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Out-of-pocket expenditure and maternal mortality nexus in China: Implications for the Sustainable Development Goal 3

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Abstract

The global maternal mortality rate has remained alarmingly high over the years. Meanwhile, socioeconomic factors such out-of-pocket expenditure, in contributing to maternal mortality remains a subject of interest. There is a scarcity of recent empirical studies that delve into the influence of out-of-pocket expenses on maternal mortality in China. Thus, this study examines the nexus between out-of-pocket expenditure and maternal mortality in China from 2000 to 2021. The data for the study was extracted from the World Development Indicators, and a Fully modified ordinary least squares was utilized to estimate the objective of the study with the following submissions; out-of-pocket expenditure and maternal mortality have a significant positive relationship in China. GDP per capita growth and maternal mortality have a significant negative relationship in China. Therefore, if the policymakers in China desire to meet the SDG 3 by reducing maternal mortality to 70 deaths per 100,000 live births, policies such as health insurance scheme should be implemented in the country for women of reproductive age. This would likely reduce the out-of-pocket expenditure and maternal mortality rate in the country. *(Afr J Reprod Health 2023; 27 [12]: 94-100).*

Keywords: Health expenditure, GDP per capita, SDG 3

Résumé

Le taux mondial de mortalité maternelle est resté à un niveau alarmant au fil des années. Dans le même temps, les facteurs socio-économiques tels que les dépenses personnelles, qui contribuent à la mortalité maternelle, restent un sujet d'intérêt. Il existe peu d'études empiriques récentes examinant l'influence des dépenses personnelles sur la mortalité maternelle en Chine. Ainsi, cette étude examine le lien entre les dépenses personnelles et la mortalité maternelle en Chine de 2000 à 2021. Les données de l'étude ont été extraites des indicateurs de développement dans le monde, et une méthode des moindres carrés ordinaires entièrement modifiée a été utilisée pour estimer l'objectif. de l'étude avec les soumissions suivantes : les dépenses personnelles et la mortalité maternelle ont une relation positive significative en Chine. La croissance du PIB par habitant et la mortalité maternelle ont une relation négative significative en Chine. Par conséquent, si les décideurs politiques chinois souhaitent atteindre l'ODD 3 en réduisant la mortalité maternelle à 70 décès pour 100 000 naissances vivantes, des politiques telles qu'un régime d'assurance maladie devraient être mises en œuvre dans le pays pour les femmes en âge de procréer. Cela réduirait probablement les dépenses personnelles et le taux de mortalité maternelle dans le pays. *(Afr J Reprod Health 2023; 27 [12]: 94-100).*

Mots-clés: Dépenses de santé, PIB par habitant, ODD 3

Introduction

The Sustainable Development Goals (SDGs) set forth by the United Nations General Assembly represent a collective global commitment to achieving prosperity and safety for all people by 2030[1,2]. Among the seventeen interrelated goals, SDG-3 stands as a dedicated endeavor to ensure healthy living and well-being for individuals of all ages[3]. Within this goal, there are thirteen health targets, with Target 3.1 bearing particular significance as it directly addresses the reduction of maternal mortality rates (MMR). This pivotal target aims to decrease the global Maternal Mortality Rate to 70 per 100,000 live births[4,5]. Defined by the World Health Organization (WHO) as the death of a pregnant woman during pregnancy or within 42 days after the end of pregnancy due to pregnancy-related causes, except accidental ones[5], maternal mortality remains a concerning global issue.

Despite concerted efforts, the global maternal mortality rate has remained alarmingly high over the years. In 2017, it stood at 211 maternal deaths per 100,000 live births[6, 5]. Although

significant progress was made between 2017 and 2020, with a reduction in maternal mortality rates observed in 31 countries, 17 other countries experienced alarming increases. Furthermore, maternal mortality rates remained stagnant in 133 countries during this period[7]. China stands out as a country that has made commendable progress in reducing maternal mortality. Over the two decades from 2000 to 2020, China achieved a remarkable decline of approximately 60.1% in its maternal mortality rate. In 2000, the rate was 58 maternal deaths per 100,000 live births, which decreased to 33 per 100,000 live births by 2010, and further dropped to 23 per 100,000 live births by 2020[7]. Despite these accomplishments, China still aspires to achieve the ambitious goal set by the State Council of the People's Republic of China, which is to attain a maternal mortality rate of 12 per 100,000 live births by 2030, in alignment with SDG Target 3.1[8,9].

