountering childbearing barriers, with the two biggest barriers being time burden (39.3%) and economic burden (36.5%).⁵ These barriers to parenthood are not unique to China, but extremely common to couples worldwide.

Globally, in response to such barriers, governments have increasingly embraced measures to encourage child rearing, such as offering parental leave, baby bonuses, tax incentives, or housing allowances.⁶ However, the effect of these approaches in reversing the long term downward trends in total fertility rates remains uncertain, as fertility is declining regardless of economic, social, and cultural environments.⁷

Although parental leave and financial subsidies can alleviate some of the time and financial pressures on new parents, the realities of parenthood, especially for mothers, are still underestimated. First, the commitment to raising children encompasses multifaceted responsibilities, including feeding, health, education, and housing. Temporary paid leaves or financial subsidies cannot completely remove barriers to childbearing related to time and money.⁶ It is therefore essential to improve the affordability and equity of childcare services, healthcare services, education, and housing to ensure the wellbeing and living security of parenthood. Moreover, for new parents, especially mothers, their various losses (of sleep, freedom, quality of life, etc), interruptions (of career development and other activities), and worries (of breastfeeding, neonatal health problems, spousal relationship, etc) should also be of concern. However, support with childbearing skills and psychological counselling for parents are scarce in China.

KEY MESSAGES

- Declining fertility rates poses serious challenges to the pronatalist policy and health services system in China
- Delayed parenthood and declining fertility intentions are contributing to the falling numbers of births
- Equitable and affordable childcare, education, and housing are essential to facilitate childbearing
- Current pronatalist policies need to be reinforced by improvements to maternal and child health services and to assisted reproductive technologies
- The solution lies in the engagement of the entire society rather than placing sole responsibility for childbearing on women

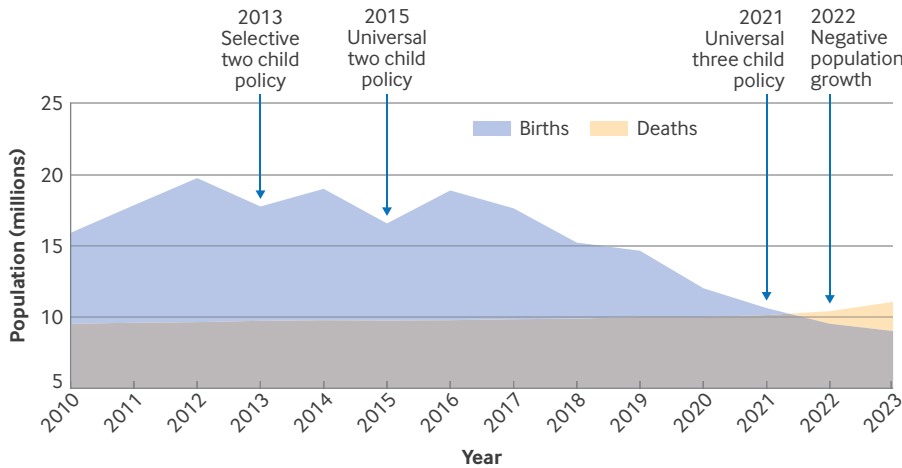


Fig 2 | China's demographic transition²

Delayed parenthood and adverse pregnancy outcomes

Many young couples now choose to delay parenthood for personal education, career development, and other reasons. Differences between men and women in the ages at which reproductive ability falls and risks to offspring's health increase may complicate these choices. Advanced paternal age is typically defined as age ≥ 45 years, whereas advanced maternal age is usually defined as ≥ 35 years.⁸ Although older parents often possess greater financial stability, more emotional maturity, and more knowledge, which could boost children's health outcomes and development, advanced parenthood has been associated with Down's syndrome, autism, and schizophrenia due to chromosomal variation or de novo mutations.⁹⁻¹⁰ Pre-pregnancy genetic counselling and prenatal genetic screening or diagnosis are therefore necessary for couples with advanced parental age. However, high costs and the

shortage of staff hinder the accessibility of these services. The innovations in high throughput sequencing (also known as next generation sequencing) technologies hold promise for substantially reducing DNA sequencing costs, thereby improving the accessibility of genetic screening and diagnosis for couples.¹¹

Advanced maternal age has also been associated with high risk maternal complications (such as gestational diabetes mellitus, hypertensive disorders of pregnancy, and postpartum haemorrhage) and adverse pregnancy outcomes (such as miscarriage, stillbirth, preterm birth, low birth weight, and birth defects).¹²⁻¹³ Between 2013 and 2019, the proportion of pregnant women in China aged ≥ 35 increased from 10.7% to 15.2%, reflecting an average growth rate of 5.95% a year.¹⁴ Although the overall proportion of pregnancies in older women is not high, the growth has outpaced that in some developed countries, including Australia

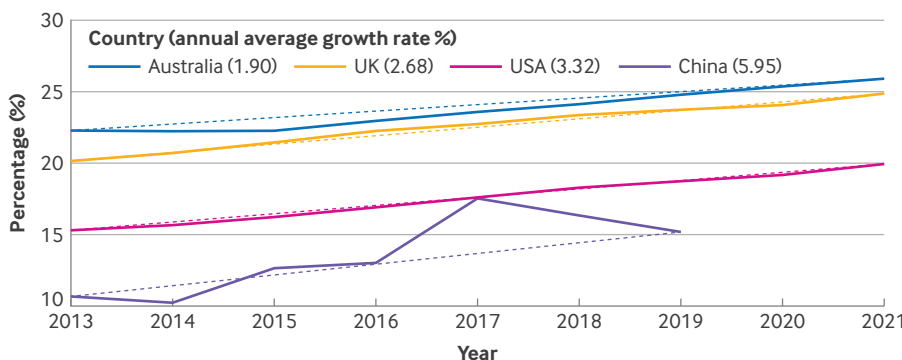


Fig 3 | Proportion of births to women aged ≥ 35 in selected countries compared with proportion of pregnancies among older women in China¹⁴⁻¹⁷

(1.9%), the UK (2.68%), and the US (3.32%) (fig 3).¹⁵⁻¹⁷

Such a rapid growth of births among women aged ≥ 35 poses a substantial burden on the maternal and child health services system. Enhancing the capability of health services and management of high risk pregnant women and newborns is challenging, especially in low resource settings. Multiple approaches will be required. First, the fragmentation of maternal and child health services and management between maternity institutions and communities should be addressed. Second, reinforcing remote medical education and services systems can effectively improve access to high quality services in low resource settings. Third, establishing a robust referral network of maternal and neonatal intensive care units (MICUs and NICUs) across institutions and regions is an effective measure to save the lives of mothers and newborns.

Declining fecundity and assisted reproductive technologies

Declining fecundity is an incontrovertible reality in both men and women, stemming from myriad diverse and intricate causes. Ability to conceive is more age dependent in women than in men. Several indicators of female fertility (anti-müllerian hormone, antral follicle count, oocyte quality, etc) fall rapidly with increasing maternal age.¹⁸⁻²⁰ Notably, in China the prevalence of infertility among couples of reproductive ages rose from 11.9% in 2007 to 18% in 2020; the annual number of assisted reproductive technology cycles reached over 1 million, with over 0.3 million babies born through assisted reproduction each year.²¹⁻²³ Currently, China has 517 assisted reproduction centres and 27 sperm banks.^{21,22}

The intricate mechanisms underpinning reproductive ageing remain elusive, making treatment of infertility challenging. The mechanisms may include genetic factors, environmental exposures, gametic senescence, diseases of the reproductive system (ovary, fallopian tube, uterus, etc), and systemic diseases (immunological diseases, cancers, etc). Further research is needed to delve into the nuanced pathogenesis and develop new therapeutic approaches. The shortage of evidence based guidelines in China has resulted in the overuse of some methods of assisted reproduction, such as use of intracytoplasmic sperm injection rather than conventional in vitro fertilisation in couples with non-severe male infertility.²⁴

The high costs of treatment (around ¥25 000 (£2500; €3200; \$3500) per cycle) are a further barrier for many infertile couples. Only a few provinces (such as Beijing, Liaoning, and Guangxi) include infertility treatments in social health insurance, and even these have limited cover. A comprehensive cost effectiveness analysis at both individual and societal levels and evaluation of the feasibility of expanding insurance coverage across the country is imperative.

Furthermore, elective egg freezing (for social rather than medical reasons) is currently illegal and controversial in China. Opponents challenge the notion that egg freezing is a foolproof insurance policy, emphasising the risks associated with delayed childbearing (failure of egg thawing or embryo implantation, systematic ageing of the body, etc). Conversely, proponents argue for the fulfilment of single women's reproductive autonomy and that prohibition may foster illicit underground markets, jeopardising women's health and rights. In modern societies, delayed childbearing or having a child alone is increasingly common for professional women, who must balance career aspirations and family planning. Egg freezing allows women to preserve their oocytes at younger ages and increases their chances of conceiving through fertility treatments later in life.

In the past two decades, substantial improvements in the effectiveness and safety of oocyte cryopreservation have made egg freezing a viable strategy to tackle age related infertility. According to the International Federation of Fertility Societies (IFFS) Surveillance 2019, 56 countries (including the US, UK, Canada, and Brazil) permit oocyte freezing for fertility preservation in non-medical indications.²⁵ In the book *Career And Family: Women's Century-Long Journey*

Toward Equity, the 2023 Nobel laureate Claudia Goldin traces how generations of women have grappled with balancing career and family.²⁶ In the US, college educated women who graduated in the 1960s and 1970s delayed childbirth for careers but struggled with infertility due to advanced age. However, the most recent cohort who graduated after the 1980s achieved a better work-life balance as advancements in fertility treatments (including egg freezing) allowed them to have children later in life.²⁶ Currently, many career oriented women in China similarly delay childbirth to pursue professional goals but face challenges conceiving at older ages. Lifting the restriction on elective egg freezing could help some women to conceive, although they should be fully informed that it does not guarantee a successful live birth because of the risks of failure of egg thawing and declining endometrial receptivity at advanced ages.²⁷

Policy priorities to reverse declining fertility rates

Building on the challenges described, we suggest policy priorities to reinforce the government's pronatalist measures, the maternal and child health services system, and assisted reproductive technology services to address declining fertility intention and fecundity in China (table 1).

Priorities in pronatalist measures

To encourage couples to have more children the government should fully acknowledge the realities of parenthood. Universal childcare and health coverage, alongside affordable education and housing, have been proved effective in response to declining fertility rates,⁶ while also promoting social equity and wellbeing. The government should therefore develop a comprehensive policy package aiming to improve the affordability and equity

of childcare, healthcare, education, and housing services.

Maternity institutions and community health services should provide evidence based support to develop childbearing skills and psychological counselling for new parents, especially mothers, to help them overcome barriers and concerns about parenting.

Priorities in maternal and child health services system

Pre-pregnancy fertility assessment and genetic counselling should be promoted to identify early the risks of infertility, subfertility, or any genetic diseases, particularly among couples of advanced ages. Affordable prenatal genetic screening or diagnosis should be provided to couples who need it. Integrating high throughput sequencing in clinical practice can reduce the costs and improve the accessibility of genetic testing.

The integrated management and referral system for pregnant women between maternity institutions and community health services should be strengthened to achieve the universal coverage of high quality maternal services and health management before, during, and after pregnancy. Remote medical education and services system should be reinforced to improve the accessibility of high quality services in rural areas. This should be accompanied by a robust referral network of maternal and neonatal intensive care units across institutions and regions to save the lives of pregnant women and newborns with life threatening complications.

Priorities in assisted reproductive technologies

There is a critical need to bolster basic research focused on reproductive ageing to fuel innovations in the prevention and treatment methods of age related infertility.

Table 1 | Challenges, barriers, and recommendations to address China's declining fertility rate

Challenges	Barriers	Policy priorities
Declining fertility intention	<ul style="list-style-type: none"> • Time costs • Economic costs • Interruptions of career development • Other losses or worries 	<ul style="list-style-type: none"> • A comprehensive policy package of universal child care and health coverage, affordable education, and housing • Childbearing skill supports and psychological counselling
Delayed parenthood and associated health outcomes	<ul style="list-style-type: none"> • Genetic diseases • Fragmentated maternal and child health services and management • Shortage of high quality services in low resource settings • Increased risks of life threatening complications during birth 	<ul style="list-style-type: none"> • Pre-pregnancy fertility assessment and genetic counselling • Affordable prenatal genetic screening or diagnosis • An integrated management and referral system between maternity institutions and communities • Remote medical education and services system • Robust referral network of maternal and neonatal intensive care units
Declining fecundity	<ul style="list-style-type: none"> • Mechanisms of reproductive ageing • Shortage of evidence based guidelines • High costs of assisted reproduction • Single women's childbirth plan 	<ul style="list-style-type: none"> • Basic research and innovations • High quality clinical research and clinical guidelines • Social medical insurance for assisted reproduction • The restriction on non-medically indicated egg freezing should be lifted

To improve the evidence base of guidelines on fertility treatment, high quality clinical trials should be supported or back financed by the government. Meanwhile, challenges of redundancy and scientific integrity persist, affecting the quality of clinical research.²⁸ The oversight of clinical research should be intensified, especially in ethical approval, management of trial registry, and data transparency.

The government should gradually increase the coverage and reimbursement rates of social medical insurance for assisted reproduction to reduce family out-of-pocket payments and improve the accessibility of infertility diagnosis and treatment. The restrictions on elective egg freezing should be lifted to give women greater reproductive autonomy, along with steps to ensure awareness of all potential risks that affect the likelihood of achieving a live birth.

If China is to return to population growth it needs to acknowledge the realities of parenthood, avoid any violation of women's reproductive autonomy, and ensure the safety and health of mothers and their babies. In essence, childbearing should not be viewed as an exclusive concern of women alone; instead, the ultimate solution lies in the engagement of the entire society.

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Empowering new mothers in China: role of paediatric care in screening and management of postpartum depression

Though general paediatricians have traditionally been the gatekeepers of children's health, they can also work as part of a multidisciplinary team to tackle postpartum depression, argue **Fan Jiang and colleagues**

The Global Burden of Disease study showed that mental disorders were still one of the top 10 leading causes to disease globally in 2019, with no discernible reduction since 1990.¹ The highest rates of depression in women occur during the first few weeks, months, or years after giving birth compared with at other times in a women's life.² Postpartum depression has an estimated point prevalence of 13% in high income countries and 20% in low and middle income countries, affecting a large proportion of women in their most productive and active years.³ In China, the prevalence of postpartum depression is about 18% (fig 1).⁴ Evidence from many studies indicates that postpartum depression has a negative effect on the health and wellbeing of women, and their families and offspring.⁵ As such, it is a serious public health concern.

In clinical settings, it is common practice for obstetricians to screen women during

pregnancy and within one month of delivery for postpartum depression. However, postpartum depression can manifest at any point during the first postpartum year and symptoms may persist for an extended period. This paper aims to review the current screening and management practice for postpartum depression, and advocates for the ongoing provision of these services beyond the initial one month period. We argue that combined with maternal care, paediatric care provides a good opportunity to conduct repeated assessments for postpartum depression and implement follow-up strategies. Moreover, we propose actionable steps for integrating such services into paediatric care and creating a continuum of care that ensures consistent and comprehensive services for women with postpartum depression in China.

Consequences of postpartum depression

Postpartum depression is a psychological disorder with multiple cascading negative effects. It is one of the most common complications of childbearing.⁶ Because it occurs within the physiological processes of pregnancy and childbirth and is widely perceived as transient, the public may mistakenly view it as a temporary condition that will naturally improve with time. This may lead to women not seeking medical help. However, if left untreated, postpartum depression can develop into severe clinical mental disorders, and even suicide.³ About 20% of women affected by postpartum depression still experience depression beyond the first year of giving birth, and 13% continue to be affected after two years. Furthermore, about 40% experience a recurrence during subsequent pregnancies or in other situations.⁶ In addition, untreated postpartum depression is associated with long term adverse events and poor quality of life. Postpartum depression occurs at a time when the infant is fully dependent on parental care and highly sensitive to the quality of the

interaction. Evidence shows that even mild maternal depression can adversely affect the emotional, social, and cognitive development of a child,⁷ often in ways that are not fully recognised (box 1).⁵

Importance of screening and management of postpartum depression

Many studies have provided evidence that timely diagnosis and appropriate treatment of postpartum depression could mitigate its effect on mothers and their offspring. As awareness of this problem has increased, professional guidelines have begun to recommend screening for depressive symptoms during pregnancy and shortly after birth. For example, the American College of Obstetricians and Gynecologists recommends screening for perinatal depression at the first prenatal visit, later in pregnancy, and at postpartum visits within the first month of giving birth.¹² In Australia, the National Perinatal Depression Plan, launched by the federal government in 2008-09 with a budget of more than \$A80m (£40m; €45m; \$63m, in 2009) over five years, promoted routine screening once or twice antenatally and at least once in the early postnatal period in primary care settings. A year after implementation of this plan, hospital admissions with a psychiatric diagnosis in the first postnatal year had decreased by up to 50%.¹³ Similar practices have been adopted in China as well. The exploration of depression prevention and treatment work service plan issued by the National Health Commission in 2020 proposed to incorporate screening for depression during the pregnancy into routine prenatal care and postpartum follow-up care.¹⁴ Actions in line with these recommendations have already been implemented in projects such as one in Shenzhen where screenings are carried out during postnatal home visits or at the six week postnatal check-up, incorporated into routine maternal healthcare delivery.¹⁵

KEY MESSAGES

- Postpartum depression greatly affects women's health, child wellbeing and long term development, and family wellbeing
- The current practice of screening for postpartum depression during pregnancy and one month after delivery is insufficient for detection and management
- Integrating diagnosis and management of postpartum depression into primary paediatric care is a promising approach to effectively manage this condition
- Implementing this approach requires reshaping maternal and child health-care services, strengthening referral systems, training health workers, reducing stigma, and fostering cross sectoral collaboration

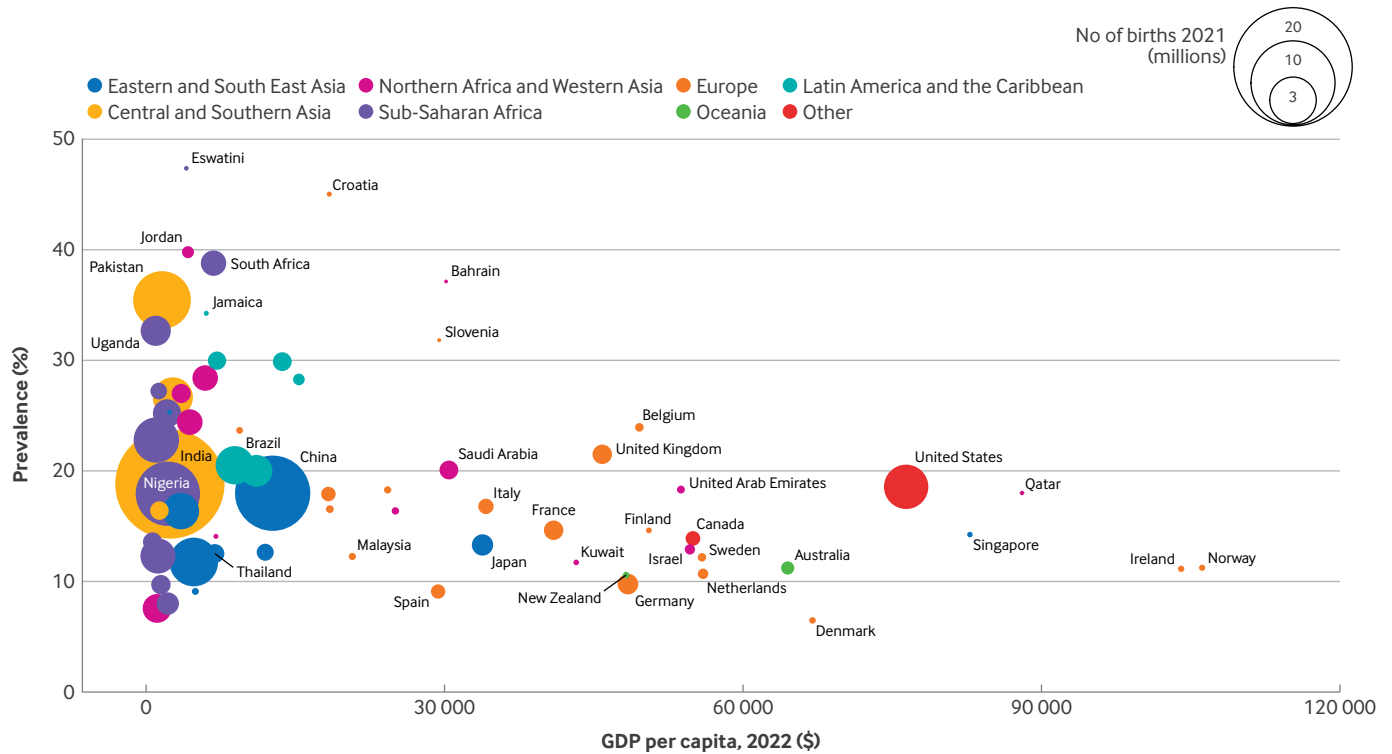


Fig 1 | Prevalence of postpartum depression and number of births by country. Prevalence data from Wang et al⁴; number of births from the United Nations World Population Prospects, 2022; Gross domestic product (GDP) per capita from World Bank, 2022

Nevertheless, screening for postpartum depression only up to four or six weeks after delivery is insufficient. A recent population based study found that 7.2% of women reported depressive symptoms at nine to 10 months postpartum, with 57.4% of them not reporting depressive symptoms in the early postpartum period (that is, two to six months).¹⁶ In addition, depression persisting beyond four to six weeks after delivery may still require treatment. Therefore, in clinical practice and clinical research, the definition of postpartum depression varies and refers to depression occurring within the first four weeks, three months, six months, or up to 12 months of childbirth.⁶

Based on current evidence, support is growing for the feasibility and importance of screening for postpartum depression beyond four weeks after delivery. The clinical practice guideline of the American College of Obstetricians and Gynecologists recommends the use of two well validated tools, the Edinburgh Postnatal Depression Scale and the Patient Health Questionnaire-9, to screen for postpartum depression.¹² The usual screening tool currently is the Edinburgh Postnatal Depression Scale.¹⁷ However, it is only applicable up to eight weeks postpartum and is not suitable for

longer term management in paediatrics. The Patient Health Questionnaire-9 seems to be a feasible alternative for screening perinatal depression, with operational characteristics similar to the Edinburgh Postnatal Depression Scale.¹⁸ Additionally, evidence has shown the effectiveness of interventions, including antidepressants and psychotherapy, after the diagnosis of postpartum depression. Furthermore, a simulation analysis found that screening and treating postpartum depression was a cost effective approach considering mothers' quality adjusted life years in both the short and long term. The results suggested that screening and treating postpartum depression was cost effective.¹⁹ However, an effective method for public health services to identify and manage postpartum depression is still not available.

