A Long March from Surviving to Thriving: A Lancet Commission on 70 years of Women's Reproductive, Maternal, Newborn, Child, and Adolescent Health (RMNCAH) in China

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Outline

Executive summary

Women's Reproductive, Maternal, Newborn, Child, and Adolescent Health (RMNCAH) is a cornerstone of healthy development for the next generation and a driving force for the progress of population and society in the future, especially in this era of population aging and low fertility in China. In past decades, China's RMNCAH has made remarkable achievements in “survival” development goals related to reducing maternal and child mortality. However, as China moves toward thriving, that is ‘ensuring health and well-being’, the country faces emerging problems and new challenges in RMNCAH. These relate to rapid and continuous improvement in social and economic conditions along with changes in demographics, lifestyles, the environment, and innovations in medical and therapeutic technologies, as well as an increasing threat of emerging infectious diseases such as Corona Virus Disease 2019 (Covid-19). The United Nations Sustainable Development Goals (SDGs) have also extended the focus from maternal and child survival alone to improvement of health across the life span. This is integrated in the visions of both the SDGs and “Healthy China 2030”. The next ten years are crucial in ensuring that China is able to meet the goal of universal RMNCAH coverage, which is embodied by access, quality and equity. The Lancet RMNCAH Commission aims to review past achievements and lessons, to analyse current problems and challenges, and then to prioritise steps towards the SDGs and “Healthy China 2030”.

Over the past 70 years, China has made outstanding progress, with rapid reductions in maternal and child mortality. Previous achievements in RMNCAH have benefited from efforts both within and outside health systems, including the rapid change in socio-economic determinants, political will and its impacts, building of the MCH system and the MCH information system, reforming social health insurances, launching national RMNCAH programmes, and poverty alleviation. The most notable contributors are strong political will to focus on RMNACH and community consensus on gender equity and women and children’s well-being. Statements such as “*Women hold up half the sky*” and “*Children are the future and hope of the motherland*” have not only been rhetoric, but consistently practised. (*Section 2*)

The focus of RMNCAH has shifted from reducing maternal and child deaths to growing demands for high-quality healthcare. In the field of reproductive health, there has been a growing focus on decreased and delayed fertility intentions, growing focus on

contraception and abortion, infertility and assisted reproductive technology, sexually transmitted diseases, reproductive cancer and the HPV vaccine, and sexual and gender-based violence. In the field of maternal and newborn health, the focus areas have been safe motherhood, stillbirth, neonatal diseases, maternal, fetal and newborn nutrition, and maternal mental health. In the field of child and adolescent health, injury, risk behaviours, mental health, and vulnerable children have moved into focus. For the health system, the areas of focus are human resource development, competency of RMNCAH services in primary health care, equity and quality of RMNCAH services, financing risk protection, and integrated RMNCAH information system. (*Section 3*)

To achieve RMNCAH-related targets for the SDGs and "Healthy China 2030", this Commission proposes a strategic framework to achieve universal RMNCAH coverage by 2030. It encompasses four essential drivers: financing, workforce development, medicine and technology, and information technology (IT) system. To achieve the goal of universal RMNCAH coverage, a supportive environment based on contextual factors within and outside the health system is essential. These factors include: governance and leadership, policy and legislation, and society and community. According to this strategic framework, we have put forward a series of five broad recommendations, covering reproductive health, maternal and newborn health, child and adolescent health, the health system, and broader contexts. We discuss how these recommendations can be transformed into policies. We also share lessons from the "Chinese experience" which may be relevant for low or lower-middle-income countries (LLMICs). (*Section 4*)

In conclusion, RMNCAH not only plays a pivotal role in guaranteeing the health of each individual woman, child and adolescent, but is also a cornerstone for the development of the next generation and the sustainable development of our whole society. There should be a commitment to ensuring that the future for each woman, child and adolescent is worthy of them. The challenges in the present and recommendations for the future discussed in this commission (Key Messages are highlighted in Panel 1), are essential to improve RMNCAH services' access, equity and quality. Looking to the future, China is acting responsibly to create a healthy and friendly environment for every woman, child and adolescent for their own sake and as important partners in RMNCAH global governance.

Section 1: Introduction

"Chinese problems, even if they affect no one outside China, are of vast importance since the Chinese constitute a quarter of the human race .... All the world will be vitally affected by the development of Chinese affairs ... during the next two centuries." Bertrand Russell's reflections after a visit to China in 1921.[1]

RMNCAH is the foundation of sustainable development for individuals, families and societies. RMNCAH encompasses the life cycle from the reproductive stage (15-49 years old), the maternal stage (a specific duration of conception and pregnancy within the reproductive stage), the newborn stage (0-27 days after birth, a specific duration of new life after birth within the child stage), child stage (0-9 years old), adolescence (10-19 years old, sometimes including young adults aged 20-24 years), and through to the next generation. These are critical and foundational stages of human life course development, physically, mentally and psychologically. The targeted subjects of RMNCAH account for almost 2/3 or more of a nuclear family, which usually consists of two parents and their children (one or more), and the father who is a vital partner for RMNCAH. Due to the forecasted trends for population ageing and low fertility, the proportion of the Chinese population covered by RMNCAH (children aged 0-19 years old and females aged 20-49 years old) will decline from 46.8% in 2015 to 39.9% in 2030 (Appendix 1-2).[2] However, RMNCAH mainly focuses on two key points: "birth" and "development" of the new generation, which are the principal driving forces for the progress of population and society in the future, especially in this era of population aging and low fertility in China.

The Millennium Development Goals (MDGs) brought great global progress in improving maternal and child health (MCH). Following this, the *Global Health Strategy for Women, Children and Adolescents (2016-2030)*, which was developed under the framework of the Sustainable Development Goals (SDGs), explicitly recognised the need to extend the focus beyond mortality alone and to promote health across the developmental years: "*By 2030, a world in which every woman, child and adolescent in every setting realizes their rights to physical and mental health and well-being, has social and economic opportunities, and is able to participate fully in shaping prosperous and sustainable societies"*. The global strategy proposed three over-arching objectives: (1) survive - ending preventable death; (2) thrive - ensuring health and well-being; and (3) transform - expanding enabling environments.[3] Due to accelerating

progress towards MDG 4 and 5 (to improve maternal and child health), the World Health Organization (WHO) rated China as one of the top 10 "fast-track" countries in women's and children's health.[4] China is now undergoing a rapid epidemiological and demographic transition, and has an increasingly ageing population and low fertility, a high burden of non-communicable and degenerative disorders, and an increasing threat of emerging infectious disease such as Covid-19. Facing these challenges, the Chinese government regards improvements in RMNCAH as key goals within the overarching framework of "Healthy China 2030".[5] It is also seen as integral to China's ongoing poverty alleviation strategy.[6,7] Moreover, China is undergoing a comprehensive social transformation, driven by economic development and globalization. These present new problems and challenges for China's RMNCAH.

In the next ten years, China has committed to achieve both the SDGs and Healthy China 2030 goals. According to a systematic analysis and estimation from the Global Burden of Disease Study 2017,[8] among the 21 RMNCAH-related SDG indicators that should be met by 2030, China is expected to attain five indicators, including goals for maternal mortality ratio (MMR), neonatal mortality rate (NMR), under-five mortality rate (U5MR), the skilled birth attendance rate, and new HIV infection rate; it should nearly attain two indicators, including the contraceptive rate for women of reproductive age and the vaccine coverage rate. It might not attain nine indicators on the basis of past trends, including stunting in children under 5 years old, wasting in children under 5 years old, overweight in children aged 2-4 years old, suicide rate, death rate due to road injuries, coverage of essential health services, intimate partner violence against women, non-intimate partner violence against women, and sexual violence against women and men under the age of 18 years old. As for those relevant SDGs which have undefined targets, adolescent birth, alcohol consumption, smoking, the size of health workforce, and nurses and midwives, China is estimated to perform worse than the global average on two: alcohol consumption and smoking. It is clear that China will succeed in achieving survival goals, but there will be difficulties in achieving thriving goals (Appendix 3). When SDGs and "Healthy China 2030" are compared (Appendix 4), although "Healthy China 2030" has more ambitious targets related to maternal and child mortality. It set only a few specific indicators that have quantitative targets in other RMNCAH-related fields (such as oral health among children, physical exercise among adolescents in school, smoking, the density of registered physicians and the proportion of out-of-pocket payment in total health expenditure). Some key RMNCAH-

related issues in the SDGs (such as violence against women, children and adolescents) are not included in Healthy China 2030.

Therefore, the aims of this Commission are two-fold. The first is to show the achievements and lessons of the past, to highlight current problems and challenges, and then to draw relevant strategies and recommendations to fulfill the RMNCAH aims in the SDGs and Healthy China 2030. The second is to share lessons with LLMICs, as well as to draw on experiences from other countries to improve China's RMNCAH system.

The Lancet Commission comprised domestic and overseas commissioners from the fields of reproductive health, maternal and child health, child and adolescent health, primary health care, health policy and management, health economics, global health, epidemiology and health statistics. This commission was invited by the Lancet, and co-led by three Chairs: Prof. Jie Qiao from Peking University, Prof. Jun Zhu from Sichuan University, and Dr. Li Song from National Health Commission. Commission members reviewed previously published academic literatures, collected global or national monitoring data, analysed the most recent nationwide surveys and monitoring data, which are published here for the first time (Appendix 5). Data obtained from different sources, including peer-reviewed literatures and from the government, were critically appraised by both domestic and overseas commissioners. Only data of high reliability and quality were used, in order to guarantee the scientific authority of the Commission and ensure that recommendations can be translated into national policies and RMNCAH systems. This Commission provides a RMNCAH baseline for *Healthy China 2030* and further updates will allow the monitoring of high-quality RMNCAH universal coverage over the next decade.

Section 2: China's efforts and achievements in RMNCAH

Since the founding of the People's Republic of China in 1949, China has seen remarkable achievements in RMNCAH. Maternal and infant mortality rates have decreased from 1500/100,000 and 200/1000 respectively in 1949 to 17.8/100,000 and 5.6/1000, respectively, in 2019.[9,10] The yearly trends in the maternal mortality ratio (MMR), neonatal mortality rate (NMR), infant mortality rate (IMR) and under-five mortality rate (U5MR) during 1990-2019 can be seen in Figure 1 (Appendix 6), which shows that regional differences between urban areas and rural areas are narrowing. The NMR in China was 4.0 times than the average of Northern America and Europe areas in 1990, and decreased to 1.7 times in 2015.[11] Meanwhile, China's MMR was 5.0 times in 1990 than the average of developed countries, and reduced to 1.2 times in 2015.[12] The total mortality rate of children and adolescents aged 5-19 years old dramatically decreased from 366.0/100,000 during 1953-1964 to 27.2/100,000 in 2016, and the mortality rate of each age group (1-4 year, 5-9 years, 10-14 years, and 15-19 years) and each gender group (girl and boy) presented a similar decreasing trend (Figure 2).[13] The stunting prevalence of children under 5 years old decreased sharply from 33.1% in 1990 to 8.1% in 2013;[14] and that of 7-18 years old decreased from 16.4% in 1985 to 2.3% in 2014.[15] The hospitalized delivery rate increased from 43.7% (73.6% in urban and 36.4% in rural) in 1985 to 99.9% in 2018, eliminating the urban-rural gap (Appendix 7).[16] The coverage of other essential RMNCAH services has also reached over 90%: antenatal care, postpartum visit, neonatal defect screening of phenylketonuria (PKU) and congenital hypothyroidism (CH), expanded programme on immunization, and registration for child healthcare management (Appendix 8). Given the vast size and diversity of the country, these achievements were particularly impressive. Due to accelerating progress towards MDG 4 and 5, the World Health Organization (WHO) rated China as one of the top 10 "fast-track" countries in women's and children's health.[4] Of course this progress has been driven by rapid socio-economic development, a key determinant of women's and children's health globally,[17,18] but it has also been driven by political will. The other important contributors have been the development of a strong nationwide MCH system, the MCH information systems, social health insurance, national RMNCAH programmes, and poverty alleviation.

Socio-economic development related to RMNCAH

During the past 70 years, and especially in the past 40 years, China has experienced a rapid socio-economic development (Appendix 9-12). The Gross Domestic Product (GDP) per capita grew from 100 RMB to 400 RMB during 1952-1980, and then rapidly rose to 64,600 RMB in 2018. Average life expectancy increased from 67.8 years in 1981 to 77.0 years in 2018. The female literacy rate among women aged 15 and above has increased from 78.4% in 1999 to 92.5% in 2018, and the gender gap in education and employment has narrowed greatly, with enrollment rates increasing at all educational levels. The Chinese government also has made substantial efforts to improve the rights and opportunities of its ethnic minorities.[19] The most important measure has been to designate regions with large ethnic minority populations as autonomous. In practice this has meant few family planning restrictions, as minority couples in these regions allowed two or three more children.[20] In education, minority students are offered financial support, and even preferential admittance to universities. These measures have improved social equity and the rights of women and children across the country, which is the basic foundation of RMNCAH.

Political will and its impacts

Over the past 70 years, the political will to focus on RMNACH has been key to the progress in this area. Since the foundation of People's Republic China in 1949, the government's iconic declarations of "Women hold up half the sky" and "Children are the future and hope of the motherland" have not been empty rhetoric, but instead have been supported by strong political commitment supported and a series of laws and actions prioritising women's and children's rights (Appendix 13). Combined with such strong political commitment, the development of the RMNCAH system in China can be divided into four stages (Figure 3):

1949-1977 As soon as the People's Republic was announced in 1949, improving the health status of the population was a priority (Appendix 14). Stability after decades of war, led to an improvement in socioeconomic conditions. The first National Health Congress took place within months, and with what can now be seen as extraordinary vision, it was announced that there would be an explicit emphasis on prevention and universal access to health care, albeit at a very low level. The focus on preventive medicine is the major factor that explains the reductions in mortality and morbidity achieved during the 1950-60s.[21] Massive immunisation campaigns were carried out, the

importance of disinfection in the delivery room was recognized, and brothels were closed. The Great Patriotic Health Campaigns mobilised the masses in tasks aimed at improving nutrition, sanitation, water quality and the control of certain infectious diseases. The introduction of barefoot doctors and the rural medical cooperative system in the mid-1960s provided the most basic medical services for rural women and children despite the poor economic conditions that persisted at that time across much of China. The government called for traditional birth attendants to be trained in antenatal and delivery care, and nearly 800,000 traditional birth attendants were trained from 1949 to 1959.[22] The coverage of the rural cooperative medical system, a form of health insurance for the rural population, then increased from 20% to 90% between 1968 and 1976.[23] Apart from the dramatic reductions achieved in the IMR and MMR, these activities resulted in the control of diseases such as plague, malaria, schistosomiasis, and sexually transmitted diseases (STDs) such as gonorrhoea and syphilis. Syphilis was "eliminated" in China for 20 years (1960-1980).[24] This model of primary care focusing on prevention became the model for primary care at Alma Ata in 1978.

1978-1997 From 1978, market reforms took hold in China. In line with this, the health care system was marketised. Lack of government investment led to the collapse of the rural cooperative medical system with the result that most of the population were forced to pay out-of-pocket for healthcare (Appendix 15). However, during this period, there were advances in medical services and technology. One of the remarkable advances in medical technology was the first in-vitro fertilization baby born in mainland China in 1988. In 1994, one of the most important milestones in China's RMNCAH happened with the *"Law on Maternal & Infant Health Care"*, which ensured protection of maternal and infant rights to appropriate health services, including premarital and pre-pregnancy counselling, antenatal, peripartum, postpartum, and neonatal care. Since 1995 China has launched the three-phase "Outline of Women's Development" and "Outline of Children's Development" (abbreviated as the "Two Outlines") (Appendix 16) as priority policies to promote the rights and interests of women and children.

1998-2008 To reverse the collapse in social health insurance, China initiated health system reforms that mainly focused on re-organizing the social insurance system which is described in more detail below. The coverage rate of social health insurance increased from 23.6% in 1998 (55.9% in urban and 12.7% in rural areas) to 87.1% in 2008 (71.9% in urban and 92.5% in rural).[25] This massively improved access to health care especially for the rural poor. In 2000 China launched the *"Reducing Maternal Death and*

Eliminating Neonatal Tetanus Programme" in remote and rural areas. This was the Chinese version of the Safe Motherhood Programme and it focused on five measures: (1) health infrastructure enhancement; (2) building a close working partnership between provincial tertiary hospitals and primary maternal care institutions to reinforce local capacity, improve referral systems, and train local health staff; (3) direct subsidies to pregnant women; (4) health education; and (5) supervision and management of obstetric services. Until 2007, this programme covered 1000 poor counties with a total population of 300 million, and was funded jointly by the central government and the local government. This contributed to a reduction in the MMR by approximately 50% in the intervention counties.[26,27] This ambitious programme ended in 2013 (Appendix 17) and was then merged into the National Major Public Health Programmes as the "Hospital Delivery Subsidy".

From 2009 to now The market-oriented health system had driven-up costs and led to serious inequalities in access to health care, so from 2009 China launched a new health system reform programme with the goal of providing universal coverage of essential health services, through the expansion of social insurance, public hospital reform, and the strengthening of the primary health care system and public health services.[28] Since 2009, China has launched a series of programmes to improve RMNCAH services and narrow the gap between urban and rural areas. In addition, quality of care became a focus. Major improvements were made in training of specialists, including general practitioners, with a focus on continuing medical education. Guidelines and regulations for health service delivery were developed. In 2013, the "Targeted Poverty Alleviation" programme was initiated with a goal of eliminating extreme poverty by 2020. A focus of this programme has been improving the health of women and children.[6,7] In 2016, China launched its blueprint for "Healthy China 2030" which aims to achieve high-quality universal health coverage by 2030. In 2019 the "Healthy China Action Plan" was issued with each government level (from provinces to counties) accountable for measurable improvement.

The hierarchical MCH System

Since the founding of the People's Republic of China, the government has attached great importance to establishing an MCH system across the country. The system has evolved over time. From 1949 to 1977, the number of MCH facilities (facilities at all levels which focus on women and children health services) rapidly increased from 9 in

1949 to a peak of 4829 across China in 1958, and were mainly operated by county-level governments and state-owned enterprises. During the Cultural Revolution, from 1966 to 1976 many MCH facilities were closed. Between 1978 and 1997, the national MCH system was resurrected. Then with the first wave of health system reform in 1998, the MCH system developed a focus on "public welfare", "equity" and "quality". This was supported by a rapid increase in government investment in MCH facilities; in 2017 this accounted for 26% of investment, compared with 8% in general hospitals. China had 3077 MCH facilities in 2017, almost all (99.6%) owned by the government (Appendix 18).[29]

Currently, China has a hierarchical MCH system covering the entire country (Figure 4), which is an extensive network that penetrates from the central to the local level that allows rapid and effective implementation of policies and the local level is close to the people. It also makes health education and monitoring very effective, benefited by such penetrates from the central all the way down to the village level. Each province, prefecture, and district/county has an MCH facility operated by the government, with three major functions: management and regulation, clinical treatment, and public health service provision. The higher-level MCH facilities supervise the lower-level MCH institutions. The district/county-level MCH facilities coordinate all MCH services in this district/county, including the general hospitals, specialist hospitals, and primary health care facilities.[30] Whilst some MCH facilities in counties/districts or higher administrative levels can offer comprensive emergency obstetric and neonatal care (CEmONC), most of this care now takes place in general hospitals, especially those with more resources and specialist facilities such as neonatal units. Government supplemetation for hospitalized delivery, as well as the greatly improved trasnport infrastructure has driven this develeopment.[30,31]

MCH Information System

One of the biggest achievements in MCH work in China is the establishment of routine surveillance and data collection systems. During the past forty years several major parallel national MCH information systems have been established (Appendix 19) and have served as data sources for government decision making and performance evaluation of national intervention programmes.

The National MCH Statistics (NMCHS) system was established in the mid-1980s and consists of county-level indicators of MCH and health care service use; it has been an

online reporting system since 2014. The system covers the entire population of China: at least one person in every village/community, township and county/district level is assigned to collect and enter data into the system. Data are aggregated at the county-level.[32]

In order to obtain the more accurate core indicators for a sample of the population, the MCH Surveillance System (MCHSS) was established in the late 1980s as an online sample registration system to collect vital data on rates and causes of maternal and child mortality and birth defects. It has covered 124 urban districts and 210 rural counties with a surveillance population of 140 million since 2006.[33] In order to support the transformation of national MCH strategy from survival to development, two new elements were added to the MCHSS. In 2010 hospital-based maternal near miss monitoring which collects in-depth information about maternal severe morbidity, and in 2012 population-based under-5 child nutrition data which on children's growth and anemia, In addition, MCHSS has set up a vertical and hierarchical data quality assurance mechanism to ensure the accuracy of core health indicators.[34-36]

China has also established other national MCH information systems, such as the monitoring system for MCH Institutions Surveillance System, Major MCH Projects Information System, and Neonatal Disease Screening Information System, which are used to monitor the development of MCH institutions, evaluate the effect of MCH projects, and monitor the progress of intervention services for birth defects.

The data collected from the above-mentioned systems are published yearly in the internal report on policy recommendations to the government. They provide evidence to establish national RMNCAH programmes (details shown later) and inform the development of key MCH policies in China.

Social health insurance

In the 1950s, early social health insurance systems in China were established and included three main schemes: the Government Insurance System (GIS) for government staff and university students, the Labor Insurance System (LIS) for employees (and their dependents) of state-owned enterprises, and the Cooperative Medical System (CMS) for people living in rural areas. As a result, health services were covered through these social insurance systems and out-of-pocket fees were minimal.[37,38] After the introduction of market economic reforms in 1978, these early social insurance systems collapsed rapidly. The total coverage of social insurance declined to its lowest level

(22.1%) in 2003, with a striking gap between urban areas (49.4%) and rural areas (12.6%) (Figure 5).

To ensure essential safeguards for financial risk protection, China established three new social health insurance systems: (1) the Urban Employee Basic Medical Insurance System (UEBMIS, established in 1998), covers urban formal sector workers who are eligible for GIS and LIS, as well as those employed by private sector companies and small public firms. The Maternity insurance for urban female employees has been merged into UEBMIS; (2) the New Rural Cooperative Medical System (NRCMS, established in 2003), covers all population groups living in rural areas as well as rural-urban migrant workers and their children; (3) the Urban Residents Basic Medical Insurance System (URBMIS, established in 2007), covers non-working urban residents, including children, students, unemployed, the elderly and people with disabilities.[38] Social health insurance coverage has increased rapidly and the urban-rural gap has narrowed. In 2013, the total coverage of social health insurance reached 95.1% (92.8% in urban areas and 97.3% in rural areas) (Figure 5). NRCMS coverage was close to 100% in 2017. NRCMS premiums per capita increased from 42.1 RMB in 2005 to 613.5 RMB in 2017 (Figure 5). In July 2018, the NRCMS and URBMIS were merged into one "Urban and Rural Residents Basic Medical Insurance System (URRBMIS)" and the annual per capita premium was increased to 710 RMB, 490 RMB from the government and 220 RMB from the individuals; 20 RMB is specifically allocated for catastrophic insurance coverage among those living in extreme poverty or poverty caused by illness or disability.[39] Such development of social health insurance is one of the principal methods of health financing for universal coverage of RMNCAH services.

