

The Use of Wearable Technologies in Combating Non Communicable Disease among the Elders in Uganda - Case Study: Masaka City and District

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Abstract
Background: Non-communicable diseases (NCDs) is becoming a burden in developing countries and accelerating day and night. The capacity of health systems in most of these countries is overwhelmed by the huge number of communicable diseases. This has resulted into double burden of diseases for these countries. NCDs have contributed to impediments in development due to increased poverty that is associated with increased mobility, looking for medication. The demand for developing elderly care services increased, and this was aiming at deploying novel technologies in order to provide independent living. This is aimed at creating an environment where elderly can have a consistent and independent health monitor, in order to detect any immerging complications before they become worse. IoT and smart wearable Technologies could provide a promising solution to this problem. These technologies have the capacity to enhance elderly people's quality of life, and also cut costs, and strains on the health care givers. A Survey strategy was used, supported by questionnaires, observations and interview, to support mixed research methodology'. A cross-sectional time horizon was adopted to support a one round data collection. The findings indicated that, majority of the elderly people are suffering from hypertension, followed by diabetes. However, most of them are poor and cannot afford medication.
Keywords: Non communicable diseases, Wearable devices/technologies, Internet of Things (IOT).
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1 Introduction

As fertility rates continue to decline, the population worldwide have continued to reduce, and the existing populations are growing towards the old age. The majority of the old generations in several regions tend to live longer than ever before (He, Goodkind, & Kowal, 2016). This means that the old generations are growing at a high rate. Predictions shows that, by 2050, the number of people who are 65 and above will triple, and this brings worries to the communities, given the fact that most societies across the globe have no plan on how to manage, accommodate, and maintain their aged people. This has gained the world attention on how to handle this critical case(North & Fiske, 2015).

The continuous increase in the elderly people have exerted pressure on health care centers, worldwide, due to numerous scarce resources like health workers, operational costs and many more(Tun, Madanian, & Mirza, 2021). This is due to the fact that majority of the aged people are characterized by impairments and many other health related issues which require proper medical attention (Azimi, Rahmani, Liljeberg, & Tenhunen, 2017).

NCDs have been registered as one of the responsible Couse of the world's morbidity and mortality among the elderly people (Murray Christopher et al., 2012). Alberti revealed that, the international policy organs, detected that, NCDs have become the new pandemic of the twenty first century due to the global increase in NCDs (Alberti, 2001). The human toll of NCDs in the world today, is unacceptable. NCDs are considered to be

the leading causes of death worldwide, and has become too costly to the patients, something which have extended beyond health to trap people in poverty, undermined workforce productivity, denied them a life of dignity, and also threatened their economic prosperity(Organization, 2018). There is a high prediction that, financial losses from NCDs will reach 7 trillion US dollars in the next 15 years globally (Organization, 2013).

The increasing prevalence of NCDs is a growing threat globally, largely in low- and middle-income countries, where the burden of these diseases are transitioning from infectious diseases to NCDs. Research has revealed that, NCDs are killing 41 million people every year, and this contributes to 74% globally (Meghani et al., 2021). All over the world, the low income earners(third world countries) are the most vulnerable populations, with high risk of getting affected with NCDs, and access to health services is that can detect and treat these diseases is limited (Organization, 2018).

According to World Health Organization (WHO), urbanization and modernization are some of the major reasons for the wide spread of lifestyle diseases. These lifestyle diseases include diabetes, cancer, cardiovascular disease, , and chronic respiratory disease (Whyte, 2014). However, the most dangerous NCDs included cardiovascular diseases and this contributed to (17.9 million deaths, accounting for 31% of all global deaths); followed by, cancers (9 million deaths, contributing to 16% global deaths); chronic respiratory diseases (3.8 million deaths, contributing to 7% of all global deaths); The chances of people dying from one of the four main NCDs in 2016 was 18% globally, where men had a slightly higher risk at a rate of (22%) than for females (15%) (Organization, 2018). East Africa has improved on its surveillance and monitoring of NCDs, although national health information management systems have not yet integrated NCDs in its programs. There is a laxity of health workers collect data about NCD (Schwartz et al. 2014).

In Uganda, the Ministry of Health's (MoH) has put policy priorities concerning NCDs ever since 2006 when they formed the Program for the Prevention and Control of NCDs. Despite the proposed policy priorities, implementation lagged behind because of inadequate local disease prevalence data, health services research, and financial resources to drive these policies. In 2016, NCDs accounted for one third of 97,600 deaths rate in Uganda, and mostly as a result of cardiovascular and cancer, together with underlying risk associated with hypertension, alcohol, and tobacco consumption (Meghani et al., 2021).

The plan to care for elderly people remain unclear irrespective of whether you are from eastern, or western culture (North & Fiske, 2015). However, the 21st century is characterized by aged people globally, followed by great advancements in health care management, resulting into increased survival rates (Nawagi et al., 2018).

