Bolstering Maternity Insurance to Support Family Health of Ethnic-Minority Women under Universal Two-Child Policy: Empirical Evidence from China's Ningxia-Hui Autonomous Region

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Bolstering Maternity Insurance to Support Family Health of Ethnic-Minority Women under Universal Two-Child Policy: Empirical Evidence from China's Ningxia-Hui Autonomous Region

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ABSTRACT

Background

Despite the overwhelming feeling of great happiness, joyful excitement and rituals that heralds the arrival of a child, for too many women (especially in developing countries), child bearing is associated with suffering, ill health and even death. The need to consolidate and support women to procreate in tranquillity has inspired international and domestic agencies to harness the resources at their disposal to protect the health of women especially during pregnancy, child birth and the post-partum period.

Methods

The study applied a systems dynamic model to selected data to establish the influence of the universal two-child policy in China on maternity insurance fund income. The study also established sensitivity analysis of the appropriate rate of contribution to keep the fund active.

Results

The study revealed that increases in utilisation rate as results of increase in number of births under the universal two-child policy increased the accumulated deficit of the maternity insurance fund income in the Ningxia-Hui Autonomous Region. At the current rate, the entire fund will be depleted by the end of 2021 unless the contribution rate is increased from 0.5% to 0.75%.

Conclusions

Maternal health is a "sentinel event" requiring an unprecedented global resource mobilisation to safeguard the future of humanity. Thus maternity insurance schemes in China require new methods of fund raising to keep a sustainable maternity insurance fund in the region. Study also reveals that population reform is not done in isolation but require changes in the fundamental social structures to ensure its sustainability.

Keywords: Maternal, Health, Maternity, Insurance, Ningxia, China, Ethnic Minority, Universal Two-Child Policy

BACKGROUND

The concept of motherhood and maternal health transcends an individual responsibility to a socio-cultural obligation in most societies across the globe[1]. Until recently and still in most parts of the world, motherhood is a dream and often associated with positive experience and honour. Particularly in traditional oriental societies, bareness is deemed a curse and misrepresented as a valley of endless and increasing sorrow for a woman[2]. Among traditional Middle East cultures, barrenness is viewed as a woman and a family's greatest misfortune[3] while in some pre-colonial African traditional societies bareness was the highest divine sanctions invoked on a woman or family for serious breaches of social mores[4].

Even in the so called ancient occidental cultures, infertility of a woman reflected her low social worth, her agony, sense of emptiness and failure which was lived with greatest social shame[5]. To this end child adoption (even in same sex marriages), artificial insemination, in vitro fertilization (IVF) etc have gained rapid acceptance and use due to the social repercussions of bareness and the intricate value of child bearing in both traditional and contemporary societies[6].

Despite the overwhelming feeling of great happiness, joyful excitement and rituals that heralds the arrival of a child, for too many women (especially in marginally developed communities), child bearing is associated with suffering, ill health and even death. In 2017, a total of 400,000 women died globally from child birth while 100,000 died in Asia alone. According to Xie et al[7], a woman's lifetime risk of maternal death i.e. the probability that a 15 year old woman will die during child birth from a maternal cause ranges from 1:3800 in developed countries such as US, UK and France to 1:150 in developing countries especially in Africa, South America and South East Asia. In Somalia, for example, it is anticipated that 1 in every 12 women can potentially die in childbirth[7]. This shows a strong association between maternal mortality and socio-economic development since maternal survivability is worse in most developing countries. To date, the main maternal health crisis include haemorrhage, infection, high blood pressure, unsafe abortion, and obstructed labour but each of these is rooted in several social, economic, cultural, technological, political and environmental sources[7].

At stake in the global fight to arrest high maternal mortality or improve survivability is the very survival of human species. This is because the implications of uncontrolled maternal mortality rate are monstrous with severe negative effect on human existence as women and child birth are the main agents of human self-perpetuation[9]. Moreover, maternal health and the health of new-borns are intrinsically linked. Poor maternal health is

responsible for the poor health, deformity and death of 3 million new-borns and 2.6 million still-borns each year[10]. The need to consolidate and support women to procreate in tranquillity has inspired international and domestic agencies to harness the resources and formulate appropriate policies and programs to protect the health of women especially during pregnancy, child birth and the post-partum period[11].

Since its formation, the United Nations and its organs have consistently taken a frontline role to promote women's health at the global level and reliably alert individual countries where women are exposed to unacceptably high levels of health vulnerabilities[12]. Unsurprisingly, the US, Joint Commission on Accreditation of Healthcare Organisations described maternal mortality as a "sentinel event" requiring an unprecedented global resource mobilisation to safeguard the future of humanity[13].

This global effort to place maternal health at the heart of modern civilisation is part of a larger global initiative to lift women from the doldrums of economic and social discrimination and alienation across the globe[14]. This is because the unacceptably high numbers of maternal deaths reflects the inequities in the access to health service, and highlights the gap between the rich and the poor. Thankfully, the framers of the Millennium Development Goals heeded to the maternal and child health advocacy and dedicated some of the goals to child and maternal health. In this way the Millennium Fathers upheld the guard of eternal vigilance on women and children[5] as an appropriate consummation of several years of global advocacy for maternal and child health of which several forbearers had paid the ultimate price[5].

China is among the countries that have embraced and made significant strides towards achieving women and children related SDGs. Apart from massive health infrastructural development and health care delivery services, China is one of the few countries on course to achieve the Millennium Development Goal 5[16]. The Healthy China 2030 Initiative proposed by President Xi Jinping outlines an unrivalled national responsibility to safeguard the health and wellbeing of women through the provision of better medical and health services[17] With strong economic growth and pragmatic policies, China again achieved Universal Health Insurance Coverage in 2011 which has broadened the frontiers for safeguarding maternal health and other socially disadvantaged groups[18].

Prior to this, similar policies had been promulgated to highlight the importance of maternal health in China. Notable among these policies are the Law on Maternal and Infant Health, the Law on the Protection of Rights and Interests of Women, the Regulation on the Placement of Surplus Staff and Workers of State-owned Enterprises, the Law on

Population and Family Planning, the Notice on Several Matters concerning Maternity Benefits of Female Employees, the Special Regulation on Labour Protection of Female Employees etc[19].