National RMNCAH programmes

The health system reform from 2009 also saw the introduction of both the "National Essential Public Health Programmes (NEPHPs)", which are freely provided at community/township/village health centers and clinics all over the country, and the "National Major Public Health Services (NMPHPs)", which are freely provided or subsidized with prioritized attention for the rural and poor areas of central and western China. Both NEPHPs and NMPHPs originated from a series of project-based pilot interventions with cost-effectiveness assessments, and were then expanded to the whole country with stable financial investments from the government.[40-43] These national RMNCAH programmes have played key roles in reducing disparities in

RMNCAH.[30,44,45]

NEPHPs were financed by the central government with an average subsidy of 15 RMB per person in 2009, increasing to 50 RMB per person in 2017. At the same time, the services were expanded from nine categories in 2009 to 14 categories in 2017. The RMNCAH-related services in the NEPHPs include immunization, health management for children aged 0-6 years old, antenatal and postnatal healthcare, and providing free condoms. For the NMPHPs, funding from the central government to NMPHPs in RMNCAH was 31.44 billion RMB during 2009-2016, which was approximately eight times the amount provided for project-based pilot interventions during 2001-2008 (Appendix 20). The services provided by NMPHPs in RMNCAH have been expanded to eight programmes since 2012, including 1) A subsidy for hospital delivery, 2) Prevention of mother-to-child transmission of HIV, syphilis and hepatitis B, 3) Screening for cervical and breast cancers, 4) Folic acid supplementation, 5) Pre-pregnancy health examination, 6) Screening for neonatal diseases, 7) Prevention and control of thalassemia, and 8) Supplementary food for children aged 6-24 months (YingYangBao, YYB) (details shown in Appendix 21). Since September 2019, the government has integrated previous NMPHPs into NEPHPs, and the per capita subsidies for the new NEPHPs provided by the central government were increased to 69 RMB. One important note is that the government recently added "Youth Tobacco Survey" and "Maternal and Child Health Surveillance" to the new NEPHPs as these could be helpful in improving the continuity and surveillance of RMNCAH in the primary health system.

Many of these national programmes originated from pilot interventions initially supported by multilateral organisations. While the country was opening itself to the rest of the world the early 1980s, multilateral organisations, including the WHO, United Nations International Children's Fund (UNICEF), the United Nations Population Fund (UNFPA) and others, started to introduce and pilot some of the best practices for maternal and child health in collaboration with the Chinese Government. As the economy has grown in China, more domestic funding and resources have ensured co-financing of these international programmes, leading to sustainable scale-up.[46] One typical example is the NMPHP of "Prevention of mother-to-child transmission (PMTCT) of HIV, syphilis and hepatitis B". The pilot programme was initially supported by UNICEF in some project counties during 2001-2003. This led to investment in a national PMTCT programme by the Central government contributing

to reductions in mother-to-child transmission of HIV, syphilis and hepatitis B (Appendix 22).

Civil society organisations (CSOs) including non-government, non-business individuals, organisations, and communities play an increasing role in RMNCAH partly due to the relaxation in restriction on registration. China's CSOs have expanded hugely in recent decades and there were 320,000 registered CSOs and another 2 million unregistered CSOs up to 2005.[47] The number of CSOs dedicated to HIV/AIDS was more than 700 in 2019 in current China, and they have been instrumental in promoting HIV counselling and testing, and other intervention strategies. The Bill & Melinda Gates Foundation is one of the best known CSOs.[48,49]

Poverty Alleviation

Poverty alleviation is another pivotal contributor to the development of RMNCAH in China. Since 1994, China has launched the three-phase "National Plan of Poverty Alleviation": 1994-2000, 2001-2010, and 2011-2020, with clear targets to reach women, children and other vulnerable groups, especially in rural and remote areas. According to the UN,[50,51] the number of people in China living below the poverty line of 2 USD/day, decreased by 439 million, from 689 million in 1990 to 250 million in 2011. Placing these numbers in the global contexts shows that China had made great contributions to global poverty reduction efforts. But China still faces serious challenges in fighting poverty. Studies have shown that families experiencing poverty and hardship not only have impeded access to RMNCAH services but also experience cumulative negative effects on parent-child interactions, toddlers' early language skills and adolescent health and behaviour.[52,53] Among poverty-stricken households in China, the proportion of households impoverished due to illness was 44.1% in 2015.[54]

Since 2013, the government has initiated a programmes of "Targeted Poverty Alleviation", to precisely identify, support, manage and ultimately alleviate poverty with the goal of eliminating absolute poverty by 2020. Poverty alleviation efforts aimed at targeting women and children are some of the most important priorities.[6,7] The standard poverty line is defined as a per capita net household income of < 2300 RMB per year (based on the constant price in 2011). The goal of poverty alleviation is to raise all households above this line, with access to compulsory education, essential health insurance, and safe housing.[6] As a result of this programme of "Targeted Poverty Alleviation", the number of people living in poverty has rapidly decreased from 30.46

462 million at the end of 2017 to 16.60 million at the end of 2018 (a decrease of 45.5%).[55]
463 There are three measures related to RMNCAH in the targeted poverty alleviation policy:
464 (1) for social health insurance, reduction of the reimbursement pay-lines by 50%,
465 increasing the reimbursement ratios by 5%, and gradually eliminating the
466 reimbursement cap-lines; (2) providing catastrophic medical coverage for cervical and
467 breast cancers among rural women, for selected congenital heart disease and certain
468 types of leukaemia in children; and (3) after using up the first two types of insurances,
469 allowing people under the poverty line to receive further medical assistance to cover
470 ≥70% of out-of-pocket payments.[7] Due to these policies, out-of-pocket payments for
471 inpatient care for children, as well as women with breast and cervical cancers, in the
472 targeted poverty alleviation populations, have decreased to 10% of all inpatient
473 expenses in 2018 (Appendix 23).
474

Section 3: Thriving Challenges of RMNCAH in China

China has made remarkable achievements in RMNCAH in terms of "surviving", but now faces many challenges as it transitions to the "thriving" phase. These challenges involve specific health problems at each stage of the RMNCAH cycle, as well as structural issues in the current health system.

Reproductive health

Reproductive health addresses reproductive processes and functions through all stages of life, including the right of access to safe, effective and affordable methods of fertility regulation and the right of access to appropriate health care services.[56] A wide range of determinants from the biological to the sociodemographic impact on reproductive health. Good reproductive health plays a role in workforce development, economic sustainability and social stability, as well as impacting maternal, newborn, child, and adolescent health. In this section, we will address the major challenges in reproductive health, including transition of population policy, birth control, contraception, abortion, infertility and assisted reproductive technology, reproductive cancers, STDs, as well as a long-neglected issue, sexual and gender-based violence.

Transition of population policy

Over the last 70 years, China has adjusted its population policy many times, which has not only greatly affected socioeconomic and demographic development at the country level, but has also had a profound impact on women, children, and families. To control overpopulation, extreme poverty and resource shortages, the family planning of encouraging "one-child" policy (abbreviated as "one-child" policy) was implemented in 1980s. The "one-child" policy is a misnomer. The "one-child" rule applied to urban residents and government employees. In much of rural China two children were allowed, though sometimes only if the first was a girl. In ethnic minority areas three or more children were often allowed. Women benefited from fewer pregnancies and births, hence lower maternal morbidity and lower mortality from subsequent conditions. An unexpected consequence was an acceleration in gender equality because of the large number of single daughters who benefited from all household resources.[57-59] On the negative side the policy led to the overuse of abortion (including sex-selective abortion, even though it's illegal) and increased the use of caesarean section.[32,60,61]

In 2013 the "one-child" policy started to be relaxed to ameliorate the stagnant population growth, ageing popultion and shrinking workforce. Initially, couples were allowed to have a second child if one of the parents was a single child. Then, in October 2015 the universal "two-child" policy was announced.[58] However, the fertility desire among Chinese couples was not stimulated up as expected, especially the young generation. The number of live births per year increased at first from 16.55 million in 2015 to 17.86 million in 2016, and then declined to 17.23 million and 15.23 million and 14.65 million over the next three years.[62] Thus, there is a need for pronatal policies, including the adjustment of the "two-child" policy, improvements in maternal and child welfare, pregnant-friendly workplace, and the provision of more affordable child health services (Panel 2).

After the implemention of universal "two-child" policy, the monthly mean percentage of mothers aged 35 and over rapidly increased from 8.5% during the baseline period (January 2015 to June 2016) to 14.3% during the effective period (July 2016 to December 2017).[63] Evidence has showed that the ideal maternal age for a woman biologically is 22-28 years old, or at least not more than 35 years old, which is the peak of fecundity or ovarian function with minimum risk of adverse fertility outcomes.[64-67] Thus, it needs to build a supportive environment in society and families to encourage childbearing in women at appropriate age for both their own and their offspring's health.

Birth control, contraception and abortion

Birth control allows for controlling the timing and number of births and the spacing of pregnancies. With the relaxation of the population policy, more attention should now be paid to birth spacing. International evidence suggests that pregnancy intervals shorter than 18 months and more than 59 months are significantly associated with an increased risk of adverse outcomes in the perinatal period.[68] A recent retrospective cohort study of 227,352 Southern Chinese women showed that the proportion of women who had a second child after a pregnancy interval of less than 18 months or more than 59 months was 29.1% and 22.8%, respectively.[69] Therefore, the encouragement of childbirth at appropriate age should be accompanied by promoting appropriate birth spacing (18-59 months).

Contraception is a useful method for birth control, avoid unintended pregnancy or artificial abortion. The contraceptive prevalence rate (CPR) among women aged 15-49 years old fell from 86.6% in 2014 to 80.6% in 2017,[16] mainly because older women

planned a second child, after releasing of the “two-child” policy. The abortion rate has increased in recent years. From 2005 to 2017, the total number of artificial abortions in China (including surgical and medical abortions) increased from 7.1 million to 9.6 million per year, while the abortion ratio (the number of abortions per 1000 women aged 15-49 years old) rose from 20.2‰ to 27.3‰.[60] A previous study showed that the repeated abortion rate (≥2 abortions) was 65.2% among women who had experienced at least one abortion in China.[70]

In China, approximately 6.9% of girls aged 15-19 years (10.8% in urban and 4.5% in rural) are sexually active.[71] When adolescents experience an accidental pregnancy (without contraception or failure of contraception), the vast majority (>90%) choose abortion to terminate the pregnancy, which can lead to adverse impacts in their physical and psychological health.[72] According to the 1% National Population Sampling Survey, the adolescent birth rate (number of live births per 1000 women aged 15-19 years) in China increased from 6.3/1000 in 2005 to 9.2/1000 in 2015,[73] far lower than the global average rate (43.6/1000 in 2012).[74]. Giving birth at a young age may increase the risk of maternal morbidity, and lead to adverse health, nutritional and educational outcomes in the child.[75]

Spontaneous abortion, miscarriage or pregnancy loss affect around 15% of clinically recognized pregnancies globally; at least 25% of all women have experienced at least one miscarriage; and recurrent miscarriage, clinically defined as two or more pregnancy losses, affects approximately 5% of couples of childbearing age and is mainly attributed to genetic, structural, infectious, endocrine, immune or unexplained causes.[76] Furthermore, the risk of miscarriage is significantly affected by maternal age. For women younger than 25 years old, the risk of recurrent miscarriages is approximately 0.13%, while the risk of recurrent miscarriages is 13% (an increase of approximately 100 times) in women over the age of 40 years old.[77] Miscarriage, especially recurrent miscarriage, is more likely to result in the dysfunction of the female reproductive system and even subsequent infertility and is accompanied by psychological effects in couples.[76,78] According to the national demographic and reproductive health survey (NDRHS) in 1997, the prevalence of miscarriage among women of childbearing age in China was reported to be 4.3%.[79] However, there is little reliable evidence on the epidemiology and causes of miscarriages and recurrent miscarriages in China. Therefore, further research is needed to improve our understanding of the epidemiology and causes of miscarriages, to strengthen screening and assessments of genetic factors,

uterine anatomy, hormonal and metabolic factors and lifestyle factors, and to provide psychological counseling and support to afflicted couples.[80]

Infertility and assisted reproductive technology

In China, infertility has been a neglected health issue for a long time partly because of the "one-child" policy. Currently, with the relaxation of population policies as well as changes in parenting attitudes and lifestyles among young couples, the trend towards "delaying" childbearing age is gaining attention. According to data obtained from the Hospital Quality Monitoring System (HQMS), after the full repeal of the "one-child" policy in 2015, the proportion of women with advanced maternal age (AMA, which is generally defined as pregnancy in women aged 35 years or older[81]) who gave birth in tertiary hospitals increased from 11.87% in 2015 to 12.85% in 2016 and peaked in 2017 (17.28%). Oocyte number and quality decrease with advancing age. Thus, fecundity decreases as age increases, with a rapid decline after the mid-30s.[81] Except for age-related infertility, infertility is probably affected by environmental exposures, chromosome abnormalities, lifestyles and unexplained factors.[82-84]

The prevalence of infertility in developed countries ranges from 3.5% to 16.7%, while in developing countries it is reported as between 6.9% and 9.3%.[85] In 1990, approximately 9% of Chinese couples were diagnosed with infertility (infertility is defined as a couple who have not used any contraception within 1 year and have a normal sex life, but failed to have a successful pregnancy).[86] Data obtained from National Reproductive Health Surveys showed that the prevalence of infertility in China increased from 11.9% in 2007 to 15.5% in 2010.[87] In China, approximately 46.5% of infertile couples included in the survey sought infertility treatment, and a proportion lower than the global average (56%).[88]

Assisted reproductive technology (ART) is considered one of the most effective treatments for infertility.[89] ART was initially designed in the 1970s to treat women with obstructed fallopian tubes and now has other uses including for male factor infertility. The first in vitro fertilization (IVF) baby was born in 1978. To date, approximately 40%–50% of infertile couples in developed countries choose ART to achieve a pregnancy.[85,90,91] The first IVF babies in mainland China were born in 1988.[92] In the 1990s, many infertile couples in China still had no access to ART. Since 2001, the Chinese government has introduced a series of regulations and standards aimed at the standardized management and supervision of ART nationwide,[93,94] and this has led to

610 the rapid growth of ART in China over the past few decades. By the end of 2019, there
611 were 517 assisted reproductive centers and 27 human sperm banks in mainland China.
612 China's ART cycles had exceeded 1 million in 2016,[95] and reached 1.15 million in 2017
613 (Figure 6). With regard for ART's overall success rate in China, the clinical pregnancy
614 rate (30.0%) and live birth rate (28.8%) were similar to those reported in the U.S. (27.3%
615 and 22.2%, respectively) and Europe (29.3% and 22.3%, respectively).[96,97]
616 In addition, with the rapid development of single-cell whole-genome sequencing and
617 gene function studies, Chinese scientists have made remarkable progress in improving
618 understanding of the molecular mechanisms underlying gametogenesis and early
619 embryo development.[98-101] The clinical transformation of these basic studies into
620 clinical applications for specific types for patients has provided effective diagnostic and
621 therapeutic clues, including new PGD methods for monogenic diseases and
622 chromosome translocation (mutated alleles revealed by sequencing with aneuploidy
623 and linkage analyses, MARSALA).[102,103]
624 Despite the very impressive progress, there remain several challenges. First, access to
625 ART is limited because of the high cost (an average of RMB 30,000 per cycle) and ART
626 is not covered by health insurance, so many couples simply cannot afford this. Second,
627 China still does not have a national ART reporting system to collect case data and results;
628 this could inform the evidence-base for improving outcomes of ART. Finally, as an
629 emerging technology, ART is affected by a variety of legal and ethical issues, such as
630 the upper age limit for ART treatment, the protection of the rights of all parties when
631 oocytes are donated, the storage time limit for embryo cryopreservation, and disputes
632 over surrogacy.
633 The best form of prevention for infertility is to become pregnant and give birth at an
634 appropriate age. To enhance primary prevention, it is also essential to provide adequate
635 reproductive health education to women and men of childbearing age while also
636 meeting the needs of adolescents for early reproductive health education. In addition,
637 as more older women begin to seek ART to have offspring, further quality control and
638 management of ART are needed to improve its results and safety.
639
640 *Sexually transmitted diseases*
641 Several sexually transmitted diseases (STDs), including syphilis, chlamydia, and
642 gonorrhea can cause pelvic inflammation, tubal-factor infertility, and even ectopic
643 pregnancy.[104] Before 1949, the prevalence of syphilis in China was extremely high, at

84% in sex workers, 5-10% in urban residents, and 1-4% in rural residents.[105] As a result of mandatory campaigns to eliminate STDs in the 1950s, China announced the total elimination of syphilis in the 1960s.[24] However, with modern and more open attitudes towards sex, syphilis began to reappear in the 1980s. Although the incidence of syphilis in China is still lower than the global levels (150/100,000),[106] the prevalence of syphilis in China had increased to 30/100,000 by 2011. The prevalence of gonorrhoea peaked in 1999 (27/100,000), probably as a result of improved screening coverage and diagnostic techniques, as well as rapid population movement. In recent years, the incidence of gonorrhoea gradually declined and has been below 10/10,000 since 2009 (Figure 7A).[107]

The Chinese government has been monitoring and reporting on acquired immune deficiency syndrome (AIDS) and human immunodeficiency virus (HIV) infection since 1997. With several effective measures to control spread of HIV/AIDS, including health education, screening, elimination of mother-to-child transmission through providing free treatment to infected-mothers, HIV/AIDS is now regarded as "under control" in China (the incidence of HIV infection is less than 10/100000).[108] However, HIV/AIDS is gradually on the rise (Figure 7A).[107] Between 2012 and 2017, sexual transmission became more common: the proportion of cases resulting from heterosexual transmission increased from 68.0% to 69.6%, and the proportion caused by homosexual transmission increased from 19.1% to 25.5%, while cases caused by other routes of transmission which had previously been common (injecting drug use, mother-to-child transmission, blood transfusions, and use of blood products) were well-controlled (Figure 7B).[109,110] AIDS prevalence has increased in adolescents: in the 15-24 age group, the number of AIDS cases increased from 1,223 in 2013 to 3,023 in 2017 (Figure 7C).[111] Therefore, given the decreasing age of first sexual activity, the prevention, education, and control of STDs among young people is becoming increasingly important.

Breast cancer and cervical cancer

Cancer is the leading cause of premature death and disability worldwide, especially among women.[112] In China, the burden of cancer-related diseases is also increasing.[113] Breast cancer is the leading cause of cancer incidence and the fifth leading cause of cancer deaths in Chinese women.[114] In 2014, the incidence and mortality rate of breast cancer in China were 28.8 per 100,000 and 6.4 per 100,000, respectively, and the incidence and mortality rate of cervical cancer were 10.6 per 100,000 and 3.0 per

100,000, respectively (Figure 8).

One of the challenges in China is low screening rates. In 2013, the estimated screening rates of breast and cervical cancer among women aged 35-64 were 22.5% (28.9% in urban areas, 17.0% in rural areas) and 26.7% (31.8% urban, 22.3% rural), respectively.[115] The screening rate for cervical cancer in women over the age of 21 years old was only 21.4% (25.2% in urban areas and 18.0% in rural areas).[116] These indicators are far below the WHO-recommended cervical cancer screening rate of 80%.[117] Although such screening has been provided free-of-charge in the "Two Cancer Screening" programme in 286 of the poorest counties since 2009 and scaled up to more than 1700 counties in 2018, this approach does not seem to be enough to encourage a majority of women to take up screening. This free screening program should be expanded into more rural areas and incorporated in social health insurance. In addition, there is ample evidence indicating that cervical cancer is primarily caused by persistent infection with human papillomavirus (HPV),[118,119] but the low uptake of HPV vaccine is a major challenge as shown in Panel 3.

Another noteworthy issue is that while more reproductive cancers are diagnosed in young women at an early stage, thus allowing better treatment opportunities, some treatments may affect reproductive organs and induce gonadal failure.[120] Therefore, for young women diagnosed with reproductive cancer, the question of how to achieve long-term survival while maintaining their reproductive function has been recognized as a major focus for maintaining the quality of life of these cancer patients.[121-124] For these women, the challenge is to remove or eliminate the cancer cells while protecting and preserving healthy oocytes and ovarian tissue. Therefore, there is a need to develop regulations and uniform clinical guidelines to accelerate collaboration between scientists and clinicians, to increase the awareness and acceptance of the need for fertility protection among oncologists and patients, and to promote the development and application of innovative technologies.[124]

Sexual and gender-based violence

SDG 5 calls for the elimination of violence and all harm against women by 2030. Sexual and gender-based violence against women is a global health issue.[125-127] With regard to its most common form, intimate partner violence (IPV), one in three women worldwide has experienced IPV, with a wide range in rates across different countries and different studies.[126,127] A study carried out in 2018 across six provinces found the lifetime

prevalence of IPV to be 77.7%, 40.2%, and 11%, for psychological, physical, and sexual violence respectively.[128] According to a nationwide survey of women's social status conducted by the All-China Women's Federation (ACWF) in 2010, 24.7% of women had ever experienced any form of IPV, including 5.5% who experienced physical violence (7.8% in rural areas and 3.1% in urban areas).[129] Evidence shows that 7.7% of women suffered from IPV during pregnancy;[130] while among those who sought abortion their rate was 7.8% experienced physical violence, 3.0% experienced emotional violence, and 18.1% experienced sexual violence.[131] Strikingly, among those who suffered from infertility, the prevalences of physical violence, emotional violence, and sexual violence were 84.5%, 58.8% and 7.7%, respectively.[132]

China enacted the Anti-Domestic Violence Law in 2015 to prevent and respond to domestic violence. However, challenges remain with regard for sexual and gender-based violence against women. Women who are pregnant, seeking an abortion, or infertile are especially vulnerable to IPV. Therefore, it is recommended that routine screening and counselling services for violence against women should be provided, especially in primary care facilities, obstetrics and gynecology departments, and reproductive medical centers. Another challenge is cultural barriers. IPV in particular is still deemed a private matter, and a source of shame and guilt.[133,134] Therefore, more research is needed into the causes, and consequences of sexual and gender-based violence in women in order to develop more effective interventions and policies.

Maternal and Newborn Health

Maternal and newborn health is a critical part of RMNCAH as it is the starting-point of life that is closely linked with the health of human's whole life cycle. Affected by the adjustment of fertility policy, and rapid reduction of maternal and neonatal mortality, major diseases affecting maternal and newborn health are also changing. China is still confronted with the challenge of the interweaving of old and new maternal and neonatal health problems. The main cause of maternal death in is still obstetric hemorrhage, but the maternal deaths due to indirect obstetric causes now exceeded half of the total. Premature birth and congenital anomalies that threaten the survival of newborn and development of child have become a more important issue. The neglected health problems of stillbirth, mental health, and nutrition problems need attention. In this section, we will discuss the priority maternal and newborn health issues in China, and

analyse the challenges and potential solutions.

