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ASSESSING THE IMPACT OF HEALTH FINANCING ON HEALTH OUTCOMES IN ZIMBABWE: (1990-2023).

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PROGRAMME FOR MASTER OF SCIENCE DEGREE IN HEALTH ECONOMICS (MSc ECONOMICS)

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Dedications

This dissertation is dedicated to my beloved sister, Ratidzai Musariri.

Abstract

This study is premised on exploring the existing relationship between health financing, under five mortality and infant mortality rates in Zimbabwe between 1990 and 2023. The study employed advanced econometric techniques, including Vector Auto regression (VAR) modeling, Impulse Response Function (IRF) analysis, and Forecast Error Variance Decomposition (FEVD) analysis, using Stata version 14.0. The empirical results reveal several critical findings. Firstly, health financing has a significant positive impact on reducing under-five and infant mortality rates in Zimbabwe. Increased health financing leads to decreased mortality rates, emphasizing the critical role of health financing in improving health outcomes. Secondly, the study reveals a positive relationship between population density and mortality rates, highlighting the need for targeted interventions addressing population density-related challenges. The study strongly recommends authorities to prioritize increasing health financing to support healthcare programs targeting under-five and infant mortality. Also, implementing long-term health financing strategies and enhancing infrastructure and human resources is critical for ensuring sustained impact, in line with the systems thinking approach. Furthermore, addressing population density-related challenges through urban planning, community-based healthcare, and family planning services is essential.

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CHAPTER I

INTRODUCTION AND BACKGROUND

1.0 Introduction

This chapter seeks to introduce the study on assessing the impact of health financing on health outcomes in Zimbabwe. It is made up of the background of the study, statement of the problem, research objectives, hypothesis statement, research questions, and significance of the study, scope, assumptions, limitations, chapter summary and definition of terms.

1.1 Background to the study

Health financing plays a pivotal role in determining health outcomes, through enabling the provision of essential healthcare services, enhancing quality of care among other things and saving lives (WHO,2022). Globally, the World Health Organization (WHO), through Sustainable Development Goals has advocated for vigorous health financing system to universal health coverage (UHC), as well as to improve health outcomes. Worldwide, countries are struggling to finance their health systems due to scarce resources. Research has indicated that effective financing mechanisms can significantly impact health outcomes ranging from reduced mortality rates, improved life expectancy, improved health equity among others. This study aims to assess the impact of health financing on health outcomes in Zimbabwe, with specific focus on, infant and under five mortality rates.

In an effort to address the above challenges, the United Nations Sustainable Development Goal (SDG 3) aims to ensure health and well-being for all by 2030. To accomplish this ambitious goal, the World Health Organization (WHO) has set specific targets, such as reducing the global maternal mortality ratio to below 70 per 100,000 live births, increasing life expectancy to 64 years, eliminating preventable deaths of newborns and children under five to 25 per 1000 live births, eradicating infectious diseases, as well as addressing Communicable Diseases. However, to make these targets a reality, focus has also been set on health financing and workforce development, chiefly in developing nations. This includes significantly expanding health financing and investing in the recruitment, development, training, and retention of healthcare professionals. The achievement of these SDGs can only become a reality through human capital as drivers for achievement.

In relation to Sub-Saharan Africa, countries grapple with many challenges including inadequate funding, reliance on high out of pocket payments and donor funding, as well as limited insurance coverage. (World Bank, 2019). In other words, out of pocket expenditure constitute 74% of the regional total health expenditure, funded from household budgets, thus leading to catastrophic health expenditures and poverty, (Mtei et al., 2020). Literature has revealed that increases in health financing result in enhanced outcomes such as increased life expectancy and child mortality rates (Odor et al., 2019). Nevertheless, the region grapples with limited fiscal space, economic instability and dependency on external assistance thus making the health financing environment complex.

Despite facing the above challenges, African countries, including Zimbabwe have committed to the Abuja Declaration which calls for 15% of the national budget to be allocated to the health sector so as to enhance health outcomes. Only a few countries managed to reach the Abuja declaration target. In addition, domestic health expenditure per capita has increased to the extent that 13 African countries have managed to spend at least $60 per capita on health from domestic sources.

Health financing trends in Zimbabwe

Health financing is pivotal to achieving SDG 3.2 and increased health financing can result in enhanced healthcare outcomes, including reduced infant and under-five mortality rates. The Zimbabwean Government has committed to increasing health financing to achieve the SDGs. In line with the Abuja Declaration, the government aims to increase health expenditure to at least 15% of the national budget by 2025, Ministry of Health and Child Care, (2020). However, statistics shows that Zimbabwe's budget allocation towards the health sector is still way below the target as it stood at 9.2% in 2024, despite identifying health as one of its priority areas on National Development Strategy 1. Figure 1 shows trends in Zimbabwe's health financing from 2010-2021.

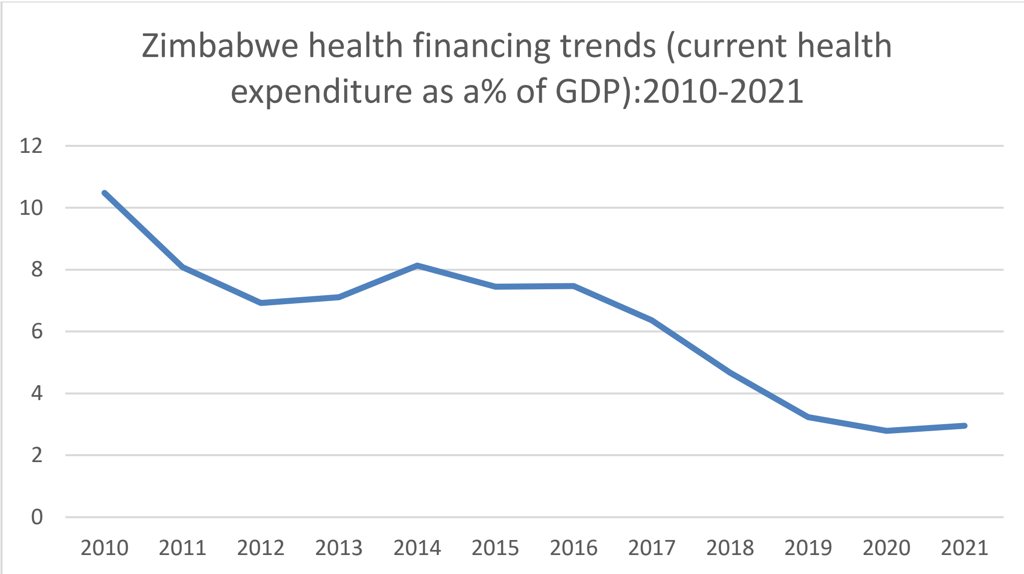

Figure 1 Zimbabwe health financing trends (2010-2021)

Source: author's own computation using world bank data

The above trends show that following the launch of the National Health Strategy (2010-2015), with the objective of improving health outcomes and health financing, 2010 health budget was high standing at 10.48%. In 2012, the health system experienced a number of challenges including inadequate infrastructure and healthcare workers, and health financing has fell from 10.48% in 2010 to 6.92% in 2012, WHO (2012). In 2014 health financing increased to 8.13 following the introduction of the National Health Policy (2016-2020) which sought to promote universal health coverage as well as increase health financing. In 2016, the government introduced the Health Sector Strategy (2016-2020) and health financing slightly increased to 7.47% from 7.45% in 2015. From 2017 on it gradually declined from 6.36 % to due to economic challenges. However, there was a sharp decline in health financing as a percentage of total government expenditure between 2020 and 2021, to 2.95 in 2012 due to the COVID 19 pandemic which significantly affected Zimbabwe's health financing due to high demand for healthcare services.

However, despite these commitments, Zimbabwe's health financing is still heavily reliant on external funding thereby compromising the sustainability aspect of the health sector. Statistics from the World Health Organization, WHO (2019), revealed that external funding made up 44% of Zimbabwe's total health expenditure, while domestic funding accounted for 56%, (WHO, 2020).

This over reliance on external funding has substantial implications for health outcomes, as it may result in financial instability and reduced access to healthcare services for vulnerable populations.

Zimbabwe's healthcare system is struggling with a myriad of challenges from inadequate funding, limited access to health care services and deteriorating health infrastructure, (WHO,2022). This challenge does not exclude the public servants whose Premier Medical Aid Society responsible for paying the medical fees is currently failing to support the health needs of this group. With this scenario, of having unhealthy labour force, it is likely to affect economic growth as the drivers may not be fit to do productive work. Poor economic performance may in turn affect health financing and health outcomes including high infant and under five mortality, maternal mortality ratio as well as high burden of infectious diseases. Figure 2 and Figure 3 show trends in infant and under -five mortality rates in Zimbabwe respectively.

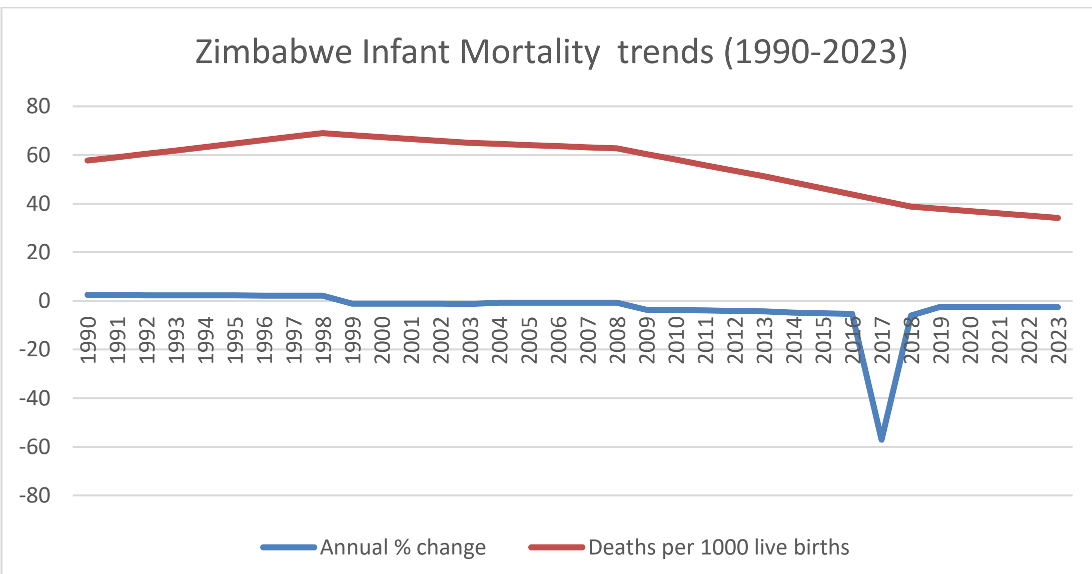

Figure 2 Zimbabwe infant mortality trends (1990-2023)

Source: author's own computation using World bank data

Fig 2 shows Zimbabwe's trends in infant mortality for the period 1990-2023.Statistics reveal that from 1990 to 1997, Zimbabwe experienced a sharp increase in infant mortality rates from 57.681 in 1990 to 67.553 due to inadequate financing and shortage of health care workers. Between 1998 and 1999, it was constant. However, there was a gradual decline from 67.391 in 2000 to 37.811 deaths per live births in 2019. In 2020 the mortality rate stood at 36.882 and declined by a 2.52% to 35.954 deaths per 1000 live births in 2021.It further experienced a 2.58% decline to 35.025 deaths per 1000 live births in 2022.Moreso, in 2023, Zimbabwe's infant mortality rate dropped to 34.096 deaths per 1000 live births by mortality, which is 2.65% decline from the previous year. From 2023 to 2024, the infant mortality rate also declined by 2.02% to 33.406 deaths per 1000 live births, which is the current 2024 mortality rate for Zimbabwe.