Maternal mortality continues to be a complex challenge, influenced by various factors, as highlighted by the World Health Organization. These factors encompass the weaknesses of healthcare systems, the persistence of harmful gender norms, biases, and inequalities, the impact of climatic and humanitarian crises, as well as socioeconomic factors including education and income[10]. Among these factors, the role of income, particularly in the form of out-of-pocket expenditure, in contributing to maternal mortality remains a subject of interest. Although income's impact on health outcomes is well-established, there is a scarcity of recent empirical studies that delve into the influence of out-of-pocket expenses on maternal mortality, particularly in the context of an upper middle income country like China. This is especially pertinent given China's consistent decline in maternal mortality rates over the years.

Therefore, this study seeks to bridge this knowledge gap by investigating the influence of out-of-pocket expenses on maternal mortality in China. By analyzing the relationship between healthcare expenditure and maternal mortality in a nation with a track record of remarkable progress, this study aims to provide valuable insights into the role of financial factors in maternal health outcomes and contribute to the ongoing global effort to achieve SDG Target 3.1, thereby enhancing the well-being of mothers and infants in China.

Literature Review

Logarajan *et al.*[11] explored the association between public, private, and out-of-pocket health expenditures and the mortality rate for children younger than five in Malaysia. The study showed that private and public health spending is not substantial enough compared to out-of-pocket medical expenses in reducing under five death rates in the country. Gunarathne *et al.*[12] examined the amount and variables related to out-of-pocket spending (OOPE) during the initial maternity medical appointment amongst pregnant women in the Anuradhapura area of Sri Lanka, which offers subsidized maternity care. The investigation indicated that the average out-of-pocket expense (OOPE) for the initial maternity hospital appointment was USD 8.12, or 2.9 and 4.5% of the household's revenue was spent on maternity care in the country. Jeong *et al.*[13] investigated the relationship between socioeconomic level and overall mortality among mothers in South Korea. Mortality among mothers and income-level adjusted variables were related, particularly those who resided in rural regions, gave birth via caesarean delivery and had maternal complications, and women with a lower standard of living were at a lesser likelihood of dying as mothers after six weeks of childbirth. Aizawa[14] estimated the impacts of medical coverage on out-of-pocket spending on maternal healthcare in Indonesia. The typical out-of-pocket expense was discovered to have decreased by contributory healthcare and non-contributory healthcare significantly in the country.

Goli and Rammohan[15] calculated out-of-pocket expenses for pregnancy treatment for deliveries in hospitals in India. The results demonstrated that women spent a significant amount ($155) on maternal medical treatment on the aggregate. The results indicated that both absolute and relative maternal healthcare spending are highly influenced by revenue, location, and amount of antenatal care coverage. Sharma *et al.*[16] examined the out-of-pocket costs associated with using maternal healthcare facilities in Rajkot City's deprived neighborhoods in Gujarat.

A cross-sectional descriptive investigation of 180 urban slum dwellers who had given birth within a year of the questioning period was conducted. The results showed that the average

