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Health and Technology: Online platform to facilitate access to care and prevention for chronic non-communicable conditions in Rwanda

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I approve this capstone as partial fulfillment of the requirements for the Master of Development Practice.

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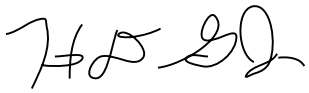

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Acronyms and Abbreviations

AIDS: Acquired Immunodeficiency Syndrome

CDC: Center for Disease Control

DALY: Disease-Adjusted Life Years

EICV: Integrated Household Living Conditions Survey

GDP: Gross Development Product

HIV: Human Immunodeficiency Virus

M&E: Monitoring and Evaluation

MEDSAR: Medical Student Association of Rwanda

NCD: Non-communicable Diseases

NGO: Non-Governmental Organization

RBC: Rwanda Biomedical Center

RNCDA: Rwanda Non-Communicable Disease Alliance

RSSB: Rwanda Social Security Board

UNAIDS: Joint United Nations Program on HIV/AIDS

UNDP: United Nations Development Program

USAID: United States Agency for International Development

WHO: World Health Organization

Personal Statement

Non-communicable diseases (NCDs), also (confusingly) known as chronic diseases, are diseases that are not transmitted from person to person. They are generally of long duration and slow progression. The most common NCDs are cardiovascular diseases (such as coronary heart disease, stroke, hypertension), cancers, chronic respiratory diseases (such as asthma), diabetes, chronic neurological diseases (such as Alzheimer's, dementia), and musculoskeletal diseases. I have personally been in contact with NCD patients both as a volunteer at the Rwanda NCD Alliance where I worked as a screening and follow-up volunteer during bi-weekly community sport events. During those events, I got the opportunity to meet patients, advocates, and health professionals whose main interests converged on fighting against NCDs. I was able to understand NCDs from diverse perspectives, and I am convinced that with my development experience, I can add value to that struggle by contributing to the improvement of NCD patient outcomes and prevention efforts. I also worked as a healthcare manager in a medical practice where I not only experienced the high incidence and prevalence of NCDs, especially in younger populations (less than 40 years old) but also noted poor knowledge in terms of healthy behavior and outlets where patients can get medicine for treatment.

As a healthcare leader, it is always painful to see people becoming sick or those with underlying conditions aggravated because of poor access to care or lack of information. With Rwanda putting technology at the forefront of its development and advancement of digital health strategies, I propose the creation and use of technology to provide patients and those at risk of NCDs in Rwanda with a solution to facilitate their access to drugs and much-needed information to improve care and prevention. A digital platform for those at risk of NCDs will allow them to order and get drugs delivered to them, read information that educates them about their

conditions, and talk to health professionals that provide them with advice and medical follow up. I believe that this platform will be my contribution to my country's struggle against NCDs.

Executive Summary

Rwanda is confronted with a growing problem of non-communicable diseases (NCD). It is important that people in Rwanda have access to effective prevention and treatment. This paper explores a program that would use a digital platform to facilitate access to information, services, and products that would help NCD at risk populations in Rwanda to access appropriate prevention and care. The program was developed based on the author's experience in Rwanda's healthcare industry, the information from review of literature as well as key informant interviews (NCD patients, advocates, and caregivers) and a survey with health professionals. The research conducted highlighted that there is a need for improvement in health education and access to services and products used for NCDs. The program will serve as a one-stop center for NCD prevention and care services.

Introduction

Rwanda is a small landlocked country in East Africa. With a population of approximately 13 million and a population density of 512 people per square kilometer, it is one of the most densely populated countries in the world. The Rwandan population is young with more than half of the population aged under 25 (Worldometer, 2020). With the progress that it has made in lifestyle and healthcare, Rwanda's life expectancy has increased by 4.3% from 66.9 years in 2014 to 69.7 years in 2020, according to the National Institute of Statistics of Rwanda (2020).

Since 1994, Rwanda has made considerable progress after the tragedy of the Genocide against the Tutsis of 1994 that left around one million people dead and another two million in exile. In the wake of that tragedy, the country has started rebuilding itself as a nation and improving the healthcare system was one of its priorities. There has been substantial social development leading to improvement in terms of general health with the successful implementation of a nationwide universal health scheme (known as Mutuelle de Santé); development of the healthcare infrastructure; and the control of healthcare issues such as the Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome (HIV/AIDS), child and maternal mortality, and malnutrition. For example, the national community-based health insurance scheme reports an enrollment rate of 88% of the total population (RSSB, 2021) and according to UNICEF (2020), the under-five mortality rate dropped from 149.6 per 1,000 in 2000 to 40.5 per 1,000 in 2020. In addition, the Center for Control Diseases (CDC) (2019) classifies Rwanda as a country on a good track in HIV control regarding the 95-95-95 UNAIDS targets (95% of people living with HIV know their status, 95% of people who know their HIV-positive status are on antiretroviral treatment, and 95% of people on treatment are virally

suppressed) (UNAIDS, 2021). Rwanda has attained 84-98-90 among the adult population. HIV prevalence has decreased from 22% of the population in 1996 and stabilized at 3% since 2005 (NISR, 2020).

However, the socio-economic progress and change in lifestyle has raised a considerable threat to health status and the healthcare system due to the increase in the prevalence of non-communicable diseases (NCDs). With increasing urbanization, people are more likely to lead a lifestyle that promotes less mobility and more processed food. Those elements have been proved by the World Health Organization (2021) to be determinants of NCDs like cancer, cardiovascular disease, chronic respiratory disease, and diabetes. In 2020, NCDs account for approximately 58 percent of all deaths in the country according to the National Strategy and Costed Action Plan for the Prevention and Control of Non-Communicable Diseases in Rwanda (2020). This is a sharp increase from the World Health Organization estimate of the NCD death toll in Rwanda at 36% in 2015 and 44% in 2018. A report from the Institute for Health Metrics and Evaluation (IHME) noted that NCDs are significant contributors to morbidity and mortality in Rwanda, accounting for 35 percent of disability adjusted life years[1] (DALYs), up from 16 percent in the 1990s. The increase in the prevalence of NCDs is partly related to the increase in life expectancy. By living longer and changing lifestyle, people may live long enough to achieve an age where they are at increased risk of getting NCDS. For instance, between 2000 and 2018, the average life expectancy at birth increased from 47 years to 69 years which means an increase of the at-risk population (World Bank, 2021).

[1] DALY is a statistic that measures the overall burden of a disease. One DALY represents the loss of the equivalent of one year of full health.

The progress made in healthcare to reduce the burden of communicable diseases now needs to be applied with the same commitment to tackle NCDs. It is important that Rwanda invest more effort to meet the WHO's goal of reducing the NCD death toll to the previously set goal of 25% by 2025 (Center for Diseases Control et al., 2015).

The Government of Rwanda has started mobilizing different stakeholders such as international partners (such as the World Health Organization, Center for Disease Control, Partners In Health, Clinton Health Access Initiative), local NGOs (Rwanda NCD Alliance, Rwanda Red Cross, etc.), and private operators (such as the Rwanda Private Sector Federation) to contribute to the fight against NCDs. For example, there have been policies, research, and campaigns to tackle NCD determinants. We can highlight for instance, the collective sports activities that happen every two weeks, the "GERAYO AMAHORO" road safety campaign, policies on tobacco control, community and school sports, as well as the NCD risk factor surveys. Those efforts have shown some results. For example, one "Car Free Day" sports event can have an attendance of up 7,000 people who walk, bike, or run and receive messages about NCDs awareness as well as NCD screening (City of Kigali, 2022). The "GERAYO AMAHORO" launched in May 2019 campaign reduced the road accident rate by 42% in the first year (The New Times, 2020). However, there is still work that needs to be done in terms of access to healthcare products and information for NCD chronic patients and other groups at risk. From the research I have conducted with healthcare providers, NCDs activists, patients, and caregivers the common themes have been the lack of awareness about NCD risk factors and best practices to control them, as well as the disparities in access to NCD care (products and services) and information based on the income level and areas where they live (urban versus rural). In fact, 21 among the 24 healthcare providers who participated in my survey agreed that their patients

have difficulties accessing medicines timely and consistently. The provided causes are living far from the healthcare facilities and frequent shortages in public facilities who provide the medicines at lower prices. This makes NCDs' care and prevention a matter that should engage not only the government, but also each and everyone in the Rwandan community.

This literature review will focus on NCDs in Rwanda, exploring the current situation, existing policies, and solutions that were put in place to prevent and control NCDs. NCDs are still a global public health issue that both public and private actors are working hard to address.

While identifying relevant literature, I found that scholarship focuses on policy to prevent and control NCDs, as well as innovation in technology as a strong driver of solutions to bend the arc of the NCD burden. Technology offers many opportunities, but it also presents some gaps and barriers that need to be addressed to take full benefit of it. There is a gap in the literature with respect to Rwanda on this topic, and that is one of the reasons I chose to design a research study to respond to the question: **"How should technology be used to improve access to care and prevention to people with chronic non-communicable conditions in Rwanda?"**

I am interested in this research question because Rwandan healthcare, NCDs included, is still a widely researched area outside the clinical[2] domain. As a development practitioner, I wanted to understand the role I can play in the fight against NCDs by bringing the technology aspect as a contributive solution to reducing the burden of NCDs in Rwanda. I am also interested in the holistic, systemic view of addressing NCDs given the critical role of lifestyle and environmental factors in NCD prevalence. Indeed, NCDs cannot be addressed with consideration of the clinical aspect only. Most of the studies done in Rwanda about healthcare in general, and

[2] Clinical health services comprise activities relating to diagnosis, therapy, rehabilitation, prevention, and palliative care as opposed to other business activities in healthcare.