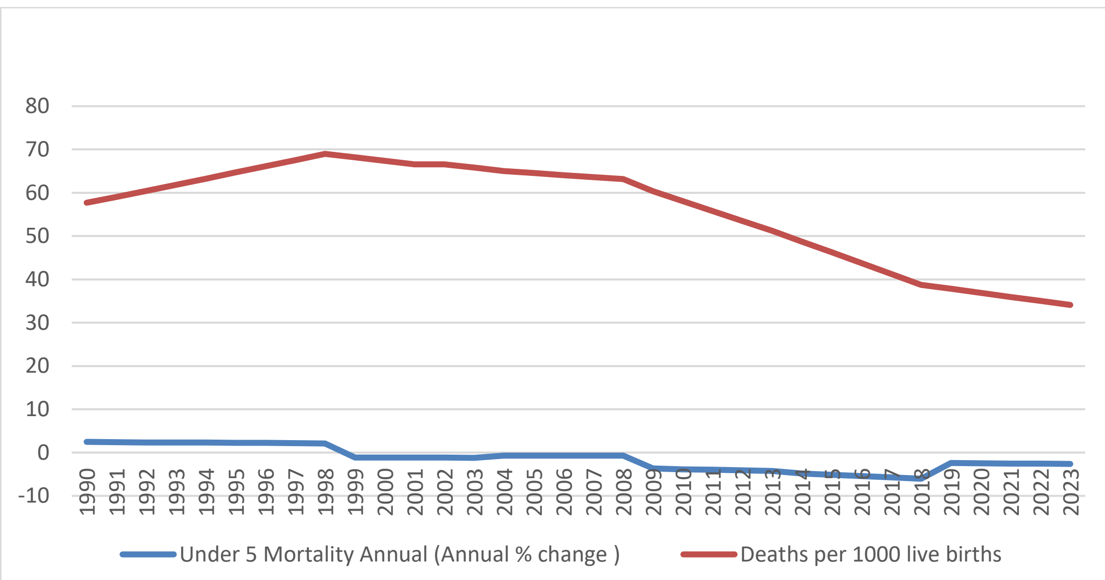

Figure 3 Zimbabwe under five mortality trends (1990-2022)

Source: author's own computation using world bank data

The above trends for under 5 mortalities indicate that there was an increase in mortality rate from 80.4% to 100.2% and this may be attributed to the economic crisis that Zimbabwe experienced in the mid-1990s.It compromised healthcare access and exacerbated poverty levels. However, there was a slight decrease from 100.2% to 99% between 1997 and 1998 respectively. This may be as a result of the implementation of health intervention programs. On the other hand, a slight increase in under-5 mortality rates was witnessed from 90.5% to 91.4% between 2004 and 2005, probably due to healthcare system challenges. Between 2005 and 2007, Zimbabwe experienced an increase in mortality rates from 91.4% to 94.5%, which could have been perpetuated by poor economic performance in the country. From 2007 to 2022, a sharp and significant decrease was seen from 93.3% to 47.7% respectively, which could have been influenced by increased funding for child healthcare programs and improved access to healthcare services including for the under-fives. Additionally, effective implementation of health interventions ranging from malaria control measures, vaccination programs, enhanced nutrition programs, as well as economic recovery and reduced poverty levels. As a result, access to healthcare and living conditions, improved. However, Zimbabwe's under 5 mortality is still high, standing at 47.7 in 2022, (World bank ,2022) and at 37 per 1000 live births in 2024.This figure is way above the anticipated target of 25 deaths per 1000 live births according to SDG3.

Moreso, Taruvinga et al., (2020) argued that poor health outcomes, including high maternal and child mortality rates, increased morbidity, and decreased life expectancy have been a result of such challenges. It is clear that inadequate funding is one of the root causes of these challenges and this predicament has emphasized the necessity for sustainable healthcare financing options. A better understanding of the healthcare challenges in Zimbabwe is vital in recommending suggestions for aligning the country's healthcare delivery system along the path of the 2030 SDGs, (Chipunza, 2019). The situation therefore, prompted the researcher to make an assessment of the impact of health financing on health outcomes in Zimbabwe with the intention to come up with a sustainable and effective financing model that will enhance health outcomes and economic growth in turn.

1.2 Statement of the problem

Studies have shown that most countries in Africa have not yet reached the Abuja Declaration mark on health financing of 15% of the nation's GDP. Zimbabwe is not an exception, as of 2024 its health expenditure still at 9.2% of national GDP, pointing to faulty financing model. Despite making significant investments in the health sector, Zimbabwe continues to grapple with challenges in achieving optimal health outcomes. The health financing system of the country is mainly characterized by high out of pocket payments which constitute approximately 39%, WHO (2022). In addition, it also comprises private insurance of less than 10%, indicating that majority of the population have no insurance coverage, and government funding constitutes 9.2% as of 2024. This health financing system is associated with inequality, inefficiency and barriers to healthcare access. This situation has significantly contributed to poor health outcomes, including high maternal which stood at 363 deaths per 1000 live births, WHO (2022), under five mortality rates which stood at 39.8 deaths per 1000 live births and infant mortality rate which is around 24.2 deaths per live 1000 births, ZIMSTAT (2020), as well as rise in infectious diseases such as cholera and malaria.

1.3 Research Objectives

i. To assess the impact of health financing on under five mortality rates in Zimbabwe.
ii. To examine the impact of health financing infant mortality rates in Zimbabwe.
iii. To give policy recommendations on what should be done to improve Zimbabwe's health financing and health outcomes based on the results of the study.

1.4 Research Questions

i. Does health financing affect the under-five mortality rate in Zimbabwe?
ii. Does health financing affect infant mortality rate in Zimbabwe?
iii. What policy recommendations can be put in place to improve health financing and health outcomes (under-5 and infant mortality) rates in Zimbabwe?

1.5 Statement of Hypothesis

H0: There is no significant relationship between health financing and under 5 mortality rates in Zimbabwe from 1990-2023

H1: There is a significant relationship between health financing and infant mortality rate in Zimbabwe

1.6 Significance of the study

The findings of the research will apprise policymakers on the most effective and efficient ways of health resources allocation and management to enhance health outcomes. The study also intends to pinpoint areas where policy interventions, such as increasing public health spending, expanding health insurance coverage, or leveraging external funding more efficiently, could have the greatest impact on key health indicators. The study also aims to contribute to the development of evidence-based health policies and strategies in Zimbabwe, thereby contributing to enhancement of health outcomes and progress towards Universal Health Coverage and SDGs.

1.7 Assumptions

The study assumes that data will be reliable, valid and accurate.

The sample size will be sufficient for analysis.

There will be no spurious regressions.

1.8 Delimitations/scope of the study

The study makes use of secondary data only. The study will focus on Zimbabwe and will not consider other countries. The research will also focus on analyzing data for the period 1990-2023 and therefore will not consider prior or subsequent periods. In terms of health outcomes, focus will be on infant and Under 5 mortality rates only while health financing, population density, GDP per capita are the explanatory variables of the study.

1.9 Limitations

Primary data collection was resource constrained and to cater for data adequacy, the researcher resorted to use of secondary data which was readily available on both electronic database and print media.

To cater for time lagged effects, where health financing changes may take time to impact outcomes, the researcher will make use of time series data over a wider period range,1990-2023.

The study utilized secondary data only and results may not be generalized.

1.10 Definition of terms

Health financing-refers to the function of mobilizing and allocating resources to provide healthcare services. (World Health Organisation,2020)

Health outcomes-refer to changes in health status, such as reduction in mortality, morbidity, or improvements in quality of life, resulting from healthcare interventions. (Agency for Healthcare Research and Quality,2020).

Under five mortality rate- the probability of dying between birth and exactly five years of age, expressed per,1000 live births. (World Health Organisation,2020).

Life expectancy at birth- is the average number of years a new-born is expected to live if mortality rates at the time of birth remain constant in the future. (World Bank,2020).

Non communicable diseases-are medical conditions that are not caused by infectious agents (such as bacteria, viruses, or parasites) and cannot be spread from person to person. (World Health Organisation,2020).

Infectious diseases-are illnesses caused by pathogenic microorganisms, such as bacteria, viruses, fungi, or parasites, that can be transmitted from one person to another or from animals to humans through various routes, including air, water, vectors or direct contact. (Centers for Disease Control and Prevention,2022).

1.11 CHAPTER SUMMARY

This chapter introduces the topic on assessing the impact of health financing and health outcomes. It also gives background of the topic in a funnel approach, from a global perspective to the Zimbabwean context. In addition, also summarizes trends in health financing and health outcomes, challenges faced as well as major strides that have been taken to increase health financing and health outcomes. In addition, it gives significance of study, research objectives, questions, hypothesis, assumptions, scope of the study, as well as definition of terms. The rest of the study will be unfolded in the remaining four chapters. Following this chapter, is the literature review, comprising theoretical and literature review related the study of interest.

CHAPTER II

LITERATURE REVIEW

2.0 Introduction

This chapter seeks to provide a comprehensive literature review on health financing and its impact on health outcomes. It lays the foundation on which the research methodology will be built. This chapter clearly lays down the theoretical framework, empirical literature, conceptual framework, as well as the research gap. It is wrapped up by a chapter summary that links the current chapter to the subsequent one on research methodology.

2.1 Theoretical Framework/Literature Review

2.1.1Grossman's health production theory

The health production theory was developed by Michael Grossman in 1972. The health production function theory explains how health outcomes are derived. This theory is grounded on three basic assumptions. Firstly, health is assumed a form of human capital or a producible commodity that an individual can produce from a combination of various inputs such as diet, medical care, exercise, sleep and lifestyle choices. In addition, these inputs combined with individual characteristics which include age, education level and genetic factors, can then produce health outcomes.

Secondly, individuals are assumed to be rational on their choices about making health inputs. Individuals can make choices to improve their health through exploring various options which include investing in health capital. This investment can be done through embarking on preventive measures or health- promoting lifestyle. In this regard, individuals can utilize exercise activities, consider healthy diets to stay healthy and can also avoid behaviours that are risky.

Moreso, according to the health production function, individuals can make a choice to combine health capital with other inputs which include medical care to produce health as an output. Alternatively, individuals can invest their time to produce health. This can be done through spending their time on health-producing activities for example, enjoying leisure activities, taking hours of sleeping or just relaxing, to improve their health. The theory can be presented with the aid of the health production function below:

$H = f(M, T, \alpha)$

Where:

H=health stock (or health capital)

M=Medical care (healthcare services)

T=time inputs (time allocated to exercise, sleep, relaxing)

α =individual specific characteristics (which include genetic factors and lifestyle)

The function explains that health stock of an individual(H) is a function of the medical care(M) that they receive at a certain time period (T) which they devote to health producing exercises or activities and combined with their individual specific characteristics.

Furthermore, individuals can make use of market goods inputs to produce health. This can be done through buying market goods including healthy foods, medical care, gym membership, health insurance covers, among other things to produce health. Also, they can produce health through optimizing health investment. This optimization can be done through a cost benefit analysis of different health- producing activities and market goods. In other words, this health investment theory examines the optimal allocation of resources to health production.

