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REVIEW

Impacts of China's One-child Policy on Public Health in China: An Overview

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ABSTRACT

In 2015, China lifted its one-child policy and replaced it with a universal two-child policy that became effective on January 1, 2016. The one-child policy, introduced in 1979 to strictly reduce population growth in the country, had profound impacts not only on population growth control, but also on public health and many other aspects affecting population health. In this article, we review its positive impacts on public health in China, such as greatly improved health status in the country, most likely due to the combination of the one-child policy and the economic reform that started approximately the same time. We also discussed several undesirable outcomes, such as skewed sex ratio and aging population. Finally, we proposed potential strategies to compliment the newly implemented two-child policy.

Keywords: China, One-child policy, public health, maternal and child health, sex ratio, aging society

摘要：2015 年底， 中国宣布取消独生子女政策，并于 2016 年一月一日开始实施二孩政策。自从 1979，独生子女政策在过去 30 多年减缓了中国的人口增长， 同时也在公共卫生和人口健康有深远的影响。这篇概述回顾独生子女政策在公共卫生方面的积极影响，也讨论了一些政策的负面影响，比如偏倚的男女比例和加速老龄化。 最后，本篇概述提出一些让二孩政策更好实施的策略。

关键词：中国，独生子女政策，公共卫生，妇幼健康，性别比，老龄化社会

1. Introduction

Family planning is an important tool for a country on many fronts, including population control, social-economic development and public health. Properly applying family planning strategies can lead to a wide range of public health benefits, such as lower rates of maternal and infant mortality, and can subsequently influence economic growth and promote health status among the whole population. As a result, family planning policy remains one of the important public health measures, especially in developing countries (USAID, 2005).

China's family planning policies over the past few decades had major changes with profound impact on the country. Between 1979 and 2015, a one-child policy was implemented as a drastic measure to reduce the population in China and alleviate the social, economic and environmental burdens associated with its large population (Hesketh, Lu & Xing, 2005). During this period, China had significantly reduced population growth and improved the economic and health status. With China's current standing as the second largest economy in the world, the one-child policy was one of the most important social policies ever implemented, not only for China, but also for the world (Potts, 2006).

However, this policy had drawn strong criticism and had been viewed as a serious violation of the principles of human rights, especially on women's reproductive freedom (The Lancet, 2011). It led to a number of negative outcomes, such as forced abortions and sterilizations, and changes in the country's social structure, such as the skewed male/female sex ratio at birth and rapidly aging society (The Lancet, 2011; Festini & de Martino, 2004). In 2015, Chinese government announced a universal two-child policy that became effective on January 1, 2016.

The objectives of this article are to, 1) conduct an overview on the positive and negative implications of China's one-child policy from the view point of public health; and 2) suggest potential strategies that may compliment and strengthen the new two-child policy. We conducted a literature search with a combination of key words including variations of "one-child policy", "family planning", "health" and "China", with publication time period set from 1979 to present. In addition, reports and publications that were released by officially recognized entities, including Chinese government, international organizations such as the United Nation and World Health Organization were also included. The publications and reports are then reviewed, compiled, summarized and discussed according to the following outline, 1) background and overview of the policy, 2) outcome in population control and overall improvement of economic status, 3) maternal health, access to maternal health services, and women's attitude, 4) infant and children's health, and 5) effects on social structure: gender imbalance and aging society.

2. Background and Overview of the Policy

China's recent modern history from the late 1800's to mid-1900's was marred by numerous wars, including a revolutionary uprising that ended China's two-thousand-year of imperial era, followed by World War I, World War II, and a civil war that ended in 1949 which led to the establishment of People's Republic of China. In the 1950's, then

China's Chairman Mao Zedong promoted that more man powers were needed and encourage child births (Hardee, Xie & Gu, 2004). The country's population rose sharply from 540 million in 1950 to 850 million in 1970 (Zhu, 2003), while the economic development in the country was minimal, if any. The total fertility rate (TFR), defined as the mean number of children born per women, was over 5 in 1970, which was more than twice of the replacement rate of 2.1 (World Bank, 2016).

