NEAR EAST UNIVERSITY

INSTITUTE OF GRADUATE STUDIES

DEPARTMENT OF BIOSTATISTICS

Barriers to Malaria Medicine Access Among Burundian Children Under Five Years

M.Sc. THESIS

FRANCINE NIYOMWUNGERE

Nicosia

June, 2024

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M.Sc.THESIS

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APPROVAL

We certify that we have read the thesis submitted by FRANCINE NIYOMWUNGERE titled **"Barriers to Malaria Medicine Access Among Burundian Children Under Five Years"** and that in our combined opinion it is fully adequate, in scope and in quality, as a thesis for the degree of Master of Educational Sciences.

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Declaration

I hereby declare that all information, documents, analysis and results in this thesis have been collected and presented according to the academic rules and ethical guidelines of Institute of Graduate Studies, Near East University. I also declare that as required by these rules and conduct, I have fully cited and referenced information and data that are not original to this study.

FRANCINE NIYOMWUNGERE

24/06/2024

Acknowledgments

First and foremost, I thank God for His continuous grace upon me.

After this work, my sincere gratitude goes to my advisor Prof. Dr. İlker ETİKAN, who, despite his many commitments, found the time to guide me through the completion of this project. His availability, numerous pieces of advice, and guidance deserve my utmost recognition.

I am also grateful to my professor, Assoc. Prof. Dr. Özgur TOSUN, and to the faculty of the Biostatistics Department at Near East University for their expertise. My gratitude also goes to the jury members who, despite their busy schedules, took the time to read and evaluate this work.

My thanks extend to the Demographic Health Survey program, which provided the data used in this research.

I am also grateful to my parents and siblings for their financial and moral support. Thanks to them, my journey has been a pleasant one.

As it is impossible to list everyone, my thanks go to all those who, directly or indirectly, contributed to the completion of this work.

Thank you all.

FRANCINE NIYOMWUNGERE

Abstract

Barriers to Malaria medicine Access among Burundian children under five years.

Burundi Demographic and Health Survey (BDHS) for the years 2016–2017 data was used in the study. Our study included 2205 children under five. Access to Malaria medicine was the dependent variable for the study, Factors influencing Access to Malaria medicine were the independents variables, child and maternal factors were the control variables. Chi-square test was used on bivariate analysis step and for multivariate analysis step binary logistic regression modelling were used to achieve the goal of the study.

The findings showed various factors influencing access to antimalaria medicine, including the children's residence, the employment status of their parents, their educational attainment, and the family's income. Compared to children in rural areas, urban children have better access to healthcare. Children with parents who work in public services or have greater education levels are more likely to receive medical care. Furthermore, rich families find it easier to obtain their kids the healthcare they need, while those in less fortunate financial situations find it more difficult to receive the care, they require.

Parent’s education, activity and health-seeking behaviors needs to be strengthened by the government. The Burundian government and non-governmental health organizations should enhance child health systems and address barriers of child's health through multisectoral partnerships by improving women’s status and promote their socioeconomic well-being. Free child healthcare policies in Burundi should be strengthened to increase the utilization of child healthcare services in Burundi

Key words: Malaria, Burundi, Healthcare access, child health, Barriers to healthcare.

Özet

Beş Yaş Altındaki Burundili Çocuklar Arasında Sıtma İlacına Erişim Engelleri

Çalışmada, 2016–2017 yıllarına ait Burundi Demografik ve Sağlık Araştırması (BDHS) verileri kullanıldı. Çalışmamıza beş yaş altı 2205 çocuk dahil edildi. Çalışmanın bağımlı değişkeni sıtma ilacına erişimdi; sıtma ilacına erişimi etkileyen faktörler bağımsız değişkenlerdi, çocuk ve anne faktörleri ise kontrol değişkenleriydi. Çalışmanın amacına ulaşmak için iki değişkenli analiz aşamasında Ki-kare testi ve çok değişkenli analiz aşamasında ise ikili lojistik regresyon modellemesi kullanıldı.

Bulgular, çocukların ikamet yeri, ebeveynlerinin istihdam durumu, eğitim düzeyi ve ailenin geliri gibi çeşitli faktörlerin sıtma ilacına erişimi etkilediğini gösterdi. Kırsal alanlardaki çocuklara kıyasla, kentsel çocukların sağlık hizmetlerine daha iyi erişimi vardır. Kamu hizmetlerinde çalışan veya daha yüksek eğitim seviyesine sahip ebeveynlerin çocukları, tıbbi bakım alma olasılığı daha yüksektir. Ayrıca, zengin aileler çocuklarına gereken sağlık hizmetini daha kolay temin ederken, maddi durumu yetersiz olan aileler gereken bakımı almakta daha zorlanmaktadır.

Ebeveynlerin eğitimi, faaliyetleri ve sağlık arayışları hükümet tarafından güçlendirilmelidir. Burundili hükümet ve sivil toplum sağlık örgütleri, kadınların statüsünü iyileştirerek ve sosyoekonomik refahlarını teşvik ederek çocuk sağlık sistemlerini güçlendirmeli ve çok sektörlü ortaklıklar aracılığıyla çocuk sağlığına yönelik engelleri ele almalıdır. Burundi'de ücretsiz çocuk sağlık hizmetleri politikaları güçlendirilerek çocuk sağlık hizmetlerinin kullanımının artırılması sağlanmalıdır.

Anahtar Kelimeler: Sıtma, Burundi, Sağlık hizmetlerine erişim, çocuk sağlığı, Sağlık hizmetlerine erişimde engeller.

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LIST OF ABBREVIATION

UN IGME: United Nations Inter-agency Group for Child Mortality Estimation

SSA: Sub-Saharan Africa

UNICEF: United Nations Children's Funds

DHS: Demographic and Health Surveys

HIS: Health Information Systems

DHIS: District Health Information Software

WHO: World Health Organization

CDC: Centers for Disease Control and Prevention

CQ Chloroquine

ASAQ Artesunate–Amodiaquine,

AL Artemether–Lumefantrine,

RDT: Rapid Diagnostic Test,

LLIN: Long-Lasting Insecticidal Net,

IRS: Indoor Residual Spraying,

IPTp: Intermittent Preventive Treatment in Pregnancy.

CHAPTER I: INTRODUCTION

I.1 Background information

Sub-Saharan Africa countries continue to face a difficult population health situation despite notable global progress made in reducing childhood illness and mortality. According to the UN Inter-agency Group for Child Mortality Estimation's 2018 report, 3.3 million children under the age of 15 died in Sub-Saharan Africa (SSA), constituting 53% of all childhood deaths worldwide (UN-IGME, 2019).

Sadly, the average child mortality rate is 1 in 13, which is significantly higher than the rate of 1 in 199 people in developed nations. Most of these deaths (85%) occur in the first few years of life, it is critical to address under-five morbidity and mortality in Sub-Saharan Africa (WHO, 2019). Although there is a decline per 1000 live births, from 174 deaths in 1990 to 58 deaths in 2018 (UN-IGME, 2019). Burundi's death rate is still high for children under five years old, given that the Sustainable Development Goal (SDG) request for a global drop in mortality for children under-five years old to 25 deaths per 1000 live births by 2030. The country's mortality rate is still particularly concerning.

Therefore, the morbidity and mortality rate of under-five years old children should be a major public health priority in both Burundi and other SSA countries, in order to meet global health targets and ensure children's wellbeing.

Children's illnesses and deaths in sub-Saharan Africa have been noticed to be influenced by inadequate health-seeking behavior (Qamar F.N., et al., 2016) and the restricted access to healthcare services (Fullman N., et al., 2016). In sub-Saharan Africa, diseases and child fatalities

are prevented in approximately half of cases; if children under five have a prompt access to high-quality healthcare services, according to the UN Inter-agency Group for Child Mortality Estimation.

Approximately 93% of hospital admissions and most deaths among Burundian children aged from 1 to 59 months in 2010 were caused by respiratory tract infections (pneumonia), malaria, and diarrhea (Moise, 2018), According to the (WHO 2019), the diseases and their complications are treatable and avoidable conditions.

Despite the implementation of free child healthcare policies, Burundi still faces significant barriers to accessing healthcare services. Thus; Burundi ranks 186th out of 195 countries for a poor healthcare accessibility in 2016, (Fullman N., et al.,2016).

More factors are included in getting health care for childhood illnesses than simply paying for services and living close to health facilities (Wambui W.M., et al, 2018). Child's age, the mother's age are one of the barriers to seek medical attention for a sick child (Tette E., et al., 2020), number of children, previous experiences with similar illnesses, standard living, geographic proximity, and cultural background (Kimani S., Wambui W.M., et al., 2018). In the same study, it showed that in Kenya, the distance plays a role in barriers: parents or guardians who live more than one kilometer from a medical facility are less likely to seek treatment services for their children

The different care-seeking behaviors of parents or guardians, especially mothers, have a significant influence on access to healthcare (Adane M., et al, 2017). Even with the availability of effective treatments, a poor care-seeking behavior (educated guardians or not, certain personal beliefs, etc) remains a major barrier in sub–Saharan Africa.