NCDs in particular, relate to their clinical aspect only. This study aims to contribute to the non-clinical aspect of healthcare focusing on how business and technology can contribute to healthcare.

Review of Literature

The literature comprises various themes ranging from NCD-related burden and policies, NCD management effort including the role of new technology developments, and challenges and opportunities in NCDs prevention and control.

Rwanda has a high NCD burden like many other sub-Saharan African countries. Rwanda is not an isolated case in the sub-Saharan Africa region. NCDs constitute a growing morbidity and mortality burden in sub-Saharan Africa as shown in a study by Mudie et al. (2019) whereas the regional prevalence was estimated to be 48% for hypertension, 5.1% for diabetes, and 20% for obesity. NCDs are also expected to change the pattern of disease occurrence in sub-Saharan Africa, and it is projected that NCDs will overtake infectious diseases as major sources of morbidity and mortality by 2030 (Mudie et al.). Specifically for Rwanda, a study by Nahimana et al. (2017) showed that the prevalence of hypertension in Rwanda was 15.3% while, according to the NCD strategy of 2020, these diseases accounted for 58% of all deaths in Rwanda. The World Health Organization (2018) estimated that 44% of the total annual mortality in Rwanda was due to NCDs, the leading among them being cardiovascular diseases, cancer, chronic respiratory diseases, and diabetes. The considerable increase in NCD prevalence is attributable to changes in lifestyle caused by urbanization (less physical activities and changes in diet). Given the WHO's 2025 target of reducing NCD prevalence to 25% (Rwanda Non-Communicable Diseases Risk

Factors Report, 2015), the data explored above makes that target practically unachievable for Rwanda, and justifies that more effort is needed to tackle NCDs.

The increasing rates of NCDs are guiding efforts outlined in the Rwanda Non-Communicable Diseases National Strategic Plan I (2014) and the National Strategy and Costed Action Plan for the Prevention and Control of Non-Communicable Diseases in Rwanda July 2020-June 2025 (2020). These plans were created in an effort to put a coordinated approach in place in NCD prevention, care, and control. The first strategic plan provided guidance on how to improve access to products and information, early detection, and develop reliable monitoring and evaluation (M&E) systems, and develop funding channels. In reviewing the two strategies, there is clear progress made in terms of the funds allocated to NCD prevention and control as well as learning from the first strategy. Some of the lessons learned were the necessity for a multi-sectoral approach to NCDs by involving public, private, and international actors. Moreover, an emphasis was put on individual and community involvement to raise awareness about NCD prevention. In the new strategic plan, there has been a consideration of the learning from the first strategy but also a will to align NCD prevention and control with key national policies and plans such as the Rwanda National Strategy for Transformation which is a 7-year (2017-2024) government program providing the guideline to achieve the trajectory to the country's Vision 2050. For example, with the new strategy, more emphasis is put on strengthening health systems for quality NCDs early detection, care, and treatment at all levels. This will be achieved by empowering healthcare facilities with infrastructure, human resources, data management systems, and funds specifically NCDs. This strategy also gives priority to strengthening intersectoral coordination, advocacy, and resource mobilization for the prevention and control of NCDs. This is an important aspect because the fight against NCDs has also been hindered by the

lack of coordination among the sectors concerned such as healthcare, education, sports, local administrations, private sector, and international partners. which makes it difficult to make enough progress. In many Sub-Saharan African countries, there are problems such as weak political will, lack of awareness across sectors, and inadequate resources that complicate action to address NCDs (Juma et al., 2018). NCDs are not only a matter of public health: their management depends on policy, business, security, and many more domains (Boudreaux, 2020). For instance, the National Strategy and Costed Action Plan for the Prevention and Control of Non-Communicable Diseases in Rwanda (2020) highlights that among many socioeconomic impacts of NCDs, a rise of 10% in NCDs is associated with a decrease of 0.5% of the annual economic growth. Additionally, the Fifth Integrated Household[3] reported a financial shock over a period of 12 months, due to serious illness or accident among household members. Thus, after those observations, NCDs do not only affect individuals' health, but they also have an impact on the community and national wellbeing in terms of socioeconomic and security status. It is important that NCDs should be handled in a synchronized manner where various actors participate. A multisectoral approach guides the current strategic plan in Rwanda where various actors such as ministries (sports, education, local government), security organizations, international and local NGOs, and the private sector were involved in the design of the strategy but also are expected to participate in its implementation. My research and proposed solution adopt this perspective of multisectoral action against NCDs.

NCDs have also been impacted by the Covid pandemic. NCDs are a known aggravating factor of Covid cases, requiring health professionals to abruptly change their management

[3] The Integrated Household Living Conditions Survey is a survey run by the National Institute of Statistics of Rwanda that provide information on changes in the well-being of the population such as poverty, inequality, employment, living conditions, education, health and housing conditions, household consumption.

operation mode and to pay more attention to NCDs (Chudasama et al., 2020). On one hand, the global pandemic had devastating effects on economies, which caused a reallocation of funds devoted to healthcare in general and NCDs prevention and control in particular. During the pandemic, it became hard to access health commodities especially for countries like Rwanda who depend on imports. The drug supply was interrupted mainly because of the disruption in global logistics but also due to the panic buying practice that made the rich buy more than needed as a precaution which led to a potential shortage affecting the poor buyers (Global Financing Facility & World Bank, 2021). On another side, patients with certain chronic illnesses such as diabetes, cardiovascular disease, chronic respiratory illness, and chronic kidney and liver conditions—were more likely to be affected by Covid-19 (NCD Alliance, 2021). Those with NCDs had a much higher risk of contracting the virus, developing more severe forms of the disease, and dying of it. Covid-19 became a common comorbidity to NCD patients. Comorbidities are diseases that occur in combination, as opposed to isolated conditions. Bayliss et al. (2013) noted that patients with comorbidities experience barriers in self-care such as problems with medications and worsening of one condition caused by the symptoms or treatment of the other. This being said, appropriate technology leverage was proven to be an effective weapon against the spread of the virus, thus benefiting high-risk groups such as NCD patients. For instance, technology tools such as drones and robots have been used to facilitate access to medications while minimizing contact for contagious patients and people in remote areas (Musanaganwa et al., 2020). Drones have been used in delivery of health commodities such as blood, drugs, and vaccines to remote healthcare facilities while robots were used in screening. Also, audio visual technologies have been used to transmit preventive information to large audiences while electronic gadgets (watches, phones, etc.) facilitated case contact tracing and

daily monitoring of patients' health conditions (Saher & Anjum, 2021). Thus, NCD management can learn from some of the technology strategies used in fighting the Covid-19 pandemic to improve NCD care and prevention.

Rwanda is making relatively good progress in terms of engaging different stakeholders, mobilizing funds and other innovations to improve NCD care and prevention. For instance, in 2020, the government sought to mobilize $640 million to tackle NCD-related mortality to finance the first strategic plan's implementation and the targeted amount for the second strategic plan is set even higher to reach $358.15 million by 2025 (Kuteesa, 2020). That effort put into raising funds shows a national will to defeat NCDs with a focus put on prevention, screening, diagnosis, and treatment of those diseases as well as advocacy and preventive education. Besides, Rwanda is supporting a knowledge-based growth pathway, and technology should play a great role in all the highlighted areas of NCDs prevention and care. A considerable portion of the funding should be allocated to technological solutions. It will not be the first time that Rwanda distinguishes itself in technological innovation use in healthcare. We can cite examples such as the use of drones to facilitate the supply of blood to geographically inaccessible areas and spray mosquito habitats to prevent malaria or the use of robots to screen for Covid-19 symptoms (Ministry of Health, 2020). A good number of healthtech enterprises have stemmed in Rwanda. Technology solutions include online consultations (Babyl Rwanda), covid screening and patient services (Zorabots), online pharmacy and medicine delivery (Afiapharma, Dotpharma, Kasha), electronic health recording (Clinic Plus, Kalisimbi Technologies), drone-supported supply chain (Zipline), etc.

Despite the progress made in Rwanda on aspects such as infrastructure and technology, patients with chronic NCDs still encounter issues in accessing pharmaceutical products, a

problem highlighted in the Rwanda NCD National Strategic Plan (2014) section on geographical, community health, and financial accessibility to provide quality health services. Also, the existing technology solutions are not interoperable to provide users with holistic service. Moreover, most of the technologies address care but put less emphasis on prevention. To address this problem, Rwanda launched an innovative model in 2005 to provide NCD services in rural areas to decentralize NCD care in district hospitals and health centers. In his preface to the National Strategy and Costed Action Plan for the Prevention and Control of Non-Communicable Diseases in Rwanda (2020), Dr. Ngamije, the Minister of Health, acknowledged that even if there was great progress accomplished in disease control and universal access to healthcare, NCDs will remain a particular challenge. Indeed, according to the strategy, the NCDs burden has increased to 58% of all deaths in the country from 36% at the time of the first strategic plan in 2015. The increase was mainly caused by the changes in lifestyle. The universal truth about NCDs is that they are largely preventable. Thus, investing in prevention contributes to the reduction of the disease and at the same time saves the expenses that should be spent on expensive treatments. However, a certain attention ought to be paid to the treatment of existing cases as well, and technology is a great tool for both care and prevention. One of the priorities of the current strategy is to address access to basic technologies for NCDs screening and management.

Beyond technological innovation, effective healthcare needs to pay attention to equitable access. Thus, aspects such as social, economic, and gender equity should be seriously considered. Rwanda is a country that has made considerable progress in terms of gender equity. In 2017, the UNDP (2018) classified Rwanda as one of the global leaders in closing the gender gaps. It emerged fourth right after three Scandinavian countries (Iceland, Finland, and Norway).