At the time, China consisted one quarter of the world's population, while occupying 7% of the world's arable land. Two third of the country's population was under 30 years of age, and the baby boomers of the 1950s and 1960s were entering reproductive age (Hesketh, Lu & Xing, 2005; Zhu, 2003). In the mid-1970s, a Later-Longer-Fewer campaign was introduced, although not in all provinces, to encourage later childbearing age (25-year for man and 23-year for women), greater spacing between children, and two children from each couple (Kane & Ching, 1999).

In 1979, Chinese government implemented a country-wide family planning policy, well known as the one-child policy, aiming at strictly control population growth to allow proportional economic and social development. This policy included a set of rules and regulations to govern approved family size and to advocate delayed marriage and childbearing. In general, one child was allowed for a couple; and if a second child was permitted and approved, there must be a wide spacing between the two children. Although widely-known as the one-child policy, the policy allowed for second children in several categories. These included minority populations, families whose first child had disability or was deceased, rural families whose first child was a girl, families in which fathers were miners or work in other high-risk occupations (Hardee, Xie & Gu, 2004).

The policy was set up at the central government level, but was implemented at local levels, which warranted considerable regional differences on how strictly and properly it was carried out. In general, it was more strictly enforced in urban and suburban areas than in rural areas, and stricter for the Han majority population than minority ethnic populations (Short & Zhai, 1998). If found non-compliance, families were generally subjected to hefty fines and were refused with many government subsidies and benefits. The "non-permitted" second or later children would have difficulty to be registered and most likely would not be given social benefits on education and health care enjoyed by the single children. In addition, such families might face stigmatism and other social burdens (Doherty, Norton & Veney, 2001).

3. Outcome in Population Control and Overall Improvement of Economic Status

Over the 36-year duration of the one-child policy, the policy's effect on population growth control was profound. The population growth was reduced from 1.3% in 1979 to 0.5% in 2014 (Fig 1). The TFR decreased from 2.8 in 1979 to 1.7 in 2002, 1.3 in urban areas and just under 2 in rural areas, and had been kept steady since then, which was well below the replacement rate of 2.1 (World Bank, 2016). An estimate of 400 million births have reportedly been prevented (China Daily, 2009).