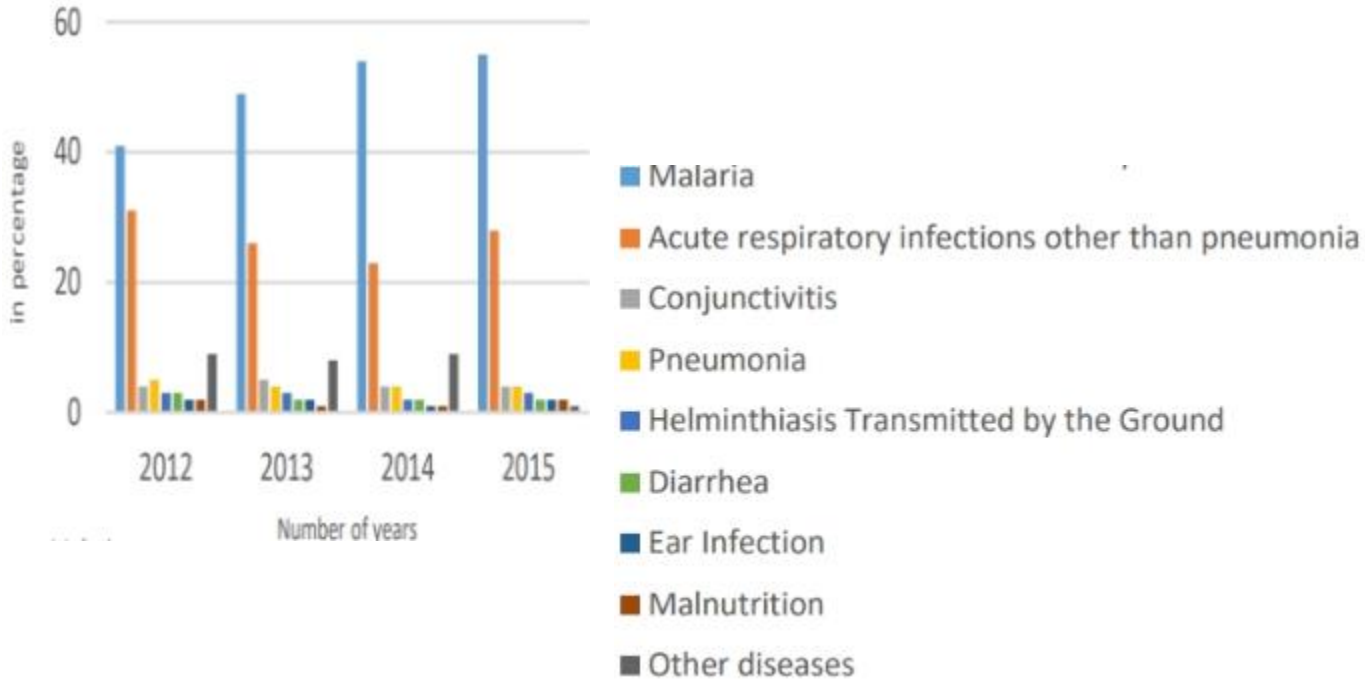
Understanding these complex factors is crucial in improving healthcare accessibility and mitigating its effects.

This study aims in the identification of factors affecting the access to antimalarial medicines in Burundian children under five years. The findings will be used to make recommendations in reducing the barriers to healthcare services. The ultimate aim is to decrease child morbidity and mortality rates in the country. Paying attention to and understanding these barrier details is an essential tool in order to enhance the accessibility of healthcare services and reducing its lackness impact.

I.2 Problem Statement

Even though young children's health has greatly improved, the gains are still brittle. The Burundian ‘children mortality rate decreased from 62 in 2017 per 1,000 live births to 53 in 2021 among children under five years old (UNICEF ,2023). The low improvement in neonatal mortality has slowed the decline in this mortality rate, so it remains high. The rate of neonatal mortality dropped from 22.4 per 1,000 live births in 2017 to 20.9 deaths per 1,000 live births in 2020 (UNICEF, 2023). According to UNICEF, the estimated infant mortality rate for 2021 was 37.6 per 1,000. Malaria, Respiratory infections, diarrhea, and are the cause of death among children under the age of five, while infections and prematurity are the main causes for newborns. From 503 cases per 1,000 in 2018 to 808 cases per 1,000 in 2019, the prevalence rate of malaria rose (UNICEF, 2023).

Figure 1. The leading Cause of death among children under 5 years old in Burundi



Source: Authors' calculations; MSPLS, Annual Health Statistics (2015)

Inadequate health care seeking (N., Qamar, et al., 2016) and inadequate access to health services (Fullman, et al., 2016) contribute significantly to the prevalence of childhood illnesses and the associated deaths in sub-Saharan Africa. According to the UN IGME, prompt access to high-quality healthcare could reduce roughly half of the mortality rate among children under five. Given that Burundi was ranked 186th out of 195 countries in 2016 for both access to and quality of healthcare services, accessing healthcare is still a major challenge in that country (Fullman, N., et al., 2016).

I.3 Research Question

More than just the cost and travel time to medical facilities affect access to care for childhood illnesses (Wambui et al., 2018); seeking medical attention also depends on parents' or guardians' participation in the process, especially the mother (M., Adane, et al, 2017).

Several questions come up: "Which factors have an impact for Burundian ‘children under five years to access malaria medicine?" Does Burundi have enough medical supplies to respond to and fight malaria parasite?

I.4 Hypothesis

I.4.1. General Hypothesis

Burundian’s children access malaria medicine difficultly because malaria medicine is linked to Socio economic, socio cultural and geographic factors which sometimes consist a barrier for then for seeking child ‘healthcare.

I.4.2 Specific Hypothesis

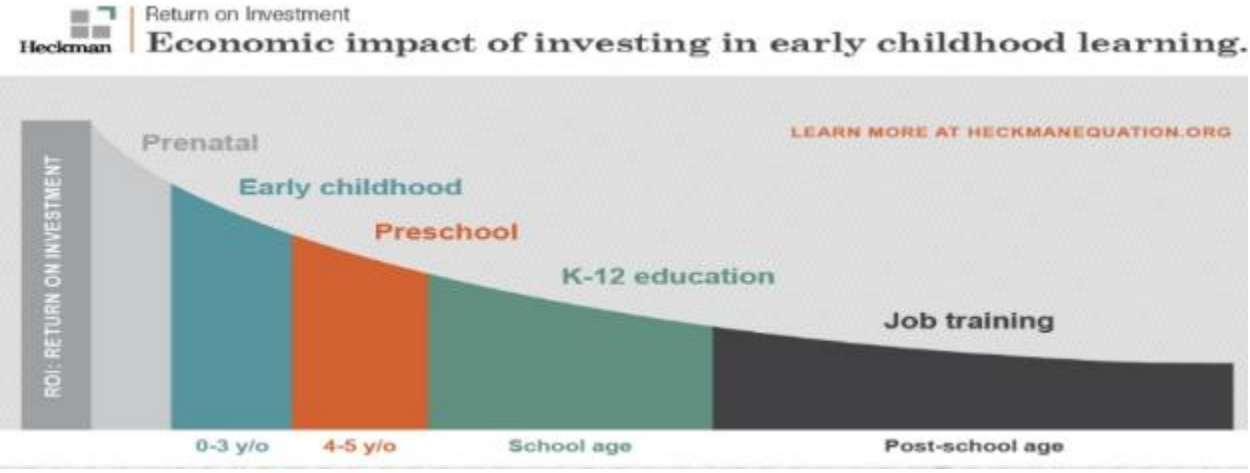
H1: Environmental factors affect children under the age of five's access to antimalarial medications; access to medical care is less favorable in rural than in urban areas; H2: High-income households are expected to provide their children with medical care; fathers' economic activity reduces the likelihood that their children won't receive treatment; socioeconomic factors affect children under the age of five's access to antimalarial medications; H3: The level of education that mothers have attained influences the treatment that their children

can receive, and sociocultural factors influence the availability of antimalarial drugs to children younger than five.

I.5. Significance of the Study

According to Heckman (2017), investing in early childhood development is both a wise financial choice and a key strategy for realizing human potential.

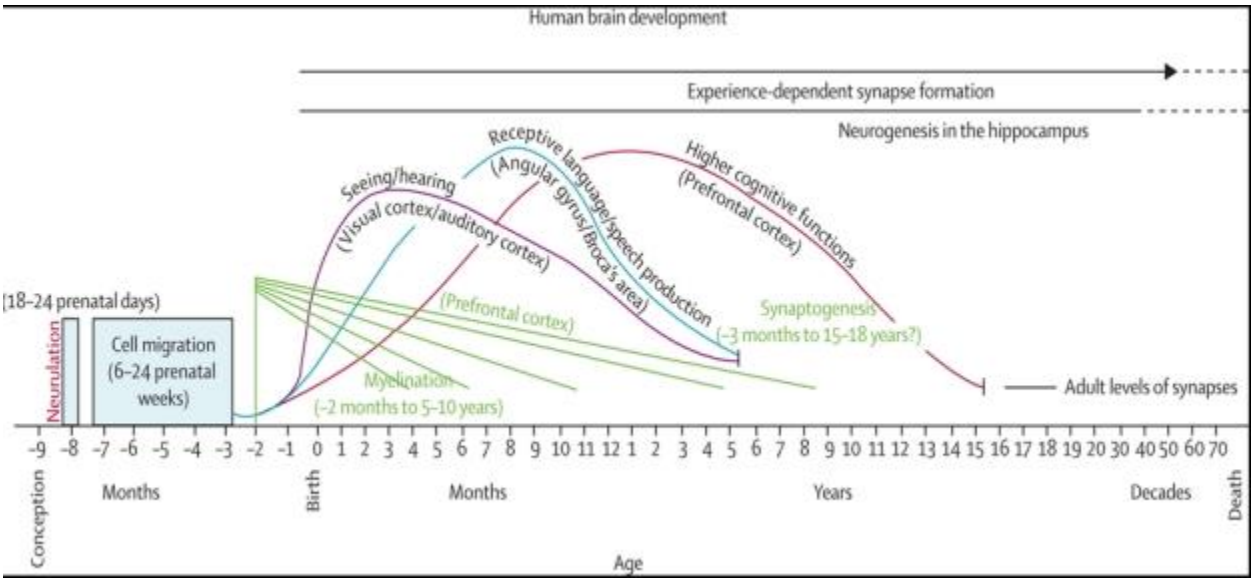
Figure 2. Economic impact of investing in early childhood



Source: Heckmanequation.org

The Heckman Curve shows that early investments in children yield the highest economic returns. It emphasizes the financial benefits of early investment and skill development, which boost productivity and increase the chances of success for more kids.