Even though these policies have accentuated national effort to consolidate maternal health, the enactment of the Trial Measures on Maternity Insurance for Enterprise Staff and Workers and the full scale implementation of the province level maternity insurance scheme is one of the most important direct intervention targeted at only mothers or would be mothers in China[20]. The contribution of the maternity insurance funds to declining maternal and child mortality rate is well documented [21, 22, 23, 24].

However as the rate of economic development in China begin to tumble and the universal two-child policy takes full effect, its negative impact on maternal insurance has become evident[14]. Specifically the universal two-child policy has increased the rate of utilisation and expenditure of maternity health insurance funds without corresponding increase in fund income. This is because women who originally could only have one chance to give birth now have a double chance to do so and this is leading to rapid depletion of available funds across provinces to unprecedented levels[25].

While it is true that minority ethnic groups were not covered by the universal one-child policy hence a change in policy must not necessarily affect the rate of child birth in their region, two factors can cause increase in birth rate due to policy changes. Firstly, there is the fear of a spill over as a result of relaxed birth control policy in the country. This is also because in the minority occupied regions, majority ethnic groups are still dominant groups and their activities have far reaching consequences on the whole province or autonomous region[26]. Thus if the rate of decline in maternity insurance funds persists maternal healthcare will be seriously affected and the case in poorer provinces in western China which has consistently underperformed in maternal mortality control will exacerbate[4].

Ningxia-Hui Autonomous Region is one province that is highly vulnerable to depleting maternal insurance scheme which can damage an already precarious maternal health conditions in the region. Ningxia-Hui Autonomous Region is located between Shaanxi Province (East), Gansu Province (South and West), Inner Mongolia Autonomous Region (North)[27]. In the past, Ningxia was part of another poor Province (Gansu) but in 1958, it was reconstituted as an autonomous region to recognise the distinctive heritage and culture of the Hui minority ethnic group in China[28]. The Hui people are one of the 55 minority tribes in China and 28% of Hui people are located in the Ningxia Hui Autonomous Region. Thus any

challenge in maternity insurance fund could potentially affect the healthcare of minority groups which is largely underserved in western Chinese provinces.

The socio-economic challenges underpinning the precarious maternal health conditions in Ningxia area stems from the fact that Ningxia-Hui Autonomous regions has many natural resources but most of them remained untapped hence has a large number of self-employed women that earns minimal income and a few employed in the formal sector who are guaranteed regular monthly income[29]. Moreover, present-day Ningxia is one of China's smallest provincial-level units. It sits at 3556 meters above sea level and among the poorest even in western China[30]. The autonomous region is largely a dry desert-like region with diverse geographical construction that includes forested mountains, hills, deserts (Tengger desert in Shapotou), table lands, flood plains and basins. The famous Yellow River, the Loess Plateau and parts of the Great Wall of China passes through this region. In terms of population, Ningxia Hui Autonomous Region is one of the least and sparsely populated regions in China with a population of 6.8 million people of which 36% are Muslims[31].

Sadly, Ningxia Hui Autonomous Region has had its fair share of threats by flood, earthquake and landslides yet Ningxia women remains one of the important resources in the region. These women mostly serve as farm hands in the 40,000 hectares of wine grapes. In the formal sector, Ningxia Hui Autonomous region produces 120 million bottles of wine each year for China[4]. This is equivalent to a quarter of the total wine demand in China. 35% of employees in large wine companies such as Changyu and Dynasty Wine and other distilleries in the region are women who potentially benefit from the maternity insurance scheme. Further, nearly 15% of employees in grape plantation by the China Petroleum and Chemical Corporation and Midea (household appliance company) near the Helan Mountains are women[21].

According to Jantasin and Yoosook[21] mining and the oil and gas industry poses a lot of risk to human health but these areas have flourished in Ningxia province and has attracted a lot of women into the sector. For example, 38% of workers in Ningxia's coal mines located at Xiangshan Mountains, Ningdong, Helen and Yuanzhou are women. These mines boast up to nearly 232 billion tons deposit of coal[12].

Ningxia women are also employed in the minimal exploration of oil and natural gas in Yangch and Lingwi County for the chemical industry. As Ningxia has become a leading producer of top grade Gypsum in China, a sizeable number of women have found employment in the Tongxin County where nearly 4.5 billion tons of Gypsu and mainly and 17 million tons of quartz sandstone are mined[12]. As at 2018, nearly 17% of employees in the

Kocel Steel Foundry, FAG Railway Bearing (Ningxia), Ningxia Little Giant Machine Tools were women.

To reduce childcare burden on mothers, the Ningxia Hui autonomous region has adopted a new regulation that allowed both parents a 10-day parental leave before the child turns four years of age. This policy was also intended to ensure healthy growth of children while protecting women's right to economic independence in the region. Moreover the region also encouraged employers to provide childcare services in workplace and put in place special facilities such as nursing rooms for pregnant and lactating women[17]. However the maternity insurance scheme which was introduced to help would-be-mothers to meet the main cost of child bearing is collapsing due to excess expenditure over income. It is believed that the introduction of the universal two-child policy has increased the rate of utilisation without a corresponding increase in income flow to the fund[18].

The extent to which this is empirically valid is still less explored in the current literature. The few available studies have used basic linear regression models with conflicting and disputable results due to the non-linearity of relationship among the variables that influences maternity insurance fund income and expenditure in Ningxia Hui autonomous region[3]. This paper combines a novel and more robust systems dynamic and actuarial models to determine the influence of the universal two-child policy on maternity insurance and determine the appropriate rate of contribution that can prolong the lifespan of the maternity insurance fund in the Ningxia Hui autonomous region. The remainder of the paper explores the methodology of the study and then the analysis of the data. The results are discussed and conclusions drawn in subsequent sections.

METHODS

Data Source

Data for the study came from a number of sources. Some of these sources provided parallel data which were used to confirm the validity of the data from the different sources. Firstly we consulted data from the National Bureau of Statistics in China as well as the Ningxia Statistical Year Book. The other source of information was the Knoema Enterprise Data Solutions. This is privately managed public statistical information that is available open data platform.