Gender equity is observed in some aspects of society such as education where gender parity was achieved in primary and secondary education with attendance rates of 85% for girls and 84% for boys. Additionally, in the economic sector, women's labor force participation is one of the highest in the world (86%) according to the UNDP Rwanda Gender Equality Strategy (2019-2022). However, there are still gender issues in healthcare access that pose barriers to some health outcomes. For instance, the USAID (2014) noted that there is a lack of male engagement in caregiving and domestic work that hinders women from looking for health information and services. This adds to some social norms and stigmas that may cause vulnerable people (illiterate people, women, people with disabilities) to have difficulty accessing the services in healthcare facilities. Additionally, women in Rwanda are at higher risk of contracting NCDs as highlighted in a study by Nuwagaba and Williams (2018) that found in 2010, 25% of Rwandan women in urban areas and 15% in rural areas were overweight or obese, which is beyond the 14% average of people aged 15 to 64 years who are overweight or obese. One of the recommendations that Nuwagaba and Williams (2018) provided is incorporating eHealth and mHealth[4] components in the national healthcare system. Indeed, the internet and mobile services penetration is high (in 2017, 4 million people had access to internet and 8 million people were subscribed to mobile services). Those are elements that should be leveraged to improve health outcomes through interventions such as personalized health education using phone calls, messaging applications, or interactive platforms (Nuwagaba & Williams, 2018).

In conclusion, as detailed in some examples below, technology has great potential to improve accessibility to drugs and information. As Binagwaho (2012) said, effective prevention and

[4] eHealth (electronic health) and mHealth (mobile health) are terms that encompasses healthcare services provided using digital technologies. mHealth holds the particularity for services provided using mobile devices.

management of NCDs is an imperative that cannot wait. Technology is a way to speed up the process as it can intervene at both the prevention and treatment levels. We have seen examples from other countries that can be replicated in Rwanda. This is the case, for instance, of Hanson et al. (2021) on the opportunities of e-pharmacies in low and middle-income countries where the use of technology improved both the accessibility to products but also facilitated information recording and transfer. For instance, the study highlighted that e-pharmacies in Kenya, Nigeria, and India presented an opportunity for improved recording which would help easy traceability of counterfeited drugs by identified batch numbers and expiry dates. Technology solutions do not only solve the issue of accessibility but also increase the level of literacy which contributes to effective prevention. Vianna and Barbosa (2019) assert that, with the growing use of digital devices, social networks, and online applications, there can be a good integration of people, data, and technology to ensure effective transmission of information and timely surveillance of behavioral risk factors resulting in better NCDs prevention. The information shared online can provide clues on people's lifestyles which can guide which information to give them and help to predict the outcomes (Nsoesie, Oladeji, & Sengeh, 2020). However, as we think about leveraging technology in healthcare, we need to think about both sides of the coin. Technology presents both opportunities and limitations in the healthcare domain. We need to consider and control issues such as the risks of fraud and data security (Hanson et al., 2021). We also need to clearly understand the behavior of patients and how they are likely to adopt the solutions (Vaz & Venkatesh, 2021). The security-related issues and customer satisfaction are important aspects when developing an effective solution.

Introduction to Community and Context

Rwanda is a landlocked country located at the edge of central and eastern Africa. It lies on an area of 26,339 square kilometers. It is bordered to the North by Uganda, to the East by Tanzania, to the South by Burundi, and to the West by the Democratic Republic of Congo. Its geography is mainly made of hills and mountains which earned it the name of "The Country of a Thousand Hills." Rwanda has a population of approximately 13 million inhabitants and with a density of 445 people per square kilometer, it is one of the most densely populated countries in the world.

Historically, Rwanda is mostly known for the 1994 Genocide against the Tutsi that took around a million lives and pushed around two million Rwandans into exile in neighboring countries and beyond. However, for the last 27 years, Rwanda has been in a generalized transformation and reconstruction phase with considerable economic growth; improvement in security; and a strong investment in infrastructure, tourism, and technology. Politically, Rwanda is a parliamentary democracy with two chambers of parliament. It holds the distinction of being one of the countries where women occupy the majority in the parliament, with 61% of the members of parliament being women. Rwanda is subdivided into four provinces and the city of Kigali. The country comprises 30 districts with decentralized administration.

More than 50 percent of the Rwandan population is under 20 years old with the median age standing at 22.7 years old. The distribution of population by sex shows a slight difference between males and females, where the latter consist of approximately 52% of the total population (Worldometer, 2020). The current life expectancy increase is mainly due to a considerable decrease in child mortality in the last two decades. Even though the fertility rate is

on the decline, the population is still on the rise where it is expected to be around 16.3 million in 2032 according to the National Institute of Statistics of Rwanda (2020) forecasts.

Most of the Rwandan population (82.6%) live in rural areas according to the World Bank (2020). However, the estimations are that 30% of the Rwandan population will live in urban areas by 2032. This is attributable to the fact that Rwanda is orienting its economy to services with fewer people supported by agriculture and farming. The current pattern is that most of the urban population is younger, but the trend is that this population is likely to be trending older with the median age of the urban population increasing from 22 years to 25 years between 2012 and 2032.

Economically, Rwanda aspires to middle income country status by 2035 and high-income country status by 2050. This is planned to be achieved through programs such as the five-year Economic Development and Poverty Reduction Strategies and the seven-year National Strategies for Transformation that are oriented towards achieving the Sustainable Development Goals. Those programs have helped Rwanda to achieve a robust growth rate with an average gross domestic product growth of 7.2% and a per capita GDP growth of 5% over the 2010-2020 decade. The GDP is 10.33 billion USD and per capita GDP is 787 USD as of 2020 (World Bank, 2021).

Even though the economic growth has been consistent in the last two decades, there are still challenges, especially with the effects of the COVID-19 pandemic. The pandemic disrupted international flows of goods and services and strongly hindered exports and tourism activities. This is causing an increase in balance of payment and fiscal pressures which risks negatively impact the country's development efforts. Moreover, the Rwanda’s public-sector led development has shown limitations with an increase in public debt. Rwanda heavily relies on

public investment which constitutes 12.3% of the GDP. Also, 56.7% of the GDP is financed by external borrowing and grants. There are still efforts needed to promote private investments, domestic saving, and efficient resource allocation.

Rwandan economic growth went hand in hand with considerable improvements in living standards. The child mortality has dropped by two-thirds in the last 20 years, and Rwanda achieved a nearly universal primary school education. The current literacy rate is 73.2%. There was also considerable progress in the healthcare system especially in the fight against malaria and HIV/AIDS. For example, HIV prevalence in Rwanda has remained stable at only 3% since 2005, but new infections were reduced from 27/10,000 to 8/10,000 according to the Rwanda Biomedical Center (2020).

However, there are still challenges in development, including poverty levels that are still high with approximately 38% of Rwanda living under the poverty line. There is also still a gap in the education system where only 68% of pupils can finish the six-year basic education course. Additionally, there is a problem of food insecurity whereby 57% of the population is food insecure or close to food insecurity. This also implies high rates of child malnutrition that stands at 38% as of 2020 (Penz, 2020). One more issue that Rwanda is facing, and that will be the focus of this program proposal, is the pressing increase in prevalence of NCDs in Rwanda.

With the development and urbanization that occurred during the two last decades, the lifestyle of Rwandan people tended to change toward sedentariness and unhealthy diet. Those factors added to some cultural factors including alcohol abuse and tobacco smoking. The Rwanda Ministry of Health Non-Communicable Risk Factors Report (2012) highlighted that the main risks factors of NCDs in Rwanda are the harmful use of alcohol, unhealthy diet, and tobacco use. By that time, the overall prevalence of alcohol drinking was 41.2% while around

99% of the population have neither the required fruit and vegetable intake (five serving of fruit per day and five serving of vegetables per day). The STEPS study in 2012-2013 observed low levels of physical activity for 13.3% of the population, and with the increased levels of obesity, it is likely that the level of physical inactivity increased. All those changes in lifestyle as well as the factors that are embedded in the culture contributed to a substantial increase in the prevalence of cardiovascular diseases, diabetes, and cancer. Moreover, smoking added to the changes in air quality, even though they need more investigation, led to an increase in the prevalence of chronic respiratory diseases.

As explored in the literature review, the National Strategy and Costed Action Plan for the Prevention and Control of Non-Communicable Diseases in Rwanda (2020) highlights some numbers showing a constant increase of the prevalence of NCDs and other issues relating to them. For example, NCD prevalence stands at 16.4% among the population aged between 15-64 years, NCD death burden has increased from 36% in 2015 to 44% in 2018. For instance, there are currently no nationwide studies on cardiovascular diseases, which makes it hard to determine their actual prevalence. This means that most detected cases were not aware of their previous health status and didn't have accurate treatment.

The Government of Rwanda is conscious of the seriousness of the NCD burden and the growing risks they present to the country. Indeed, this burden is not only epidemiological, but it also presents a huge cost for the nation, households, and individuals. NCDs affect more than the health aspect of people's life by, for example, the cost associated with long-life treatments and loss of productivity. Patients and their families spend a lot of money in NCDs treatment, that often become for lifetime. The cost is also related to the loss of productive workforce. Translated in numbers, research showed that a 10% rise in NCDs is associated with 0.5% lower rated of

annual economic growth, and about 20% of households have reported to be financially affected due to serious chronic illness in the Rwanda Fifth Integrated Household Living Survey (EICV 5) (2017).