Figure 3. Development of Brain.



Source: (Nelson CA., Thompson RA, 2001; 56: 5–15).

The brain develops most rapidly in the first years of life and the foundation is laid for future growth, innovation, well-being and productivity, as shown in the graph. However, is the government of Burundi investing enough in early health care?

Burundi is one of the fastest-growing countries, and it has one of the youngest populations in the region. Around 2.4 million children, or nearly 18.7% of the population, are younger than six years old (UNICEF, 2023-2024).

This study will try to find out the barriers that stand in their way to health among Burundian's children under five years, with a particular focus on malaria, one of the leading causes of death in Burundi among children under five (UNICEF, 2023).

I.5 Objective

I.5.1. General objective

Investigate the variables affecting Burundi's children under the age of five's access to antimalarial therapies.

I.5.2 Specific Objectives

- Assess the socioeconomic factors that affect Burundian children under five access to antimalarial medicine, such as mother education level, family income, and employment status.
- To investigate how geographic factors, such the distance to medical facilities affects the accessibility to antimalaria medicine for Burundian children under the age of five years.
- Evaluate how socio-cultural factors beliefs, cultural, etc has impact on accessibility on Burundians children under the age of five’s access to healthcare.
- Findings from this study are intended to improve Burundian children under-five years access to malaria medicine by identifying barriers, so that the government of Burundi should make target intervention in eradication of malaria in the country.

I.6 Delimitation and Scope

Data collected from women whose children had contracted malaria two weeks before the 2016-2017 Burundi Demographic and Health Survey will be used in this study. The analysis will only consider variables that are part of the dataset, which will limit the investigation of other factors that may affect access to healthcare.

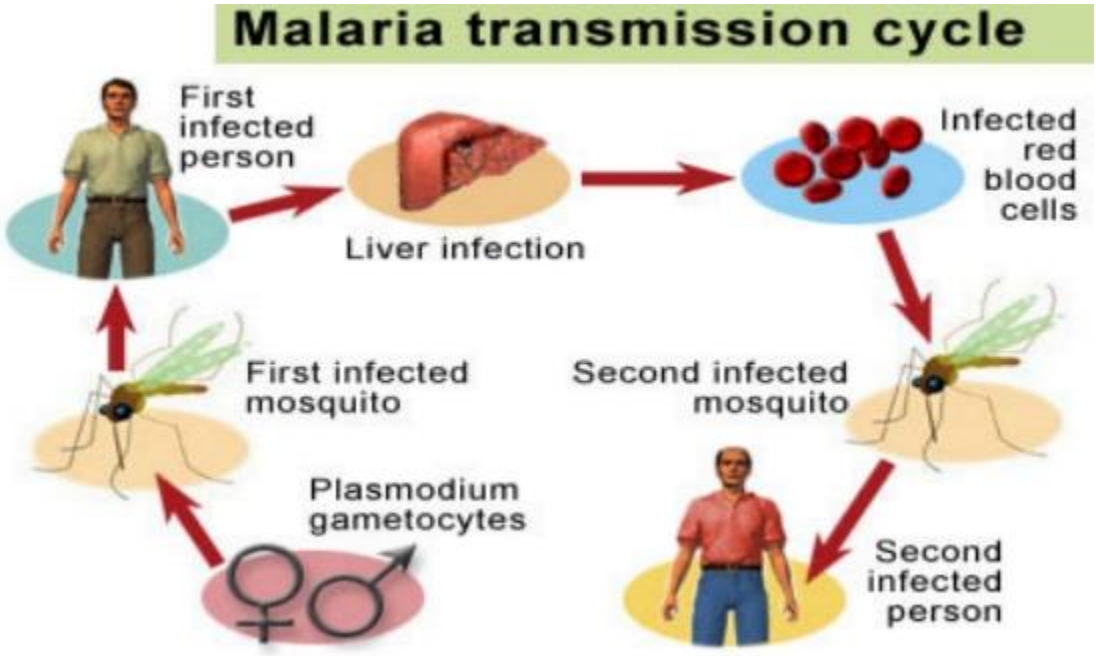
CHAPTER II: LITERATURE REVIEW

II.1 Introduction

Ronald Ross, a British physician, made the discovery of the malarial parasite in mosquitoes (1857-1932)

Sir Ronald Ross made the first conclusive observation that Anopheles mosquitoes carry the malaria parasite (Plasmodium sp.) that infects humans on August 20, 1897, in Secunderabad, India. In less than a year, he clarified the parasite's life cycle, and by 1899, he had initiated the first scientific attempts to suppress malaria by lowering mosquito populations.

Figure 4. Lifecycle of the malarial parasite in human



Source: http://kmbiology.weebly.com/human-health-and-disease---notes.html

The human body undergoes several processes after malaria parasite transmitted by the females Anopheles mosquitoes carrying the malaria parasite:

- when an Anopheles mosquito infected bites a human, introducing the malaria parasite which is called sporozoites into the bloodstream.
- During the liver stage, sporozoites multiply inside hepatocytes after being transmitted by a mosquito bite. Eventually, they mature into mature forms, called merozoites (CDC - Malaria – Biology., 18 Jan. 2019).
- Blood stage: Merozoites infect red blood cells, after they leave liver cells and enter the bloodstream after maturing. (CDC - Biology of Malaria, January 18, 2019).
- Symptoms: More merozoites are released into the bloodstream when the parasites burst as they expand inside the red blood cells. The symptoms of malaria, which can include chills, fever, sweating, extreme exhaustion, muscle aches, and occasionally nausea and vomiting, are caused by this process of invasion, multiplication, and bursting. (CDC - Biology of Malaria, January 18, 2019).
- The immune system produces the antibodies to fight the parasite and activating immune cells when the body becomes infected. But the malaria parasite has evolved defense mechanisms that combat the immune system, which keeps it alive and helps it spread (Bartoloni and Weiss, 2004).
- Severe Complications: If treatment is not received, malaria can sometimes progress to severe forms that cause organ failure, respiratory distress, cerebral malaria (affecting the brain), severe anemia, and even death. (CDC - Biology of Malaria, January 18, 2019).

These procedures show how the malaria parasite's intricate life cycle in the human body gives rise to the illness's symptoms and possible complications.

II.2 Types of parasites

Malaria is caused by a group of parasitic species that are all members of the genus Plasmodium.

Principal species of Plasmodium are:

- Plasmodium falciparum, which is the most aggressive and is primarily found in sub-Saharan Africa;
- Plasmodium Ovale is found in West Africa,

- Plasmodium vivax, presents in Latin America, Asia and some parts of Africa;
- Plasmodium malariae is a parasite that causes chronic infections in humans and is found in tropical and subtropical regions. It is less common than P. vivax and P. falciparum.
- Plasmodium knowlesi: Found in Southeast Asia, especially Malaysia, P. knowlesi was initially found infecting macaque monkeys.

To effectively prevent, diagnose, and treat malaria on a global scale, it is imperative to comprehend the biology, distribution, and traits of these Plasmodium species.

II.3 Treatment

As the most effective antimalarial drugs on the market right now, the World Health Organization (WHO) advises treating patients with artemisinin-based combination therapies (ACTs). As a result, ACTs are accessible and selected in accordance with the regional strains of P. falciparum malaria. The preferred treatment for P. vivax-induced malaria is still chloroquine. Using an ACT is then advised in areas where resistance has grown.

Injections of artesunate, both intramuscular and intravenous, should be administered for at least 24 hours to treat severe malaria. This should be followed by three days of ACT.

II.4 Preventive

1.Individual Defense

- Use insect repellents.
- Nets for mosquitoes: Sleep beneath bed nets treated with insecticide (ITNs), which not only act as a physical barrier but also instantly kill mosquitoes upon contact.
- Wear long sleeves and long pants as protective clothing, especially in the evening and at night when mosquitoes are most active.
- Indoor Protection: Install insecticides or mosquito coils inside, and cover windows and doors with mosquito screens.

2.The Management of Environment

- Take Breeding Sites Out: Eliminate any areas with standing water where mosquitoes may breed, such as gutter clogs, flowerpots, and old tires.
- Larvicides: To kill mosquito larvae in water bodies that cannot be drained, apply larvicides.
- Applying Insecticides: Take part in community initiatives that involve indoor residual spraying (IRS) of insecticides on surfaces such as walls that serve as mosquito resting places.

II.5 Vector control

The two primary interventions are indoor residual spraying and nets treated with insecticides. However, the emergence of insecticide-resistant mosquitoes poses a threat to global progress in the fight against the disease. The most recent World Malaria Report lists a number of additional threats to insecticide-treated mosquito nets, including poor access, the needless disposal of nets due to daily stressors before they can be replaced, and changes in anopheles mosquito behavior, with some biting earlier in the day before people go to bed and resting outside to avoid contact with insecticides.

II.6 Malaria's vaccination in Burundi

In October 2021, RTS, S/AS01 malaria vaccine was approved by World Health Organization for children who lives in areas with high risk of transmission of P. falciparum malaria. Vaccination has been shown to significantly reduce malaria morbidity and mortality in young children. The R21/Matrix-M is another safe and effective malaria vaccine that was introduced by the WHO in October 2023. Two new malaria vaccines have the potential to be widely distributed throughout Africa.

II.7 Malaria elimination

Notable achievement was made in 2022; compared to only 13 countries in 2000, 34 countries reported fewer than 1000 cases of indigenous malaria.

Application for WHO certification of malaria elimination is open to countries that have gone at least three years without reporting any cases of malaria within their borders. The World Health Organization has certified that malaria has been eradicated in twelve countries since 2015. Belize

(2023), Azerbaijan (2023), Algeria (2019), Paraguay (2018), China (2021), Uzbekistan (2018), Sri Lanka (2016), Kyrgyzstan (2016), Tajikistan (2023), Kyrgyzstan (2016), and the Maldives (2015) are a few of these (WHO, 2023).

