ORIGINAL RESEARCH ARTICLE

Government health expenditures and neonatal mortality in China: Implication for Sustainable Development Goal 3

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Abstract

This study utilized comprehensive graphical, descriptive and econometric methods to provide empirical answers to the nexus between government health expenditures and neonatal mortality in China. Secondary data from 2000 to 2021 was extracted from the World Development Indicators, after which it was analyzed empirically with the following results; in the past two decades, the incidence of neonatal death has reduced by 85%. Meanwhile, domestic general government health expenditure per capita ranged between $326.2 and $9.4 during the period with a mean value of $138. Average neonatal mortality rate recorded an approximately 10 deaths per 1000 live births, while government health expenditures and neonatal mortality showed a significant negative relationship in China. Therefore, this study confirms that China has been able to meet the SDG 3 with evidence indicating that this may be due to increased government health expenditure. *(Afr J Reprod Health 2024; 28 [5]: 78-83).*

Keywords: SDG 3, health expenditure per capita, GDP per capita, neonatal death

Résumé

Cette étude a utilisé des méthodes graphiques, descriptives et économétriques complètes pour fournir des réponses empiriques au lien entre les dépenses publiques de santé et la mortalité néonatale en Chine. Les données secondaires de 2000 à 2021 ont été extraites des indicateurs de développement dans le monde, après quoi elles ont été analysées empiriquement avec les résultats suivants : au cours des deux dernières décennies, l'incidence des décès néonatals a diminué de 85 %. Dans le même temps, les dépenses de santé des administrations publiques nationales par habitant ont varié entre 326,2 et 9,4 dollars au cours de la période, avec une valeur moyenne de 138 dollars. Le taux de mortalité néonatale moyen a enregistré environ 10 décès pour 1 000 naissances vivantes, tandis que les dépenses publiques de santé et la mortalité néonatale ont montré une relation négative significative en Chine. Par conséquent, cette étude confirme que la Chine a été en mesure d'atteindre l'ODD 3 avec des preuves indiquant que cela pourrait être dû à l'augmentation des dépenses publiques de santé. *(Afr J Reprod Health 2024; 28 [5]: 78-83).*

Mots-clés: ODD 3, dépenses de santé par habitant, PIB par habitant, décès néonatals

Introduction

According to the World Health Organization, neonatal period, which is the first day of birth to 28 completed days of life, is the most critical time for child survival[1]. As such, neonatal mortality has been one of the public health problems confronting most of the developing countries in the past decades[2]. In these countries, if drastic efforts are not put in place to address this issue, 27.8 million neonates have been estimated to die between 2018 and 2030[1]. Consequently, the Sustainable Development Goal 3 of the United Nations stipulates a global reduction in neonatal death to at least 12 deaths per 1000 live births by 2030[2].

To date, available evidence indicates that that several factors such as poor pregnancy outcomes, low birth weight and poor use of antenatal care are the major determinants of neonatal deaths globally[3,4]. Additionally, the strategic role of health economics cannot be undermined due to a growing global awareness of the connection between health financing and improved health outcomes across countries. Existing literature has shown that one of the major risk factors for neonatal mortality in low and middle income countries is the low socioeconomic status of households[5]. However, evidence has also shown that in the high income countries, high levels of government health spending have attributed to low rates of neonatal mortality.

Against this background, China, as a middle income has prioritized policies on health-care expenditure with the introduction of health reform in 2009. From 2009 to 2021, the health expenditure per capita in China has increased from $87.6 to $326.2, which is 36.7% increase[6].

In the recent times, the role of health expenditure in contributing to neonatal mortality remains a subject of interest among scholars and policymakers. This is especially crucial given China's consistent decline in neonatal mortality rates over the years. In view of the above, this study seeks to bridge the knowledge gap by assessing the influence of government health expenditureson neonatal mortality in China. By empirically investigating the relationship between government's healthcare expenditure and neonatal mortality in a country with a track record of measurable progress, this study aims to provide an invaluable insight into the role of China in reducing neonatal mortality through increased health care expenditure, and the implications this has for achieving SDG 3 in low-and-middle-income countries.