childbirth cost was high. Private medical facilities and home deliveries had standard labour costs that were greater than those of public medical centers. Over 10 per cent of the entire yearly household revenue was spent on health care for about 75% of women who gave birth in private facilities. Mohanty and Kastor[17] evaluated the effects of out-of-pocket expenses and disabling illness on maternal healthcare provided by public and private healthcare organizations in the pre-and post-national rural health mission eras. According to the finding, women who used public healthcare facilities for antenatal, neonatal, and postnatal care climbed from 11% in 2004 to 31% by 2014, whereas women who used private medical facilities varied from 12% to 20% over the exact period. Kumar *et al.*[18] examined the socioeconomic differences in the effect of out-of-pocket medical expenses on poverty in China and India. The research examined the socioeconomic differences in the effect of out-of-pocket medical expenses on poverty in China and India using information obtained from the World Health Organization's Research on Worldwide Ageing and Adult Wellness (WHO SAGE) and bivariate and multivariate approaches. The research revealed that yearly, roughly 7% and 8% of the people in China and India, consequently, drop into distress as a result of out-of-pocket expenditure. In addition, the amount of the cost of living that falls below the poverty level as a result of out-of-pocket expenditure was 1.3% in India and 2% in China. Additionally, the results of the multivariate evaluation showed that out-of-pocket expenditure in both China and India greatly raises the probabilities of slipping lower than the poverty level while both inpatient and outpatient services are associated with poorer financial standing.

Methods

To provide the best research design for this study, an ex-post facto type of research was employed for this study due to the focus of study which is assessment of viable relationship between out-of-pocket expenditure and maternal mortality in China. It is important to stress that this study made use of the country`s aggregate data. Also, the study considered the periods of 2000 to 2021 for the analysis. These periods were selected based on the availability of the data. All the data for study were collected from the World Development Indicators published by the World Bank[24]. Furthermore, maternal mortality serves as the dependent variables whereas, out-of-pocket expenditure, industrial output, Heath expenditure and GDP per capita are the set of independent variables in this study.

This is grossly inadequate – was this a national or sub-national study. What were the dependent and independent variables, and how were they collected. More details of the research methodology need to be provided.

Model specification

This study adapted its model by utilizing insights from studies such as Olowookere *et al.*[19] and Zhou *et al.*[20] as follows;

Maternal mortality (MTR) = f (out-of-pocket expenditure, OPE) (1)

Following Aderemi *et al.*[21], Okoh *et al.*[22] and Olanipekun *et al.*, control variables like GDP per capita, industrial output and domestic general government health expenditure per capita were added to enhance the robustness of the model. Therefore, model (1) is restated as thus;

$$MTR_t = \alpha_0 + \alpha_1 OPE_t + \alpha_2 GDPCA_t + \alpha_3 MVD_t + \alpha_4 DGE_{it} + u_t \quad (2)$$

Whereas, the full meanings of all abbreviations in equation 2 are illustrated in the Table 1 below

Estimation technique

The preferred methods of estimation for the study are fully modified least squares. This is the analytical technique used to estimate unknown parameters in the study. This is a regression that includes deterministic variables, integrated processes and their powers as regressors. The errors are allowed to be correlated across equations, over time and with the regressors. Also, the regression is constructed in such a way that the usual least squares procedure yields asymptotically efficient estimators**.**

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

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
MTR	Maternal mortality	This stands for both maternal mortality (per 100,000 live births)	Depended variable
OPE	Out-of-pocket expenditure.	Out-of-pocket expenditure as percentage of current health expenditure.	+
MVD	Industrial output.	Manufacturing value added as percentage of GDP	+
DGE	Heath expenditure.	Domestic general government health expenditure per capita (current US dollars)	+
GDPCA	GDP per capita.	GDP per capita growth (annual percentage.	+

data was already freely available to the general public. Hence, further ethical clearance was not obtained for this study.

Results

Table 2 accounts for the description of various statistics of the key variables associated with the study. In the first instance, between the periods of 2000 and 2021, domestic general government health expenditure per capita has a mean value of $137.7. In the same vein, $319.2 and $9.4 are both the highest and least per capita domestic general government health expenditure recorded respectively.