This development provides hope for future worldwide successes in the fight against malaria by highlighting the significance of coordinated efforts towards the disease's eradication.

II.8 Medicine for Malaria in Burundi.

From 2003 to 2019, artesunate-amodiaquine (ASAQ) was used as the main treatment for malaria in Burundi. In 2002, a clinical study was conducted and the observations were that the treatment response rates of artemether-lumefantrine (AL) and ASAQ were greater than 99%, and 95% respectively (Ndayiragije et al., 2004). ASAQ was initially chosen as a first-line treatment because of its affordability.

However, by 2006, the response rate for ASAQ had dropped to 94%, and it further decreased to 92% by 2019 due the plasmodium falciparum resistance. In 2020, Burundi adopted AL as its primary treatment for malaria, aligning its regimen with Tanzania and Rwanda under the East Africa Community. The standard treatment for severe malaria involves the intravenous administration of artesunate for a minimum of 24 hours and to be followed with artemether cachets. It is important to adhere to this regimen.

II.8.1. Testing Methods

Until 2005, Burundi's malaria testing method was limited to light microscopy. However, in 2016 rapid diagnostic tests (RDTs) was introduced and gradually gained traction, eventually accounting for more than 75% of malaria diagnoses by 2018. Both public and private healthcare facilities are trained in the use of RDTs to ensure the accuracy, and the national malaria control program provides regular supervision to see how it's used.

After implantation of RDTs a clinical study showed that there was nearly no difference in the positivity rates between tests performed with RDT and light microscopy, demonstrating their similar diagnostic accuracy, with RDTs at 56.0% and microscopy at 56.7% (WHO, 2016).

Rapid diagnostic tests accuracy (RDTs) is compromised by deletion in Histidine rich protein 2 (Hrp2) which is a protein produced by plasmodium falciparum parasite, and RDTs used that protein as a target due its abundance in malaria parasite. That deletion can lead to false negative results.

Horn of Africa countries have reported a decrease in the effectiveness of RDTs (Berhane, A. et al., 2018). For instance, a significant rate of Histidine rich protein 2 have been reported in the neighboring Democratic Republic of Congo, WHO emphasizes the importance of molecular monitoring of these deletions (Parr, J. B. et al., 2017). This issue is especially critical in Burundi

II.8.2 Malaria prevalence and the intervention in Burundi.

Figure 5: Deaths and cases per million population annually in Burundi.

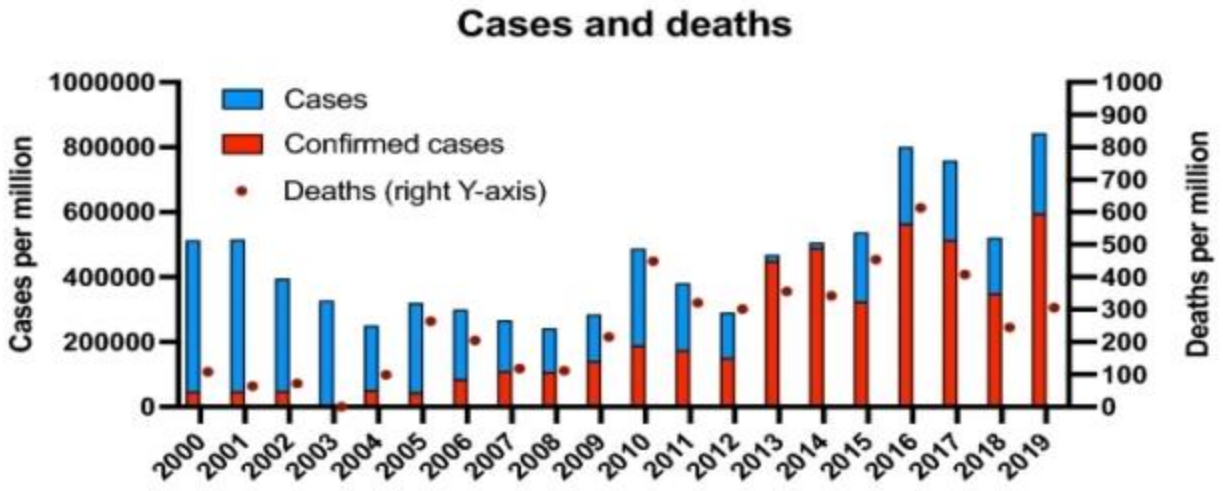
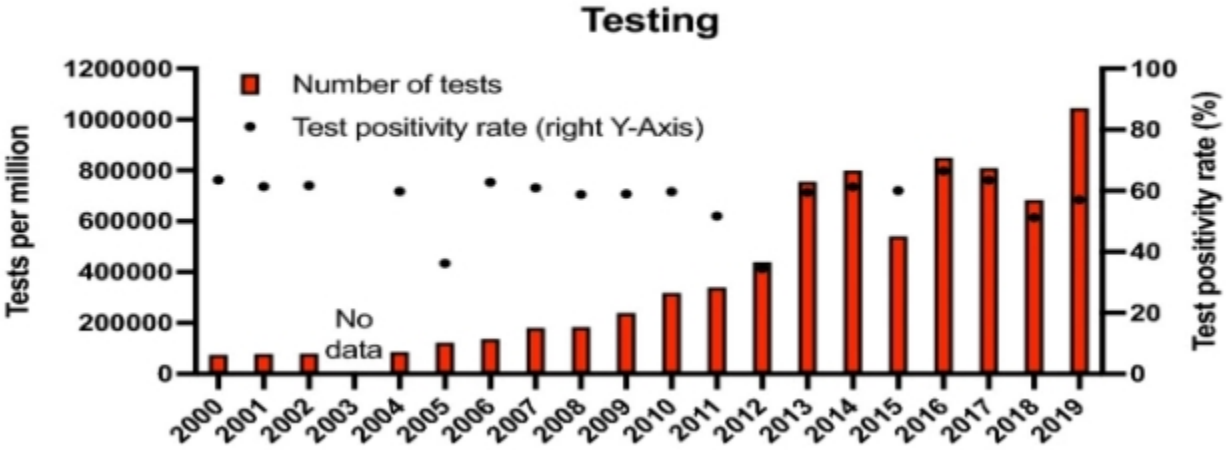


Figure 6: Malaria Testing Capacity and Trends in Burundi

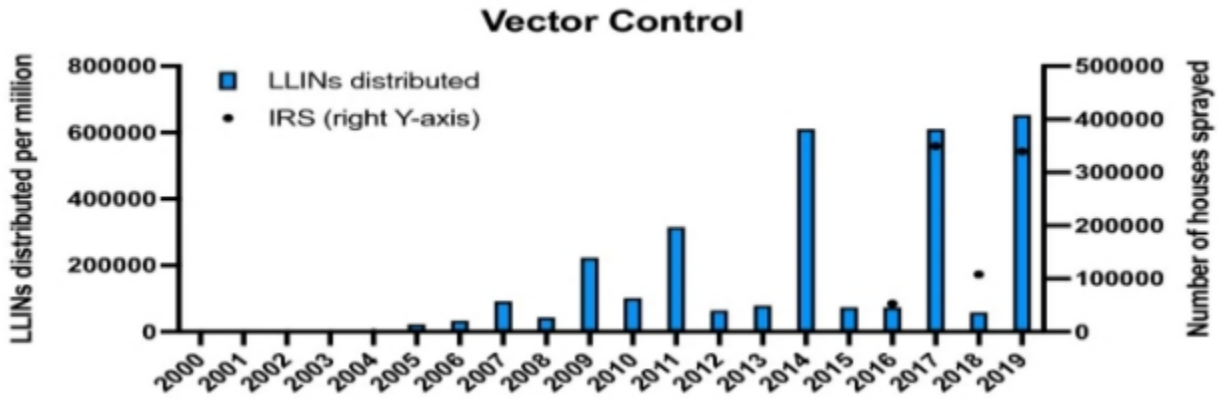


Source: malaria trends and control interventions in Burundi 2000 to 2019.

As the graphic shows Burundi's confirmed malaria case rate increased significantly from 9.2% in 2000 to 70.6% in 2019, which is a notable improvement in diagnostic accuracy and efficiency.

A significant increase is also observed in the total number of tests performed from less than 75,000 per million inhabitants in 2000 to 1,044,000 per million inhabitants in 2019, but positive rate of the tests remained relatively stable between 52% and 65% during this period despite the substantial increase in testing capacity. This stability suggests that malaria cases may have been underreported, indicating a difference between reported and actual numbers of cases, or due to the Hrp2 deletion. Investigation must be done in order to solve that issue.

Figure 7: Distribution of LLINs and Indoor Residual Spraying per million individuals



Source: "malaria trends and control interventions in Burundi 2000 to 2019"

Long-lasting Insecticidal Nets (LLINs) were introduced in Burundi in 2003 as a result of marketing campaigns. Mass distribution campaigns of LLINs had started by 2009 as the graphics shown and it was for young children and pregnancy women who have a high risk of getting malaria. After the 2014 campaign, LLIN coverage hit a high of 97%, and it held steady at 96.7% following the 2019 campaign.

Through distribution of LLINs and indoor residual spray Burundi can reduce malaria transmission, a study done in Karuzi, one of Burundi's provinces, showed that the use of indoor insecticide spraying (IRS) initiatives in conjunction with the distribution of long-lasting insecticide-treated nets (LLINs) has been demonstrated to reduce the risk of malaria (Denis Sinzinkayo, et al., 2019).

II.9 COVID impact in Burundi

Burundi managed to effectively contain the spread of SARS-CoV-2 by closing border at the beginning of the pandemic, resulting in a relatively low number of confirmed cases only 818 until 31 December 2020. However, the confirmed case count had increased to more than 4700 in May 31, 2021. The distribution of Indoor Residual Spraying (IRS) and Long-lasting Insecticidal Nets (LLINs) continued uninterrupted despite the obstacles presented by the pandemic [OMS, 2020].