In the Zimbabwean context, Grossman's model proposes that an increase in health financing can result in enhanced health outcomes including infant and under-5 mortality rates. This is in the sense that increased health financing improves access to medical care, vaccinations, immunization as well as other vital health services in reducing child mortality rates, (Grossman,1972).

Therefore, the theory has been applied in evaluating the effectiveness of healthcare interventions assessing the impact of lifestyle choices on health outcomes and finally, in estimating the returns to investment. This is closely related to this study as health outcome is viewed as an output which comes from inputs by individuals (investment in health). This study therefore, heavily borrows the model from this theory as shall be seen under the theoretical model and model specification in chapter 3.

2.2.2 Human capital Theory

The human capital theory was developed by Gary Becker (1964). It postulates that investments in healthcare can enhance an individual's productive capacity and earning potential. By improving health, these investments increase a person's ability to work, learn, and engage in economically productive activities. This, in turn, can lead to higher incomes, which can further enhance access to healthcare and other determinants of health, creating a virtuous cycle of improved health and economic outcomes. This theory suggested that health and education financing impact productivity and GDP per capita.

2.2.3 Social determinants theory

The social determinants theory was developed by Michael Marmot, Sophia Chan and Rajat Gupta in 2008, under the WHO's Commission on social determinants of health. The theory stresses that social determinants such education, housing, employment, social support among others, play a role in influencing health outcomes, (Marmot et al.,2018). The theory is based on three key components namely social determinants, health outcomes and social context. The rationale behind is that social factors influence health outcomes, while the social determinants factors are shaped by the social context in which people live.

Moreso, this theory is based three assumptions, the first being that social factors which include education and income significantly influence health outcomes. Secondly, the social context in which individuals live shapes the social determinants and shapes the health outcomes. Thirdly, the theory assumes that health outcomes can be improved by addressing the social determinants of health.

Furthermore, this theory has important implications in as far as addressing health outcomes is concerned. It stresses the need for a comprehensive approach that includes social determinants of health. This is because the addressing of these social determinants is vital for enhancing health outcomes such as under-5 and infant mortality rates. Also, the theory is of the view that policy and interventions play fundamental role in addressing the social determinants of health, as well enhancing health outcomes.

Similarly, applied in the context of infant and under-5 mortality rates, the Social Determinants theory is very critical, as it proposes that social determinants such as education, housing and living conditions (which encompass population density), employment and income among others, can lead to improved health outcomes, if addressed.

In the same vein, Becker et al. (1964) argued that if individuals are educated, they have better understanding on health information and therefore can make informed and sound decisions. Pertaining to health behaviors, Marmot et al. (2019) postulated that educated individuals are more likely to engage in healthy behaviors, WHO (2019) stated that education influences one's access to healthcare through its effect on employment opportunities and income. Hence, it can be justified that the variables used in this study namely population density (PD), Gross National Income (GNI), and GDP per capita (GDPC) are backed by literature.

2.2.4 WHO FRAMEWORK

The World Health Organization's (WHO) Framework for Health Systems provides a useful basis for understanding how the health system can be strengthened to address the social determinants of infant and under-five mortality. This theory considers health financing as one of its six key building blocks which are critical for a well-functioning health system which is capable of improving health outcomes. The six key building blocks that make up this framework are service delivery, health information systems, health workforce, medical products and technologies, and leadership, health financing and governance, (WHO, 2019). This implies that health outcomes are not influenced by health financing alone but all the other five factors have influence on health systems and outcomes.

It is therefore imperative to improve these building blocks for they are vital in addressing the social determinants of infant and under-five mortality. For instance, in this context, strengthening service delivery and health workforce can enhance access to quality healthcare services by pregnant mothers and children, thereby contributing to reduced maternal, infant and under- five mortality rates, (Koblinsky et al., 2016). Furthermore, strengthening health information systems can help implementers to keep track on health outcomes (infant and under-five mortality rates), giving policymakers an advantage of early identification of areas for improvement and come up with target interventions accordingly, (AbouZahr & Boerma, 2018).

Furthermore, the theory posits that addressing of social determinants of health outcomes call for a multisectoral approach by various players of the health, education and social protection sectors, as well as economic development, (Solar & Irwin, 2019). In this regard, the approach acknowledges that the social determinants of health are influenced by a range of factors outside the health sector, which include education, income, housing, and employment (WHO, 2019).

Finally, the strength of this theory is that it utilizes the systems thinking approach in improving the health system, for improved health outcomes. The systems thinking approach provides a holistic perspective on complex relationships that exist between health financing, health care delivery, utilization and health outcomes. Also, it takes cognizance of the interconnectedness of various components and players within the health system. Therefore, it has the ability to identify and address the root causes of problems including inadequate health financing and poor health outcomes, rather than addressing the symptoms. In this way, sustainable solutions will be guaranteed for Zimbabwe.

2.3 Empirical Evidence

This section presents related studies that have been conducted prior, to the current study. Wang et al. (2020), conducted an analysis of global, regional, and national trends in under-five mortality rates. The study utilized descriptive analysis of trends in under-5 mortality rates using 1990- 2019 data. Findings of the study revealed a significant global, regional national reduction in under-5 mortality. These findings have important implications for global health policy and demonstrates the essence of continued efforts to reduce under-5 mortality rates in line with SDG3, by countries which still have high child mortality rates. In relation to the current study, the inclusion of additional variables, such as health financing, GDP per capita, gross national income, and population density, give a comprehensive explanation of dynamic factors influencing under-five mortality rates in Zimbabwe.

Bokhari and Gai (2018), explored the relationship between health expenditure financing and infant mortality rates in Sub-Saharan Africa. They utilized panel data regression analysis on 1995-2015 data and focused their study infant mortality rate, health expenditure per capita as dependent and independent variables respectively, as well as GDP per capita, access to improved sanitation facilities and urbanization rate as control variables. The findings revealed a significant negative relationship between health expenditure and infant mortality in Sub-Saharan Africa. This study therefore, is related to the one by Bokhari and Gai (2018) in the sense that it focuses on child health outcomes. However, this current study is specifically for Zimbabwe and has recent data 1990-2023, uses an additional dependent variable infant mortality and different control variables.

Kirigia et al. (2015), employed panel data analysis using data from 46 African countries, for the period 1995-2015 to assess the impact of health financing on health outcomes in African countries. The study results revealed a positive correlation between government health expenditure, health insurance coverage and health outcomes in African countries. On the other hand, out of pocket payments were found to have negatively impacted health outcomes. The study recommended that increased government health expenditure and insurance coverage can improve health outcomes in Africa.

On the other hand, Ataguba et.al (2018) used quantitative research design and secondary data analyses using panel regression analysis technique for the period 1995-2015 to analyze health financing and health outcomes in Sub-Saharan Africa. The researcher found a positive relationship between government health expenditure and life expectancy. From that regional analysis, Government health expenditure was positively correlated with life expectancy for East Africa, for West Africa, OOP payments were negatively correlated with Life expectancy. For Southern Africa, health insurance coverage was positively correlated with life expectancy. Regional analysis depicted varying relationships between health financing and health outcomes. However, the study did not consider country specific factors and child health outcomes.

Furthermore, Abdalla, et al., (2019), analyzed the relationship between health financing, C02 emissions and health outcomes on 35 Sub-Saharan African countries for the period 1990-2015. The study utilized quantitative research and used panel data regression analysis and in his econometric modelling, he also used ordinary least squares, fixed and random effects, as well as instrumental variable. The findings revealed a positive relationship between health financing and health outcomes. On the other hand, a negative relationship was found between carbon dioxide emissions and health outcomes. Similarly, an inverse relationship between CO_2 and health outcomes was also noted. In addition, the findings revealed the importance of socioeconomic factors such as income and education as key determinants of health outcomes.

Wang et al. (2019) in his study on Asia-Pacific Region, made use quantitative research design and utilized panel data analysis technique for 27 countries for the period 2000-2015.It was revealed that increased health spending was associated with higher mortality rates in some Asian countries probably as a result of inefficient healthcare systems. Recommendation was made for government to implement cost-effective interventions as well as optimize resource allocation, so as to improve healthcare efficiency. In addition, implementation of policies that address socio economic determinants such as poverty, education and social equality would improve health outcomes. Hence the researcher for this study will include social determinants such as population density, as control variables to assess their impact on health outcomes in Zimbabwe.

Also, AbouAish et al. (2020) conducted a related study with a sample of 20 countries using panel data analysis for the period 2000-20218 and found no significant relationship between health expenditure and life expectancy in the Middle Eastern and North Africa. In relation to the results found, it was suggested that strengthening health systems, implementing health reform, as well as prioritization of preventive care and addressing social determinants of health were bound to improve health outcomes.

Another study by Kouadio (2020), using panel data analysis for of 150 countries the period 2000-2020, investigated the relationship between health expenditure and population health outcomes in West African Countries. Results showed a positive relationship between public and private health expenditures. He therefore recommended governments to strive towards increasing resources allocated to the health sector to achieve SDG 3, as well as to implement Universal Health Coverage to eradicate poverty.

2.4. Conceptual Framework

The conceptual framework is based on the theoretical assumptions that improved health financing results in improved healthcare outcomes, which include reduced infant and under-five mortality rates. In addition, GDP per capita, gross national income, and population density have been included as control variables to safeguard validity and reliability of the findings of the study.