Paediatrician screening and management of postpartum depression

Globally, child health workers, such as paediatricians, general practitioners, or nurses, who have regular contact with new mothers during well baby visits, are often considered the best choice for screening and managing postpartum depression during the first year postpartum. The guidelines of professional associations,

such as the American Academy of Pediatrics, call for the establishment of a postpartum depression screening and management system within paediatric healthcare.²⁰ Apart from the easy accessibility of child health workers, they have other advantages. A systematic review showed that child health workers have a rapport with postpartum women and these women are more likely to talk to them about their depression.²¹ Child health workers offer child focused interventions with a family perspective, which are effective in reducing maternal depressive symptoms and motivating mothers to improve their wellbeing for the sake of their children.²²

Drawing on the global experience, the Chinese maternal and child healthcare system would be the most suitable platform for the extension of postpartum depression screening and management. This system, which covers more than 90% of the country's primary care institutions and operates under a hierarchical ranking system from the county level to the national level, is well structured and effective. In addition to maternal and child healthcare, child health workers, including paediatricians, general practitioners, and nurses in community centres or township hospitals, provide primary child healthcare services within this framework. This system

Box 1: Effects of postpartum depression on maternal and child health⁵**Diminishing maternal wellbeing**

- Short term. Postpartum depression results in a deterioration of maternal mental health, an increase of anxiety and depressive symptoms, and a decline in overall quality of life. For example, women with postpartum depression have lower self esteem, decreased happiness, heightened irritability, increased sadness, lower anger control ability, and poorer responses to negative stimuli compared with mothers without postpartum depression. In severe cases, the condition may even lead to suicide.³
- Long term. Mothers diagnosed with postpartum depression score lower on emotional wellbeing at one year postpartum compared with mothers without postpartum depression. Even three and a half years after childbirth, mothers with postpartum depression still have considerably higher anxiety levels than mothers without postpartum depression, and they tend to face more negative life events and financial challenges in the subsequent years. The likelihood of homelessness for mothers who have experienced postpartum depression is twice that of mothers without postpartum depression. Postpartum depression is also associated with more interpersonal difficulties and lower social functioning. As regards quality of life, the classic core symptoms of a depressive disorder would be expected to decrease the subjective quality of both an individual's inner life experiences—for example, with signs of anhedonia, sadness, hopelessness, and thoughts of death—as well as their functioning, including slowed thought, reduced physical movements or restlessness, and disturbed sleep.³

Impairment of offspring's development

- Short term. Children born to mothers with postpartum depression are more likely to experience excessive crying, sleep disturbances, and temperament problems. Additionally, postpartum depression leads to less favourable mother-infant interactions, which reduces the likelihood of mothers starting and sustaining breastfeeding and ultimately hinders the formation of a normal parent-child attachment.⁸ Presence of maternal depressive symptoms when infants are 5 months predicts increased overall health problems and a higher incidence of diseases in infants at 9 months. Furthermore, postpartum depression is linked to a threefold increase in the risk of death for infants younger than 6 months and about a twofold increase for infants younger than 12 months.⁹ In cases of severe postpartum depression, infanticide is a risk.¹⁰
- Long term. In the long term, postpartum depression has been associated with stunting and reduced weight gain.¹¹ It also affects the motor, cognitive, and language development of the offspring, thus increasing their emotional and behavioural problems, and greatly influences their long term achievements and overall wellbeing.

has already been shown to be effective in reducing maternal and child mortality rates.²³ In particular, child health workers in the maternal and child healthcare system offer six free well-child visits for each child during their first year, with continued check-ups every six months for children aged 1-2 years, and annual check-ups for children older than 2 years. Additionally, nearly half of the child health workers have a first degree or higher.²⁴ Based on this system, a pilot project screening for postpartum depression in mothers at many postpartum time points has already been undertaken in Shanghai.²⁵

However, evidence on real-world implementation is still limited.²⁰ Globally, pilot studies have provided weak but promising evidence, while also revealing some barriers to implementation.²⁶ First, time constraints and incomplete training were the barriers most often noted by the child health workers who were surveyed.²⁷ Second, the lack of free and available community mental health services, a referral system between primary health care and mental health services, and continuity of care were also barriers to the detection and management of postpartum depression in women.²⁸ Third, ethical and legal issues on the boundaries of paediatric care were also mentioned as a challenge, because the primary obligation of child health workers

is to children rather than mothers.²⁹ Fourth, the lack of reimbursement strategies impedes the implementation of postpartum depression screening and management systems, especially in paediatric practice settings where mothers are not the identified patients.³⁰ Last but not least, even in paediatric settings, pervasive stigma surrounding psychosocial health in maternity is still a considerable obstacle that prevents mothers from accepting mental health screening and support.³¹

Integrating postpartum depression screening and management in paediatric care in China

For implementation in China, it is important to recognise that addressing the aforementioned concerns is essential to enhance the role of paediatric practice to effectively screen and manage women with postpartum depression. Based on the framework for analysing the integration of targeted health interventions in health systems,³² we propose four actions.

Intervention

Introducing postpartum depression screening and management into child healthcare is complex, as it is characterised by episodes of care (many screening time points), a comprehensive set of components within the system (screening, home visits, community based counselling,

psychological support, referral, and follow-up management), and different levels of care (health professionals in both primary care and psychiatric hospitals). Given the complexity, efforts need to be made in three areas.

First, institutional arrangements should be based on existing evidence, which includes defining methods and time points for screening and counselling. Second, as child health workers are often not equipped with the necessary skills to provide psychological support for new mothers, training is crucial. The World Health Organization's thinking healthy manual is designed to reduce postpartum depression in low socioeconomic settings and improve health outcomes in these children through the adaptation and integration of cognitive behaviour therapy into the routine work of community health workers.³³ This approach has already been effective in reducing postpartum depression and improving long term child development outcomes, and it can be adapted and implemented in regions with limited psychiatric resources.³⁴

Third, referral systems to psychiatric hospitals need to be further strengthened in primary health care. Recent policies, such as those released by the Shanghai municipal health bureau, offer opportunities in this regard. For instance, these policies promote a higher priority

in primary health care for tertiary hospital appointments, including mental health institutions.³⁵

Adoption of the intervention

The framework underscores the important role of key stakeholders such as health workers, patient groups, and communities, whose perceptions and positions greatly influence the adoption of new interventions. In the context of postpartum depression screening and management, community stigmatisation is an important problem that cannot be overlooked. Stigma about mental disorders is notably prevalent in east Asia and often acts as a barrier to healthcare utilisation. Choosing non-stigmatising language has proved effective in tackling this challenge.³⁶

By drawing insights from initiatives such as “She Conquers,” a programme in South Africa that originally targeted HIV reduction and successfully evolved to empower young women and avoid stigma,³⁷ we can initiate similar pathways in postpartum depression screening and management. Transitioning these services to paediatric care presents an opportunity to reshape young mothers’ perspectives on postpartum depression. This approach shifts the perception of postpartum depression as only an individual medical condition to recognising that it affects parenting skills and family function and that managing the condition enhances these aspects.

In line with this approach, we propose framing the goal of the initiative as “empowering new mothers for happy and healthy children,” rather than only emphasising the aim of reducing mental disorders. This reframing not only fosters greater acceptance of psychosocial support among depressed mothers and their families but also helps child health workers embrace this new responsibility. It is grounded in the understanding that detecting and supporting mothers with postpartum depression ultimately contributes to the wellbeing of young children.

Health system characteristics

In the broader context of integrating new interventions, it is important to recognise that this process goes beyond simply changing service content. It necessitates revisions in regulations, financing mechanisms, and governance within the health system. For postpartum depression screening and management, ensuring child health workers have the appropriate qualifications to work effectively with young

women is paramount. Equally important are confidentiality, medical documentation standards, and liability matters, all of which should be prioritised.

Evidence exists that supports the use of child health workers to provide mental health care for mothers. A WHO guideline highlights the importance of supporting maternal mental health as one of the four recommendations to improve early childhood development.³⁸ In China, emphasis on continuity of care is growing. Recently, paediatricians, traditionally responsible for patients younger than 18 years, have been authorised to see patients up to 35 years of age.³⁹ Additionally, other factors, such as financing for new services and establishing relevant regulations and supervision policies, need to be considered.

Context

In the context of China’s declining birth rate, strengthening the identification and management of postpartum depression is particularly important because of its profound effect on women’s long term health and the development of future generations. This initiative is crucial for China to effectively adapt to the evolving changes in population dynamics and promote optimal development of its people. The importance of this initiative should be widely recognised beyond the health sector, and cross sector collaboration with departments such as finance and medical insurance should be fostered. This collaboration would ensure better support for the implementation and advancement of projects related to postpartum depression screening and management.

Summary

Integrating the screening and management of postpartum depression into primary paediatric care, combined with maternal care and through multidisciplinary collaboration, represents key pathways for China to effectively manage this condition. We see this as a good opportunity in China to reshape maternal and child healthcare services at a time when the birth rate is declining substantially and the workload of child health workers is tending to decrease. On the other hand, grandmothers also serve as caregivers for infants in China, so the incorporation of this new component into paediatric care not only benefits young mothers but also extends to a larger population of women, including elderly women.

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Research needs for birth defect prevention and control in China in the genomic screening era

Yu An and colleagues emphasise the importance of prioritising vital research questions in genomic testing to empower prevention strategies for birth defects in China

Birth defects are a global health concern, not only contributing significantly to infant morbidity and mortality but also negatively affecting mothers' lives. The burden on women with children who have birth defects is particularly heavy during pregnancy and even greater after the birth. They face increased physical, emotional, and financial challenges, along with the risk of adverse obstetric outcomes and the burden of raising children with birth defects. Thus, birth defects are highly relevant to women's health.

Approximately 900 000 infants are born with birth defects each year in China.^{1 2} Consequently, the incentive to prevent

birth defects is so strong that it has become a national policy and an unremitting goal.^{3 4} A "three stage prevention strategy" was developed to serve as a nationwide approach to prevention of birth defects,⁴ focusing primarily on pre-conception education and folic acid fortification, prenatal screening for various aneuploidies and structural defects, and screening of newborns for congenital genetic diseases (fig1). This strategy has led to notable changes in the incidence of major birth defects in China. For example, free pre-conception folic acid supplementation to approximately 102 million women between 2009 and 2018 decreased the incidence of prenatal neural tube defects from 27.4 per 10 000 in 1987 to 1.5 per 10 000 in 2017.⁵ Additionally, offering free pre-pregnancy health examinations to 11.73 million people nationwide in 2017 had a significant impact in reducing congenital disorders with high prevalence.⁶ The thalassaemia carrier screening for about 1 645 000 couples dramatically decreased the incidence of thalassaemia in Guangxi Province and Guangdong Province from 21.7 and 44.6 per 10 000, respectively, in 2006 to 1.93 and 3.15 per 10 000 in 2017.⁵

The ability to prevent birth defects has been further improved with advances in genetic testing. Traditional genetic screening primarily focused on Down's syndrome and chromosomal aneuploidies. With the availability of non-invasive prenatal testing and chromosomal microarray analysis, the scope for detecting birth defects has expanded to cover a large number of genomic imbalance disorders. However, many genetic disorders caused by sequence variants remain undetected before conception and during pregnancy. Next generation sequencing offers new testing methods for preventing birth defects caused by sequence variants. Next generation sequencing can be applied to genomic carrier screening and pre-implantation genetic testing, prenatal genetic testing, and newborn genomic screening, effectively identifying pathogenic variants responsible for genetic

birth defects, especially functional birth defects such as metabolic disorders and developmental disorders. Next generation sequencing has proved highly effective in diagnostic testing, with greater than 95% sensitivity and 99% specificity.⁷ As a result, next generation sequencing based testing is considered to be a promising solution for preventing many genetic birth defects that were elusive to traditional approaches. A recent systematic survey found the perinatal prevalence of birth defects in China to be as high as 208.94 per 10 000 in 2020-21,⁸ highlighting the need for comprehensive genomic testing across pre-conception, prenatal, and neonatal stages.

For successful implementation of this promising novel approach, we highlight critical concerns to meet the associated challenges (table 1). These concerns are critical for providing more precise disease risk predictions, preventing over-diagnosis and screening induced family stress, and maximising benefits. Although this discussion is tailored to China's distinct situation and challenges, our analysis also aims to provide beneficial insights for other countries encountering similar concerns in the era of genomic medicine development.

Systematic studies on incidence of genetic disorders across China

Understanding the breadth of genetic diseases from genomic data in China is the first step in this effort. However, traditional methods of assessing disease prevalence have limitations in counting affected individuals within a population. Severe genetic disorders, such as carnitine-acylcarnitine translocase deficiency caused by the *SLC25A20* gene mutations, often lead to prenatal or perinatal mortality. The mortality results in a misleadingly low disease prevalence, such as the situation in southern China, where the prevalence of lethal disease is reported as zero despite a high carrier rate.⁹ Correspondingly, the medical community and affected families remain largely unaware of such severe diseases, leading to repeated neonatal fatalities. Including the *SLC25A20* gene in

KEY MESSAGES

- Genomic medicine provides novel approaches to reduce birth defects that disproportionately affect the lives of children and parents in China, but the research priorities identified in this article are of global relevance
- Doing incidence based rather than prevalence based disease burden analyses using comprehensive population genomic data would provide a more accurate understanding of the portfolio of genetic diseases in China to facilitate effective prevention
- Disease severity assessment based on the current healthcare settings in China is a key step for determining the inclusion of diseases to be covered by the birth defect prevention policy to avoid over-screening
- Genetic counselling is an indispensable component to ensure informed decision making for participating in genomic screening and to minimise adverse outcomes
- Cost effectiveness studies are needed before the new genomic medicine based birth defect prevention approaches are implemented in China to leverage benefits over costs

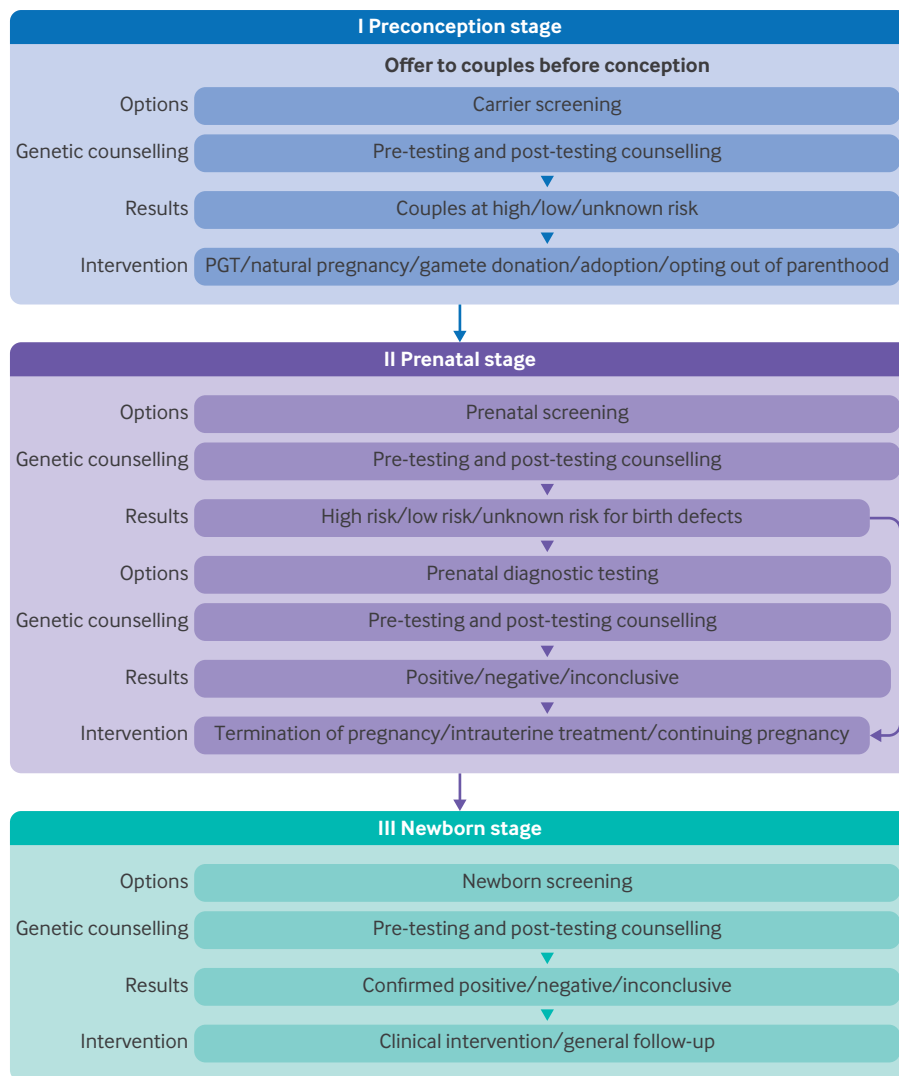


Fig 1 | Three stage prevention and control scheme for birth defects. A comprehensive multistage approach for prevention and control of birth defects is carried out at three stages: pre-conception, prenatal, and newborn. The roles of each stage are complementary. At the pre-conception stage, genetic carrier screening is provided to all prospective parents to assess the genetic variants that carry a risk of causing genetic disorders in the next generation; the parents can choose the most appropriate reproductive option (eg, pre-implantation genetic testing (PGT)) depending on the risk and the findings of genetic counselling. Most couples then proceed to stage II, except in cases of adoption or opting out of parenthood. At the prenatal stage, traditional non-invasive prenatal testing (NIPT) and ultrasound examinations are offered to all pregnant women. In addition, genetic diagnostic testing using samples collected by chorionic villus sampling or amniocentesis should be considered to detect genetic disorders caused by genomic imbalances or sequence variants; again, genetic counselling should be an integral part of prenatal tests. At the newborn stage, heel prick blood samples are collected for almost all babies. Newborn screening using tandem mass spectrometry for metabolic disorders and genomic sequencing for mendelian disorders should be offered to uncover diseases that are treatable at the pre-symptomatic stage. Both pre-test and post-test genetic counselling sessions are crucial at all stages to ensure that parents can make informed decisions

the carrier screening panel could potentially reduce the occurrence of such related severe birth defects inherited in a recessive genetic model. This approach could also be beneficial for many other similar disorders. Furthermore, the prevalence of genetic diseases is under-reported in China owing to the lack of physicians trained to diagnose

rare diseases or a reluctance to seek medical help. To effectively prevent birth defects, particularly functional congenital disorders, we advocate a shift to examining rates of carriage of gene mutation rather than the disease prevalence based on the number of identified patients who were screened for the particular diseases.