Nevertheless, the pandemic hampered some surveillance efforts and disrupted the community health posts' supply chain for malaria drugs. There were delays in the planned nationwide switch from ASAQ to AL in the middle of 2020 because there were not enough AL supplies. Moreover, only 17 out of 27 health districts were able to resume malaria treatment at community health posts after artesunate suppositories were introduced due to delays in drug delivery. COVID-19 pandemic caused also a one- to two-month delay in the LLIN durability study (USAID, *OCTOBER* 1, 2021–SEPTEMBER 30, 2022).

II.10 Malaria surveillance in Burundi

Before 2007, Burundi collected daily data on healthcare and services from hospitals, health centers, and community settings. Paper forms were used to record this data, which was subsequently forwarded to the national level and manually entered into an Excel database. A revised process was put in place in 2008 and lasted until 2013, during which health facilities sent their paper reports to the health district then entered into a Geographic Information System (GIS) program for further processing and analysis.

From 2014, health data from public and private health facilities across Burundi are collected and entered daily into the District Health Information Software (DHIS2). The National Health Information System Office supervises the processing and analysis of this data.

The National Health Information System Office ensures that the data obtained through DHIS2 is accurate, current, and comprehensive, after evaluation they produce regular reports, including bulletins and statistical yearbooks. Additionally, the National Health Information System Office provides health districts with information regarding the effectiveness and quality of the data. The health districts then give particular medical facilities feedback, encouraging an iterative process of refining procedures for collecting and reporting data.

II.11 Drug Distribution

In Burundi, the pharmaceutical supply chain is organized into three tiers. First, supplies are distributed to national hospitals and district pharmacies by the Central Drug Purchasing Unit (CAMEBU). District pharmacies then serve as middlemen, supplying drugs to different medical facilities such as health centers and district hospitals. Lastly, patients receive their medications directly from these healthcare facilities. Burundi's healthcare system benefits from the effective distribution of pharmaceuticals thanks to this organized approach.

District pharmacies have to depend largely on the private sector to acquire prescription drugs, medical equipment, and supplies due to CAMEBU's inadequate provision. Nevertheless, there are strict regulations governing these purchases. District pharmacies place a large percentage of their orders with the private sector—roughly 40% of the total quantity requested—due to CAMEBU's inadequate fulfillment rates. Even with this dual supplier mechanism in place, stock shortages still happen frequently, and prescription drug prices are still somewhat high.

II.12 Barriers to healthcare seeking among children under five years

II.12.1 Socio- economic and Socio-cultural Factors

Disparities in how people seek healthcare across national borders may be caused by sociocultural differences. One significant barrier is financial accessibility, which is especially problematic for women who struggle to obtain insurance for medical costs and, as a result, are less likely to seek medical attention for their children’s illnesses (Assefa T, Belachew T, et al., 2008). Similar findings have been reported in Kenya, Nigeria and Niger (Bedford KJ, Sharkey AB, et al., 2014),

highlighting the pervasiveness of financial barriers to healthcare-seeking behaviors for illnesses in children.

Moreover, another study demonstrates that there is a difference in child health outcomes between children from the poorest households in low- and middle-income countries (Ikeako LC , Onah HE, , t al, 2006).

In contrast counties like Kenya, Ghana, Rwanda and Ethiopia due to existing health insurance programs, financial barriers might not be the primary issue in accessing healthcare. Instead, transportation to medical facilities can hinder seeking medical attention for childhood illnesses (Anafi, P., et al., 2018).

II.12.2 Geographic factors

A study conducted in Ethiopia and Bangladesh showed that Mothers who lived in rural areas were less likely to seek medical attention compared to those who lived in urban areas (Anafi, P., et al., 2018). This aligns with another study showed that Women in rural areas invest more time and resources in traveling to healthcare facilities, which are often located on the outskirts of towns, due to limited access to basic infrastructure (Geleto, A., et al., 2018). Additionally, topographical challenges and environmental barriers further complicate timely access to medical care (Chowdhury ME., Alam N., et al., 2016).

II.12.3 Sociodemographic factors

Married women are more likely to seek healthcare for their children compared to single women (Kolola T, Gezahegn T, et al., 2016). Single women may encounter financial challenges and lack support to access medical care for their children.

In addition, compared to men, female household heads might not have as much access to education and economic opportunities, which could affect their capacity to identify symptoms of illness and make decisions about their families' medical care (G., Sen, et al, 2007). Boys and men are frequently prioritized as the primary breadwinners in society, which leads to differences in wealth and education that affect how influential women are when it comes to health-seeking behaviors.

The relationship between healthcare utilization and parity appears to differ in Burundi, in contrast to previous research. Higher parity women are less likely to seek medical attention (Voors MJ, Nillesen EE, et al., 2012). This could be due to a variety of factors, including the availability and accessibility of healthcare facilities, financial constraints, and historical barriers resulting from protracted conflict.

Burundi experienced repeated political crises between 1994 and 2015, which caused population displacement both inside the nation and to neighboring countries. During the presidential elections of 2005, 2010, 2015, and 2020, there was a noticeable increase in migration. Over 420,000 Burundians fled the country as refugees between 2015 and 2017, while an additional 55,000 were internally displaced, according to UNHCR reports [Burundi situation, 2017].

Malaria protection is frequently insufficient for displaced populations (Draebel, T., Kueil, et al, 2013).

The rapid population growth continues to be a barrier to any kind of intervention. With a 5.4 births per woman, Burundi is one of the top 10 countries in the world that is seeing the fastest population growth. Maintaining the current level of defense requires constant resource enhancement for malaria control, and increasing resources are needed to expand control initiatives even further.

CHAPTER III. RESEARCH METHODOLOGY

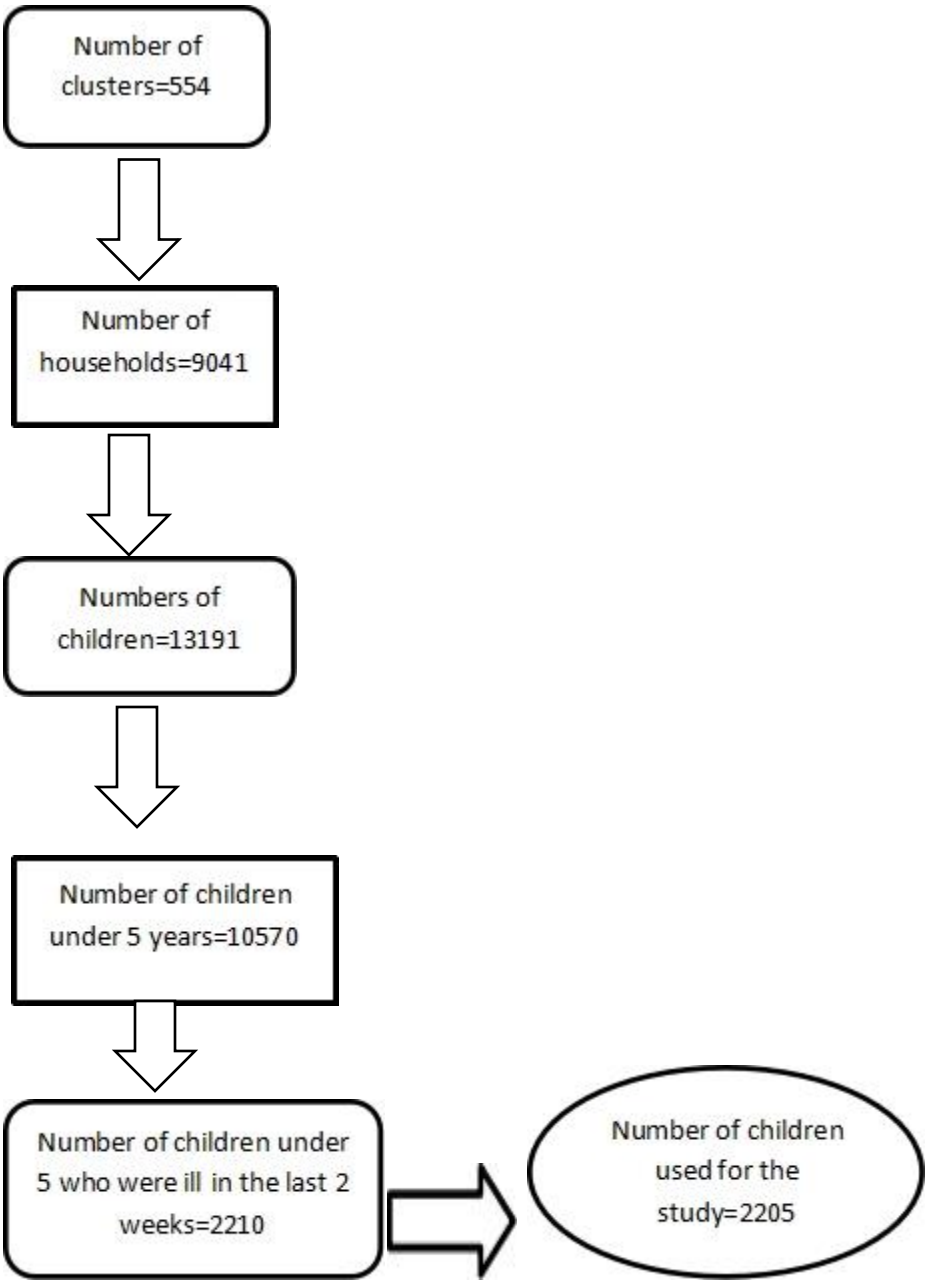
This study investigates the possible reasons behind children under five years old accessing antimalarial medicine. Its main data source will be the Burundian Demographic and Health Survey (DHS) for the years 2016–2017. This chapter aims to outline the methods used to collect data and how data will be analyzed.

III.1. Sources of Data Utilized

Data from the Burundi Demographic and Health Survey (BDHS-III) carried out between October 2016 and March 2017, will be used to evaluate the theories. After the survey from 2010, this is the third of its kind.