Literature review

Zhihui *et al.*[7] examined how global neonatal mortality rate could be reduced through early identification of high-risk pregnancies in 56 low- and middle-income countries. The finding from the study showed that subsequent neonatal death in low- and middle-income countries was significantly orchestrated by maternal history of neonatal death. Garcia *et al.*[8] investigated the influence of national public expenditure on neonatal mortality and under five mortality in 147 countries low- and middle-income countries, the results from the generalized propensity score indicated that public investments and other social sectors had different impacts on neonatal mortality and under five mortality. Kiross *et al.*[9] examined the impact of healthcare expenditure on infant and neonatal mortality in 46 African countries. The authors submitted that a significant association existed between healthcare expenditure and neonatal and infant mortality. Adejoh *et al.*[10] assessed the role of public health spending on post-neonatal mortality across poorer and wealthier Sub Saharan countries. It was concluded in the study that public health financing significantly curtailed post-neonatal deaths in all the studied countries in Africa.. Yu *et al.*[11] examined the epidemiological

features of neonatal death resulting from premature delivery at 28–36 weeks prenatal across various areas between 2009 and 2018. The Child Mortality Surveillance System (U5CMSS) in China provided the data. In the research, the Cochran-Mantel-Haenszel technique, Poisson regression, and trend analysis were applied. According to the analysis, the eastern area had the largest percentage of neonatal infant mortality with an expected gestation period of less than thirty-two weeks. It was also shown that compared to the eastern and central area, the western area had a notably higher number of premature neonates' babies who weren't born in healthcare facilities.

Methods

Data

This study covered the periods 2000 and 2021, while the data for the analysis was sourced from the World Development Indicators published by the World Bank[6]. Data for neonatal deaths per 1000 live births, domestic general government health expenditure per capita, inflation rate, FDI as percentage of GDP and GDP per capital growth were extracted from the secondary source These data are usually published by the research unit of the World Bank for the general public. As such, this study made use of the data for its empirical analysis. These periods of analysis were selected based on the data availability.

Model specification

To develop a model in assessing the nexus between government health expenditure and neonatal mortality in China, the study drew insights from similar works such as Zhou *et al.*[12] and Ai1*et al.*[13] as follows

Neonatal mortality= f (Government health expenditure)   (1)

Model 1 states that Neonatal mortality, which is the dependent variable is a function of government health expenditure, which is the independent variable. However, to improve the robustness of model 1, effort was made to restate the model in econometrical form. As such, some control variables were included to change the structure of the model to this form,

$$NM_t = \alpha_0 + \alpha_1 GHE_t + \alpha_2 GPDCa_t + \alpha_3 FDI_t + \alpha_4 InF_t + u_t \qquad (2)$$

In the model 2, the explicit explanations of each of the variables are enclosed in the Table 1.

Moreover, t represents the scope of the study which spans between 2000 and 2020. And the selection of these periods was driven by data availability.

Estimation procedures

The following are the step-by-step procedures employed to estimate the dependent variable and set of the explanatory variables in this study. The study carried our preliminary analyses of the data as follows:

Trend analysis: This type of analysis provided a historical perspective in evaluating and identifying patterns, trends, or changes in data over time. In this study, trend analysis was achieved with the aid of bar graph which shows the pictorial representation of the variables over the periods of the analysis.

Descriptive statistics**:** These were employed to enunciate the main characteristic features of data, and they account for concise summaries of the sample. The statistics give comprehensive message about the features, distribution, and patterns of the variables under investigation by explaining statistics such as the mean, maximum and minimum values. The mean value was estimated by adding all the data from 2000 to 2021 and divided by the number of the observations, which is 22.

Consequently, canonical cointegrating regressions method of estimation was preferred in this study because this analytical technique is used to estimate unknown parameters in the study. In this regression, deterministic variables, integrated processes and

their powers as regressors were embedded. Also, the errors were allowed to be correlated across equations, over time and with the regressors. Meanwhile, this regression was designed in such a manner that the usual least squares procedure yields asymptotically efficient parameters. Canonical cointegrating regressions was estimated using Eviews 10 econometrics software.

Ethical consideration

The data in the WDI were obtained using appropriate ethical procedures and guidelines. Consequently, further ethical issues were minimal. The data were completely anonymized, while the data was already freely available to the general public. Hence, further ethical clearance was not obtained for this study.

Results

Figure 1 shows the relationship between government health expenditure and neonatal mortality in China. From the chart, it is revealed that domestic health expenditure in China experienced a sustained and significant increase from 2000 to 2021 except 2017 where there was a slight fall. Meanwhile, there were incidences of 12 neonates per 1000 live births in 2000, and this figure declined on annual basis to reach 3 incidences of neonates in 2021.

The descriptive features of the major components of the study are displayed in table 2. In the first instance, from 2000 to 2021, inflation rate ranges between 5.9% to -0.73% with a mean value of 2.1%. This shows that inflation rate has been a single digit number in China for past two decades. As such, there is high tendency that citizens will enjoy a stable living standard in the country.