In the genomic medicine era, comprehensive genome sequencing and analysis increasingly promotes the determination of disease incidence. Many countries have launched national genome projects with unique features specifically serving different populations. Prominent examples are the UK Biobank,¹⁰ the All of Us Program,¹¹ and several others.¹² Databases such as ClinVar, which classifies variants, and gnomAD, a population based resource, are instrumental for accurate interpretation of variants and clinical intervention.¹³ However, the genomic landscape in China seems to be notably more diverse than in the rest of the world. The *SLC25A20* gene mutation serves as a typical example, showing a 10-fold difference in carrier rates between the south Chinese and north Chinese populations. This highlights the necessity for systematic studies of the diverse population to accurately estimate nationwide disease incidence and improve the interpretation of variants, particularly for founder or population specific variants.

Knowing how many diseases are present across China on the basis of the genomic data is the first step. We next need to know how many of these diseases should be targeted for prevention on the basis of disease severity.

Assessment of disease severity

Prevention of birth defects aims to reduce the occurrence of severe conditions through screening for carriers and prenatal screening, while improving the prognosis for people who have less severe and treatable conditions via newborn screening. To effectively prioritise diseases for genetic screening, the severity of disease is the most important parameter to be considered. Besides being a criterion for selection for genetic screening, disease severity is also crucial information needed for parents to make informed decisions about reproduction. With genomic testing uncovering approximately 5000 monogenic disorders, assessing disease severity becomes a critical factor in birth defect prevention strategies. However, the criteria for assessing the severity of genetic diseases remain insufficiently explored.

Previous approaches have categorised disease conditions into profound, severe, moderate, or mild,¹⁴ on the basis of clinical traits such as early age of onset, shortened lifespan, and cognitive or physical impairments, as well as the availability and accessibility of treatment options.¹⁸ Only genes linked to conditions with moderate or higher severity are selected for expanded carrier screening.

Table 1 | Current status of and potential solutions to key research concerns for implementation of genomic strategies for prevention of birth defects

Key research question	Current status	Potential solution	Solutions from other countries/evidence
Disease incidence	Inaccurate estimate or unknown disease incidence among the Chinese population for almost all rare diseases	Analyse the gene carrier rate for clinically significant variants in all disease genes by using aggregated genomic data from all regions of China	UK biobank (European), All of Us (USA), gnomAD (USA), Shariant (Australian) ⁹⁻¹²
Disease severity assessment	Diseases have not been assessed for severity in the Chinese population	Develop a severity assessment scheme and apply it to all rare diseases under the current medical and social setting	A standardised, evidence based protocol to assess clinical actionability of genetic disorders associated with genomic variation (ClinGen Actionability Curation Module) ^{13 14}
Genetic counselling service	Genetic counselling is not an established profession in China, and no routine genetic counselling services are provided to people	Accredit genetic counselling training programmes in China; certify genetic counsellors and employ them as essential team members of medical services	Two year masters degree training programmes accredited by the ACGC and certified by the ABGC in the US
Cost effectiveness analysis	Few cost effectiveness analyses have been conducted (eg, Down's syndrome screening using NIPT). ¹⁵ Most genomic screening lacks cost effectiveness analyses in China	Set up pilot studies for assessing the cost effectiveness for various genomic screening approaches, as well as surveying implementation related issues	Cost effectiveness analyses have been used to assess the effectiveness of various approaches in genetic and genomic screening for birth defects ^{16 17}

ABGC=American Board of Genetic Counseling; ACGC=Accreditation Council for Genetic Counseling; NIPT=non-invasive prenatal testing.

However, severity assessments can vary across healthcare settings, depending on the current medical care level of different countries. For instance, Peutz-Jeghers syndrome is assessed differently in terms of treatment effectiveness and intervention costs between China and the US. In the US, tumour surveillance for Peutz-Jeghers syndrome includes baseline colonoscopy, upper endoscopy from age 8, and small bowel video capsule endoscopy or magnetic resonance imaging enterography. These procedures are often unavailable in China owing to high costs and lack of recognition. Therefore, disease severity must be assessed on the basis of contemporary medical care conditions and the life quality of patients in China. Additionally, the coverage of newborn screening and the timeliness of diagnosis, which were not considered in previous studies, also need to be evaluated. Initiating pilot studies on the severity of genetic diseases in China is crucial to achieve this goal.

Enhancing genetic counselling

As the costs for genetic testing have significantly decreased, genomic screening based approaches are available for prevention of birth defects on the basis of these advances. However, concerns including potential over-diagnosis, variants of uncertain significance, and the lack of effective interventions have been raised. These factors underscore the critical importance of genetic counselling while offering genetic testing.

Genetic counselling, a healthcare profession that has flourished in many countries over the past 30 years,¹⁹ remains underdeveloped in China. Trained genetic counsellors are scarce in China, leaving a gap in professional services for families seeking genetic testing. Genetic counsellors play a multifaceted role across

various medical specialties. Their expertise extends beyond mere technical knowledge; they provide education and emotional support and empower individuals to make decisions by understanding potential risks and available options. As genomic testing becomes more prevalent, the demand for genetic counselling services is rising. In China, challenges for clinicians include a lack of genetic counsellors and well developed genetic training programmes. Most medical providers are unaware of genetic screening and lack the ability to interpret the genetic variants, thus hindering the integration of genetic testing into clinical practice. Without proper counselling, genetic testing can impose a psychological burden on families, potentially reducing their willingness to participate in genetic screening and even resulting in adverse outcomes.

Genetic counsellors serve as intermediaries among various stakeholders, including physicians, nurses, and researchers, assisting them in navigating medical, social, ethical, and legal matters. Unfortunately, a comprehensive training programme for the next generation of genetic counsellors has not yet been established in China, although training programmes and certification systems for genetic counsellors are well established in the US and other countries. Promisingly, some pilot training programmes in China have shown good responses in this field.^{18 20} We urge the government to promptly establish the position of genetic counselling in healthcare facilities and communities and to develop professional training programmes that equip genetic counsellors with expertise in genomics. Additionally, these programmes should raise awareness about discrimination, privacy and confidentiality, and personal and family related social factors.

The research needs mentioned above can pave the way for the application of genomic testing (also called next generation sequencing based testing) aimed at further reducing the burden of birth defects in China. Although advances in genomic testing have increased the ability to prevent and diagnose genetic disorders, cost effectiveness analyses are needed to determine whether it can be accommodated within healthcare budgets before routine implementation, compared with traditional approaches and single gene testing.

Cost effectiveness analyses

Cost effectiveness analyses are designed to evaluate the costs and clinical benefits of specific interventions, guiding decisions on which strategies offer optimal value for a given population. Such analyses enable understanding of the short term and long term benefits and outcomes of different strategies on the healthcare system at a national, societal, and individual level, as well as the time needed for counselling on tests and their outcomes, psychosocial influences, and deviations from expected decision making paths.

Cost effectiveness analyses assessing the effectiveness of interventions such as pre-implantation genetic diagnosis and screening for carriers of fragile X and spinal muscular atrophy have been done in other countries,^{16 17} along with studies on the cost effectiveness of genomic testing.^{15 21} Comparatively, only a few studies have explored the cost effectiveness of genomic testing in China, such as non-invasive prenatal testing for Down's syndrome²²; further research on this aspect is needed for application of novel technology and strategies. In addition, the economic evaluations during cost effectiveness analyses are heavily influenced by a

nation's economic status, its capacity to implement diagnostic procedures, and its cultural characteristics. These factors are often unique to each country and cannot be adequately generalised from studies conducted in other nations. Therefore, cost effectiveness analyses need to be conducted in China to justify the benefits over the costs, maximise the benefits, and minimise the adverse effects of genetic screening.

Conclusions

In summary, to optimise the benefits of the genomic medicine era and empower new prevention strategies for birth defects, we have identified four urgent needs based on the current situation in China. These include comprehensively understanding disease burden through nationwide population genome data, evaluating disease severity as a pivotal criterion for constructing genetic screening panels, training a new generation of genetic counsellors, and initiating pilot studies to assess the cost effectiveness of genetic screening. By tackling these essential concerns, more informed policies can be made for funding the proper research, establishing the appropriate infrastructure, and using the most suitable and practical approaches for population-wide genomic screening. Moreover, this serves as a demonstrative model to showcase the effectiveness of these approaches, offering valuable insights for other nations.

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Tackling social and behavioural risk factors for cardiovascular diseases in Chinese women

Chinese women have benefited more than men from improvements in social determinants of health in decreasing the burden of cardiovascular diseases in recent decades; however, Chinese women, especially those in the younger generation, are facing new challenges, argue

Siyan Zhan and colleagues

Cardiovascular disease, the leading cause of death worldwide, is a major public health concern.¹ From a global perspective, cardiovascular disease is more severe in China. In contrast to the global trends, the incidence and prevalence of cardiovascular diseases have increased in recent decades in China (fig 1). The increasing trend in cardiovascular disease morbidity in Chinese women has been more modest than that in Chinese men. For example, the total percentage increase in the age standardised incidence of cardiovascular diseases between 1990 and 2021 was 0.86% and 5.83% in Chinese women and men, respectively.²

Nevertheless, global estimates show that the total percentage increase in incidence of cardiovascular diseases was 1.03% in women and 0.44% in men. Therefore, the gender disparities in the rate of increase in incidence of cardiovascular disease in China is the opposite of those seen worldwide. The changes in cardiovascular disease burden among Chinese women could be partly attributable to the reduced social and behavioural risks that seem to play a more critical role, especially accompanied by the tremendous improvement in determinants caused by China's rapid economic growth.

In this analysis, we present a comprehensive picture of the social and behavioural risk factors for cardiovascular diseases and their potential effects on cardiovascular disease burden by using the Conceptual Framework for Action on the Social Determinants of Health proposed by the World Health Organization (fig 2).³ This conceptual framework systematically incorporates almost all determinants of cardiovascular disease and shows how they influence each other and ultimately influence cardiovascular health. We first describe the improved determinants in China and their effects on cardiovascular disease burden; we then discuss new challenges related to the possible risks of cardiovascular disease; and finally we describe the features of cardiovascular disease risks and burdens among Chinese women and provide implications and suggestions for countries or regions in a same stage of booming development.

Improvements in social determinants of cardiovascular health

Since the founding of the People's Republic of China, the socioeconomic and political status of women has largely improved and brought about better living conditions and reduced the burden of cardiovascular disease, especially among middle aged and older women. In this section, we briefly

introduce these improvements and the mechanisms underlying the reduction of cardiovascular disease burden in Chinese women.

Socioeconomic position

As a guarantee of improvements in other social determinants, political positions for Chinese women have been significantly promoted in the past 70 years. The proportions of female members in the two most important Chinese political congresses increased by more than 10% from the first to the 13th session.⁴ An increase in the number of female decision makers increased the opportunities to focus on promoting women's health.

In addition to political status, other socioeconomic determinants, including education, occupation, and income, also improved among Chinese women during this period. Compared with those for men, improvements for women were more obvious and made greater contributions to reducing the burden of cardiovascular disease.

Gender equity in education has improved tremendously in China. Male and female literacy rates in China were 79.2% and 51.1%, respectively, in 1982 and 98.6% and 95.6% in 2020.⁵ As well as the gender specific improvement in education, a gender specific effect of education on cardiovascular diseases has also been seen in China. The China Kadoorie Biobank showed that the association of lower educational attainment with a higher risk of ischaemic heart disease was stronger for women than for men.⁶ The Prospective Urban and Rural Epidemiological study in China also showed that the burden of cardiovascular disease attributed to low education was greater in women than in men (11.3% v 8.7%).⁷

As a consequence of the improvement in education among Chinese women, the gender gaps in employment and income have narrowed. In 2022 the female and

KEY MESSAGES

- Since 1950, the burden of cardiovascular diseases has increased in China, with tremendous and varied changes in social and behavioural risk factors, especially among women
- Under the Asian cultural background, China's rapid globalisation, urbanisation, and industrialisation have led to gender disparities in cardiovascular disease and its risk factors
- Although improving structural determinants has partially offset the burden of cardiovascular disease in Chinese women, the younger generation is facing new challenges such as sedentary behaviours, smoking, alcohol consumption, and bearing and raising children, which increase the burden of cardiovascular disease
- The implementation of comprehensive interventions involving multiple levels and roles for cardiovascular disease prevention and control targeted at women, especially those in the younger generation, is urgently needed

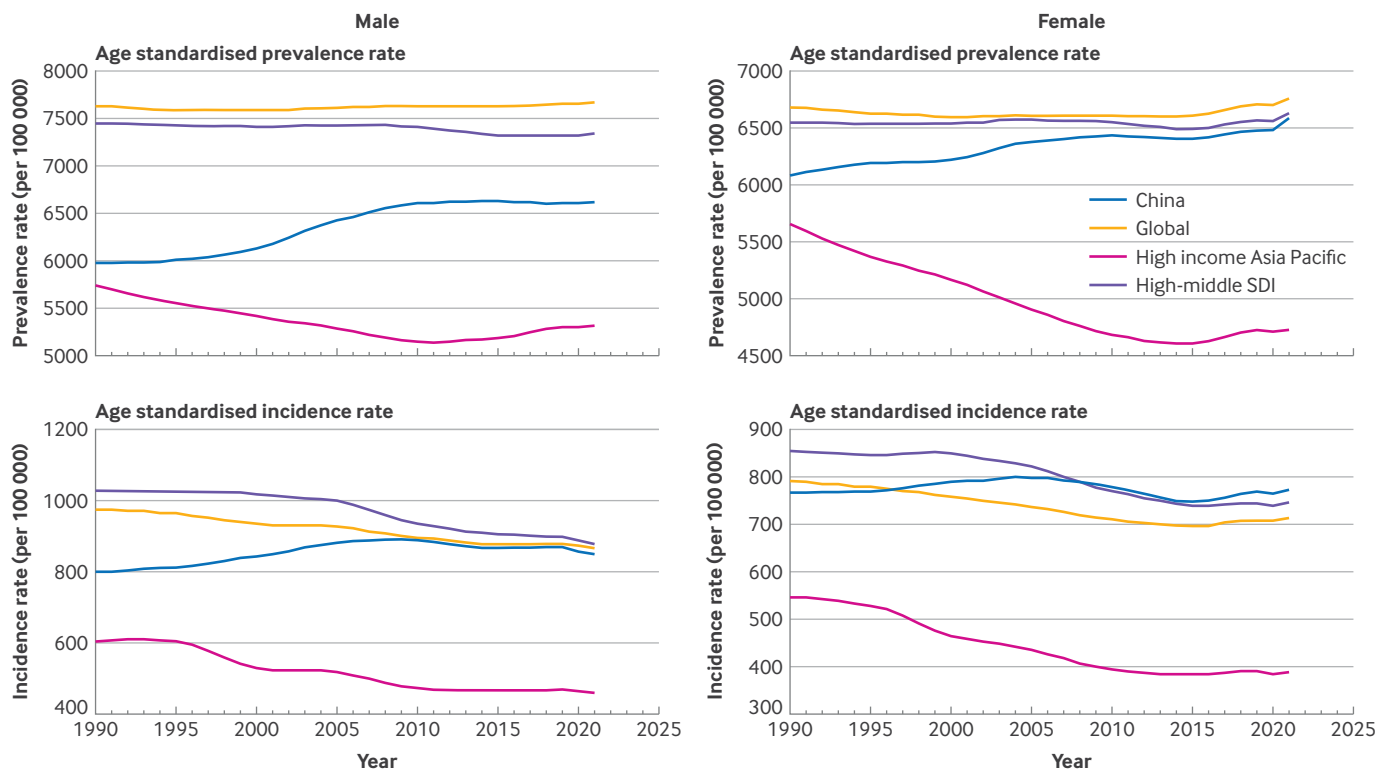


Fig 1 | Sex specific, age standardised prevalence and incidence of cardiovascular diseases globally and across China between 1990 and 2021. Top panels show sex specific prevalence of cardiovascular diseases; bottom panels show sex specific incidence of cardiovascular diseases. SDI=sociodemographic index. Data from Global Burden of Disease 2021 database

male labour force participation rate was 61.1% and 72.6%, respectively.⁸ Ownership of bank accounts and houses among women is increasing.⁹ A large meta-analysis derived primarily from studies conducted in high income countries showed that the inverse associations of socioeconomic status measured by occupation and income with coronary heart disease and stroke were stronger in

women than in men.¹⁰ Therefore, women may benefit more from improvements in socioeconomic status than do men.

Material circumstances

The improvement in socioeconomic status has changed material circumstances for both better and worse in China. However, Chinese women have benefited from better material circumstances. For example, the

transition from traditional fuels to clean energy sources has led to a reduced risk of cardiovascular disease mortality in women, who do most of the housework.¹¹ The employment rate among Chinese women has greatly increased, but the occupational risk exposure is much lower in women than in men, which also partially explains why Chinese women have had a lower increase in cardiovascular risk than men.

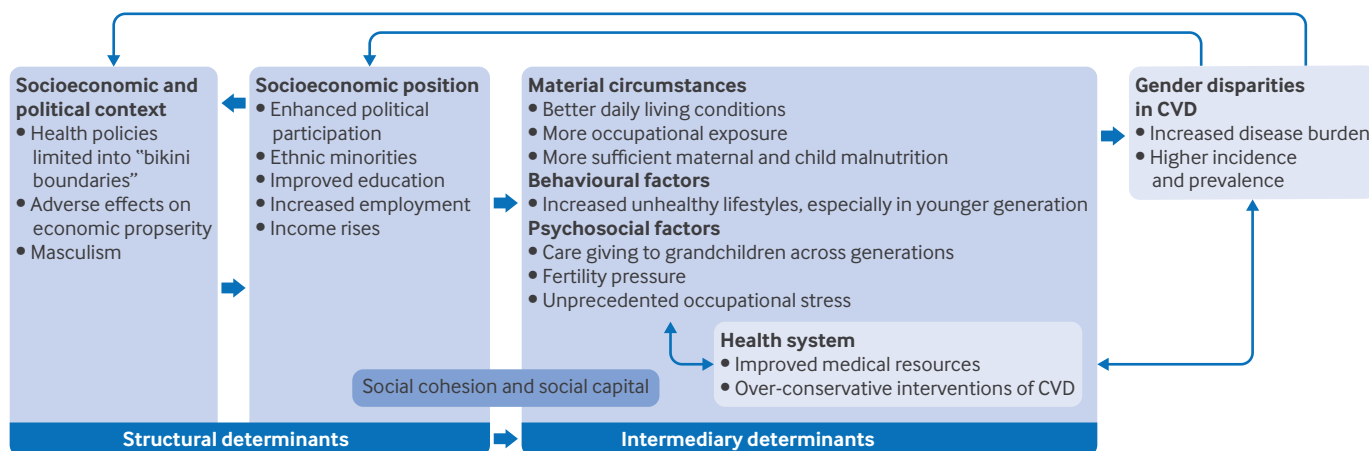


Fig 2 | Conceptual framework of gender disparities in social determinants of cardiovascular diseases among Chinese women. CVD=cardiovascular disease. This figure was modified from the final form of the Conceptual Framework for Action on the Social Determinants of Health³

For material circumstances during early life, previous epidemiological studies of births in China during the famine around the 1960s showed that women had a greater risk of cardiovascular disease caused by earlier exposure to famine compared with men, which suggested that Chinese women might benefit more than men from a sufficient food supply.¹² Although the improvement in food equity in recent decades might have reduced cardiovascular disease risks in Chinese women, the existing gap in child and maternal malnutrition between the sexes cannot be ignored.² More actions to increase food availability for women need to be implemented.

New challenges in social determinants of cardiovascular health

The reduction in the burden of cardiovascular disease among Chinese women, especially older women, has been attributed to the remarkable improvement in social determinants mentioned above. However, potential challenges exist in other social determinants of cardiovascular health in younger women. In this section, we discuss the potential risks of cardiovascular diseases caused by socioeconomic and political factors, behavioural factors, psychosocial factors, and health systems.

Socioeconomic and political contexts

As the basis for improving social determinants, gender equity was proposed in the constitution of China in 1954 and included as a basic state policy 40 years later. The Chinese government has proposed gender equity policies from the top level design perspective and formulated more than 20 national laws and regulations relating to women's rights and interests. However, almost all of these female specific health related policies focused on maternal health, and none of them is related to cardiovascular disease.

As part of Asian culture, the custom of "male domination and female subordination" still exists in parts of China, which means that women tend to remain in traditional roles. As "carrying on the family line" is one of the most critical responsibilities in traditional culture, more attention may be paid to "bikini boundaries" in women's health to boost fertility.¹³ In addition, as a multiethnic country, the ethnic disparities in cardiovascular disease burden in China cannot be ignored. In addition to genetic differences, unique cultural backgrounds,

particular behaviours, and unbalanced healthcare resources might play vital roles in the development and progression of cardiovascular disease.