The birth recode dataset, which includes information for each child born to women surveyed, was specifically used in this study. With an emphasis on crucial facets of maternity and child health, DHS surveys are thorough assessments conducted in more than 85 low- and middle-income nations, yielding data that is nationally representative.

Aliaga and Ruilin's two-stage stratification sampling strategy is employed to ensure the survey's national representativeness. In the initial phase, enumeration areas (EAs), typically derived from recent national census data, were used to develop a sampling framework. After that, each EA was split up into standard segments, each of which had between 100 and 500 homes. Subsequently, a systematic selection of households was conducted from the enumeration areas, and in-person interviews were conducted with members of the target demographic, which consisted of men aged 15 to 64 and women aged 15 to 49.


Number of clusters=554
Number of households=9041
Numbers of children=13191
Number of children under 5 years=10570
Number of children under 5 who were ill in the last 2 weeks=2210
Number of children used for the study=2205

III.2. Data analysis methods

III 2.1 Univariate Analysis

Univariate Analysis is a descriptive analysis that can be used as an introduction for more future investigation but does not attempt to explain the relationships between variables. In order to ascertain the distribution of each of a variable's modalities, non-applicable cases, the non-response rate, missing values, how values are distributed about the mean (variance), the features of central tendencies, and the form of the distribution curve (for quantitative variables), frequency and proportion for qualitative variables. Univariate analysis provides the statistical distribution of the variable.

III.2.2. Bivariate analysis

This method of statistical data analysis looks for potential relationships between variables that are measured two at a time. Using Chi-square statistic, this level of analysis will help us to investigate the relationship between independents variables variables and children under the age of five's access to antimalaria treatments in Burundi. The p-value connected to the Chi-square test will be used for the interpretation. In fact, the independent variables are either categorical or qualitative, and the dependent variable is dichotomous qualitative (i.e., whether or not it has access to antimalaria medicine).

III.2.3. Multivariate Analysis

Data from several variables are summarized using multivariate analysis in an effort to retain as much information as possible. In order to provide a more comprehensive explanation, it includes a collection of techniques intended to combine data from various variables (Taffé, 2004). The type of variables (qualitative or quantitative) determines which approach is best.

The Binary Logistic Regression method will be employed in our investigation. This approach was chosen because the dependent variable is a dichotomic variable in this study and the explanatory variables can be qualitative or quantitative. It provides the net effects (odds ratios) of each independent variable; the results are in line with the goal of this study. The following is the method's guiding principle:

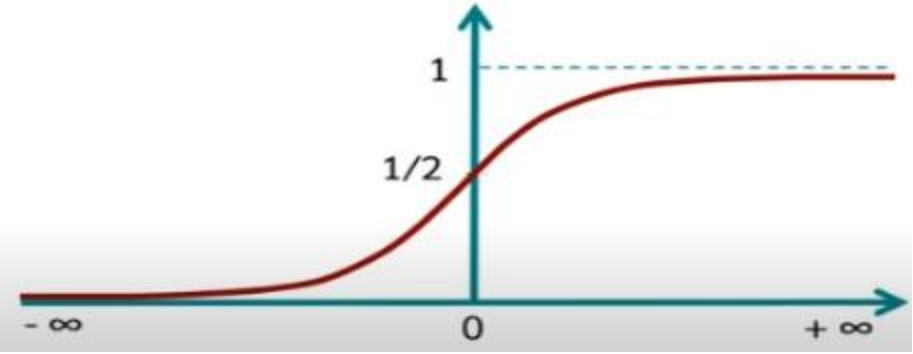
In order to comprehend the evolution of the phenomenon being studied, regression is a technique used to fit a mathematical curve through a set of experimental points (Essafi, 2003; Leblanc, 2000cited by Taffé, 2004). By minimizing the error—the difference between the theoretical curve and the experimental points—this method seeks to identify the curve that best fits all of the measured points. Regression makes it possible to analyze how much the explanatory variables contributed to the development of the variable of interest. Additionally, the model that is produced can be utilized for prediction.

When the dependent variable (Y) has two distinct categories, or is dichotomous, binary logistic regression is utilized. Both qualitative and quantitative measures can be included in the predictor variables (independent variables Xi). The dependent variable, in this case access to antimalarial medications, typically denotes the presence or absence of an event. Simultaneously, the

independent variables are those that are thought to affect the probability that this event will occur.

The goal of logistic regression is to forecast the chance or likelihood that an event will occur. This means that the prediction's value range should be between 0 and 1. Thus, a function that only accepts values between 0 and 1 is required.

Figure 8. Binary Logistic function



The equation looks like this: $f(z) = \frac{1}{1+e^{-z}}$

Z is the equation of the linear regression:

$$f(z) = \frac{1}{1 + e^{-(b_1 * x_1 + \ldots + b_k * x_k + a)}}$$

As a result, given the values of the independent variables, the equation gives the likelihood that the dependent variable will equal 1.

$$P(y = 1 x_1, \ldots, x_k) = \frac{1}{1 + e^{-(b_1 * x_1 + \ldots + b_k * x_k + a)}}$$

The maximum likelihood method is used to solve the problem of coefficients $(b_1, \ldots, b_k)$ There are effective numerical techniques for this purpose that can solve the problem quickly. A statistical software like SPSS is utilized to compute the coefficients.

A 50 percent threshold is applied when determining whether or not an individual has access to healthcare. This individual is classified as "having access to healthcare" if the regression model yields an estimate of more than 50%; otherwise, "not."

In order to determine the significance of the model, the Chi-square Test will be employed. For this, two models will be contrasted. All of the independent variables are used in one model, while none are used in the other. We can determine whether there is a significant difference between these two results using the Chi-square Test.

III.3 The evaluation of the model through the ROC curve:

values	Decisions
0.5	No discrimination
0.5-0.7	Poor discrimination
0.7-0.8	Acceptable discrimination
0.8-0.9	Excellent discrimination
> 0.9	Outstanding discrimination

The area under the curve can be used to quantitatively describe the ROC curve.

The probability that a randomly selected positive instance will be ranked higher than a randomly selected negative instance is represented by the Area Under the Curve (AUC). Consequently, AUC = 1 exists in the perfect discrimination scenario, in which positives are always ranked higher than negatives.

In contrast, there is an equal chance of ranking a positive instance higher than a negative instance and a negative instance higher than a positive instance if the model assigns scores randomly. Here, the diagonal line—the first bisector—and the ROC curve coincide, yielding an AUC of 0.5.

This serves as the baseline reference, so in order for our model to be deemed to be functioning well, it must exceed this threshold. Generally, different thresholds are suggested to give a sense of the discrimination's quality (D.W. Hosmer, S. Lemeshow).

We evaluate our model's predictive power using the ROC curve and the AUC (Area Under Curve). For variable X, the predictive power is represented by the AUC. The AUC criterion, a synthetic indicator that is simple to interpret, can be linked to the ROC curve, a useful tool for assessing and comparing the performance of logistic regression models.

CHAPTER IV FINDINGS AND DISCUSSION

IV. 1 Univariate Analysis

A fundamental data analysis procedure known as univariate analysis ensures data quality, facilitates comprehension of the data, and creates the groundwork for more complex research.

Table 1. Univariate Analysis

Variables	Values	Frequency	Percent
Religion	Catholic	1303	58.4
	Protestants	775	34.7
	Muslims and others	154	6.9
Malaria incidence	No	848	38.0
	Yes	1384	62.0
Educational attainment of women	No education	1081	48.4
	Primary	887	39.7
	Secondary and others	264	11.8
Region of residence	Central East	653	29.3
	South	583	26.1
	North	578	25.9
	West	350	15.7
	Bujumbura-Mairie	68	3.0
Household standard of living	Poor	858	38.4
	Moyen	919	41.2
	Rich	455	20.4
Mother's economic activity	Farmer	1886	84.5
	Service and others	272	12.2

	Business	74	3.3
Father's economic activity	Farmer	1592	71.3
	Service and others	520	23.3
	Business	120	5.4
Husband's level of education	No education	1094	49.0
	Primary	870	39.0
	Secondary and others	268	12.0
Place of residence	Rural	1895	84.9
	Urban	337	15.1
Access to Information	Acces	1118	50.1
	No acces	1114	49.9
Mother'age	15-19	48	2.2
	20-24	332	14.9
	25-29	482	21.6
	30-34	471	21.1
	35-39	357	16.0
	40-44	319	14.3
	45-49	223	10.0
Sex of household head	Male	1924	86.2
	Female	308	13.8
Have mosquito bed net for sleeping	No	957	42.9
	Yes	1275	57.1
Getting money needed for treatment	Big problem	1451	65.0
	Not a big problem	781	35.0
distance to health facility	Big problem	764	34.2
	Not a big problem	1468	65.8

IV 2. Bivariate Analysis

Problem

To identify the association between Socio-Economic, Socio-Cultural, Geo-demographic factors and access to antimalaria measures among children under 5 years in Burundi.

Hypotheses

H1: There is a significant association between socioeconomic factors and access to antimalarial measures in Burundi among children under 5 years.

H2: There is a significant association between socio-cultural factors and access to antimalarial measures in Burundi among children aged 5 years old.

H3: There is a significant association between geo-demographic factors and access to antimalarial measures.

Table 2. Relationship between Socio-Economic Factors and children under 5 years on access to Malaria medecine.