Table 1: Measurement of variables

In table 1, the operational definitions of various variables in the study are discussed as follows

Abbreviation	Variable	Operational Definition	Expected sign
NM	Neonatal mortality.	This is measured as mortality rate, neonatal (per 1,000 live births).	
GHE	Government health expenditure	Domestic general government health expenditure per capita (current US dollars)	-
GDPCA	GDP per capita	GDP per capita growth (annual percentage).	-
FDI	Foreign direct investment	Foreign direct investment as percentage of GDP	-
INF	Inflation rate	Consumer prices (annual %)	-

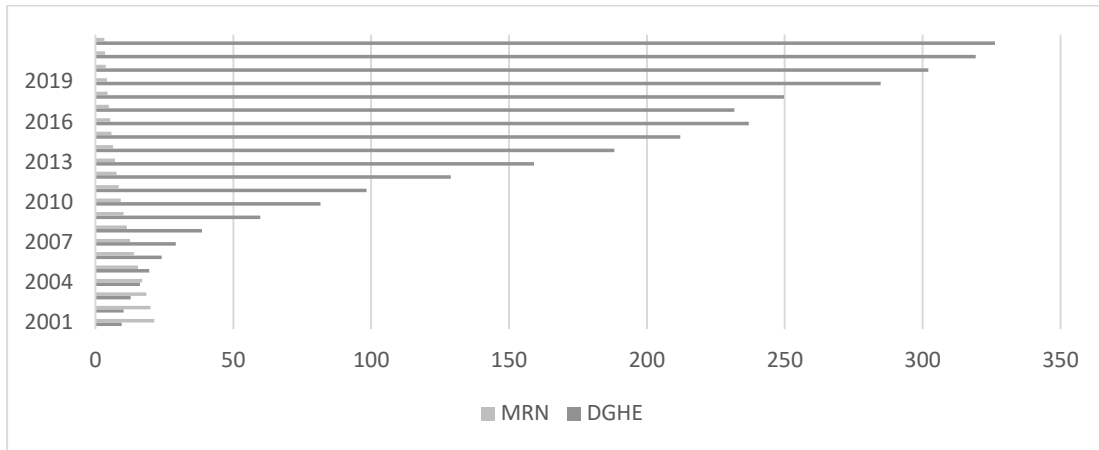Source: Authors` Computation (2024)

Figure 1: Relationship between government health expenditure and neonatal mortality in China from 2000 to 2021

Table 2: Descriptive statistics of the variables of the study

Descriptive Statistics	CPI (%)	DGHE ($)	FDI (%)	GDP (%)	MRN (Per 1000 live births)
Mean	2.182862	138.1009	2.964940	8.088908	9.690909
Median	1.960822	113.5411	3.257490	7.995159	8.000000
Maximum	5.925251	326.2770	4.554263	13.63582	21.30000
Minimum	-0.731971	9.447972	1.310716	1.995558	3.200000
Std. Deviation	1.738150	115.3479	1.051421	2.433732	5.717301
Skewness	0.486554	0.308890	-0.156152	-0.003935	0.670406
Kurtosis	2.983060	1.563383	1.771480	3.900019	2.177369
Jargue-Bera	0.868290	2.241728	1.472896	0.742587	2.268293
Probability	0.647818	0.325998	0.478812	0.689841	0.321697
Sum	48.02297	3038.219	65.22868	177.9560	213.2000
Sum Sq. Dev.	63.44449	279407.8	23.21522	124.3841	686.4382
Observations	22	22	22	22	22

Table 3: Canonical cointegrating regressions of government health expenditure and neonatal mortality in China

Regressors	Coefficient	Std. Error	t-Statistic	Prob.
FDI	0.459355	1.229112	0.373729	0.7135
DGHE	-0.044879	0.011728	3.826786	0.0015
GDP	-0.519206	0.499186	1.040105	0.3138
CPI	-1.181407	0.541319	2.182460	0.0443
R- squared	0.850784			
Adjusted R- Squared	0.813480			

Similarly, domestic general government health expenditure per capita ranges between $326.2 and $9.4 with a mean value of $138. However, neonatal deaths per 1000 live births recorded a minimum value of 3 and a maximum value of 21, in which the average value stood at approximately 10 deaths per 1000 live births. FDI as percentage of GDP and GDP per capital growth possess an average value of 2.9% and 8.0% respectively in the country.

This study employed a canonical cointegrating regression to estimate the association between government health expenditure and neonatal mortality in China with the results displayed in the above table. First and foremost, government health expenditure, GDP per capita and inflation rate follow the aprori expectation. Also, the value of R-squared is 0.85% this indicates that about 85% of the variation in the dependent variable, neonatal mortality was explained by all the explanatory variables, this attests to the fact the study`s model is relatively robust in the estimation of the selected variables for the study.