To the problem of the high burden of NCDs, multiple issues are added in terms of programming and governance of the NCDs prevention and control. The main issues include:

- low levels of awareness about NCDs risk factors, signs and symptoms which delay the care,
- insufficient funds allocated to NCDs prevention and control activities,
- lack of effective tracking and research for NCDs which affect the planning for resources and M&E,
- unavailability of some essential medicines and basic technologies for NCD screening management,
- low collaboration across partners for NCDs, and insufficient numbers of partners working in NCDs prevention and care across public and private sectors
- difficulties in accessibility to treatment and the healthcare facilities where patients can get that treatment. So far, advanced NCDs care is only available at district and referral hospital level. This means that for appropriate care NCDs patients need to visit one of the 48 hospitals (Rwanda NCD Alliance, 2021) or a maximum of 2 hospitals per district which is not enough to serve the whole population.

However, there are some strengths and opportunities that can be leveraged to improve NCDs prevention and control. These include the establishment of a dedicated division of NCDs at the Ministry of Health level, a national NCD policy and relevant guidelines, the integration of essential NCD services in the national healthcare facility network, comprehensive health

insurance coverage for major NCDs, regularly organized awareness events such as the monthly car free days which constitute an opportunity of community sport activities, presence of professional training facilities, as well as global initiatives and high-level political commitment at global and regional levels to support the country's efforts.

Therefore, the prevention and control of NCDs requires a multisectoral approach to address the socioeconomic, behavioral, environmental, and other determinants that constitute risk factors. The government is making efforts to coordinate different actors to better manage NCDs prevention and care. It is from that perspective the government has initiated a partnership with Partners in Health for cancer care.

Stakeholder Analysis and Needs Assessment

Stakeholder Analysis

The prevention and treatment of NCDs includes a vast ecosystem with various actors with diverse roles. NCDs affect many aspects of life, going beyond the health status. Comprehensive action against NCDs needs the engagement of government sectors, the private sector, civil society, development partners, academic and research institutions, as well as communities. Those stakeholders include those affected by NCDs as well as the contributors to the solution. Each stakeholder plays a considerable role in bending the curve of the NCD burden. The stakeholders presented in this analysis are related to the project that will be implemented. Their stake in the project may be the incentives that they may find in the project or the risks that they may present to the program. *Table 1.* conveys different stakeholders that are involved in NCDs care, especially in the proposed project through the use of technology to improve care.

Table 1. Program Stakeholders

Type of Stakeholders	Name & Description	Relationship to project	Incentive, motivation, risks	How to engage
Individuals	NCDs Patients and those at risk of getting NCDs	Direct beneficiaries of action against NCDs.	Improve access to products and information Improve their health outcome	Blogposts, order processing, customer feedback surveys.
Government	Ministry of Health Rwanda Biomedical Center (NCD Division)	Potential funding Data about NCDs Advice on project implementation	Support to their work and mission	Funding applications Feedback request (through reporting and progress updates).
Organizations	Public and private hospitals	Partnership for joint services for patients involved in the program	Support their mission	Patient treatment and follow up plans. Capacity building sessions.
Individuals	Caregivers/ Community Health Workers/ Provider (Physicians, nurses)	They support the beneficiaries (NCD patients). They will be the intermediaries for patients who are unable to effectively	Increased knowledge on how to support patients.	Capacity building sessions. Social media and platform engagement (chats, messaging).

		use the platform products and services	Facilitation of their workload while caring for the patients Risks of not differentiating the scope of the current program with what they used to do	
Nonprofit organizations	Rwanda NCD Alliance (network of organizations working on NCD prevention, advocacy, and care).	Have an active community of NCD patients and care providers Will introduce the program to their NCD patient community. Share experience working with NCDs patients (help in curriculum development)	Alignment with their mission Extension to their programs of supporting NCD patients (medical product access and education programs). Risk of conflict of interest with the scope of their work. There may be other stakeholders working together with them creating competition to us.	Sharing sessions with their team. and field visits to patients supported by the organization

	MEDSAR (Rwanda Medical Student Association	Curriculum development Campaign support (curriculum vulgarization).	Contribution to their mission Practice opportunity provided to their interns.	Collaborate in curriculum design. Meetings and focus groups Priority given to their interns.
	International NGOs (Clinton Health Access Initiative, Partners in Health, Bill & Melinda Gates Foundations, World Diabetes Alliance, etc.)	Funding Capacity development	Contribution to their mission Grass-root representation (the program will facilitate them to make an impact at the lowest level in the community.)	Funding applications Regular updates (Newsletters, high level meetings, emails, featuring in their events and communications initiatives).
Insurance Companies	Rwanda Social Security Board, Military Medical Insurance, Old Mutual	Support their beneficiary to access preventive services (check-up, health education subscriptions, etc.)	Provide care to their beneficiaries, support their cost-cutting strategies (the more subscribers access prevention, the less they get sick, cutting healthcare expenses).	Contracts, data analysis on cost control, shared prevention campaingns

Private Businesses	Drug suppliers IT developers	Provide drugs and other medical supplies for our patients. Develop the platform that we will be using and provide support to beneficiaries.	Income from our payment. Risk of feeling threatened by competition (for drug suppliers).	Orders and payment.

Needs Assessment

Research Findings

I conducted a needs assessment to better understand the issues in the NCD care ecosystem to understand the best ways they can be solved. The needs assessment process focused on gathering information on the following domains:

- **Understanding the relevance and requirements to ensure the success of my program:** What are the needs of NCDs patients? How can a technology solution help them to improve their care? Is a platform what is needed to help chronic NCD patients? If yes, how should it be used in the most beneficial way? If not, what else should be done or added?
- **Reflecting on the resources I have:** What do I have to successfully implement my solution? What have I done right so far, and how can I foster it?
- **Identifying the gaps in my plans and resources:** What do I need to correct in my plans and how? Which resources don't I have so far? What can I do to meet the needs of my beneficiaries and correctly engage my stakeholders? What are the best ways to engage beneficiaries?
- **Identifying appropriate ideas on how to fill the gaps:** How can I adjust my plans to meet the needs of my beneficiaries and work with my stakeholders appropriately?

Part of the needs assessment process is the field research I conducted with healthcare providers, NCDs activists, governmental actors, patients, and caregivers. Through this research, I wanted to have more perspectives on the current situation regarding NCD care, especially how

patients are supported, but also how people are empowered for better prevention. During my research phase, I conducted:

- November 13th, 2021, a one-on-one interview with the Executive Secretary of Rwanda NCD Alliance. Rwanda NCD Alliance is a network of 26 organizations working in NCD care. The network is diverse in terms of members' backgrounds but also the NCDs of focus. Among the network members there are healthcare providers, students, patients, caregivers, etc. The diseases covered are mainly diabetes, cardiovascular diseases, and cancers.
- November 20th, 2021, a one-on-one interview with an officer of the NCD division at the Rwanda Ministry of Health. The NCD division at the Rwanda Ministry of Health works under the authority of the Rwanda Biomedical Center (RBC). They coordinate all the national efforts in terms of prevention, care delivery, policy, fund mobilization, etc. In my interview, I had the pleasure of talking with the Manager of the NCDs division.
- December 1st, 2021, focus group with five chronic NCD patients and caregivers. Thanks to the Rwanda NCD alliance, I was able to connect with some patients and caregivers in a focus group. The participants in the focus group had different NCDs and were in different age ranges.
- From November 20th to December 3rd, 2021, a survey of health providers (20 nurses and doctors, community health workers). This was an online survey where 24 doctors, nurses, pharmacists, and community health workers participated. The participants officiate in different areas of Rwanda and have working experience of between 2 to 15 years of service.

Several themes emerged from my research findings. The first one is that **diabetes and cardiovascular diseases are the most common NCDs in terms of awareness as well as prevalence.** All 24-provider respondents reported encountering cases of diabetes and cardiovascular diseases in their practice and throughout my interviews and focus groups, the two diseases were the most frequently mentioned in the discussions. This may lead to the assumption that they are the most common but also that they may be the ones that people are open to talk about or are aware of.

The second theme is about the **low awareness about NCDs risk factors and burden**. From the providers' point of view, people don't really know the danger they incur with some high-risk behaviors such as tobacco use, alcohol abuse, poor diet, and lack of physical activity.

Also, according to the healthcare providers, few people are aware of the need for regular checkups to know their status. As highlighted by the RBC-NCD division manager, many people are seeking care at advanced levels of diseases which complicates their care. On this note, the patients also highlighted that they didn't know much about NCDs until they had to live with them. They also talked about the stigma that they experience and feel like victims in society due to that lack of information as well.

The last common theme from my research findings is the **intersectionality of determinants to NCD care access.** The main ones identified are economic status and rural/urban residence. The patients and caregivers as well as the NCD Alliance project coordinator mentioned that it is difficult for people of low income to have access to products such as medicines and food supplements without the help of the government which may make it hard for them in case of shortages. Additionally, most of the NCD treatments require a special diet and lifestyle that may not be affordable for people of low income. There is also the problem

that NCD care is not well-decentralized. As mentioned in the community context, comprehensive NCD care is available at the hospital level only. Given the ratio of one or two hospital per district, it is often difficult for patients to get to the nearest hospital for care. It is important to highlight that being far from care facilities is also likely to affect consistency in their care schedule whereby the patients risk interrupting treatment because they find it difficult to get to the healthcare facilities to get treatment.

Intersectionality

The data collected conveys several points of **intersectionality** highlighting issues relating economic status and areas of residence (urban vs rural) as factors that can determine NCDs prevention and care. There is a correlation between economic status and access to NCDs prevention and care. In fact, the higher the economic status, the better the access to care and prevention. People of higher income can afford care and are better informed on how to avoid risk factors. They are likely to have more education and access to information technology that allows them to be informed about NCDs. They can also easily access a better diet.

When it comes to the area of residence, the prevalence of NCDs is higher in urban areas than rural areas. This can be explained by the fact that people in urban areas lead a lifestyle of less physical activity, more polluted air, and more processed food. Even though the access to care is better in urban areas, the exposure to risk factors coupled with low awareness lead to increased likelihood to have NCDs.