Of recent, the demand for developing elderly care services increased, and this was aiming at deploying novel technologies in order to provide independent living (Azimi et al., 2017). This is aimed at creating an environment where elderly can have a consistent and independent health monitor, in order to detect any immerging complications before they become worse. Otherwise, if no steps taken, aged group are likely going to face challenges in this industrialized economy, regardless of where you are coming from (North & Fiske, 2015). In order to curb down this pressure, an effective healthcare service is needed. IoT and smart wearable Technologies could provide a promising solution to this problem. These technologies have the capacity to enhance elderly people's quality of life, and also cut costs, and strains on the health care givers (Tun et al., 2021). The improvements in technology has improved the life expectancy of the aged people in the previous years, and increased the proportion of the elderly. IoT has the capacity to connect physical and virtual things to enhanced services like remote elderly monitoring (Azimi et al., 2017). This can be achieved through the interconnection of objects with sensors and unique identifiers which enables them to communicate to each other using internet with the aim of achieving a specified objects (Whitmore, Agarwal, & Da Xu, 2015)

2 Literature reviews.

2.1 Elderly people in Uganda

The United Nations(UN) reported that, the number of people aged 60 are expected to grow up to 56 percent between 2015 to 2030, and is projected to increase to 2.1 billion by 2050 (Khemapech, Sansrimahachai, & Toachoodee, 2019). Nawagi 2018, also indicated that, the number of aged people has increased tremendously from 205 million in 1950, to 810 million in 2012, and is projected to reach 2billions in 2050. The sub-Saharan Africa is contributing 43 million (5%) of the total population of the elderly people. Old age is associated with a lot of health burdens worldwide, but relevant information from third world countries like Uganda remains scarce (Nawagi et al., 2018).

Uganda's population on the other hand is quite young, with the proportion of children (below 15 years of age) being 47.9 percent, while the 'Older persons' (aged 60 years and above) constitutes only 2.9 percent (Mungyereza, 2017). Uganda Beaural of Statistics (UBOS, 2017) also justified that Uganda's elderly population is small, but steadily increasing. On the other hand, Uganda is registered among those countries with high population of the young generation in the whole world. However much the elderly population is still small compared to young generation, there is a significant and consisted increase in the number of elderly people in Uganda today. This is justified with the scientific report conducted by National Population and Housing Census

that took place on the 2014, which indicated that 4% (1,433,596) of the total population in Uganda were ranging between 60 years of age (UBOS, 2017), and the number is projected to increase up to 5.5 million by 2050 (Wamara, 2019).

A cross-sectional research that was conducted at Mulago National Referral Hospital in Kampala revealed that, 134 among the patients received in the hospital are aged 60 years which contribute 11% of the global population and this number is projected to increase to 20% by 2050(Nawagi et al., 2018). The life expectancy for the aged group has changed from 50 to 63 years over the past decade. It is assumed that, the aged group are the most poverty stricken in Ugandan societies, where by 64% are living a poverty line below average, because they don't have access to regular income and luck of benefit from social security services(Nawagi et al., 2018). Old people also suffer from discrimination, theft, rape, and dispossession of property (Wamara, 2019).This makes old people to find difficulty in moving from one place to another, which may cause serious problems that can result into loss of lives, since our elderly are the most vulnerable group.

2.2 Non communicable diseases among the elders

Several Researches that was done in sub-Saharan Africa did not reflect the burdens surrounded with NCDs, and very little community-based studies have been conducted (Dalal et al. 2011). Hypertension(HTN) is registered as one of the most common NCD worldwide and is affecting adult population at a rate of 20% (Osamor & Owumi, 2010). To put that aside, it was found out that 54 percent cases of stroke as well as 47% cases of coronary heart disease in the whole world are characterized with HTN. In a survey that was conducted by Nawagi, (2018) indicated that Hypertension was one of the most common age-related medical problem, and this is due to increased poor nutrition among the elderly people accompanied by lifestyle issues, both in Africa and elsewhere.

Research which was conducted in south western Uganda concerning cardiovascular diseases indicated that, HTN was one of the NCD with high risk factors with an observed prevalence of 22.5 % for both males and females (Maher et al. 2011). Another survey that was conducted in a certain community showed that, 4432 people who are above 15 years from the two districts of Uganda showed that, high Blood pressure was predictors to have contributed to other subtypes of uncontrolled HTN. The study showed that, people aged (35 years and above) had high chances of being affected with HTN compared to those of (15–34 years of age) (Musinguzi, Van Geertruyden, Bastiaens, & Nuwaha, 2015). Above all, the uncontrolled HTN is accompanied with increased mobility which has increased mortality among elders (Musinguzi et al., 2015).

HTN is becoming a common problem in Uganda, and majority of people, including young adults are at higher risk of getting affected by this problem. The wide spread of HTN is very common in the central, western and eastern regions of Uganda (Lunyera et al., 2018), of which Masaka is among the central districts that are registered to have been affected by HTN. It is narrated that; HTN is one of the leading contributor to the global burden of disease (GBD). Therefore, the ubiquity of HTN in Uganda seems to be high, ranging from 11% to 32%. Recent research have pointed out some imbalance in the prevalence of HTN among particular demographic groups, like men, middle-aged adults, professionals, and people in Kampala (Lunyera et al., 2018). It is reported that rural areas are more affected with heart diseases at 4.3% that those in urban centers, at a rate of 2.3%. One of the health workers in Butaleja district narrated that, HTN and diabetes had increased due to lack of attention to the extent that, the former District Health Officer named them a real Neglected Tropical Diseases (Whyte, 2014).

NCDs are considered to be recent, although growing into health problems in Uganda. This has exerted pressure on the healthcare systems, which is already struggling with various communicable diseases. HTN has been registered as the most common NCD in Uganda as well. The most affected group with NCDs are the females than males. For example, High blood pressure together with heart problems are equally affecting 5.3 % of the females compared to 2.4 % and 2.6 % males, respectively. This was also supported by Uganda national burial of statistics (UBoS), on the research that was conducted on National Household Survey (2009/2010), where by a big percentage of females were affected with NCD than males.