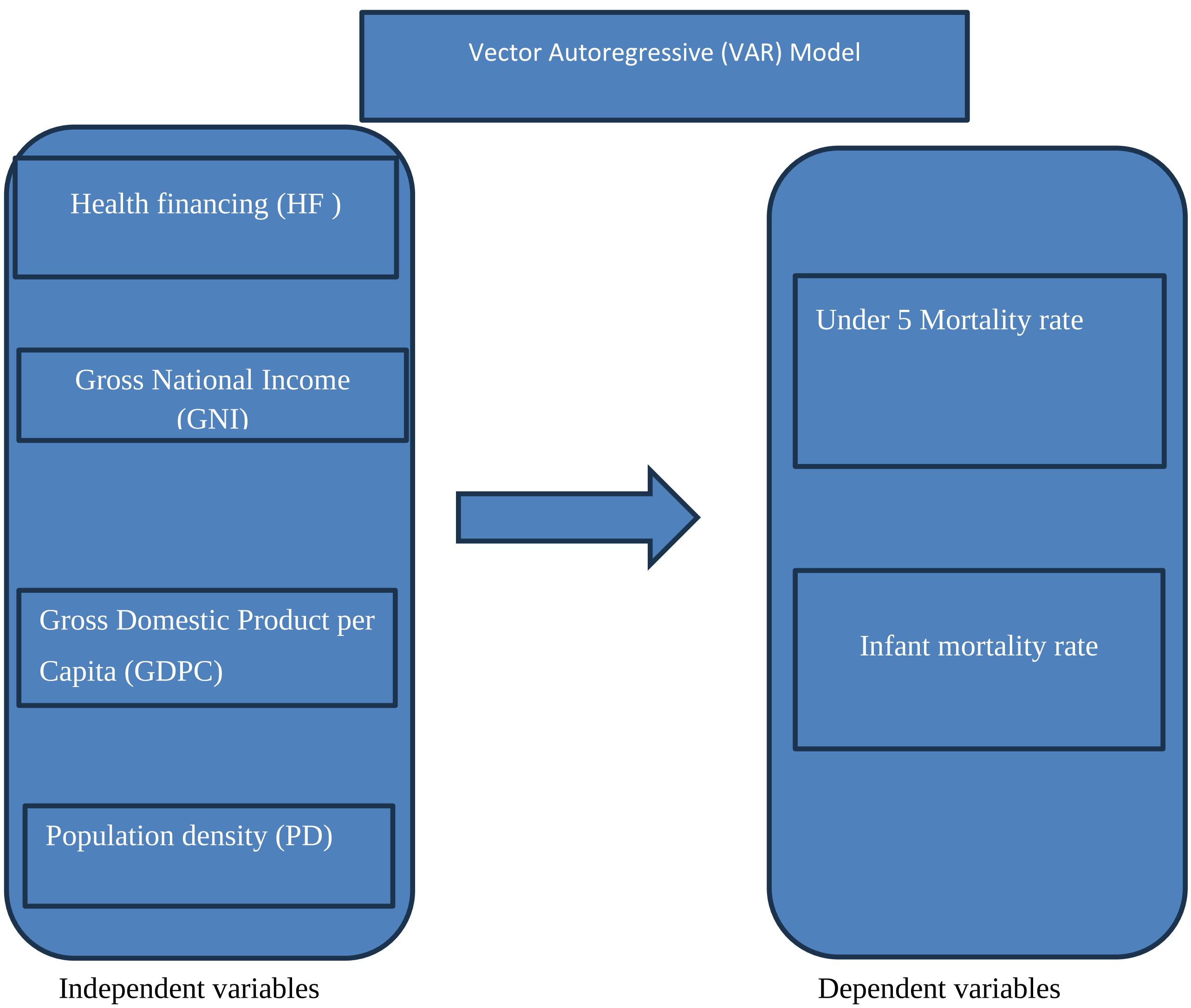

Figure 4 Conceptual Framework

This conceptual framework above displays a visual illustration of the associations between the variables in this study. It also demonstrates how health financing, the treatment variable, is expected to influence health outcomes, in this case infant and under-five mortality rates as the dependent variables. Similarly, the control variables namely population density, gross national income, and GDP per capita, are also included so that their potential influence on the relationship between health financing and infant and under-five mortality rates are accounted for.

2.5 Research Gap

From the analysis of the already explained empirical literature, majority of previous studies focused on Sub Saharan, OECD or Western African Countries to explore relationships on health expenditures and population health, the results of which did not address or reveal country specific issues. This paper therefore, covers the research gap by focusing on assessing the impact of health financing on health outcomes for a single specific country Zimbabwe. Furthermore, this study examines the impact of infant mortality and under five mortality rates, which are child health outcomes, while prior studies considered other indicators which are not specific to a certain target population or age group only such as life expectancy and the environment. In addition, while most of the prior studies used panel data, the researcher utilized Multivariate time series analysis, specifically Vector Autogressive (VAR) model to analyze the relationships. Lastly, while most of the related studies considered period ending on or before 2020, the researcher made use of current data (1990-2023) to analyze the relationship between health financing and health outcomes in Zimbabwe.

2.7 CHAPTER SUMMARY

The chapter summarizes theoretical models, findings from empirical studies, conceptual framework as well as outlines the research gap. Literature has evidenced that increased health financing has resulted in reduced child mortality rates in some countries, however, for others, it was found to have negative effects. In this case, literature review also laid the foundation or set the tone for the subsequent chapter (III) which will be on research methodology.

CHAPTER III

RESEARCH METHODOLOGY

3.0 Introduction

The study seeks to assess the impact of health financing on health outcomes in Zimbabwe. The focus is to have a clear understanding on the relationships between health financing and health outcomes (infant and under five mortality). This can only be achieved through clear methodology. Research methodology is therefore defined as the systematic, theoretical and analytical process of that is used to develop and test research questions, hypotheses and objectives, Kouadio (2023). This chapter outlines the research design, theoretical model, model specification, research philosophy, research methodology, diagnostic tests, results estimation, ethical considerations and finally the chapter summary.

3.1. Research design

The study employs a quantitative research design, using secondary data. Time series data analysis is also used for all variables, selected for Zimbabwe over a thirty-three-year period. Pertaining to method, secondary data has been extracted from World Bank development Indicators databank for the period 1990 -2023. In relation to the study setting, context has been set on the global perspective, with specific focus on Zimbabwe to establish relationships that exist between health financing, population density, GDP per capita and health outcomes (under 5 and infant Mortality rates) in Zimbabwe. Selection of the study period is based on data availability

3.2 Theoretical model

A theoretical model can be defined as a conceptual framework that describes the relationships that exist between variables and help to make projections on future outcomes. The researcher adopted a Vector Autogressive (VAR) model and where the relationship between health financing and health outcomes is based on Grossman's model of health production function. This model was developed in 1972 by Michael Grossman. The model is grounded on the view that individuals can make investments in health, regarding it as a capital good. In addition, they can also produce health by using various inputs such as time, money and other resources to have health as an output. In relation to the researcher's topic of interest, health outcomes (under 5 mortality and infant mortality) are a product of the individual's inputs after making choices to improve their health, (Grossman,1972).

The Grossman's model of health production can be presented as:

$H = f(M, T, \theta)$

Where:

H=health stock (or health capital)

M=Medical care (healthcare services)

T=time inputs (time allocated to exercise, sleep, relaxing)

Ɵ=individual specific characteristics (which include genetic factors and lifestyle)

The function explains that health stock of an individual(H) is a function of the medical care(M), that they receive at a certain time period (T), which they devote to health producing exercises or activities and combined with their individual specific characteristics.

Therefore, health financing becomes an input in the production of health, it will enable access and utilization of services to improve health outcomes (reduction in mortality rates). This decision and capacity to finance health is also influenced by or is dependent on the economic performance, in this case measured by GDPCC and the level of income measured by GNI.

In the light of the above, the model has been borrowed from this theory such that all the mentioned variables including social determinants are inputs in the health production function to produce better health outcomes.

Expected relationships

Health financing (HF)- We expect to have a negative relationship between HF and U5MR and IMM. That is, as HF of a country increases, under-five and infant mortality rates will fall.

GDPC

If a nation's economic performance is viable, the higher the likelihood of investing more in population's health and also, the healthier the population is, with reduced infant and under-five mortality rates. Therefore, a negative relationship is anticipated between GDPC and health outcomes (IMM and U5MR).

GNI

Countries with high gross national incomes are associated with improved health outcomes (lower infant and under-5 mortality rates). Therefore, a negative relationship is anticipated between GNI and health outcomes (IMM and U5MR).

PD

Living conditions which may be depicted by population density, are expected to play a significant role in shaping or influencing health outcomes. Densely populated areas are associated with poor health outcomes which include high IMM and U5MR.Therefore, we anticipate a positive relationship between population density (PD) and U5MR, as well as IMM.

3.3 Model Specification

Model specification is defined as the process of defining and describing the relationships that exist between variables in a statistical model (Wooldridge,2013). Moreso, Gujarati (2009), went on to explain model specifications as involving the identification of dependent, independent, as well as control variables and also specifying the functional form of the relationships between them. This study seeks to analyze the impact of health financing on under-5 and infant mortality rates in Zimbabwe from 1990-2023.The researcher has adopted the model from Grossman's model and modified it by addition of other variables peculiar to her objectives.

The VAR model will be specified as:

$$U5MR_t = \beta_0 + \sum\left[\beta_{1j}U5MR_{t-j} + \beta_{2j}HF_{t-j} + \beta_{3j}PD_{t-j} + \beta_{4j}GDPC_{t-j}\right] + \varepsilon_t$$

$$IMM_t = \beta_0 + \sum\left[\beta_{1j}IMM_{t-j} + \beta_{2j}HF_{t-j} + \beta_{3j}PD_{t-j} + \beta_{4j}GDPC_{t-j}\right] + \varepsilon_t$$

j=1 to p

Where p=2

Where:

$U5MR_t$= Under-Five Mortality at time t

IMM_t= Infant Mortality at time t

HIF_t = Health financing at time t

PD_t= Population Density at time t

$GDPC_t$ = Gross Domestic Product Per capita at time t

εt = error term at time t (accounts for omitted variables which may have impact on health outcomes)

β, α = coefficients of the model

p = number of lags

3.4 Variable Description

3.4.1 Dependent variables

The study is hinged upon assessing the two health outcomes which comprise infant and under five mortality rates as dependent variables.

3.4.1.1 Infant mortality rate (IMM)

Number of deaths of infants under one year of age per live 1000 live births, was used to measure infant mortality rates. This is regarded as a widely used health status indicator as well as socioeconomic development because of its comparability between countries, World Bank (2019), sensitivity of changes in healthcare, WHO (2019), ability to reflect the socio-economic conditions UNICEF, (2020) and finally its power to predict overall health outcomes. (Lopez et al ,2006)

3.4.1.2 Under 5 mortality rates(U5M)

It was measured by the number of deaths per 1000 live births, of the children under the age of five years of age. The have the same advantages or justification as IMM.

3.4.2 Independent variables

The study has uses health financing as a treatment variable, while population density and GDPC are control variables. The variable description is as given below.

3.4.2.1 Health financing (HIF)

For this study, current health expenditure per capita, PPP (current International $), is used as a proxy indicator to measure health financing. CHE measure the total amount spent on health in a given year, excluding capital expenditures, as a percentage of a nation's GDP. The essence of using current health expenditure is its ability to capture current spending, WHO (2019). It also allows for comparability across countries for evaluation, World bank (2020) and it has the ability to reflect economic context or situation (WHO,2019).

3.4.3 Control variables

3.4.3.1 GDP per capita (GDPC)

GDP per capita is a widely used indicator of economic performance, capturing the average standard of living in a country and can also influence healthcare expenditure, as wealthier countries tend to allocate more resources to healthcare, World Bank (2019). The study employs GDP per capita as a control variable for economic performance. This variable is measured by GDP per capita constant local currency at constant prices.

3.4.3.2 Gross National Income (GNI)

Is defined as the total amount of money earned by a country's citizens and businesses within a specific period of time, regardless of where it is earned. The advantages of including it in this study includes its ability to give a comprehensive view of a nation's economic performance by including income from both domestic and foreign sources, it therefore allows for comparisons between countries and finally, it reflects the standard of living because it reflects average income earned by citizens. In addition, it is a good measure of economic development and also informs policy decisions. This variable is measured by Gross National Income per capita (current US$).

3.4.3.3 Population density (PD)

This variable has been measured and defined by the number of people living per unit area, expressed people per square kilometer (km). The rationale for including this variable in the model is that it is correlated with numerous health outcomes including transmission of infectious diseases, mental health, child, mortality rates and access to health care, only to mention a few. This variable is justified for inclusion in the study because it can be used to inform health policy, track progress towards sustainable development through assessing the balance between population growth and environmental sustainability.

Population growth rate (annual %) is used as a proxy indicator for measuring population density. Population density can influence healthcare access and utilization, as densely populated areas may have more healthcare facilities and providers, while sparse areas may face shortages. (WHO, 2019). Therefore, the inclusion of this variable in the model as a control variable is justified.

3.5 Research philosophy

The researcher employs positivism approach which is objective, real and is shown by empirical evidence. According to Bryman (2012), objectivism seeks to reveal objective truths through empirical observation and measurement.

3.6 Research Methodology/ Estimation method

The research also makes use of annual time series data over a period of 33 years from 1990 to 2023.Data that is used for this study will be extracted on health outcomes (infant and under-5 mortality rates). Analysis of the data to determine relationships for this study is done using Stata Software, where the Vector Auto Regressive Model will be estimated.