Safe motherhood

Since 2000, maternal complications have become more frequent, in large part due to the older age at childbirth, a higher prevalence of preexisting chronic diseases such as hypertension and diabetes, and the high rate of caesarean section delivery. The data on the grade of pregnancy risk in China during Sep. 2018 and Jul. 2019 showed that 5.0% of pregnancy women were marked as orange risk that refers to pregnant women with potentially life-threatening conditions, and 0.8% as red risk refers to pregnant women with life-threatening conditions.[135] The causes of maternal mortality have changed during the past decades. Although maternal mortality due to direct obstetric causes has declined dramatically (Figure 9A),[136] obstetric haemorrhage remains the leading cause of death, at 23% of total maternal deaths in 2018. The MMR due to obstetric hemorrhage is much higher in China than in high income countries, such as France and the UK.[137] A retrospective analysis of women at a maternity center in Shanghai between 2007 and 2016 showed that 20% suffered obstetric hemorrhage serious enough to be categorized as a maternal near-miss.[138] Older childbearing age,[139] increasing incidence of maternal complication,[139-143] and the high proportion of pregnancies with a history of cesarean section,[144-146] may all contribute to the higher risk of obstetric hemorrhage in China. But China also faces the challenges of dealing with the indirect obstetric causes of death which are increasing from 28.7% in 2000 increase to 54.1% in 2018 (Appendix 25).[136] Chronic non-communicable diseases, such as chronic cardiovascular and cerebrovascular diseases, viral hepatitis, epilepsy, and other diseases, such as venous thrombosis and pulmonary embolism and pneumonia, are most frequent medical causes of maternal death. Moreover, the global epidemic of infectious diseases, such as H1N1 and COVID-19, also threatens maternal health. An analysis of 9966 patients hospitalized with laboratory-confirmed 2009 H1N1 infection during Sep. 2009 to Feb. 2010 indicated that the risk of severe illness (defined as intensive care unit admission or death) due to H1N1 among pregnancies was more than 3 times than that of non-pregnancies.[147] An observational study in Wuhan showed that 8% of pregnant women infected with COVID-19 will develop severe symptoms with hypoxemia.[148] Pregnant women diagnosed with COVID-19 in the second or third trimester of pregnancy are also at higher risk of death.[149]

Early identification and intervention of maternal complications, interdisciplinary care

779 and highly efficient referral systems are essential to prevent maternal deaths. Since the
780 implementation of "Two Child Policy" in China, maternal and newborn referral centers
781 for severe morbidity have been constructed at provincial, prefectural and county level,
782 and risk factors are assessed in pregnant women according to the “Five-Colour”
783 management scheme.[150] But there reamin serious challenges to providing quality care.
784 *(1) Insufficient knowledge/skills of health professionals.* National MCH Surveillance
785 data from 2018 showed that 46.3% of maternal deaths occurred in city or provincial
786 level hospitals, and a proportion of these deaths might be related to untimely referral.
787 The premise of timely referral is early identification and essential intervention for
788 serious complications, and it requires sufficient knowledge/skills for health
789 professionals in lower level hospitals. A review of 556 maternal deaths caused by
790 obstetric haemorrhage in 2011-2018 suggested that 68.3% of the deaths were related to
791 problems within healthcare institutions, with approximately 90% of them attributable
792 to health care professionals' insufficient knowledge about haemorrhage risk or
793 inadequate skills to respond to it (Appendix 24). *(2) Lack of compliance with clinical*
794 *guidelines.* Many clinical technical guidelines have been formulated in China. However,
795 they still cannot be effectively implemented in some hospitals, especially those in
796 remote rural areas where the skill level of doctors as well as the limited facilities makes
797 adherence to guidelines virtually impossible. *(3) Implementation of multidisciplinary*
798 *care.* Medical causes of maternal death require multidisciplinary collaboration.
799 Encouragingly, many hospitals have realized the importance of multi-disciplinary
800 teams (MDT) and are using them to manage critical pregnancies. But MDT
801 approaches have not been standardized in China, and the potential benefits MDT has
802 not been realized yet in many Chinese provinces.
803 Therefore, China needs to deal with more complicated maternal health problems
804 effectively to further reduce MMR. Priorities are to improve the quality of maternal
805 health care services, by improving the knowledge and skills of doctors at grass-roots
806 hospitals, strengthening the supervision of obstetric service quality, and establishing
807 standardized comprehensive MDT.
808
809 *Stillbirth*
810 Stillbirth is a long-neglected public health problem. In 2015, there were approximately
811 2.6 million stillbirths worldwide, resulting in a stillbirth rate of 18.4 per 1000.[151] The

Global Plan of Action of the United Nations aims to achieve a stillbirth rate of less than 12 per 1000 in all countries by 2030. From 2000 to 2015, the estimated rate of stillbirth (at least 28 gestational weeks) among pregnant women in China decreased annually by 4.6%.[151] The stillbirth rate in China was 8.8 per 1000 in 2012-2014, much higher than the developed region average of 3.4 per 1000.[151] In 2015, the number of stillbirths (122,300) was 1.3 times higher than the number of neonatal deaths (93,400).[33,151,152] A cross-sectional study of 441 hospitals across China showed that the highest stillbirth rates were observed among women without antenatal care (38.3/1000), those with low educational status (26.9/1000), or those who had given birth at least four times (23.2/1000).[153]

Increasing the awareness of the government and society to stillbirths is the key to stillbirth prevention. However, stillbirth hasn't been included in the core MCH indicators, and stillbirth monitoring is absent from the existing vital registration systems. The cause of the stillbirths is still unknown in most cases: autopsy typically reveals the cause in only 40%.[154] Worldwide, the top five causes of stillbirths are childbirth complications, maternal infection in pregnancy (malaria, syphilis, and HIV), post-term pregnancy, maternal disorders (especially hypertension, obesity, and diabetes), fetal growth restriction and congenital abnormalities. A previous study suggested that 45% of stillbirths can be prevented by ensuring 99% coverage with 10 interventions including syphilis detection and treatment, the detection and management of maternal complications, as well as basic and comprehensive emergency obstetric care.[155] Access to high-quality antenatal care is still very limited for pregnant women in poor areas of China. There are no specific clinical guidelines with the aim of stillbirth prevention to guide clinical practice and recommendations for antenatal and intrapartum care or for the psychosocial support for pregnant women who experience stillbirth.[156] In addition, relevant services, including autopsy and reproductive counselling following a stillbirth are rarely available in China. Thus, the underlying causes of stillbirth remain unknown in the overwhelming majority of cases. To reduce the disease burden of stillbirth in China, a number of measures are necessary: routine monitoring of stillbirth, development and promotion of guidelines for prevention of stillbirth, and provision of postpartum consultation and psychological support.

Neonatal diseases

With improvements in healthcare, the rate of neonatal deaths caused by infectious diseases has dropped dramatically in the last two decades. Increased hospital delivery rates, improved resuscitation skills and the development of neonatal intensive care have contributed to the substantial decline in neonatal mortality. Preterm birth has become the leading cause of neonatal deaths, contributing 22.0% of total neonatal deaths in 2000 and 27.3% in 2018. The proportion of deaths caused by congenital abnormalities increased from 12% in 2000 to 20% in 2018.[157] Preterm birth and congenital abnormalities accounted for approximately half the total neonatal mortality in 2018 (Figure 9B).[158]

Preterm birth. A 2014 systematic estimation of global preterm birth rates showed that nearly 15 million premature births occur each year around the world, with 1.2 million (7.8%) occurring in China [159] An analysis of 77,879 birth records between 2015 and 2016 from 89 hospital in 25 provinces showed 0.4% of live births were born at 24-27 gestational weeks, 0.7% at 28-31 weeks, 0.8% at 32-33 weeks and 4.7% at 34-36 weeks.[160] Prevention and management of preterm birth needs a prevention and treatment strategies in China. However, the identification of women at risk of preterm delivery remains a challenge. Although many risk factors including maternal, fetal, and placental conditions, as well as metabolic and ultrasonic markers,[161] can help to predict premature birth, the effects in different populations are unclear. More research is needed on clinical interventions for inhibition of uterine contraction and promotion of fetal lung maturation. Besides, with the development of perinatal medicine and the improvement of neonatal critical care in China, many infants in China born at 26-28 weeks of gestation do now survive with survival rates close to those in high income countries such as the US or Australia (Figure 10).[162-164] However, extremely preterm births are at a high risk of brain damage, lung dysplasia and nutritional-metabolic disorders. Effective management of premature infants requires a multidisciplinary approach available only in specialized centres. There are no specific regulations and guidelines for the treatment and management of extremely premature infants, because the defined threshold of "preterm" remains 28 gestational weeks in China. High income countries have established sound follow-up and rehabilitation systems for preterm infants, but China has limited systems for follow-up..[165] In addition, and very importantly, the costs of care for extremely premature infants, is nearly all out-of-pocket and many families are unable to afford this, and so they request that the treatment is stopped.

Congenital anomalies. Congenital anomalies (CAs) have become one of the most important conditions affecting newborn survival and child development in China, similar to many developed countries.[166] The most frequency serious CAs are congenital heart defects, hearing impairment, Down's syndrome, inherited metabolic disorders, and neural tube defects. In the last decade, China has made substantial prevention efforts by providing free services in poor areas. Since 2010, all women of childbearing age in rural areas have been provided with free folic acid tablets by the Chinese government. The coverage of serological screening for Down's syndrome rose from 18.1% of all pregnancies in 2009 to 71.6% in 2018, and the newborn hearing screening from 29.9% in 2008 to 86.5% in 2016, while the newborn screening for inherited metabolic disorders (including phenylketonuria and congenital hypothyroidism) from 31.3% in 2006 to 98.5% in 2018. Active promotion for neonatal congenital heart defects screening started in 2018.

China still faces numerous challenges in improving the service's quality, fairness and accessibility. Firstly, with improved access to technologies (fetal ultrasound, genetic testing), antenatal diagnosis of CAs in the antenatal period in increasing. In 2018 as the data from China Birth Defects Surveillance System showed, that there 33.4% of congenital heart defects had been diagnosed during pregnancy. Multi-disciplinary teams are needed to manage the condition from the antenatal period through to the postnatal period. But there are no guidelines yet for this process, and there are not enough trained specialists yet to manage the complexities of these pregnancies. Secondly, the disparities in the coverage of services are also observed among different regions and different socio-economic groups. There were two provinces in the western region with the coverage of newborn screening for phenylketonuria and congenital hypothyroidism less than 80% in 2018. At least one study has showed that the coverage of serological screening for Down's syndrome was much lower among the low educated and income groups than the others in China.[167] In addition, health insurance for congenital abnormalities is far from comprehensive, which limits the access to the treatment of CAs. The new rural cooperative medical system currently reimburses for the treatment costs of only five abnormalities, including congenital heart disease, hemophilia, cleft lip and palate, phenylketonuria, and hypospadias.

Maternal, fetal, newborn nutrition

Good nutritional status meaning healthy body composition without nutrient deficiency or excess during pregnancy is essential for a positive birth outcome. With improved socioeconomic conditions, the nutritional status of Chinese women, including pregnant women, has greatly improved. However, as a rapidly developing country, China faces the dual burdens of undernutrition and overweight as people adopt less nutritious (but calorie-rich) diets and less active lifestyles.

Maternal nutrition

It is estimated that the global prevalence of anemia in pregnant women was around 40%in 2016 .[168] In China, a national survey showed the prevalence of anemia (hemoglobin<110 g/L) in pregnant women to be 32.1% in Beijing and 48.1% in Tianjin in 2017 both wealthy cities.[136] The target of reducing the prevalence of anemia in women of reproductive age by 50% by 2025, set at the World Health Assembly (WHA) in 2012,[169] will be a challenge for China. Micronutrient deficiency is another challenge. For instance, 75.4% and 3.5% of rural pregnant women suffer from vitamin D and A deficiency respectively, and the prevalence of vitamin A deficiency is higher in urban areas (7.4%).[170] The proportion of pregnant women with iodine deficiency varied from 45.3% to 62.6% in the developed cities of China from 2009 to 2014.[171] Thus, it is important to promote detection of micronutrient deficiency before and during pregnancy in order to provide supplementation where necessary.

Obesity in pregnancy is emerging as a major problem In 2012, around half of pregnant women in China gained too much weight during the second trimester (53.6%) or the third trimester (46.5%) according to the weight gain reference suggested by Institute of Medicine of America.[172] These women are at increased risk of obesity, gestational diabetes mellitus (GDM), and hypertensive disorders complicating pregnancy. Pregnant women should have access to lifestyle and nutritional advice to manage weight gain during pregnancy.[173] The weight monitoring and guidance in pregnancy also need to be strengthened, and to establish the weight growth standard suitable for Chinese pregnant women is critical for scientific guidance of maternal nutrition.

Low birth weight and macrosomia

Low birth weight (LBW), defined as < 2500g, is an important risk factor for neonatal mortality and long-term morbidities. An estimated 15% of all births worldwide were

LBW in 2015, representing 20 million newborns each year.[174] The data from hospital-based Maternal Near Miss surveillance of China showed that the incidence of LBW (≥28 gestational weeks) was unchanged between 2012 to 2018 at around 5.5%.[136,175] WHO has released the lists of evidence-informed interventions to prevent low birth weight.[176] In China, it is critical to promote these affordable, accessible and appropriate interventions in the poorer areas.

On the other hand, macrosomia defined as birth weight > 4000g, poses another challenge not only for delivery but, more importantly, for future child and adult obesity and metabolic disorders.[177-179] The WHO Global Survey on Maternal and Perinatal Health showed that the prevalence of macrosomia was 6.9% in China in 2007-2008, higher than the average of the surveyed 23 developing countries.[180] While other studies with a larger sample size confirmed that the prevalence of macrosomia in China ranges from 7.3% to 8.7% in 2010-2014.[181-183] The main risk factors for macrosomia are well recognized, including gestational diabetes, higher gestational weight gain and maternal obesity.[181-184] However, the efforts of standardized management of GDM, gestational weight gain monitoring and nutrition counseling still need to be strengthened.

Breastfeeding

Breastfeeding is the one of the most affordable, effective measures to improve children's health and development. In the last decades, the Chinese government has made continuous efforts to promote breastfeeding, such as evaluating practice in baby-friendly hospitals, promoting the implementation of the International code of Marketing of Breastmilk Substitutes, and providing comfortable spaces for breast-feeding in public places. According to the National Health Service Survey in China, the exclusive breastfeeding rate at six months increased from 27.6% in 2008 to 58.5% in 2013 higher than the global average of 40%.[185] The rate of exclusive breastfeeding among the Han population and urban residents was lower, than among rural residents and minority ethnic groups.[186]

Failure to exclusively breastfeed is influenced by a number of factors. Women are entitled by law to three months of maternity leave, and after return to work, a one-hour breastfeeding break up to one year. This has just been introduced, but this precludes exclusive breast-feeding for many women. In addition, although 70% of hospitals providing obstetric services are signed-up to the Baby Friendly Initiative, specific training in breastfeeding support is often inadequate. Although the government supports

the implementation of the International Code on the Marketing of Breastmilk Substitutes, in reality advertising of breast milk substitutes is not sufficiently regulated and this probably encourages women to prematurely cease exclusive breast-feeding.

Maternal mental health

The promotion of mental health is a specific target of the 3rd Sustainable Development Goal. Perinatal mental disorders are a common problem worldwide, occurring in an average of 15.6% of pregnant women and 19.8% of postpartum women.[187] Systematic reviews have shown that postpartum depression affects at least one in 10 women in China.[188] Perinatal depression occurs in as many as 17.4% of women, compared with a prevalence of 5-10% in the general population.[189] Perinatal mental disorders are of particular concern because of the potential impact on the infant, spouse, and other family members. Evidence suggests that postpartum depression can have serious negative influences on the children's development.[190]

WHO guidelines on maternal health recommend the assessment of postpartum depression, screening for family abuse, and the provision of social and psychological support within 10-14 days after delivery.[191] The screening, diagnosis, and treatment of perinatal mental disorders are a priority in many countries.[192-195] In 2011, the Ministry of Health in China recommended that routine maternal health care incorporates mental health care throughout pregnancy and puerperium. But this is very difficult to achieve. First, mental health problems are still poorly understood and are stigmatized in China, so pregnant women do not seek help. Second, although an expert consensus guideline was developed for the prevention and treatment of postpartum depression in China in 2014[196], the accessibility of psychological counselling services is still very limited. For example, a survey of 16 MCH institutions in Hunan Province showed that only seven carried out screening for postpartum depression, and only two offered psychological counselling and treatment.[197] Finally, China still lacks its own diagnostic standards or guidelines to manage mental health during pregnancy. The diagnosis of depression in China is based mostly on instruments developed in Western societies and they may not be entirely applicable in the Chinese population due to substantial cultural differences.

Child and Adolescent Health

The last 70 years have brought spectacular improvements in overall health outcomes from infancy through to adulthood, especially in child survival. Key strategies and

measures to reduce child mortality in China are outlined (Appendix 26), including skilled attendance and hospitalized delivery, the expanded programme on immunization (EPI), and comprehensive programmes and measures focusing on specific causes of child mortality. As with other areas of RMNACH, moving beyond the early focus on survival has brought new challenges. For both children and adolescents, there are inequalities in health and access to quality health care across the country. Among adolescents, there are additional challenges from unhealthy lifestyles and risk behaviours, and emerging serious concerns about mental health. There is a growing number of vulnerable groups, including children in extreme poverty and those abused and neglected. In this section, we focus on the major emerging challenges and policy priorities for children and adolescents, and what is currently being done to address these problems. We begin with injury as the major cause of mortality and morbidity, many causes of which are preventable. We then focus on key lifestyle-related conditions, including obesity and myopia. Mental health disorders pose a special challenge because of the lack of reliable epidemiological data and the paucity of services for children and adolescents. We also discuss the challenges encountered by the most vulnerable children, the role of early child development programmes, and the need for greater child protection.

Injury

As in many high and middle income countries,[198] injury is now the leading cause of death in children and adolescents in China (Appendix 27).[199] In 2015, these accounted for 45% of all child deaths in the 0 to 19-year-old age group. The most common causes are drowning (37%), road traffic injury (32%), choking (11%), falls (7%) and poisoning (4%).[199]

Addressing the determinants of injury is a key to its prevention. Boys had a consistently higher injury mortality rate than girls, especially rural boys who have the highest mortality rate in Chinese adolescents.[200] Studies show that children's physical and cognitive abilities, degree of dependence, and exposure to environmental dangers affect injury risk.[201,202] Adult supervision is also key, and this is especially relevant in China, because of the large numbers of children left behind by migrant parents in rural areas. There is now a solid body of evidence supporting the implementation of effective measures in preventing unintentional injury in children. These are based on legal requirements, which are known to modify behaviours and reduce the risk of injury.

Examples include removing or covering water hazards, the use of appropriate child restraints and seat belts in vehicles, and child resistant packaging of poisons and medicines. However, the Chinese legislative framework in this area remains weak. In 2015, Li et al analysed the legislative coverage in China for 27 known effective interventions against injury-related child mortality. Seventeen interventions were covered, but only seven were covered by legislative documentation of the State Council. The remaining ten were covered by regulations that failed to assign responsibility to government departments, making them virtually impossible to enforce.[203] The risk of injury for millions of children can be reduced by ensuring that effective interventions are covered by national laws with accountability lying with specific governmental departments.

Lifestyles and health risk in children and adolescents

Behaviors acquired in childhood and adolescence, such as poor nutrition, a sedentary lifestyle and risk behaviors, have implications for short- and long-term health outcomes, especially the risk of non-communicable diseases.

Diet and sedentary lifestyles. In China, the sheer rapidity of the epidemiological transition, socio-economic improvement and urbanization have had marked impacts on lifestyles and health risks. Changes in diet combined with sedentary lifestyles, plus the "one-child" policy, and persisting low fertility, have contributed to a sharp increase in the prevalence of overweight and obesity.[204] From 1995 to 2014, the overweight and obesity rate increased from 4.2% to 14.0%, and from 1.0% to 6.4%, respectively, with urban males having the highest obesity rate (11.5%) in 2014 among children and adolescents aged 7 to 18 years (Figure 11).[205] Type 2 diabetes is more frequently diagnosed in adolescents.[206] As early as 1982, the Ministry of Education issued a "*Notice to Ensure One Hour of Daily Physical Activity in Primary and Secondary Schools*", and this was recently reiterated in "Healthy China 2030". However, a nationwide survey in 2016, showed that only 32% of boys and 28% of girls at primary and middle school reported at least one hour of moderate-to-vigorous physical activity per day.[207] The same survey showed that 37% exceeded the recommended two-hour maximum for daily screen-time (of any type) outside school time.[208,209] Specific guidelines on the prevention and control of overweight and obesity in children were published in 2008.[210] However, the emergence of overweight and obesity in all parts of

China suggests a need for further policy responses. These could include a sugar tax on food and drinks, enforcement of regulations regarding the promotion of physical activity in schools, targeted health education, and access to services to support the ability of overweight children to lose weight. All of these require multi-sectoral responses from the government, schools, families and communities.

Tobacco and alcohol. The other key risk behaviors are tobacco and alcohol use, which are usually initiated in adolescence. Smoking is far more common in males than in females in China. Among 15-24 years old, the rate of self-reported smoking at least once in the past 30 days increased from 16.0% to 23.5% in males and from 0.4% to 1.1% in females between 2003 and 2013.[211] Boys from low-income families are twice as likely to report having ever smoked than boys from high-income families.[212] Notably, a nationwide study of middle school students showed that the rate of although the prevalence of e-cigarette use was 1.2%, it was strongly correlated with intention to use tobacco[213] Sex differences in alcohol use are less marked than those for tobacco. A systematic review showed that the rate of alcohol use in the last 30 days was 23.6% in males and 15.3% in females aged 12–15 years, and 36.5% and 21.2% in 16–18 year olds,.[214] Both "Healthy China 2030" and the "China Children's Development Programme (2011-2020)" have called for measures to prevent tobacco and alcohol use in children and adolescents. "Healthy China 2030" calls for increasing taxation and legislation to prohibit the sale of tobacco, alcohol and drugs to children and sets a goal for controlling the rate of smoking to below 20% for people older than 15 years of age by 2030.

Myopia. Increases in sedentary behavior, studying and screen time influence health outcomes for children and adolescents. In China the most common is myopia. The nationwide prevalence of myopia in children and adolescents aged 7-18 years increased from 47% to 57% from 2005 to 2014 [215] and showed a gradient across this age range (Figure 12). Apart from the cost and inconvenience of the need for correction of refractive errors, early-onset myopia can progress to sight-threatening consequences, such as myopic macular degeneration.[216] Until recently there was no known effective intervention for preventing myopia, and attempts to slow increases in the severity of myopia throughout childhood have had only limited success. However, a recent randomized controlled trial among 6-year-olds in Guangzhou showed that the addition

of 40 minutes of outdoor activity at school (compared with normal activities) resulted in a reduced incidence rate of myopia at the 3-year follow-up (a cumulative incidence in the intervention group of 39% compared with 30% in controls).[217] In 2018, the Ministries of Education and Health combined to launch a programme for the prevention and control of myopia in children and adolescents",[218] with the goal to reduce the myopia rate by at least 0.5% annually by 2030. The plan outlines specific roles for each participating government body, including those responsible for sports, news, radio, and television. It establishes concrete targets, including two hours outdoors every day for all children, and restrictions on homework time. Crucially, measures of homework load and myopia prevalence are included in the government's system of assessment.[219]

Mental Health

In China, mental disorders in children and adolescents have only recently gained attention, despite recognition of the potential life-long benefits of early identification and treatment of mental health problems.[220] There is now a small but growing body of research, particularly on common conditions in childhood such as developmental disorders, attention deficit hyperactivity disorder (ADHD), and autism spectrum disorders (ASD). A meta-analysis of 18 studies from China showed the pooled prevalence of childhood autism to be 1.2 per 1,000, [221] much lower than the prevalence estimates of 6-10 per 1000 for ASD in developed countries[222]. ASD is more prevalent in boys than in girls, but consistent across ethnicity, and socioeconomic levels. ADHD has only been identified in China since the early 1980s. A meta-analysis of 33 studies published from 1980 to 2011 found that the prevalence increased from 3.7% in 1980 to 6.2% in 2011 (almost certainly because of improved detection), which is slightly higher than the worldwide pooled prevalence of 5.3%.[223]

In the adolescent period, depression and anxiety are common and recurring disorders. Accurate figures are difficult to obtain and compare, because of the use of different methodologies and the inclusion of different sub-populations in epidemiological studies.[224] The prevalence of depression and anxiety in adolescents has recently been estimated to be around 17% and 32%, respectively.[225-230] A recent meta-analysis suggested that anxiety and depression have become more common across Chinese birth cohorts from the 1990s to 2010.[231]

Suicide is an important cause of death in children and adolescents in China.[232] Reliable figures for self-harm and suicide-related behaviors are difficult to obtain,[233] but there

are concerns about recent self-harm increases in urban 10- to 14-year-olds.[234] Two meta-analyses reported an overall pooled prevalence for suicidal ideation of 10.7% and for ever attempting suicide of 2.8% among college students.[235,236] A recent study in adolescents from Shandong province reported that the rates of suicide ideation, suicide planning and suicide attempts in 2015 were 12.5%, 3.3%, and 1.5%.[237]

The determinants of mental health problems are multifactorial. An often-cited factor is the extremely competitive academic environment, which is partly integral to a didactic exam-based education system, and partly the pressures associated with parental expectations, which in many cases are focused on one child. Further research is needed to explore the association between academic burden and mental health. Another important factor is likely to be family separation, especially for children left behind in rural areas by migrant parents. A number of studies have found that children who are left behind are prone to a range of mental health disorders.[238-240] Bullying is another contributor. A recent systematic review found that 15.9% of Chinese students are victims of bullying and that 7.3% admit to bullying others.[241] The recent rapid development of social media may have also affected children's well-being, with cyber-bullying emerging as more harmful than traditional bullying.[242]

The challenges are immense. Mental health problems are highly stigmatized especially in children and adolescents. The problems start with lack of recognition by children and parents that there is a problem. Then there is the problem of accessing appropriate services. There is a dearth of service providers and a lack of child psychiatrists, and most of these practise in large cities.[223] Child and adolescent psychiatry is hardly taught in medical school, and primary care physicians receive no training in child psychiatry. Few mental hospitals provide specific services for children and adolescents. Those that exist focus on younger children with conditions, such as ADHD and learning difficulties.[223] Service provision could be improved through the use of nurses and social workers with specialised training. Some colleges and universities are already offering such training. In addition, general pediatricians and primary care physicians can be trained to conduct screening and follow-up for children with mental disorders.[243]

Vulnerable children

The Chinese government is committed to eliminating absolute poverty by 2020, but inequalities remain. Children living in poverty may be vulnerable in terms of cognitive

and social-emotional development, with impacts on educational achievement.[244,245] A cohort study conducted in poor counties in Shaanxi Province found that developmental delay (measured with the Bayley Scales) increased from 13.4% of the children at 6 months to 50.4% at 30 months, [250] much higher than the prevalence reported in urban areas in the same period.[246,247]

Early child development programmes. To address the needs of these most vulnerable children the government has developed a range of Early Child Development programmes. There is now strong evidence that investment in early child development (ECD) programmes [248] has benefits for longer-term health, learning, and behaviour. Child health care systems have been in place for 60 years to provide regular health checkups and nutrition consultations for children. These have made it easier to track child development and nutritional indicators. The China Food and Nutrition Surveillance System showed that the overall prevalence of underweight decreased from 19 % in 1990 to 2.4% in 2013 and in rural areas form from 23% to 3.1%. Stunting decreased from 33.4% to 8.1%, and from 41.4% to 11.2%, in rural areas, and wasting from 2.7% to 1.9%. However, in poor rural areas, challenges remain. The prevalence of stunting, underweight, and wasting were still 18.7%, 5.2%, and 3% in 2013, respectively.[168,249] Targeted interventions have been implemented in the poorest areas. They included a nutrition supplement programme called "Ying Yang Bao (YYB)" for children aged 6-24 months that was implemented in the 341 poorest counties and has been scaled-up to include all poor counties across the country.[169] Despite of the direct input of nutrition supplement powder, it could not substitute for dietary quality and diversity.[250] However, lack of clean water and sanitation, , stood as highest of all deprivation dimensions of children living in poor areas.[251]

A lack of early stimulation is another issue, especially in poor areas. Evidence was consistent to find inadequate learning resources and activities and its association with developmental delay in poverty-stricken areas.[252,253] The Yunnan Household Survey 2013 was conducted in a representative sample of rural 3- to 6-year- old children in Yunnan, one of the poorest provinces. This survey included a high proportion of households in the poorest counties of rural Yunnan, in which 72% of the caregivers had not played with their children and 47% had not read to them in the past year.[254] Lack of stimulation was found to be more severe in left behind children than children staying with both parents in the same area.[255] Several pilot studies providing home visiting

services or establishing ECD centers have been carried out in rural areas, and these studies suggest that such interventions can improve children's developmental outcomes and social skills.[185,256] A recent cost-benefit calculation of government investment into early childhood development in rural China found that the returns on investment in economic terms are high, with a benefit-cost ratio ranging from 4.2 to 8.4.[257] The scaling-up of such programmes in poor rural areas is clearly desirable.