Majority of male adults suffer from Prostate Cancers and female adults equally suffer from cervix cancers and are ranked highly among NCDs(Whyte, 2014). On the other hand, many people have resorted to traditional herbal medicine as form of healthcare, to help then eradicate the massive increase in NCDs. This is done by traditional medical practitioners(TMPs) (Kakudidi et al., 2016). This has resulted into increased concerns by the Doctors and government officials in Uganda are warried about the growing incidences of NCDs in Uganda, which is attributed to increased obesity and changes in lifestyle (Whyte, 2014).

Basing on the above, many developing countries are facing various problems in delivering health care and medical services to their population due to lack of funds and constrained resources as well as a dramatic shortage of trained and experienced health workers. The prolonged shortage of professional medical personnel, significantly hinder proper medical service delivery, more especially in developing countries (Khemapech et al., 2019). A lot of effort is required to automate medical services, to improve on regular monitoring of the elderly people and set up warning systems in order to eradicate feasible injuries and loss of lives for the elderly people

(Khemapech et al., 2019).

The World Health Organization report for the healthy ageing between 2021–30 sets the stage for a change in the methodology for monitor the health conditions of the aged people (Sen, Jette, Husain, & Sander, 2020). However, the conventional diagnosis assistance is becoming inadequate to curb the situation down. Electronic health is aimed at dispensing affordable household access to medical services(Zhang, Liu, Su, Jiang, & Wei, 2015). The available pharmaceutical control of HTN is not sufficient enough to manage this huge problem, more so, for the poor people, who are already struggling with other NCDs (Musinguzi et al., 2015).

To manage these complications, a well-integrated health care service might be a better strategy to overcome the chronic diseases in sub-Saharan Africa. (Shiri et al., 2021). Various sectors should be called upon to help in managing and cab down the situation. These sectors include education and environment, trade, agriculture, health as well as government who need to get in touch so that the problem of NCDs can be combated. Otherwise, millions of people will continue to die every now and again, in their prime age (Organization, 2018).

2.3 Technological aspect on non-communicable diseases

In this modern error, new technologies have ushered in, which incorporate physiological sensors and wireless communication, which has gained great prominence(Zhang et al., 2015). GPS (Global Positioning System) is playing a role in tracking patients' position. The next great wave of Internet-enabled innovation is poised to revolutionize the way humans interact with the world around them. This paper highlights how elderly patients can be monitored by the rise of the so-called Internet of Things (IoT) in general and wearable technologies in particular (Thierer, 2015).

The logic in IoT is its capacity to enable interrelated objects to interact autonomously without human intervention(Garale, 2019). This technology enables physical objects that contain embedded technologies that are logically connected to enable them to sense, communicate, and interact with the physical world, and among themselves" (Nogueira & Carnaz, 2019).

The application of IoT in healthcare can improve the access of healthcare to people in remote locations or to those who are incapacitated to make frequent visits to the hospital (Vermesan & Bacquet, 2017; Vermesan et al., 2017) . Some developed countries have been implementing the IoT enabled applications in healthcare sector and obtained satisfactory result (Yuan & Cheah, 2020). The greatest registered gains with IoT is its capacity to manage healthcare services, which has boosted remote health monitoring, detection of chronic diseases, fitness programs, and above all, elderly monitoring and care(Nogueira & Carnaz, 2019).

A huge number of elderly people are scattered in developing countries with scarce health services. This has brought about new innovations like Remote Mobile Health Monitoring (RMHM) systems as a research hot-sport in this new generation of computing. The WHO also tried to give some guidance on how to implement the integrated care for old people (ICOPE), under the global Delphi study (Organization, 2018). WHO realized that there was a huge demand to come up with integrated care system to act as a paradigm shift to advance personal centered care in all communities, irrespective of their capacities (Organization, 2018).

The contemporary models available today are targeting fixed areas in health sector, which cannot span the entire scope of the health sector. Therefore, there must be a strategic plan to integrate internet of things (IoT) health care, aiming at improving elderly people’s health (Organization, 2018). Nowadays, IoT, wearable devices and smartphone are no-longer expensive. Many people in their capacities can afford them because they are all over the place. A number of applications have been developed from various vendors like run keeper Apple Watch, fit bit, etc. to enable continuous physiological data collection (Ravi, Wong, Lo, & Yang, 2016). These devices have inbuilt sensors that enable them to collect data from the environment, and then process that data, then transfer the collected data to the appropriate storage area. Device users can either dress them up, or place them in the pocket, or money purse or install them at the workplace or at home (Ravi et al., 2016).

These Wearable technologies have potential to snapshot some one’s daily activities using motion sensors, and then record them on the mobile device, or laptops. A number of wearable technologies are registered including activity tracker, smart watch, Fitbit etc. Multiple fields have benefited from the wearable technologies, however, the health care have benefited more from them. Hospitals and clinics have benefited from the wearable technologies and below are some of the benefits.

Wearable devices support Proactive Healthcare. This is because it can enable people to detect health problems early enough before it creates danger to the patient. It can also detect irregularities for those people with health problems before they become hazardous.