3.7 Diagnostic tests

3.7.1 Stationarity test

According to Angrist and Pischke (2014), checking for stationarity is considered the first step in any time- analysis. They also recommended the Augmented Dickey Fuller (ADF) as the widely used test for unit roots. In addition, argued that failure by researchers to account for non-stationarity, can result in spurious regressions. The null hypothesis for stationarity states that there is a unit root which means data is non-stationary. On the other hand, the alternative states that there is no unit root, which means data is stationary. Also, the decision rule is to reject null hypothesis and conclude that there is no unit root, if the Test statistic is less than the 5% critical value. However, if the T-static is greater than the 5% critical value, we fail to find evidence to reject the null hypothesis and conclude that there is a unit root, thus a variable is non-stationary.

The unit root tests help to determine if variables are integrated of the same order or not and therefore helps the researcher to determine the most appropriate methods of conducting subsequent tests. If variables are stationary at level or order 0, the researcher can proceed to estimate the VAR model and if variables are stationary non stationary at level, they can be differenced and tested for stationarity. If they all prove to be stationary at first level, then one can proceed to estimate the VAR. On the other hand, if they prove not to be stationary of the same order, the researcher can proceed with the Vector Error Correction Model (VECM). However, if variables fail to be stationary at first difference and become stationary at second difference, they no longer qualify for VAR inclusion in the model.

3.7.2 Lag length determination (Pre-lag and post estimation)

Bauwens et al., (2020) viewed pre-lag and post estimation as critical for ensuring validity of the VAR models, particularly in the existence of non-stationarity. In other words, the essence of pre-lag estimation is to ensure randomness and uncorrelatedness of residuals. For the pre-lag determination, the researcher will make use of any of methods ranging from the Akaike Information Criterion (AIC), Bayesian Information Criteria, (BIC), HQIC to SC, where one can select the lag length basing on the minimum value. Moreso, Clements and Hendry (2020) argued that insufficient lag length can result in omitted variable bias and incorrect inference. In addition, the well determined lag length also enhances the model's predictive power, reduce uncertainty and improve model fit. This is followed by the VAR model estimation and post estimation of the model, which is done to determine if the proposed lags produce meaningful results.

3.7.3 Granger Causality Test

Granger causality test can be defined as a statistical tool to assess whether one time series can be used to forecast another. (Koop and Korobilis,2022). The null states that X does not Granger cause Y and alternative hypotheses states that X Granger-causes Y. As for the decision rule, reject H0 if the p-value is less than the significance level (0.05) and conclude that X Granger causes Y. Furthermore, Bauwens et al., (2020), pointed out that if the null hypothesis is rejected it denotes the existence of Granger causality from one variable to another. Thereafter, the researcher can move on to conducting the autocorrelation test.

3.7.4 Autocorrelation Test (Langrage Multiplier test)

Greene (2020) defines the LM test as a vital statistical tool for detecting autocorrelation in residuals. In fact, autocorrelation may result in incorrect inference and poor forecasting if not dealt with, Hamilton (2020). In addition, it can also result in overestimated regression coefficients and inflated R-squared values, Lutkepohl, (2020). For the LM test, the researcher observes the null hypothesis which states that there is no serial autocorrelation in residuals. On the other hand, the alternative hypothesis states that there is serial autocorrelation in residuals. Pertaining to the decision criteria reject the null hypothesis if p-value <0.05 and conclude that there is serial autocorrelation. If p-value >0.05, we then fail to find evidence to reject H0 and conclude that there is no serial autocorrelation.

3.7.5 Normality Test

According to Greene, (2020), normality tests help determine if the residuals follow a normal distribution, which is a critical assumption in many statistical models. However, if residuals fail to satisfy the normality condition, this may affect power and magnitude of statical tests, (Bauwens et al.,2020). The researcher will conduct the normality test using the Jarque-Bera Test. The null hypothesis states that residuals are normally distributed while the alternative hypothesis, states that residuals are not normally distributed. The decision criteria, states that if p value < 0.05, reject the null hypothesis and conclude that residuals are not normally distributed.

3.7.6 Eigenvalue Stability test

The Eigenvalue Stability test is defined as a test that examines whether eigenvalues lie within the unit circle, indicating stability (Lutkepohl,2020)**.** In other words, the purpose of the stability test is to verify the stability and constancy of VAR model's coefficients. The researcher will conduct the Eigen stability test whose null hypothesis states that the model is stable, while alternative hypotheses states model is unstable. Following the Eigenvalue stability test, comes the results estimation which is explained under the heading below.

3.8 RESULTS ESTIMATION

3.8.1 Impulse Response Functions

The essence of Impulse Response Functions (IRFs) is to analyze the shock effects on variables in VAR models, (Lutkepohl,2020). On the other hand, Koop and Korobilis (2022) defined IRFs as, "the direction of causality between variables." The null hypothesis states that the IRF of Y with respect to X is not statistically different from zero, (Lutkepohl,2020). On the other hand, the alternative is that the IRF of Y with respect to X is significantly different from zero, (Greene,2020). Therefore, the decision is to reject H0 if p-value < 0.05 (Greene,2020) and conclude that the variable significantly responds to the shock. The next stage that the researcher conducts is the variance decomposition (VD).

3.8.2 Variance decomposition (VDC)

Variance Decomposition measure the proportion of the forecast error variance attributed to each shock, (Hamilton,2020). The importance of VDC includes policy analysis, assessment of risks, VAR model evaluation and forecasting enhancement, Koop and Korobilis (2022). The implications of VDC includes informing health policy Bokhari et al., (2017) and determining areas for effective resource allocation for enhancement of health outcomes Gmeinder et al., (2017). The null hypothesis states that the forecast error variance for the variable is not significantly explained by its own shocks or the shocks of other variables. On the other hand, the alternative hypothesis states that forecast error variance for the for the variable is significantly explained by its own shocks or the shocks of other variables. The decision rule is to reject H0 if p-value<0.05 and conclude that the variable's forecast error variance is significantly explained by its own shocks or the shocks of other variables.

3.9 Ethical considerations

Since the study uses secondary data, the researcher will only use permissible data to acquire information to observe informed the informed consent principle.

Data anonymization is observed as secondary data does not contain personal identifiable information.

The subjects under study will not be harmed.

3.10 Chapter Summary

The Chapter presents the research design, methodology and data analysis and presentation procedures. The subsequent chapter Four, gives detailed discussion and presentation of results. These results will the inform recommendations and conclusions which will form the final chapter of this paper.

CHAPTER IV

DATA ANALYSIS AND RESULTS PRESENTATION

4.0 Introduction

This chapter presents data analysis and results presentation in line with pre-defined approach in Chapter (III). It includes diagnostic tests and estimation of results obtained through time series multivariate regression analysis. The results will be presented in tabular and graphical formats.

4.1 Descriptive Statistics

Table 1 Descriptive statistics

	U5MR	IMM	PD	HF	GNI	GDPC
Mean	79.36176	48.21765	1.547749	299.265	786.7647	14441.53
Sd	18.40051	7.287618	0.6421528	173.5438	486.3265	2616.38
Variance	388.5788	53.10937	0.4123602	30117.46	236513.5	6845446
skewness	-0.5893981	-0.7855861	-0.899881	0.3019647	0.58966	-0.3807974
kurtosis	1.724617	2.090835	1.771127	1.861898	1.923025	2.420059
Min	47.7	33.7	0.5238506	60.21536	130	8486.446
Max	100.2	55.9	2.68096	617.9072	1740	18385.89

Source: authors own computation

There are 33 observations in the study, and one of the dependent variable Under-five mortality rate (**U5MR**) a measure of health outcomes, has a range of 47.7 to 100.2 and negatively skewed to the left as indicated by skewness of -0.59 and has relatively normal distribution suggested by the kurtosis of 1.72.It also have a mean of 79.36 suggesting an average of approximately 79 deaths per 1,000 live births and moderate variation in the **U5MR** values across the observations as indicated by a standard deviation of 18.40 .

The variable Infant Mortality Rate **(IMM)** has a mean of 48.22, suggesting an average of approximately 48 deaths per 1,000 live births, a standard deviation of 7.29 proposes relatively low variation in **IMM** values across the observations. The variable has a data set with a range of 33.7 to 55.9 and is slightly negatively skewed to the left as evidenced by skewness of -0.79, whilst having a relatively normal distribution as indicated by the kurtosis of 2.09.

4.2 Diagnostic tests

4.2.1 Stationarity test

Stationarity is a precondition in econometric modelling, the table below shows unit root test results based on the ADF test.

Table 2 Unit root test at level

VARIABLE	ADF STAT	CRITICAL VALUES			ADF P-VALUE	DECISION
		1%	5%	10%		
HF	-2.046	-3.696	-2.978	-2.620	0.2666	NON-STATIONARY
GNI	0.655	-3.696	-2.978	-2.620	0.9889	NON-STATIONARY
PD	-1.948	-3.696	-2.978	-2.620	0.3099	NON-STATIONARY
GDPC	-1.385	-3.696	-2.978	-2.620	0.5896	NON-STATIONARY

Authors' computation using ADF results at level

The ADF test decision criteria states that a variable is said to be stationary if the p value is less than 0.05. In this case all the variables are not stationary at level. According to Lutkepohl (2005), the researcher could not estimate the VAR model for the original variables but had to difference the variables and test them for stationarity again at first difference. This is because non-stationary variables lead to spurious regression and therefore will not give meaningful results.

Table 3 Unit root at first difference

VARIABLE	**ADF T-STAT**	**CRITICAL VALUES**			**ADF P-VALUE**	**DECISION**
		1%	**5%**	**10%**		
HF	**-3.007**	**-3.702**	**-2.980**	**-2.622**	**0.0342**	**STATIONARY**
GNI	**-4.383**	**-3.702**	**-2.980**	**-2.622**	**0.0003**	**STATIONARY**
PD	**-3.855**	**-3.702**	**-2.980**	**-2.622**	**0.0024**	**STATIONARY**
GDPC	**-3.752**	**-3.702**	**-2.980**	**-2.622**	**0.0034**	**STATIONARY**

Authors' computation using ADF results at first difference

The researcher went on to perform first differencing on all variables and the results revealed that all the variables were stationary at first difference as denoted by p-values which are all less than 0.05. This therefore, follows that the variables qualify for inclusion into the VAR model, since they are stationary of the same order (1). Then the next step was to estimate the lag length as shown below.

4.2.2 Lag length determination (Pre-lag and post estimation)

The researcher conducted pre-and post-lag estimation to identify the optimal lag length to use. The table below shows the results of the pre-lag test.

Table 4: pre-lag estimation

	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	-194.275				1207.81	12.7672	12.919	13.2252
1	-93.7514	201.05	4	0.000	2.92437	6.73446	6.94702	7.37572
2	-60.9234	65.656*	4	0.000	.490719*	4.93272*	5.20601*	5.75719*

Source: pre-lag estimation results

From the results above the optimal lag is 2 as indicated by the lag with the least value, of 0.490719 under the FPE criterion. In fact, all the four criteria suggest that the optimal lag length is 2 as indicated by the stars along that lag row. If the lag length becomes too big, degree of freedom is lost.

4.2.3 Granger Causality Test

The researcher conducted Granger Causality test to determine the causal relationships between variables of interest. Table 5 shows the results of the Granger Causality test.