From the research, there is no clear correlation between access to NCDs prevention and care and gender. The responses from the participants did not point out disparities in how women and men have access to care for NCDs. However, based on the previous literature and the determinants

mentioned above such as economic status, residence, and literacy, we can identify an indirect link between gender and access to NCD prevention and care. Indeed, gender is a strong determinant of income and literacy. A gender analysis using the Jhpiego Gender Analysis Framework, can help to elucidate the differences in access to resources, practices and participation, beliefs and perceptions, as well as institutions, laws, and policies can lead to disparities that may affect access to NCD prevention and care. The analysis is summarized in *Figure 1*.

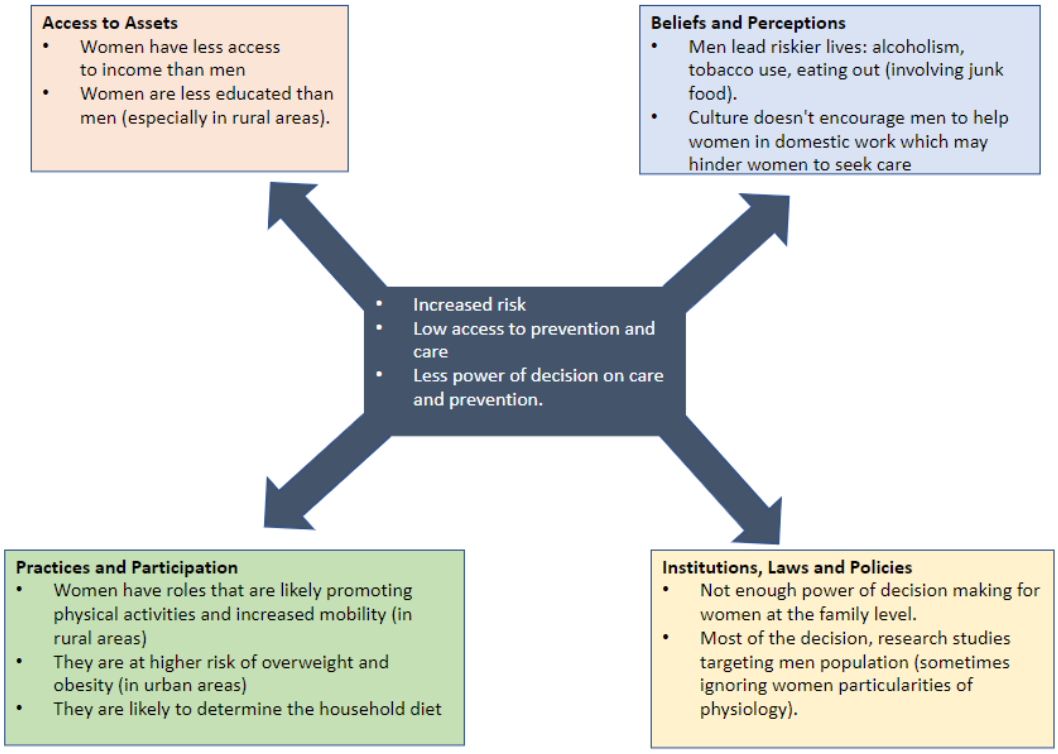


Figure 1. Gender Analysis

The framework shows how multiple factors contribute to increasing women's, people with less education, and people with low income's risk of contracting NCDs. Considering those

two categories, women in Rwanda are likely to be at higher risk than men. This brings in a gender aspect in the disparities in access to NCD care and prevention.

SWOT Analysis

Figure 2. analyzes the strengths and weaknesses as well as the accomplishments and limitations of the national NCD prevention and control ecosystem in Rwanda. This analysis will allow me to identify the areas where more action is still needed as well as the strengths and opportunities that can be leveraged in my program. This SWOT analysis is inspired by the National Strategy and Costed Action Plan for the Prevention and Control of Non-Communicable Diseases in Rwanda (2020).

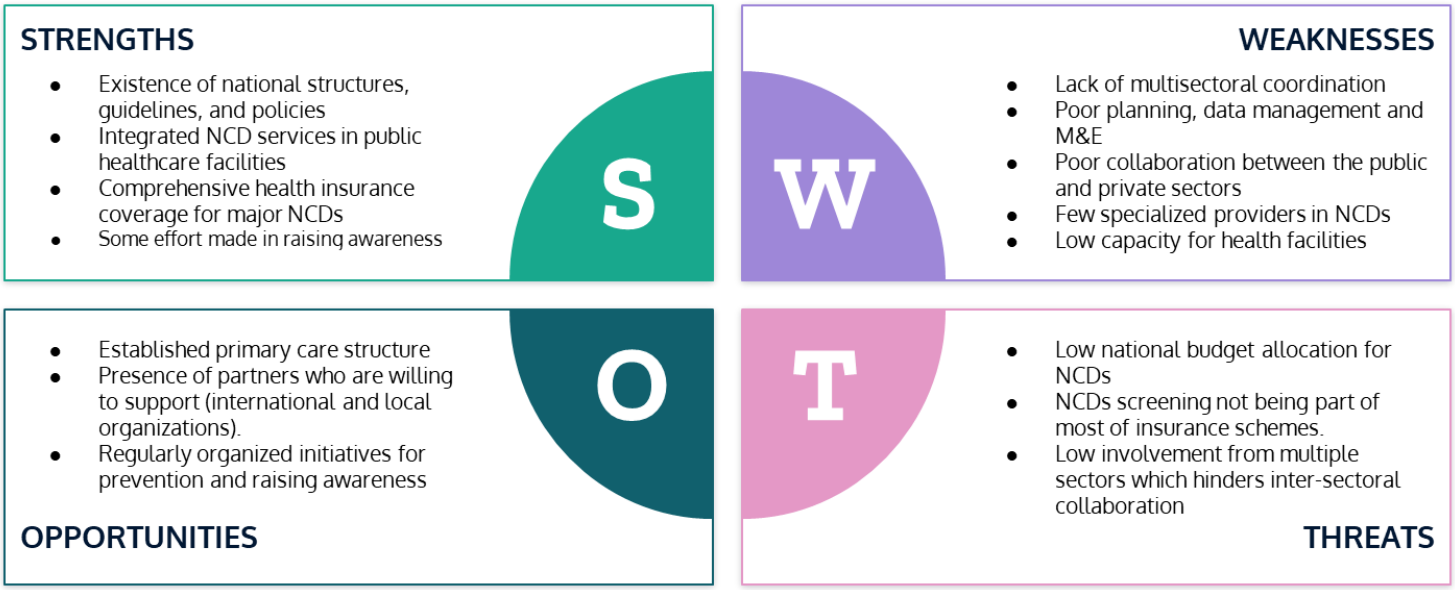


Figure 2. SWOT Analysis

Theory of Change

The program intends to support the prevention of NCDs and improve NCD patient outcomes by using digital technology. A digital platform will be developed where users can access information on NCD risk factors and good practice while NCD patients can have support on accessing medicines and accompaniment[5] during their treatment. The program's theory of change is based on the idea that the health information and services offered to patients will give them access to quality care and result in improved health outcomes. The assumption is that by providing NCD patients with access to appropriate medicines and the right information on how to take care of themselves, they will be able to stabilize their conditions and sustain improvements in their health outcomes. This is informed by the concerns from the field research where patients expressed worries about not being able to find care support on time near them. Some stages of the theory include not only the patients but also caregivers as people who live and take care of patients and play a role in supporting the patients.

By providing products and information through an online platform, users are expected to be able and willing to access technology platforms. Basic skills using digital devices will be the prerequisites for the users. Thus, the program will have to assess if patients or their caregivers have the skills and ability to access online platforms. It may happen that patients and caregivers do not have access to the internet or digital devices such as smartphones and/or computers. In that case, we would change our approach to using solutions that do not rely on digital technology. For instance, we should involve community members such as community health workers and local leaders (village committees for example) and train them to be our

[5] Accompaniment is a model adopted by organizations such as Partners in Health that consists of medical, social and economic support provided by paid community health workers – as the key to delivering quality health care in poor communities

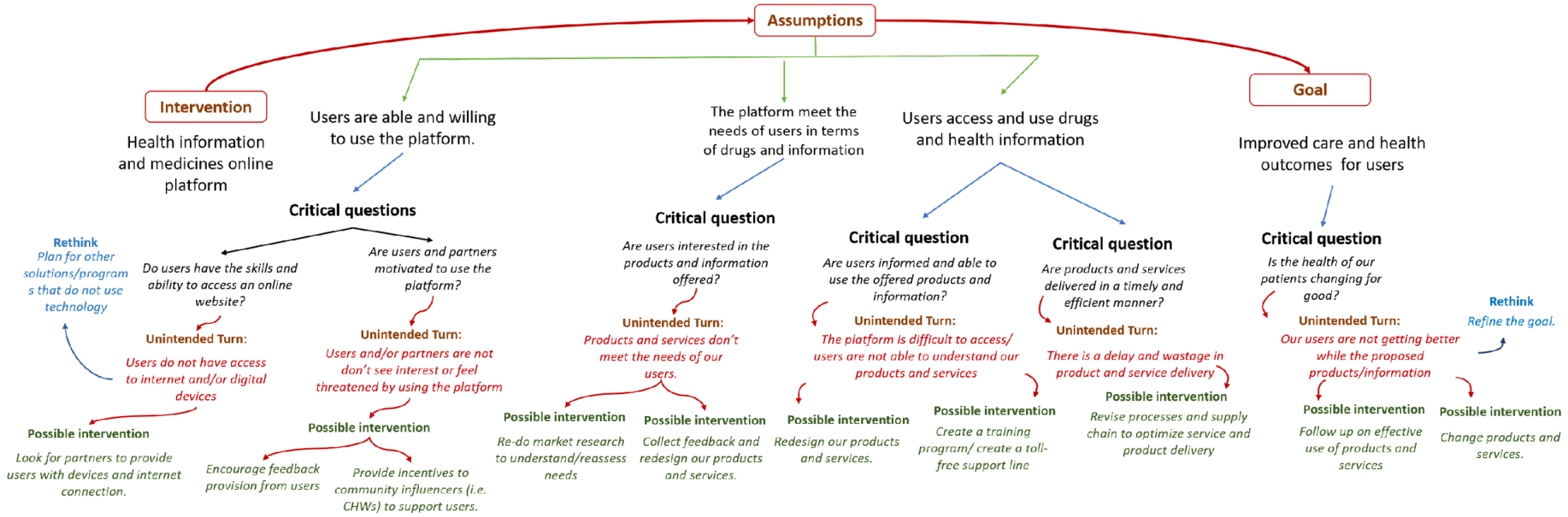
intermediaries to support patients with advisories and treatment accompaniment. We should also think about shared access points such as kiosks where patients can place orders for products and receive handouts and advice about their conditions.