2) Patients are more engaged with wearable devices to track their health by themselves. Patients get real time data concerning their health conditions, so that they can easily alert the responsible people to provide necessary solutions to their problems.

3) Wearable devices can frequently monitor Vulnerable Patients on real time. This enables health work to keep track of their patients who have medical issues, remotely(Chawla, 2020).

The adoption of wearable technologies therefore, have made it easy to monitor the health conditions of sick

people instantly. The increasing number of elderly population require electronic-health system for household usage, at a low cost (Zhang et al., 2015). This will enable the patients leave a health life at a low cost, boost their lives, and live longer than ever before.

According to estimates of Cisco Systems, IoT is expected to connect 50 billion devices with the aid of internet, by 2020. these physical objects like sensors, computers are assigned unique identifiers and capacity to transmit data from daily activities to specified medical records, in a more secure way (Nogueira & Carnaz, 2019). This brings hope for Ugandans to develop systems using IOT, and wearable technologies, to take care of our elders.

2.4 Courses of NCDs

NCDs are group of diseases that share similar risk factors because of exposure, to unhealthy diets, inactive physical activities, too much smoking, continuous use of alcohol and possibly increased stress"(Steyn, Nel, Nantel, Kennedy, & Labadarios, 2006). Two thirds of NCDs are caused by cardiovascular diseases chronical lung diseases, cancer and diabetes (Meghani et al., 2021). Other related causes include too much exposure to high salts, fats and calories deities coupled with increased sedentary lifestyle. Population aging, political instability, social-economic pressures among others, have also contributed to increased NCDs. The situation for NCDs is complicated with lifelong antiretroviral treatment in Uganda (Kakudidi et al., 2016).

2.5 Strategic plans for reducing NCDs.

Political involvement and commitment should be at the fore front to enable quality care. The government should emphasize regular drug supply, improve diagnostic and treatment services in various health centers, and consistent monitoring and evaluation of medical services (Maher, Harries, Zachariah, & Enarson, 2009). Other authors advised to incorporate NCD services in the existing HIV infrastructure (Crabtree-Ramírez, Del Río, Grinsztejn, & Sierra-Madero, 2014). NCDs can also be embedded in the existing programs for infectious disease (Schwartz et al., 2015). (Jaffar, Amberbir, Kayuni, Musicha, & Nyirenda, 2013).

In Uganda, the Ministry of Health's (MoH) policy priorities considered NCDs among its priority programs since 2006 as a strategy to cub down NCDs among its citizens (Schwartz et al., 2015). MoH also proposed that health workers should be trained and prepared to diagnose and manage NCDs(Rogers, 2014). Uganda Initiative for Integrated Management of Non-Communicable Diseases (UINCD) was also formed and aimed at putting up a Center of Excellence for NCD, As part of medical education collaboration between Makerere University in Kampala, Uganda and Yale University in New Haven, which helped in providing clinical care and medical education at Mulago National Referral Hospital since 2006(Schwartz et al., 2015). In 2011, the idea of a Center of Excellence (CoE) was also formed to focus on NCD through trainings and health service delivery research based at Mulago Hospital (Ronald, Kamya, Katabira, Scheld, & Sewankambo, 2011). Despite the above, a need for integration of multiple sectoral collaboration among different stakeholders to address NCDs with the aim of improving health services for the affected people. (Schwartz et al., 2015)

3 Methodologies

3.1 Study design.

The philosophical approach that was adopted was a pragmatic approach, which caters for mixed method (qualitative and quantitative) (Alturki, 2021). The research approach was a deductive approach, since the researcher first identified the problem, then found out the theory, then preceded to data collection to relate the findings with the existing theory. UTAUT 3 was therefore the most appropriate theory to underpin this research. A Survey strategy was used which worked hand in hand with deductive approach (Saunders et al., 2009). Data was collected using questionnaires, observations and interview**,** to support mixed research methodology'. A **cross-sectional time horizon** was adopted to support a one round data collection. Data was analyzed using SPSS and NVIVO method.

3.2 The target population

The target population were the elderly people, who are 60 years and above. The study also involved health workers in various medical centers of Masaka region. The focus was generally on elderly people with NCD's, and specifically those with high blood pressure, cancer, and diabetes.

The sample size was 388, out of 12797 elderly people, from all the sub counties in Masaka district/city. The Slovenes formula was used to compute the sample size of 388 elderly people from whom, data was collected.