Behavioural factors

In addition to the macro environment, individual behaviour is also a major determinant of cardiovascular disease risk. Economic prosperity in China has led to unhealthy lifestyles, including inadequate physical activity and unhealthy diets. For example, the increase in public transport facilities and family cars has contributed to the decline of active commuting in China. The decline in physical activity was more obvious among women than among men from 1991 to 2011.¹⁴ The proportion of domestic activities increased among men but decreased among women. More importantly, owing to the popularity of information technology products, sedentary behaviour is becoming increasingly common, particularly in younger Chinese women.

With the increase in agricultural productivity and the abolishment of food rationing in China, dietary patterns have transitioned to consumption of more meat, dairy products, eggs, and edible oils. As a result of industrialisation and marketisation, processed food and fast food have led to high consumption of sugar, fat, and salt in the population. Both men and women in China have a greater risk of having an unhealthy diet than they did in the past. Although previous studies reported a greater rate of unhealthy diets in Chinese men than in Chinese women from 2013 to 2018, Chinese women might face more complex exposure to unhealthy diets.¹⁴ For example, the main dietary risk factor in China is over-nutrition rather than malnutrition, but excessive food restrictions resulting in weight loss are becoming more common among young women.

As one of the highly prevalent risks for cardiovascular disease, smoking remains the most common unhealthy behaviour in China. Studies have found that the effects of smoking on the incidence of major coronary events and intracerebral haemorrhage and on mortality from ischaemic heart disease and ischaemic stroke are greater in women than in men.¹⁵ Although the prevalence of smoking has decreased in China,¹⁴ the prevalence among young and middle aged women has slightly increased in recent years, which might be due to mounting stress, the demand for weight loss, and misunderstandings about gender equity.²

Moreover, the rate of alcohol consumption has increased in China. Despite men having a higher prevalence of alcohol consumption, women have had a more evident increase in alcohol consumption.² The dramatically increased proportion of alcohol consumption among women might be attributed to more frequent social activities owing to their improved social position. Therefore, future cardiovascular prevention policies need to pay more attention to unhealthy lifestyles such as smoking and alcohol consumption among young Chinese women.¹⁶

Psychosocial factors

The conflict between traditional culture and modern roles means that the pressure to have children has increased for Chinese women, especially since the abolishment of the family planning policy. Chinese women of childbearing age might experience greater stress regarding procreation and parenthood. The negative feedback of pressure leads to a vicious cycle of fertility reduction. Moreover, the pressure to have multiple children might also have increased. As the number of pregnancies and deliveries increases, longer and more frequent maternity leave will result in career stagnation. The psychosocial burden of severe career damage has increased among women.

Since the short baby boom in recent years, the burden of providing care for grandchildren has increased, especially among women. Although the Nurses' Health Study showed no association between care giving stress and incident coronary heart disease in the American population, the cultural differences between western countries and China might lead to heterogeneous outcomes.¹⁷ Compared with that in western countries, the childcare workload might be heavier in China. Moreover, owing to the younger generation's higher educational and economic levels, a significant gap in babysitting patterns across generations might trigger conflicts, particularly between grandmothers and mothers.

Health systems

The rate of participation in primary health insurance among Chinese women reached 95% in 2020, leading to 650 million female beneficiaries, 3.4 times more than in 2011.⁴ Although considerable advances in medical resources for Chinese women have been achieved, the attention given to cardiovascular health in Chinese women is still limited. An imbalance between the

sexes remains in cardiovascular disease prevention and management. Studies have indicated a lower probability of drug use for secondary prevention of cardiovascular disease and of invasive diagnostic and therapeutic procedures for acute ischaemic heart disease among women than among men.^{18 19} Individual socioeconomic status accounted for only a small proportion of the sex differences in coronary angiography and coronary revascularisation. The primary reason is unconscious bias or beliefs in physicians and patients. The proportion of female participants in cardiovascular trials in China between 2010 and 2017 was approximately 40%.²⁰ Therefore, women are under-represented in cardiovascular research.

Compared with western countries, the concern for women's cardiovascular health among the medical community in China is insufficient. The American Heart Association and American Stroke Association published 12 guidelines and statements specific to women, whereas the Chinese Society of Cardiology published only four guidelines.

Discussion and recommendations

China's rapid economic prosperity has greatly improved socioeconomic status and living environments, as well as dramatically changed lifestyles and reduced psychosocial stress in women. However, compared with women in developed countries, Chinese women with higher socioeconomic positions are more likely to have unhealthy behaviours. Similarly to other East Asian countries, cultural backgrounds and demographic structures might increase cardiovascular disease burden through psychological stress and lack of attention to prevention and management of cardiovascular

disease in Chinese women. Furthermore, insufficient concern about cardiovascular disease in Chinese women of all ages is a common problem (box 1). Sex specific under-diagnosis and under-treatment of cardiovascular disease might lead to underestimation of the disease burden among Chinese women. Better healthcare among women due to improved structural determinants of health may reverse the disadvantages of cardiovascular disease burden in women compared with men. Maintaining these improvements in socioeconomic status and material circumstances might lead to a decline in the cardiovascular disease burden. However, unhealthy lifestyles and increased pressure might counteract the positive effects of improving social determinants.

Therefore, measures involving multiple levels and multiple roles are urgently needed to reduce the burden of cardiovascular disease in Chinese women. Specific policies for women's cardiovascular health should be developed. Strengthened clinical practices for and research on cardiovascular diseases in women are needed to eliminate the sex specific bias of cardiovascular disease related healthcare. Health education targeted at female patients is helpful for preventing overly conservative attitudes towards decision making related to control of cardiovascular disease. As young Chinese women are facing new challenges to cardiovascular disease prevention such as sedentary behaviours, over-nutrition, smoking, alcohol consumption, and bearing and raising children, diversified publicity should be reinforced and expanded. More friendly built environments with low economic and time costs for healthy behaviours should be provided to relieve pressures.

Countries or regions with similar cultures to China and in a similar stage of rapid economic development are facing or will face a dramatic increase in the burden of cardiovascular disease. Implications from China suggest that improving women's social and behavioural risk factors could offset part of the cardiovascular disease burden resulting from globalisation, urbanisation, and industrialisation.

The data used for the analyses come mainly from the Institute for Health Metrics and Evaluation (<https://www.healthdata.org/>), the World Health Organization (<https://www.who.int/data>), the World Bank (<https://data.worldbank.org/>), the National Bureau of Statistics of China (<https://www.stats.gov.cn/>), and the National Health Commission of the People's Republic of China (<http://www.nhc.gov.cn/wjw/index.shtml>).

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Box 1: Social and behavioural risk factors for cardiovascular diseases among Chinese women across generations

Shared risks

- Masculism
- Lack of public attention

Specific risks for older women

- Low socioeconomic status
- Worse material circumstances
- Over-conservative interventions for cardiovascular disease

Specific risks for young women

- Unhealthy lifestyles
- Occupational stress
- Fertility pressure

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Breaking the societal silence on domestic violence against women in China: the role of mental health services

Mental health professionals can make the breakthrough needed to combat the underseen impact of domestic violence on women's health in China, say **Yueqin Huang and colleagues**

China's dedication to women's rights was initiated in 1949 by the foundation of the All-China Women's Federation (ACWF), the first national organisation for women. In response to domestic violence, the legislation of the Anti-Domestic Violence Law in 2016 set a firm legal grounding to protect women from domestic violence.

Even with the advances made, domestic violence against women is still often neglected by the public services, community, and the women themselves owing to the deep rooted cultural bias, resulting in pervasive societal silence on domestic violence. Tackling this requires multilevel efforts such as cultural shifts, legal action, community support, and training programmes for survivors and perpetrators. Trained mental health professionals are key to these interventions and essential to breaking the silence.

KEY MESSAGES

- In China and many other Asian countries, domestic violence against women is often hidden under societal norms of family affairs, and concurrent psychological problems create dual difficulties for survivors seeking help
- Chinese women rarely seek help, so empowering them and recognising their right to challenge cultural norms is necessary
- Preventing and combating domestic violence against women requires multilevel efforts, and mental health professionals can play pivotal roles at these levels to break the silence on domestic violence
- Leveraging mental health services and cooperating with other support systems can gradually change the Asian cultural conception of domestic violence

The unspoken reality of domestic abuse

Defined as any form of gender based violence resulting in physical, sexual, or psychological harm and controlling behaviour by an intimate partner, domestic violence is a prevalent and severe problem in China. The national survey on the status of Chinese women conducted by the ACWF in 2010 reported that the lifetime prevalence of domestic violence in marriages was 24.7%.¹ However, this prevalence was derived from a closed question that could have failed to capture the full spectrum of violence in China. Additionally, the definition of domestic violence in many Asian cultures deviates from western interpretations. Most Asians, particularly Chinese people, do not recognise psychological and sexual violence as domestic violence.² Therefore, the actual prevalence of domestic violence is probably underestimated.³

Much like in many other Asian cultures, this problem is often perceived as a "family affair" in Chinese society, seen as a private or familial shame that should be hidden from public view.⁴ Such cultural influence is deeply ingrained in the rural areas of China, and domestic violence is more prevalent than in urban areas.¹ These social norms and cultural concepts further pose considerable obstacles to survivors seeking help and appropriate responses to the perpetrators of abuse. Despite recent improvements in legislation aimed at reducing violence against women and an upsurge in law enforcement training in China, a study found that the likelihood of the police arresting perpetrators remains unchanged, and mediation is still the primary intervention strategy for domestic violence in China's judicial system.⁵ This approach, entrenched in deep rooted patriarchal norms, often prioritises maintaining harmony over reducing the dangers faced by women.⁶ Traditional cultural conventions, such as the principle of non-interference in family affairs, further compound the problem that medical

personnel often neglect the needs of female survivors of domestic violence in China and fail to assist them.⁷ In addition, the harm caused by domestic violence, especially psychological and sexual violence, can be challenging to substantiate. Evidence of minor physical injuries may become insufficient over time, which also creates an evidential burden. As a result, despite increased awareness, victimised women in public services are still overlooked at the societal level.

At the individual level, most survivors of domestic violence in China do not seek help.⁸ The main contributing factors to this reluctance are underestimation of the violence, stigma of domestic violence, lack of awareness of aid resources, and a belief in the futility of help. Even when help is sought, survivors typically turn to family and acquaintances rather than to professional services. This pattern highlights some important cultural factors in China, where women often have a high tolerance for domestic violence, may be unaware that they are being abused, and tend to internalise the problem and share it only within their close social circles. Although evidence is limited, confronting domestic violence is more challenging for women in rural areas and needs greater attention owing to disadvantages relating to marital status, education, and income under the influence of traditional culture.¹

The societal and individual obstacles described above mean that the problem of domestic violence remains silent in China (fig 1). The silence at the social and individual levels causes physical and psychological harm to survivors, of which psychological harm is most likely to be overlooked.

The hidden impact of domestic violence on mental health in China

Globally, domestic abuse is notably associated with mental illnesses, including anxiety disorder, depressive disorder, and post-traumatic stress disorder.⁹ However,

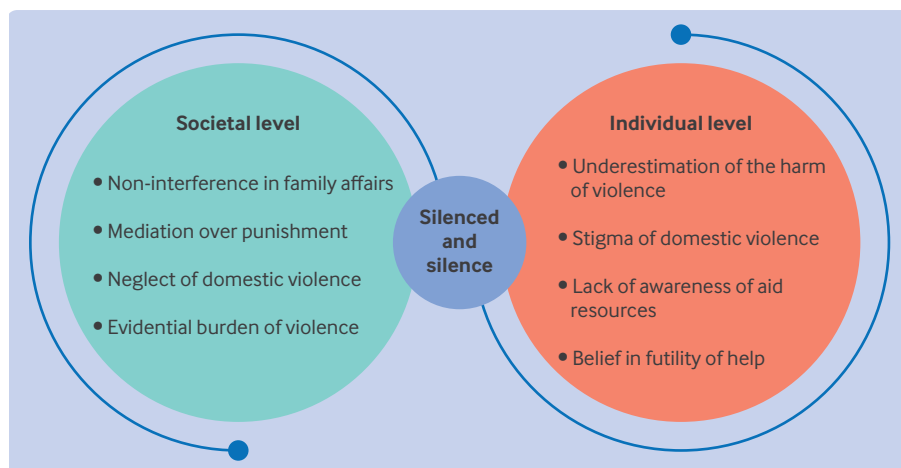


Fig 1 | Reasons underlying the silence of domestic violence against Chinese women

compared with the western world, studies in China exploring the association between mental health and domestic violence are notably limited.¹⁰ A recent study across six provinces of China provided some insight into this area, showing that about 70% of female survivors of abuse have symptoms of depression, with a 2.5 times higher prevalence than in non-abused women.¹¹ These figures are striking despite the relatively low response rate and limited national representativeness.

Although the effects of domestic violence are known, perpetration stems from complex psychosocial factors.⁹ Research indicates that perpetrators often have depression, anxiety, and substance misuse problems in China, where additional factors such as neurotic personality, maladaptive coping, adverse life events, weak social support, economic stress or gender income disparities, and entrenched gender biases contribute.¹² Hence, domestic violence results from a complex interplay of psychological, economic, and cultural influences. Survivors often face social prejudice, victim blaming, and self-stigmatisation, profoundly affecting their mental health.¹³ Interventions must be comprehensive, involving societal support systems, the empowerment of women, and a cultural shift in views on domestic violence for both prevention and remediation.^{14 15}

Many studies have proposed that the involvement of mental health professionals in developing strategies targeting the aforementioned factors can be beneficial.¹⁴⁻¹⁸ Mental health professionals working with clients who often experience a high prevalence of domestic violence have

specialised training and knowledge in this area.⁹ Their expertise enables them to offer valuable insights and recommendations for developing a responsive support framework covering the organisational, population, and individual components to assist survivors of domestic violence better, resulting in improved outcomes.

Embedding the role of mental health professionals in organisations

The framework at the organisation level emphasises collaboration and advocacy across multiple social services departments for improving the prevention of and response to domestic violence.^{15 18} At the top level of the organisational strategies, social service organisations such as the civil administration, public security, and women's federation would facilitate coordination among various departments and develop comprehensive policy, including planning, counselling, advocacy, and empowerment programmes. Mental health professionals can contribute their expertise and provide valuable suggestions to enhance these strategies, ensuring more effective assistance for survivors of domestic violence.

At the middle level, the regional domestic violence committee provides essential services within the network, including temporary shelters, emergency medical assistance, resource referrals, and legal aid. Mental health professionals can offer crisis intervention to help survivors to cope with the psychological effect of domestic violence. Additionally, mental health professionals can refer survivors to various social resources that are available to them. The collaboration between mental health

professionals and the regional committee can tackle both the immediate protection and the long term wellbeing of survivors of domestic violence by improving the coordination within the support system.

At the lower level, the neighbourhood committee and primary or general care providers are often the first contact in identifying and monitoring instances of domestic violence and advocating against its harmful effects. Mental health professionals can contribute by providing training that enhances the committee members' skills in identifying signs of domestic violence and improves their communication abilities. This training can equip the neighbourhood committee with the necessary tools to deal effectively with cases of domestic violence in their communities and to help individuals at high risk to identify stressors and change their attitudes towards domestic violence, preventing them from perpetrating violence.^{14 17} Furthermore, primary care providers often face challenges in tackling domestic violence owing to their limited psychological and crisis intervention training. Mental health professionals can support primary care providers by offering specialised training that helps them to recognise the signs of domestic violence, respond appropriately, and provide necessary referrals to support services, ensuring that people experiencing violence receive the support they need.

As well as contributing their expertise at the organisational level of the domestic violence support framework, mental health professionals can provide care at both the population and individual levels to reduce the risk of domestic violence, encourage survivors to speak for themselves, and promote better health outcomes (fig 2). Through engaging in population and individual level services, mental health professionals can gain valuable experience and build a strong body of evidence on domestic violence. This positions them as influential examples in raising awareness and effectively tackling domestic violence.

Extending population based support from mental health professionals

Mental health professionals can advocate empowerment programmes offering safety planning, legal advocacy, financial guidance, and community social resources.^{14 16} A study has shown that such empowerment interventions lead to improvements in depressive symptoms, general health, and quality of life for abused Chinese women, making

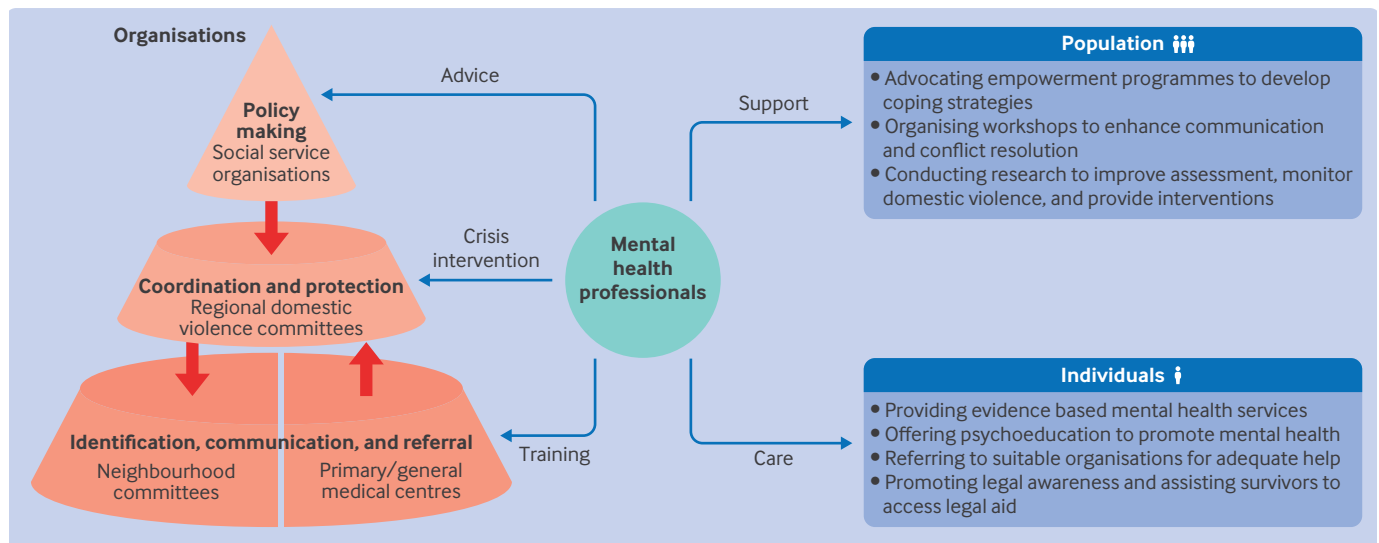


Fig 2 | Strategies for mental health professionals to break the silence on domestic violence

the promotion of such interventions a promising strategy to aid survivors of domestic violence.¹⁹

In addition, raising women’s awareness of overlooked violence and altering men’s attitudes and behaviour are crucial. Mental health professionals can offer school based and community based workshops to foster better communication and conflict resolution, which have been shown to help in preventing violence.^{14, 16} Such educational initiatives can allow mental health experts to discuss the risks of domestic violence and advocate for healthy, equal relationships and women’s rights.

Lastly, conducting research on domestic violence is another critical role for mental health professionals. With the development and use of culturally sensitive evaluation tools, monitoring people at high risk and previously reported cases within communities, despite the contentious nature of such surveillance,⁹ can speed up the identification of survivors and potentially lead to better outcomes. More research is needed in this field. Mental health professionals can have a significant impact in developing culturally sensitive evaluation tools and conducting population based studies that focus on risk factors, interventions, and the mental health consequences of domestic violence. By exploring the complex dynamics of domestic violence and its intersection with mental health, taking cultural aspects into account, mental health professionals can gain a deeper understanding of the problem and tailor interventions accordingly. These studies can inform the development of

effective strategies for prevention, early intervention, and support for individuals affected by domestic violence.

Providing mental healthcare for survivors of domestic violence

Besides population based support, prioritising individual care is essential as people experiencing domestic violence risk mental disorders and need tailored psychological care. Mental health service providers can actively engage and help survivors at various levels, building on the earlier strategies. Direct intervention and recommended principles can be used within their professional roles.

Beyond advocacy and collaborative efforts, mental health professionals can directly enhance their support for survivors of domestic violence. One way to achieve this is by practising evidence based treatments and social-cognitive psychoeducation.^{20, 21} Treatments such as cognitive behavioural therapy,^{14, 18} culturally sensitive interventions,²² integrative therapy, and humanistic therapy can be instrumental in treating trauma related symptoms.²³ At the same time, psychoeducation can help survivors to understand the nature of trauma, learn recovery strategies, and navigate recovery. Supplementing these with drug interventions can further support survivors in regaining their social functions and rebuilding self-esteem and trust. Understanding the complex, long term nature of domestic violence is also essential for mental health professionals.¹⁸ They should grasp the personality traits,

life experiences, and family histories that shape survivors’ realities. This comprehensive understanding informs effective support strategies.