The second assumption is that patients and/or caregivers will be interested in our information and products. It is expected that if the users are able and willing to access the technology, the platform will meet their needs and make them interested in consuming our information and products. To avoid the unintended turn that our products and information are not fulfilling the needs of our customers (patients and caregivers), the program will work with experts in the Rwandan NCD field (such as the Rwanda NCD Alliance, the Ministry of Health, and healthcare providers) to accurately identify the need and adapt the design of our products and information. Additionally, the program will constantly collect feedback and be ready to re-design products and services according to the market insights to adapt products and services to the needs of the users.

Another assumption is that the patients or their caregivers will be skilled enough and motivated to effectively use the products and information on the platform. For instance, the platform should be user-friendly, with products and information easily accessible. In case the patients and their caregivers may find difficulties accessing the products and information, the project would be responsible for redesigning the product and services or creating a training program (session or guidelines) to meet the needs of the patients. Moreover, the platform should have a toll-free support line to receive users' complaints. On another side, the ineffectiveness in access to products and services may be caused by technical glitches in the electronic systems. In such a case, the program should revise the processes and supply chain to optimize the service and product delivery.

Additionally, the users should be interested in using the platform. To ensure that this is achieved, the team will do market research to tailor the platform to their needs. This will also continue as the project operates to ensure that the user is put at the center of each aspect of the content and interface. Indeed, the intention is to support and complement the existing efforts as well as filling the current gaps. Last, if patients and caregivers can efficiently use the platforms and access the products and information, they are expected to show improvements in health outcomes. There is planned monitoring and evaluation that we are going to explore later. What if the intended result is not the one observed? In that case, the program should follow up on the use of the products and services to see if they are used as expected. In that case, more capacity building should be provided to ensure that the products and services are effectively used. Otherwise, the program should consider creating a process to identify barriers to the use of the products and services. Depending on the results, changing the products or services to produce the intended outcomes or redefine the goal for example, the project should think about something else it should do to improve the general health outcomes.

Figure 3. is a visual representation of the theory of change


Assumptions
Intervention
Health information and medicines online platform
Users are able and willing to use the platform.
The platform meet the needs of users in terms of drugs and information
Users access and use drugs and health information
Goal
Improved care and health outcomes for users
Critical questions
Do users have the skills and ability to access an online website?
Are users and partners motivated to use the platform?
Unintended Turn:
Users do not have access to internet and/or digital devices
Unintended Turn:
Users and/or partners are not don't see interest or feel threatened by using the platform
Rethink
Plan for other solutions/programs that do not use technology
Possible intervention
Look for partners to provide users with devices and internet connection.
Possible intervention
Encourage feedback provision from users
Provide incentives to community influencers (i.e. CHWs) to support users.
Critical question
Are users interested in the products and information offered?
Unintended Turn:
Products and services don't meet the needs of our users.
Possible intervention
Re-do market research to understand/reassess needs
Possible intervention
Collect feedback and redesign our products and services.
Critical question
Are users informed and able to use the offered products and information?
Unintended Turn:
The platform is difficult to access/ users are not able to understand our products and services
Possible intervention
Redesign our products and services.
Critical question
Are products and services delivered in a timely and efficient manner?
Unintended Turn:
There is a delay and wastage in product and service delivery
Possible intervention
Create a training program/ create a toll-free support line
Possible intervention
Revise processes and supply chain to optimize service and product delivery
Critical question
Is the health of our patients changing for good?
Unintended Turn:
Our users are not getting better while the proposed products/information
Possible intervention
Follow up on effective use of products and services
Rethink
Refine the goal.
Possible intervention
Change products and services.

Program Description

The program consists of a one-stop access point for non-communicable disease-related information, services, and products. The digital platform that will integrate access to educational content, interaction with specialists, as well as provide treatment and prevention products. The program will start with a 2-year pilot in one district before expanding progressively to the rest of the country. The pilot will inform the program about the sustainability and best practices of expansion. For example, the pilot will help to determine if the program will be able to sustain itself from user payments – for instance exploring the subscription model – or if the model implemented in the pilot should be integrally replicated to the rest of the country. Through the pilot, the program will also explore whether the allocated resources are enough to run the program countrywide or they need to be increased. For instance, we will assess the number of staff, partnerships, funding, etc.

Goals and Objectives

The program's overall goals are:

- To improve NCD patient experience through timely access to medicines and constant guidance and accompaniment by experts.

  Under this goal, the program aims to achieve the following objectives:

  - Have every patient enrolled in the program and diagnosed with any of the four major NCDs follow the treatment plan in an accurate and timely manner by 2027. The enrollment target is 100,000 patients in the program and 1,000 in the pilot.
  - By January 2026, have trained 500 community health workers to serve as a contact person to patients and provide basic information and accompaniment to patients. The target for the pilot is 20 community health workers.

- All the 44 district and 4 referral hospitals' NCD divisions involved in a partnership for joint NCD control program by January 2026.
- One specialist and four counselors (for each of the 4 major NCDs) enrolled by January 2025 to help enrolled patients to get constant advice and guidance on their treatment plans.
- 100% of all the basic medicines for the 4 major NCDs (diabetes, hypertension, cancers, and chronic respiratory diseases) control available through our platform by January 2026. The program will ensure to practice according to the existing regulations and in partnership with health facilities.

- To foster NCD prevention by providing the right and easy-to-understand information about NCDs to help people be aware and measure their risk of NCDs and lead healthy lifestyles.

  That goal will be achieved through these objectives:

  - Enroll a million users by the end of 2027
  - Ensure timely service for all the enrolled users in our program by 2027.
  - Educate users about NCD risks and best practices through weekly educational blogs, videos, and games.
  - Provide users with tools for NCD self-assessment and through the digital platform.
  - User access chats with specialists, counselors, and community health workers 24/7.

Activities and User Population

The program is centered on technology, people, and content. The main activities include partnership establishment, technology infrastructure and content development, and product promotion.

First, the program will develop a working and user-friendly digital platform. The platform will be the place for users to interact with experts, access educational content, as well as access to care and accompaniment (for patients).

For the technology infrastructure development, the platform will be developed in two versions, the web and mobile version to facilitate access for users who use all types of devices. The platform is inspired by existing platforms like babyl.rw, kasha.rw, and dotpharma.rw. The main intention is to integrate education, basic consultation, as well as treatment follow-up and accompaniment options for NCD patients. The program intends to unite pre-existing functionalities operating in silos into one platform. Both the mobile and web versions will have the following features:

- A live chat that allows users to call or text experts and counselors for advice and guidance. Also, through the live chat, our workers will be able to have scheduled follow-up with patients for accompaniment in treatment and lifestyle. The users who will benefit from this functionality are mainly patients who are already diagnosed with NCDs and are undergoing treatment.
- A learning management system where users will be able to learn by reading content, watching videos, and playing games. Also, with this functionality, users will be able to test their knowledge about NCDs and measure their risk using tools such as quizzes and

surveys. The users who will benefit from this functionality are everyone who want to learn and measure their risk of NCDs.

- An online shop for health products. This functionality will have two parts: one for general healthcare products such as food supplements, and another for prescribed medications for the four major NCDs. The latter will need the involvement of specialists to ensure that the products are provided with effective medical advice. Prescribed medicines will need the advice from partner healthcare facilities. The users of this service will be mainly patients on treatment or following a certain diet.

It is important to note that the content and the platform will be replicated in all three languages used in Rwanda (Kinyarwanda, English, and French) to allow all the users in Rwanda to easily use it. The technology infrastructure development will be a one-time activity with regular updates of content. It will involve developers, healthcare providers, and end-users. Developers will oversee the technical aspect of the products and healthcare providers (project workers and partners) will support content development. There will also be an involvement of end-users as the infrastructure development will progress to ensure that every aspect of the platform is user-friendly.

The program will considerably rely on partnerships for funding, patient accompaniment, education, and awareness raising. With the support of organizations such as the Medical Student Association of Rwanda (MEDSAR) and the Rwanda NCD Alliance, we will have access to their expertise to have content that will be used in raising awareness. Those organizations are currently involved in activities of NCD prevention. The program will also partner with the government through the Ministry of Health, the Rwanda Biomedical Center, as well as the national network of hospitals. The ministry and RBC will be involved in funding through their

annual budget for NCDs and the hospitals will help with expertise (specialists and counselors) and patient referrals.