3.3 Sampling techniques.

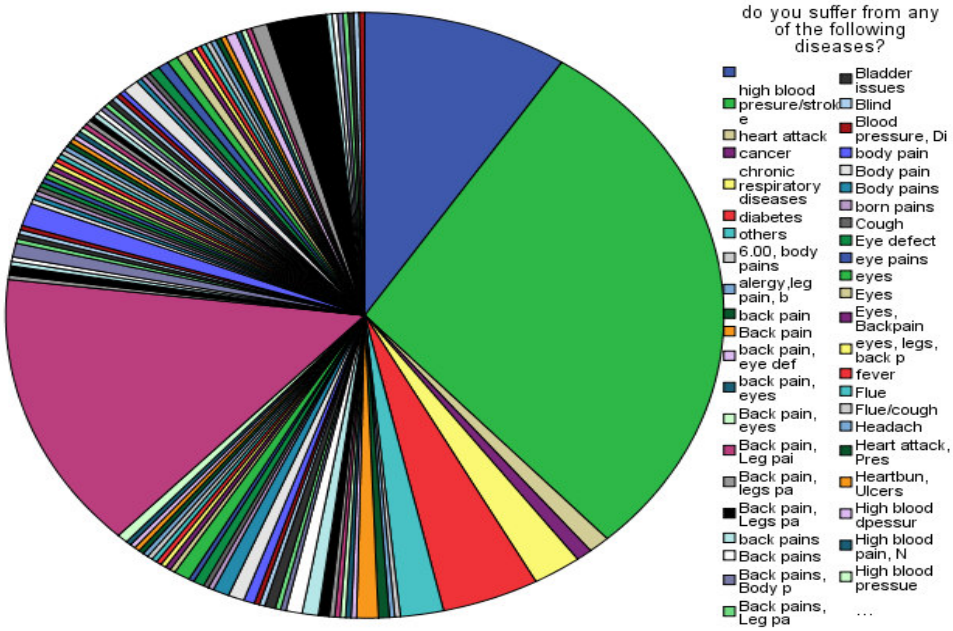
A Simple random sampling technique was used in order to give equal opportunity for each respondent to be selected. Cluster random sampling technique was also used, where by target population was divided into groups called clusters according to villages or sub counties. Data was collected using a questionnaire, observations and

interview methods.

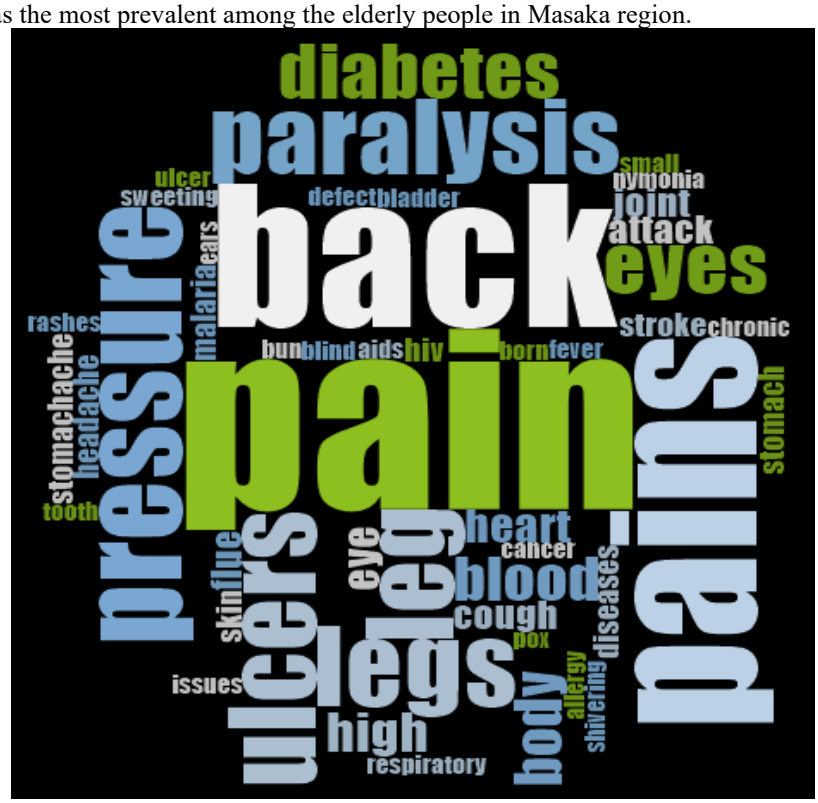
4 Data analysis

4.1 Chronic diseases among the elderly (quantitative data).

High blood pressure and related stroke was reported highest (in green color of the pie chart), followed by back pains and leg pains (pink color of the pie chart). Eye problems were also common among the elders (in blue color), while a wide range of combined other diseases or ill health conditions constituted a small percentage to the rest of the results. These included diabetes, malaria, different forms of allergies, ulcers, HIV/AIDS, cancer, to mention but a few.



The most common words are back pains. However the most clear words concerning NCD was pressure, followed by diabetes. The rest of the chronical diseases were invisible in this diagram. An indication that high blood pressure was the most prevalent among the elderly people in Masaka region.



3.2 Health workers position on the health status of the elderly people in Masaka.

a) The rate at which high blood pressure is a threat to elderly health.

Majority of the health workers strongly agreed that elderly patients are highly affected with high blood pressure at a rate of 88%, well as 9% agreed, and 3% strongly disagreed that elderly patients were affected by high blood pressure.

b) The rate at which stroke is a threat to elderly patients.

Health workers strongly agreed that elderly patients are affected by stroke at a rate of 64%, 30% agreed, 3%disagreed, and 3% strongly disagreed that elderly patients are affected by Stroke.

c) The rate at which Heart attack is a threat to the elderly patients.

50% of the health workers agreed that the elderly patients were affected by heart attack, 31% also agreed about the same, only 6% disagreed and strongly disagreed that the elderly patients were affected by heart attack.

d) The rate at which Cancer is a threat to elderly patients.