Child protection programmes. Security and safety are key factors in Early Child Development, and they are crucial beyond this life stage and into adolescence. Such security and safety depend on the existence of child protection systems and function of families. However, these remain under-developed in China, and are still focused on certain groups such as left-behind children.

Child abuse and neglect are common in China. A systematic review of 68 studies reported that 26.6% of children under the age of 18 years had suffered physical abuse, 19.6% psychological abuse, 8.7% sexual abuse, and 26.0% neglect.[258] However, definitions across the included studies varied substantially. Physical punishment is widely regarded as a legitimate form of discipline and is therefore not generally regarded as abuse.[259] Over the last decade, a series of high-profile child abuse cases have raised awareness of the seriousness of the problem of domestic child abuse and encouraged the government to take action to develop a child protection system.

A pilot child protection programme was initiated in 2013 in 98 cities and counties. However, the focus was specific groups such as left behind children, and the children of mentally ill or disabled parents, rather than abused and neglected children.[260] In 2016, the Domestic Violence Law for the first time acknowledged that children need to be protected in their own homes. The law introduced a reporting system for suspected child abuse for the first time. Medical professionals, teachers, and childcare providers now have an obligation to report cases of abuse. However, the idea of reporting child abuse runs contrary to the widely-held belief that child discipline is a family matter, so how this will be implemented is unclear. However, the Domestic Violence Law represents real progress in terms of providing a starting point for a child protection framework.

There remain many challenges. There need to be clearer definitions of child abuse, child neglect is not mentioned, and it is not at all clear how the legislation will be enacted at a local level. Second, procedures and standards for evaluating cases of child abuse and neglect need to be developed. This all requires the training of social workers in child

protection. The discipline of social work has developed and grown rapidly over the past decade and child social work is now a recognized sub-speciality.[261,262]

Challenges in the health system

Besides these specific health problems in each stage as discussed above, there are also a series of structural challenges that are rooted in the current health systems, and which may affect access, equity and quality in RMNCAH services.

Quality of Human Resources and Career Development

Density of human resources for health is significant in accounting for maternal and child mortality and other health outcomes.[263,264] A recent study has shown that one additional health professional per 1000 population was associated with a 2.6% reduction of U5MR in rural China.[265] Due to the dramatic decline in the number of women of reproductive age and newborns in recent years,[2,10,266] together with an increase in the absolute number of healthcare providers,[10,14] there seems to be no shortage of human resources for RMNCAH at present. According to data from the Department of Women and Children Health, National Health Commission, there were 182,000 midwives (12.0/1000 newborns), 205,000 obstetricians (13.5/1000 newborns) and 144,000 paediatricians (0.61/1000 children aged 0-14 years old) in 2018, all nearly reaching the standards recommended by the WHO (6 midwives/1000 newborns)[267] and the targets of Chinese government (0.69 paediatrician/1000 children aged 0-14 years old by 2020).[268] However, China has not established a formal midwifery registration system, and a large number of registered midwives in China are actually obstetricians. China's successful model of almost 100% hospitalised deliveries is largely based on doctors. China needs a more midwife-led model of maternal care, which includes physical-psychological-emotional and social support for mothers. So there is an urgent need to establish a formal midwifery training and registration system.

The quality of RMNCAH human resources and their career development has become another increasing source of concern, along with an increasing demand for high-quality RMNCAH services. Among all-specialty registered physicians in China, the proportion of those who have a bachelor's degree or higher was only 58.3% in 2017.[29] This means that over 40% of registered doctors across all specialties had only three years of training. According to *The White Paper on Chinese Physicians* (2017) published by the Chinese Medical Doctor Association,[269] in which 146,000 physicians were surveyed nationwide,

71% reported suffering from the pressures related to medical disputes, heavy workloads and/or their patients' excessive expectations regarding treatment effects. More than half reported having experienced at least one instance of work related pressures in the past year. Obstetricians, midwives and pediatricians are more likely to work under huge pressures compared to other medical professionals because of the sensitivity to events in maternal and child health.[270,271]

Competency of RMNCAH services in Primary Health Care

One of the most important recent strategies in reforming China's health system has been to establish a GP-led primary health system and promote tiered diagnosis and treatment protocols. The Chinese government has proposed that "by 2020 and 2030, the average number of GPs per 10,000 population should reach 2-3 and 5, respectively".[272] The number of GPs in China has grown rapidly in recent years, rising to 2.22 per 10,000 population in 2018, 2.93 in eastern areas, 1.73 in central areas and 1.66 in western areas, with the highest in Jiangsu (5.94) while the lowest is in Tibet (1.02).[16] The current 36-month routine described for GPs in Standardized Training in China[273] includes only two months of paediatrics and one month of obstetrics and gynaecology with six months in community health services. So they are not qualified to provide appropriate RMNCAH services in primary health care. Pediatricians do form an important part of health workforce in primary health care but 50% to 60% of pediatricians in primary care facilities graduated from junior colleges and polytechnic schools.[274] Moreover, the GP-led primary health system generally covers key populations such as children under five, pregnant women, and the elderly. The adolescent health has long been neglected. Adolescent health services largely depend on the school health service providers. Although the school health providers actually take some responsibility for students' health, both quantity and quality problems exist. According to an investigation of school health providers in primary and secondary schools in 16 provinces in 2015,[275] 33% of 6466 schools had at least one school health provider, who had responsibility for an average of 2814 students. There are big gaps in school health provision especially in rural areas in the Central and Western regions.

Equity and Quality of RMNCAH Services

Equity. According to the Global Healthcare Access and Quality Index, China's performance increased from 42.6 to 77.9 (out of 100) between 1990 and 2016 and

improved in rank from 107th to 48th out of 195 countries and territories, but there are wide disparities between provinces with Beijing scoring 91.5 and Tibet 48.0.[276] With unbalanced socioeconomic development in China, high-quality health resources tend to be concentrated in developed regions (Appendix 28). In the absence of gate-keeping, people are more likely to go directly to high-level services creating overwhelming demand at higher levels while lower level services are often underutilized. (Appendix 29). Geographic and economic inequities also influence the utilization of RMNCAH services in different regions and population groups (Appendix 30). Evidence has shown that poorer women and adolescents from rural areas, those from ethnic minorities and rural-urban migrants are less likely to access to sexual and reproductive health services.[277-279] A meta-analysis showed that ethnic minority women were less likely to use antenatal care and to immunise their children compared with Han populations in western China.[280] Rural-urban migrants are particularly vulnerable in the health care utilization because their health insurance generally does not cover services at their urban destination.[281-283]

Quality. As in many other countries, China's RMNCAH faces the twin problems of the "Too Little, Too Late" (TLTL) and "Too Much, Too Soon" (TMTS), which refers to the absence of timely access to quality care for some, and overtreatment for others, respectively.[284] With respect to TLTL in the field of RMNCAH services, the many evidence-based guidelines are often not followed. For instance, a study conducted in four provinces (Beijing, Shaanxi, Sichuan, Inner Mongolia) showed that early newborn care practices in hospitals were not consistent with WHO recommendations for 10 (59%) of the 17 recommended measures.[285] Another example is that among 315 drugs recommended in the WHO Model List of Essential Medicines for Children (EMLc)-the sixth version launched in 2017,[286] only 226 drugs (71.7%) have been covered by the National Essential Drug List (2017 version).[287] Furthermore, China has not established a specific list for Children to set criterions of drug dosages or dosage forms recommended for children.

TMTS or over treatment is a huge problem. The overuse of cesarean section is a prime example. The overall annual rate of cesarean sections in China was reported to increase from 28.8% in 2008 to 34.9% in 2014,[144] and then to 36.7% in 2018.[288] Many factors contributed to the rise. First, around one-quarter of caesarean sections are at maternal request.[289,290] Second, the economic incentives for hospitals and providers, inadequate resources for good pain relief in labour, and the convenience of cesarean sections in a

culture of obstetrician-led delivery, are also important contributors.[289-293] Third, along with the relaxing of population policy in recent years, the rate of cesarean sections among nulliparous mothers declined significantly, but the rate of cesarean sections among multiparous mothers was virtually unchanged, mainly due large numbers of multiparous mothers with previous cesarean section and maternal complications with advanced maternal age.[63,294] The government has made a series of recommendations: compliance with standard medical indications for cesarean section, increasing the capacity of midwifery services, and better access to pain relief in labour. Epidural analgesia is regarded as safe and effective, but requires anesthesiologists to be available at all times, which is unrealistic at present in many hospitals. According to data obtained from the China Maternal and Child Health Association (CMCHA), the prevalence of epidural analgesia among vaginal deliveries in 302 Mother-Baby Friendly Hospitals (MBFHs) in 26 provinces had increased from 5.0% in 2012 to 37.9% in 2018. In March 2019, the National Health Commission launched a nationwide pilot program on epidural analgesia in 913 hospitals across the country.[295]

Another problem of TMTS is the inappropriate use of antibiotics, especially for children, in part due to the absence of evidence-based specific guidelines. In 2016, the percentage of children <5 years old using antibiotics because of diarrhea or surgical prophylaxis was over 55% and 80%, respectively, according to the Centre for Antibacterial Surveillance in China.[296] Another study performed in Chinese primary healthcare settings showed that the percentage of cases of antibiotic use among outpatient prescriptions was 52.9%, and 55% of these were for antibiotic combination therapy including 2 or more agents.[297] In addition, there are also other TMTS problems in RMNCAH, such as induction of labour, augmentation with oxytocin, and episiotomy.[284] Such widespread TMTS problems in RMNCAH can cause avoidable harms, or unnecessarily increase the need for additional intervention.[284] Guidelines aimed at reducing TMTS procedures are urgently needed.

Financial Risk Protection

Financial risk protection is a critical determinant of universal health coverage.[298] A multi-country analysis showed that an increase of 1% in the proportion of out-of-pocket payments out of total health expenditures at the national level is associated with an average increase of 2.2% in the proportion of households facing catastrophic expenditures (catastrophic expenditures refer to household's financial contributions to

the health system that exceed 40% of its income, after subsistence needs have been met).[299] If the proportion of out-of-pocket payments is reduced to less than 15% of total health expenditure, the incidence of financial catastrophe and impoverishment falls to negligible levels.[299] This is a difficult target for many countries, so the WHO has recommended a more modest target of 30-40% for countries in East Asia and Western Pacific Region[298] and the target was set to below 25% for 2030 in the Outline of Healthy China 2030.[5]

The proportion of out-of-pocket payments out of total health expenditures for all healthcare services in China had decreased from 60% in 2001 to 28.8% in 2016.[300] In 2017, that out-of-pocket proportion for all healthcare services was still at 28.8%, but those out-of-pocket proportions for maternal, children and adolescent healthcare services were higher: 33.7% for maternal healthcare, 54.7% for 0-4 year-old child healthcare, 59.5% for 5-9 year-old child healthcare, and 61.0% for 10-19 year-old adolescent healthcare (Figure 13). The rest would be covered by a combination of social health insurance and some moderate government subsidies, especially for maternal health and children under 4 years old. In China, social health insurance coverage has reached over 95% of the population, so the higher out-of-pocket payments is not due to whether mothers and children have insurance or not, but the depth and breadth of coverage. For example, according to data from the 2017-2018 national hospitalization records (Appendix 31), the UEBMIS reimbursement proportion for hospitalization in obstetrics and gynaecology (OBGYN) was 61.1%, compared to 75.6% for other populations and diseases (UEBMIS does not cover children and adolescents aged 0-18 years old). Similarly, the NRCMS reimbursement proportions were 56.2% for OBGYN hospitalization, 57.1% for children & adolescents aged 0-18 years old vs 62.2% for other conditions; and the URBMIS reimbursement proportions were the lowest among the three types of insurances, 44.2% and 47.5% vs 53.6%, respectively. These differential reimbursement levels are most likely due to higher demand and use of services or drugs among mothers and children that fall outside the essential benefit package.

The higher out-of-pocket burden on children and adolescents are further exacerbated by the fact that UEBMI do not cover them. They are covered by NRCMS and URBMIS which offer less generous coverage policies due to less funding[301] and also importantly, most NRCMS and URBMIS primarily covered inpatient care and provided limited (or no) coverage for outpatient visits,[302] yet, children and adolescents are more likely to

seek outpatient services.[303,304] However, recent government policies have stipulated that all insurance funds have to cover outpatient services.

Integrated RMNCAH information system

There are problems with existing MCH information systems. One problem is that the information system such as NMCHS, MCHSS, and NDSIS, are not linked, and data cannot be exchanged and shared between systems because of different surveillance population, non-unified information and statistical standards. The rapid development and extended application of information technologies in China, e.g. 5th-Generation, mobile communication equipment, means that an integrated RMNACH information system is now feasible. This will cover all stages of the life cycle, and involve participation of health institutions and multiple stakeholders. Another challenge will be linkages between the RMNACH information system and the existing hospital information system.

Section 4: Turning challenges into opportunities in the critical next 10 years

Ten years to Healthy China 2030 - a key time to stay on track in RMNCAH

By 2030, China has committed to achieving both the SDGs and Healthy China 2030, both of which present RMNCAH as one of the key components and universal health coverage as a principal target. China is currently entering a transition period, with huge changes in socio-economic conditions, epidemiology, demographics, and technologies. These transitions may accelerate over the next 10 years. RMNCAH in China is also in a transition period from a focus on survival to one on thriving, with high-quality service demands and emerging challenges for access to RMNCAH services, as well as equity and quality in the new era. From the data and analysis in Section 3, the main challenges in the field of RMNCAH that may impede the realization of the SDGs and Healthy China 2030 are summarised in Figure 14.

RMNCAH mainly focuses on two key matters: "birth" and "development" of the new generation, as these are principal driving forces for a high-quality workforce and social development in the future, especially in this era of low fertility and population ageing in China. In other words, RMNCAH is a crucial determinant of social sustainability for a better future. Therefore, it is necessary to put forward an RMNCAH strategy framework and corresponding recommendations towards 2030. Otherwise, China may fail to achieve the "thriving" goals of RMNCAH in the next 10 years.[8]

RMNCAH Strategy Framework for Healthy China 2030

To achieve the "thriving" goals of RMNCAH by 2030, the Commission has developed a RMNCAH strategy framework for Healthy China 2030 (Figure 15) based on WHO frameworks of health systems building blocks and universal health coverage.[305,306] In the current framework, RMNCAH service delivery consists of four essential elements: financing, workforce, medicine and technology, and information technology (IT) system. Its performance will be evaluated in terms of access, quality, and equity, with a supportive environment based on contextual factors including governance and leadership, policy and legislation, society and community, in order to ultimately achieve universal health coverage in RMNCAH. Detailed descriptions of this framework and each component can be seen in Appendix 32.

Recommendations for achieving RMNCAH universal coverage by 2030

We have summarized the priority areas and drawn-up a series of recommendations according to the strategic framework, for reproductive health, maternal and newborn health, child and adolescent health, the health system, and the broader context beyond health systems, to progress towards RMNCAH universal coverage.

Reproductive health

In the field of reproductive health, the major challenges involve: i. decreased and delayed fertility intention; ii. birth control, contraception and abortion; iii. infertility and ART; iv. STDs; v. breast cancer, cervical cancer and HPV vaccine; and vi. sexual and gender-based violence. Here, we make several recommendations to improve reproductive health services and outcomes:

(1) Increase the fertility rate and fulfil reproductive health rights by promoting and enacting pronatal population policies, including:

a. build a supportive environment in society and families, by improving maternity benefits of working, education, social welfare, and access to affordable child bearing and caring;

b. encourage childbearing in women at an optimal reproductive age (the best age range is 22-28 years old, the better is age<35 years old) and appropriate birth spacing (18-59 months) for both their own and their offspring's health;

c. adjust the "two-child" policy, starting with a pilot implementation in some low-fertility regions.

(2) Strengthen sexual and reproductive health education from the early stage of childhood and adolescence, including the prevention of STDs, promoting contraceptive methods, menstrual health care, and awareness of sexual and gender-based violence.

(3) Improve accessibility, quality and equity of reproductive and fertility services, including:

a. integrate reproductive health counselling, premarital screening, and preconception health care as parts of national essential public health packages, within primary care. Such an approach needs to be piloted and evaluated before introduced to the whole country;

b. expand the coverage of social health insurances for assessment, diagnosis and treatment of infertility, to reduce financial barriers of access to fertility services;

c. strengthen the accreditation, supervision, regulation, and surveillance of ART,

especially the approvals of technologies, such as fertility preservation, which should be comprehensively considered with reproductive health rights, ethical principles, medical indications and social cultures.

(4) Promote the prevention and screening of women's cancers, including:

a. improve the screening and early diagnosis of breast cancer and cervical cancer and link it with social health insurances, in line with the Healthy China Initiative (2019-2030);[307,308]

b. support domestic production of HPV vaccine and link it with social health insurances, to cover all girls and boys before sexually active.

(5) Establish mechanisms that screen, prevent and respond to sexual and gender-based violence for women, children, and adolescents. These efforts should aim to increase the experience and sensitivity of medical personnel, teachers, and community health workers to identify violence.

Maternal and newborn health

In the field of maternal and newborn health, the priority issues include: i. safe motherhood guarantee; ii. stillbirth; iii. premature birth and birth defect; iv. maternal, fetal and newborn nutrition; and v. maternal mental health. Our recommendations are as follows:

(1) Improve the quality of maternal health care and obstetric services, including:

a. take the maternal near miss ratio and mortality index as an important indictor to evaluate the quality of obstetric services,[309] and use reduction of these indicators as an evaluation goal;

b. develop a regular mechanism for technical training to improve medical skills in early identification and intervention of maternal complications in grassroots hospitals, and incorporate the deployment and retention of skilled obstetricians and midwives into the national poverty alleviation programme;

c. establish a routine mechanism of supervision and training for the implementation of clinical norms and guidelines and the mechanism of monitoring obstetric quality;

d. develop and promote technical guidelines about comprehensive MDT for obstetrics appropriate to the local context

(2) Develop and promote technical guidelines for prevention and management of stillbirth. Provide high quality preconception and perinatal care and reproductive counseling for women at high risk for stillbirth and prematurity. Improve the services

of stillbirth autopsy and develop training in provision of bereavement support after stillbirth and neonatal death.

(3) Improve services for the prevention and treatment of premature birth and congenital abnormality, including:

a. develop and promote regulations and technical guidelines for the treatment and management of extremely premature infants less than 28 weeks, and integrated management of infant with severe congenital abnormalities in the prenatal and postnatal periods;

b. establish a comprehensive long-term postnatal follow-up, to provide assessment, treatment, support and guidance for the care of preterm infants and those with birth defects;

c. comprehensive care and rehabilitation of children born premature or with birth defects and other disabilities should be provided free of charge for poor families.

(4) Strengthen the monitoring, intervention and guidance of maternal and newborn nutrition, including:

a. strengthen nutrition monitoring, assessment and counseling before and during pregnancy, especially for women with high risk pregnancy, such as pregnant women with gestational diabetes and hypertensive disorders;

b. promote the affordable, accessible and appropriate interventions suggested by WHO in poor areas;

c. formulate nutritional standards for Chinese women during pregnancy, e.g. the standard of weight gain during pregnancy;

d. carry out specific training in breastfeeding support in hospitals, regulate the marketing of breastmilk substitutes and strengthen social support for breast feeding in the from community and work place.

(5) Establish a system for screening, diagnosis and intervention for perinatal depression, develop diagnostic tools for perinatal depression suitable for the Chinese population; and increase public awareness of perinatal depression, so that patients can obtain adequate social support and/or professional attention.

Child and adolescent health

For child and adolescent health, the priorities include: i. injury; ii. lifestyle and health risks; iii. mental health; and iv. vulnerable children. Thus, we make several recommendations aimed at improving child and adolescent health services and

outcomes:

(1) Identify culturally appropriate cost-effective ECD interventions with a focus on vulnerable children, including:

a. ensuring that ECD interventions are piloted and rigorously evaluated before scale-up. Robust evidence needs to be collected on the effectiveness of all the investments by government and private sectors in ECD programmes;

b. build surveillance system for child development to motivate, track political and financial commitments on ECD, and to evaluate implementation and impact of ECD programs and policies with internationally comparable assessment tool.

(2) Develop the subspecialty of adolescent health with appropriate training of professionals, including:

a. establish specific adolescent health indicators with a focus on mental health in the ongoing national surveillance systems for adolescent health;[310]

b. integrate the school health service providers, with service providers in community clinics, as well as hospitals with youth friendly services, to create targeted adolescent health teams at different levels.

(3) Improve the capacity for primary care providers to deliver treatment and prevention for children and adolescents Competency oriented medical education and continuous education system for paediatric general practitioners are urgently needed.

a. pediatric training programs and general standards for accreditation should be reviewed and upgraded. Priority should be given to curriculum content specification to include more general pediatrics training;

b. encourage regional collaborations for paediatric training to provide education in line with local needs;

c. given the heavy workload of senior pediatricians in teaching hospitals, investment on workforce support in generalists, hospitalists, and advanced clinical practitioners (including medical officers, physician assistants, nurse practitioners) is urgently needed to guarantee their teaching time.