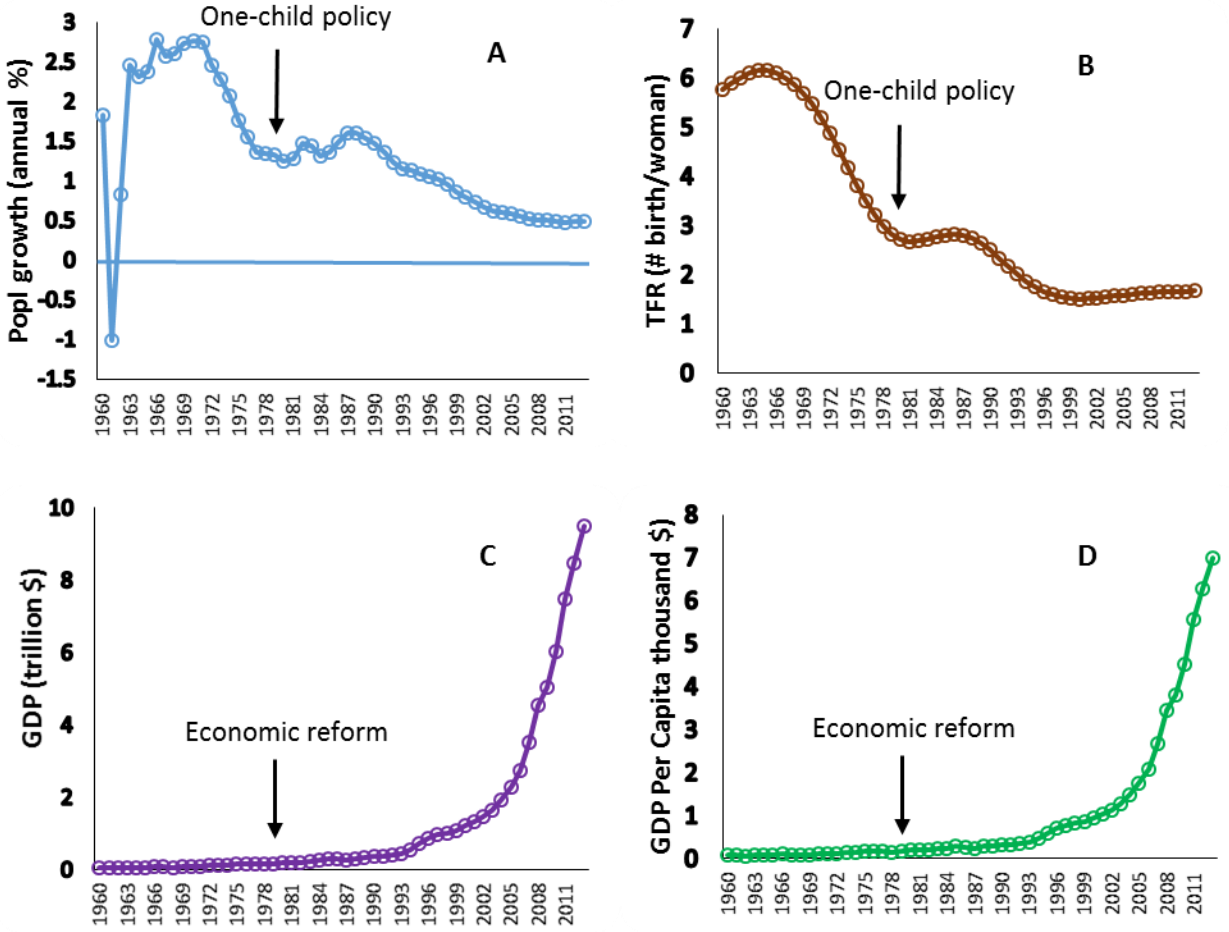

Fig 1. Historical data on (A) China's population growth (annual %), (B) total fertility rate (TFR), (C) gross domestic product (GDP, in trillion dollars), and (D) GDP per capita (in thousand dollars) from 1960 to 2014. Data source: the World Bank.

Coinciding with the one-child policy was China's economic reform that started in late 1978. The economic reform included the de-collectivization of agriculture, the "open-door" policy that opened up the country to foreign investment, and permission for entrepreneurs to start businesses, all of which were a deviation from the socialistic planned economic system that the country had since the establishment of the People's Republic of China in 1949. Since the late 1970's, unprecedented economic growth occurred. The country's gross domestic product (GDP) growth estimated at an average rate of 10.0% a year. The GDP in 2014 increased by 58 times compared to 1979, and the per capita GDP also increased by 42 times during the same period (Fig 1). At present, China's economy is the second largest after the United States, surpassing industrial countries such as Japan and western European countries.

This rapid economic development is most likely a result of both the economic reform that encouraged foreign and domestic investments and entrepreneurship, and the one-

child policy that helped slowing the population boom (Feng & Mason, 2005; Hesketh & Zhu, 1997). The debated question is, was it absolutely necessary to carry out the mandatory, and sometimes ill-implemented one-child policy that was widely criticized by many for violating basic human rights?

Some agreed with the justification and necessity of the policy. One circumstance that would require such measures is "demographic entrapment", defined as 1) a community either has, or is about to, outgrown the carrying capacity of its ecosystem, and 2) its people have no place to migrate to, or access of such migration is limited or non-exist, and 3) a country has too few exports to exchange for food and other essentials (King, 2005). Such entrapment will undoubtedly lead to an array of problem, such as severe poverty, starvation and potentially political instability. China experienced these problems in the 1950's and 1960's, and "dis-entrapped itself" within possibly the shortest amount of time by combing the one-child policy and economic reform. Some recognized the success of such policy and was even discussing and opening the dialogue on one-child family in other parts of the world, such as in certain African countries (King, 2005).