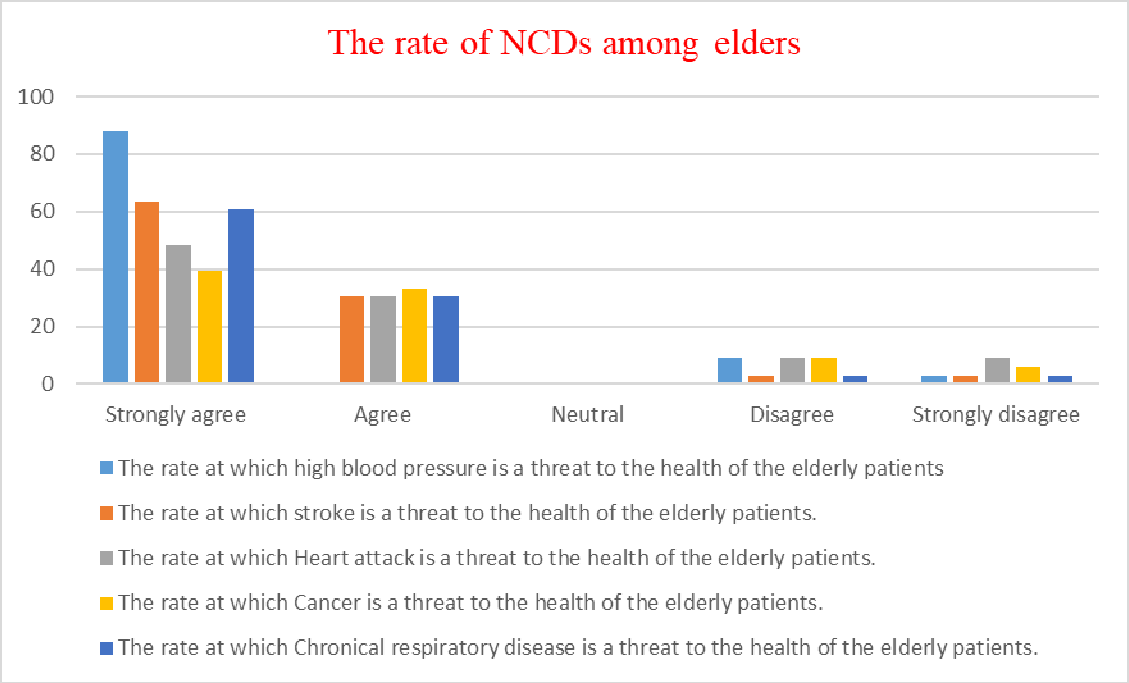
45% of the respondents agreed that the elderly patients were affected by Cancer, 37% also agreed, 10% disagreed, and 7% strongly disagreed that the elderly patients were affected by Cancer.

The rate at which Chronical respiratory disease is a threat to elderly patients.

63% of the health workers indicated that, the elderly patients were suffering from Chronical respiratory diseases, 31% of them agreed and the 6% disagreed and strongly disagreed that the elderly patients had issues with Chronical respiratory diseases.

THE RATE AT WHICH CHRONICAL DISEASES ARE BURDENING ELDERS

Questions	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The rate at which high blood pressure is a threat to the health of the elderly patients	87.9	0		9.1	3
The rate at which stroke is a threat to the health of the elderly patients.	63.6	30.3		3	3
The rate at which Heart attack is a threat to the health of the elderly patients.	48.5	30.3		9.1	9.1
The rate at which Cancer is a threat to the health of the elderly patients.	39.4	33.3		9.1	6.1
The rate at which Chronical respiratory disease is a threat to the health of the elderly patients.	60.6	30.3		3	3