Establishing direct cross departmental cooperation protocols is another essential strategy that mental health professionals can use to help survivors.^{22, 24} These professionals often refer survivors to domestic violence agencies for secondary referrals to other services. However, establishing direct collaboration across different departments within mental health services can significantly reduce delays and social barriers, ensuring that survivors receive immediate help. Mental health professionals should thus familiarise themselves with local social protection agencies to facilitate effective community level interventions that require timely support.

Furthermore, these protocols necessitate a thorough understanding of the laws on domestic violence and the rights of mental health patients, aiming to safeguard the rights of survivors. Mental health professionals assume a crucial position in legal advocacy by disseminating clear information to enhance survivors’ awareness and promote help seeking behaviours. By providing accessible and accurate information, mental health professionals can empower survivors to assert their rights and take the necessary steps towards seeking assistance. Moreover, professionals can guide survivors in documenting domestic violence incidents, providing vital evidence to aid further legal action.¹⁵

The success of these strategies depends on widespread awareness and engagement of society to tackle domestic violence. Mental health professionals can be actively involved, which leads to a shift in cultural norms and helps to combat the social stigma associated with domestic violence. Once survivors recognise the harm of domestic violence and feel empowered to disclose their adversity, they can reach out to the domestic violence support framework and be better assisted.

Limitations of analysis

When implementing the abovementioned strategies, the limitations of this analysis should be considered. Firstly, the existing evidence is insufficient and inconsistent. Although some studies have shown positive outcomes from specific strategies, the overall effectiveness of these strategies, when implemented holistically, remains uncertain and requires further verification. Secondly, although these strategies show potential for contributing to societal improvements in tackling domestic violence, their scalability, particularly in rural or low-to-middle income areas, remains underexplored. In these settings, the motivations and competencies of mental health professionals can be compromised owing to insufficient resources.

Conclusions

Urgent action is needed to reduce the profound impact of domestic violence on women in China, and mental health professionals are uniquely equipped to break this silence. The strategies outlined in this article provide a roadmap for their impactful engagement, enabling them to tackle the root causes of domestic violence effectively. Additionally, the involvement of mental health professionals within communities has the potential to bring about a cultural shift in the perception of domestic violence, not only in China but also across Asia. Through dedicated efforts, collaboration across various departments, and necessary changes in societal attitudes, mental health professionals can collectively break the silence surrounding domestic violence, provide better support and care to survivors, and ultimately create a safer environment for women.

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Improving maternal healthcare further in China at a time of low maternal mortality

More needs to be done to eliminate inequalities in maternal healthcare and provide universal, high quality obstetric services to maintain China's improvements in maternal health, say **Yangyu Zhao and colleagues**

China has made remarkable progress towards achieving sustainable development goal 3.1 over the past decades—that is, reduce maternal mortality ratio to less than 70 per 100 000 live births by 2030.^{1,2} From 1949 to 2022, the maternal mortality ratio fell from 1500 deaths to 15.7 deaths per 100 000 live births.² The successes are attributable to multidimensional efforts, including rapid socioeconomic development, strong political will to improve maternal and child health, establishment of a maternal health system, advances in health technologies, reformation of social health insurance, implementation of national maternal health programmes, and poverty alleviation.¹ However, China's improvement in maternal health appears to be reaching a plateau as indicated by a slowdown in the decline of the maternal mortality ratio. From 2013 to 2022, the maternal mortality ratio decreased by 7.5 deaths per 100 000 live births, which is roughly a quarter of the reduction achieved in the preceding decade from 2003 to 2012.²

KEY MESSAGES

- China has achieved a substantial reduction in maternal mortality in the past decades and has transitioned from high to low maternal mortality
- To improve maternal health further, China should shift to tackling emerging or neglected conditions that threaten the quality of obstetric services and put better quality on par with expanded coverage
- A strategic framework including people centred regional networks of maternal care that facilitate cooperation between health institutions and a quality management system with a learning culture are recommended to eliminate inequalities and provide universal, high quality maternal healthcare

Similar to China, more countries are in an obstetric transition, with a shift from high to low fertility and maternal mortality, and from direct to indirect causes of maternal mortality.³ Souza and colleagues' obstetric transition model conceptualises the process of eliminating maternal deaths in five stages.⁴ High income countries and a growing number of low and middle income countries (for example, China) are categorised in stage IV, which is characterised by a reduction in the maternal mortality ratio to lower than 50 deaths per 100 000 live births. These countries have benefited from a substantial improvement in healthcare accessibility. They must now respond to new challenges in order to end all avoidable maternal deaths and reach stage V.

China has made considerable progress in improving healthcare accessibility. A hierarchical maternal and child health system has been established nationwide with 26 000 maternal health facilities.⁵ This means each province, prefecture, and district or county has at least one maternal and child health facility, with each level taking a supervisory and teaching role for the level below it. Over 90% of Chinese households can reach the nearest health facility within 15 minutes,⁶ and most pregnant women can obtain affordable maternity services with about 95% of women covered by social health insurance.⁷ Coverage of maternity services has reached over 90% for antenatal care and postpartum visits and over 99% of deliveries are in hospital.² Despite the need for improved accessibility in certain regions, overall China is in a period of low maternal mortality. Thus, to substantially improve maternal health further, the country should now shift its efforts to tackling emerging and neglected conditions that affect the quality of care, and put better quality on a par with expanded coverage. China's experience in addressing these important issues will be of value to both developed and developing countries.

Challenges faced by obstetric services in China

Characteristics of pregnant women

Changes in the characteristics of the pregnant population and the spectrum of obstetric diseases have emerged in China with population ageing and the relaxation of restrictions on the number of children a woman can have. These changes include older maternal age, a consistently high rate of caesarean section, increasing proportion of pregnancies with previous caesarean section, and coexisting threats from increasing maternal complications and chronic conditions.⁸

Low compliance with clinical guidelines among health professionals

Health professionals have insufficient knowledge and skills and low compliance with clinical guidelines in relation to maternal health. Prolonged use of antibiotics cannot improve the preventive effect further and may lead to increased bacterial resistance. In 2021, only 45.4% of prophylactic antibiotics were stopped within 24 hours of having a caesarean section as guidelines recommended.⁹ Postpartum haemorrhage is the leading cause of maternal death in China. A case review of 556 maternal deaths caused by obstetric haemorrhage in 2011-18 found that 71.8% of the factors attributable to healthcare were related to insufficient knowledge of haemorrhage risk or inadequate skills to respond to it among healthcare professionals at the rural or county level.¹

Coexistence of insufficient healthcare and excessive medical interventions

In some rural areas and less developed provinces, it is still difficult to access specific antenatal care services and even sufficient contacts.² At the same time, a trend of over-medicalisation in antenatal care has emerged in developed urban areas, which is characterised by too many antenatal care visits, cumbersome procedures, and an increasing number of non-essential examination items. For

example, in the Tongzhou district of Beijing in 2017, more than 50% of pregnant women had more than 11 antenatal care visits.¹⁰ In addition, despite the implementation of universal two and three child policies, which can lead to pregnant women being more likely to choose vaginal delivery when giving birth to their first child, the overall annual rate of caesarean section in China did not decline as expected but increased from 43.4% in 2017 to 45.0% in 2022.⁸ The rate of caesarean section among nulliparous mothers substantially increased from 37.7% in 2018 to 43.6% in 2022, raising concerns about the risk of placental accreta, uterine rupture, and postpartum haemorrhage during their second pregnancy.⁸

Regional and institutional differences in quality of care

The disadvantages of lower availability of licensed maternal health facilities, obstetricians and midwives and access to the recommended antenatal care visits in western China, which had poorer economic development compared with eastern China, have significantly improved.² However, significant regional inequalities remain in the proportion of highly educated health professionals, quality of care, and outcomes of care—for example, maternal mortality ratio was 25.2 per 100 000 live births in western China versus 10.9 per 100 000 live births in eastern China in 2018.^{5,8} Notably, one third of all pregnant women gives birth in secondary level hospitals, which have relatively inadequate obstetric service capacity. For instance, the rate of neonatal asphyxia in secondary level hospitals is almost twice that in tertiary level hospitals.⁸

Career development for obstetric professionals

Obstetricians and midwives are more likely to work under greater pressure than other medical professionals because of concerns for maternal and fetal health. Moreover, the current payment mechanism of medical services and performance evaluation of public hospitals give more weight to disease treatment and surgical services, and to some extent neglect the efforts for disease prevention and health promotion integral to maternal healthcare. Salaries for obstetric health professionals are disproportionately low given the value and risk associated with these services, and hospitals providing more obstetric services will get lower performance scores. These factors, together with the declining fertility rate,¹¹ have made obstetrics a marginalised

service in hospital development and this has consequently become a growing concern for the career progression of obstetricians and midwives.

Moving faster towards universal, high quality obstetric healthcare

For countries in stage IV obstetric transition, such as China, comprehensive reforms aimed at enhancing the quality, efficiency, and equity of maternal healthcare services must be implemented. Here, as the National Centre for Healthcare Quality Management in Obstetrics (NCHQMO), we propose a strategic framework for the promotion of universal, high quality obstetric healthcare in the context of low maternal mortality. This framework consists of people centred regional networks of maternal care that integrate and redesign service delivery strategies to optimise health system functions by facilitating interinstitutional collaboration and a learning quality management system that has the learning culture facilitating adaptation and response. We also provide a set of feasible policy recommendations based on international experiences and China's institutional context (fig 1).

People centred regional network of maternal care

Given increasingly complex characteristics of pregnant women and indirect obstetrical events becoming the main cause of maternal mortality, referral and cooperation among medical institutions is increasingly necessary for the successful management of high risk pregnant women. The cooperative network of maternal care connects all maternity and other health facilities through a management model which promotes a structure and culture that prioritises people centred, effective and efficient cooperation and collaborative learning.¹² Studies show that such networks of maternal care have the potential to improve healthcare efficiency, continuity, quality and outcomes in resource limited settings.¹³

Both the United States and China have carried out trials on service delivery redesign aimed at establishing comprehensive networks for maternal care. In 2015, the American College of Obstetricians and Gynecologists, in collaboration with the Society for Maternal-Fetal Medicine, introduced a classification system categorising levels of maternal care. This system encompasses birth centres, basic care (level I), specialty care (level II), subspecialty care (level III), and regional

perinatal healthcare centres (level IV), each of which is designed to provide risk appropriate care.¹⁴

China started the Five Strategies for Maternal and Newborn Safety in 2017 as an integral part of its ambitious national public health programme within the framework of Healthy China 2030.¹⁵ The core constituents of these five strategies include risk screening and assessment, risk graded management and referral, case specific management of high risk pregnancies, strict reporting mechanisms, and a robust system of accountability.

To ensure the effective implementation of the five strategies, regional referral and treatment networks have been established, specifically designed to cater for critically ill pregnant women and newborns. These networks consist of maternal health facilities at various levels of care and multiple maternal and neonatal critical care centres. Within each county or district, prefecture, and province, these centres are managed by hospitals with strong comprehensive treatment capabilities. When necessary patients can be transferred from county level centres to municipal or provincial centres.

The success of this network relies on important elements including accurate risk assessment, sufficient information exchange, streamlined referral mechanisms, reasonable redesign of patient management responsibility, multidisciplinary teams, and collaborative learning. These mechanisms are crucial to ensure timely access to healthcare that meets the needs of pregnant women. Achievements have been made by this service delivery model in China, but some challenges remain in maintaining resilience of the network.

In the Chinese context, the risk based management of pregnant women mainly relies on the nominal level of a hospital rather than its actual treatment capacity.¹⁵ This may lead many pregnant women characterised as high risk to seek care in or be referred to tertiary hospitals, thereby increasing the burden on tertiary hospitals and reducing the capacity of primary maternal health facilities, which have already experienced a decrease in service demand owing to declining birth rates. This inefficient use of medical resources will adversely affect the overall effectiveness and efficiency of the healthcare system.

It is important to emphasise that referring high risk pregnant women to high level institutions is not the only solution to bridging the gap between healthcare demand and service delivery.

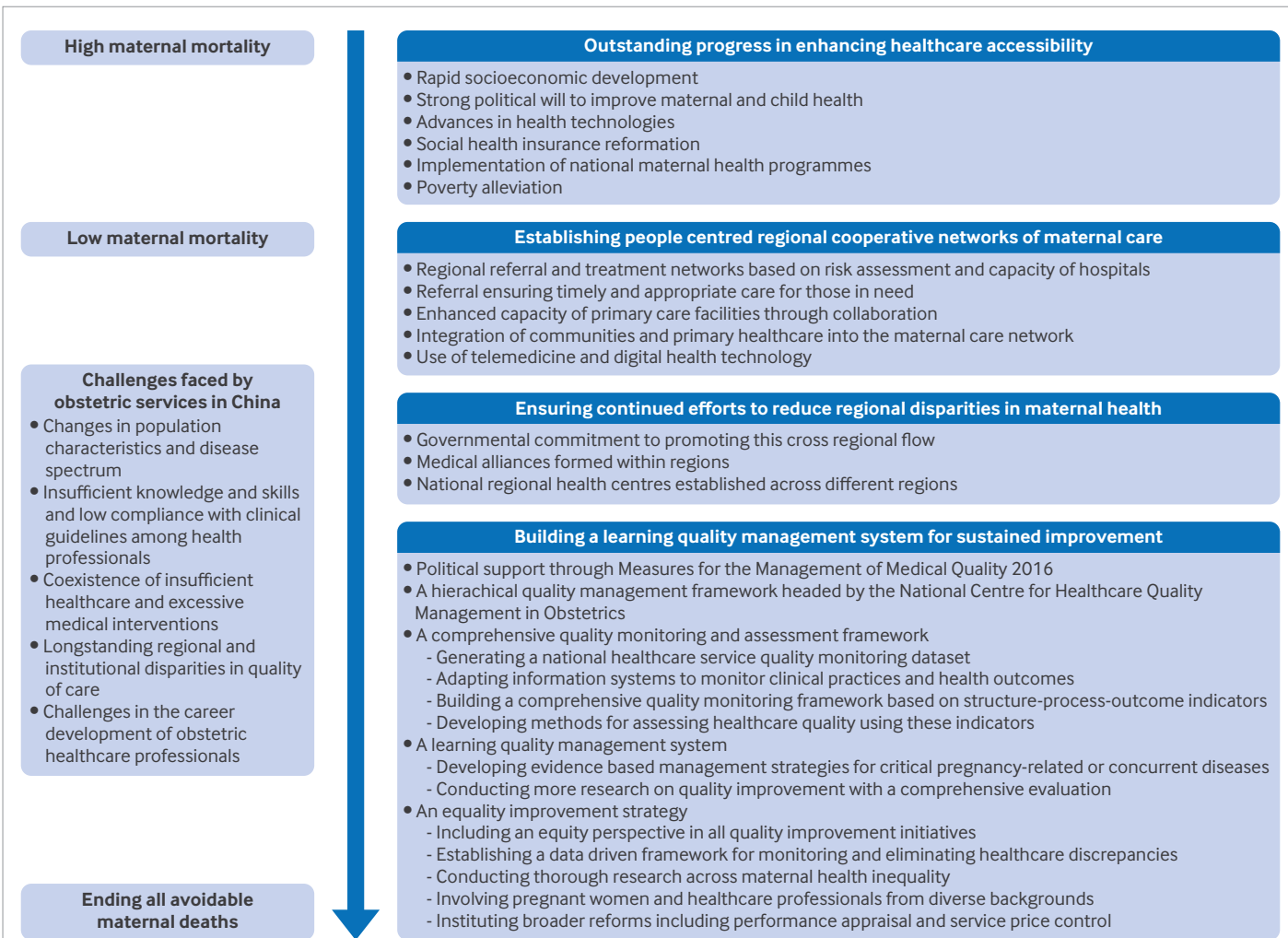


Fig 1 | Strategic framework for providing universal, high quality obstetric healthcare in context of low maternal mortality

Various factors, such as transportation, availability of medical resources, and coping strategies for patients who are reluctant to be referred, need to be considered when constructing a maternal care network. In certain situations, primary maternal health facilities may be the only option for high risk pregnant women to give birth. Therefore, the main goal should be to enhance the capacity of primary health facilities through collaboration between hospitals in the maternal care network. Higher level referral institutions in China are responsible for providing guidance and training for lower level hospitals. However, implementation of this support system needs improvement.

In countries in stage IV of obstetric transition, where chronic diseases are increasing, it is imperative that communities and primary healthcare are part of the maternal care network to ensure the consistency of care.¹⁶ Telemedicine and digital health advances (eg, support

systems for clinical decision making enabled by artificial intelligence) can be used to improve the technical competency of primary healthcare professionals and increase their adherence to clinical guidelines, thereby improving clinical outcomes.¹⁷ Regional health information integration also contributes to the optimisation of the allocation of medical resources and the improvement of health service efficiency, as done in Yinzhou District of Ningbo City, China.¹⁸

Reducing regional inequalities in maternal health

China has taken action to eliminate regional inequalities in maternal health. The country has established 18 000 medical alliances—that is, integrated organisations formed within regions by medical institutions of different levels where members collaborate and share resources. Furthermore, 125 national regional medical centres have been

established, by top-ranking hospitals independently or jointly establishing new branches across different regions. During the 14th Five Year Plan, 1953 tertiary hospitals provided targeted assistance to 1497 county level hospitals in 940 counties, fostering long term stable support and collaborative relationships. Other approaches taken to enhance equity include allowing top ranked hospitals to manage or merge with lower level hospitals and applying telemedicine technology.

Facilitating the transfer of medical resources from developed to developing areas is challenging. Government commitment to promoting this cross regional flow is essential. The sustainability and scalability of China’s measures remain to be tested. However, the effects of promoting medical equity have been observed. For example, in Xizang, pregnant women can access services at a new branch of the West China Women’s and Children’s Hospital of Sichuan University, which

is one of western China's top maternity hospitals.

Building a learning quality management system

In 2016, China introduced the Measures for the Management of Medical Quality, marking a milestone in medical quality control in the country. Since then, China has developed a hierarchical quality management framework that includes the NCHQMO, along with 31 provincial centres and increasing numbers of prefecture and county level centres, which are tasked with monitoring and improving the quality of healthcare. Several national big data platforms have been established to monitor the quality of healthcare services, including individual level data from the hospital quality monitoring system and hospital level data from the national clinical improvement system and NCHQMO. Nevertheless, several elements are needed to further advance quality improvement.

First, a comprehensive quality monitoring and assessment framework is needed—if you can't measure it, you can't improve it. In countries such as the United States and France, quality control indicators are mainly based on process oriented metrics.¹⁹ China introduced obstetric quality control indicators in 2019, most of which are outcome indicators owing to challenges in collecting process oriented data. To overcome this problem, we suggest that information systems be adapted to monitor maternal health and clinical practices by developing structured and standardised electronic medical records. Then, a comprehensive quality monitoring framework should be built that includes structure, process, and outcome indicators. In addition, it is important to develop methods to evaluate healthcare quality using these indicators at institutional and regional levels, which would not only assess the current healthcare landscape but also guide efforts to areas requiring improvement.

Second, a learning quality management system should be established. Measurement will not improve healthcare on its own and must be coupled with specific quality improvement actions, especially to tackle the aforementioned challenges. A quality management system with a learning culture has the capacity to adapt and reorganise quickly to deliver quality care. It is important to develop evidence based management strategies for critical pregnancy related or concurrent diseases, such as postpartum

haemorrhage, hypertensive disorders, and pregnancy with cardiovascular disease.²⁰ Treatment of these diseases may require multidisciplinary teams. In Sri Lanka, successful management strategies have been implemented to reduce maternal deaths from indirect causes associated with heart disease complicating pregnancy.²¹ In China, maternal mortality reviews have been carried out in almost all provinces, but studies on these death reviews are scarce, indicating that this mechanism has not been fully used for learning.²² Similarly, various large trials on service delivery redesign are under way in China and efforts have focused on taking action rather than looking back. More research on quality improvement and a comprehensive evaluation of the cost effectiveness and shortcomings of quality improvement models are needed.

Third, an equality improvement strategy is warranted. An equity lens should be applied to all quality improvement initiatives to tackle any inequalities.²³ Achieving equity requires political and technological investment to develop information systems geared towards monitoring equity related concerns and establish a data driven framework for eliminating healthcare discrepancies by conducting thorough research in a wide range of areas related to fairness of maternal healthcare services.²⁴ We call for involvement of pregnant women and healthcare professionals from different backgrounds in the process of developing, implementing, and evaluating quality improvement measures. Moreover, we recommend offering incentives for health professionals in primary hospitals to maintain and improve the continuity and quality of routine obstetric services. Broader reforms, including performance appraisal and service price control, are needed to relax restrictions in obstetric services and instil greater enthusiasm among obstetric healthcare workers to provide high quality services.