The study also collected data from the 2018 Social Insurance Rates in China by China Labour Watch. This data provides information for payment, expenditure and utilisation of the different social insurance and pension schemes across the provinces and the autonomous regions in China. Specifically in this study, the main data used for the analysis includes, the birth rate, the population of women, the contribution rate for maternity insurance, the total maternity insurance fund balance, the maternity insurance fund income, the maternity insurance fund expenditure and the payment rate of the maternity insurance in the Ningxia-Hui Autonomous Region.

The rest were the average wage rate of insured people, the number of enrolment under the maternity insurance fund in the autonomous regions, the number of people who have benefited or utilised the maternity health insurance, the number of newly enrolled person and many other related ones which are explained in appropriate section of the methodology. Secondary data was also computed from a combination or extrapolation from the original primary sources. In order to account for the most current information, the study period was restricted to the five periods beginning from January 2012 to December 2017. This period was also suitable since all the required data needed for the study were available in the respective databases.

Analytical Model

We model an analytical framework that hybridizes a systems dynamic model and actuarial model to compute maternity insurance premiums and its sensitivities. The actuarial model is first used to express the mathematical equation for the income and expenditure of the maternity insurance fund. The systems dynamic model is then used to analyze the relationship between the variables. As noted in the prior works of Long et al[32] and Zhang et al[33], income inflow into the maternity insurance fund $(MFI)_t$, depends on the payment rate $(MPR)_t$ and the payment base $(MPB)_t$. The payment base also depends on the average wage of insured person or social wage $(MAP)_t$ and the number of insured persons $(MIN)_t$,.Thus the actuarial equation of the maternity insurance fund income in Ningxia-Hui Autonomous Region can be expressed mathematically as;

$$MFI_t = (MPR)_t \times (MPB)_t = (MPR)_t \times [(MAP)_t \times (MIN)_t] \qquad \text{Equation 1}$$

On the other hand the maternity insurance fund expenses for year t $(MFE)_t$ depend on the per capita (average) utilization cost $(MAT)_t$ and the number of beneficiaries in a

year $(MEN)_t$. The number of beneficiaries in a year also depends on the number of insured persons$(MIN)_t$, the number of newly insured people in year t (SN_t), the frequency of insurance fund utilization denoted by the rate of birth (br_t), the death rate of women (dr_t), the probability of an insured person giving birth to twins (1/89) probability of an insured person giving birth to twins as proposed by Zhang et al[33] and the effect of birth promotion policy such as the universal two-child policy which came into effect in 2015. We thus incorporated $(natc)_t$ as the modelled increment to the number of beneficiaries of maternity insurance as a result of the two-child policy in year *t*. Our final actuarial model for the attrition rate of the maternity insurance fund is mathematically expressed as;

$$MFE_t = (MAT)_t \times (MEN)_t = (MAT)_t \times \{[((MIN)_t + SN_t) \times br_t] - [((MIN)_t + SN_t) \times dr_t] - [0.011236((MIN)_t + SN_t) \times br_t] + (natc)_t\} \quad \text{Equation 2}$$

With universal two-child policy, it is assumed that women have a higher chance to give birth and utilized the maternity insurance fund more often but there are practical variations. For example, minority tribes in Ningxia were excluded from the one-child policy but a spill over is expected because Ningxia-Hui Autonomous Region has a high concentration of Han majority group. Yet even in the case of groups bound by the one-child policy, the second child policy alone and the universal two child policy has not had a major impact on population boom. This is due to unwillingness to give birth due to high cost of living and demanding work responsibilities. Secondly, the population covered by second child alone in Ningxia-Hui Autonomous Region is relatively small. In June 2015, only 653, 481 persons had applied for the second child only and 345,298 were granted the permission. The universal two-child policy is much wider as it targets a higher population group hence may have a bigger impact.

The nationwide implementation can increase the inflow of new born babies in the future and will largely increase maternity insurance utilization, the maternity insurance fund expenditure and which can speed up the depletion of the fund. Prior to the implementation of the universal two-child policy, the Ningxia-Hui Autonomous Region recorded an average birth-rate over 15 years from 2000 to 2015. By 2017, the birth rate had exceeded 15.14%. This significant leap is attributable to the spill over of the universal two-child policy. This will require an upward adjustment in the contribution rate of maternity insurance to ensure its sustainability. Taking these into consideration, we mathematically compute the effect of the

second child policy $(natc)_t$for Ningxia-Hui Autonomous Region using the following actuarial model;

$$(natc)_t = (NCT)_t \times \frac{(MIN)_t}{(TP)_t}$$

where $(natc)_t$ represents new additions to insured population of the Ningxia-Hui Autonomous Region in year *t* resulting from the two-child, $(NCT)_t$ represents new additions to the population of Ningxia-Hui Autonomous Region in year *t* resulting from the two-child policy and $(TP)_t$ representing the total population of Ningxia-Hui Autonomous Region in year *t.* According to the Statistical Yearbook of Ningxia-Hui Autonomous Region in 2017, the ratio of the number of people insured in the maternity insurance scheme in Ningxia-Hui Autonomous Region to the total population remained around 0.18. The calculation shows that the number of newly-born children in Ningxia's maternity insurance group is about 10,000 each year. Our final model for the accumulated balance of the maternity insurance fund$(MFB)_t$ is expressed mathematically as;

$$\mathrm{S}(\mathrm{t_x}) = \mathrm{S}(\mathrm{t_{x-1}}) + \int_{\mathrm{t_{x-1}}}^{\mathrm{t_x}} \mathrm{rateS}(\mathrm{t_x})\,\mathrm{dt}$$

$$= \mathrm{S}(\mathrm{t_{x-1}}) + \left[(MFI)_{\mathrm{t_x}} - (MFE)_{\mathrm{t_x}}\right] \times 1 = \mathrm{S}(\mathrm{t_{x-1}}) + \left[(MFI)_{\mathrm{t_x}} - (MFE)_{\mathrm{t_x}}\right]$$