Table 2: Descriptive statistics of the dependent and explanatory variables of the study

Descriptive Statistics	DGE ($)	GDPCA (%)	MVD (%)	MTR (Death)	OPE (%)
Mean	137.6991	8.088863	30.43642	34.63636	45.70252
Median	113.5411	7.994664	31.49140	32.50000	40.53278
Maximum	319.2770	13.63582	32.45233	58.00000	64.19144
Minimum	9.447972	1.995558	26.28517	20.00000	34.71910
Std. Deviation	114.6746	2.433727	2.061971	12.16375	10.92233
Skewness	0.296175	-0.003879	-0.786922	0.509862	0.507831
Kurtosis	1.541268	3.900051	2.048911	1.992924	1.583787
Jargue-Bera	2.272212	0.742639	3.099758	1.882868	2.784127
Probability	0.321067	0.689824	0.212274	0.390068	0.248562
Sum	3029.380	177.9550	669.6013	762.0000	1005.455
Sum Sq. Dev.	276155.6	124.3835	89.28625	3107.091	2505.241
Observations	22	22	22	22	22

The rate of GDP per capita growth has a mean value of 8.1%. Also, this variable ranges between 13.6% and 1.9% within the periods of the analysis. In contributing to China`s aggregate GDP, manufacturing value added recorded a mean value of 30%. The highest contribution of manufacturing sector to the GDP is 32.5% and the lowest contribution is 26.3% respectively. Maternal mortality has an average value of 34 deaths per 100,000 live births. Whereas, the country recorded 58 deaths as the highest maternal mortality and 20 deaths as the lowest maternal mortality per 100,000 live births during the periods of analysis. In addition, out-of-pocket expenditure as percentage of current health expenditure registered a mean value of 45.7%. The variable has a minimum value of 34.7% and a maximum value of 64.2% simultaneously within the periods of 2000 and 2021.

In estimating the relationship between out-of-pocket expenditure and maternal mortality in China, FMOLS utilized with the results displayed in Table 3 as follows. Considering the significant results first, GDP per capita growth and maternal mortality have a significant negative relationship in China. However, out-of-pocket expenditure and

Table 3: Fully Modified Ordinary Least Squares (FMOLS) of out-of-pocket expenditure and maternal mortality nexus in China
Dependent variable: MTR

Regressors	Coefficient	T-Statistics	Prob.
GDPCA	-0.778861**	2.608115	0.0190
DGE	-0.005909	0.243017	0.8111
MVD	1.527693***	1.836313	0.0850
OPE	0.858839*	6.049253	0.0000
C	-44.11567	1.335514	0.2004
R- squared	0.970099		

Notes: *Significant at1% **significant at 5% ***Significant at 10%

maternal mortality possess a significant positive relationship. Similarly, manufacturing value added contributed a positive impact to maternal mortality, though, the contribution is significant at 10 percent level of significance. Whereas, domestic general government health expenditure per capita has an insignificant negative relationship with maternal mortality.

Furthermore, in testing the power of the model, the value of R-squared indicates that about 97% of the variation in the dependent variable, maternal mortality was explained by all the explanatory variables. This suggests that the study`s model is relatively excellent for the estimation of the variables of interest in the study.

Discussion

With reference to both the research question and the objective of this study, a compressive discussion of the results is enunciated as follows; between 2000 and 2021, $137.7 is an average domestic general government health expenditure per capita in China. This implies that $137.7 was an average government health expenditure per each citizen in China during the periods of the analysis. The value is far bigger than $77.09 currently recorded in sub Saharan Africa World Bank [24]. However, the situation reports in the East Asia & Pacific registered $437.32 and Middle East and Northern Africa registered $473.66 respectively. In the same vein, domestic general government health expenditure per capita in China is very low while comparing with countries like the United Kingdom which has $4,668.02, USA which has $6,643.36 and Canada which has $4,420.72 as their domestic general government health expenditure per capita[24].

