

Maternal Mortality in the United States, Ghana and Sweden: A Descriptive Comparative Study

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Abstract

Approximately one third of a million women die from complications related to pregnancy each year. It has been found that socioeconomic factors such as poverty, inadequate resources, and lower levels of maternal education contribute to the alarmingly high rates of maternal mortality amongst developing countries. The purpose of this study is to examine the relationships between socioeconomic variables amongst the United States, Ghana and Sweden. The specific variables examined are primary school enrollment, level of income (GNI per capita), and maternal deaths. Prior research on the subject has discovered that GNI per capita and education levels are notably lower in countries with a higher maternal mortality rate. A descriptive comparative study was conducted using the MDG Database and the Gender Statistics Database within the WDI-DA. The indicator values for each country, along with demographic data were collected from the databases and compared. The results of this study demonstrated an inverse relationship between maternal mortality and GNI per capita with a correlation coefficient of -1. Furthermore, the data indicates that as school enrollment approaches 100%, there is less of an effect on maternal mortality. While the data is consistent with previous findings, neither the data or former literature have addressed why increased income and education levels do not completely resolve the issue of maternal mortality. More research can be done to examine why maternal mortality still persists in countries with higher income and education levels such as the United States and Sweden.

Keywords: Maternal Mortality, United States, Pregnancy

1. Introduction

Each year, approximately one third of a million women die from complications related to pregnancy⁷. It is estimated that 99% of these deaths occur in developing countries, with 87% occurring in Sub-Saharan Africa or Southeast Asia⁶. The World Health Organization lists eight interdependent health initiatives established by the United Nations that are collectively known as the Millennium Development Goals (MDG)⁹. The fifth declared goal, called MDG 5, specifically aims to improve maternal health and decrease the maternal mortality ratio. Maternal mortality, as defined by the World Bank Group and World Health Organization, is the non-accidental death of a woman during her pregnancy or within 42 days of a terminated pregnancy^{9 10}. The maternal mortality ratio (MMR) refers to the number of women who die from pregnancy-related causes per 100,000 live births⁶. While some primary causes of these deaths have been linked to complications from infection and unsafe abortion, research has provided insight into socioeconomic factors such as poverty, inadequate resources, and lower levels of maternal education, and how they contribute to the alarmingly high rates of maternal mortality among developing countries⁶. The primary purpose of this study is to examine, evaluate, and describe the relationships between socioeconomic variables, specifically primary school enrollment and level of income, and maternal deaths in the United States, Ghana, and Sweden.

2. Literature Review

Understanding the determinants of maternal mortality is crucial for improving health outcomes. This can be accomplished by comparing trends related to income and education levels among some of the most successful and unsuccessful nations. Ghana, Sweden, and the United States are quality examples when examining the disparity in maternal mortality and they provide insight into differing causes of maternal mortality.

In a study involving 82 countries, it was found that maternal mortality was significantly correlated with several socioeconomic factors⁶. Specifically, it was discovered that there was an inverse relationship between income groups and maternal mortality⁶. Furthermore, there was a statistically significant ($p < 0.001$) negative relationship between MMR and the GNI per capita⁶. Another study found that there was a healthcare disparity between rural and urban communities in Ghana¹. As a result, poor women experienced more negative health outcomes¹. Even in Sweden, where the maternal mortality is significantly lower (4/100,000 live births), the maternal mortality burden was significantly higher in women who had immigrated from low-income countries, with HIV/AIDS and other infectious diseases among the leading causes of death⁵. By contrast, death related to mental and behavioral problems were significantly more common in women born in Sweden or who had immigrated from high-income countries⁵.

In recent years, improvements in data collection procedures have led to an increase in the MMR of the United States⁸. Examination of maternal deaths in the United States found that there was a significant relationship with median income⁸. The data strongly suggests that income level is a significant determinant of health outcomes. For example, income level has the ability to affect several aspects of life including access to healthcare, proper nutrition, safe housing, and other important resources. However, in the United States, an even stronger association was found between maternal mortality and educational status — 5.3% of the increase in deaths was attributable to high school non-completion⁸. Analysis of the cross sectional WHO Global Survey on Maternal and Perinatal Health further supports the relationship between education and maternal mortality⁷. The study found that women with less than six years of education had nearly twice the risk of maternal mortality when compared to women with more than twelve years of education⁷.