(4) programs on enhancing parenting skills should be incorporated into primary health care, aiming to establish emotionally supportive and developmentally stimulating nurturing relationship to ensure positive lifelong development of children from an early age, including:

a. home visiting and ECD centers which are effective interventions, should be implemented in the poorest areas. For a broader range of population, integration of

parenting skills education into regular child health checkups is needed;

b. facing with the digital era, more investment could made in enhancing parenting skills by mHealth programs, which is much less costly than face-to-face interventions.[311]

(5) Create a youth-supportive environment, including youth-friendly communities and hospitals, free public gyms and outdoor activity areas to promote physical activity.

(6) Establish a child protection service system for the screening and reporting of and intervention in child maltreatment. This requires raising awareness of this issue developing procedures and standards for evaluating cases of child abuse and neglect and training of social workers in child protection.

(7) Enforce legislation on injury protection (e.g., car-seats, a poisoning hotline, child protection packaging for falling and drowning). We recommend to examine and ensure the legislation of effective interventions on prevention of child injury as the first step, and then ensure the enforcement.

(8) Actions are necessary to support healthy lifestyles in adolescents, including:

a. "Healthy China 2030" calls for increasing taxation and legislation to prohibit the sale of tobacco and alcohol to children and sets a goal for controlling the rate of smoking to below 20% for people older than 15 years of age by 2030, and we call for making it illegal to sell tobacco products to those under 21 and stronger anti-smoking campaigns and high tobacco taxes;

b. we propose a sugar tax, and strategies to promote physical activity;

c. these measures require the co-operations of the food, drinks and tobacco sector, encouraging them to provide better, healthier and lifestyle-oriented products can be seen as a commercial opportunity.

The health system

For the health system related to RMNCAH, the major challenges involve: i. human resources and career development; ii. competency of RMNCAH services in primary health care; iii. equity and quality of RMNCAH services; iv. financing risk protection; and v. integrated RMNCAH information system. Our recommendations to improve the RMNCAH-related health system are as follows:

(1) Enhance the capacity and quality of the RMNCAH health workforce by establishing an appropriate professional and vocational training system for general practitioners (GPs) and midwives, by encouraging task shifting to recruit the RMNCAH-related

healthcare workers from the health system or other related systems, and by promoting the innovation of learning and training approaches via the application of new IT technologies.

(2) Improve the quality of the RMNCAH-related primary health system, including:

a. improve the competency of RMNCAH services in GPs and community health workers, by integrating essential RMNCAH services (such as nutrition promotion and mental health) into the current training curricula;

b. establish the quality measurement and improvement systems that are linked with incentives to ensure that services are monitored, outcomes are assessed, and providers are held accountable;[312]

c. integrate clinical care with essential public health services, by combining the public health budget with the social health insurance budget and adopting the capitation payment method that should be risk adjusted and cover the RMNCAH service packages of health promotion, prevention, management and clinical care;[312,313]

d. establish the medical alliance or integrated delivery system (as encouraged by the State Council[314]) between primary health services institutions, MCH facilities, and general/specialized hospitals, for dual referral mechanisms, staff training and technical support via the application of new IT technologies, such as e-health and artificial intelligence (IT);

e. enrich the contents and forms of health education and promotion for individuals, families and communities. Except for the healthy knowledge and behaviors, information of available healthcare sources, health and medical insurances, and measures on how to protect women's and children's health rights should be considered as matters of great concern. Furthermore, the application of new IT technologies will make the communication and education more convenient, timely, vivid and far-reaching.

(3) Strengthen financial risk protection and reduce out-of-pocket healthcare burden by improving the reimbursement ratios and service coverages of social health insurances for RMNCAH services. Efficient use of RMNCAH services and establishing a case-based payment system is equally important for avoiding the overuse of any service payment system.

(4) Avoid "too little, too late" and "too much, too soon" in RMNCAH services by promoting evidence-based practice and thus reducing over-intervention, by developing or amending technical guidelines with specific evaluation indicators and assessment criteria, which should be linked with the performance measurements of healthcare

providers. In addition, the continuously updated capacity and equipment on the supply side (services facilities / providers) is beneficial to reducing “too little, too late”, while the trusting relationship between providers and patients in the health service delivering systems and patients’ engagement for shared decision-making in healthcare are very helpful to reducing both “too little, too late” and “too much, too soon”.

(5) Improve person-centred healthcare in the field of RMNCAH by fostering dignity in health care and professionalism among healthcare workers by improving professional management system (within and across-specialties), multidisciplinary team work, and organizational culture in health institutions.

(6) Advance the surveillance and monitoring of RMNCAH indicators, including:

a. add new indicators for major RMNCAH problems that are emerging or neglected, including infertility and subfertility, stillbirth, early child development, mental health, and sexual and gender-based violence;

b. establish an integrated health information system covering the whole life course of RMNCAH, from women to their offspring, to help link key events and trajectories at each stage and then make sound and timely decisions for better services and interventions;

c. further advance data sharing across sectors to link different kinds of health databases together as well as link them with other basic population databases (household registration, mobile population, social and commercial insurances, human resources and others) to provide more accurate evidence for RMNCAH interventions and policy making, through applying new IT and AI technologies and breaking down non-technical barriers.

The broader social context beyond health systems

As shown in the RMNCAH strategy framework, besides improving the access, equity and quality of RMNCAH services delivery within the health system, the universal health coverage in RMNCAH should be supported by the broader context of non-health systems. Therefore, we have made several recommendations around building a supportive environment for universal health coverage in RMNCAH:

(1) Universally ensure the health rights of women and children, by further improving women’s socio-economic status and empowerment, promoting equity and fairness, and breaking culture barriers and discrimination in every corner of society.

(2) Improve research, monitoring, investments, and substantial evidence-based

measures focusing on how to improve the health-related social rights (such as education, employment, security, welfare, childbearing and supportive surroundings) of women and children.

(3) Enforce health in all policies & multi-sector collaboration in the field of RMNCAH, with RMNCAH considerations incorporated into the top-level design of policies, legislations and decision-making across sectors. The National Working Committee Children and Women serves as a deliberative coordinating body of 35 national sectors based on the framework of "Two Outlines". It should further promote the allocation of responsibility and division of labour in cross-sectoral cooperation.

(4) Promote men's involvement in RMNCAH, especially their roles in reproductive health and responsive parenting, to protect their partners' sexual and reproductive health rights and participate in their children's early development and family education.

(5) Develop civil society as an essential part of the current social governance system. This will require improving the citizen's self-awareness and empowerment to ensure their own health rights, as well as encouraging the non-governmental organizations and grassroot communities to participate in all aspects of RMNCAH strategies and actions for Healthy China 2030.

Translating recommendations into policy

Translating the recommendations of the Commission into policy is crucial to achieving the "thriving" goals of RMNCAH over the next 10 years. First, many domestic experts on the Commission are participating in the evaluation of the "Two Outlines" (*Outline of Women's Development* and *of Children's Development*) (2011-2020) and the formulation of the new "Two Outlines" for 2021-2030. This will ensure that the challenges and recommendations of the Commission are introduced at the highest policy level. Second, the Commission Report will be submitted to the National Working Committee on Children and Women and other relevant entities, such as the National Health Commission, Ministry of Education, Ministry of Science and Technology, and Ministry of Finance, to promote and realize the principle of "RMNCAH in all policies". Third, all domestic and international experts are engaged in different fields of RMNCAH, and their academic work is vital evidence for making RMNCAH-related policies in many sectors of China. Fourth, it is necessary to hold a multi-media campaign to motivate the public and civil societies participating in each aspect of RMNCAH strategies and actions for Healthy China 2030. Finally, China is a huge and

diverse country; therefore, implementation of recommendations needs to be planned and piloted, tested and evaluated using by cost-effective assessments, and then disseminated nationwide. This is one of the most important lessons from China's RMNCAH achievements in the past.

Lessons to share with low and lower-middle-income countries

China has actively participated in international medical assistances and global health governance. Since the first medical team dispatched to Algeria in 1963, health is one of the most important fields in the government's foreign assistance, mainly involving dispatching medical teams, training local medical professionals, providing medicines and medical equipment, and building hospitals and health service centers. More than 80% of the recipient countries are low or lower-middle-income countries (LLMICs).[315,316] China promised to implement 100 foreign assistance programmes for women and children's health in developing countries during 2016-2020.[317] The "Beijing Communiqué of the Belt and Road Health Cooperation" issued in 2017, has clearly indicated that women, children and adolescents are target groups in the cooperation for global health in the Belt and Road Initiative.[318] There is a very broad spectrum of RMNCAH systems and services in China, lessons from China can help LLMICs improve their own RMNCAH systems and services.

Several successful lessons have been extracted from China's efforts and achievements in RMNCAH in the past, as detailed discussed in *Section 2*, including: political will to focus on RMNACH, building of the hierarchical MCH system and the MCH information system, providing comprehensive social health insurances, launching national RMNCAH programmes, and poverty alleviation. Furthermore, reducing MMR and U5MR, as the biggest achievement of RMNCAH in China, is still a tough challenge for the vast majority of developing countries. Thus, we highlighted key points from China's successful experiences when struggling with those "survival" goals (Panel 4). In addition, during the pandemic of Covid-19, China has responded quickly to ensure the continuity and quality of essential maternal and child services when coping with such major public health emergencies. Key points on preventing and controlling of Covid-19 among women and children in China have been summarized, including to safeguard and reconstruct health resources; epidemiological, clinical and basic research; and guidelines & reforming services (Panel 5).

Except for these successful lessons, there are also some precautions when introducing

the “Chinese experience” into LLMICs, including: (1) ***China's unique MCH system cultural factors.*** China's achievements in RMNCAH are inseparable from two important determinants. The first is its strong political will to focus on RMNACH and the hierarchical MCH system, which facilitates uniform implementation of RMNCAH policies. The second is the gender equity as the consensus of the whole society. China also has its unique characteristics in population size, economic pattern, geographic distribution, and social culture, all of which may affect the applicability and transferability when sharing the “Chinese experience” with LLMICs. (2) ***Impacts on existing health systems and conflict of interests.*** Introducing any new intervention or policy will inevitably have certain impacts on the existing health system and bring about conflict of interests. Therefore, when considering the transformability of interventions and health policies that have succeeded in China, three aspects need to be concerned: first, whether the current health system has the implementation capacity to undertake certain reforms; second, the potential for adverse incentives to arise from implementing reforms; and third, the acceptability of interventions to different stakeholders.

Conclusion

RMNCAH services play a pivotal role in the lives of each woman, child and adolescent, as well as guaranteeing the sustainable development of the whole society. Following outstanding achievements in RMNCAH over recent decades, China is making a transition from an emphasis on “survival” to “thriving”. The over-arching goal has shifted from reducing maternal and child mortality to achieving high-quality universal health coverage with a continuing emphasis on access, equity and quality as well as nurturing a supportive environment for health and health services. Therefore, the principles of “RMNCAH for all” and “all for RMNCAH” should become a consensus all over the country. In addition, along with the deep-going “Belt and Road Initiative” and globalization, China has been actively participating in global health governance. Based on those achievements and lessons in the past, we believe that China is well on its way to achieve the high-quality universal health coverage in RMNCAH towards SDGs and “Healthy China 2030”. Looking to the future, China is acting responsibly to create a healthy and friendly environment for every woman, child and adolescent for their own sake and as important partners in RMNCAH global governance.

Contributors

JQ, LS, and JZ conceived and led the preparation, organisation, structure and all contents of the Commission. TH improved the concepts and revised specific elements and contents of this Commission. FJ, JunMa, JingMa, and WF were responsible for specific contents of Child Health, Adolescent Health, Health Financing, and Health System. YW, XL, YZ, and YS were involved in data collection, analysis, interpretation, and the writing and editing of draft texts. RP, ZZ, JZhang, XQ, LW, JW, MM, DM, YG, JQiu, LL, and HW participated in the preparation, discussion and revision of the Commission. JL, R.E.B, CR, and GP participated in the preparation, discussion and revision of the Commission with their international backgrounds. H.M.C, P.C.K.L, and R. J. N were involved in the revision of the Commission. JQ coordinated the Commission. All authors approved the final version for publication and agree to be accountable for resolving any future questions related to the integrity or accuracy of the report.

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References

1. Hesketh T, Wei XZ. Health in China. From Mao to market reform. *BMJ* 1997; **314**(7093): 1543-5.
2. World Population Prospects 2017 - United Nations. 2017. https://esa.un.org/unpd/wpp/.
3. The Global Strategy for Women's, Children's and Adolescents' Health (2016-2030): Survive, Thrive, Transform: UN/WHO, 2016.
4. PMNCH, WHO, World Bank and AHPSR. Success Factors for Women's and Children's Health Policy and programme highlights from 10 fast-track countries. Geneva: WHO, 2014.
5. *Outline Programme for Healthy China 2030*. 2016. http://www.gov.cn/zhengce/2016-10/25/content_5124174.htm (accessed 2018/08/14.
6. The State Council. The Outline of the 13th Five-Year Plan for targeted poverty alleviation. 2016.
7. National Health Commission. The implementation plan of targeted poverty alleviation in health (2018-2020). 2018. http://www.nhc.gov.cn/caiwusi/s7812c/201812/63e47d97fa9b4100afe632dca19d1395.shtml.
8. Lozano R, Fullman N, Abate D, et al. Measuring progress from 1990 to 2017 and projecting attainment to 2030 of the health-related Sustainable Development Goals for 195 countries and territories: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet* 2018; **392**(10159): 2091-138.
9. Li L. Reflections on the public health of People's Republic of China for the past 60 years. *Chin J Publ Health Med* 2014; **30**: 311-5.
10. National Health Commission. 2019 Statistical Bulletin of National Health Development in China, 2020.
11. UNICEF. Neonatal mortality. 2019. https://data.unicef.org/topic/child-survival/neonatal-mortality/ (accessed 15 July 2020).
12. Collaborators GBDMM. Global, regional, and national levels of maternal mortality, 1990-2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 2016; **388**(10053): 1775-812.
13. Yanhui Dong PH, Yi Song, Bin Dong, Zhiyong Zou, Zhenghe Wang, Rongbin Xu, Dongmei Luo, Disi Gao, Bo Wen, Yinghua Ma, Jun Ma, Xiaobo Tian, Xiaona Huang, George C Patton. Secular trends in mortality and causes of death among children and adolescents aged 1–19 years in China from 1953 to 2016: a national and subnational variations systematic analysis *Journal of Adolescent Health* 2019.
14. Department of Maternal and Child Health, National Health Commission. Report on the development of maternal and child health in China (2019). 2019. http://www.nhc.gov.cn/fys/s7901/201905/bbd8e2134a7e47958c5c9ef032e1dfa2.shtml.
15. Song Y, Agardh A, Ma J, et al. National trends in stunting, thinness and overweight among Chinese school-aged children, 1985-2014. *Int J Obes (Lond)* 2018.
16. National Health Commission. China Health Statistics Yearbook 2019. Beijing: Union Medical University Press; 2020.
17. Kuruvilla S, Schweitzer J, Bishai D, et al. Success factors for reducing maternal and child mortality. *Bull World Health Organ* 2014; **92**(7): 533-44B.
18. Langer A, Meleis A, Knaul FM, et al. Women and Health: the key for sustainable development. *Lancet* 2015; **386**(9999): 1165-210.
19. Hannum E, Wang MY. Geography and educational inequality in China. *China Econ Rev* 2006; **17**(3): 253-65.
20. Hesketh T, Lu L, Xing ZW. The effect of China's one-child family policy after 25 years. *N Engl J Med* 2005; **353**(11): 1171-6.
21. Hipgrave D. Communicable disease control in China: From Mao to now. *J Glob Health* 2011; **1**(2): 224-38.

22. Department of Maternity and Children MoHotPsRoC. Achievements in women's health care in new China. *Heilongjiang Medicine Journal* 1960; **5**.
23. Gu X, Fang L. Between voluntariness and compulsion — Analysis on Institutional Embeddedness and Sustainable Development of Rural Cooperative Medical Schemes in China. *Sociological Research* 2004; (5): 1-18.
24. Chen ZQ, Zhang GC, Gong XD, et al. Syphilis in China: results of a national surveillance programme. *Lancet* 2007; **369**(9556): 132-8.
25. *An Analysis Report of National Health Services Survey in China, 2013*: Center for Health Statistics and Information, NHFPC.
26. Feng XL, Shi G, Wang Y, et al. AN IMPACT EVALUATION OF THE SAFE MOTHERHOOD PROGRAM IN CHINA. *Health Economics* 2010; **19**: 69-94.
27. Liang J, Li X, Dai L, et al. The changes in maternal mortality in 1000 counties in mid-Western China by a government-initiated intervention. *PLoS One* 2012; **7**(5): e37458.
28. Li L, Fu H. China's health care system reform: Progress and prospects. *International Journal of Health Planning and Management* 2017; **32**(3): 240-53.
29. National Health Commission. National Health Statistics Yearbook 2018. Beijing: Peking Union Medical College Press; 2018.
30. Zhang T. Health Care for Women and Children in China: over half sky. Beijing: People's Medical Publishing House; 2019.
31. Feng XL, Guo S, Hipgrave D, et al. China's facility-based birth strategy and neonatal mortality: a population-based epidemiological study. *Lancet* 2011; **378**(9801): 1493-500.
32. Li H-T, Luo S, Trasande L, et al. Geographic Variations and Temporal Trends in Cesarean Delivery Rates in China, 2008-2014. *Jama-Journal of the American Medical Association* 2017; **317**(1): 69-76.
33. He C, Liu L, Chu Y, et al. National and subnational all-cause and cause-specific child mortality in China, 1996-2015: a systematic analysis with implications for the Sustainable Development Goals. *Lancet Glob Health* 2017; **5**(2): e186-e97.
34. Liang J, Zhu J, Dai L, Li X, Li M, Wang Y. Maternal mortality in China, 1996-2005. *Int J Gynaecol Obstet* 2010; **110**(2): 93-6.
35. Li X, Zhu J, Wang Y, et al. Geographic and urban-rural disparities in the total prevalence of neural tube defects and their subtypes during 2006-2008 in China: a study using the hospital-based birth defects surveillance system. *BMC Public Health* 2013; **13**: 161.
36. Lu R, Li X, Guo S, et al. Neonatal mortality in the urban and rural China between 1996 and 2013: a retrospective study. *Pediatr Res* 2016; **79**(5): 689-96.
37. Shi L. Health care in China: a rural-urban comparison after the socioeconomic reforms. *Bull World Health Organ* 1993; **71**(6): 723-36.
38. Barber SL, Yao L. Development and status of health insurance systems in China. *Int J Health Plann Manage* 2011; **26**(4): 339-56.
39. National Healthcare Security Administration. Notice on Urban & Rural Residents Basic Medical Insurance System. 2018. http://www.nhsa.gov.cn/art/2018/8/14/art_37_316.html.
40. Zhao P, Diao Y, You L, Wu S, Yang L, Liu Y. The influence of basic public health service project on maternal health services: an interrupted time series study. *Bmc Public Health* 2019; **19**.
41. Tao W, Zeng Z, Dang H, et al. Towards universal health coverage: achievements and challenges of 10 years of healthcare reform in China. *Bmj Global Health* 2020; **5**(3).
42. Tao W, Zeng Z, Dang H, et al. Towards universal health coverage: lessons from 10 years of healthcare reform in China. *Bmj Global Health* 2020; **5**(3).
43. Evaluation report of major public health service projects for women and children: Department of Maternal and Child Health, National Health Commission, 2012.
44. Gao Y, Zhou H, Singh NS, et al. Progress and challenges in maternal health in western China: a Countdown to 2015 national case study. *Lancet Global Health* 2017; **5**(5): E523-E36.

45. Feng XL, Theodoratou E, Liu L, et al. Social, economic, political and health system and program determinants of child mortality reduction in China between 1990 and 2006: A systematic analysis. *J Glob Health* 2012; **2**(1): 010405.
46. Yang X, Tang S, Yamey G, Qian X. Strengthening maternal and child health in China: Lessons from transforming policy proposals into action. *Bioscience Trends* 2018; **12**(2): 211-4.
47. Kaufman J. HIV, sex work, and civil society in China. *J Infect Dis* 2011; **204 Suppl 5**: S1218-22.
48. Xu H, Zeng Y, Anderson AF. Chinese NGOs in action against HIV/AIDS. *Cell Res* 2005; **15**(11-12): 914-8.
49. Liu L, Wang D, Qin X, Hu Z, Chen R. The impact of social capital on civil society organizations delivering voluntary counseling and testing HIV/AIDS service: a cross-sectional study in China. *Biosci Trends* 2020.
50. United Nations | The Millennium Development Goals Report 2015. New York: United Nations, 2015 年.
51. United Nations System in China & Ministry of Foreign Affairs, People's Republic of China | Report on China's Implementation of the Millennium Development Goals (2000-2015), 2015.
52. Green MJ, Stritzel H, Smith C, Popham F, Crosnoe R. Timing of poverty in childhood and adolescent health: Evidence from the US and UK. *Social Science & Medicine* 2018; **197**: 136-43.
53. Justice LM, Jiang H, Purtell KM, et al. Conditions of Poverty, Parent-Child Interactions, and Toddlers' Early Language Skills in Low-Income Families. *Maternal and child health journal* 2019.
54. State Council Information Office. The State Council holds a press conference on the implementation of health poverty alleviation projects. 2016. http://www.scio.gov.cn/xwfbh/xwbfbh/wqfbh/33978/34697/index.htm.
55. News in National Bureau of Statistics (2019-02-15). 2019. http://www.stats.gov.cn/tjsj/zxfb/201902/t20190215_1649231.html.
56. Starrs AM, Ezeh AC, Barker G, et al. Accelerate progress-sexual and reproductive health and rights for all: report of the Guttmacher-Lancet Commission. *Lancet* 2018; **391**(10140): 2642-92.
57. Ding QJ, Hesketh T. Family size, fertility preferences, and sex ratio in China in the era of the one child family policy: results from national family planning and reproductive health survey. *British Medical Journal* 2006; **333**(7564): 371-3.
58. Hesketh T, Zhou X, Wang Y. The End of the One-Child Policy Lasting Implications for China. *Jama-Journal of the American Medical Association* 2015; **314**(24): 2619-20.
59. Hesketh T, Lu L, Xing ZW. The effect of China's one-child family policy after 25 years. *New England Journal of Medicine* 2005; **353**(11): 1171-6.
60. TAN X, FANG J, XIAO C, LIAO A, GONG X. The situation and countermeasure of induced abortion and contraceptive of China in the context of sustainable development goals of UN. *Chinese Journal of Family Planning* 2019; **27**(03): 276-80.
61. Liang J, Mu Y, Li X, et al. Relaxation of the one child policy and trends in caesarean section rates and birth outcomes in China between 2012 and 2016: observational study of nearly seven million health facility births. *Bmj-British Medical Journal* 2018; **360**.
62. National Bureau of Statistics. National Annual Statistical Bulletins. http://www.stats.gov.cn/tjsj/tjgb/ndtjgb/.
63. Li H-T, Xue M, Hellerstein S, et al. Association of China's universal two child policy with changes in births and birth related health factors: national, descriptive comparative study. *BMJ (Clinical research ed)* 2019; **366**: l4680-l.
64. Kelsey TW, Wright P, Nelson SM, Anderson RA, Wallace WHB. A validated model of serum anti-mullerian hormone from conception to menopause. *PloS one* 2011; **6**(7): e22024.
65. Broekmans FJ, Soules MR, Fauser BC. Ovarian aging: mechanisms and clinical consequences. *Endocrine reviews* 2009; **30**(5): 465-93.
66. Schummers L, Hutcheon JA, Hacker MR, et al. Absolute risks of obstetric outcomes by maternal age at first birth: a population-based cohort. *Epidemiology (Cambridge, Mass)* 2018; **29**(3): 379-87.