Conclusion

About half of maternal deaths in low and middle income countries could be averted with better healthcare.²⁵ The quality of maternal care needs to be improved worldwide. To ensure every pregnant woman everywhere has access to high quality maternal healthcare, it is recommended that countries in obstetric transition stage IV adopt a strategic framework including people centred regional networks of maternal care that facilitate cooperation between health

institutions and a quality management system with a learning culture. China's efforts offer insights for sustainably integrating quality improvement efforts into national health systems.

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How can China achieve WHO's 2030 targets for eliminating cervical cancer?

Lan Zhu and colleagues assess the challenges of eliminating cervical cancer in China and suggest stepwise approaches tailored to local settings will be required

As a preventable disease, cervical cancer remains a major global public health problem, ranking as the fourth most common cause of cancer in women worldwide in 2022.¹ In 2018, the World Health Organization's director general called for all nations to mobilise resources to eliminate cervical cancer (reduce incidence below 4/100 000 women years). In November 2020, WHO launched the global strategy to accelerate the elimination of cervical cancer.² The strategy includes achieving 90% coverage of the human papillomavirus (HPV) vaccine among girls by the age of 15 years, 70% coverage of twice lifetime cervical screening with a high performance test by age 45 years, and 90% delivery of treatment needed for cervical cancer and precancer by 2030. After the initial enthusiasm, the challenges of meeting these targets in all settings have become clear. Moreover, the effect of the covid-19

pandemic on delivery of health services delayed the implementation of cervical cancer elimination for three years. How to accelerate the cervical cancer elimination goal in the post-pandemic era is a pressing global concern.

China has made considerable efforts in cervical cancer prevention since the late 1990s (fig 1). In 2023, the central government put forward the Action Plan for Accelerating Elimination of Cervical Cancer (2023-2030).³ As part of the Healthy China Initiative, a nationwide campaign launched by authorities in 2019 to promote overall national health, several pilot healthy cities have initiated demonstration programmes for eliminating cervical cancer, including health education and local government funded HPV vaccination for girls aged 9 to 14 years. By the end of 2022, 8 of 11 pilot cities (including Ordos, Chengdu, and Jinan) with free or financial compensation policies for HPV vaccination had achieved vaccination coverage of 80% or higher among targeted girls.⁴

However, great challenges remain to achieve the elimination goal for the whole country, considering its vast size, large population, and disequilibrium in health and economic development. For regions or populations with low health resources (including underprivileged groups in both urban and rural areas), imposing elimination targets without appropriately coordinated management and government support could lead to local confusion or absence of motivation. Such outcomes could worsen health inequities within the country and impede cervical cancer elimination.

China's cancer burden is severe. The "two cancers" (cervical and breast cancer) screening programme is the only nationwide government led cancer screening initiative, with other cancer screening programmes still in the small scale exploration stage. Although including HPV vaccination in the national immunisation programme and scaling up screening requires substantial financial investment in the short term, in the longer

term an effective elimination programme could be cost saving because of reductions in expenditure on treating invasive cervical cancer.⁵ Accelerating the elimination of cervical cancer can free up financial resources earlier for tackling other cancers, and serve as a model for broader cancer prevention efforts in China.

Expanding HPV vaccination

HPV vaccination is not only an efficient measure to prevent cervical cancer but also an important supplemental strategy to enhance health equity in low resource settings, where access and affordability of screening and treatment services are usually poor. To date, 139 countries out of 194 have introduced HPV vaccination into their national immunisation programmes, but China is not one of them.⁶ Leaving HPV vaccination uptake purely to market forces decreases vaccine accessibility for women in low resource settings. According to a recent study, the coverage of all marketed vaccines not included in the national immunisation programme was 41.2% among local urban children (excluding urban children in migrant families) but only 5.7% among children whose migrant parents left them behind in rural areas.⁷ The striking disparity in vaccination uptake exacerbates existing health inequities.

The first HPV vaccine was licensed by China's National Medical Products Administration in 2016, 10 years after the first global licensing. With the recent licensing of two domestic bivalent HPV vaccines, there are now five types of HPV vaccines available in the country: Cervarix, Gardasil, Gardasil 9, Cecolin, and Walrinvax. The domestic bivalent HPV vaccines are highly effective against high grade genital lesions and persistent infection related to HPV16 and HPV18.⁸ Moreover, they are cheaper than imported vaccines. The cost of domestic HPV vaccines was about \$46 (£36; €43) per dose in 2023, compared with \$82.86-\$185.43 per dose for imported vaccines. Notably, tender prices in government funded HPV vaccination programmes

KEY MESSAGES

- Five years after the launch of the cervical cancer elimination initiative, China still faces implementation challenges
- Accelerating the inclusion of the HPV vaccine in the national immunisation programme is essential, prioritising areas with low health resources to reduce health inequities
- Meeting the screening target requires greater use of HPV tests, locally appropriate screening strategies, expanded population coverage, and a comprehensive information platform
- Accelerating approval process of regulatory authorities, developing tailored strategies for local settings, fostering collaborative platforms, and enhancing capacity building are recommended
- Additionally, strong political will is essential to meet the established goal

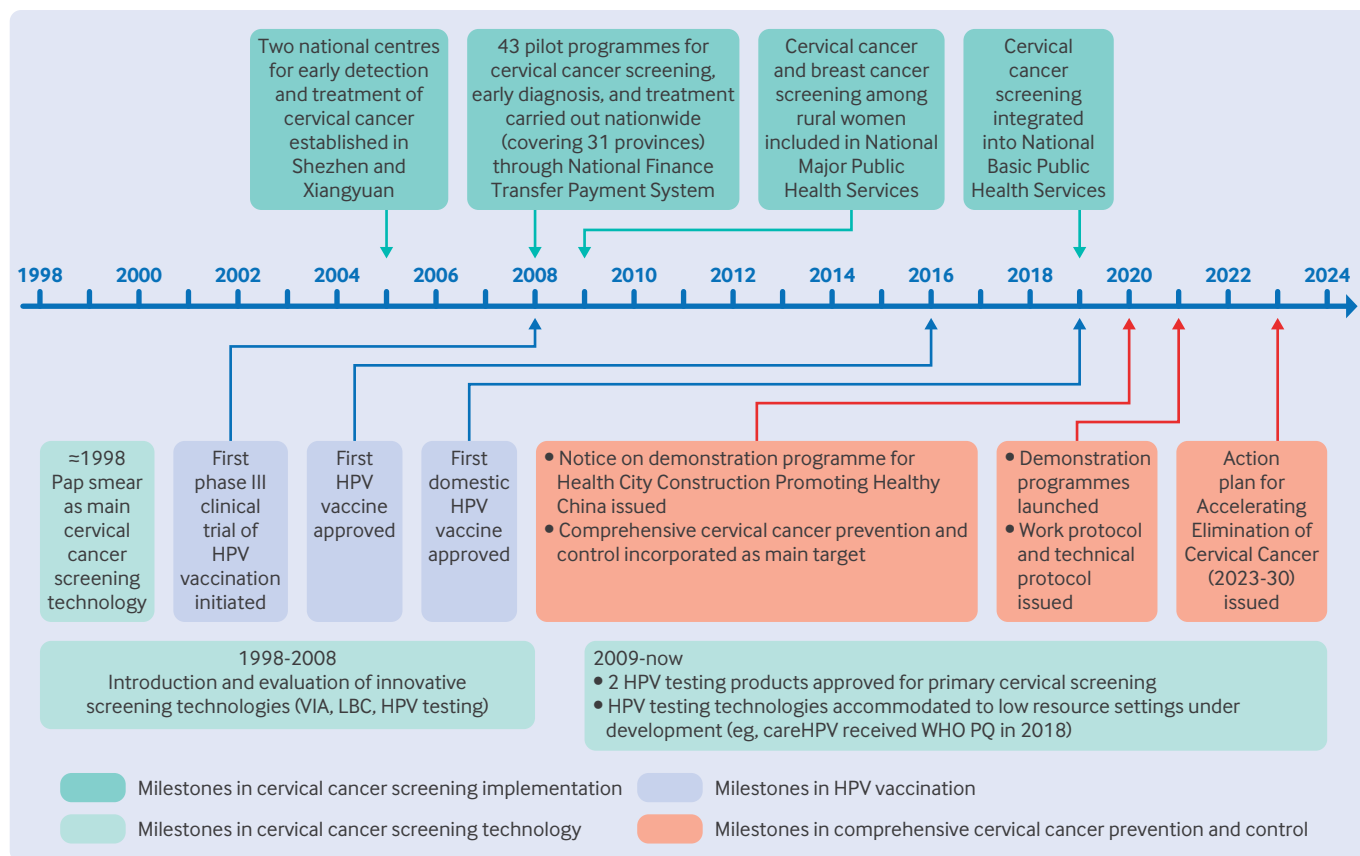


Fig 1 | Key milestones in cervical cancer prevention in China

have decreased to \$9.39-\$21.79 per dose for domestic bivalent vaccines.

Both domestic vaccine companies have also recently announced an annual vaccine production capacity of 30 million doses each. According to the latest census data there are around 7.5 million 14 year old girls in China,⁹ representing a basic demand of 13.5 million vaccine doses a year to achieve a 90% coverage in the two dose schedule. Moreover, new generation vaccine candidates are under development. As such, the vaccine supply should meet the demand of the national immunisation programme in the foreseeable future. The effective and affordable vaccine resources from China will also provide high quality vaccine options for other middle and low income countries that have not yet included HPV vaccines in their immunisation programmes.

China has a relatively comprehensive vaccine service infrastructure, encompassing well developed information systems, robust hardware facilities for cold chain transportation, and adequately matched human resources. It therefore has the flexibility to include a new vaccine for nationwide immunisation. Moreover, the covid-19 pandemic pushed the country to enhance its capacity in vaccine delivery

and increased the public awareness and acceptability of vaccination. Nevertheless, several studies indicate that rural areas, which bear a heavier burden of cervical cancer, have lower levels of awareness regarding HPV infection and vaccination.¹⁰ This may affect the implementation of comprehensive cervical cancer prevention and control strategies in these areas. To address this issue, China has promoted interventions such as HPV awareness day events and group educational interventions in recent years.

Increased availability of domestic advances and improved awareness pave the way for achieving the 90% HPV vaccination coverage goal, even for low health resource regions. However, inclusion of HPV vaccination in the national immunisation programme is a long term plan. The current high price of HPV vaccines would create a large annual financial burden and challenge the financial sustainability of the programme. China needs to negotiate a reasonable and affordable price for bulk purchase and to establish a sustainability mechanism involving multiple stakeholders, including governments at different levels, HPV vaccine manufacturers,

and non-governmental organisations. Moreover, policy incentives and financial support are needed for low health resource settings.

Emerging global evidence from immunogenicity trials, efficacy trials, and post-licensing observational studies has indicated that one dose of vaccine could be as effective as two or three doses in protecting against infection and clinical endpoints over more than 10 years.¹¹ In 2022, a WHO position paper recommended one or two doses in females aged 9-20 years,¹² which could expedite progress towards scaling up HPV vaccination in settings with limited supply and budget. Adopting a one dose schedule in China would reduce the costs and free up doses to allow more rapid scale-up of vaccination.¹³ However, population based evidence on the effectiveness of the one dose schedule is lacking in the country. More robust evidence is required before national approval of a one dose schedule.

Public health authorities have a moral obligation to assess prospective immunisation initiatives and deliver essential basic health services for the overall wellbeing of the nation. Besides negotiating lower prices and exploring

options tailored to low resource settings, the government must bolster political determination to implement the HPV immunisation programme. This could ensure full resource integration, directing policy makers towards more effective and efficient actions, and equally benefiting all eligible girls regardless of their economic status.

Cervical cancer screening coverage

Cervical screening aims to find and treat precancerous cervical cell changes to prevent cervical cancer from developing. The National Cervical Cancer Screening Programme in Rural Areas was launched in 2009 to provide free cervical examinations for rural women.¹⁴ Since then, the coverage of cervical cancer screening has gradually expanded, with an estimated 85 million examinations up to 2018. However, the number of rural women participating in screening during 2016-18 accounted for only 26% of the rural women of appropriate age in the same period.¹⁵ Screening coverage was also low at the national level (both urban and rural areas), with the lifetime screening coverage for women aged 35-64 years in China was reported to be 36.8% in 2018-19.¹⁶ This is substantially below WHO's goal of 70% coverage with at least two lifetime screenings.

The Chinese government integrated cervical cancer screening into the basic public health services in 2019. However, this created challenges for budget allocation. Although the per capita fiscal subsidy for basic public health services increased from ¥69 (£7.50; €8.90; \$9.50) in 2019 to ¥89 in 2023, it is still hard to cover the 19 basic public health service projects. Without specific allocations from local governments, it is challenging to achieve improvements in screening coverage and screening quality, especially in low health resource settings. A stepwise approach assigning pragmatic, time bound, local targets might be useful to encourage developed regions to innovate in the resource allocation and financing of cervical cancer screening. Alternatively, the central government could adjust the proportion of financial support to low resource regions according to the local economic situation.

Applying new technology

China needs to improve not only the coverage but also the screening technology. In 2020, WHO recommended the HPV nucleic acid test as the primary screening tool for cervical cancer because of its high

sensitivity and performance. However, the most widely used screening tools in China are the Pap smear test and visual inspection with acetic acid or Lugol iodine (82.28% and 13.75%, respectively, of the total screened population in 2009-18).¹⁵ Because of the complicated approval process and other restrictions, only two of more than 100 HPV nucleic acid test products were approved by the National Medical Products Administration for primary cervical cancer screening by 2023.

Another major barrier to cervical cancer screening is the lack of qualified staff. According to the 2019 national pathology quality report, 48% of the pathology departments had two or fewer pathologists.¹⁷ As a result of insufficient colposcopy and histopathology capacity, some regions mainly rely on specialist hospitals or third party agencies for their screening tests and pathological diagnosis. Greater use of simple screening approaches such as self-sampling testing, point-of-care screening, and artificial intelligence (AI) based diagnostic technology could help overcome capacity problems and improve screening efficiency.

Appropriate screening strategy

Taking into account the unbalanced economic development of countries around the world, WHO recommends a minimum of two lifetime screens with a high performance HPV test, one by age 35 and another by age 45 years.² The incidence of cervical cancer in China significantly increases with age and peaks at 50-54 years.¹⁸ The national cervical cancer screening protocol issued in 2021 recommends screening every three years with a cytology test or five years with HPV test for women aged 35-64 years, which fits well with the age trend of cervical cancer in China.¹⁹ However, use of the traditional cytology test in national screening programmes is not sustainable because of its low sensitivity and high dependence on the medical workforce and diagnostic services. There were more than 296 million women aged 35-64 in China in 2020, and a cytological examination every three years for these women would require a lot of labour and resources. China should therefore accelerate the switch from cytology testing to HPV testing to save screening costs and improve screening efficiency.

In most regions of China, a five yearly HPV test should be feasible and appropriate. However, it could create financial and workforce challenges in low

resource settings. A Chinese study based on the cervical cancer screening cohort among Chinese women showed that the probability of transitioning from normal cells to CIN2 or CIN3+ over 10 years was ≤ 0.01 .²⁰ Given this extremely low transition probability, extending the screening interval (to 10 years or more) based on health service capacity and health budget assessments is also acceptable in settings with extremely low health resources.

Effective integration of information and data

Currently, China lacks an information system to effectively manage screening invitations and follow-up, which is critical to improving screening compliance. Cervical cancer screening data are derived from screening programmes organised by governments and opportunistic screening in hospitals or medical examination centres, and the collection and reporting of screening data also vary by institution type. By the end of 2022, China had more than 36 000 hospitals, 970 000 primary care institutions, and 3000 maternal and child health institutions. The lack of a standardised data collection platform poses a major challenge to the management of screening information from multiple sources and could lead to overscreening, which wastes health resources and results in unnecessary diagnosis and treatment because of false positive results. Therefore, there is an urgent need to establish an information sharing network for cervical cancer screening to track and monitor screening, online follow-up, and referral appointments.

Optimising linkage between screening and treatment

WHO recommends that anyone who tests positive for HPV DNA on screening should be treated without histopathological confirmation.²¹ However, Chinese guidelines still require histopathological confirmation before treatment. Limited diagnostic resources and lack of easy-to-use screening resources have resulted in poor treatment coverage in low resource areas. A survey reported that almost all hospitals carrying out cervical cancer screening could provide colposcopy examination, but only 40% of rural clinics were able to do pathology diagnosis.²²

An alternative approach using well established electronic colposcopy technologies has been proposed in China. This approach involves immediate thermocoagulation to treat suspected high grade lesions identified during colposcopy,

Table 1 | Main challenges in cervical cancer elimination in China and recommended resolutions

Target	Main challenges	Resolution
HPV vaccination: 90% coverage among girls by age of 15 years	High vaccine price poses challenges for affordability and sustainability	Negotiate reasonable and affordable price for bulk purchase and establish sustainability mechanism involving multiple stakeholders Explore one dose schedule as compromise option for low resource settings Bolster the government's political commitment to include HPV vaccine into national immunisation programme
Cervical cancer screening: 70% twice lifetime coverage with a high performance test: one test by age 35 years and another by age 45 years	Low screening coverage	Develop a stepwise policy approach assigning a pragmatic, time bound, local target to encourage developed regions to innovate in the resource allocation and financing of cervical cancer screening Central government could adjust distribution of financial support towards low resource regions
	Availability of HPV DNA test products is limited and the costs are high	Fast track approval of emerging innovative, low cost screening technologies Promote use of simple screening approaches such as self-sampling test, point-of-care testing, and artificial intelligence diagnostic technology
	Recommended screening age and interval do not fit all settings in China	HPV based screening with extended interval in low resource settings
	Lack of information system to effectively manage screening populations and information	Establish a cervical cancer screening information sharing network to achieve screening case registration, screening service monitoring, online follow-up, and referral appointments
Cervical cancer treatment: 90% delivery of treatment for cervical cancer and precancer	Diagnostic capacity is weak	Change current recommendations to enable immediate treatment before histopathological confirmation Develop new technologies for treatment of HPV infection and cervical precancerous lesions, such as therapeutic HPV vaccines

which is performed concurrently with biopsy. Colposcopy and thermal ablation have been shown to be effective in one large scale study in rural China.²³ A “screen and treat” approach with a self-sampling HPV test linked to thermal ablation was shown to be the most cost effective approach for cervical cancer prevention in China.²⁴ In addition, it is critical to develop simpler and more suitable technologies such as therapeutic HPV vaccines that can be easily used in primary healthcare facilities.

Recommendations

If China is to reach WHO’s target’s for cervical cancer screening and elimination it will need to adopt approaches that are adapted to local settings. The most effective measures to ensure equal and accessible healthcare services for eligible women are adding HPV vaccination to the national immunisation programme, encouraging developed regions to innovate in the resource allocation and financing of cervical cancer screening, and providing more central financial support to low resource regions (table 1).

A one dose vaccination schedule or screening with extended interval might be helpful in the transition period. However, more evidence is required to carefully evaluate the trade-offs. Moreover, it is also crucial to establish an efficient mechanism to incorporate evidence into policy decisions.

Robust policies are essential to foster technological breakthroughs. Streamlining evaluation processes, optimising systems, and expediting approvals for cutting edge

innovations, including HPV therapeutic vaccines, point-of-care tests, and AI assisted screening, diagnosis, and treatment technologies, will significantly bolster China’s ability to control cervical cancer.

Achieving cervical cancer elimination demands the engagement of diverse stakeholders. Capacity building is essential not only in the health service sector but also in community engagement and the development of information platforms. Bolstering the government’s moral and political commitment to conduct national interventions is key for adequate resource mobilisation, effective actions, and the expedited elimination of cervical cancer throughout China.

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Contributors and sources: FZ’s research focuses on cervical cancer comprehensive prevention including screening, HPV vaccination, and health economic evaluation. YQ specialises in public health and population medicine research. LZ has been engaged in clinical and scientific research in difficult critical diseases and rare diseases in obstetrics and gynaecology for more than 30 years. JL is a leading expert in obstetrics and gynaecology in China, with extensive clinical experience and comprehensive knowledge. All authors contributed to writing and revising the article. FZ and LZ contributed equally and are the guarantors.