Afulani¹ discovered that disparities in Ghana's healthcare system, affecting rural populations, carried a significant burden for illiterate women. In another study, it was found that 34.4% of maternal deaths in Ghana were women with no education and 54.9% were women with a basic level of education (up to nine years), while only 8.6% of maternal deaths were women with a senior level of education and 2.1% were women who had completed a tertiary level of education². A sibling comparison analysis on post-reproductive mortality discovered that mortality rates are the highest among those who attain the lowest levels of education³. A lower level of education can negatively impact an individual's ability to obtain a steady income, understand healthcare information, and make decisions. Studying these factors further would be useful in determining appropriate interventions to reduce maternal mortality.

The research conducted from 2011 to 2018 consistently suggests that income and education are significantly related to maternal mortality. However, the studies do not fully address why increased income and education levels do not completely resolve the issue of maternal mortality. This is evidenced by the fact that maternal mortality persists in countries with higher income and education levels such as the United States and Sweden. Additionally, data reported in multiple studies found that the leading causes of maternal mortality were different between Ghana, Sweden, and the United States. For example, the leading cause of maternal mortality in Ghana is hemorrhage². In Sweden, the leading cause of maternal mortality is neoplasm, followed by external causes such as suicide⁵. The leading cause of maternal mortality in the United States, however, is cardiovascular conditions⁴. These markedly different causes of maternal mortality cannot be resolved using the same interventions. Therefore, a closer examination of the extent that income and education can improve maternal mortality would be beneficial in the development of interventions specific to each country.

3. Methods

3.1 Design

A descriptive, comparative study was conducted in which data was collected on maternal mortality in Ghana, Sweden, and the United States in relation to primary school enrollment, GNI per capita, percentage of the population that was

female, and the total population. The data points were compared to determine possible correlations and to suggest certain causative relationships.

3.2 Data Collection Procedure

The databases used for this study were accessed through the World Development Indicators Database Archive (WDI-DA) which contains a compilation of statistics concerning global development and prevention of poverty¹⁰. The archive has been collecting data on more than 1,600 indicators for 50 years. Specifically, the data in the archive concerns global rates of poverty, inequality, environment, economy, markets, global links, and people¹⁰. The WDI-DA was formed by the World Bank Group, a worldwide collaboration between five organizations that work to create sustainable solutions to poverty and build prosperity¹⁰. The majority of the data used in this study was drawn from the MDG Database. The MDG Database contains data on poverty, gender, education, environment, climate change, social development, urban development, economic policies, and external debt¹⁰. Values collected from this database include MMR, primary school enrollment percentage, GNI per capita, and total population. Female population percentage values were not available from the MDG Database; this data was collected from the Gender Statistics Database. This database contains data on education, demographics, health, labor force, and political participation¹⁰.

3.3 Data Analysis Procedure

Once data was collected, it was displayed in a table in its raw form. The data for the percentage of primary school enrollment, total population, GNI per capita, and MMR by country was entered into Microsoft Excel to create bar graphs. For the bar graph on total population, a logarithmic scale was used to consolidate the data. The data was also entered into a program called Logger Pro. In this program, MMR values were plotted in comparison to primary school enrollment for each country. School enrollment is defined as the number of individuals enrolled in school expressed as a percentage of the total population¹⁰. MMR values were also plotted in comparison to GNI per capita for each country. GNI is defined as the gross national income and represents the sum of domestic products and product taxes as well as compensation of employees and property income from abroad¹⁰. GNI per capita is the gross national income divided by the midyear population¹⁰. Finally, a best fit line was applied to each of the Logger Pro graphs to illustrate the trends.

4. Results

4.1 Sociodemographic Data

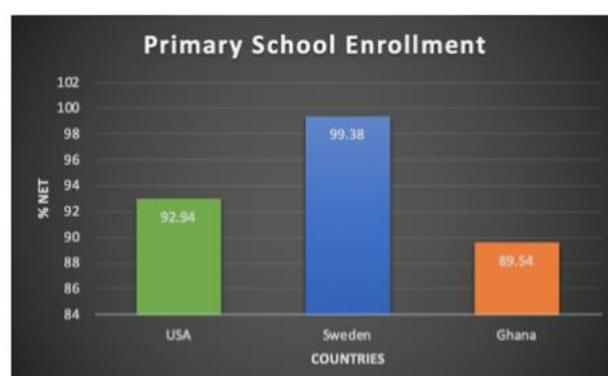
Maternal mortality was evaluated relative to population distribution for Sweden, the United States, and Ghana. These countries widely vary in regard to total population: the United States is over ten times more populated than Ghana, which is three times more populated than Sweden (Table 1, Figure 1c). When accounting for the population differential mentioned, the comparison between MMR in these countries reveals a stark difference: Ghana has over twenty times and one-hundred times more maternal deaths than the United States and Sweden, respectively (Table 1, Figure 1d). There is no significant difference in gender distribution amongst these countries (Table 1).