Table 5 Granger Causality Wald Test

Equation	Excluded	Chi 2	df	Prob>chi2
U5MR	IMM	1.7323	2	0.421
U5MR	ALL	1.7323	2	0.421
IMM	u5mr	4.2765	2	0.118
IMM	ALL	4.2765	2	0.118

Source: Authors' computation using the Granger results

For this test, a variable is said to Grange cause another variable if it has a probability value is less than 0.05. From the results above, we fail to find evidence to reject H0 since the probabilities of 0.421 and 0.118 respectively are greater than 0.05. Hence, we conclude that **U5MR** does not granger cause **IMM** and vice versa. Therefore, it implies that there are no overlaps in policies that affect **IMM** and those that affect u5mr.Policy makers should therefore consider **U5MR** and **IMM** separately when making policy.

4.2.4 Autocorrelation Test

Table 6 shows the results of the Langrage Multiplier autocorrelation test.

Table 6 the LM Correlation Test

Lag	Probability	Df
1	0.09671	4
2	0.00674	4

From the LM test, it was noted that there was no autocorrelation at lag 1 as denoted by p-values which is greater than 0.05.

4.2.5 Normality Test

Residuals have to satisfy the normality condition for them to retain the power and magnitude of statistical tests. Table 7 shows the Jarque-Bera results.

Table 7 Normality Test

Equation	Chi2	Df	Prob>chi2
U5MR	0.024	2	0.98784
IMM	1.802	2	0.40611
ALL	1.827	4	0.76759

The researcher conducted the normality test and Jarque-Bera results indicated that the p-values (0.98784 **U5MR**, 0.40611 for **IMM**, 0.76759 for all other dependent variables) are greater than 0.05. We therefore, fail to find evidence to reject the null hypothesis and conclude that residuals are normally distributed.

4.2.6 Eigenvalue Stability test

To determine the stability of the VAR model, the researcher conducted the Eigenvalue stability test and the results are shown in the table 8.

Table 8 Eigenvalue Stability Table

Eigenvalue	Modulus
0.8018146	0.801815
0.7687931 + 0.1590758i	0.785078
0.7687931 - 0.1590758i	0.785078
-0.1269755	0.126976

Source: Authors computation using Eigenvalue Stability results

The stability condition states that for the model to be deemed stable, all the eigenvalues should not lie outside the unit circle. From the results shown in the above table, to all the modulus of the eigenvalue lie inside the unit circle, thus satisfying the stability condition. Therefore, it can be concluded that the model is stable.

4.3 Results Estimation

This section estimates and analyses results using the impulse response functions and the Variable Decomposition tables, to draw meaningful relationships and make forecasts for planning purposes.

4.3.1 Impulse Response Functions

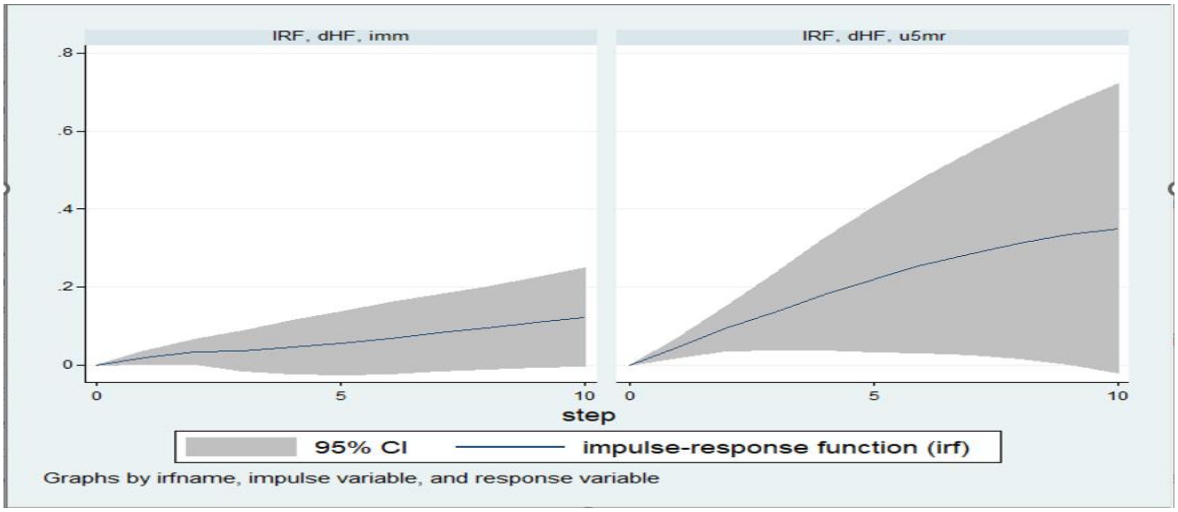

Figure 5: Impulse Response Functions

Source: Impulse Response Function Results

IRFs can be used to show the effect or variation in the dependent variable (U5MR and IMM) that is caused by the treatment of explanatory variable (health financing). In this case health financing is the impulse. The researcher has used a 10-year period to project the relationship between health financing and under mortality as well as between health financing and infant mortality.

The graph above shows how infant mortality responds to a one -unit deviation or impulse in health financing over a period of (10) years. The results reveal the existence of a positive effect between health financing and infant mortality rate, which implies that an increase in health financing (expenditure) results in a decline in infant mortality rates over the 10-year period from now. This positive effect implies that current increases in health financing yields current or immediate decline in infant mortality rate and this is known as the immediate effects. In addition, it can be explained in terms of sustained positive effects, where increases in health financing will result in reduction in infant mortality rate over the 10-year period, which goes 3 years beyond Zimbabwe's Vision 2030.

In relation to Zimbabwe, this means that investing in health financing can result in significant and sustainable reduction in infant mortality rate for long period of up to 10 years, yet can it can also address the immediate challenges of high infant rate, which in a cause of concern according SDG 3 specifically target 3.2 ending preventable deaths under the ages of 5years.This therefore means that health financing in Zimbabwe has a significant and long-term positive effect or impact on infant mortality rate.

In this regard, if policy makers can give priority to health programs that enhance child health such as maternal care, and immunization among others, in resource allocation, as they contribute to reduction in infant mortality rate. Also, sustainable health financing or expenditure can also lead to long term reduction in infant mortality to a period of 10 years. In addition, increasing health financing results in reduced infant mortality.

With reference to the under 5 mortality IRF graph on the right-hand side (Fig 4.1), a strong positive effect is also reflected between health financing and under mortality rate. This means an increase in health financing can result in a significant and speedy decline in under 5 mortality rates. This implies that increase in health financing or health expenditure will expedite the reduction of under 5mortality rates in Zimbabwe, have push the SDG 3 target 3.2 of reducing preventable deaths in under 5, as well unlock opportunities to improve health infrastructure and supply of medicines. This way, some of the challenges which impede achievement of health outcomes such limited access and utilization, and hence Zimbabwe can have enhanced child health outcomes.

From a comparison between the two IRF graphs, it can clearly see that there is a strong positive effect between health financing and under 5 mortalities than infant mortality rate. The IRF for under 5 mortality shows that under 5 mortalities can decrease at an increasing as health financing increases. In addition, the impact of health financing becomes stronger for each additional year over the projected 10-year period. This can be evidenced by the graph, which shows that from 1 to about year 3(around 2026) there will be a gradual decline in under 5 as health financing increase. However, from about year 5(around 2028) onwards to 2033, the effect will be getting stronger as shown by U5MR declining on a faster rate as health financing increases.

4.3.2 Variance Decomposition Results

Under 5 Mortality FEV

The impact of health financing on under 5 mortalities can also be analyzed using the Variance decomposition (VDC or FEV) table 9.

Table 9 :Under-5 Forecast Error Variance

Step	(1) fevd	(1) lower	(1) Upper
0	**0**	**0**	**0**
1	0	0	0
2	0.069883	-0.018376	0.158142
3	0.134761	-0.026152	0.295675
4	0.182303	-0.042313	0.406919
5	0.227725	-0.052382	0.507832
6	0.267901	-0.05433	0.590131
7	0.302254	-0.046623	0.651132
8	0.328856	-0.033502	0.691214
9	0.347688	-0.019758	0.71513
10	0.359119	-0.010061	0.7283

Source: Authors' computation using forecast error variance results

The researcher performed the Forecast Error Variance in order to determine how much of the variability in the dependent variable is explained by the explanatory variable, health financing. The researcher also made of use of the Cholesky decomposition for degree of influence or shock of health financing on health outcomes identification purpose, using 10- year time horizon period.

In overall, from the table above, results indicate that for the first 2 years, health financing does not influence the under 5 mortality rates as indicated by the zero values on those 2 years, that year 0 and year 1(that is around 2024). From the 2 year (around 2025) about 7% of the Under-five mortality rate will be influenced by health financing and trend increase with increase in the number of years. From the third year going forward, health financing begins to gain significant influence of 13% on the under -5 mortality rates, and FEVD values show an increasing trend over time. The trends also show that by the 10^{th} year, about 36 % of the variance in under-5 mortality rate is explained by health financing.

In relation to the objective of determining whether health financing impacts under -5 mortality rates in Zimbabwe, the question can be answered by the empirical results above. The results indicate health financing has a significant influence on under -5 mortality rates in Zimbabwe, explaining about 36% of the variance in the tenth year, that is around 2033.

In addition, the results reveal that the degree of influence of health financing on under -5 mortality rates increase as time increases and this suggests that sustained investments in health financing can lead to improved health outcomes. Furthermore, the results suggest that health financing is a critical determinant of under-5mortality rates in Zimbabwe. Therefore, policy makers should prioritize investments in health financing to reduce under-5 mortality rates.

Infant mortality FEV

The researcher went further to examine the impact of health financing on infant mortality rates in Zimbabwe using the Forecast Error Variance (FEV) over the ten- year period. The results are indicated in table 10.

Table 10: Infant mortality Under-5 Forecast Error Variance

Step	(2) fevd	(2) lower	(2) upper
0	0	0	0
1	0	0	0
2	0.037202	-0.036971	0.111375
3	0.066369	-0.05732	0.190058
4	0.071657	-0.089793	0.233108
5	0.088021	-0.125551	0.301594
6	0.108875	-0.160756	0 .378506
7	0.139045	-0.186155	0 .464246
8	0.173193	-0.192624	0.53901
9	0.208725	-0.17646	0 .59391
10	0.241491	-0.143909	0 .626891

Source: Author's computation using Forecast Error Variance results

The results indicate that in the first two years, that is year 0 and year 1, health financing has no significant influence on infant mortality rates as shown by the FEVD values of zero in both years. From the third year onwards, health financing begins to show significant influence on infant mortality rates, as evidenced by the rising FEVD values from year two 3.7% to approximately 6.7% in year 3 and 21% in the 8th year. rise over time. Furthermore, the influence of health financing on infant mortality rates will reach a peak in the tenth year, that is around 2033, where about 24% of the variance in infant mortality rate will be explained by health financing.

Based on the variance decomposition results, above, we conclude that health financing has a significant influence on infant mortality rates in Zimbabwe, explaining up to 24% of the variance in the tenth year. In addition, the influence of health financing on infant mortality rates increases over time and this suggests that sustained investment health financing can result in improved health outcomes. Moreover, results suggest that health financing is a vital determinant of infant mortality rates in Zimbabwe. Therefore, policy makers should prioritize increasing both private and public investments in health financing for sustained reduction in infant mortality rates.

4.4 Chapter Summary

This chapter summarized the empirical results of the study. The chapter made use tables to present the obtained results and also interpretation of the results on diagnostic tests and estimation of results obtained through time series multivariate regression analysis. Based on these results, the next chapter V, will summarize the results, give the conclusion, as well as policy recommendations.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the findings of the empirical analysis, examining the impact of health financing on health outcomes in Zimbabwe. Specifically, this chapter discusses the results of the Vector Auto regression (VAR) model, Impulse Response Function (IRF), and Forecast Error Variance Decomposition (FEVD) analysis. These econometric techniques enable a comprehensive understanding of the dynamic relationships between health financing and health outcomes, including under-five mortality rates and infant mortality rates.