67. Wang Y, Qiao J. Trends and social determinants of adolescent marriage and fertility in China. *Lancet Glob Health* 2020; **8**(7): e873-e4.
68. Conde-Agudelo A, Rosas-Bermudez A, Kafury-Goeta AC. Birth spacing and risk of adverse perinatal outcomes - A meta-analysis. *Jama-Journal of the American Medical Association* 2006; **295**(15): 1809-23.
69. Zhang L, Shen S, He J, et al. Effect of Interpregnancy Interval on Adverse Perinatal Outcomes in Southern China: A Retrospective Cohort Study, 2000-2015. *Paediatric and Perinatal Epidemiology* 2018; **32**(2): 131-40.
70. Zhang B, Nian Y, Palmer M, et al. An ecological perspective on risk factors for repeat induced abortion in China. *Sexual & Reproductive Healthcare* 2018; **18**: 43-7.
71. Zhao FH, Tiggelaar SM, Hu SY, et al. A multi-center survey of age of sexual debut and sexual behavior in Chinese women: suggestions for optimal age of human papillomavirus vaccination in China. *Cancer Epidemiol* 2012; **36**(4): 384-90.
72. Li Y, Jiao N, Jiang H, Tan H, Qian X. The status and needs of sexual and reproductive health among adolescences in China. *Maternal & Child Health Care of China* 2015; **30**(13): 2122-5.
73. National Bureau of Statistics. China Statistical Yearbook 1999-2017. http://www.stats.gov.cn/tjsj/ndsj/ (accessed 2018-8-14 2018).
74. Santelli JS, Song X, Garbers S, Sharma V, Viner RM. Global Trends in Adolescent Fertility, 1990-2012, in Relation to National Wealth, Income Inequalities, and Educational Expenditures. *Journal of Adolescent Health* 2017; **60**(2): 161-8.
75. Fall CH, Sachdev HS, Osmond C, et al. Association between maternal age at childbirth and child and adult outcomes in the offspring: a prospective study in five low-income and middle-income countries (COHORTS collaboration). *Lancet Glob Health* 2015; **3**(7): e366-77.
76. Rai R, Regan L. Recurrent miscarriage. *Lancet* 2006; **368**(9535): 601-11.
77. Saravelos SH, Li TC. Unexplained recurrent miscarriage: how can we explain it? *Hum Reprod* 2012; **27**(7): 1882-6.
78. Robinson GE. Pregnancy loss. *Best Pract Res Clin Obstet Gynaecol* 2014; **28**(1): 169-78.
79. Liu B, Sheng G. Risk Factors for Spontaneous Abortion of Chinese Married Women at Reproductive Age. *China Public Health* 2002; **18**(7): 890-2.
80. Medicine PCotASfR. Evaluation and treatment of recurrent pregnancy loss: a committee opinion. *Fertil Steril* 2012; **98**(5): 1103-11.
81. Heffner LJ. Advanced maternal age - How old is too old? *New England Journal of Medicine* 2004; **351**(19): 1927-9.
82. Gelbaya TA, Potdar N, Jeve YB, Nardo LG. Definition and epidemiology of unexplained infertility. *Obstet Gynecol Surv* 2014; **69**(2): 109-15.
83. Vander Borght M, Wyns C. Fertility and infertility: Definition and epidemiology. *Clin Biochem* 2018; **62**: 2-10.
84. De Jonge C, Barratt CLR. The present crisis in male reproductive health: an urgent need for a political, social, and research roadmap. *Andrology* 2019.
85. Boivin J, Bunting L, Collins JA, Nygren KG. International estimates of infertility prevalence and treatment-seeking: potential need and demand for infertility medical care. *Hum Reprod* 2007; **22**(6): 1506-12.
86. Che Y, Cleland J. Infertility in Shanghai: prevalence, treatment seeking and impact. *J Obstet Gynaecol* 2002; **22**(6): 643-8.
87. Zhou Z, Zheng D, Wu H, et al. Epidemiology of infertility in China: a population-based study. *BJOG* 2018; **125**(4): 432-41.
88. Inhorn MC, Patrizio P. Infertility around the globe: new thinking on gender, reproductive technologies and global movements in the 21st century. *Hum Reprod Update* 2015; **21**(4): 411-26.
89. Cohen J, Fehilly CB, Fishel SB, et al. Male infertility successfully treated by in-vitro fertilisation. *Lancet* 1984; **1**(8388): 1239-40.

90. de Kretser DM. Male infertility. *Lancet* 1997; **349**(9054): 787-90.
91. Hirsh A. Male subfertility. *BMJ* 2003; **327**(7416): 669-72.
92. View C. China's first test-tube baby enters college. 2007.
93. Ministry of Health of the People's Republic of China (National Health Commission of the People's Republic of China). Managerial Method for Human Assisted Reproduction. 2001. http://www.nhc.gov.cn/fzs/s3576/201808/99ad3444a14340e79c8361ee23b96251.shtml (accessed 4-2 2019).
94. Ministry of Health of the People's Republic of China (National Health Commission of the People's Republic of China). Technical Standard for Human Assisted Reproduction. 2001. http://www.nhc.gov.cn/fzs/s3576/201808/99ad3444a14340e79c8361ee23b96251.shtml (accessed 4-2 2019).
95. Bai F, Wang DY, Fan YJ, et al. Assisted reproductive technology service availability, efficacy and safety in mainland China: 2016. *Hum Reprod* 2020; **35**(2): 446-52.
96. De Geyter C, Calhaz-Jorge C, Kupka MS, et al. ART in Europe, 2014: results generated from European registries by ESHRE: The European IVF-monitoring Consortium (EIM) for the European Society of Human Reproduction and Embryology (ESHRE). *Hum Reprod* 2018; **33**(9): 1586-601.
97. Centers for Disease Control and Prevention. Assisted Reproductive Technology (ART) Data, 2016 http://nccd.cdc.gov/drh_art.
98. Guo F, Yan L, Guo H, et al. The Transcriptome and DNA Methylome Landscapes of Human Primordial Germ Cells. *Cell* 2015; **161**(6): 1437-52.
99. Wang T, Sha H, Ji D, et al. Polar body genome transfer for preventing the transmission of inherited mitochondrial diseases. *Cell* 2014; **157**(7): 1591-604.
100. Guo H, Zhu P, Yan L, et al. The DNA methylation landscape of human early embryos. *Nature* 2014; **511**(7511): 606-10.
101. Hou Y, Fan W, Yan L, et al. Genome analyses of single human oocytes. *Cell* 2013; **155**(7): 1492-506.
102. Yan L, Huang L, Xu L, et al. Live births after simultaneous avoidance of monogenic diseases and chromosome abnormality by next-generation sequencing with linkage analyses. *Proc Natl Acad Sci U S A* 2015; **112**(52): 15964-9.
103. Xu J, Zhang Z, Niu W, et al. Mapping allele with resolved carrier status of Robertsonian and reciprocal translocation in human preimplantation embryos. *Proc Natl Acad Sci U S A* 2017; **114**(41): E8695-E702.
104. Pellati D, Mylonakis I, Bertoloni G, et al. Genital tract infections and infertility. *European Journal of Obstetrics & Gynecology and Reproductive Biology* 2008; **140**(1): 3-11.
105. Zhang J. The past, present and future of Sexually transmitted diseases in China. *CHINESE JOURNAL OF EPIDEMIOLOGY* 1998; **19**(2): 118-21.
106. Newman L, Rowley J, Vander Hoorn S, et al. Global Estimates of the Prevalence and Incidence of Four Curable Sexually Transmitted Infections in 2012 Based on Systematic Review and Global Reporting. *Plos One* 2015; **10**(12): e0143304.
107. National Health and Family Planning Commission. National Health Statistics Yearbook 2017. Beijing: Peking Union Medical College Press; 2017.
108. Galvani AP, Pandey A, Fitzpatrick MC, Medlock J, Gray GE. Defining control of HIV epidemics. *Lancet HIV* 2018; **5**(11): e667-e70.
109. NCAIDS, China CDC. Update on the AIDS/STD epidemic in China and main response in control and prevention in December, 2012. *Chin J AIDS STD* 2013; **19**(2): 85.
110. NCAIDS, China CDC. Update on the AIDS/STD epidemic in China in December 2017. *Chin J AIDS STD* 2018; **24**(2): 111.
111. Han J, Mao Y, Tang H, Li J, Wu Z. Initial follow-up and CD4+ T cell count test of newly reported students HIV cases in China, 2013-2017. *Chinese Journal of Preventive Medicine* 2018; **52**(12): 1254-8.
112. Soerjomataram I, Lortet-Tieulent J, Parkin DM, et al. Global burden of cancer in 2008: a

systematic analysis of disability-adjusted life-years in 12 world regions. *Lancet* 2012; **380**(9856): 1840-50.
113. Ginsburg O, Bray F, Coleman MP, et al. The global burden of women's cancers: a grand challenge in global health. *Lancet* 2017; **389**(10071): 847-60.
114. Chen W, Sun K, Zheng R, et al. Cancer incidence and mortality in China, 2014. *Chinese Journal of Cancer Research* 2018; **30**(1): 1-12.
115. Bao Heling, Wang Linhong, Wang Limin, et al. Study on the coverage of cervical and breast cancer screening among women aged 35-69 years and related impact of socioeconomic factors in China, 2013 *(in Chinese). Chinese Journal of Epidemiology* 2018; **39**(2): 208-12.
116. Bao H, Zhang L, Wang L, et al. Significant variations in the cervical cancer screening rate in China by individual-level and geographical measures of socioeconomic status: a multilevel model analysis of a nationally representative survey dataset. *Cancer Med* 2018; **7**(5): 2089-100.
117. World Health Organization. Comprehensive cervical cancer control: A guide to essential practice - Second edition, 2014.
118. Kim HJ, Kim H-J. Current status and future prospects for human papillomavirus vaccines. *Archives of Pharmacal Research* 2017; **40**(9): 1050-63.
119. Malik H, Khan FH, Ahsan H. Human papillomavirus: current status and issues of vaccination. *Archives of Virology* 2014; **159**(2): 199-205.
120. Rodriguez-Wallberg KA. Principles of Cancer Treatment: Impact on Reproduction. *Reproductive Health and Cancer in Adolescents and Young Adults* 2012; **732**: 1-8.
121. De Vos M, Smitz J, Woodruff TK. Fertility preservation in women with cancer. *Lancet* 2014; **384**(9950): 1302-10.
122. Kim S-Y, Lee JR. Fertility preservation option in young women with ovarian cancer. *Future Oncology* 2016; **12**(14): 1695-8.
123. Feichtinger M, Rodriguez-Wallberg KA. Fertility preservation in women with cervical, endometrial or ovarian cancers. *Gynecologic oncology research and practice* 2016; **3**: 8.
124. Qiao J, Li R. Fertility preservation: challenges and opportunities. *Lancet* 2014; **384**(9950): 1246-7.
125. Heise LL, Kotsadam A. Cross-national and multilevel correlates of partner violence: an analysis of data from population-based surveys. *Lancet Global Health* 2015; **3**(6): E332-E40.
126. European Union Agency for Fundamental Rights. Violence against women: an EU-wide survey. Luxembourg, 2014.
127. Garcia-Moreno C, Jansen HAFM, Ellsberg M, Heise L, Watts CH, Wo WHOM-CS. Prevalence of intimate partner violence: findings from the WHO multi-country study on women's health and domestic violence. *Lancet* 2006; **368**(9543): 1260-9.
128. Yuan W, Hesketh T. Intimate Partner Violence and Depression in Women in China. *J Interpers Violence* 2019: 886260519888538.
129. All-China Women's Federation (ACWF). Executive report of the 3rd survey on the social status of Chinese women. *Collection of Women's Studies* 2011; (6): 5-15.
130. Wang T, Liu Y, Li Z, et al. Prevalence of intimate partner violence (IPV) during pregnancy in China: A systematic review and meta-analysis. *PLoS One* 2017; **12**(10): e0175108.
131. Wu J, Guo S, Qu C. Domestic violence against women seeking induced abortion in China. *Contraception* 2005; **72**(2): 117-21.
132. Guo X, Cheng Y, Huang N, et al. Analysis on situation and influence factors of domestic violence among infertility couples. *Chin J Public Health* 2006; **22**(5): 552-4.
133. Domestic violence in China. *Lancet* 2016; **387**(10023): 1028-.
134. Tam DMY, Schleicher K, Wu W, Kwok S-M, Thurston WE, Dawson M. Social work interventions on intimate partner violence against women in China. *Journal of Social Work* 2016; **16**(2): 228-49.
135. NCfMaCH S. National maternal and child health information analysis report, 2019.
136. Surveillance NCfMaCH. National maternal and child health information analysis report, 2018.
137. Deneux-Tharaux C, Saucedo M, Bouvier-Colle M-h. 479: Maternal deaths due to hemorrhage

in France, 2001-2009. *American Journal of Obstetrics and Gynecology* 2014; **210**(1, Supplement): S239.
138. Yun Xie PH, Jiang Du, Mei Kang, Rui Tian, Hui Xie, Ruijie Cheng, Wei Jin, Ruilan Wang. Massive obstetric hemorrhage in maternal near miss in ICU: a retrospective analysis from a maternity center in Shanghai, China. *International journal of clinical and experimental medicine* 2018; **11**(9): 8.
139. Ma J. Two child policy impact on the incidence of postpartum hemorrhage and its risk factors . Chinese National Knowledge Infrastructure; 2017.
140. Bener A, Saleh NM, Al-Hamaq A. Prevalence of gestational diabetes and associated maternal and neonatal complications in a fast-developing community: global comparisons. *International journal of women's health* 2011; **3**: 367-73.
141. Gao C, Sun X, Lu L, Liu F, Yuan J. Prevalence of gestational diabetes mellitus in mainland China: A systematic review and meta-analysis. *Journal of diabetes investigation* 2018.
142. Walker JJ. Pre-eclampsia. *Lancet* 2000; **356**(9237): 1260-5.
143. Qide QCYXL. Advanced research in epidemiology of preeclampsia. *Chinese Journal of Family Planning & Gynecotokology* 2013; **5**(6): 3.
144. Li HT, Luo S, Trasande L, et al. Geographic Variations and Temporal Trends in Cesarean Delivery Rates in China, 2008-2014. *Jama* 2017; **317**(1): 69-76.
145. China MoHotPsRo. China health statistics yearbook. China union medical college press; 2018.
146. Liang J, Mu Y, Li X, et al. Relaxation of the one child policy and trends in caesarean section rates and birth outcomes in China between 2012 and 2016: observational study of nearly seven million health facility births. *Bmj* 2018; **360**: k817.
147. Yu H, Feng Z, Uyeki TM, et al. Risk factors for severe illness with 2009 pandemic influenza A (H1N1) virus infection in China. *Clinical infectious diseases : an official publication of the Infectious Diseases Society of America* 2011; **52**(4): 457-65.
148. Chen L, Li Q, Zheng D, et al. Clinical Characteristics of Pregnant Women with Covid-19 in Wuhan, China. *The New England journal of medicine* 2020.
149. Hantoushzadeh S, Shamshirsaz AA, Aleyasin A, et al. Maternal death due to COVID-19. *Am J Obstet Gynecol* 2020; **223**(1): 109 e1- e16.
150. China NHCotPsRo. Standards for risk assessment and management of pregnant women. In: health Domac, editor. http://www.nhc.gov.cn/fys/s3582/201711/f40145d5d1a84e998047c33c31ebd12d.shtml; 2017.
151. Lawn JE, Blencowe H, Waiswa P, et al. Stillbirths: rates, risk factors, and acceleration towards 2030. *Lancet* 2016; **387**(10018): 587-603.
152. He C, Liu L, Chu Y, et al. National and subnational all-cause and cause-specific child mortality in China, 1996–2015: a systematic analysis with implications for the Sustainable Development Goals. *The Lancet Global Health* 2017; **5**(2): e186-e97.
153. Zhu J, Liang J, Mu Y, et al. Sociodemographic and obstetric characteristics of stillbirths in China: a census of nearly 4 million health facility births between 2012 and 2014. *Lancet Glob Health* 2016; **4**(2): e109-18.
154. Cacciatore J. A phenomenological exploration of stillbirth and the effects of ritualization on maternal anxiety and depression: University of Nebraska - Lincoln; 2007.
155. Bhutta ZA, Yakoob MY, Lawn JE, et al. Stillbirths: what difference can we make and at what cost? *Lancet* 2011; **377**(9776): 1523-38.
156. Ladhani NNN, Fockler ME, Stephens L, Barrett JFR, Heazell AEP. No. 369-Management of Pregnancy Subsequent to Stillbirth. *Journal of obstetrics and gynaecology Canada : JOGC = Journal d'obstetrique et gynecologie du Canada : JOGC* 2018; **40**(12): 1669-83.
157. An Analysis Report of National Health Services Survey in China. Center for Health Statistics and Information, NHFPC., 2018.
158. National Annual Report on Maternal and Child Health (2018): Office of National Annual Report on Maternal and Child Health, 2018.
159. Chawanpaiboon S, Vogel JP, Moller AB, et al. Global, regional, and national estimates of levels

of preterm birth in 2014: a systematic review and modelling analysis. *Lancet Glob Health* 2019; **7**(1): e37-e46.
160. Chen C, Zhang JW, Xia HW, et al. Preterm Birth in China Between 2015 and 2016. *Am J Public Health* 2019; **109**(11): 1597-604.
161. D'Silva AM, Hyett JA, Coorssen JR. Proteomic analysis of first trimester maternal serum to identify candidate biomarkers potentially predictive of spontaneous preterm birth. *J Proteomics* 2018; **178**: 31-42.
162. ZSFZea KX. A multicenter study of the early prognosis of ultra / extremely premature infants in 14 hospitals in China. *Chinese Journal of Medicine* 2018; **5**(12): 7.
163. Rysavy MA, Li L, Bell EF, et al. Between-hospital variation in treatment and outcomes in extremely preterm infants. *The New England journal of medicine* 2015; **372**(19): 1801-11.
164. Bolisetty S, Legge N, Bajuk B, Lui K, New South W, the Australian Capital Territory Neonatal Intensive Care Units' Data C. Preterm infant outcomes in New South Wales and the Australian Capital Territory. *Journal of paediatrics and child health* 2015; **51**(7): 713-21.
165. CCY L. The significance and development of treatment technology for extremely preterm infant. *Chinese Journal of perinatal medicine* 2016; **19**(10): 3.
166. Health TMo. Report on the Prevention and Treatment of Birth Defects in China 2012.
167. Zheng-chao CHEN K-bL, Hong-yan XU. Utilization and its influencing factors of serological screening for Down's syndrome among mothers having a fetus or newborn with congenital defect in Beijing: 2007 – 2016. *Chinese Journal of Public Health*.
168. S.Y. C, W. H, C.M. C. The Growth characteristics of children under 5 in the past 15 years. *JOURNAL OF HYGIENE RESEARCH* 2006; **35**(6): 768-71.
169. Jiao XU, Huo JS, Sun J, Huang J. Complementary food supplements interventions for 6 to 24 months old infants in poverty areas. *Chinese Journal of Food Hygiene* 2017.
170. Hu Y, Li M, Chen J, et al. [The anemia and vitamin A, vitamin D nutritional status of Chinese rural pregnant women in 2010-2012]. *Wei Sheng Yan Jiu* 2017; **46**(3): 361-72.
171. Zheng W, Li G. Nutritional status and interventional strategies during pregnancy in China. *Chinese Journal of Perinatal Medicine* 2018; **21**(10).
172. Bi Ye DY, Wang Jie, Jiang Shan, Pang Xuehong, Yin Shian, Yang Zhenyu. Status and related factors for gestational weight gain of Chinese pregnant women during 2010-2012. *Chinese Journal of Preventive Medicine* 2018; **52**(1): 26-30.
173. Shen J, Zhang Z, Chen K, et al. Prepregnancy obesity status and risks on pregnancy outcomes in Shanghai: A prospective cohort study. *Medicine* 2018; **97**(40): e12670.
174. Blencowe H, Krasevec J, de Onis M, et al. National, regional, and worldwide estimates of low birthweight in 2015, with trends from 2000: a systematic analysis. *Lancet Glob Health* 2019; **7**(7): e849-e60.
175. Tang W, Mu Y, Li X, et al. Low birthweight in China: evidence from 441 health facilities between 2012 and 2014. *The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstet* 2017; **30**(16): 1997-2002.
176. Organization WH. Global Nutrition Targets 2025-Low Birth Weight Policy Brief, 2014.
177. Herzberg S, Kabiri D, Mordechai T, et al. Fetal macrosomia as a risk factor for shoulder dystocia during vacuum extraction. *The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstet* 2017; **30**(15): 1870-3.
178. Hermann GM, Dallas LM, Haskell SE, Roghair RD. Neonatal macrosomia is an independent risk factor for adult metabolic syndrome. *Neonatology* 2010; **98**(3): 238-44.
179. Pan XF, Tang L, Lee AH, et al. Association between fetal macrosomia and risk of obesity in children under 3 years in Western China: a cohort study. *World journal of pediatrics : WJP* 2019; **15**(2): 153-60.
180. Koyanagi A, Zhang J, Dagvadorj A, et al. Macrosomia in 23 developing countries: an analysis

of a multicountry, facility-based, cross-sectional survey. *Lancet* 2013; **381**(9865): 476-83.
181. Liang H, Zhang WY, Li XT. [Reference ranges of gestational weight gain in Chinese population on the incidence of macrosomia: a multi-center cross-sectional survey]. *Zhonghua fu chan ke za zhi* 2017; **52**(3): 147-52.
182. Wang D, Hong Y, Zhu L, et al. Risk factors and outcomes of macrosomia in China: a multicentric survey based on birth data. *The journal of maternal-fetal & neonatal medicine : the official journal of the European Association of Perinatal Medicine, the Federation of Asia and Oceania Perinatal Societies, the International Society of Perinatal Obstet* 2017; **30**(5): 623-7.
183. Li G, Kong L, Li Z, et al. Prevalence of macrosomia and its risk factors in china: a multicentre survey based on birth data involving 101,723 singleton term infants. *Paediatr Perinat Epidemiol* 2014; **28**(4): 345-50.
184. He XJ, Qin FY, Hu CL, Zhu M, Tian CQ, Li L. Is gestational diabetes mellitus an independent risk factor for macrosomia: a meta-analysis? *Archives of gynecology and obstetrics* 2015; **291**(4): 729-35.
185. Jin X, Sun Y, Jiang F, Ma J, Morgan C, Shen X. "Care for Development" intervention in rural China: a prospective follow-up study. *Journal of Developmental & Behavioral Pediatrics Jdbp* 2007; **28**(3): 213.
186. hui-tang H, Hui L, Jian-wei H, et al. Breastfeeding and associated factors in five areas of China (in Chinese). *Suzhou University Journal of Medical Science* 2012; **32**(4): 5.
187. Fisher J, Cabral de Mello M, Patel V, et al. Prevalence and determinants of common perinatal mental disorders in women in low- and lower-middle-income countries: a systematic review. *Bull World Health Organ* 2012; **90**(2): 139G-49G.
188. Tao Jianqin GJ, Lu Jinyin. **Meta Analysis of the Prevalence Rate of Post Depressive Depression in China**. *China Journal of Health Psychology* 2018; **26**(2): 171-4.
189. Lin Xiang ZD, Lin Xuefeng, Dai Yue. A meta-analysis of the incidence of perinatal depression in China. *Fujian Medical Journal* 2017; **39**(5): 131-3.
190. Rahman A, Fisher J, Bower P, et al. Interventions for common perinatal mental disorders in women in low- and middle-income countries: a systematic review and meta-analysis. *Bull World Health Organ* 2013; **91**(8): 593-601I.
191. Organization WH. WHO recommendations on maternal health: guidelines approved by the WHO Guidelines Review Committee. http://www.who.int/maternal_child_adolescent/documents/maternal-health-recommendations/en/; 2017.
192. Care DoHaS. Guidance- National service framework: children, young people and maternity services. https://www.gov.uk/government/publications/national-service-framework-children-young-people-and-maternity-services; 2014.
193. Care. DoHaS. Safer maternity care: next steps towards the national maternity ambition. https://www.gov.uk/government/publications/safer-maternity-care; 2016.
194. Ageing. AGDoHa. National Women's Health Policy 2010. http://www.health.gov.au/internet/main/publishing.nsf/Content/national-womens-health-policy.; 2013.
195. Australian Government Department of Health C, Australian Health Ministers' Conference. . National Maternity Services Plan. 2011.
196. Ding Hui CL, Di Xiaolan. Expert consensus on guidelines for management of postpartum depressive disorder (based on obstetrics and community physicians). *Chinese Journal of Clinical Obstetrics and Gynecology* 2014; **15**(6): 572-6.
197. Jie WY-IG. Current situation of and demands for prevention and treatment of postpartum depression in maternal and child health institutions of Hunan Province. *Practical Preventive Medicine* 2015; **22**(12): 1498-501.
198. Alonge O, Khan UR, Hyder AA. Our Shrinking Globe: Implications for Child Unintentional Injuries. *Pediatric Clinics of North America* 2016; **63**(1): 167.