Some others, however, viewed the impact and necessity of the one-child policy differently. The sharpest decrease on China's population growth and fertility rate occurred in the early to mid-1970, before the one-child policy was introduced (Fig 1). Meanwhile, the TFR was also decreasing at the same time in the neighboring countries and areas in Eastern Asia, including Singapore, Japan and Hong Kong (Hesketh, Lu & Xing, 2005). Therefore, one could argue that without such rigid policy, China might still have success in population growth control with the voluntary Later-Longer-Fewer policy that preceded the one-child policy. This opinion, as expected, can be debated by studying the historical backdrop. The culture revolution from the year of 1966 to1976 that crippled the country's economic, health and education system could be the main reason for the sharp decrease on fertility in most of the 1970's. The voluntary family planning policy, though was effective in bringing down the TFR to 2.9 by 1979, most likely would not reduce the fertility rate to 2 or less, considering the traditional view and desire for multiple children and son-preference (Merril, Cong & Li, 2006; Poston Jr, et.al, 1997). Moreover, considering two third of the country's population at the time were under the age of 30-year and the baby boomers of the 1950's and 1960's were entering into their reproductive age, even a modest fertility rate could still result in a large population growth.

4. Maternal Health, Access to Maternal Health Services and Women's Attitude

The one-child policy included wide-spread family planning services and community-based contraceptive delivery services to the population, as well as family planning education and marketing. It also provided almost universal government subsidized prenatal care for women with approved pregnancies. Since the implementation of the policy, the overall health status, especially health indicators for women and children, improved greatly. For example, China's maternal mortality rate (MMR) was 165 per 100,000 live births in 1980 (Hogan et al. 2010) and decreased steadily to 27 per 100,000 live birth in 2014 (World Bank, 2016). China's MMR was markedly lower than most developing countries such as India (174/100,000) and Brazil (44/100,000), although was

still higher than most developed countries, such as the United State (14/100,000), Japan (5/100,000) and South Korea (11/100,000) (World Bank, 2016). The progress made on the improvement of maternal health can be contributed to many factors, including reduction of infectious disease, improvement of sanitation, availability of food, access to maternal and child health services, increase in women's literacy, and access to family planning services (Hesketh & Zhu, 1997).

It should be noted that most of the available data were based on official birth records. Even with the rigorous regulation on allowable number of children, it was common for women and families to opt for "underground" unapproved child births, almost exclusively for the reason of son-preference (Poston Jr, 2002; Arnold & Liu, 1986). For unapproved pregnancies, the choices for pregnant women were limited and often did not include proper obstetric care. They often concealed their pregnancies, delivered outside of proper facilities secretly, or migrated outside of their residential area to have more babies. Many did not seek proper maternal services. Even for those who could afford and plan to pay the fine upon childbirth, the pregnant women may delay prenatal care for fear that they might be encouraged to terminate the pregnancy at an early stage (Doherty, Norton & Veney, 2001). Given the unknown data on unapproved pregnancies, the actual maternal health indicator was likely to be worse than the official estimates.

Many studies focused on rural population, due to the lower socioeconomic status, less access to health care, lower overall health indicators, and most importantly, much stronger traditional view on son-preference. Indeed, there had been a gap between urban and rural areas and between different regions, as shown in a report by the Chinese Ministry of Health (MOH) (China MOH, 2011). Encouragingly, although the rural MMR was significantly higher than the urban MMR, the rate in rural area had also seen more rapid reduction than the urban area during recent years. In 2010, there was virtually no difference between the urban and rural MMR based on the China MOH report.

Short and Zhang (2004) studied the use of maternal health services in rural China, which could impact the maternal and child health. Roughly 60% of rural women had at least one prenatal visit and 40% had a professionally assisted childbirth over the period of 1988 to 1997. Moreover, there was a modest overall increase in the use of maternal services, despite the concern about growing inaccessibility in rural area due to the health care system shift from a socialist to more privatized decentralized system. However, it was noted that for women having their third or higher-order birth, the use of maternal service and rate of delivery by health professionals steadily decreased from 1994 to 1997, reflecting the effect of policy enforcement and women's avoidance of health care when having unapproved pregnancy (Short & Zhang, 2004).