Variables	Values	Malaria Medicine Access			Chi-square	P-value
		No access	access	Count		
Education attainment of Women	No education	383(35.4%)	698(64.6%)	1081	12.077	.030
	Primary	355(40.0%)	532(60.0%)	887		
	Secondary and others	60(22.8%)	204(77.2%)	264		
Husband's level of education	No education	380(34.7%)	714(65.3%)	1094	17.778	0.0001
	Primary	338(38.9%)	532(61.1%)	870		
	Secondary and others	130(48.5%)	138(51.5%)	268		
Access to information	Access	429(38.4%)	689(61.6%)	1118	.137	.712
	No Access	419(37.6%)	695(62.4%)	1114		
Household standard of living	Poor	342(39.9%)	516(60.1%)	858	9.085	.011
	Moyen	316(34.4%)	603(65.6%)	919		
	Rich	120(26.4%)	335(73.6%)	455		
Have mosquito net	No	358(37.4%)	599(62.6%)	957	.243	.622
	Yes	490(38.4%)	785(61.6%)	1275		
Getting money needed for treatment	No problem	0	0.0%	0	.378	.539
	Big problem	558(38.5%)	893(61.5%)	1451		
	Not a big problem	290(37.1%)	491(62.9%)	781		

According to the table, there seems to be a significant correlation between women's educational attainment and access to antimalaria measures, as well as between husbands' educational attainment and household quality of life, at a five percent significance level. This suggests that better levels of education for spouses and wives may be associated with increased malaria control.

Table 3. Relationship between Socio-Cultural Factors and children under 5 years on access to Malaria medicine.

Variables	Values	Malaria Medicine Access			Chi-square	P-value
		No access	Access	Count		
Religion	Catholic	481(37.3%)	810(62.7%)	1291	2.333	.311
	protestants	311(40.9%)	449(59.1%)	760		
	Muslims and others	61(39.6%)	93(60.4%)	154		
Women's economic activity	Farmer	676(36.4%)	1181(63.6%)	1857	31.913	.0001
	Others	65(45.5%)	78(54.5%)	143		
	Service	37(28.03%)	95(71.97%)	132		
	Business women	30(41.1%)	43(58.9%)	73		
Husband's economic activity	Farmer	700 (44.2%)	884(55.80%)	1584	24.994	0.0001
	Service	96(26.2%)	271(73.8%)	367		
	Others	76(55.9%)	60(44.1%)	136		
	Business man	45(38.1%)	73(61.9%)	118		
Sex of household head	Male	741(38.8%)	1171(61.2%)	1912	.258	.611
	Female	112(38.2%)	181(61.8%)	293		

The results show that there is a significant correlation between the wife and her husband's economic activity and the availability of antimalarial medication for children under five in Burundi, as indicated by the Pearson chi-square test. This implies that children who live with a married couple who are both employed have good health.

The head of the household's sex or religion, however, do not substantially correlate with the accessibility of antimalarial drugs.

Table 4. Relationship between Geo-demographic Factors and children under 5 years on access to antimalarial drugs

Variables	Values	Access on anti-malaria measures			Chi-square	P-value
		No access	Access	Count		
Place of residence	Rural	725(38.8%)	1142(61.2%)	1867	.016	.900
	Urban	128(37.9%)	210(62.1%)	338		
Region of residence	Central East	300(45.9%)	353 (54.1%)	653	18.661	.001
	South	241(41.7%)	337(58.3%)	578		
	North	197(35.4%)	359 (64.6%)	556		
	West	151(43.1%)	199(56.9%)	350		
	Bujumbura-Mairie (capital)	36(52.9%)	32(47.1%)	68		
Getting medical help for self: distance to health facility	No problem	0.0%	0.0%	0	.577	.447
	Big problem	280(37.1%)	474(62.9%)	754		
	Not a big problem	573(39.5%)	878(60.5%)	1451		

Number of children in the household	None	29(39.2%)	45(60.8%)	74		
	1-3 children	343(36.9%)	587(63.1%)	930		
	4-6 children	281(37.4%)	470(62.6%)	751		
	7 children and more	200(44.4%)	250(55.6%)	450	10.982	.012
Mother'age in 5-year groups	15-19	13(27.1%)	35(72.9%)	48		
	20-24	117(35.2%)	215(64.8%)	332		
	25-29	176(36.8%)	302(63.2%)	478		
	30-34	186(40.2%)	277(59.8%)	463		
	35-39	139(39.2%)	216(60.8%)	355		
	40-44	140(45.3%)	169(54.7%)	309		
	45-49	82(37.3%)	138(62.7%)	220	13.475	.036

Chi-square testing reveals a strong correlation between the mother's age, the number of children living in the home, the region of residency, and the availability of antimalarial medication for Burundian children under five.

IV.3 Binary Logistic Regression

In the preceding chapter, we observed several factors related to access to anti-malaria drugs in a bivariate analysis. However, we expressed reservations regarding the persistence of these relationships because bivariate analysis does not take into account the effects of other variables present, which could inhibit or mediate the relationship. Thus, to verify the strength of these relationships and test our research hypotheses, this chapter will analyze the determinants of accessibility to medication through the method of binary logistic regression. This method requires, among other conditions, the absence of multicollinearity issues among the variables to be used, as well as adequacy and validation of the model.

IV.3.1 Multicollinearity

The application of binary logistic regression method requires that the variables used are not strongly inter-correlated. Checking for multicollinearity is done by comparing the "Tolerance" statistic with the value of "0.3". If the value of VIF>3.3 (equivalent to Tolerance<0.3), it means that the corresponding variable is a linear combination of one or more other variables and should therefore be eliminated from the model.

$$\text{Tolérance} = 1 - R_{ij}^2$$

Rij represents the coefficient of linear correlation between the variables Xi and Xj. This measures the strength and direction of the linear relationship between these two variables.

Table 5. Multicollinearity

	Collinearity Statistics	
Variables	Tolerance	VIF
Religion	.913	1.096
Educational attainment of women	.693	1.443
Region of residence	.874	1.144
Number of children in the household	.511	1.957
Husband's level of education	.904	1.107
Place of residence	.610	1.640
Access to Information	.827	1.210
Mother ‘age in 5-year groups	.514	1.944
Sex of household head	.939	1.065
Have mosquito bed net for sleeping (from household questionnaire)	.921	1.085
Getting medical help for self: getting money needed for treatment	.816	1.225
Getting medical help for self: distance to health facility	.891	1.122
Household standard of living	.534	1.873
Mother's economic activity	.670	1.492
Father's economic activity	.790	1.266

Based on the results presented in the preceding table, no variable has a tolerance value lower than 0.3. Therefore, no problem of strong inter-correlation is detected among the variables to be used. This allows us to retain all our variables for the logistic regression model.

IV.3.2 Adequacy and validation of the model

The Hosmer-Lemeshow test evaluates whether the logistic regression model provides a good fit to the observed data by comparing expected and observed outcomes across various groups. A non-significant result indicates that the model accurately represents the relationship between the independent variables and the outcome variable.

Table 6. Model adequacy and validation Test

	Adequacy of the model (Pearson)	Validation of model (Hosmer-Lemeshow)
Chi-deux	387,624	13,580
Sig.	0,0001	0,093

The Pearson Chi-square of the saturated model is 387.624 with a significance of 0.000. This means that the model is adequate and, consequently, there is at least one variable in the model that discriminates the dependent variable.

An assessment of model fit is the Hosmer and Lemeshow Test. In cases where the significance value is less than 0.05, the Hosmer-Lemeshow statistic suggests a poor fit. In this case, the model fits the data quite well. As a result, the observed and predicted data are identical.

Table 7. Explanatory power of the model

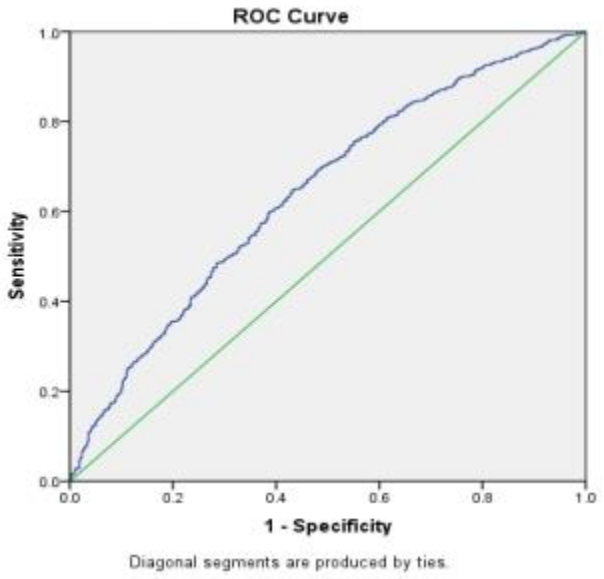
Step	Cox & Snell R Square	Nagelkerke R Square
1	.341	.460

The table shows that between 34 percent to 46 percent of the variance in the dependent variable are explained by the model.

IV.3.3 The Receiver Operating Characteristic

A graphical plot called the ROC curve shows how well a binary classifier system can diagnose problems as its discrimination threshold is changed. For various threshold values, it plots the true positive rate (sensitivity) against the false positive rate (1-specificity).

Figure 9. Roc curve



The area under the ROC curve in the figure is 0.7. This means that the overall explanatory power of the model is 70%. Thus, since the conditions for applying the logistic regression model are met, we can confidently proceed with the analysis.

Table 8. Binary logistic regression results

variables	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Religion	-.064	.074	.731	1	.393	.938	.811	1.086
Education of women	.876	.187	21.859	1	.000	2.400	1.663	3.120
Region	-.139	.041	11.337	1	.001	.870	.802	.943
Number of children	-.134	.076	3.119	1	.077	.875	.754	1.015
Education of husband	.474	.185	6.528	1	.011	1.606	1.117	2.311
Place of residence	-.090	.026	14.402	1	.000	0.914	0.872	0.957
Information	.015	.098	.022	1	.881	1.015	.837	1.230
Mother's Age	-.051	.038	1.796	1	.180	.950	.881	1.024
Sex of head of household	.048	.134	.129	1	.719	1.049	.807	1.364
Mosquito net	-.040	.094	.182	1	.669	.961	.799	1.155
Distance	-.087	.099	.765	1	.382	.917	.754	1.114
Standard of living	.188	.082	5.204	1	.023	1.207	1.027	1.419
Mother's activity	.596	.164	13.150	1	.000	1.816	1.315	2.506
Father's activity	.610	.151	16.358	1	.011	1.840	1.369	2.473
Constant	1.791	.390	21.123	1	.000	5.994		

The significant p-values for variables such as education of women, region, education of husband, place of residence, standard of living, mother's activity, and father's activity indicate that these variables are statistically associated with Access to antimalarial measures among Children Under 5 Years in Burundi.