4.3 Qualitative data analysis on NCD

Health worker's interview responses on NCD

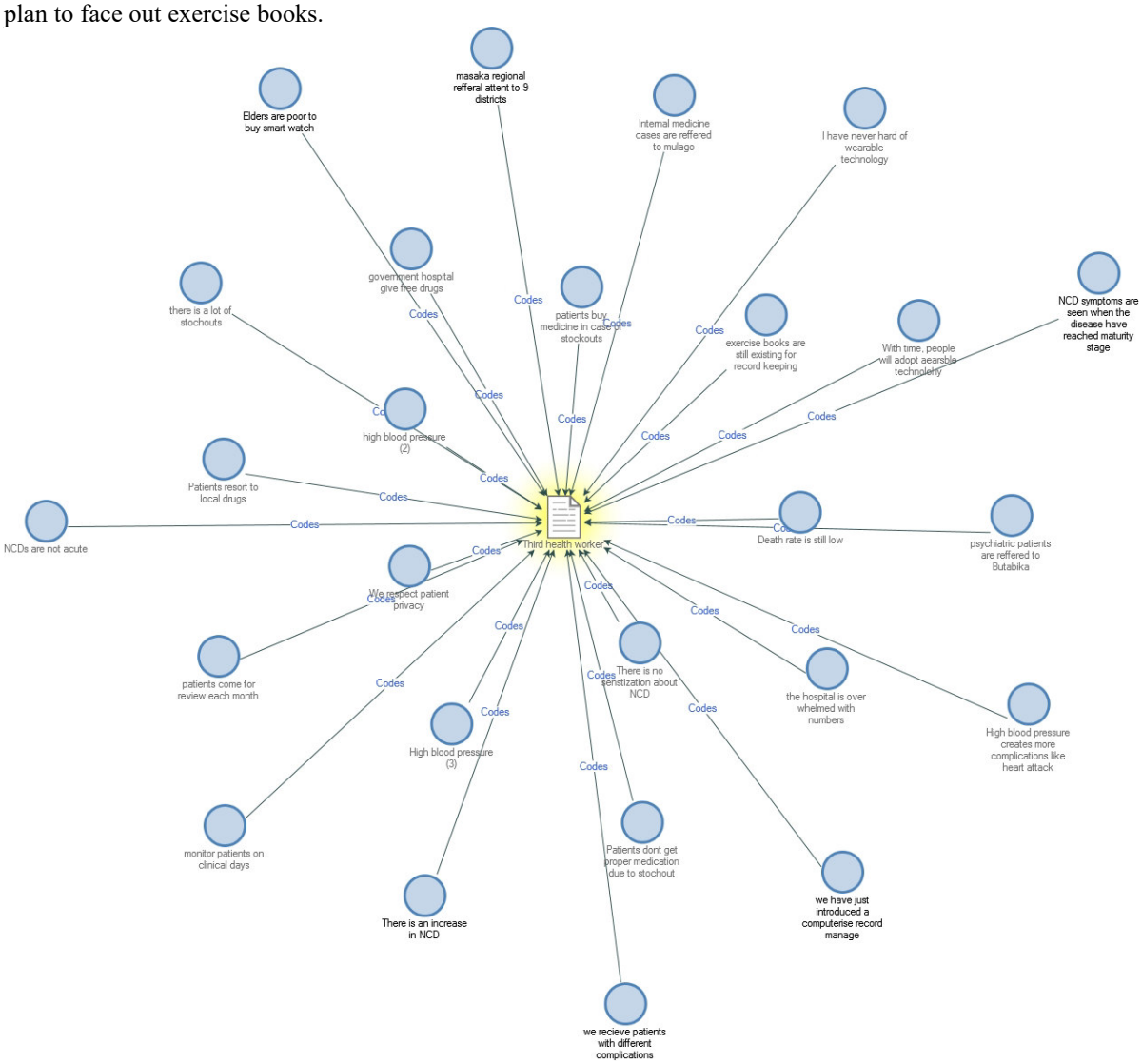
Masaka regional referral hospital is the biggest hospital in greater Masaka, and attend to nine districts. This hospital gives free medications to its patients, since it is a government hospital. However, in many cases, this hospital experience many cases of stock outs due to overwhelming number of patients. As a result, patients are given prescriptions to go and buy medicine by themselves. However, these people live a very humble life in that, they cannot afford to buy medication prescribed to them. In this case these people end up missing their doses and this result into complications. As a result, elderly people improvise with traditional medicine, which cannot impact on their lives.

In a situation where these elderly patient develop complications, they become a burden to the hospital, where by the hospital cannot afford to take care of them, they therefore refer them to a higher level. In this case

internal medicine cases are referred to Mulago national referral hospital, and psychiatric patients are referred to Butabika national referral hospital.

Hypertension is the most common NCD among these people, as it doubles the number of patients for diabetes. The biggest challenge is that these NCDs cannot easily be detected because they are not acute, and above all, there is no sensitization about NCD. In the end, patients come to realize that they have NCDs when it has reached maturity stage. This doctor narrated that, hypertension can cause other complications like heart attack, kidney failure to mention but a few. However the death rate is still low. It only happen to those who neglect their drugs.

The monitoring systems available to these patients are the clinical days, where each patient is assigned a day among the clinical days to visit the hospital for a checkup, so that they can make a refill, change drugs, etc. They ensure that patients' privacy are protected. On the other hand, the doctor was ignorant about wearable technology, and thought that his patients would not adopt to this technology. Later, he realized that wearable technology would be of great benefit, and therefore predicted that with time, elderly will adopt to wearable technology. Currently, exercise books are still existing for each patient for record keeping, and it's a responsibility of the elderly to keep the book intact. On the other hand, the hospital had just introduced computerized record keeping, where each patient is given OPD number, as a reference for his record, as they plan to face out exercise books.



5 Results

5.1 State of the Elderly people

The elderly people are experiencing very hard time in their lives. This was evidenced in the number of elderly people received in various hospitals. Majority of patients received in hospitals are elders and more so females. The doctor from Sunga hospital in Masaka narrated that, the hospital largely works on the elderly patients at a rate of 60% of total number of patients received in that hospital. He also indicated that the elderlies leave a very

poor life whereby they cannot easily afford medication.

NCDs were found to be the deadliest diseases during the investigations, and high blood pressure was considered the top most NCD among the elderly patients, followed by diabetes. It was reported that, High blood pressure patients double those of diabetes. Other NCDs included cancer, and Chronical respiratory disease. Sunga health Centre indicated that the elderly people are largely suffering from hypertension, diabetes, and muscular scrotal pains. The head of OPD at MRRH narrated that, he receives mainly those patients with hypertension and diabetes, and these NCDs have the most active clinics in the hospital. Hypertension predisposes someone to other complications like heart attack, stroke, kidney failure and the like. The deadly part of the NCDs is the fact that they are not acute, in this, symptoms come when the NCDs have reached maturity stages. They cannot be detected at their early stages. This means that you can only tell that you have NCDs after getting symptoms.

5.2 Reason for increase in NCD

First, the elderly people embark on traditional drugs whenever they get strange pains in their health. The hospital is always resorted to when the situation worsens. And when the NCDs reach maturity stage, in most cases it's irreversible, and result into other complications like heart attack, kidney failure and stroke, which reads to intensive care for our patients.