$$(MFB)_{t_x} = \mathrm{S}(\mathrm{t_0}) + \left[\left(\int_{\mathrm{t_0}}^{\mathrm{t_1}} \mathrm{rateS}(\mathrm{t_1})\,\mathrm{dt}\right) + \cdots + \left(\int_{\mathrm{t_{x-1}}}^{\mathrm{t_x}} \mathrm{rateS}(\mathrm{t_x})\,\mathrm{dt}\right)\right]$$

$$= \mathrm{S}(\mathrm{t_0}) + \sum_{t=t_1}^{t_x} \left(\int_{\mathrm{t_{x-1}}}^{\mathrm{t_x}} \mathrm{rateS}(\mathrm{t_x})\,\mathrm{dt}\right)$$

$$= \mathrm{S}(\mathrm{t_0}) + \sum_{t=t_1}^{t_x} \{\left[(MFI)_{\mathrm{t_1}} - (MFE)_{\mathrm{t_1}}\right] + \left[(MFI)_{\mathrm{t_2}} - (MFE)_{\mathrm{t_2}}\right] + \cdots$$
$$+ \left[(MFI)_{\mathrm{t_x}} - (MFE)_{\mathrm{t_x}}\right]\}$$

$$= \mathrm{S}(\mathrm{t_0}) + \sum_{t=t_1}^{t_x} \{[(MFI)_{\mathrm{t}} - (MFE)_{\mathrm{t}}]\}$$

The maternity insurance t-year fund income$(MFI)_t$ and maternity insurance t-year fund expenditure $(MFE)_t$ generations can be obtained using the following formula;

$$(MFB)_{t_x} = \mathrm{S}(\mathrm{t}_0) + \sum_{t=t_1}^{t_x} \{[(MPR)_t \times (MAP)_t \times (MIN)_t] - [(MAT)_t \times (MEN)_t]\}$$

$$= \mathrm{S}(\mathrm{t}_0) + \sum_{t=t_1}^{t_x} \left\{ - \left[(MAT)_t \times \begin{pmatrix} [(MPR)_t \times (MAP)_t \times (MIN)_t] \\ \big(((MIN)_t + SN_t) \times br_t\big) - \\ \big(((MIN)_t + SN_t) \times dr_t\big) - \\ (0.011236((MIN)_t + SN_t) \times br_t) \end{pmatrix} \right] \right\}$$

where $\mathrm{S}(\mathrm{t_x}) = (MFB)_{t_x}\ \mathrm{S}(\mathrm{t}_0)$ means the balance of maternity insurance fund at year t_0.

System Dynamic Model

Due to the complexity of the interactions of factors indicated in the actuarial model, a system dynamic model that incorporates three subsystems i.e. (economic subsystem, utilization subsystem and population subsystem) was designed to analyze the actual model. The utilization subsystem is sandwiched between the economic subsystem (top) and the population subsystem (down) intertwined by a seamless set and network of relationships and interrelations that justifies the application of a systems dynamic model for analysis.

Further, applying systems dynamic model may help answer a question posed by Zhang et al[34] on whether western development strategies can narrow down China's regional disparity. Previous studies have ignored the influence of value-added income to the fund such as interest of the maternity insurance fund, penalty for late fees etc as they constitute a small amount of income inflow into the maternity insurance fund[33]. The variables and functional relationships of the maternity insurance system dynamic model for Ningxia-Hui Autonomous Region is shown in table 1. All the data were derived from the historical data whereas the Statistical Yearbook of Ningxia-Hui Autonomous Region and from the survey. The final maternity insurance systems dynamic inflow is given as follows in figure 1;

RESULTS

Test of Goodness of Fit

Table 1: Test of Consistency of Maternity Insurance Fund Income and Expenditure

Year	Actual Income of the Maternity Insurance Income (billion)	Simulated Income Value of Maternity Insurance	Relative Error	Actual Expenditure of the Maternity Insurance Fund (billion)	Simulated Expenditure Value of the Maternity Insurance Fund	Relative Error
2012	11.7	11. 54	-0.0025	6.78	7. 42	0.02
2013	15	14.52	-0.005	10.17	9.49	-0.01
2014	17.14	17. 13	0.01	13. 63	12.53	-0.005
2015	19.01	20. 18	0.035	16.17	14.63	-0.04
2016	18.04	19.33	-0.0004	20.42	19.55	0.02

Source: Ningxia Statistical Yearbook and the results of the System Dynamics Simulation

As a test of goodness of fit, recent data from the statistical yearbook for the period 2012-2016 was used to simulate the system dynamic model to establish its goodness of fit i. e. the consistency of the simulated data and the actual data for the period. Table 2 shows that the relative results of the test variables (actual values of the maternity insurance fund income, expenditure and the number of enrolment) are within 10% and most of them were within 5% error. This confirms the robustness of the model (strong goodness of fit). Moreover its parameters variation represents the development trend of variables therefore scenario analysis can be conducted and conclusions therefrom.

Sensitivity Test

Two sets of sensitivity tests were run to measure how much change will occur in the model results based on percentage change in the number of utilization and the rate of premium payment set by government.

Sensitivity Analysis of Number of Utilization as a result of Two-child Policy

In scenario 1, the current rate of premium contribution which is the 0.5% of the wages of employees or the national social wage is set as a control variable i.e. (remains constant) but the rate of utilization as a result of increase in population is varied between 50% and 150%.

From the previous calculations, an expected number of 10,000 new born babies will be added to the population of per Ningxia as a result of the universal two-child policy.

Thus at 50% policy efficiency level, the number of utilization will increase by 5000 while a 150% policy efficiency level will mean 15000 additional new births and possible fund utilization will be generated. Figure 2 shows the sensitivity of the maternity insurance fund balance to changes in utilization efficiency levels as a result of the universal two-child policy. The information shows that as the number of new additions increases due to arrival of second children (with a constant rate of contribution to the maternity insurance funds), the rate of depletion increases correspondingly and this puts the sustainability of the maternity insurance fund at risk without a corresponding increase in the fund balance.