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Optimising contraceptive services as fertility rates fall in China

Jun Zhang and colleagues argue that new strategies are needed to meet the contemporary demands for contraception in China

As a longstanding national priority, family planning services used to be provided free to all married couples in China to temper rapid population growth and promote economic development.¹ Birth control was the primary goal. However, since the lifting of the one child policy in 2015 to address the ageing population issues, the mission of family planning services has become less clear. Doubts even arose about whether family planning services would be counterproductive to the new national population policies.

Here we argue that family planning services should not be marginalised but enhanced in the new era. Since the lifting of the one child policy, long acting contraceptives (eg, intrauterine devices (IUDs) and sterilisations) have been gradually replaced by less effective short acting contraceptives such as condoms (fig 1).¹ A higher frequency of sex among the younger generation and more contraceptive failures have resulted in more unintended pregnancies and abortions.^{1,5} An estimated 58% of pregnancies in China during 2015-19 were unintended, 78% of which ended in abortion.⁶ This, coupled with a dropping birth rate, led to an increase in the ratio of abortions to births from 0.54 in 2016 to 0.75 in 2020 (fig 1). The rise indicates a growing unmet need for contraception in China.

Family planning service needs a new mission

With the improvement in social equity and women's education and job prospects

KEY MESSAGES

- The mission of the family planning service needs to move from birth control to ensuring the health and wellbeing of all people of reproductive age
- Changes are needed to improve access, equity, and quality of services
- Infrastructure and investment should be centred around a three level contraceptive service encompassing individuals, communities, and hospitals

over recent decades, China has witnessed the postponement of marriage and childbearing.⁷ From 1990 to 2020, the average age at which women married for the first time increased nationwide from 22 to 28 years. The mean age at first birth also rose.⁷ Given the delay in marriage and childbearing and more open attitudes towards sex, the prevention of unintended pregnancy and sexually transmitted infections (STIs) is becoming important among young women and men. In addition, the growing sexual activity among adolescents in China also warrants urgent recognition and action to avoid the adverse physical and psychological impacts of STIs, unintended pregnancy, and repeated abortion.⁵ Finally, as most women of reproductive age in China are employed, birth spacing is essential for married couples.

These changes indicate that preventing unintended pregnancies, subsequent abortions, and STIs should be priorities for contemporary contraceptive services. Evidence shows that full provision of contraceptive services can result in a 52% decline in both unintended pregnancies and abortions.⁶ Scaling up barrier contraception and advocating dual protection can prevent more STIs.^{5,8} Secondary contraceptive benefits also include physical and psychological health,

girls' education, women's rights and career development, and gender equality. In essence, the old mission of curbing the population growth among married couples needs to be replaced by a new mission of improving the health, prospects, and family wellbeing of all people of reproductive age.

More efficient infrastructure for contraceptive services is needed

China's family planning services evolved from being scarcely available in the 1950s and 1960s to becoming a nationwide priority from the 1980s to the mid-2010s with the introduction of the one child policy.⁵ However, after the policy was relaxed, the family planning system was merged into the maternal and child health programme, a national hierarchical network responsible for providing medical care, health maintenance, and health administration for reproductive, women's and children's health from national to village levels.⁵

Although contraceptive services are now provided as part of the essential public health service programme, the staff working for the national family planning programme were not transferred. Additionally, the new service focuses on providing free contraceptives and surgical methods to married couples.⁹ A new infrastructure is therefore needed to efficiently meet

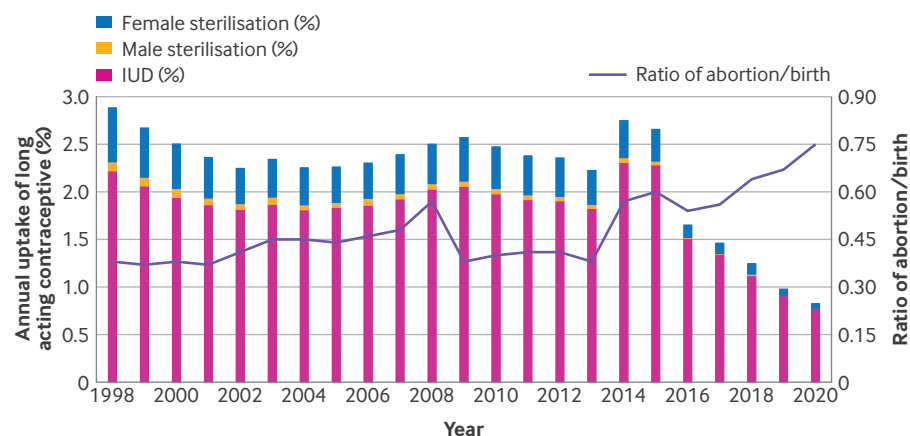


Fig 1 | Trends in choice of contraceptive among women of reproductive age in China from 1998 to 2020 and ratio of abortions to births²⁻⁴

the family planning needs of all people of reproductive age and make up for the shortfall in the workforce.

The services required for delivering contraceptives vary depending on the method, ranging from self-service (eg, condoms) or pharmacy services (eg, contraceptive pills) to well trained medical services (eg, IUDs). Here, we propose a three level system model of provision, including self-care, community clinics, and hospitals. Corresponding facilities, products, and services are tailored to each level (box 1).

For each level in the new infrastructure of contraceptive services, the available resources and staffing are crucial. Providing space, supplies, and equipment, as well as technology, information, and knowledge, requires sufficient financial support. In China, it was estimated that it would cost \$7 (£5.50; €6.50) per capita annually (compared with current \$5.47) if all needs are met, and every additional dollar spent on contraceptive services would save \$2.50 in the cost of pregnancy related care for unintended pregnancies.⁶ Therefore, additional investment is necessary if the new, broader mission of improving the health and wellbeing of everyone of reproductive age is to be achieved.

Education has important role in level 1 service

At the self-care level, the dissemination of contraceptive knowledge in the school and public education system is essential to our new mission. In 2021, the Chinese State Council adopted outlines for women's development and children's development for 2021-30. The plans underlined the importance of the dissemination of sexual knowledge to women and children and the role of school education.^{12 13} Comprehensive sex education needs to be incorporated into the school curriculum to educate young people about contraception and the choices available at various levels. In the Netherlands, for example, sex education has been mandatory in primary and secondary schools since 2012, and this has contributed to the high prevalence of contraceptive use, low rates of adolescent pregnancy, birth, and abortion, low STI rates, and low unmet needs.¹⁴

Public education is also required to facilitate the dissemination of contraceptive knowledge and reduce the barriers of social prejudice and misinformation. Recent national reports suggest that China has about 1.1 billion mobile internet users, and about 90% of adolescents use smartphones.^{15 16} Additionally, the number of people

accessing short videos and live streaming is 1 billion and 0.8 billion, respectively.¹⁵ Therefore, new approaches such as social media campaigns, video sharing platforms, and live streaming may also help promote the availability and appropriate use of contraception. In addition, sex education can be more effective when complemented by community based services, such as community education, contraception counselling, and condom distribution.

Easy access to contraceptives is essential for efficient service

The realisation of women's sexual and reproductive health and rights is a cornerstone of the new mission.¹⁷ Access to a choice of affordable and acceptable methods of contraception for all women of reproductive age is vital.¹⁷ A study showed that free distribution of condoms increased their use from 28% to 36% by women and from 40% to 54% by men.¹⁸ Although the Chinese government continues to provide free contraceptives, public awareness of the policy, the types of contraception available, and how to acquire them needs to be raised, especially among people with low income or low educational levels and new migrants.¹⁹⁻²¹ Public awareness of free long-acting contraceptives is lower than that of free condoms.^{19 21} Since the original government initiative targeted married couples of reproductive age, more efforts are needed to increase the awareness of free contraceptives for unmarried people through the public and school education system.^{19 21} Lower satisfaction with the quality and comfort of free condoms has also been reported.^{21 22} Further investment and publicity are therefore needed to promote public awareness and ensure the quality of products.

Convenient access is another factor in the distribution of free contraceptives.²⁰ Online pharmacies and online healthcare services are well suited for the supply of condoms and pills. In 2023, more than 0.5 billion and 0.3 billion people in China were estimated to have used online ordering and online healthcare services, respectively.¹⁵ China also has an efficient delivery system that can bring both over-the-counter and prescription drugs to people quickly in urban settings. Nevertheless, some studies found that women in urban areas had a higher incidence of unintended pregnancy and abortions than rural women, probably because of a more open attitude towards sex and a lower proportion of women using highly effective contraceptive methods in urban areas.^{23 24} In addition, migrants

Box 1: Three level contraceptive service

Level 1: Self-care and pharmacy

This mainly involves short acting methods, such as male and female condoms, hormonal pills, and emergency contraceptive pills. Postpartum women can use the lactational amenorrhea method. Self-administration of injectable contraception should be encouraged.¹⁰ Self-care can efficiently promote health and ease the strain on the existing health system.¹¹ An efficient level 1 service requires a high quality school and public education system, widescale condom distribution, easy access to pharmacies, and an efficient pharmacy delivery system. Good linkage of self-care to the relevant community or facility based healthcare services is also important.

Level 2: Community clinics

Community health workers provide public education and contraceptive advice to help both adolescents and adults make informed decisions and ensure their access to contraception products. Advice should be based on up-to-date and evidence based information, including the benefits, options, effectiveness, side effects, and costs. Injectable contraceptives can be provided, as well as implants and IUDs when adequate resources and trained staff are available. High quality level 2 services require a framework for rigorous training, up-to-date training materials, and adequately trained health workers. Community clinics also have a key role in postpartum contraception.

Level 3: Hospitals

In China, maternity hospitals and obstetrics and gynaecology departments in general hospitals are the main providers of long term contraceptive methods such as implants, IUDs, and female and male sterilisation. Hospital health professionals can also provide contraceptive education for girls and women, especially in post-abortion care. A close partnership between the community and hospitals is important to establish a comprehensive and continuous service. Maternity hospitals are also responsible for providing technical support and training for community health workers.

showed poor awareness and insufficient use of family planning services.²⁵ Thus, investment to increase awareness and motivate women to use more effective methods is needed for urban residents and migrants. In contrast, in remote and rural areas with low internet penetration and weak delivery capacity, investment in easy access to contraception—for example, through community clinics and convenience stores—is essential for services and products to reach as many people as possible.

Staff support is crucial for community and hospital services

Training, certification, and ongoing performance evaluation of family planning providers in the community and hospital services are needed to optimise the role. This should include attitudes and professional and practice competencies.²⁶ Currently, family planning providers in community clinics are often unable to provide individualised contraceptive counselling and meet the complex needs of clients because they lack systematic medical training and clinical experience.²¹ Thus, adequate training is urgently needed for community health workers, especially in remote and rural settings where they have a central role in counselling and delivering family planning.

Post-abortion and postpartum contraceptive services are the two weakest areas currently. At least 70% of the pregnancies among women in the first postpartum year were reported to be unintended.²⁷ A retrospective cohort study among 17 466 postpartum women at 60 hospitals in 15 provinces in China showed that the rates of unmet needs for postpartum modern family planning methods between 2015 and 2016 were 35.5%, 25.6%, and 24.6% at 6, 12, and 24 months postpartum, respectively.²⁸ For post-abortion contraceptive counselling, a nationwide cross-sectional study among 561 service providers in 30 provinces in 2013 found that their overall knowledge of contraception was limited, and only 57% spent more than 10 minutes on counselling.²⁹ Another cross-sectional survey among 431 women in three public hospitals in Guangzhou in 2018 reported that 42% of the women undergoing abortion used post-abortion services, including contraceptive counselling and provision. The proportion of migrants using the post-abortion services was significantly lower than that of residents (19% v 80%).³⁰

The reasons for the unmet needs include a lack of trained health workers and space, heavy workloads among providers, and disconnection between the maternal healthcare system and the contraceptive service system.²⁷⁻²⁹ Providing postpartum contraceptive service at same time as “well baby” visits may be feasible and acceptable to both women and providers, according to a recent study in Shanghai.³¹ The integration of post-abortion and postpartum care into community clinics and hospitals warrants more support and investment.

Research to improve contraceptive services

The current contraception options do not fully meet women's needs and align with their preferences, and the development of new technologies has remained stagnant for decades.³² The failure rates (the proportion of women who will become pregnant within the first year after initiating method use) of short acting methods remain high. Longer acting methods such as implants and IUDs require medical visits and invasive procedures, and side effects stop many women from using hormonal products.³²

Affordable and desirable methods with more convenience, higher reliability, and fewer side effects need to be developed. Additional investment should also be made to address data gaps by monitoring the family planning progress and establishing a nationwide contraception database covering urban and rural areas, migrants, adolescents, and married and unmarried adults. The patterns of contraceptive use, efficacy, safety, and management of side effects should be included in the database.

Role of government and non-governmental organisations

The new, wider mission for contraceptive services and optimisation strategies cannot be achieved without policy, funding, and publicity support, and coordination by government and non-governmental organisations (NGOs). Furthermore, to tailor contraceptive services to the needs and preferences of different age and marital groups, government and NGOs need to achieve a wider mix of methods through the three level system.

IUDs, female sterilisation, and condoms have been the dominant methods of contraception in China for many decades.³³ However, the proportion using condoms increased rapidly after the relaxation of fertility policies, and the uptake of other methods, such as contraceptive pills,

injectables, and implants, remains low.^{33,34} Although contraception is provided free in China's essential public health service programme, lack of awareness and familiarity among both consumers and providers, the concerns about side effects, and misconceptions about safety and effectiveness remain considerable barriers to greater use.^{19,34-36}

Achieving a balanced method mix requires the support of the government and NGOs. The national Management Centre for Drugs and Medical Devices (responsible for the supply, management, and guidance of free contraceptives and services among others functions) and its counterparts at the provincial level, should optimise the regulations, strengthen the supply chain systems, and address research gaps to expand the coverage of free contraceptives. The China Family Planning Association, which is the country's largest NGO in reproductive health and a member of the International Planned Parenthood Federation, could have an important role in the three level system, including in school and public education and staff training. In addition to making existing free contraceptives more available, expanding the range of options is also critical. More effort is needed to address the affordability and improve the awareness and access to new methods, such as the new generation oral contraceptive.

Conclusion

With the relaxation of the fertility policy and a changing social environment in China, more attention needs to be paid to meeting the contemporary demands for contraception and optimising contraceptive services. As well as shifting the focus from birth control to ensuring the health and wellbeing of girls and women, contraceptive services should also be expanded to include adolescents and men. Fulfilling the need for modern contraception would not only help build a healthy, friendly, and supportive environment for everyone in need of contraception in China but also meet the global commitment to leave no one behind.

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Improving integrated perinatal care for women with hepatitis B in China

Huishu Liu and colleagues argue that integrated care for women with hepatitis B in China needs improving, including better severity stratification, comprehensive counselling and education, seamless multidisciplinary care, and better referral

Hepatitis B virus infection is a public health issue globally, with a worldwide prevalence of nearly 3.8% and 1.5 million new infections each year.¹ In China, a highly endemic area, more than 10 million women of childbearing age had hepatitis B in 2021.² Mother-to-child transmission (MTCT) is the predominant mode of transmission, accounting for 90% of new infections.³ Thus, the management of hepatitis B during pregnancy is of particular concern.

Although the prevalence of hepatitis B in pregnancy in China fell by 25% between 2015 and 2020, approximately 1 000 000 women with hepatitis B still give birth each year (fig 1).³ With China moving away from its one child policy, older women, who have a higher prevalence of hepatitis B, are now more likely to become pregnant (fig 2).²

Reducing hepatitis B in pregnancy is essential for maternal and fetal safety. Because more than 90% of newborn hepatitis B infections progress to chronic

infections and are difficult to cure, preventing MTCT is the key to eventually eliminating hepatitis B.⁴ Hepatitis B also increases the risk of maternal complications.⁵ Globally, severe hepatitis flares account for 6% of admissions to intensive care in pregnancy and increase the risk of adverse pregnancy outcomes.⁶

Several strategies have been implemented in China to prevent MTCT, and most areas of China have MTCT rates of 1% or less.⁴ Other high endemic regions such as South East Asia and Africa still have rates above 1%.⁷ Globally, there is still some way to go in achieving the World Health Organization's 2030 goal of reducing the rate to less than 0.1%.¹ As China is responsible for nearly a third of the worldwide burden of hepatitis B,⁴ the effectiveness of China's perinatal care programmes for reducing MTCT are fundamental to the global goal of eliminating hepatitis B by 2030 and can provide important learning opportunities for other regions.

Perinatal care for hepatitis B in China Strategies for elimination

To eliminate MTCT of hepatitis B, China has expanded free prenatal blood testing for hepatitis B surface antigen (HBsAg),

free combined vaccination with hepatitis B vaccine and hepatitis B immunoglobulin, and antiviral treatment for women with high viral load, as recommended in current guidelines.^{3,4} Since 2015, the national comprehensive prevention of MTCT plan (PMTCT, which covers hepatitis B, HIV, and syphilis) has expanded nationwide, and the government has invested ¥1.4bn (£150m; \$190m; €180m) annually to provide free screening and comprehensive intervention services for hepatitis B in pregnancy, covering 97.7% of China (11 516 counties).⁴

Combined vaccination (vaccine and immunoglobulin) is considered the most effective measure for preventing MTCT of hepatitis B.¹ A series of regulations for hepatitis B vaccination was implemented in China in 1982 and was integrated into WHO's expanded immunisation programme in 2002. In 2005, a free hepatitis B vaccination programme was adopted by the Chinese government. Hepatitis B immunoglobulin has also been provided free of charge to pregnant women who test positive for HBsAg in the PMTCT programme since 2011.⁷

Antiviral treatment is given to pregnant women with high hepatitis B viral load

KEY MESSAGES

- China has made steady progress in improving integrated perinatal care towards the goal of eliminating perinatal transmission of hepatitis B
- Better severity stratification for the management of hepatitis B in pregnancy improves care and helps mitigate challenges caused by regional imbalances in incidence and management capabilities
- Advancements in the quality and accessibility of counselling and education improve adherence to the treatment recommended by the perinatal care algorithm
- Seamless multidisciplinary care and inter-institutional referral is critical to ensure effective care coordination for pregnant women with hepatitis B

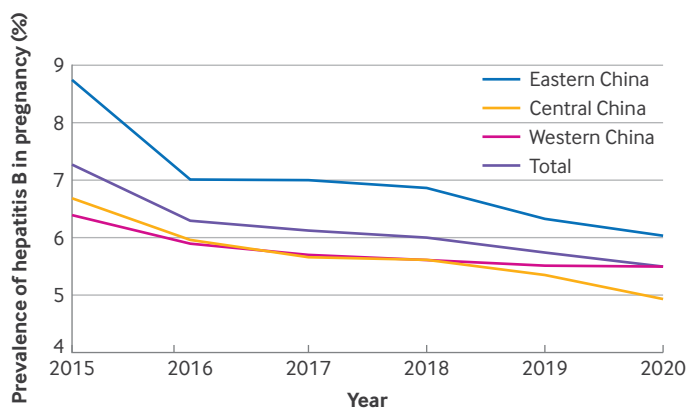


Fig 1 | Prevalence of hepatitis B virus infection in pregnant women in different regions of China (2015-20). Data from China's National Notifiable Disease Reporting System (NNDRS) and the Management Information System of the National Integrated Prevention of Mother-to-Child Transmission of HIV, Syphilis, and Hepatitis B (iPMTCT) programme.^{2,3}

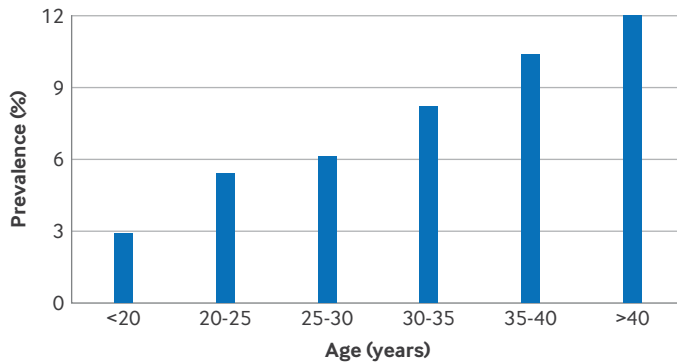


Fig 2 | Prevalence of hepatitis B virus infection in pregnancy in different age cohorts (2020). Data from NNDRS and the iPMTCT programme.^{2,3}

in China. Despite combined vaccination, patients who test positive for HBeAg (hepatitis B e-antigen; generally a measure of infectious disease) with high viral load (DNA level $\geq 200\ 000$ copies/ml) still have MTCT rates of 5-10%.⁶ Based on key clinical trials of antiviral treatment for hepatitis B in China, tenofovir disoproxil fumarate (TDF) and telbivudine were added to the Chinese national medical insurance formulary of antiviral drugs to prevent MTCT in 2017.^{2,4} Tenofovir alafenamide fumarate, a new antiviral formulation for treatment of hepatitis B resistant to TDF was approved in China in December 2018.⁴