There have been clear indications that the Chinese population, especially women's attitude is changing towards less children and were less traditional on son preference, which would result in less unapproved pregnancies. In a 2005 survey of 4600 women in 19 Chinese provinces, most women supported China's family planning policy and preferred a small family with on average less than 1.9 children (Cao et al., 2010). In a 2001 Chinese national family planning and reproductive health study, the preferred number of children in 39,344 women interviewed averaged 1.7 (Ding & Hesketh, 2006). In an earlier 1996-1998 study surveying 4500 women in 6 rural counties located in 3 provinces with different economic development, women related the policy to the

economic improvement and to their ability to prosper by having fewer children (Hardee, Xie & Gu, 2004). In the province with the highest economic development, 73-75% of participants with one child were satisfied with their number of children, regardless of sex, while in the two less developed provinces, 54-58% of women with only a son and 31-50% with only a daughter were satisfied (Hardee, Xie & Gu, 2004). These surveys further demonstrated the attitude in Chinese women towards small family size. Although studies were conducted mostly among women, the surveys reflected the opinion of the whole population in the society on their preference of small-sized families.

5. Children's Health and Nutritional Status

Similar to the maternal health status, children's health status in China has been improved remarkably over the past few decades. The infant mortality rate (IMR) has been steadily and significantly reduced from 50 per 1000 live births in 1979, to 9.2 per 1000 live births in 2015 (World bank, 2016). China's MOH report also showed a similar observation that the under-five mortality rate was reduced by 73.1% and 58.7% in 2010, in comparison to data in 1991 and 2000 (China MOH, 2011).

Also similar to maternal health indicators, there was a substantial gap between the urban and rural infant and children's health indicators (Feng et al., 2011). The under-five mortality rate in rural areas was 2.8 times higher than in urban areas in 2010 (China MOH, 2011). Moreover, it is highly likely that the actual infant and young children's mortality rates in the rural area were under-estimated due to the higher likelihood of unapproved pregnancies and childbirths that may not be reported.

Child nutritional status, another important indicator to children's health, has improved markedly over the past few decades. According to data collected from the China Health and Nutritional Survey (CHNS), the prevalence of stunting among children under 5 years of age decreased by 42% between 1992 and 2002, marking the largest decline in under-nutrition in any country during the same period (Wang et al., 2007). Using four cycles of data from CHNS from 1991 to 2000, the only-child status was found to be one of the most important predictors for nutritional status, after controlling for socio-economic characteristics of the household such as family income and mother's educational level (Bredenkamp, 2009). Although the author cautioned that the analysis and conclusion were focused on the single-child status, rather than the effect of the one-child policy, it is evitable that the one-child policy was the factor leading to the vast majority of the single-child families.

On the opposite end of the nutritional status lies over-nutrition and the consequences of over-nutrition such as overweight and obesity. China has seen a rapid increase in obesity in the population, including children (Ji, 2009). The prevalence of overweight and obesity in 2006 increased by 118% and 250%, respectively, compared to those in 1991, based on 6 cycles of the NCHS survey (Cui et al., 2010). This problem was more serious in boys than girls, in children from urban areas than those from rural countryside, and in children from higher income families, which is different from that in other western countries.

Many factors contribute to overweight and obesity in the new generations of Chinese children, such as the availability of food, the increased overall fat content in diet, the imported unhealthy fast food that are viewed as trendy, more sedentary lifestyles,

knowledge lag in healthy eating, and the traditional favorable views on fat babies. The one-child policy has also been proposed as an important factor, because the single children are the focus of the parents and grandparents, who tend to over feed and over nurture these children. Yang (2007) investigated the relationship between the policy and overweight in young children, drawing from the longitudinal data from the CHNS and a cross-sectional analysis of the 2000 survey data from different regions with policy variations. The study found that single children and those in strict policy communities had a higher incidence of overweight than children with sibling and those in areas with less strict policy. However, these differences disappeared after adjusting for household and community characteristics such as children's age, parental BMI, maternal education levels, household income, local socioeconomic development and urban residence. Therefore, the study concluded that the one-child policy did not bear an independent association with childhood overweight, and that other socioeconomic risk factors might be the main reason driven the apparent crude association between the policy and overweight (Yang, 2007).

6. Skewed Sex Ratio

The combination of strong traditional son-preference in Chinese culture and the rigorous family size enforcement led to many unethical practices, such as sex-selective abortions, and strikingly higher infant mortality in female babies born of higher birth order. It was reported that early neonatal mortality for second-parity daughters was 6.2 times higher than that of second-parity sons, while there was no significant difference between the sexes for first-born infants (Wu, Visainen & Hemminki, 2006). A national study on maternal health care and infant mortality in rural China found that a female infant of higher birth order without a brother was especially vulnerable to high mortality rate (Chen, Xie & Lin, 2007). This problem was highlighted in a review on non-medical sex-selective abortions that estimated 40 million missing females in China (Nie, 2011). Moreover, second or higher order born girls after first born girls had a higher risk of being subjected to mistreatment, child abandonment, or even infanticide.