Sensitivity Analysis of Maternity Insurance Policy

In second scenario, the number of additions to the utilization per-annum as a result of universal two child policy is held constant at 10000 (100% efficiency rate) based on previous computation. The contribution rate of the maternity insurance is instead varied since it is the easiest way by which the government can influence maternity insurance policies. In 2015, the Chinese government issues Policy Document 331 that indicates that any future change in the contribution rate of maternity insurance in China will be between 0.45% (worst-case scenario) and 1% (best-case scenario). This means that an unlikely increase of the contribution rate to 1% will lead to a 10% increment in fund balance. If the current contribution rate of 0.005% is adjusted over a range between 90% and 200%, the trend in the time to deficit and time to depletion of the maternity insurance fund is shown in figure 3.

The information in figure 3 shows the operational results for the sensitivity analysis under different parameters and scenarios to adjust the contribution rate. The trend shows that the rate of contribution set by the government has substantial influence on the future sustainability of the maternity insurance fund. If the current contribution rate (0.5%) increases by less than 100%, it will speed up the deficit of the maternity insurance fund.
On the other if the contribution rate changes by 150% (increasing the maternity insurance rate from 0.5% to 0.75%), the maternity insurance fund balance will increase and this will extend the deficit accumulation period for the maternity insurance in Ningxia-Hui Autonomous Region. This information affirms the fact that the universal two-child policy requires proper

adjustment to contribution rate to maintain the sustainability of the maternity insurance fund in Ningxia-Hui Autonomous Region.

Figure 4 presents the predicted maternity insurance fund values and the dynamic adjustments that ought to be made ensure its sustainability.

Table 2: Prediction of the deficit trend of the maternity insurance fund in Ningxia-Hui Autonomous Region and the dynamic adjustment strategy under the effects of universal two-child policy

Policy efficiency	$(natc)_t$ Additional Births	Rate of Payment	Current deficit time	Depletion Time	Adjusted Payment Rate
50%	5000	0.5%	2019	2021	0.72%
60%	6000	0.5%	2019	2021	0.73%
70%	7000	0.5%	2019	2021	0.73%
80%	8000	0.5%	2019	2021	0.73%
90%	9000	0.5%	2019	2021	0.74%
100%	10000	0.5%	2019	2021	0.74%
110%	11000	0.5%	2019	2021	0.75%
120%	12000	0.5%	2019	2021	0.75%
130%	13000	0.5%	2019	2021	0.76%
140%	14000	0.5%	2019	2021	0.76%
150%	15000	0.5%	2018	2020	0.77%

Source: Simulated Results

The final table 2, presents the output of the simulated results the range of adjustments that must be effected to sustain the maternity insurance fund in Ningxia-Hui Autonomous Region active. At different levels of additional new births triggered by the universal two-child policy, if the current contribution rate of 0.5% remains unchanged, the fund balance will plunge into deficit in 2019 and the entire maternity insurance fund will be completed depleted by 2021. If on the other hand the government increase the contribution rate from 0.5% to 0.74%, then even if at 100% effectiveness rate of the new policy which will drive new births by10000, the maternity insurance fund will generate a surplus balance until 2028. The information in the table gives a general picture suggestion that anytime the new births as a results of the universal two-child policy $(natc)_t$ rises or decline by about 2000, the contribution rate must be adjusted corresponding by 0.0001 adjustment (increase/decrease) of need to be done in the contribution rate needs of 0.1% must be effected to maintain a surplus balance on the maternity insurance fund between 2018 and 2028.

DISCUSSION

As indicated in earlier sections of the study maternal health is a “sentinel event” requiring an unprecedented global resource mobilisation to safeguard the future of humanity. This call is more urgent in communities with underserved population such as minority ethnic groups in western China that faces several development challenges. It is within this context that the depletion of maternity insurance fund in Ningxia-Hui Autonomous Region in China; an area occupied by ethnic minority groups in China demand urgent attention[3]

This study sought to determine the influence of the universal two-child policy on maternity insurance fund in Ningxia-Hui Autonomous Region. It is the case that ethnic minority groups in Ningxia province were excluded from the universal one-child policy introduced in the late 1970s; the universal two-child policy has increased the utilisation rate of the maternity insurance fund in the autonomous region[8]. This increase may be attributed to spill over from relaxed policy as well as the increasing number of births by the large number of majority ethnic group members that live in the Ningxia area. To date nearly 52% of the population in Ningxia belong to the majority ethnic groups that are free to give additional birth due to the universal two-child policy.

The stress of this population boom on maternity insurance in the region is largely because the qualified women can draw from the maternity insurance fund during pregnancy, child bearing and postnatal period[35]. Thus women who only had a single chance to use the maternity insurance fund now have more than one chance to use the same fund due to additional new births. The simulation of the additional new births as a results of the universal two-child policy indicates that even though increases in birth rate in Ningxia area after the universal two-child policy has not been astronomical as predicted, the additional births are significant enough to cause quick depletion of the maternity insurance fund.

The simulation results show that the current rate of maternity insurance contribution of 0.5% is not sustainable. If this continues, the rapid increase in the expenditure of the maternity insurance will increase deficit accumulation that potentially endangers the sustainability of the maternity insurance in Ningxia Hui Autonomous Region. This may in turn negatively affect maternal health in general and minority women in particular. Through simulation, the study noted that without an increase in maternity insurance contribution by companies, the entire maternity insurance fund in Ningxia Hui Autonomous Region will be depleted by the year 2021. This observation proves consistent with earlier claims by Zhou[36] and Xu [37]

To prolong the rate of deficit accumulation and depletion of the maternity insurance fund, the simulation results projects an increase in the current rate of contribution to 0.74%. However, adjusting the contribution rate can only be a short term measure considering its implications for female unemployment. Since the contribution rate is paid by the employer, excessive increase will lead to employers shunning female employment in preference for their male counterparts. This will further aggravate the already precarious economic inequality between male and female employees[33].