Table 1. Raw data on maternal mortality, school enrollment (primary), GNI per capita, total population and the percent of the population that is female as collected from the WDI Database¹⁰.

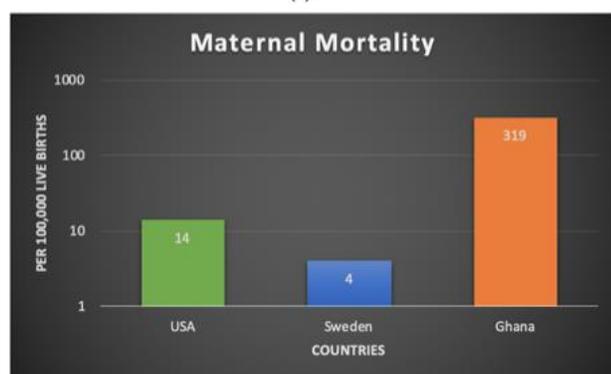
Indicator	USA	Sweden	Ghana
Maternal Mortality per 100,000 live births	14	4	319
School enrollment, primary (% net)	92.94	99.38	89.54
GNI per capita, Atlas method (current US\$)	56,300	57,880	1,490
Population, Total	321,039,839	9,799,186	27,582,821
Population, % female	50.5	50.0	50.2



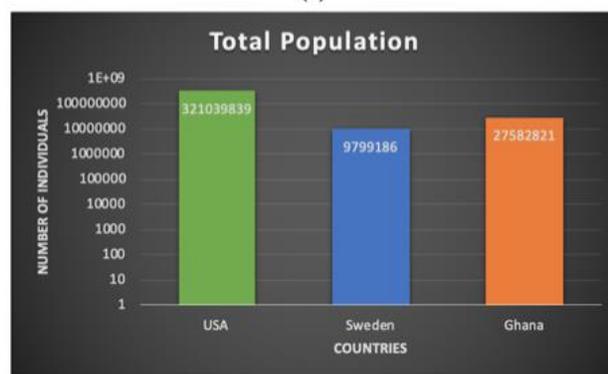
(a)



(b)



(c)



(d)

Figure 1a. GNI per capita in US dollars for USA, Sweden, and Ghana. Figure 1b. Net percentage of primary school enrollment in USA, Sweden, and Ghana. Figure 1c. Maternal mortality per 100,000 live births in the USA, Sweden, and Ghana. Figure 1d. Total population as expressed as number of individuals in the USA, Sweden, and Ghana.

4.2 Health Indicators

Table 1 and Figure 1b illustrate the primary enrollment rates of Ghana, the United States and Sweden. Figure 2 compares the percentage of school enrollment (primary education) against the MMR. In this graph, the line of best fit was a logarithmic function demonstrating that school enrollment impacts maternal mortality. However, the effect of primary education on maternal mortality is not as substantial at higher levels of school enrollment. The increase from

92.4% in the United States to 99.38% in Sweden reduced the maternal mortality by 11 deaths. Yet, the increase from 89.54% in Ghana to 92.94% in the United States reduced maternal mortality by more than 300 deaths. The results obtained from the data showed that as school enrollment approaches 100%, there is less of an effect on maternal mortality (Figure 2). Table 1 and Figure 1a display the GNI per capita for Ghana, the United States and Sweden. Figure 3 is a comparison between GNI per capita and MMR. In this graph, the line of best fit was a negative linear correlation with a correlation coefficient of -1. This demonstrates that as GNI per capita increases, maternal mortality decreases. The strong negative correlation between maternal mortality and GNI per capita supports trends that were observed in the literature review.