199. Report of the status quo of Children's injury in Chinese Children and Adolescent: Chinese Center for Disease Control and Prevention 2017.
200. Yin Z, Wu J, Luo J, Pak AWP, Choi BCK, Liang X. Burden and trend analysis of injury mortality in China among children aged 0-14 years from 2004 to 2011. *Bmj Open* 2015; **5**(7).
201. Hu H, Gao J, Jiang H, Xing P. A comparative study of unintentional injuries among schooling left-behind, migrant and residential children in China. *International Journal for Equity in Health* 2018; **17**(1): 47.
202. Shen M, Yang S, Han J, et al. Non-fatal injury rates among the "left-behind children" of rural China. *Inj Prev* 2009; **15**(4): 244-7.
203. Li L, Robert S, Jing W, et al. Legislation coverage for child injury prevention in China. *Bulletin of the World Health Organization* 2015; **93**(3): 169-75.
204. Song Y, Agardh A, Ma J, et al. National trends in stunting, thinness and overweight among Chinese school-aged children, 1985–2014. *International Journal of Obesity* 2018: 1.
205. Dong Y, Catherine J, Ma Y. Economic development and the nutritional status of Chinese school-aged children and adolescents from 1995 to 2014: an analysis of five successive national surveys. *Lancet Diabetes and Endocrinology* 2019; **7**(4): 288-99.
206. Ye Q FJ. Paediatric type 2 diabetes in China—Pandemic, progression, and potential solutions. *Pediatr Diabetes* 2018; **19**(1): 27-35.
207. Fan X, Cao ZB. Physical activity among Chinese school-aged children:National prevalence estimates from the 2016 Physical Activity and Fitness in China—The Youth Study. *Journal of Sport & Health Science* 2017; (4): S2095254617301175.
208. Cai Y, Zhu X, Wu X. Overweight, obesity, and screen-time viewing among Chinese school-aged children: National prevalence estimates from the 2016 Physical Activity and Fitness in China-The Youth Study. *J Sport Health Sci* 2017; **6**(4): 404-9.
209. Yunting Z, Shengxia M, Chang C, et al. Chinese Physical Activity Guideline for Children and Youth. *Clin J Evid Based Pediat* 2017; **12**(6): 401-9.
210. Bureau of Disease Prevention and Control MoHotPsRoC. Guideline of Overweight and obesity prevention and control for children and adolescents in China. Beijing: People's Medical Publishing House 2008.
211. Wang M, Luo X, Xu S, et al. Trends in smoking prevalence and implication for chronic diseases in China: serial national cross-sectional surveys from 2003 to 2013. *Lancet Respiratory Medicine* 2019; **7**(1): 35-45.
212. Liu Y, Wang M, Tynjala J, Villberg J, Lv Y, Kannas L. Socioeconomic differences in adolescents' smoking: a comparison between Finland and Beijing, China. *BMC Public Health* 2016; **16**: 805.
213. Xiao L, Parascandola M, Wang C, Jiang Y. Perception and Current Use of E-cigarettes Among Youth in China. *Nicotine Tob Res* 2018.
214. Feng Y, Newman IM. Estimate of adolescent alcohol use in China: a meta-analysis. *Archives of Public Health* 2016; **74**(1): 45.
215. Dong Y, Liu H, Wang Z, Xu R, Yang Z, Ma J. The epidemic status and secular trends of myopia prevalence for Chinese children and adolescents aged 7-18 years from 2005 to 2014. *Zhonghua yu fang yi xue za zhi [Chinese journal of preventive medicine]* 2017; **51**(4): 285-9.
216. Chen Y, Xiao O, Guo X, et al. Methodology of the ZOC-BHVI High Myopia Cohort Study: The Onset and Progression of Myopic Pathologies and Associated Risk Factors in Highly Myopic Chinese. *Ophthalmic Epidemiol* 2018; **25**(1): 31-8.
217. He M, Xiang F, Zeng Y, et al. Effect of Time Spent Outdoors at School on the Development of Myopia Among Children in China: A Randomized Clinical Trial. *JAMA* 2015; **314**(11): 1142-8.
218. Education Mo. Integrated Prevention and Control Program for Children and Adolescents with Myopia2018. (accessed http://www.moe.gov.cn/srcsite/A17/moe_943/s3285/201808/t20180830_346672.html).
219. Jan CL, Congdon N. Chinese national policy initiative for the management of childhood myopia. *The Lancet Child & Adolescent Health* 2018; **2**(12): 845-6.

220. Arango C D-CC, McGorry PD, Rapoport J, Sommer IE, Vorstman JA, et al. Preventive strategies for mental health. *Lancet Psychiatry* 2018 **5**(7): 591-604.
221. Sun X AC, Matthews FE, Sharp SJ, Auyeung B, Baron-Cohen S, et al. . Prevalence of autism in mainland China, Hong Kong and Taiwan: a systematic review and meta-analysis. Mol Autism. *Mol Autism* 2013; **4**(4): 7.
222. Elsabbagh M DG, Koh YJ, Kim YS, Kauchali S, Marcin C, et al. . Global prevalence of autism and other pervasive developmental disorders. . *Autism Res Official J Int Soc Autism Res* 2012; **5**(3): 160–79.
223. Zheng Y ZX. Current status and recent development of child psychiatry in China. *Child and Adolescent Psychiatry and Mental Health* 2015; **9**: 10.
224. Liu Y MD. Examining the association between parenting and child depression among Chinese children and adolescents: a systematic literature review. *Children and Youth Services Review* 2018; **88**: 316-22.
225. Li J, Chen X, Zhao C, Xu Y. Meta-analysis of the prevalence of depressive symptoms in Chinese children and adolescents. *Chinese Journal of Child Health* 2016; **24**(3): 295-8.
226. Wang K, Cui X. Survey on the anxiety status of adolescents at Yimeng mountain area. *Occupation and Health* 2012; **28**(14): 1684-6.
227. Wang X, Sun Y, An J, Hao J, Tao F. Gender difference on depressive symptoms among Chinese children and adolescents. *Chinese Journal of Epidemiology* 2013; **34**(9): 893-6.
228. Xi M. Survey on the anxiety status of secondary school students in Hebei province. *Modern Primary and Secondary Education* 2015; **31**(4): 115-9.
229. Yao M, Chen Y, Zhou H, Song Y, Li D. Epidemiological survey of anxiety tendency among primary and secondary school students in southern China. *Clinical Pediatric Journal* 2009; **27**(2): 165-8.
230. Yue P, Huang Z, Wei Y, Zhao M, Luo J. Survey of anxiety symptoms among middle school students in Beijing. *Chinese Medical Science* 2016; **6**(20): 141-4.
231. Xin Z, Niu J, Chi L. Birth cohort changes in Chinese adolescents' mental health. *Int J Psychol* 2012; **47**(4): 287-95.
232. Chen R AJ, Qu J. . Suicidal behaviour among children and adolescents in China *Lancet Child and Adolescent Health* 2018; **2**(8): 551-3.
233. Han A, Wang G, Xu G, Su P. A self-harm series and its relationship with childhood adversity among adolescents in mainland China: a cross-sectional study. *BMC Psychiatry* 2018; **18**(1): 28.
234. Commission NHaFP. Chinese health and family planning statistics yearbook. . Beijng: Chinese Union Medical University; 2017.
235. Li ZZ LY, Lei XY. . Prevalence of suicide ideation in Chinese college students: a meta-analysis. *PloS One* 2014; **9**: e104368.
236. Yang LS ZZ, Sun L, Sun YH, Ye DQ. . Prevalence of suicide attempts among college students in China: a meta-analysis. *PLoS One* 2015; **10**: e0116303
237. Liu BP, Wang XT, Liu ZZ, Wang ZY, Liu X, Jia CX. Stressful life events, insomnia and suicidality in a large sample of Chinese adolescents. *J Affect Disord* 2019; **249**: 404-9.
238. He G, Xie J-f, Zhou J-d, Zhong Z-q, Qin C-x, Ding S-q. Depression in left-behind elderly in rural China: Prevalence and associated factors. *Geriatrics & Gerontology International* 2016; **16**(5): 638-43.
239. He B, Fan J, Liu N, et al. Depression risk of 'left-behind children' in rural China. *Psychiatry Research* 2012; **200**(2-3): 306-12.
240. He B FJ, Liu N, Li H, Wang Y, Williams J, Wong K. . Depression risk of left behind Children in rural China. *Psychiatry Research* 2012; **200**(2-3): 306-12

241. Yang J, Xie Y, Qu H, Liu Z, Wang Y. Meta-analysis of the reporting rate of bullying-related behaviors in Chinese students. *Chinese Journal of Health Psychology* 2016; **24**(11): 1658-62.
242. Chan H WD. Traditional school bullying and cyberbullying in Chinese societies: prevalence

and a review of the whole-school intervention approach. . *Aggression and violent behaviour* 2015; **23**: 98-108.
243. Zheng Y, Zheng X. Current state and recent developments of child psychiatry in China. *Child and Adolescent Psychiatry and Mental Health* 2015; **9**.
244. Grantham-McGregor S, Cheung YB, Cueto S, Glewwe P, Richter L, Strupp B. Developmental potential in the first 5 years for children in developing countries. *The Lancet* 2007; **369**(9555): 60-70.
245. Victora CG, Adair L, Fall C, et al. Maternal and child undernutrition: consequences for adult health and human capital. *Lancet* 2008; **371**(9609): 340-57.
246. Cui Y, Gao J, Yue A, Luo R, Rozelle S. Early childhood development and risk factors in rural China: a cohort study. *Chinese Journal of Pediatrics* 2018; (2): 103-9.
247. Wenjie S, Yunting Z, Qingmin L, Yanrui J, Qi Z, Fan J. Study on the status quo of early child development in eight provinces of China. *CJCHC* 2019; **27**(4): 362-5.
248. Cunha F, Heckman J. The Technology of Skill Formation. *American Economic Review* 2007; **97**(2): 31-47.
249. Yu DM, Zhao LY, Yang ZY, et al. Comparison of Undernutrition Prevalence of Children under 5 Years in China between 2002 and 2013. *Biomedical and environmental sciences : BES* 2016; **29**(3): 165-76.
250. NWCCW, NBS, UNICEF. Children in China: An Atlas of Social Indicators, 2018.
251. Wei Q, Wang X, Hao B, et al. Status and measurement of multidimensional poverty among small children in poor rural areas of Shanxi and Guizhou province. *Chin J Public Health* 2018; **34**(2): 204-9.
252. Zhang C, Zhao C, Liu X, et al. Inequality in early childhood neurodevelopment in six poor rural counties of China: a decomposition analysis. *Int J Equity Health* 2017; **16**(1): 212.
253. Wei QW, Zhang JX, Scherpbier RW, et al. High prevalence of developmental delay among children under three years of age in poverty-stricken areas of China. *Public Health* 2015; **129**(12): 1610-7.
254. Liang XZ, Yinan; Fu, Yu. China - Early child development project : Early childhood education in Yunnan : challenges and opportunities (English, Chinese). Washington, DC: World Bank Group, 2013.
255. Gao Y, Zhao C, Zhang J, Wang X. Effect of parental labor migration on early development of children aged 0 ~ 3 years old. *Chinese Journal of Reproductive Health* 2018; **29**(4): 301-6.
256. Shi HF, Zhang JX, Wang XL, et al. [Effectiveness of integrated early childhood development intervention on nurturing care for children aged 0-35 months in rural China]. *Zhonghua Er Ke Za Zhi* 2018; **56**(2): 110-5.
257. Wang Lei;, Xian Yue;, Zhang Siqi;, et al. Benefit-Cost Calculations of Government Investment into Early Childhood Development in Rural China. *Journal of East China Normal University (Educational Sciences)* 2019; **37**(3): 121-31.
258. Fang X, Fry DA, Ji K, et al. The burden of child maltreatment in China: a systematic review. *Bulletin of the World Health Organization* 2015; **93**(3): 176-85C.
259. Ji K, Finkelhor D. A meta-analysis of child physical abuse prevalence in China. *Child abuse & neglect* 2015; **43**: 61-72.
260. Man X, Barth R, Li Y-e, Zuobao W. Exploring the new child protection system in Mainland China: How does it work?; 2017.
261. Chui C, Jordan L. Child protection in China: threats and opportunities; 2018.
262. Zhao F, Hämäläinen JEA, Chen HL. Child protection in China: Changing policies and reactions from the field of social work. *International Journal of Social Welfare* 2017; **26**(4): 329-39.
263. Anand S, Barnighausen T. Human resources and health outcomes: cross-country econometric study. *Lancet* 2004; **364**(9445): 1603-9.
264. Hosseini Jebeli SS, Hadian M, Souresrafil A. Study of health resource and health outcomes: Organization of economic corporation and development panel data analysis. *Journal of education*

and health promotion 2019; **8**: 70-.
265. Liang S, Macinko J, Yue D, Meng Q. The impact of the health care workforce on under-five mortality in rural China. *Human Resources for Health* 2019; **17**.
266. National Bureau of Statistics. 2018 Statistical Bulletin of National Economic and Social Development in China. 2019. http://www.stats.gov.cn/tjsj/zxfb/201902/t20190228_1651265.html.
267. The state of the world's midwifery 2014 - A universal pathway. A women's right to health.: World Health organization, 2014.
268. Bureau of Medical Administration. Opinion on the reform and development of child health services. 2016. http://www.nhfpc.gov.cn/yzygj/s3594q/201605/d8c3d4f7bcda487fb145fc95fac9c8b3.shtml.
269. Chinese Medical Doctor Association. The 2017 white paper on Chinese medical doctor's professional situation (in Chinese), 2018.
270. Macpherson I, Roqué-Sánchez MV, Legget Bn FO, Fuertes F, Segarra I. A systematic review of the relationship factor between women and health professionals within the multivariant analysis of maternal satisfaction. *Midwifery* 2016; **41**: 68-78.
271. Pak-Gorstein S, Frintner MP, O'Callahan C, et al. Global Health Education for Pediatric Residents: Trends, Training Experiences, and Career Choices. *Pediatrics* 2019; **143**(1).
272. The State Council. Opinions on reform and improvement of the incentive mechanism for training and utilization of general practitioners. 2018.
273. Chinese Medical Doctor Association. Contents and standards of standardized training for resident physicians (Pilot version). 2015. https://www.ccgme-cmda.cn/news/22/1/article.
274. Zhang Y, Huang L, Zhou X, et al. Characteristics and Workload of Pediatricians in China. *Pediatrics* 2019; **144**(1): e20183532.
275. Yao H, Zhu G, Zhang X, et al. Current situation and analysis of school physicians in primary and secondary schools in 16 provinces in China. *Chinese Journal of School Health* 2018; **39**(10): 1455-8.
276. Collaborators GHAaQ. Measuring performance on the Healthcare Access and Quality Index for 195 countries and territories and selected subnational locations: a systematic analysis from the Global Burden of Disease Study 2016. *Lancet* 2018; **391**(10136): 2236-71.
277. Tang L, Wu S, Li J, et al. Post-abortion family planning counselling practice among abortion service providers in China: a nationwide cross-sectional study. *European Journal of Contraception and Reproductive Health Care* 2017; **22**(1): 24-9.
278. Liu J, Wu S, Xu J, Temmerman M, Zhang WH, Group I. Is Repeat Abortion a Public Health Problem among Chinese Adolescents? A Cross-Sectional Survey in 30 Provinces. *Int J Environ Res Public Health* 2019; **16**(5).
279. Wang X, Wu J, Li Y, et al. Changes in the Prevalence of Induced Abortion in the Floating Population in Major Cities of China 2007-2014. *Int J Environ Res Public Health* 2019; **16**(18).
280. Huang Y, Shallcross D, Pi L, Tian F, Pan J, Ronsmans C. Ethnicity and maternal and child health outcomes and service coverage in western China: a systematic review and meta-analysis. *Lancet Global Health* 2018; **6**(1): E39-E56.
281. Zheng L, Hu R, Dong Z, Hao Y. Comparing the needs and utilization of health services between urban residents and rural-to-urban migrants in China from 2012 to 2016. *Bmc Health Services Research* 2018; **18**.
282. Mou J, Griffiths SM, Fong H, Dawes MG. Health of Chinas ruralurban migrants and their families: a review of literature from 2000 to 2012. *British Medical Bulletin* 2013; **106**(1): 19-43.
283. Song X, Zou G, Chen W, Han S, Zou X, Ling L. Health service utilisation of rural-to-urban migrants in Guangzhou, China: does employment status matter? *Tropical Medicine & International Health* 2017; **22**(1): 82-91.
284. Miller S, Abalos E, Chamillard M, et al. Beyond too little, too late and too much, too soon: a pathway towards evidence-based, respectful maternity care worldwide. *Lancet* 2016; **388**(10056): 2176-92.

285. Xu T, Yue Q, Wang Y, Murray J, Sobel H. Childbirth and Early Newborn Care Practices in 4 Provinces in China: A Comparison With WHO Recommendations. *Glob Health Sci Pract* 2018; **6**(3): 565-73.
286. World Health Organization. WHO Model List of Essential Medicines for Children, 6th List (March 2017, amended August 2017). 2017. https://apps.who.int/iris/bitstream/handle/10665/273825/EMLc-6-eng.pdf?ua=1 (accessed 2020-02-24.
287. Meng X, Huo J, Shi W, Zhao Z. Comparison between the Drug List for National Essential Social Insurances and WHO Model List of Essential Medicines for Children. *Herald of Medicine* 2019; (10): 1379-83.
288. Li H-t, Hellerstein S, Zhou Y-b, Liu J-m, Blustein J. Trends in Cesarean Delivery Rates in China, 2008-2018. *Jama-Journal of the American Medical Association* 2020; **323**(1): 89-91.
289. Feng XL, Wang Y, An L, Ronsmans C. Cesarean section in the People's Republic of China: current perspectives. *International journal of women's health* 2014; **6**: 59-74.
290. Feng XL, Xu L, Guo Y, Ronsmans C. Factors influencing rising caesarean section rates in China between 1988 and 2008. *Bulletin of the World Health Organization* 2012; **90**(1): 30-9, 9A.
291. Hellerstein S, Feldman S, Duan T. China's 50% caesarean delivery rate: is it too high? *BJOG : an international journal of obstetrics and gynaecology* 2015; **122**(2): 160-4.
292. Peng Z. Practice and exploration of reducing the rate of cesarean birth effectively. *Chinese Journal of Social Medicine* 2013; **30**(1): 37-8.
293. Wen Y, Cheng Z. The analysis of affection of prenatal ultrasound in improving cesarean section rate. *Modern Preventive Medicine* 2013; **40**(5): 840-1.
294. Liang J MY, Li X, et al. Relaxation of the one child policy and trends in caesarean section rates and birth outcomes in China between 2012 and 2016: observational study of nearly seven million health facility births. *Bmj-British Medical Journal* 2018.
295. National Health Commission | Notice on the first batch of pilot hospitals for painless labor. 2019. http://www.nhc.gov.cn/yzygj/s3573/201903/3417aba95eb14808bcf4d09b07db9b28.shtml (accessed 2019-04-23.
296. Li H, Yan S, Li D, Gong Y, Lu Z, Yin X. Trends and patterns of outpatient and inpatient antibiotic use in China's hospitals: data from the Center for Antibacterial Surveillance, 2012-16. *The Journal of antimicrobial chemotherapy* 2019.
297. Wang J, Wang P, Wang X, Zheng Y, Xiao Y. Use and prescription of antibiotics in primary health care settings in China. *JAMA Intern Med* 2014; **174**(12): 1914-20.
298. World Health Organization. Health systems financing: the path to universal coverage (World health report 2010). Geneva, 2010
299. Xu K, Evans DB, Kawabata K, Zeramdini R, Klavus J, Murray CJ. Household catastrophic health expenditure: a multicountry analysis. *Lancet* 2003; **362**(9378): 111-7.
300. Fu W, Zhao S, Zhang Y, Chai P, Goss J. Research in health policy making in China: out-of-pocket payments in Healthy China 2030. *BMJ* 2018; **360**: k234.
301. Meng Q, Fang H, Liu X, Yuan B, Xu J. Consolidating the social health insurance schemes in China: towards an equitable and efficient health system. *Lancet* 2015; **386**(10002): 1484-92.
302. Zhang Y, Coyte PC. Inequality of opportunity in healthcare expenditures: evidence from China. *BMC Health Serv Res* 2020; **20**(1): 379.
303. GUO F, ZHANG Y-h, WAN Q, et al. The Expenditure Accounting and Analysis of Financing for Children Treatment in China———Based on the System of Health Account 2011. *Health Economics Research* 2015; (6): 8-11.
304. Yu X, Li T, Wang M. The Expenditure Accounting and Analysis of Financing for Children Treatment in China———Based on the System of Health Account 2011. *Medicine and Society* 2017; **30**(9): 7-11.
305. World Health Organization. Monitoring the building blocks of the health system: a handbook of indicators and their measurement strategies. Geneva: World Health Organization, 2010.