In the long term a number of policy interventions that have proven successful in other countries must be pursued. The analysis of the literature revealed that maternity insurance fund investment is a negligible portion of the maternity insurance income in China in general and the Ningxia Hui Autonomous Region in particular. In other countries such as the USA, Japan, UK, several high yielding but less risky investments in the bond market (special-issue government bonds), real estates and other high yielding securities are destination investment by statutory funds and other social security funds[4].

Significantly the Chinese government has a strong investment portfolio for the countries pension or social security scheme which invests in securities that are backed by the full faith and credit of the Chinese government. The experiences of Ghana, Tanzania and Kenya where specialised levies have been imposed to sustain health insurance funds with relative success are credible examples for the China[38]. In the case of Ghana, the national health insurance scheme is funded through 2.5% levy on goods and services covered by the Value Added Tax (VAT) law as well as 2.5% of Social Security and National Insurance Trust (SSNIT) contributions in the case of formal sector workers[38].

Specialised funding schemes for social intervention is not new to China hence must be pursued with the greatest possible firmness. For example the Healthy China 2030 Initiative and the Belt and Road Initiative are all ambitious state funded projects that have reliable source of funding to ensure sustainable execution of their intended objectives. As China has placed maternal health at the centre of its healthcare obligations, moving a step further to create a sovereign fund for maternity insurance scheme will more than signal its commitment to make progress on maternal and child health across its provinces in general and minority ethnic occupied regions in particular.

CONCLUSIONS

Since 2015, the maternity insurance income in the Ningxia-Hui Autonomous Region has experienced excessive stress due to reduction in income amid high expenditure. The objective of this research was to explore the effect of the universal two-child policy on the maternity insurance fund in the Ningxia-Hui Autonomous Region. The study noted that additional source of funding is needed to make up of the increasing expenditure of the maternity insurance scheme. In the short term, the government should consider increasing the current rate of maternity insurance contribution. In the long term other funding schemes including proper investment strategies are needed to guarantee the survivability of the fund. Further research is needed on investment strategies for maternity and social insurance income in China. This area is still under developed in the current situation.

LIST OF ABBREVIATIONS

IVF-In Vitro Fertilization
MFI- Maternity Insurance Fund Income
MPR- Maternity Insurance Payment Rate
MPB- Maternity Insurance Payment Base
MAP- Average Wage of Insured Person or Social Wage
MIN- Number of Insured Persons
MFE- Maternity Insurance Fund Expenditure
MAT- Per Capita Utilisation Cost
MEN- Number of beneficiaries in a year
SN-Number of Insured Persons
BR- Birth Rate
DR- Death Rate
NATC- New additions to insured population (number of children born out of second child policy)
NCT-New Additions to the population of Ningxia-Hui Autonomous Region
TP- Total Population of Ningxia-Hui Autonomous Region
MFB- Accumulated Maternity Insurance Fund Balance

DECLARATIONS

Ethics approval and consent to participate

The study employed mainly publicly available secondary data hence ethical and consent to participate is “Not applicable”

Consent for Publication

All the authors have consented to the publication of the articles. There are no details, images, or videos relating to an individual persons involved in the research and. Finally all the secondary data analysed in the study were procured from publicly available databases and do not require special permission to analyse and report in an academic studies such as this.

Availability of Data and Materials

The data for this research is held by the authors and will be made available upon reasonable request

Competing Interest

The author declare that there is no conflict of interest amongst them

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AUTHORS' CONTRIBUTIONS

LZ: is the supervisor of the project and sequentially aligned the parts of the research paper, HAA: conducted the analysis of the data and drafted manuscript. MOA: collected the data, conducted analysis. TM: collected data, JOM: collected data,

All authors read and approved the final manuscript.

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FIGURE LEGENDS

Figure 1: Systems dynamic model for maternity insurance fund flow in China

Figure 1: Sensitivity test on the balance of maternity insurance after two-child policy in Ningxia province

Figure 2: Sensitivity test on the analysis of maternity insurance policy under different parameters and scenarios

Figure 4: Maternity Insurance Fund Simulation under the Universal Two - child Policy