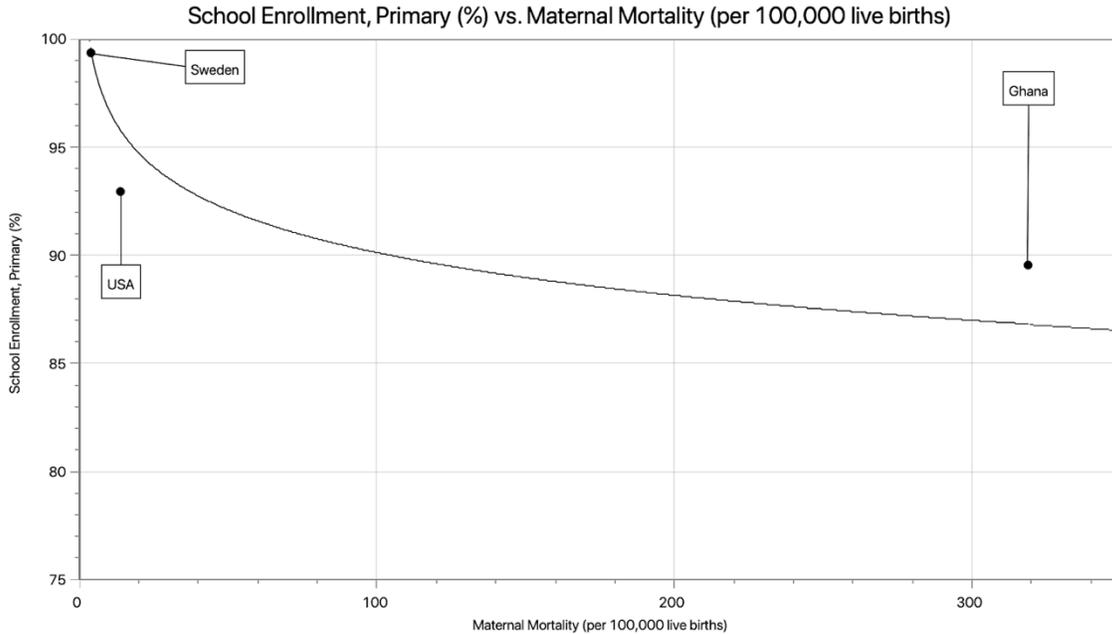


Figure 2. Net percentage of primary school enrollment compared to maternal mortality per 100,000 live births for USA, Sweden, and Ghana. Logarithmic function is the line of best fit, demonstrating the greater significance of maternal mortality relative to lower primary school enrollment.