Meanwhile, the rate of GDP per capita growth recorded an average of 8.1%. This shows that China is one of the economies with the biggest GDP per capita growth in the world. Average value of manufacturing value added is 30%. This is an indication that the manufacturing sector contributed about 30% to the overall growth of the Chinese economy over the periods of the study. However, averagely, maternal mortality recorded 34 deaths per 100,000 live births in China. This is far below 536 deaths in SSA, 103 deaths in India and 74 deaths in the East Asia and Pacific. On the other hand, maternal mortality in China is bigger than 6 deaths registered in European Union countries, 11deaths in Canada and 21 deaths in USA respectively[24]. Also, out-of-pocket expenditure as percentage of current health expenditure registered a mean value of 45.7%. This indicates that approximately 46% of health expenditure in China came out of the pocket of the citizens. As such, this implies that out-pocket expenditure in China is low comparing to other emerging economies like India with 62.6% and South Asia sub region with 53.37% respectively. Whereas, out-pocket expenditure is much lower in other BRICS like Russia which currently registered 27.79%, Brazil which currently recorded 22.39%, and 5.4% which is the current situation in South Africa.

Furthermore, out-of-pocket expenditure and maternal mortality have a significant positive relationship in China. A unit change in out-of-pocket expenditure will increase mortality by 0.85 deaths in the country according to the finding. This result is similar to the conclusion of Jeong *et al.*[13] in a related study within South Korea. This is evidence that out-of-pocket expenditure is a serious factor contributing to maternal deaths in the country. This points to the urgency of providing catastrophic health expenditure in the country. Therefore, if the policymakers in China desire to meet the SDG 3 by reducing maternal mortality to 70 deaths per

100,000 live births, policies such as robust health insurance scheme should be implemented in the country for women of the reproductive age. This will drastically reduce the out-of-pocket expenditure of this group of people, as such the level of maternal deaths will consequently reduce. Meanwhile, GDP per capita growth and maternal mortality have a significant negative relationship in China. If GDP per capita growth changes by a unit, maternal mortality will drop by 0.77 deaths. This finding corroborates the assertion of Jeong *et al.*[13] which reiterates the importance of household economy as a major determinant of maternal mortality in South Korea. Thus, in order for the country to experience a significant reduction of maternal deaths, the policymakers need to ensure that GDP per capita growth enters double digit threshold. This will enhance economic and financial stability of all citizens, especially pregnant women in the country to have sufficient money to afford quality health care services.

Similarly, domestic general government health expenditure per capita has an insignificant negative relationship with maternal mortality. This implies that government expenditure in health sector possesses the capacity to reduce maternal mortality in the country. As such, for the maternal mortality to reduce below 70 deaths per 100,000 live births in China, which is in tandem with SDG 3, the policymakers in the country should increase their budget for health sector in the country. Also, policy and programme that will facilitate public-private investment in maternal health care should be encouraged in the country.

Moreover, manufacturing value added and maternal mortality have a positive and significant relationship in China. This implies that in spite of the fact that China is highly industrialised, the manufacturing sub sector increases maternal mortality in the country. The reason for this result could be probably attributed to the negative spillover effects of manufacturing firms on health outcomes of the citizenry. This calls for urgent action of the policymakers in China to implement policy that will ameliorate negative spillovers of manufacturing sector on health of women in the country.

Strengths and limitations

The strength of this study lies in its high level of novelty in terms of its contribution to the body of knowledge. Another strength of this paper is its clearly stated research question, rigorous empirical analysis. This study is limited and serves as a future direction for other researchers. The study focused on China. Further studies could be carried out on other Asian countries. In addition, future studies could apply different methods of estimations. The interpretations of this study are based on the specific regression analysis performed and should be considered in light of any limitations or assumptions made during the analysis.

Conclusion

This study therefore concludes that between 2000 and 2021, $137.7 is an average domestic general government health expenditure per capita in China. The rate of GDP per capita growth recorded an average of 8.1%. However, averagely, maternal mortality recorded 34 deaths per 100,000 live births, and out-of-pocket expenditure as percentage of current health expenditure registered a mean value of 45.7% in China. Furthermore, out-of-pocket expenditure and maternal mortality have a significant positive relationship in China. GDP per capita growth and maternal mortality have a significant negative relationship in China. Domestic general government health expenditure per capita has an insignificant negative relationship with maternal mortality in the country. Finally, manufacturing value added and maternal mortality have a positive and significant relationship in China.

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