Once the infrastructure is available and partnerships are established, the program will undertake activities of promotion to make people use the available products. Our main channel for promotion will be the existing structure of healthcare providers from the community health workers to the hospital level as well as NCD-related organizations to inform users and help them use the products. The community health workers will be much involved and trained to guide users who may have low digital literacy, especially in rural areas. The program will also run media campaigns to advertise our programs and how to use them. It will leverage both social media and mass media to make the message get to as many users as possible. Partners' training will be an essential part of the implementation as they will be the ones to guide most of our users. The partners who will be trained include community health workers, partner healthcare providers, and members of the Rwanda NCD Alliance network. The training will be about the basics of the digital platform for the partners to correctly guide the users.

The last activity will be establishing a customer service center that will assist users 24/7 through live chats, calls, and product deliveries. The customer service center will comprise counselors, specialists, and other agents who will help our users to get the information and products they need. After the establishment of the center, most of the activities will be recurrent according to the demand.

Partners

To achieve the goals set, the program will work in partnership with different actors. Partners will intervene in the domains of funding, content development, implementation, and promotion.

On the funding side, there is the Government of Rwanda through the Ministry of Health and RBC. Both are involved in NCDs prevention and control through policies, and they also have programs that need partners. They are potential funders to the program because they usually work with international partners such as the WHO, the World Bank, the Gates Foundation, etc. to collect funds that are either redistributed to local organizations or directly used to serve beneficiaries. The Government will also endorse the program for funding from international partners. They can also link grassroots directly to potential donors. In exchange, the program will support the mission of the Rwandan government according to the guidelines provided by the National Strategy and Costed Action Plan for the Prevention and Control of Non-Communicable Diseases in Rwanda (2020). Additionally, the program will source for opportunities of funding from foundations that are involved in NCD initiative funding. These include the World Diabetes Foundation, Bloomberg Foundation, MasterCard Foundation, and the Unilever Foundation (Jailobaeva et al., 2021). Moreover, the program will leverage the expertise from the local partners such MEDSAR and RNCDA to approach funders and design fundraising strategies.

On content development, the program will partner with the Rwanda Medical Student Association (MEDSAR) and the Rwanda Non-Communicable Alliance (RNCDA) because both organizations have a long experience in health education especially in NCDs. Our role in the partnership will be to digitalize the content using our platform. MEDSAR is a non-governmental and nonprofit organization grouping medical students of Rwanda. Since 1997, the organization has been working to represent and empower medical students, conducting health-related research and health promotion activities (MEDSAR, 2021). One of the organization's projects is the Youth Education Activities on NCDs (YEAN project) that is implemented in partnership with the International Medical Cooperation Committee (IMCC). The project conducts educational and

advocacy activities aiming to raise awareness about NCDs in the community of Kigali city and Huye District.

RNCDA is a network of 26 non-profit organizations who work in the field of NCD prevention and care. Their activities include capacity-building and technical support to the network members, raising awareness on health life and NCD prevention, NCDs patient empowerment and advocacy, and research on NCDs (Rwanda NCD Alliance, 2021). One of their projects is the virtual fitness show and healthy life education. This is a show run on local TV stations and social media.

With the help of the experts from the two organizations, the program will create lessons and materials that will present information about NCDs and their prevention in the easiest way possible. The lessons development will consider the language as well as the format. For instance, most of the lessons should be in the form of videos and games that would help the users to keep interested. Additionally, the program, with the help of those two partners, will create assessments that will help users to test their knowledge and know their status about NCDs. This partnership will be a win-win situation as the program will help the partners to widen their impact to more services and increased span. The program will guarantee coverage throughout the whole country for services such as the ones provided by MEDSAR, and it provides more technology to RNCDA and makes their content available and accessible anywhere at any time.

Last, on the implementation side, the program will work with health providers (doctors, nurses, community health workers) and healthcare facilities (health centers and hospitals). The role of those actors is crucial to the program's success because they have a lot of information about the beneficiaries. Healthcare providers and facilities will play the role of intermediaries between the program and the beneficiaries. They will be involved as counselors and specialists

who will help users in case they want advice or counseling from experts. A certain category of healthcare providers, community health workers, will play a particular role in rural areas where access to technology may be limited. The plan is to involve them in assisting users that would need more guidance. Thus, community health workers should be facilitated to access technology tools such as smartphones and tablets to be able to support users with the lessons or orders for products. Moreover, community healthcare providers and healthcare facilities will support the promotion of the program by sensitizing NCD patients and other users to use the program's services by referring them to the program. The partnership will be possible through a partnership from the high level of the national healthcare structure. The program aims to be part of the network as a complementary option for NCD prevention and patient accompaniment. From our side, the healthcare providers involved in the program will receive incentives such as monetary remuneration for served users and capacity building relating to NCD prevention and care.

Other important implementation partners will be Rwanda public and private insurance companies such as the Rwanda Social Security Board, the Military Medical Insurance, Old Mutual Rwanda, etc. The program will involve them in incentivizing users for check-up and preventive services. If this partnership is successful, it would even contribute to the financial sustainability of the program through user/insurance payments.

The program will work to incentivize the partnerships to keep them sustainable. First, what the program is doing aligns with the mission and supports the work of our partners. Thus, the program will fill in the gaps observed in the existing NCD prevention and treatment effort. This also justifies working with partners instead of starting the program from scratch. The program is indeed intended to fix the issues in NCD prevention and care by building on existing programs and infrastructure.

Sustainability

The program is designed to bridge the existing gaps in NCD prevention and care in Rwanda as well as to have a long-lasting impact on patients, the healthcare system, and the general population. The program intends to reduce NCDs' prevalence and improve patient outcomes through timely access to information and products. Therefore, strategies need to be developed to keep the program working until a significant impact is made and the program keeps running in the smoothest way possible. The program's sustainability plan revolves around funds, users, and partners.

First, the program will develop a financial resource development plan that provides details on how funds will be raised on a regular basis, used effectively, and how the relations with the funders will be sustained. Some of the fundraising strategies include targeting funders with the same mission (international organizations, philanthropists, and the government). However, the program will also run some activities that can cover some expenses. These include consultancy services from our experts to organizations working in the field of NCDs and joint research with other institutions where the program could generate data and help process them. The program will also gain funds from suppliers of products that will be delivered to users from our platform.

Second, users of the program need to stay motivated to use the program services. Thus, the program will prioritize regularly gathering feedback from the users and make necessary adjustments of the services accordingly. Additionally, the program should incentivize users to retain them. For instance, the program will put in place a system of tracking users' progress and give virtual awards to users as the progress through the program. Awards will include badges, levels, and possibilities to unlock more content.

Moreover, partners should have the highest commitment to support our program. In order to keep them committed, the program will develop incentives for partners. Our implementation partners (healthcare providers and community health workers) will be earning money from the users they help. They will also be given training and capacity-building opportunities that will help them serve our users better and will increase their experience. Additionally, our corporate partners including the government partners and the nonprofits shall receive incentives such as the support to their programs' implementation. The program will strive to build solid relationships with those partners through constant and regular communication. The communication will be done through monthly newsletters and meetings with senior management. The program will also support partners' events and campaigns in participating in personal educational campaigns, advertising through the platform, and sharing data and information.

Last, the program will need to keep users engaged in using the services provided to them. In order to achieve maximum engagement among users, the program will ensure the provision of regular content and service so that our audience does not get bored and keeps having the urge to come and see what is new in the program. For instance, the educational content will be designed in a way that is progressive and that our users will access it gradually. There will also be virtual rewards to users (such as badges, levels, kudos, points, etc.) encouraging them to earn more and stay motivated to complete the activities. Additionally, the nature of some services will contribute to user retention. For example, some activities will engage the users to track their progress on aspects such as the body mass index, weight, blood sugar, blood pressure, etc. In the long term, the program will also plan to automate the tracking of indicators such as steps counting, calorie burning, and heart rhythm in mobile phones and wearables. Another strategy that the program will leverage is the creation of communities of users who have the same issues.

For instance, there will be communities of users with issues relating to physical activities, healthy diet, smoking, etc. These communities will share experience and encourage each other to achieve goals.

Evaluation

The evaluation for this program will include some measures weekly and others on a quarterly basis, and will comprise both qualitative and quantitative information. The evaluation will use data collected from the platform traffic and regular surveys to users. It will intend to track how the program is being implemented and how the lives of the users are transformed through the program's services.

Evaluation Plan

Outcomes/ Objectives	Indicators	Methodology	Frequency	Responsible
Goal #1: To improve NCDs' patient experience through timely access to medicines and constant guidance and accompaniment by experts.				
Have 10,000 patients enrolled in the program and diagnosed with any of the four major NCDs follow the treatment plan in an accurate and timely manner by 2027.	(1) Number of users who order products through our platform. (2) Average time for delivery (3) Number of referrals received from healthcare facilities/providers (4) Number of users following treatment plans with our specialists (5) % of successful plan	(1) to (4) Platform records (5) Survey users following treatment plan	(1) to (4) Weekly (5) Quarterly	**IT team** **Program Manager**

By January 2026, have trained 500 community health worker per each village to serve as contact person to patients and provide basic information and accompaniment to patients.	(1) Number of trained and enrolled community health workers (2) Ratio CHW-Users (3) % of covered villages	Program data	Monthly	Program Manager
All the 48 district hospitals' NCD divisions are involved in a partnership for joint NCD control program.	(1) Number partnerships signed with DHs (2) Average referrals per DH	Program data	Monthly	Program Manager
1 specialist and 2 counselors (for each of the 4 major NCDs) enrolled by January 2025 to help enrolled patients to get constant advice and guidance on their treatment plans.	(1) Number of specialists/ counselors hired and trained (2) Average active time per specialist/counselor (3) Users' average service rating	(1) Program data (2) and (3) Platform records	(1) Monthly (2) and (3) Weekly	Program Manager IT Team