Achievements

These widely implemented strategies and ongoing government funding have reduced MTCT of hepatitis B in China. Coverage of combined vaccination at birth for babies exposed to hepatitis B in pregnancy increased from 22.2% in 1992 to 95.6% in 2015 and 99.7% in 2020.^{3,4} Before combined vaccination, the MTCT rate of hepatitis B in China was approximately 50%, with as many as 9.9% of children <5 years testing positive for HBsAg.² By 2015, the MTCT rate had dropped to 3% after combined vaccination.⁴ After antiviral treatment capabilities were made available in most of China, the MTCT prevention rate

significantly improved: from 90% in 2010 to 99.7% in 2020.⁴

The pooled seroprevalence of HBsAg in China decreased from 8.2% in 1973-1992 to 5.7% in 1993-2005 and 3.6% in 2006-2021. Seroprevalance in children under 5 declined from 5% in 1973-1992 to 0.6% in 2006-2021, and death related to hepatitis B fell from 0.02% in 2000 to 0.011% in 2020.² The prevalence of hepatitis B among pregnant women fell from 7.3% in 2015 to 5.44% in 2020,³ with related maternal mortality in pregnancy of 0.001%.^{2,4}

Future goals and integrated algorithm design

To achieve the 2030 WHO goal of eliminating hepatitis B, China has issued an action plan.^{2,3,8} This plan proposes three targets in pregnancy: a detection and treatment rate of 95%, timely combined vaccination coverage of 95% of cases, and an MTCT rate below 1% country wide.⁴

A national integrated management algorithm for hepatitis B in pregnancy was designed in 2019 through the efforts of experts from the China Foundation for Hepatitis Prevention and Control in the fields of infectious diseases, hepatology, immunology, obstetrics, and public health.⁹ This algorithm covers screening, severity stratification, monitoring, antiviral treatment, neonatal immunoprophylaxis,

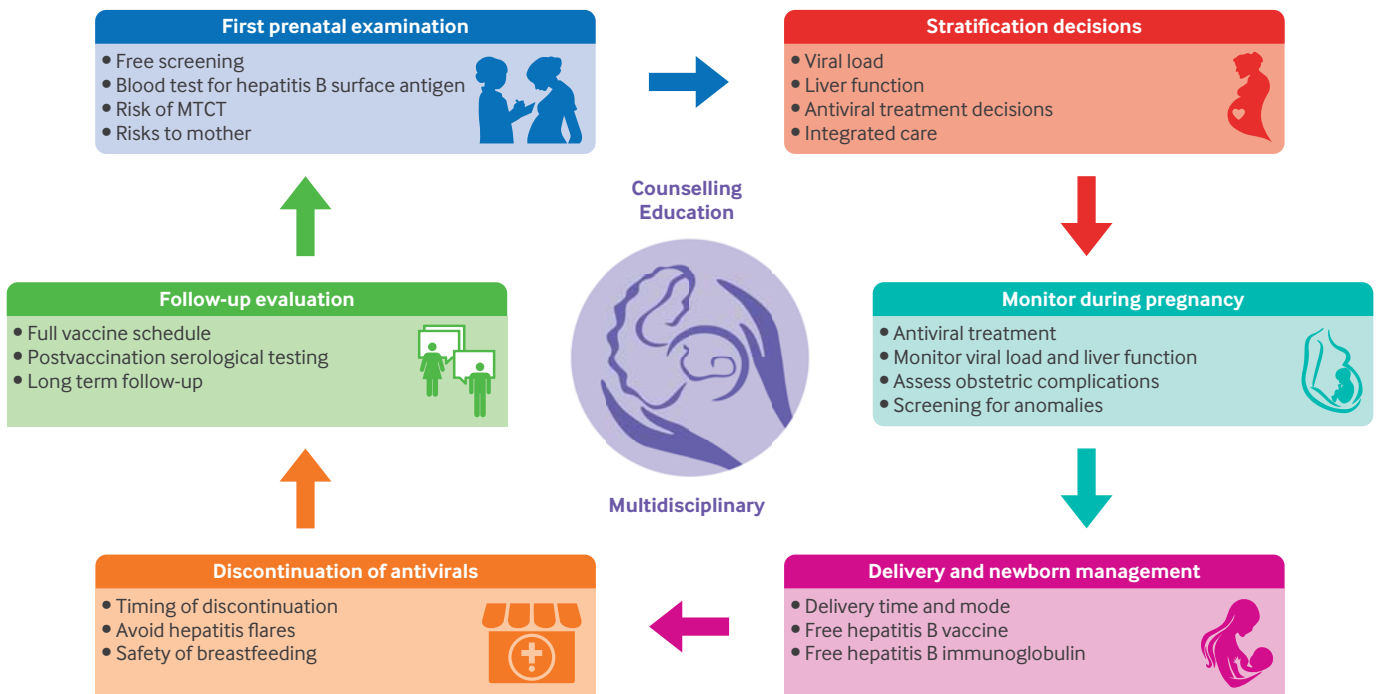


Fig 3 | Integrated algorithm of perinatal care for women with hepatitis B virus infection in China. This care algorithm covers comprehensive management of hepatitis B in pregnancy including prenatal screening, severity stratification, monitoring, antiviral treatment, neonatal immunoprophylaxis, discontinuation of antivirals and postvaccination follow-up.⁹

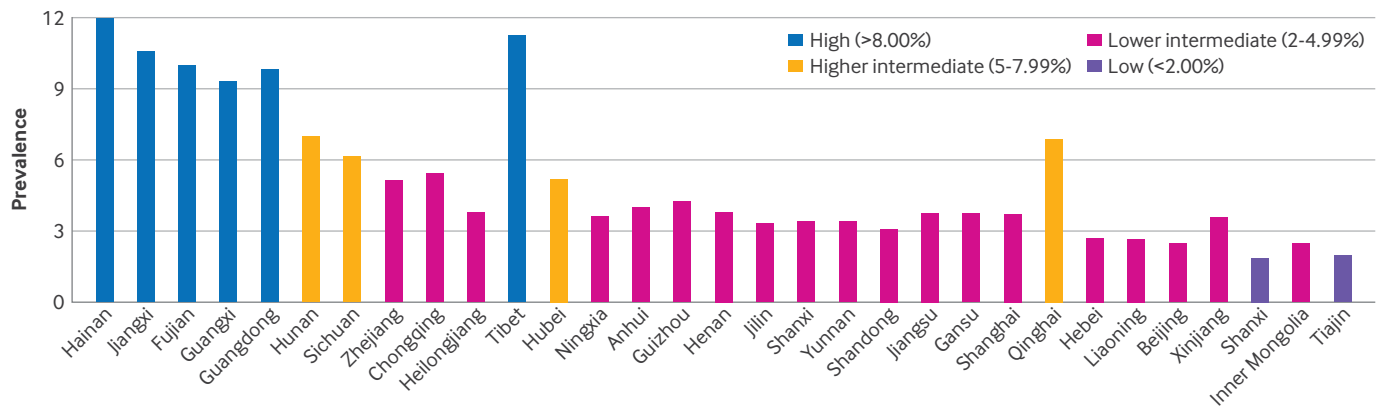


Fig 4 | Prevalence of hepatitis B virus infection in pregnancy in different provinces (2020). Data from NNDRS and the iPMTCT programme.²³

and postvaccination follow-up (fig 3). The SHIELD app, based on this algorithm, provides a real time patient-hospital-community health integration platform for counselling, education, and communication in multidisciplinary treatment and follow-up.¹⁰

Practical challenges

Regional imbalances

Substantial differences in the prevalence of hepatitis B in pregnancy are seen across China (fig 1, fig 4). The country’s large migrant populations in urban areas make the infection patterns more complex. Discrepancies in management capabilities also exist across regions and medical institutions, which might influence the prevalence of hepatitis B in different regions.³ In a survey of rural medical clinics in China, only 56% of clinicians could diagnose hepatitis B accurately, 78% could not completely explain the serological results, and 36% of cases were not correctly uploaded to the National Notifiable Disease Reporting System.¹¹

Adherence to the care algorithm

Meticulous adherence to all aspects of the algorithm is necessary for prevention of MTCT. One barrier to adherence seems to be persistent concerns among both health professionals and patients about the risk of fetal birth defects from antiviral treatment.¹ A survey of pregnant women in China showed that awareness of specialised interventions for hepatitis B in pregnancy was less than 50%, and less than 20% of pregnant women would choose to actively seek treatment because of inadequate understanding about the risks of MTCT and concerns about the safety of antiviral treatment.^{12 13}

For medical providers, especially in rural communities, knowledge gaps and stigma also affect the quality of care. A study among 149 community health centres in China found inadequate education and training regarding interventions for hepatitis B in 80% of centres, which affected adherence to treatment.¹⁴ Stigma around hepatitis B is still common among healthcare providers, with 34% reporting taking extra safety and hygiene precautions when interacting with patients with the infection.¹⁵

Care coordination

Effective implementation of the national algorithm also requires coordination through a multidisciplinary team of specialty providers. Pregnancies managed by a multidisciplinary team were 3.7 times more likely to have a timely diagnosis of liver dysfunction.¹⁶ In practice, this care coordination is still insufficient in many regions. One survey showed that only 70% of pregnant women with hepatitis B visited a liver specialist as part of their care.¹⁷ Communication gaps and treatment fragmentation exist in different departments and between medical institutions for specialised hepatitis B care in pregnancy.⁴

Suggestions for improving integrated perinatal care for hepatitis B

Optimise severity stratification

To tackle the regional and institutional imbalances of care for hepatitis B in pregnancy, broad support for optimised MTCT prevention services must be achieved. Simplification of severity stratification models is recommended to assure more widely available access to testing and treatment.¹⁸

In WHO’s *Regional Framework for the Triple Elimination of Mother-to-Child Transmission of HIV, Hepatitis B, and Syphilis in Asia and the Pacific (2018-2030)* a simple tiered approach is proposed to introduce a comprehensive care package of interventions for prevention of MTCT, considering differing health system capacities.¹⁹ This simplified and tiered approach would refer patients with more advanced hepatitis B to more sophisticated institutions to optimise the management process.¹⁸

The detailed stratification of maternal and infant interventions for prevention of MTCT based on severity of hepatitis B relies on laboratory tests (including quantification of DNA in the blood to monitor viral load, HBeAg to monitor infection, and alanine transaminase to monitor liver function) and the presence of cirrhosis (fig 5).⁹

Comprehensive patient counselling and education

More focus on counselling for women with hepatitis B in pregnancy might be useful to enhance adherence to treatment. Modern methods of counselling that might help improve hepatitis B care outcomes have been tried, such as internet promotion and mobile apps, with positive outcomes.⁶ The SHIELD app is a successful example.²⁰ It was first introduced in diverse health settings across China, involving over 30 000 pregnant women from 178 hospitals, including general hospitals, infectious disease hospitals, and maternal and child health centres. The SHIELD programme then successfully implemented an intense intervention package in all community health centres and hospitals in the Baoan district of Shenzhen (a total of 4.5 million people). The MTCT rate was much lower

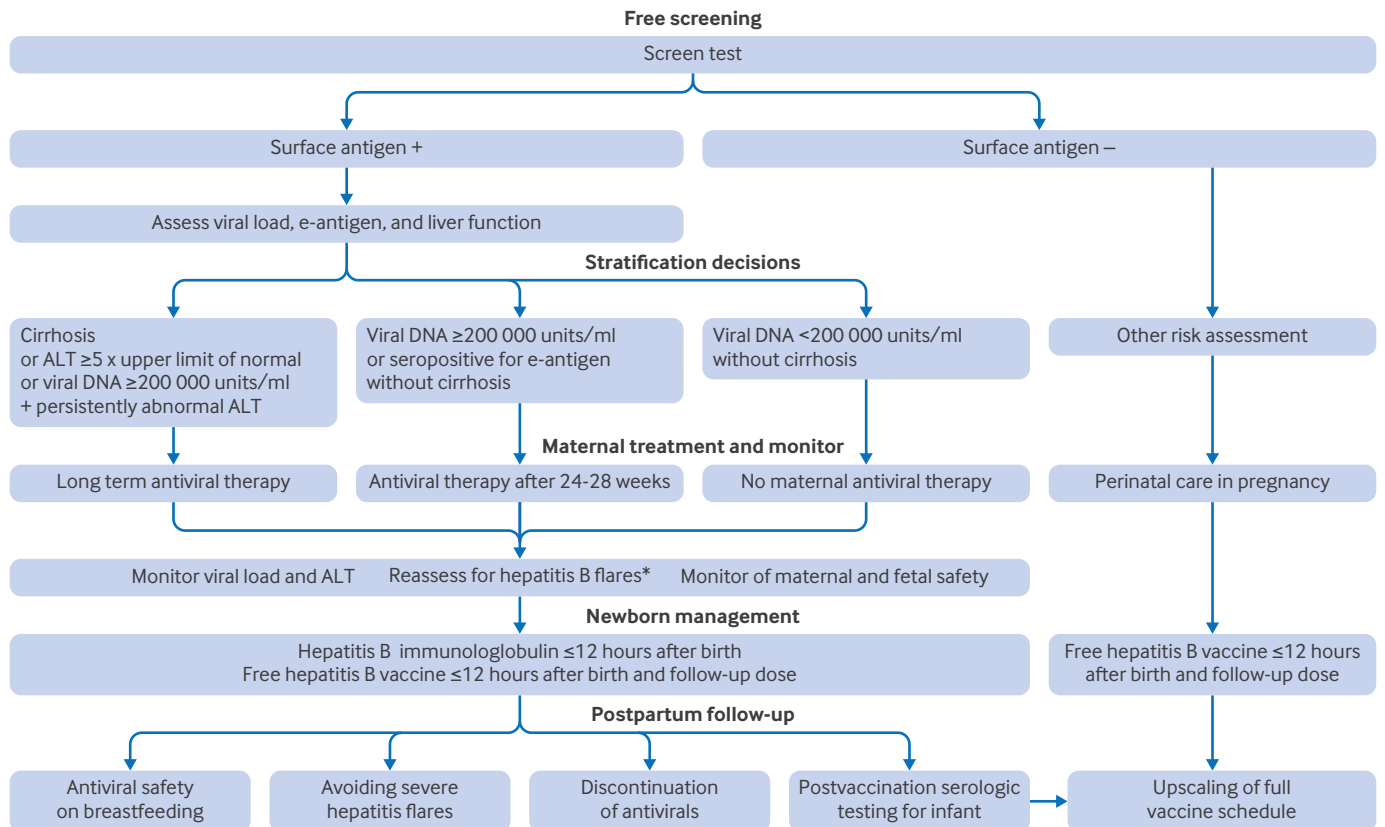


Fig 5 | Stratification algorithm for prevention of MTCT of hepatitis B. Based on guidelines from China and WHO, this stratification algorithm aims to prevent MTCT based on the severity of hepatitis B. Free screening should be implemented as early as possible. Management of antiviral treatment relies on serological examinations and liver cirrhosis manifestations in screening and monitoring during pregnancy. Liver function abnormalities caused by factors other than hepatitis B (such as medication or pregnancy complications) need to be excluded. *If monitoring shows increased viral load or alanine transaminase (ALT), the mode and timing of antiviral treatment should be reassessed.

among participants who were compliant with SHIELD (0.03%-0.16%) than among those who were non-compliant (1.91%-3.16%, $P < 0.001$).¹⁰

People with hepatitis B and their family members need to be aware of susceptibility to viral transmission and should participate in the prevention of MTCT.¹⁸ Multiple modes of education at family and community levels are recommended to enhance the public's awareness of hepatitis B, reduce discrimination, and enhance public social support in China.⁹ A scoping review in China showed that more public service campaigns and school based education programmes could familiarise the public with the realities of hepatitis B and the imperative to reduce MTCT in pregnancy.¹⁵ Meanwhile, education for medical providers and pregnant women about the safety of antiviral drugs through the internet, training lessons, and public service campaigns, were found to be helpful to facilitate adherence.⁴

Seamless multidisciplinary care and referral
The necessity of improving care coordination and multidisciplinary care has been mentioned in national strategies such as the *Outline for Women's Development in China (2021-2030)* and the *Action Plan for Eliminating Mother to Child Transmission of HBV (2022-2025)*.⁸ Comprehensive care coordination requires seamless cooperation and communication between obstetricians in women and children's hospitals, hepatologists or infectious disease specialists in general hospitals, and general practitioners in community hospitals.⁶

Availability of all relevant information is the key to ensuring seamless multidisciplinary care and referral management for hepatitis B in pregnancy. Strategies to promote better communication between patients and specialists in obstetrics, hepatology, and infectious disease need to be developed. Tools like the SHIELD app can be a key resource for data sharing among medical providers and pregnant women with hepatitis B. In one study, the real time use of SHIELD increased multidisciplinary

hepatitis B treatment and reduced the MTCT rate to an average of 0.23%.¹⁰

In recent years, one-stop multidisciplinary care for the elimination of MTCT has shown advantages in China. Specialised clinics for eliminating MTCT integrate prenatal examination and specialised hepatitis B interventions, providing reliable referrals and follow-up services that are less disruptive to the patient.⁹ One study showed that such clinics increased the successful treatment rate of high hepatitis B viral load in pregnancy from 28% in 2018 to 84% in 2020.²¹

Efforts to improve multidisciplinary care, severity stratification, and referral need to be supported by governmental budgets and reimbursements. A cost effectiveness evaluation model suggests that implementing antiviral treatment of hepatitis B with multidisciplinary care in pregnancy could potentially prevent approximately 1.1 million neonatal hepatitis B infections by 2030. This strategy would be cost effective in around 70% of countries, particularly if there

was a reduction in treatment costs.²² Studies conducted in China and Thailand have shown that the cost effectiveness of multidisciplinary hepatitis B treatment is influenced by factors such as gross domestic product and reimbursement rates, especially in resource limited areas.^{23 24}

Scientific research needed to guide evidence based care

More research into the effectiveness of the hepatitis B treatment algorithm is needed to further optimise integrated perinatal care (box 1).

The safety and effectiveness of hepatitis B treatments need more validation in large cohort studies or randomised controlled trials. The optimal time to start antiviral treatment in pregnancy to prevent MTCT

is also controversial.⁶ Although the recombinant hepatitis B vaccine derived from Merck's technology has been widely used in China since the 1990s,⁹ more effective hepatitis B vaccines, such as a multi-protein hepatitis B vaccine, need to be developed to improve protection for newborns exposed to hepatitis B in utero.²⁵ Optimisation of combined hepatitis B vaccines and immunoglobulin also need more large cohort studies to understand the effect of earlier use of hepatitis B vaccine on preventing MTCT.²⁶

Obstetric management of women with hepatitis B needs more basic and translational research to improve outcomes in pregnancy.^{5 9} The Chinese Center for Disease Control has created and improved a management information system for the prevention of MTCT, which covers all districts and counties in the country.²⁷ This system, along with strong basic science resources and PMTCT network support, real time monitoring, supervision evaluation, and continuous epidemiological study will continue to build a research foundation for eliminating MTCT of hepatitis B.

Research on increasing adherence to treatment and optimising care coordination needs to continue. Social and financial barriers for women with hepatitis B, their partners, and their families need further study to enhance MTCT prevention strategies.^{18 21}

Conclusion

Improving perinatal care for women with hepatitis B and eliminating MTCT will require multiple parallel initiatives including optimisation of severity stratification through a national algorithm, more focus on professional counselling and education, seamless multidisciplinary care and facilitation of referral to specialised care. Progress in scientific research is also required to improve perinatal safety and optimise MTCT strategies for pregnant women with hepatitis B.

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Box 1: Future scientific research areas for hepatitis B in pregnancy

Screening and assessment

- New tools and biomarkers for severity stratification
- Develop and validate point of care testing for screening
- Expanding screening strategy to the population

Antiviral treatment

- Formal evaluation of safety and benefits of antivirals
- Evidence for benefits of antivirals at varying viral loads
- Optimal time to start antiviral treatment in pregnancy
- Risks of hepatitis flare after discontinuation
- Safety assessment of long term antiviral treatment

Vaccination and immunoglobulin

- Develop more effective hepatitis B vaccines
- Assess feasibility and acceptability of vaccination before pregnancy
- Optimise the combined vaccination programme (dose and time)

Obstetric management

- Assess the relative risks for adverse outcomes in pregnancy
- Effects of delivery mode and timing

Adherence and coordination

- Optimum approaches to education and counselling in different settings
- Optimise education and multidisciplinary care using information technology
- Extend coverage of PMTCT programmes
- Identify the social and financial barriers in eliminating hepatitis B
- Effective ways to eliminate discrimination in pregnancy
- Methods for family counselling and engagement

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