As a result, the imbalanced sex ratio in China has become more prominent and has received much attention (Festini & de Martino, 2004; Ding & Hesketh, 2006; Zhu, Liu & Hesketh, 2009; Zhou et al., 2011). The sex ratio at birth (SRB), defined as the ratio of number of boys born to girls born, was 1.06 in 1979, and increased to 1.11, 1.17 and 1.21 in 1988, 2001 and 2005, respectively (Hesketh, Lu & Xing, 2005; Zhou et al., 2011). The SRB was dependent on the birth order, at 1.06, 1.24 and 1.28 for first, second and third childbirth, respectively, based on a 2001 survey (Hesketh, Lu & Xing, 2005). In addition, the progression of sex ratio imbalance was also reflected in a 2005 inter-census survey of the national population. The sex ratio was 1.08 among the 15-19 age group that were born at the early stage of the one-child policy (1985-1989), then increased to 1.14 for the 10-14 years of age (born 1990-1994), 1.19 for 5-9 year olds (born 1995-1999), and peaked to 1.24 in 1-4 year olds (born 2000-2004), before dropping to 1.19 in the <1 year infants that were born in 2004-2005 (Zhu, Lu & Hesketh, 2005), potentially as a result of Chinese government's public education campaign advocating for girls and gender

equality and policy measures that encourage rural families with daughters (Zhou et al., 2011).

The skewed sex ratio could have profound implication on the society and cause a variety of social problems and instabilities, as discussed in detail elsewhere (Hesketh, Lu & Xing, 2005). It is imperative to alleviate and eventually stop practices leading to the imbalance sex ratio. The key is to change the traditional son-preference view among the general population by aggressive education and empowerment, in combination of properly and strictly enforced government policies such as illegalization of non-medically necessary prenatal sex determination, sex-selective abortions, and severe punishment on those who offer such services.

7. Aging Society and Impact on the Health Policy Development

A family planning policy would shape or re-shape a country's demographic structure, and its consequences can be far reaching. While the one-child policy achieved its goal of reducing offspring within possibly the shortest amount of time, China's economic condition and stand of living improved drastically, which led to increased longevity in the country. In addition, the baby boomers born in the 1950's and 1960's are entering their golden age. This combination resulted in the rapid aging of the society and the population. In 1982, 4.9% of China's population was over 65 years; in 2000, this percentage rose to 7% and China became an "aging society" as defined by the United Nations (Festini & de Martino, 2004). In 2014, 9.2% of the population aged 65 years and older (World Bank, 2016).

Aging population is a well-known and challenging problem. In contrast to developed countries where the countries became rich before their population became aged, China is becoming old at an unprecedented rate before or at the same time as the country undergoes economic development. This has created a number of problems, such as income inequality in rural areas (Zhong, 2011). More notably, taking care of the aging population becomes particularly challenging (Wan, Yu & Kolanowski, 2008; Flaberty et al., 2007; Feng et al., 2011; Leng et al., 2010). Traditionally, caring for the aged people falls on their grown children. Even though this view has alleviated gradually, family support is still the dominant approach for elderly care in China. This type of care, however, is more and more difficult. Many adult children work and live away from their aged parents. The one-child policy created a 4-2-1 family reversed pyramid-like structure, with four grandparents, two parents and one child (Leng et al., 2010). This means a single child couple potentially would need to care for their one child, four parents and up to either grandparents without help from any siblings – a situation very difficult, if not impossible, for working couple to handle.