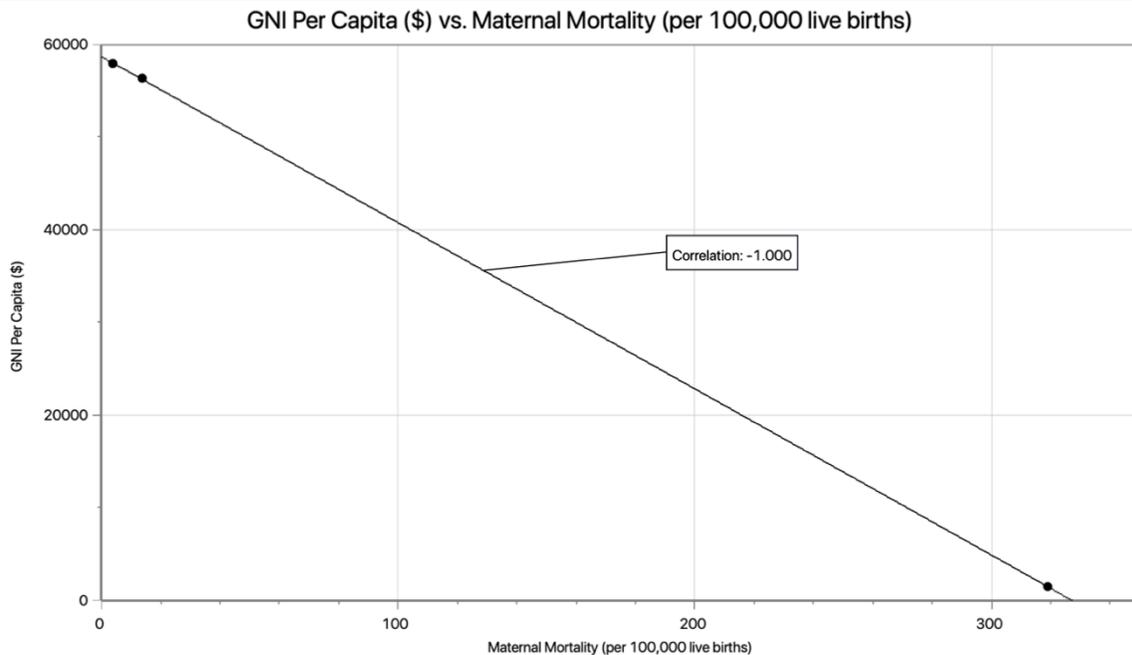


Figure 3. GNI per capita in US dollars compared to maternal mortality per 100,000 live births for USA, Sweden, and Ghana. A linear function is the line of best fit for this graph, demonstrating that as GNI per capita increases, maternal mortality decreases.

5. Discussion

Previous research has shown that there is a close relationship between income and education level with maternal mortality⁶. The relationships observed in this study are supportive of previous findings. However, it is important to note that this study is limited due to the fact that only three data points were used. There is not enough data to state with certainty that maternal mortality is greatly affected by primary school enrollment levels and GNI per capita. While the exact relationship between maternal mortality and the examined indicators is unclear, the comparison made, and conclusions drawn were consistent with previous research. Therefore, it would be beneficial to repeat this study, considering data from several other countries, to increase the significance of any conclusions drawn from the data.

Exploring the type of education (primary, secondary and tertiary) may determine the particular education level that primarily affects maternal mortality. As mentioned in the literature review, despite high income, countries may still have an existing, albeit low, MMR because women choose not to utilize health care services, which may result in their death⁷. Additional research should be done to see if women with adequate access to health care actually utilize it. Furthermore, it has been suggested that varying causes of maternal mortality are related to the income and education levels of the population⁷. It would be valuable to further assess the numerous causes of maternal mortality as it relates to income and education levels. For example, the literature suggests that countries with low income and education, like Ghana, would likely benefit from increased access to immunizations and healthcare to address infectious disease. By contrast, countries with higher income and education may require more preventative measures to address the increase in chronic diseases and improved treatment for mental health disorders.

Since low income and education levels are associated with higher maternal mortality rates, nurses should be knowledgeable about community resources for pregnant women and mothers. While nurses cannot directly impact patients' income levels or school enrollment, they can be active within the community to promote maternal health. The creation of local outreach programs may educate the general public about healthy behaviors for pregnancy and postpartum. By participating in local community outreach programs, nurses have the opportunity to promote primary and secondary prevention by providing patient teaching, connecting women to resources early in pregnancy, screening for high-risk individuals, and providing care. Furthermore, teaching healthcare literacy can empower women to make

better-informed health decisions. Important teaching points include expectations for a healthy pregnancy, signs and symptoms that indicate a need for medical care, and appropriate follow-up care for both the mother and infant during and after birth. Additionally, referring women to various resources may improve adherence to treatment and maintenance of a healthy lifestyle during and after pregnancy. These resources may include low-cost healthcare, local food banks, and safe and affordable housing. By utilizing these resources and identifying high-risk individuals early on, maternal outcomes can be significantly improved.

Currently, healthcare policies that directly aim to improve maternal mortality across these countries are limited. Specifically, healthcare policies addressing the inequities of healthcare for low socioeconomic areas (like Ghana) should be explored to ensure that necessary resources are readily available. Girum & Wasie identified inaccessible and unaffordable health care as underlying causes for poor maternal outcomes⁶. This issue could be addressed by implementing a universal government-funded healthcare system. For example, this would extend care to women who might otherwise forego seeking medical treatment during their pregnancy due to high costs. Sweden has already implemented a government-funded universal health care system. This may explain why MMR is lower in Sweden than in the United States despite similar education and income levels. Additionally, government funds could be set aside to build healthcare facilities in low socioeconomic areas. Afulani¹ discussed how many women have to travel far for better healthcare and can only do so if they have the financial capacity and resources. By implementing facilities in rural areas, governments can help to address similar problems in low income nations like Ghana. Lastly, if facilities cannot be built, programs could be implemented to send healthcare workers and midwives to underserved areas. This would increase the ability to access care and potentially lower the cost in lower socioeconomic areas.

6. Acknowledgements

The authors wish to express their gratitude toward the Louise Herrington School of Nursing, specifically Dr. Shelby Gardner in her assistance and guidance in the creation of this paper.

7. References

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