Figures

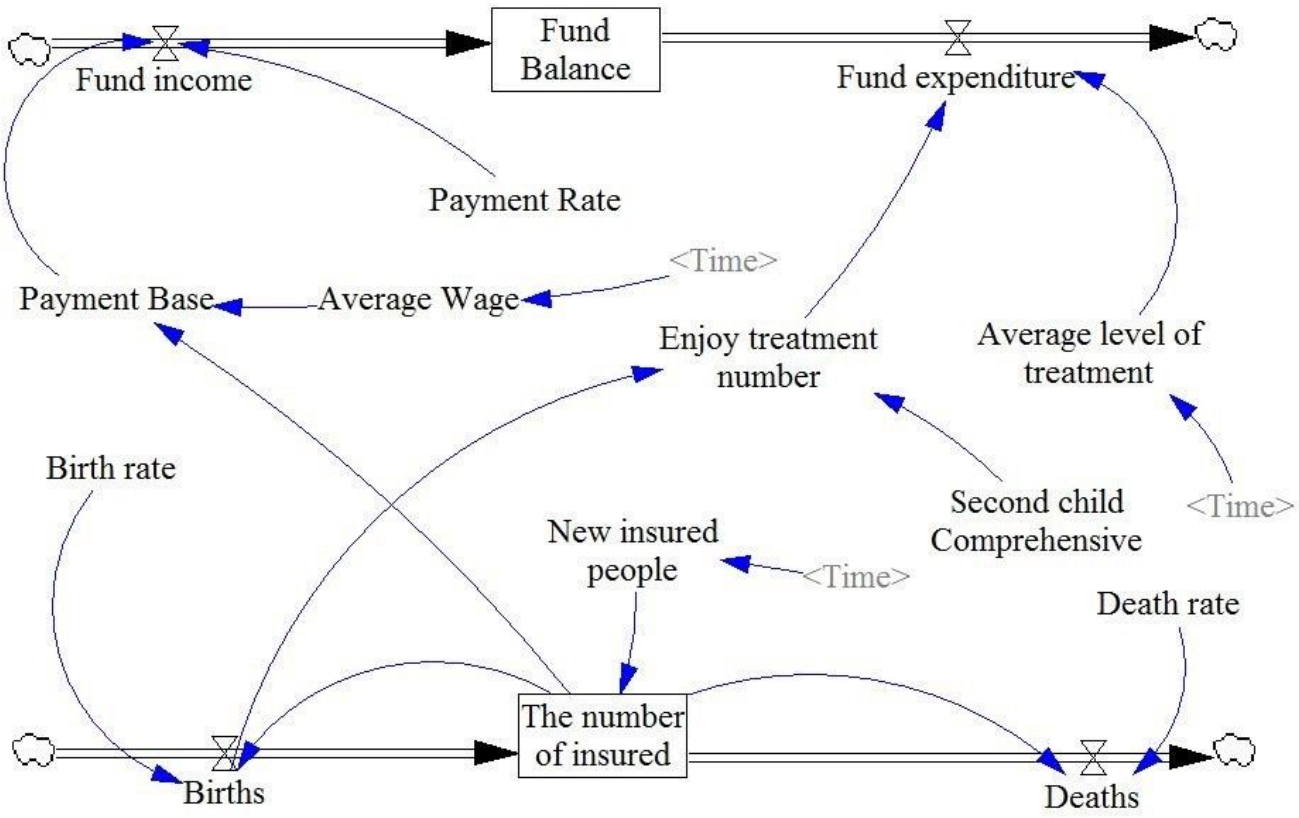

Figure 1

Systems dynamic model for maternity insurance fund flow in China

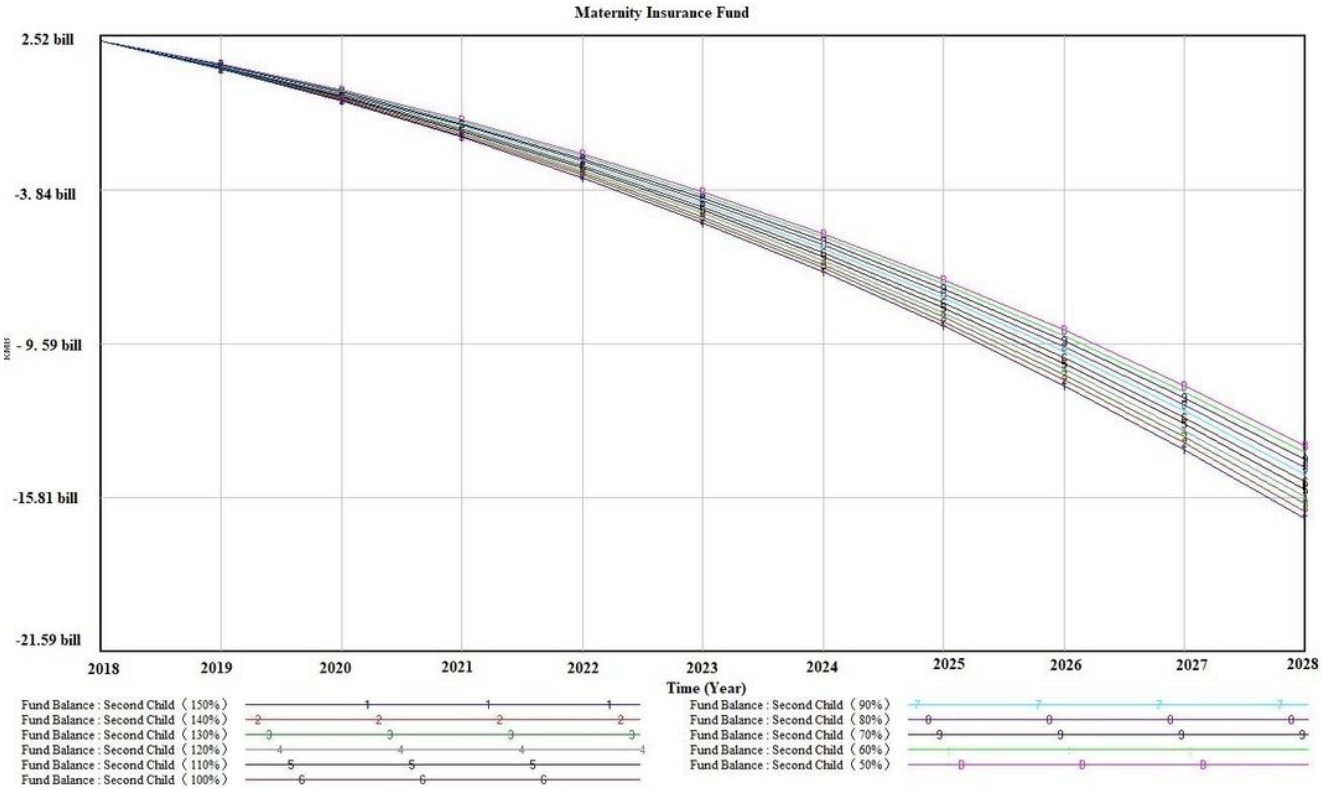

Figure 2

Sensitivity test on the balance of maternity insurance after two-child policy in Ningxia province