306. World Health Organization | Health topics | Universal health coverage - our work. https://www.who.int/health-topics/universal-health-coverage#tab=tab_1 (accessed 2020-02-24.
307. The State Council. Healthy China Initiative (2019-2030). 2019. http://www.gov.cn/xinwen/2019-07/15/content_5409694.htm.
308. National Health Commission. Healthy China Initiative -- Cancer Prevention and Control Implementation Plan (2019-2022). 2019. http://www.nhc.gov.cn/jkj/s5878/201909/2cb5dfb5d4f84f8881897e232b376b60.shtml.
309. Say L, Souza JP, Pattinson RC, Mortality WHOwgoM, Morbidity c. Maternal near miss--towards a standard tool for monitoring quality of maternal health care. *Best Pract Res Clin Obstet Gynaecol* 2009; **23**(3): 287-96.
310. Telford A, Salmon J, Jolley D, Crawford D. Reliability and Validity of Physical Activity Questionnaires for Children: The Children's Leisure Activities Study Survey (CLASS). *Pediatric Exercise Science* 2004; **16**(1): 64-78.
311. Hall CM, Bierman KL. Technology-assisted Interventions for Parents of Young Children: Emerging Practices, Current Research, and Future Directions. *Early Child Res Q* 2015; **33**: 21-32.
312. Li X, Krumholz HM, Yip W, et al. Quality of primary health care in China: challenges and recommendations. *Lancet (London, England)* 2020; **395**(10239): 1802-12.
313. Magill MK. Time to Do the Right Thing: End Fee-for-Service for Primary Care. *Annals of Family Medicine* 2016; **14**(5): 400-1.
314. The State Council. Guiding opinion on promoting the establishment and development of medical alliances. 2017. http://www.gov.cn/zhengce/content/2017-04/26/content_5189071.htm.
315. Department of Foreign Assisstance, Ministry of Commerce of the People's Republic of China. White Paper on China's Foreign Assisstance(2011). http://yws.mofcom.gov.cn/article/m/policies/201304/20130400090253.shtml.
316. Department of Foreign Assisstance, Ministry of Commerce of the People's Republic of China. White Paper on China's Foreign Assisstance(2014). http://yws.mofcom.gov.cn/article/m/policies/201412/20141200822172.shtml.
317. National Health Commission of the People's Republic of China. China's foreign assistances : 100 programmes on women and children's health in five years. http://www.nhfpc.gov.cn/zhuz/xwfb/201805/9c8bf79272c14acaa427970ff0b5d00f.shtml.
318. Belt and Road Portal. Belt and Road countries to enhance health cooperation: communique. 2017. https://eng.yidaiyilu.gov.cn/qwyw/rdxw/24190.htm.
319. Hesketh T, Zhu WX. The one child family policy: the good, the bad, and the ugly. *BMJ* 1997; **314**(7095): 1685-7.
320. Zhou C, Wang XL, Zhou XD, Hesketh T. Son preference and sex-selective abortion in China: informing policy options. *Int J Public Health* 2012; **57**(3): 459-65.
321. Zeng Y, Hesketh T. The effects of China's universal two-child policy. *The Lancet* 2016; **388**(10054): 1930-8.
322. The State Council. National population development plan (2016-2030). 2016. http://www.gov.cn/zhengce/content/2017-01/25/content_5163309.htm.
323. Sabeena S, Bhat PV, Kamath V, Arunkumar G. Global human papilloma virus vaccine implementation: An update. *Journal of Obstetrics and Gynaecology Research* 2018; **44**(6): 989-97.
324. Colombara DV, Wang S-M. The impact of HPV vaccination delays in China: Lessons from HBV control programs. *Vaccine* 2013; **31**(38): 4057-9.
325. Zhao FH, Tiggelaar SM, Hu SY, et al. A multi-center survey of HPV knowledge and attitudes toward HPV vaccination among women, government officials, and medical personnel in China. *Asian Pac J Cancer Prev* 2012; **13**(5): 2369-78.
326. Zhang SK, Pan XF, Wang SM, et al. Perceptions and acceptability of HPV vaccination among parents of young adolescents: a multicenter national survey in China. *Vaccine* 2013; **31**(32): 3244-9.
327. Petrosky E, Bocchini JA, Jr., Hariri S, et al. Use of 9-Valent Human Papillomavirus (HPV) Vaccine:

Updated HPV Vaccination Recommendations of the Advisory Committee on Immunization Practices. *Mmwr-Morbidity and Mortality Weekly Report* 2015; **64**(11): 300-4.
328. Human papillomavirus vaccines: WHO position paper, May 2017. 2017. www.who.int/immunization/documents/positionpapers/en/.
329. Roberton T, Carter ED, Chou VB, et al. Early estimates of the indirect effects of the COVID-19 pandemic on maternal and child mortality in low-income and middle-income countries: a modelling study. *The Lancet Global health* 2020.
330. World Health Organization. COVID-19: Operational guidance for maintaining essential health services during an outbreak. Mar 25, 2020. https://www.who.int/publications-detail/covid-19-operational-guidance-for-maintaining-essential-health-services-during-an-outbreak (accessed Mar 30, 2020.
331. Chen S, Zhang Z, Yang J, et al. Fangcang shelter hospitals: a novel concept for responding to public health emergencies. *Lancet* 2020; **395**(10232): 1305-14.
332. National Health Commission of China. List of designated hospitals serving for pregnant women suspected or confirmed with Covid-19 (up to Feb. 19, 2020). 2020. http://www.nhc.gov.cn/fys/s7901/202002/8a56063c2261495c94c071501add27aa.shtml (accessed 2020/04/04.
333. National Health Commission. Notice on strengthening the management of medical services and meeting people's essential medical needs during the epidemic. 2020. http://www.nhc.gov.cn/yzygj/s7659/202002/6d5a8556c5ce46368263711698d8237a.shtml (accessed 2020-02-17.
334. Chen H, Guo J, Wang C, et al. Clinical characteristics and intrauterine vertical transmission potential of COVID-19 infection in nine pregnant women: a retrospective review of medical records. *Lancet* 2020; **395**(10226): 809-15.
335. Qiao J. What are the risks of COVID-19 infection in pregnant women? *Lancet* 2020; **395**(10226): 760-2.
336. Dong L, Tian J, He S, et al. Possible Vertical Transmission of SARS-CoV-2 From an Infected Mother to Her Newborn. *Jama-Journal of the American Medical Association* 2020; **323**(18): 1846-8.
337. Zeng H, Xu C, Fan J, et al. Antibodies in Infants Born to Mothers With COVID-19 Pneumonia. *Jama-Journal of the American Medical Association* 2020; **323**(18): 1848-9.
338. Dong Y, Mo X, Hu Y, et al. Epidemiology of COVID-19 Among Children in China. *Pediatrics* 2020.
339. Liu X, Chen Y, Tang W, et al. Single-cell transcriptome analysis of the novel coronavirus (SARS-CoV-2) associated gene ACE2 expression in normal and non-obstructive azoospermia (NOA) human male testes. *Science China-Life Sciences* 2020.
340. Zhu FC, Li YH, Guan XH, et al. Safety, tolerability, and immunogenicity of a recombinant adenovirus type-5 vectored COVID-19 vaccine: a dose-escalation, open-label, non-randomised, first-in-human trial. *Lancet* 2020; **395**(10240): 1845-54.
341. Gao Q, Bao L, Mao H, et al. Rapid development of an inactivated vaccine candidate for SARS-CoV-2. *Science* 2020.
342. National Center for Healthcare Quality Management in Obstetrics. Advice on the delivery services and management for pregnant women with COVID-19. *Chin J Obstet Gynecol* 2020; **55**.
343. Maternal and Fetal Experts Committee, Chinese Physician Society of Obstetrics and Gynecology, Chinese Medical Doctor Association, Obstetric Subgroup, Society of Obstetrics and Gynecology, Chinese Medical Association, Society of Perinatal Medicine, Chinese Medical Association, Editorial Board of Chinese Journal of Perinatal Medicine. Proposed management of 2019-novel coronavirus infection during pregnancy and puerperium. *Chin J Perinat Med* 2020; **23**(2): 73-9.
344. National Health Commission of China. Notice on strengthening the treatment and safety of delivery for pregant women during the prevention and control of Covid-19 epidemic. Feb 8, 2020.

http://www.nhc.gov.cn/fys/s3581/202002/4f80657b346e4d6ba76e2cfc3888c630.shtml (accessed Feb 16, 2020.
345. Yu Y. COVID-19 Prevention and Control Q&A for Pregnant Women. Beijing: People's Medical Publishing House; 2020.
346. Ministry of Health. National Health Statistics Yearbook 2012. Beijing: Peking Union Medical College Press; 2012.
347. Ministry of Health. National Health Statistics Yearbook 2009. Beijing: Peking Union Medical College Press; 2009.
348. NCAIDS, China CDC. Update on the AIDS/STD epidemic in China and main response in control and prevention in December, 2012. *Chin J AIDS STD* 2013; **19**(2): 85.
349. Cancer Statistics Center , American Cancer Society. https://cancerstatisticscenter.cancer.org/?_ga=2.115144643.559733434.1542588377-949007798.1542588377#!/ (accessed 2018/08/14 2018).
350. Ferlay J, Steliarova-Foucher E, Lortet-Tieulent J, et al. Cancer incidence and mortality patterns in Europe: Estimates for 40 countries in 2012. *European Journal of Cancer* 2013; **49**(6): 1374-403.
351. Torre LA, Bray F, Siegel RL, Ferlay J, Lortet-Tieulent J, Jemal A. Global Cancer Statistics, 2012. *Ca-a Cancer Journal for Clinicians* 2015; **65**(2): 87-108.
352. Manual - System of Health Accounts (SHA 2011)
(Revised edition): World Health Organization, 2016.

Panels & Figure Legends

Panel 1 Key messages in this commission

Key messages in this commission
· RMNCAH focuses on two key matters: “birth” and “development”, which are the primary driving forces for the development in future, especially in the era of aging population and low fertility rate in China. · Over the past 70 years, China has made remarkable achievements in the “survival” development goals of lowering maternal and child mortality. Maternal mortality rate (MMR): 1500/100,000 (1949) → 17.8/100,000 (2019), and Infant mortality rate (IMR): 200/1000 (1949) → 5.6/1000 (2019). · Any successes in RMNCAH are attributable to efforts both within and outside health systems. The most notable contributors in China are strong political will to focus on RMNACH and improvements in gender equity. · China is in a transition period from “survival” to “thriving” in RMNCAH, with growing demands for high-quality healthcare. · A series of emerging or neglected conditions in RMNCAH should be brought to the forefront. These include infertility, advanced maternal age, stillbirth, child protection, psychological disorders among children and adolescents, and sexual and gender-based violence, as well as emerging infectious diseases such as coronavirus disease 2019 (COVID-19). · To achieve universal RMNCAH coverage by 2030, attention must be paid to the following key issues: RMNCAH in all policies, disparities and equity in subgroups, financing risk protection, evidence-based practices; the continuity of RMNCAH services, dignity care and professionalism; and the application of innovative sciences and technologies. · It is necessary to consider the applicability and transferability of these results when sharing the “Chinese experience” with LLMICs. · Above all else, the most important goal is to build a friendly and supportive environment for every woman, child and adolescent.

Panel 2 The historical transition of population policy in China

❒ With the end of the long civil war and the establishment of the People's Republic of China, the Chinese government began to implement policies to encourage fertility under slogans such as "There is Strength in Large Numbers of Peoples (人多力量大)". In 1950, the State began to restrict abortion, a policy first applied to government workers. In 1952, this policy was extended to all Chinese women. The policy stated that women were prohibited from undergoing sterilization and elective or voluntary abortion for nonmedical reasons. But the unpopularity of the policy, led to a reversal and by 1955 women were allowed an abortion with the approval of the local government.

❒ By 1970 the population had almost doubled and the total fertility rate (TFR) had reached 5.9, leading to concerns about a shortage of resources. In 1973, the Government introduced the "Later, Longer, Fewer" policy, which encouraged couples to delay their first child, reduce the number of births, and increase birth spacing to at least 3-4 years. By 1979 the TFR was halved to 2.9. However, two thirds of the population was still under the age of 30 years old, and early baby boomers were entering childbearing age at that time in China.[59] To control overpopulation, extreme poverty, and resource shortages, China introduced the "one-child" policy in 1980.[319] The implementation of the "one-child" policy varied widely across the country. In urban areas, one child was allowed. In rural areas of Western and Central China, two children were allowed with spacing of at least 4-5 years. In eastern rural areas, there was a "one and a half child" policy, whereby if the first child was a girl, a second child could be born. In remote areas and ethnic minority groups, three or more children were allowed.

❒ The "one-child" policy had a profound impact on women, children and families.[20] Positive aspects included the following: (1) the TFR was reduced from 2.9 in 1979 to 1.6 in 2015, the cumulative number of births was reduced by approximately 400 million, which helped to lift 300 million people out of poverty; (2) women benefited from a smaller number of pregnancies and births, which reduced morbidity and mortality; (3) family resources were concentrated in fewer children, promoting their healthy growth and development, and especially benefiting girls.[58] The negative effects included: (1) the decrease in births, lead to a reduction in the labour force which is necessary for sustained economic growth;[58] (2) the strict limitation on family size, together the strong tradition of son preference, led to a large number of sex-selective abortions, resulting in an excess of male newborns and an unbalanced sex ratio;[320] and (3) it led to the so-called 4:2:1 phenomenon, in which many couples were solely responsible for the care of one child and four elders.

❒ As a result of the "one-child" policy, China gradually entered a stage of "low births, low deaths, and low natural growth". The government realized that change was necessary. In 2011, the government started to relax restrictions on the "one-child" policy, allowing couples with one-child status to have two children. In 2013, further relaxation allowed couples in which one spouse with one-child status to have two children. However, these policies have had little effect on increasing the birth rate, and as of May 2015, only 1.45 million of the 11 million eligible couples (13.2%) had applied to have a second child.[321] So in late 2015 the "universal "two-child" policy" was introduced, allowing all Chinese couples to have two children. The government planned to achieve a TFR target of 1.8 by 2030 (1.5-1.6 in 2015).[322] But the "one-child" per family has become a "social norm", and the costs of raising children have become very expensive. China will be a low-fertility country for the foreseeable future.[16] After an initial increase in births with the policy change (related to couples waiting for permission to have a second child), annual birth numbers have declined from 17.23 million in 2017, 15.23 million in 2018 to 14.65 in 2019 (Appendix 2). There is now a need for pronatal policies, statutory maternity pay, and the provision of more affordable child care and health services.

2706 **Panel 3 HPV vaccination in China**

HPV vaccination in China

On July 31, 2017, China announced that the HPV vaccine would be available across 17 provinces. However, there have been a number of challenges in China:

(1) ***Delayed application of the HPV vaccine in China.*** The HPV vaccine has been licensed and successfully applied in different countries since 2006.[323] However, the use of the HPV vaccine in China has been delayed for nearly a decade. In July 2016, China approved the 2vHPV vaccine; in June 2017, it passed a license for the 4vHPV vaccine; and in April 2018, it approved the 9vHPV vaccine. These delays and the inability to use the HPV vaccine in China have led to a considerable health burden.[324]

(2) ***Awareness of the HPV vaccine is still low.*** Since the official introduction of the HPV vaccine in China in 2016, public awareness and knowledge of it remains low. Only 24% of ordinary women and 25% of parents raising young adolescents have heard of the HPV vaccine.[325,326] Among healthcare providers, less than 20% consider women who have not had sex to be the most suitable for HPV vaccination.[325] Further health education and broader counselling support are therefore required to increase awareness of the HPV and its vaccine.

(3) ***The recommended age for HPV vaccination does not comply with recommendations.*** Since the best time for HPV vaccination is before sexually activity starts, the main target group recommended by the WHO is 9- to 14-year-old girls whereas the recommended age for the 9vHPV vaccine in China is 16-26 years old. Given earlier sexual activity now in China the age for HPV vaccination should be lower and in-line with WHO guidelines. Women are also advised to be vaccinated before the age of 26.[327,328]

(4) ***Shortage of supply of the HPV vaccine.*** China's HPV vaccine is reported to be in short supply. In February 2019, the Sichuan Provincial Center for Disease Control and Prevention suspended vaccination due to a shortage of the HPV vaccine, and women in Shenzhen were then vaccinated by a lottery.

(5) ***The HPV vaccine is expensive.*** Currently, at community health service centers, a dose of 9vHPV vaccine costs at least 1300 RMB (almost 4000 RMB for three doses in total). As a result, the HPV vaccine available in China is too expensive for the public, especially women with lower socioeconomic status and those in rural areas. To reduce the cost and improve the uptake of HPV vaccine, it is necessary to support domestic production of HPV vaccine and link it with social health insurance.

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Panel 4 Lessons on reducing maternal and infant mortality in China

Lessons on reducing maternal and infant mortality in China

❒ Improving the legal system of protecting the rights and interests of women and children, especially to guarantee women enjoy equal education and labour rights with men.

❒ Developing the infrastructure in transportation and communications to promote the geographical equity of health services and ensure the timely referral of pregnant women and infants with critical conditions.

❒ The government takes the main responsibility to ensure the safety of pregnancy women and infant. Therefore, the needed financing, personnel and properties and other resources could be efficiently integrated to ensure the popularization of essential MCH services and the rescue of patients with critical and severe diseases.

❒ Carrying out appropriate health education with full consideration of the characteristics of local culture and religion. Health education is not only for women themselves, but also for those who can affect women's health behaviors, such as women's families, religious authorities, as well as doctors.

❒ Establishing a network of MCH care services, and establishing emergency centers for pregnant women and infants.

❒ Advocating skilled attendance and hospital delivery, and promoting targeted intervention technologies with low cost and easy operation, e.g. manual removal of placenta and resuscitation of birth asphyxia, to decreased mortality caused by postpartum hemorrhage, puerperal infection, neonatal asphyxia and tetanus, which are the most common causes of maternal and newborn deaths in developing countries.

❒ The government provides free essential vaccination for all children to promote the comprehensive child immunization plan in the national-wide.

❒ Establishment of an information system for maternal and child deaths to monitor maternal and child mortality and causes of deaths. It is very effective and efficient to implement death case review recommended by WHO to develop targeted interventions.

❒ Actively carrying out international cooperation on MCH projects and summarizing the beneficial experience of the projects and promoting it to the whole country.

Panel 5 Preventing and controlling of Covid-19 among women and children in China

Preventing and controlling of Covid-19 among women and children in China

Health systems are facing rapidly increasing demands arising from the Covid-19 pandemic. When health systems are overwhelmed, the indirect adverse outcomes will emerge, apart from the direct mortality and morbidity from an outbreak.[329] Therefore, there should be a balance between maintaining essential services and controlling infection risks.[330] China has responded quickly to protect women's and children's safety and health during the Covid-19 outbreaking.

❒ **Policies to safeguard and reconstruct health resources**

All 31 provinces in mainland China rapidly launched the first-level response to major public health emergencies in the early stage of the outbreak. The government released a series of policies to safeguard and reconstruct health resources, including:

(1) guaranteeing the supply of medical supplies and personal protective equipment (PPE);

(2) dispatching expert groups and medical teams to manage and control the outbreak response in the hardest-hit areas;

(3) providing free screening for people with a history of epidemiology, and free treatment for patients suspected or confirmed with Covid-19;

(4) building temporary Fangcang shelter hospitals to isolate patients with mild to moderate COVID-19;[331]

(5) 1654 maternity hospitals across all 31 provinces of mainland China were designated by the government to serve for pregnant women suspected or confirmed with Covid-19;[332]

(6) ensuring emergency and essential services to give priority to the healthcare demands of pregnant women, children, elders, and patients with emergency or severe diseases.[333]

❒ **Epidemiological, clinical and basic research**

National Health Commission established the Covid-19 epidemic reporting system to upload epidemiologic history and medical records of confirmed or suspected cases each day, to analyze and monitor the epidemic situation and clinical outcomes. In addition, the central government, local governments and lots of research institutions have funded grants on epidemiological, clinical and basic research. Several significant achievements in the research field of women and children health are:

(1) constantly updating the evidence of the vertical transmission potential of Covid-19 though collecting and testing multi-samples, such as neonatal nasopharyngeal swab, amniotic fluid, cord blood, and breastmilk;[334-337]

(2) describing the epidemiologic and clinical characteristics of pregnant women and children with Covid-19,[148,338] and further follow-ups of mothers and children on both physical and psychological health have already begun;

(3) performing single-cell RNA seq analysis of ovary, testis, germ cell, embryo and maternal-fetal interface to assess the effects on human reproductive system and fertility function;[339]

(4) developing two types of Covid-19 vaccine and launching clinical trials: one is a recombinant adenovirus type-5 vectored vaccine,[340] the other is a purified inactivated vaccine.[341]

❒ **Guidelines & reforming services**

A series of governmental guidelines and expert consensuses were launched immediately to guide and reform healthcare services for women and children.[342-345] These measures and recommendations mainly include:

(1) all maternity hospitals should build a pre-triage flow system, evaluate each pregnant woman by the history of epidemiology, symptoms, clinical features and maternal complications, identify and manage pregnant women with different level of risk;

(2) all pregnant women with suspected or confirmed infection should be transferred to the designated hospitals;

(3) suspected or confirmed cases should be placed in an isolation room; and, if possible, labour and delivery should be managed in a designated negative pressure isolation room;

(4) follow-up management of suspected or confirmed pregnant women and their neonates should be done to evaluate their safety and health by community health professionals;

(5) online healthcare service is recommended as an effective alternative approach in health education, counselling, and follow-up management.

Figure 1 Trends in maternal and child mortality in China (1990-2018)

(Source: Data for MMR (A), NMR (B), IMR (C) and U5MR (D) were from the Maternal and Child Health Surveillance System. Data published by the UN present a similar decreasing trend during a longer period, and data obtained in the same year from these two sources were also similar, seen in Appendix 6.)

Figure 2 The total mortality of Chinese children and adolescents of different age groups from 5 to 19 years from 1953 to 2016

(Note: Mortalities (total, boys, and girls) from 1953 to 2010 of children and adolescents were calculated using the data based on life tables and national demographic censuses from 1953 to 1981, and the GBD from 1990 to 2016. A clearer line chart by age group was further expanded from 1990 to 2016 for the total (A1), boys (B1), and girls (C1).[13])

Figure 3 RMNCAH-related national policies and programmes in China

Figure 4 The hierarchical MCH system in China

Figure 5 Trends in social insurance coverage in China

(Source: Data on social insurance coverages during 1993-2013 were obtained from The Fifth National Health Service Survey Report, 2013, by the National Health Commission Statistical Information Center;[25] Data on the coverages of the CMS/NRCMS during 1958-1998 were obtained from Gu X and Fang L;[23] and data on the coverages of NRCMS and NRCMS premiums per capita during 2004-2017 were obtained from Health Statistics Yearbook (2009, 2012 and 2018) and the National Health Commission.[29,346,347])

Figure 6 Trends in China's ART Cycles from 2009 to 2017

(Source: Data are from Maternal and Child Health Division, National Health and Health Commission. Assisted reproductive technology (ART) total technical service cycle numbers include IVF-embryo transfer (IVF-ET), intracytoplasmic sperm injection (ICSI), frozen-thawed embryo transfer (FET), preimplantation genetic diagnosis (PGD), artificial insemination by husband (AIH) and artificial insemination by donor (AID). The number of live births in 2017 has not been reported.)

Figure 7 Trend of sexually transmitted diseases in China

(A) Trends in the incidence of sexually transmitted diseases in China (1982-2016) *(Source: China Health Statistics Yearbook in 2017, National Health and Health Commission.[107])* **(B) Transmission of HIV infection in China (2012 vs 2017)** *(Source: Center for STD/AIDS Prevention and Control, Chinese Center for Disease Control and Prevention.[110,348])* **(C) Incidence cases of AIDS among students in China (2013-2017)** *(Source: Center for STD/AIDS Prevention and Control, Chinese Center for Disease Control and Prevention.[111])*

Figure 8 The incidence and mortality rates of breast and cervical cancer in women in some countries and regions (1/100,000)

(Source: China National Cancer Center (China 2014),[114] American Cancer Society Cancer Statistics Center (incidence rate: US 2010-2014, mortality: US 2011-2015),[349] European Cancer Registry Network (UK 2012 and Europe 2012),[350] and the Global Cancer Observatory and the International Agency for Research on Cancer (more developed regions in 2012 and less developed regions in 2012).[351] All morbidity and mortality rates are age-standardized.)

Figure 9 Cause-specific maternal and neonatal mortality in China, 2000 and 2018

(Source: National maternal and child health information analysis report.[136])

Figure 10 Overall Survival Rate of Preterm Infants born in China, US or Australia, depending on gestational age at birth

(Note: Data for China come from 2013-2014; Australia, 2007-2011; and USA, 2006-2011.[162-164])

Figure 11 The prevalence of overweight and obesity from 1995 to 2014

(Source:1995~2014 Chinese National Survey on Students' Constitution and Health.[205])

Figure 12 The myopia prevalence from 2005 to 2014 by age group among Chinese students

Figure 13 The out-of-pocket proportion of total health expenditure in China (2017)

(Note: Data of total health expenditure in 2017 are from the China National Health Development Research Centre. The original data were collected through the National Total Health Expenditure Monitoring Network of National Health Commission, which was established in 2015 and covered about 26,000 health institutions in all 31 provinces of mainland China. The total health expenditures, by age, gender and specific disease, were statistically measured based on the System of Health Accounts 2011 (SHA 2011) recommended by WHO.[352] The bar of "Total" refers to the total health expenditure for all healthcare services for all people.)

Figure 14 China's Challenges of RMNCAH in the process of "Healthy China 2030"

Figure 15 RMNCAH Strategy framework for "Healthy China 2030"

(This framework is adapted from WHO frameworks of health systems building blocks and universal health coverage. Six blocks are service delivery, health workforce, information, medical products & vaccines & technologies, financing, and leadership & governance.[305] Six essentials of universal health coverage are health financing, essential medicines and health products, health systems governance, strengthening health workforces, health statistics and information systems, and service delivery and safety.[306])