The binary outcome variable, denoted as Y, represents whether an individual has access to antimalaria measures (1 = Yes, 0 = No).

Equation

Logit(P(Y=1) = 1.791+ 0.876 Education of Women – 0.139 Region + 0.474 Education of husband – 0.090 Place of Residence +0. 188 Standard of living + 0.596 Mother's activity + 0.61 Father's activity

Interpretation:

- The intercept term (1.791) represents the baseline log odds of having access to antimalaria drugs when all predictor variables are zero
- For each one-unit increase in the education level of women, the log odds of accessing antimalarial drugs increase by 0.876, holding all other variables constant.
- For each one-unit increase in the region variable, the log odds of accessing to antimalarial drugs decrease by 0.139, holding all other variables constant.
- Positive coefficients (e.g., Education of Women, Education of husband, Standard of living, Mother's activity, Father's activity) indicate factors associated with higher odds of access,

while negative coefficients (e.g.,Place of Residence, Region) suggest factors associated with lower odds of access to antimalarial drugs.

To understand which specific values within each significant variable, have an impact on access to antimalaria drugs, we adopt a method of backward stepwise likelihood. This approach ensures thorough consideration of interactions with independent variables, allowing us to discern the true determinants of access to medical treatment for young children.

Table 9. Direct effects and Indirect effects of the independent's variables on Access to malaria medicine

variables	Direct effects	indirect effects						
	M0	**M1**	**M2**	**M3**	**M4**	**M5**	**M6**	**M7**
Place of residence								
Rural	0,239*	0,230*	0,229*	0,230*	0,230*	0,229*	0,229*	0,230*
Urban	REF	REF	REF	REF	REF	REF	REF	REF
Religion								
Christians	REF	REF	REF	REF	REF	REF	REF	REF
Musulmans	1,346	1,421	1,410	1,415	1,412	1,432	1,429	1,439
others	2,119*	0,705	,704	0,702*	0,702*	0,712	0,709	0,707
Region								
North	REF	REF	REF	REF	REF	REF	REF	REF
Central-East	1,161	0,962	0,961	0,955	0,951	0,941	0,941	0,943
Central-west	1,107	0,935	0,934	0,925	0,919	0,919	0,916	0,917
South	1,04	0,523*	0,524*	0,517*	0,515*	0,510*	0,512*	0,516*
Bujumbura-Mairie	0,644*	0,803	0,780	0,774	0,766	0,756	0,755	0,755
Mother's activity								
Farmers	REF	REF	REF	REF	REF	REF	REF	REF
Business women	1,074	0,709	0,703	0,705	0,708	0,705	0,708	0,707
Service	0,813	1,480*	1,470*	1,474*	1,468*	1,442*	1,451*	1,436*
Others	1,646*	0,809	0,805	0,808	0,809	0,810	0,810	0,810
Father's activity								
Farmers	REF	REF	REF	REF	REF	REF	REF	REF

Business man	1,144	1,039	1,038	1,041	1,039	1,043	1,049	1,052
Service (Fonctionnaire)	1,259	0,859	0,858	0,861	0,861	0,859	0,861	0,861
Others	1,21	0,702*	0,703*	0,703*	0,708*	0,712*	0,708*	0,706*
Mother's education								
No education	REF	REF	REF	REF	REF	REF	REF	REF
Primary	0,757*	1,099	1,099	1,099	1,103	1,119	1,123	1,129
Secondary et more	0,850	1,297	1,289	1,292	1,297	1,338*	1,356*	1,379*
Father's education								
No education	REF	REF	REF	REF	REF	REF	REF	REF
Primary	0,935	0,944	0,944	0,945	0,943	0,954	0,955	0,957
Secondary and more	0,867	1,186	1,184	1,186	1,196	1,217	1,218	1,218
Standard of living								
Poor	REF	REF	REF	REF	REF	REF	REF	REF
Moyen	0,923	0,997	0,997	0,998	0,997	0,995	1,011	1,009
Rich	0,87	1,176	1,169	1,176	1,178	1,162	1,191*	1,189*
Access to information								
No access	0,915	1,072	1,072	1,072	1,077	1,076		
Access	REF	REF	REF	REF	REF	REF		
Mother's age								

Under 25 years	REF	REF	REF	REF	REF			
25-34 years	1,264*	0,911	0,910	0,912	0,900			
35-49 years	1,07	0,866	0,866	0,866	0,862			
Number of children								
1 child	REF	REF	REF	REF				
2 children	1,166	0,902	0,901	0,901				
3 children and more	1,004	0,968	0,967	0,967				
Distance to heath facilities								
Big problem	0,877*	0,949	0,952					
No problem	REF	REF	REF					
Sexofheadofhousehold								
Female	1,069	0,953						
Male	REF	REF						

Significance: * p<0,05

CHAPTER V. CONCLUSION, SUMMARY, AND RECOMMENDATION

V.1 Summary

The study shows that the following variables might be thought of as factors explaining access to medical treatment based on the results of this table: The factors are household quality of living, region, place of residence, mother's and father's economic activities, and the educational attainment of both parents.

- Compared to children residing in the northern area, those living in the southern region had a 48.4% lower likelihood of receiving therapy.
- Children whose mothers are employed by the government are 1.4 times more likely to receive medical care than children whose mothers are farmers.
- Compared to children whose father is a farmer, children whose father does not engage in any income-generating activity have a 29.4% lower likelihood of receiving therapy.
- Offspring of mothers with a secondary education or above are 1.3 times more likely to receive therapy than offspring of mothers without any formal education.
- Compared to children living in urban areas, children residing in rural regions have a 77% lower likelihood of receiving medical care.
- Children who grow up in high-income families are 1.18 times more likely to receive medical care.

Other factors that have been eliminated from the model because they are not significant, include religion, geographic accessibility, woman's age, number of children, child's age, and information availability.

V.2 Conclusion

According to our research, Burundi's under-five medical care policy is influenced by a number of factors, including the children's residence, the employment status of their parents, their educational attainment, and the family's income. Compared to children in rural areas, urban children have better access to healthcare. Children who have parents who work in public services or who have greater levels of education are more likely to receive medical care. A study conducted in Malawi by Chilanga, E., Collin-Vézina, D., et al. supports this conclusion by emphasizing the significance of parental profession and education. In a same vein, educated women attend more prenatal care visits than uneducated women, according to 2020 Burundian research by Ahinkorah, B. O., et al.

Furthermore, rich families find it easier to obtain their kids the healthcare they need, while those in less fortunate financial situations find it more difficult to receive the care they require. This is consistent with research from Ethiopia and Kenya by Assefa T., Belachew T., et al., which found that children's inability to pay for medical treatment was a barrier.

It is crucial to take them into account and adopt a comprehensive strategy that tackles geographic, educational, occupational, and economical inequities in order to increase children's access to healthcare in Burundi.

V.3 Recommendation

Naturally, prevention is preferable to treatment. The risk of malaria in Burundian children under five might be decreased with carefully thought-out health education and intervention programs. Thus, the malaria burden among children under five in Burundi may be effectively decreased by policies that maximize individual and organizational commitment to strengthening malaria control activities and that support low-income groups' access to malaria diagnosis, treatment, and prevention tools.

Policies pertaining to free child healthcare should be reinforced in order to increase the number of children in Burundi who receive medical treatment and increase the availability of medicine in public health facilities. The government should also set up a centralized emergency call system that includes nurses and doctors. Through this approach, patients may get in touch with medical experts before arriving at the hospital for prompt consultation and first treatment.

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APPENDICES

Ethical approval

Since secondary data utilized in this study are publicly available, no further permission was needed. However, the authors applied to MEASURE DHS for permission to use the data, and they were granted permission.

Data accessibility

Demographic and Health Surveys (DHS) provided the data for this study, which can be accessed at https://dhsprogram.com/data/dataset_admin/index.cfm.

Apr 15, 2024

Francine NIYOMWUNGERE
Near East University
Turkey
Request Date: 04/14/2024

Dear Francine NIYOMWUNGERE:

This is to confirm that you are approved to use the following Survey Datasets for your registered research paper titled: "Factors Influencing Access to Malaria Control Measures for Children Under 5 years in Burundi":

Burundi

To access the datasets, please login at: https://www.dhsprogram.com/data/dataset_admin/login_main.cfm. The user name is the registered email address, and the password is the one selected during registration.

The IRB-approved procedures for DHS public-use datasets do not in any way allow respondents, households, or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each enumeration area (Primary Sampling Unit) has a PSU number in the data file, but the PSU numbers do not have any labels to indicate their names or locations. In surveys that collect GIS coordinates in the field, the coordinates are only for the enumeration area (EA) as a whole, and not for individual households, and the measured coordinates are randomly displaced within a large geographic area so that specific enumeration areas cannot be identified.

The DHS Data may be used only for the purpose of statistical reporting and analysis, and only for your registered research. To use the data for another purpose, a new research project must be registered. All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey. Also, be aware that re-distribution of any DHS micro-level data, either directly or within any tool/dashboard, is not permitted. Please reference the complete terms of use at: https://dhsprogram.com/Data/terms-of-use.cfm.

The data must not be passed on to other researchers without the written consent of DHS. However, if you have coresearchers registered in your account for this research paper, you are authorized to share the data with them. All data users are required to submit an electronic copy (pdf) of any reports/publications resulting from using the DHS data files to: references@dhsprogram.com.

Sincerely,

Bridgette Wellington

Bridgette Wellington
Data Archivist
The Demographic and Health Surveys (DHS) Program