Furthermore, government health expenditures and neonatal mortality have a significant negative relationship in China. In the same vein, inflation rate and neonatal mortality possess an inverse relationship which is significant at 5% level of significance in one hand, on the other hand, GPD per capita and neonatal mortality exhibit insignificant negative relationship. However, FDI and neonatal mortality have an insignificant positive relationship.

Discussion

From trend analysis, it is evidence that domestic health expenditure in China experienced a sustained and significant increase from 2000 to 2021 except 2017 where there was a slight fall. This is an indication that the Chinese government has invested in the health sector in the past two decades in line with the global commitment to achieving the SDG 3 by 2030. Whereas, neonatal mortality which was 21 deaths per 1000 live births in 2000 in China has been on a continuous decline, to the extent of reaching 3 neonatal deaths per 1000 live births in 2021. This shows that, in the past two decades, the incidence of neonatal death has reduced by 85% in the country. With this result, it is important to submit that China has been able to meet the SDG 3 which targets the reduction of neonatal death to at least 12 deaths per 1000 live births. As such, the policymakers in China should ensure that at least this feat is sustained if further efforts could not be made to completely eliminate neonatal death in the country.

Consequently, in assessing the average performances of all the studied variables in this study, the mean value of inflation rate in China for past two decades shows 2.1%. This is an evidence of a single digit inflation rate which is an indication that citizens will enjoy a stable and decent living standard in the country. Meanwhile, domestic general government health expenditure per capita ranged between $326.2 and $9.4 with a mean value of $138. This shows that health expenditure funded from government domestic sources spent per person is relatively low. This implies that this finding was relatively low when compared with $437.32 and $473.66 which are government health expenditure per each citizen in the East Asia &Pacific, and Middle East and Northern Africa respectively[6]. However, in the past two decades, on an average basis, neonatal deaths recorded an approximately 10

deaths per 1000 live births. This value shows that China is on the SDG 3 track which stipulates the reduction of neonatal death to at least 12 deaths per 1000 live births.

Moreover, the results of the nexus between government health expenditures and neonatal mortality show a significant negative relationship in China. A unit change in government health expenditures will reduce neonatal death by 4 deaths per 1000 live births. This finding is in tandem with the submission of Kiross et al.[9] in related study. Hence, the policymakers in China should improve health expenditure funded from government domestic sources spent each person in the country, so that incidence of neonatal death will be further reduced drastically in the country. Therefore, the global community, especially low-and-middle-income countries that are currently facing neonatal mortality crisis should learn from the experience of China, by embarking on policy that will sustain massive government health expenditures in these countries. This will catalyse the reduction of neonatal mortality in these countries in the nearest future.

Similarly, both GDP per capita and inflation rate reduce neonatal mortality in China, though the impact of inflation rate is significant while that of GDP per capita is otherwise. GPD per capita and inflation rate are the strategic macroeconomic variables that show the economic and financial stability of households in an economy. This implies that Chinese economic and financial environment enhance the reduction of neonatal mortality. In addition, other low-and-middle-income countries that are currently facing neonatal mortality crisis should ensure the stability of their strategic macroeconomic variables such as GPD per capita and inflation rate in their economies over the time, this will spur a decrease in neonatal mortality. On the other hand, FDI and neonatal mortality have an insignificant positive relationship. This suggests that the current level of foreign investment flowing to China is not adequate enough to propel the reduction of neonatal death in the country. As such, it is important to stress that the policymakers in China should mobilize more FDI inflows in the country into the direction of health sector. This will further deepen the country`s commitment towards achieving the SDG 3 by 2030.

Strengths and limitations

Nexus between government health expenditures and neonatal mortality show a in China possesses a high level of novelty in the body of knowledge, and this could serve as the strength of this study. Also, this study has a clearly stated research question, and comprehensive graphical, descriptive and econometric methods of analysis, which would make the contents of the study to be easily understood by both experts and laymen. However, this study is limited and serves as a future direction for other researchers. The study focused on only on the second largest country by population in Asia. Further studies could be carried out on other Asian countries and African countries, especially those countries with low domestic general government health expenditure per capita.

Conclusion

This study therefore concludes that the Chinese government has been continuously investing in health sector on a sustainable manner in the past two decades. In the past two decades, the incidence of neonatal death has reduced by 85% in China, which confirms that this country has been able to meet the SDG 3 which stipulates the reduction of neonatal death to at least 12 deaths per 1000 live births. Meanwhile, domestic general government health expenditure per capita ranges between $326.2 and $9.4 with a mean value of $138. Finally, the nexus between government health expenditures and neonatal mortality shows a significant negative relationship in China.

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