The analysis focuses on three primary objectives:

i. Assessing the impact of health financing on under-five mortality rates,
ii. Examining the impact of health financing on infant mortality rates, and
iii. To give policy recommendations based on the findings of the study (in relation to control variables).

The findings provide valuable insights into the effectiveness of health financing in improving health outcomes in Zimbabwe.

5.2 Summaries

Summary on Objective 1: To assess the Impact of Health Financing on Under-Five Mortality Rate

The findings of this study reveal a significant relationship between health financing and under-five mortality rates in Zimbabwe. Utilizing a Vector Auto regression (VAR) model, Impulse Response Function (IRF), and Forecast Error Variance Decomposition (FEVD) analysis, this study provides valuable insights into the dynamic relationships between health financing and under-five mortality rates.

The FEVD table shows a gradual increase in the impact of health financing on under-five mortality rate over a 10-year period. Initially, there is no discernible impact in the first two years, followed by a small positive impact in the third year (0.04), which steadily increases to 0.36 by the tenth year. This suggests that health financing initiatives take time to yield significant reductions in under-five mortality rates.

The IRF analysis further elucidates the temporal responses of under-five mortality rates to shocks in health financing, highlighting the importance of sustained investment in healthcare infrastructure, human resources, and service delivery. The results are in sync with the study by Bishai et al. (2015) who found that increased health expenditure was associated with a signification reduction in under-five mortality rates in developing countries. However, Wang (2019) found contradictory results and hence the need for further research for a deeper understanding on the relationship that exists between health financing and health outcomes

Summary on Objective 2: **Examine the Impact of Health Financing on Infant Mortality Rate**

This study's findings also reveal a significant relationship between health financing and infant mortality rates in Zimbabwe. The VAR model, IRF, and FEVD analysis demonstrate the dynamic relationships between health financing and infant mortality rates.

The FEVD table shows a gradual increase in the impact of health financing on infant mortality rate over a 10-year period. Initially, there is no discernible impact in the first two years, followed by a small positive impact in the third year (0.07), which steadily increases to 0.24 by the tenth year.

The IRF analysis highlights the temporal responses of infant mortality rates to shocks in health financing, emphasizing the importance of targeted interventions and investments in infant healthcare. These results are consistent with a study by Bokhari and Gai (2018), who found a significant negative relationship between health expenditure and infant mortality in Sub-Saharan Africa.

Summary on Objective 3: To give policy recommendations on what should be done to improve Zimbabwe’s health financing and health outcomes based on the results of the study.

The analysis revealed a significant positive relationship between population density and health outcomes, specifically infant mortality rates **(IMM)** and under-five mortality rates **(U5MR)** in Zimbabwe. Notably, the findings indicate that as population density increases, **IMM** and **U5MR** also increase. This positive correlation suggests that densely populated areas are associated with higher infant and under-five mortality rates, highlighting the need for targeted interventions addressing population density-related challenges. In this regard policy should be directed towards improving health facilities in highly populated areas. The results are similar to those found by Abdollahian et al. (2015), which revealed that increased population density can lead to higher under-five mortality rates in low-income countries. On the other hand, Cutts et al. (2018) revealed a complex relationship between population density and health outcomes, which involved many factors of influence.

5.3 Conclusions

Conclusions on Objective 1

The conclusions drawn from this objective underscore the critical role of health financing in reducing under-five mortality rates in Zimbabwe. The gradual increase in the impact of health financing on under-5 mortality rates over time emphasizes the need for sustained investment in healthcare infrastructure, human resources and service delivery. Policymakers should prioritize health financing to support healthcare programs targeting U5MR.

Conclusions on Objective 2

This study's findings emphasize the importance of health financing in reducing in infant mortality in Zimbabwe. While the impact of health financing was slightly less pronounced compared to U5MR, the positive relationship suggests that increased health financing leads to improved health financing to support healthcare programs targeting infant mortality rates.

Conclusions on Objective 3

The positive relationship between population density and health outcomes has profound implications for healthcare policy and planning in Zimbabwe. High population density areas face increased pressure on healthcare resources, leading to decreased access to quality healthcare services. Consequently, this contributes to higher IMM and U5MR. The findings underscore the importance of considering population density in healthcare planning and resource allocation. By addressing population density-related challenges, policymakers can develop effective strategies to improve health outcomes in Zimbabwe.

5.4 Recommendations

Recommendations on Objective 1

The positive impact of health financing on under-five mortality rates emphasizes the need for:

Increased health financing; Policymakers should implement targeted interventions addressing healthcare programs targeting under-five mortality rates. Sustain investment in healthcare; sustained investment in healthcare infrastructure, human resources, and services delivery is crucial to maintaining the positive impact of health financing on U5MR.

Enhance healthcare infrastructure; enhancing healthcare infrastructure, including healthcare facilities, equipment, and supplies, is essential to improving health outcomes. Developing a skilled healthcare workforce is also critical to delivering quality healthcare services.

Recommendations on Objective 2

Increasing health financing; policymakers should prioritize increasing healthcare expenditure to support healthcare programs for infant healthcare programs. Developing targeted interventions for infant mortality reduction such as immunization programs and maternal healthcare services. Enhancing healthcare infrastructure and human resources is also essential to improving health outcomes for infants.

Recommendations on Objective 3

To mitigate the negative effects of population density on health outcomes, policymakers should consider the following recommendations:

Firstly, investing in urban planning and infrastructure development can reduce population density and improve access to healthcare services. This can be achieved through initiatives such as housing development, transportation infrastructure, and public services. Secondly, allocating healthcare resources strategically, prioritizing densely populated areas, can enhance healthcare access and quality. This may involve increasing healthcare personnel, facilities, and equipment in high-density areas.

Additionally, implementing community-based healthcare programs can further improve healthcare access and quality. Community health workers can provide essential healthcare services, health education, and referrals. Furthermore, promoting family planning and reproductive health services can manage population growth and reduce pressure on healthcare resources. Moreover, establishing robust monitoring and evaluation systems can track population density and health outcomes, informing policy adjustments and interventions.

5.5 Conclusion

This dissertation provides a comprehensive assessment of the impact of health financing on health outcomes in Zimbabwe, focusing on under-five mortality rates, infant mortality rates, and the relationship between health outcomes and population density. The study employed advanced econometric techniques, including Vector Auto regression (VAR) modeling, Impulse Response Function (IRF) analysis, and Forecast Error Variance Decomposition (FEVD) analysis.

The empirical results reveal several critical findings. Firstly, health financing has a significant positive impact on reducing under-five and infant mortality rates in Zimbabwe. Increased health financing leads to decreased mortality rates, emphasizing the critical role of health financing in improving health outcomes. Secondly, the study reveals a positive relationship between population density and mortality rates, highlighting the need for targeted interventions addressing population density-related challenges.

The study's findings have significant policy implications for healthcare financing and planning in Zimbabwe. To improve health outcomes, policymakers should prioritize increasing health financing to support healthcare programs targeting under-five and infant mortality. Implementing long-term health financing strategies will ensure sustained impact.

Enhancing healthcare infrastructure and human resources is also crucial. Furthermore, addressing population density-related challenges through urban planning, community-based healthcare, and family planning services is essential.

This study contributes to the existing literature in several ways. It provides empirical evidence on the impact of health financing on health outcomes in Zimbabwe, utilizing advanced econometric techniques to examine dynamic relationships. The study's findings offer actionable policy recommendations for healthcare financing and planning.

Despite the study's contributions, some gaps remain. Future researchers should explore the impact of health financing on other health outcomes, such as maternal mortality and morbidity. Investigating the effectiveness of different health financing models in Zimbabwe and analyzing socioeconomic factors mediating the relationship between health financing and health outcomes are also essential.

Future researchers can build upon this study by conducting comparative analyses of health financing models across countries, examining the impact of health financing on healthcare service utilization and quality, and developing predictive models to forecast health outcomes based on health financing scenarios.

This study acknowledges several limitations. It relies on secondary data sources and the findings may not be generalizable to other contexts.

In conclusion, this study underscores the critical role of health financing in improving health outcomes in Zimbabwe. By addressing the study's recommendations and gaps, policymakers and future researchers can contribute to developing effective health financing strategies.

To achieve better health outcomes, policymakers should prioritize health financing in national development agendas, develop sustainable health financing models, and strengthen healthcare infrastructure and human resources. Future researchers should explore innovative health financing models, investigate the impact of health financing on healthcare service utilization, and develop predictive models for health outcomes.

By addressing these recommendations, Zimbabwe can move towards achieving better health outcomes and improved healthcare financing.

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Appendices

Appendix 1 Utilized dataset

YEAR	U5MR	IMM	HF	PD	GNI	GDPC
1990	80.4	51.5	617.9072	2.68096	740	16962.49833
1991	84.2	52.1	596.4954	2.576033	700	17445.58436
1992	88.2	52.7	575.0836	2.509119	550	15479.45386
1993	91.9	53.6	553.6717	1.431392	510	15419.90731
1994	95.7	54.5	532.2599	0.588137	490	16745.19152
1995	98.8	55.6	510.8481	1.239656	470	16565.02583
1996	100.1	55.6	489.4363	1.660946	560	17980.14353
1997	100.2	54.9	468.0245	1.634689	520	18162.77338
1998	99	53.7	446.6126	1.623404	410	18385.89469
1999	96.8	52.2	425.2008	1.44504	400	17973.91509
2000	94.5	51.2	403.789	1.003969	360	17250.00202
2001	92.5	50.7	382.3772	0.642663	390	17386.24096
2002	91.2	50.5	360.9653	0.616567	370	15742.54146
2003	90.3	50.5	339.5535	0.75796	340	12968.41584
2004	90.5	51.6	318.1417	0.701856	320	12129.83676
2005	91.4	52.7	296.7299	0.523851	330	11377.33501
2006	93.6	54.8	275.3181	0.861223	290	10889.3228

2007	94.5	55.9	253.9062	0.969119	250	10390.31624
2008	93.3	55.6	232.4944	0.798207	130	8486.446359
2009	90.2	54.7	211.0826	1.026265	440	9409.417105
2010	85.4	52.5	189.6708	1.25365	650	11285.55904
2011	80	51.1	168.2589	1.438339	950	12750.80603
2012	71.7	46.8	162.5883	1.822309	1120	14491.89676
2013	65.9	45	179.4569	2.163267	1200	14635.11772
2014	62.3	43	208.4596	2.191391	1210	14530.4488
2015	60.2	41.9	194.9871	2.136294	1220	14511.15821
2016	57.5	40.4	196.2841	2.081806	1200	14340.23235
2017	55.8	39.2	143.9224	2.04362	1170	14623.4298
2018	53.4	37.8	111.0784	2.020537	1550	15048.88315
2019	52.4	36.9	72.01596	1.989253	1450	13818.28777
2020	51.4	36.4	60.21536	2.031112	1460	12482.00341
2021	49.1	35.5	63.13697	2.045715	1540	13264.82638
2022	47.7	34.6	66.05857	2.024036	1720	13846.88656
2023	48.2	33.7	68.98018	2.0911	1740	14232.36161

Source: Word Bank Development Indicators (WDI)