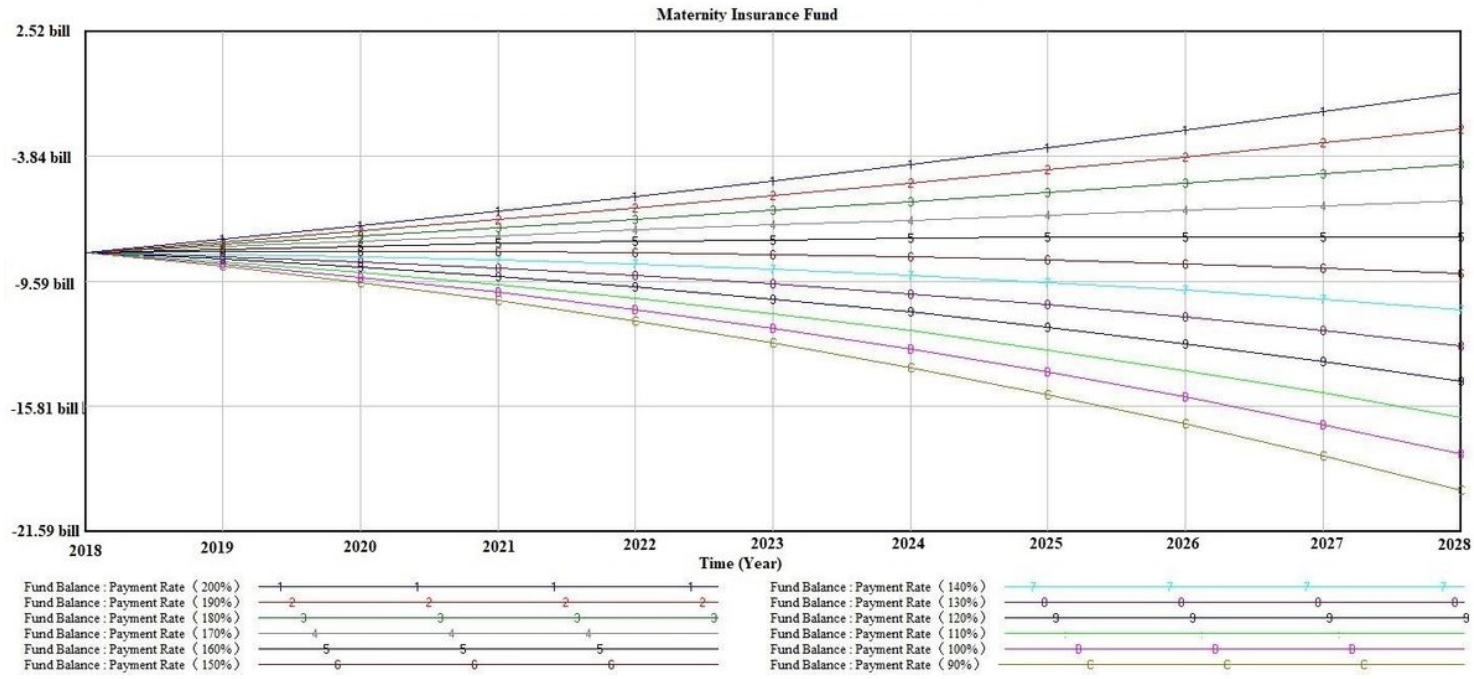

Figure 3

Sensitivity test on the analysis of maternity insurance policy under different parameters and scenarios

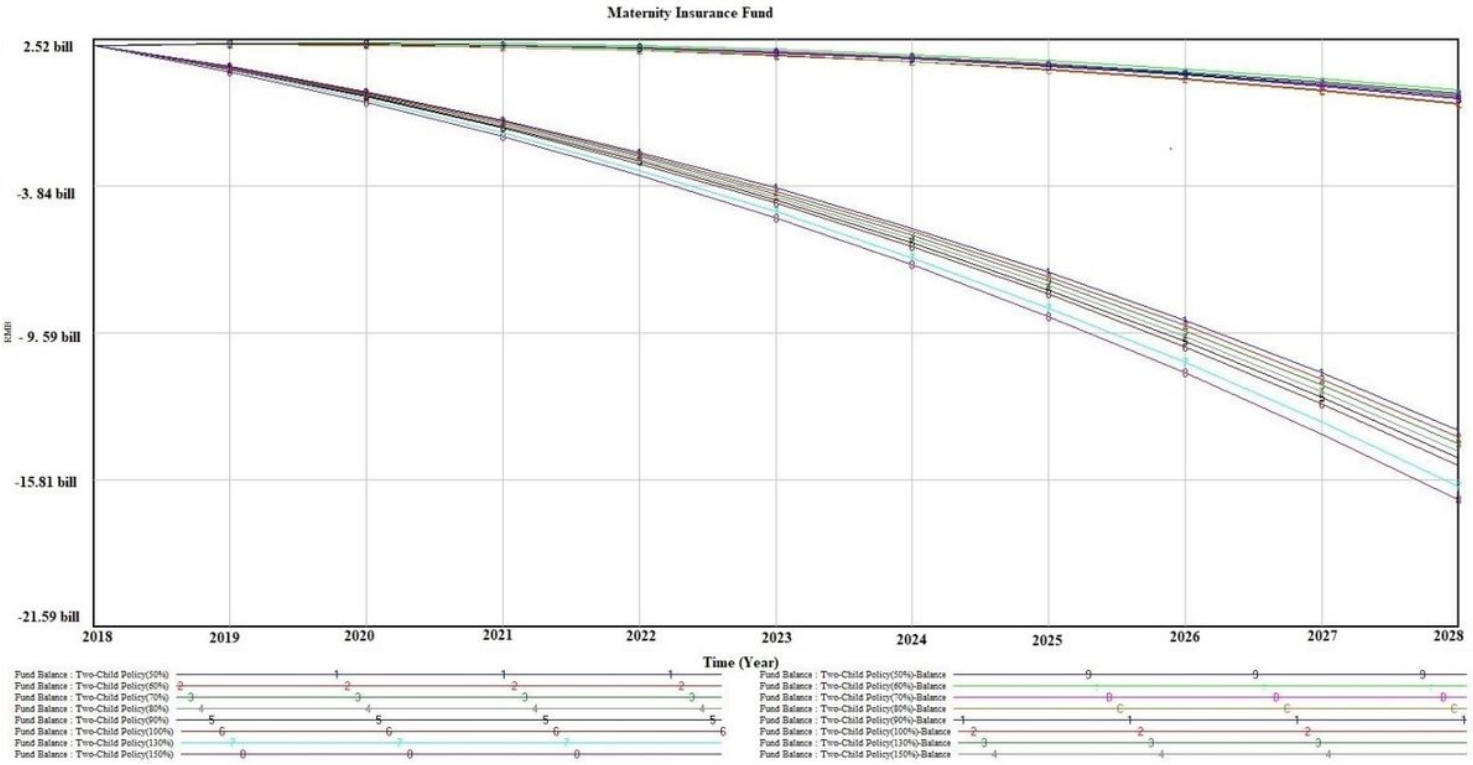

Figure 4

Maternity Insurance Fund Simulation under the Universal Two - child Policy

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