There are limited commercial and social support systems available for elderly in China, as reviewed elsewhere (Wan, Yu & Kolanowski, 2008). The support systems, such as government-sponsored or private elderly health care facilities, are in general only available to those who with higher income, pension and healthcare. There are few government-run social welfare facilities serving mostly low-income mentally retarded, deficient adults without family support and childless elderlies (Feng et al., 2011). All of these facilities are in general located at the urban areas and are out of reach for the vast

rural population. In addition, the capacity and quality of care for such systems is often criticized for lacking systematic monitoring and evaluation. Therefore, replying on commercial and social elderly care is often the last resort and sometimes marked with stigmatism in the society. With the current demography structure change and rate of aging, there has been an increase of institutionalized elder care homes in recent years, especially in large cities, and Chinese government has made progress in encouraging social resources and support for a variety of government and private-owned and operated senior care institutions (Flaberty et al., 2007; Feng et al., 2011; Chen et al., 2010). However, the existing system can only accommodate 0.8% of China's aged population, far fewer than what are expected based on international standards (Flaberty et al., 2007).

Financing the elderly care is another challenge. Currently, elderly care costs are mostly paid by individuals and their families. Chinese healthcare system is based on a fee-for-service system (Wan, Fu & Kolanowaski, 2008; Flaberty et al., 2007), and currently, China does not have a national health insurance program for older people that is equivalent to Medicare in the United State (Feng et al., 2011). The fee-for-service system has faced or created certain challenges, such as larger increase on the cost of health care compared with cost of living, and incentives for providing more expensive medications and services. Even for those with health insurance, the out-of-pocket expenditure has increased from an average of 38.8% of the total healthcare costs in 1991 to 60.5% in 2001 (Flaherty et al., 2007). It is common for hospitalized patients to be discharged against medical advice or for a potential patient to be turned away from hospitals because they do not have sufficient amount of money to cover the medical cost. China has recognized these challenges and is currently undergoing a healthcare reform that takes in consideration of access to healthcare in rural areas and insurance reform. In addition, some cities and academic institutions have been developing geriatric programs or models to build up the medical service capacity and healthcare system suitable for caring for aged populations (Leng et al., 2010; Chen et al., 2010).

8. New Two-child Policy

In light of the challenges facing China, Chinese government has recognized the necessity for change and has been relaxing the family planning policy gradually. In 2011, China started to allow for a second child when both parents were single children. In 2013, China widened the two-child eligibility to couples in which one parent was a single child. In October 2015, China announced a universal two-child policy that became effective on January 1, 2016.

While the two two-child policy is welcomed throughout the country, it would also be beneficial to consider necessary measures to prepare for, compliment and strengthen the new policy and the health of the nation. First, with the anticipated increase in childbirth in the coming years, it is important to have sufficient maternal and pediatric health care resources across the country and regions, rural or urban. Particularly, there most likely will be an increase in the number of high-risk pregnancies related to high maternal age that will require more specialized prenatal, neonatal and pediatric care. Second, country-wide public campaigns on healthy eating and active lifestyle should be initiated and continued by engaging all stakeholders, including the public, government agencies,

healthcare professionals, academic institutions and public/private organizations, aiming at slowing down or stopping the alarming increase of overweight and obesity rate in the general population, especially in children. Third, as China is carrying out a healthcare reform encompassing the whole population, it is time to establish a well-planned elder care system that covers all facets needed for taking care of the large number of aging population in the country, such as elderly care facilities, cost, insurance, appropriate staffing and trainings. Lastly, continue the public education campaign on gender equality, strengthen and strictly enforce laws, regulations and punishments on non-medical prenatal sex determination and sex-selective abortions. Evidences have shown that women and the population's view have changed substantially towards less children and less son-preference, especially in more economically developed areas such as cities and affluent suburbs. Therefore, such public education campaigns should be more focused on rural and less developed areas, in order to continue reducing the son-preference view and the practices associated with this damaging attitude.

To conclude, China's one-child policy was one of the most far-reaching social policies ever implemented. This policy, in combination with the economic reform that started at around the same time, changed the country fundamentally, by reducing the population growth within a relatively short amount of time and increasing the standard of living and overall health status for the whole population. Inevitably, it also brought up a number of negative outcomes, such as skewed sex ratio at birth, insufficiently cared un-approved pregnancies and births, and a rapidly aging population. The newly established universal two-child policy should gradually alleviate the negative outcomes, especially if combined with other strategies, such as aggressive country-wide public campaigns on gender equality, healthy eating and living, a well-planned elder care system.

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