Unit root tests

ADF Unit root test: HF both level and first difference

```
. dfuller hf

Dickey-Fuller test for unit root                   Number of obs   =        33

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -2.046            -3.696            -2.978            -2.620
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.2666

. dfuller dHF

Dickey-Fuller test for unit root                   Number of obs   =        32

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -3.007            -3.702            -2.980            -2.622
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0342
```

ADF Unit root test: GNI both level and first difference

```
. dfuller gni

Dickey-Fuller test for unit root                   Number of obs   =        33

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)              0.655            -3.696            -2.978            -2.620
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9889

. generate dGNI=D.gni
(1 missing value generated)

. dfuller dGNI

Dickey-Fuller test for unit root                   Number of obs   =        32

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -4.383            -3.702            -2.980            -2.622
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0003
```

Appendix 2 ADF Unit root test: both level and first difference

```
. tsset year
        time variable:  year, 1990 to 2023
                delta:  1 unit

. dfuller gdpc

Dickey-Fuller test for unit root                   Number of obs   =        33

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -1.385            -3.696            -2.978            -2.620
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.5896

. generate dGDPC=D.gdpc
(1 missing value generated)

. dfuller dGDPC

Dickey-Fuller test for unit root                   Number of obs   =        32

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -3.752            -3.702            -2.980            -2.622
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0034
```

Descriptive statistics

stats	u5mr	imm	pd	hf	gni	gdpc
mean	79.36176	48.21765	1.547749	299.265	786.7647	14441.53
sd	18.40051	7.287618	.6421528	173.5438	486.3265	2616.38
variance	338.5788	53.10937	.4123602	30117.46	236513.5	6845446
skewness	-.5893981	-.7855861	-.0899881	.3019647	.58966	-.3807974
kurtosis	1.724617	2.090835	1.771127	1.861898	1.923025	2.420059
min	47.7	33.7	.5238506	60.21536	130	8486.446
max	100.2	55.9	2.68096	617.9072	1740	18385.89

```
. dfuller pd

Dickey-Fuller test for unit root                     Number of obs   =       3

                               ———————— Interpolated Dickey-Fuller ———————
                  Test         1% Critical       5% Critical      10% Critica
               Statistic           Value             Value            Value
──────────────────────────────────────────────────────────────────────────────
 Z(t)             -1.948            -3.696            -2.978           -2.62
──────────────────────────────────────────────────────────────────────────────
MacKinnon approximate p-value for Z(t) = 0.3099

. generate dPD=D.pd
(1 missing value generated)

. dfuller dPD

Dickey-Fuller test for unit root                     Number of obs   =       3

                               ———————— Interpolated Dickey-Fuller ———————
                  Test         1% Critical       5% Critical      10% Critica
               Statistic           Value             Value            Value
──────────────────────────────────────────────────────────────────────────────
 Z(t)             -3.855            -3.702            -2.980           -2.62
──────────────────────────────────────────────────────────────────────────────
MacKinnon approximate p-value for Z(t) = 0.0024
```

Appendix 3 ADF gni Stationarity Test Result Test- both level and first difference

```
. dfuller gni

Dickey-Fuller test for unit root                   Number of obs   =        33

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             0.655            -3.696            -2.978            -2.620
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.9889

. generate dGNI=D.gni
(1 missing value generated)

. dfuller dGNI

Dickey-Fuller test for unit root                   Number of obs   =        32

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -4.383            -3.702            -2.980            -2.622
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0003
```

Appendix 4 hf Stationarity Test Result Test- both level and first difference

```
. dfuller hf

Dickey-Fuller test for unit root                   Number of obs   =        33

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -2.046            -3.696            -2.978            -2.620
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.2666

. dfuller dHF

Dickey-Fuller test for unit root                   Number of obs   =        32

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)            -3.007            -3.702            -2.980            -2.622
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0342
```

Appendix 5 pd Stationarity Test Result Test- both level and first difference

```
. dfuller pd

Dickey-Fuller test for unit root                   Number of obs   =        33

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -1.948            -3.696            -2.978            -2.620
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.3099

. generate dPD=D.pd
(1 missing value generated)

. dfuller dPD

Dickey-Fuller test for unit root                   Number of obs   =        32

                               ---------- Interpolated Dickey-Fuller ---------
                  Test         1% Critical       5% Critical      10% Critical
               Statistic           Value             Value             Value
------------------------------------------------------------------------------
 Z(t)             -3.855            -3.702            -2.980            -2.622
------------------------------------------------------------------------------
MacKinnon approximate p-value for Z(t) = 0.0024
```

Appendix 6 Jarque Bera Normality Test Results

```
varnorm, jbera skewness kurtosis
```

Jarque-Bera test

Equation	chi2	df	Prob > chi2
u5mr	0.024	2	0.98784
imm	1.802	2	0.40611
ALL	1.827	4	0.76759

Skewness test

Equation	Skewness	chi2	df	Prob > chi2
u5mr	.02376	0.003	1	0.95693
imm	-.4466	1.031	1	0.31004
ALL		1.033	2	0.59648

Kurtosis test

Equation	Kurtosis	chi2	df	Prob > chi2
u5mr	2.8708	0.022	1	0.88326
imm	3.773	0.772	1	0.37968
ALL		0.793	2	0.67257

Appendix 7 Granger causality table

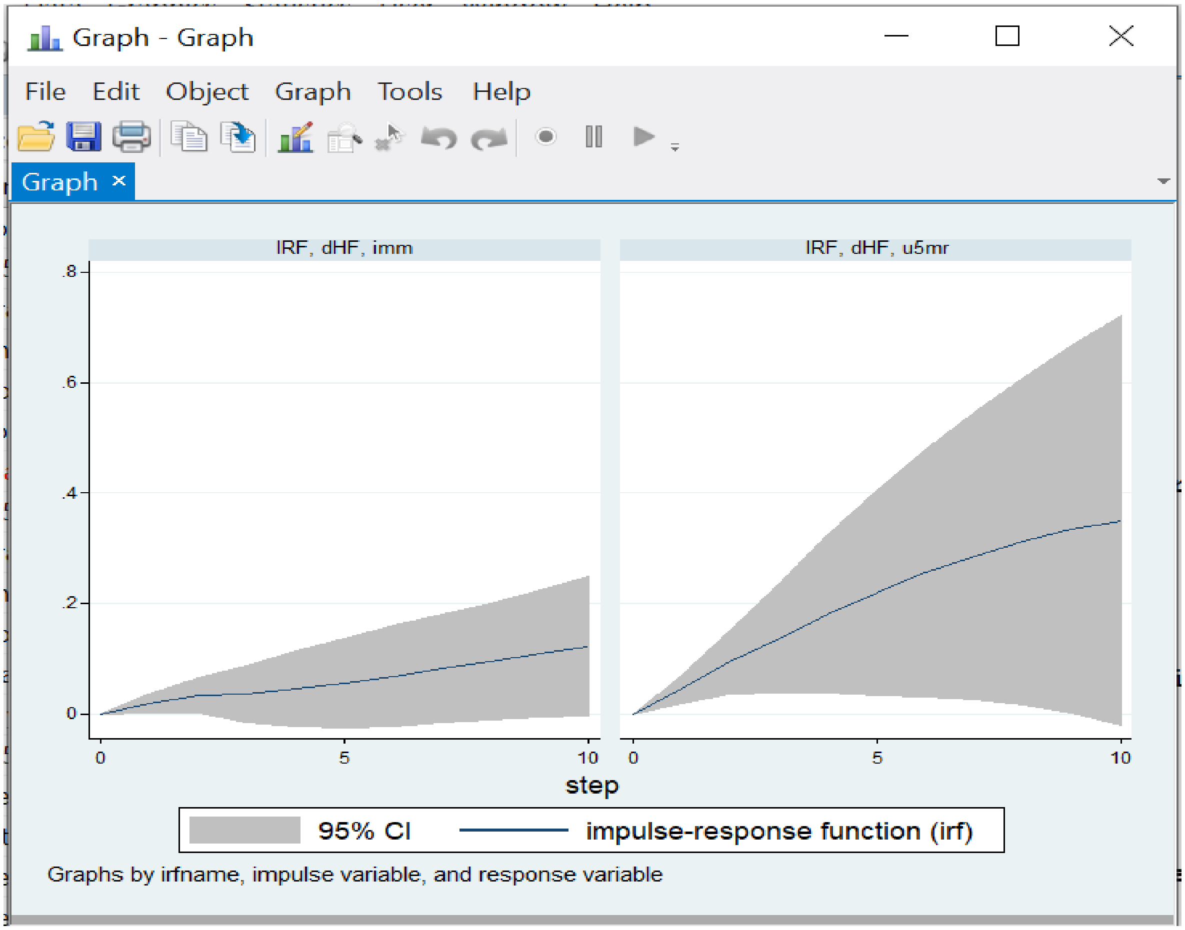
```
. vargranger
```

Granger causality Wald tests

Equation	Excluded	chi2	df	Prob > chi2
u5mr	imm	1.7323	2	0.421
u5mr	ALL	1.7323	2	0.421
imm	u5mr	4.2765	2	0.118
imm	ALL	4.2765	2	0.118

.

Appendix 8 IRF Results for both IMM and U5MR



Appendix 9 Lag estimation results

```
. varsoc u5mr imm, maxlag(2) exog(dGDPC dGNI dPD  dHF)

   Selection-order criteria
   Sample:  1992 - 2023                          Number of obs      =        32
```

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-194.275				1207.81	12.7672	12.919	13.2252
1	-93.7514	201.05	4	0.000	2.92437	6.73446	6.94702	7.37572
2	-60.9234	65.656*	4	0.000	.490719*	4.93272*	5.20601*	5.75719*

```
   Endogenous:  u5mr imm
    Exogenous:  dGDPC dGNI dPD dHF  _cons

. var u5mr imm, lags(1/2) exog(dGDPC dGNI dPD dHF)
```

Appendix 10 Eigenvalue Stability Test

```
varstable

 Eigenvalue stability condition
```

Eigenvalue	Modulus
.8018146	.801815
.7687931 + .1590758i	.785078
.7687931 - .1590758i	.785078
-.1269755	.126976

```
 All the eigenvalues lie inside the unit circle.
 VAR satisfies stability condition.
```

Appendix 11 IMM Variance Decomposition Table

step	(2) fevd	(2) Lower	(2) Upper
0	0	0	0
1	0	0	0
2	.037202	-.036971	.111375
3	.066369	-.05732	.190058
4	.071657	-.089793	.233108
5	.088021	-.125551	.301594
6	.108875	-.160756	.378506
7	.139045	-.186155	.464246
8	.173193	-.192624	.53901
9	.208725	-.17646	.59391
10	.241491	-.143909	.626891

95% lower and upper bounds reported
(1) irfname = IRF, impulse = dHF, and response = u5mr
(2) irfname = IRF, impulse = dHF, and response = imm

Appendix 12 U5M Variance Decomposition Table

step	(1) fevd	(1) Lower	(1) Upper
0	0	0	0
1	0	0	0
2	.069883	-.018376	.158142
3	.134761	-.026152	.295675
4	.182303	-.042313	.406919
5	.227725	-.052382	.507832
6	.267901	-.05433	.590131
7	.302254	-.046623	.651132
8	.328856	-.033502	.691214
9	.347688	-.019758	.715134
10	.359119	-.010061	.7283

List of acronyms

GDPC- Gross Domestic Product

HF-Health Financing

GNI-Gross National Income

PD- Population Density

IRF-Impulse Response Function

VDC-Variance Decomposition