100% of all the basic medicines for the 4 major NCDs (diabetes, hypertension, cancers, and chronic respiratory diseases) control available through our platform by January 2026.	(1) Number of medicines available in stock (2) Rate of order fulfillment	Program data	Monthly	Program Manager
Goal #2: To foster NCDs' prevention by providing the right and easy-to-understand information about NCDs to help people be aware and measure their risk of NCDs and lead healthy lifestyles.				
Enroll a million users by the end of 2027	(1) Number of subscriptions	Platform data	Monthly	IT Team
Ensure timely service for all the enrolled users in our program by 2027.	(1) Number of users who went for checkups after using our services (2) Number of users who took the proposed assessments on the platform	(1) Surveys of users (2) Platform records	(1) Quarterly (2) Weekly	Program Manager IT Team

Educate users about NCDs risks and best practices through weekly educational blogs, videos, and games	(1) Average scores on the assessments (2) % of completion of the lessons (3) % of progression to upper levels (4) User ratings score on the quality of the content	Platform records	Weekly	IT Team
Provide users with tools for NCDs self-assessment and through the digital platform	(1) % of completion of the self-assessment (2) Rating scores on the assessment	Platform records.	Weekly	IT Team
User access chats with specialists, counselors, and community health workers 24/7.	(1) Number of active chat and session hours	(1) Platform records (2) User rating score (2) Survey to users.	(1) Weekly (2) Monthly (2) Quarterly	IT Team Program Manager

	(2) user satisfaction rate			

Implementation

Timeline

	Year 1 (2023)												Year 2 (2024)											
	Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4		
Activities	M #1	M #2	M #3	M #4	M #5	M #6	M #7	M #8	M #9	M #10	M #11	M #12	M #1	M #2	M #3	M #4	M #5	M #6	M #7	M #8	M #9	M #10	M #11	M #12
Recruitment of the core team (1PM and 2 PAs)*																								
Financial and project planning																								
Requirements and feasibility analysis																								
Fundraising Campaigns																								
Recruitment of the IT team*																								
Content Development and Coding																								
Recruitment of the technical team (specialists, counselors)																								
Integration and testing																								
Iteration and feedback																								
Recruitment & Training of CHWs*																								
Partnerships with healthcare facilities																								
Customer service center setting																								
Validation and service launch																								

	Year 3 (2025)												Year 4 (2026)											
	Q1			Q2			Q3			Q4			Q1			Q2			Q3			Q4		
Activities	M #1	M #2	M #3	M #4	M #5	M #6	M #7	M #8	M #9	M #10	M #11	M #12	M #1	M #2	M #3	M #4	M #5	M #6	M #7	M #8	M #9	M #10	M #11	M #12
Piloting																								
Evaluation																								
Scaling																			Start					

PM: Program Manager* PAs: Program Assitant* IT: Information technology* CHWs: Community Health Workers*

Capacity

The successful completion of this program will depend on effective human resources, infrastructure, and skills. The program's team will be composed of a program manager, three program associates, two information technology officers, four consultant NCDs specialists, four counselors, two pharmacists, and four support staff.

The program manager will oversee the whole program running from planning and implementation, until the launch of the pilot. Their main responsibilities will be leading the planning meetings, initiating and following up on partnership, directing the fundraising efforts, as well as supervising fund allocations and use. He will report to the board of directors.

The three program associates respectively run the operations, finance, and communications. The operations associate will oversee all the activities relating to logistics and human resource management. Their responsibilities will include making essential purchases, running the office space and calendar, planning logistics for all the program activities, planning and follow-up on the implementation of training, and ensuring human resources compliance (contracts, performance review, employee's records, etc.). The finance associate will lead all the accounting and fund management activities. They will manage the program's accounts, disburse funds for all the program's activities, and keep all the financial records. The communications associate will manage all the program communication and reporting (newsletters, official emails, social media, and mass media outreaches). They will also work under the supervision of the program manager to implement the partnerships. All associates will report directly to the program manager.

The information technology officers will be responsible for all the IT-related tasks. They will lead the effort to develop the platform and work with external consultants in digital platform development. They will also ensure platform maintenance and onboarding partners who are going to use the platform (clinical team, content developers, and other partners). They will report to the program manager.

The clinical team is composed of four specialists, four counselors, and two pharmacists. There will be a specialist for each of the four major NCDs observed in Rwanda (cardiovascular diseases, cancers, diabetes, and respiratory diseases). The specialists are specialized physicians in each disease. They are going to work on a part-time basis, where their sessions with users will be scheduled. The choice for part-time specialist considers cost control and the existing reduced number of specialist providers. The experience working in out-patient healthcare facilities shows that part-time specialists can effectively operate. The specialists will provide users with preliminary consultations, referrals to further consultations (in partnership with health facilities), and follow-up on treatment. The counselors will be nurses (two nurses with training and certification in NCDs and two others specialized in mental health and psycho-social education). They will help users with education and information about NCDs as well mental health support. The pharmacists will ensure effective supply of pharmaceutical products to users who need them in collaboration with the other members of the clinical team. The clinical team will directly report to the clinical team leader who will be elected among the team.

The support team will have four people: two receptionists and two drivers. The receptionists will be at the forefront of physical and virtual contact with the program users. They will guide the visitors at the program office, ensure that the office space is well arranged, and receive phone and online inquiries from users and guide them to the right person or place in the program. They

will report to one of the program associates. The drivers will support the logistics but transporting the team, partners, and materials for program purposes. Under the supervision of the operations associate, he will ensure that all the motorized vehicles are in good condition and ensure their maintenance.

Talking about the infrastructure, there will be physical and virtual infrastructure. The physical infrastructure will consist of an office equipped with furniture and technology hardware. It will be equipped with a customer service center with communications tools that will allow contact with users such as office phones and computers. It is also important to note that the community health workers who will be enrolled in our program will be equipped with smartphones that will help them to support users navigating the platform and use the program's services. All the phones will remain a property of the program. The program will also have two cars and two motorbikes to facilitate the movement of people and things. The virtual infrastructure will comprise a digital platform, the content, and the records. The digital platform and content will serve for the implementation while the record database will be used for reporting, evaluation and learning, as well as research purposes.

Note that the program will not hold any warehouse. It will partner with existing stores and the services and the program will provide delivery services to patients from the partner stores.

Funding

Most of the funds are expected to be grants from the governments through the Ministry of Health and partners such as international cooperation agencies (USAID, DFID, etc.) and international health programs (Defeat-NCD Partnership, Clinton Health Access Initiative, World Diabetes Foundation, NCD Alliance, etc.). Efforts to create partnerships have started, and the program will leverage the existing network with the government of Rwanda and local organizations like MEDSAR and Rwanda NCD Alliance. While brainstorming potential funders, the program looked for organizations that are already involved locally and partner with the government as outlined in the National Strategy and Costed Action Plan for the Prevention and Control of Non-Communicable Diseases in Rwanda. (2020). Through our joint action with the ministry, the program expects facilitated contact with funding partners. It is also important to mention that the program will accept funds as money or in nature. All the funding streams are outlined in this budget for five years.

5-Year Budget					
Item	**Quantity**	**Unity Price**	**Total Price**	**Source**	**Comments**
Salaries					Salaries considered the local ranges (Besamusca et al., 2012).
Specialists	240	$ 1,000.00	$ 240,000.00	Grants (International NGOs)/ Users Payment	4 specialists for 5 years each. The specialists will work as consultants and will be paid according to the active time they worked. The budgeted amount is an estimate for the monthly maximum they can make.

Counsellors	240	$ 600.00	$ 144,000.00	Grants (International NGOs)/ Users Payment	4 counsellors for 5 years each.
Pharmacists	120	$ 600.00	$ 72,000.00	Grants (International NGOs)/ Users Payment	2 pharmacists for 5 years each
Program Manager	60	$ 1,200.00	$ 72,000.00	Grants (International NGOs)	
Program Associates	180	$ 600.00	$ 108,000.00	Grants (International NGOs)	3 associates for 5 years each,
Receptionists	120	$ 300.00	$ 36,000.00	Grants (International NGOs)	2 receptionists for 5 years each
Driver	120	$ 300.00	$ 36,000.00	Grants (International NGOs)	2 drivers for 5 years each
IT Officers	120	$ 800.00	$ 96,000.00	Grants (International NGOs)	2 full-time IT officers 5 years each.
CHWs	500	$ 500.00	$ 250,000.00	Grants (Government)	In the first year, the program expects to enrol 500 Community Health Workers in the program. They are expected to have incentives according to the users they will help. The amount of $200 is the estimate that a CHW can make through serving users and enrolling them. Note that this amount can increase depending on the earned commissions through sales and deliveries.
Physical Infrastructure					
Rent	60	$ 1,000.00	$ 60,000.00	Grants	Possibility to provide material aid (office, vehicles, phones, computers)
Utilities Bills	60	$500	$ 30,000.00	Grants	
Office Furniture	1	$ 10,000.00	$ 10,000.00	Grants	

Car	2	$ 12,000.00	$ 24,000.00	Grants	
Motorcycle	2	$ 2,000.00	$ 4,000.00	Grants	
Phones	500	$ 80.00	$ 40,000.00	Grants	
Computers	4	$ 800.00	$ 3,200.00	Grants	
Fuel	12000	$ 2.00	$ 24,000.00	Grants	
Tech Infrastructure					
Web Development	1	$ 20,000.00	$ 20,000.00	Grants	Consultant developers
Hosting and Security	5	$ 5,000.00	$ 25,000.00	Grants	
Training					
Participant Facilitation	500	$ 50.00	$ 25,000.00	Grants	
Space and Catering	4	$ 2,000.00	$ 8,000.00	Grants	
Marketing & PR					
Yearly budget for Marketing and PR	5	$ 10,000.00	$ 50,000.00	Grants	
Total			**$ 1,377,200.00**		

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