Second, Patients don't take proper medication. They don't follow the prescription given by the health workers, due to excess stoke outs in the MRRH, where patients don't get proper dosage. This forces health workers to tell the patients to buy the drugs by themselves, of which majority of these patients are poor. They end up not buying it. This result into complications on the side of the patients. Third, many of the elderly people out there are ignorant about the NCDs and they end up not responding to these complications as required.

5.3 Special services for elderly

The available special services were the dedicated clinical days for elderly people, for the NCDs, in some of the private and government hospitals, and these clinics are conducted on a weekly basis. Elderly are also admitted in both government and private hospitals when the situation becomes uncontrollable. The NCD patients are handled at the OPD. Each patient is given one day in a month to go for checkup, following the days of the clinics. For those patients with NCDs who normally come when they are in advanced states, are received in accident and emergency ward. If the situation gets worse, the patients are retained in the hospital. From this point, health workers attend to them in their respective wards.

5.4 Access to Treatment

The elderly patients get treatments from various hospitals, like government and private hospitals. Most of the patients go for government hospital, largely MRRH. Private hospitals were found to have good services to their patients, however, the services are very expensive to the majority of the elderly people. Some elderly patients fail to raise money after being given a services, therefore the hospital reschedule payment plans for their patients. One of the Medical officers at MRRH narrated that, they give free treatment at this hospital to all their patients, since it is a government hospital. However, this hospital experience a lot of stock outs (drugs, gloves, and lab reagents), due to overwhelming numbers of patients in the hospital. The minority of the elderly people can afford private services, and the majority cannot afford it.

The reason for the increased number of elderly patients in the hospital and ward in particular, is the fact that the elderly people have a lot of complicated diseases. This was justified by the medical officer in charge of OPD, that elderly people always get multiple complications. OPD always receives two categories of patients, that is; continuing and startups. The continuing patients always come for refill, report progress or change drugs in case the one used is not effective. This is done on a monthly basis. Startup patients are those that come with symptoms of NCDs, they are then diagnosed, when the doctor encounter some NCDs or any other disease, he then initiate drugs to the patient.

At Sunga hospital, they frequently received elderly people and they handle them, at a subsidized payment, because it's a church hospital, which is non for profit. However, some patients cannot afford paying even when the prices are low. They therefore give them treatment and they pay at scheduled period. One of the elderly patient in Lambu landing site said that, they get proper treatment for their health, but they have to travel to Kitovu hospital which is located in Masaka city. He said that small health Centers in their area cannot handle complicated disease. Whenever, a village member develops complications, the association comes on board to give a hand financially to that patient so that he/she can get proper medication.

Another elderly narrated that they get treatment with a lot of hardship from MRRH. They find long ques whenever they go to pick medicine prescribed to them from the hospital pharmacy. They also experience frequent stock outs in the pharmacy, which prevents them from getting proper dose as prescribed by the medical doctor. They therefore find themselves buying medicine by themselves. These Drugs that are prescribed to the

patients are always expensive, in that, majority of the patients cannot afford to buy the medication. They end up buying half of the prescription, or even go without proper medication due to stock outs, which has resulted into increased numbers of patients for NCDs. One patient attendant claimed that the available drugs are of poor quality which cannot impact on their health. He explains that drugs that are made from abroad like German are the ones that can treat them well, however, they are not affordable by majority. And whenever they fail to buy proper medication, they end up being condemned by the health workers claiming that they want to kill themselves for not taking proper medication.

5.5 Monitoring system used in health centers.

Some of the hospitals in Masaka like Kitovu hospital have tried to put up some monitoring systems for their patients, for instance, they save phone contacts for all their patients and make a fall up of their patients whenever they are away from the hospital. Alternatively, when the elderly gets challenged, they themselves call the health workers to come to their rescue. However, the health worker narrated that, the elderly people are monitored well when they are at the hospital than when they are away from the hospital, and their lives are better when they are at the hospital than when they are at home. In MRRH, patients are not remotely monitored, instead, patients bring themselves to the hospital whenever they get challenges with their health. Then the patients are diagnosed to discover what they are suffering from. The health workers get detailed information from the elderly patients basing on their historical narrations.

6 Discussion of the results

6.1 State of the Elderly people

The elderly people are experiencing very hard times in their lives. This is evidenced in the number of elderly people received in various hospitals, at a rate of 60% and above, of the total number of patients received in the hospital. The doctor from Sunga hospital in Masaka narrated that, the villages are largely occupied by elderly people because the youth migrated to urban centers. “Theories of the Aging Individual” states that, there are some elements of psychological change in the late days of elderly people that forces them to adjust and adopt to the reality of old age (Putnam, 2002), for example, “Disengagement theory” states that old age is always accompanied by natural withdrawal or disengagement from the role of life as a mechanism to substantial satisfaction in the older life. This means, when people grow old, they have to withdraw from work, thereby decide to go for retirements in their village homes. Villages are characterized with too much poverty where by most of the elderly people cannot afford basic need of their lives. They therefore end up living miserable lives. Majority of the elderly stay in substandard houses, and above all, with very poor feeding, which results into high chances of getting chronic diseases (Nawagi et al., 2018). And because of too much poverty associated with elders, they cannot easily afford medication.

Most of the health workers, narrated that, the most common problems encountered by the elderly patients was largely financial burden, long distance and high transport costs, accompanied with Poor transport means. This is because, most elderly people prefer to visit MRRH because it’s the only one government hospital that gives free medication to the patients in greater Masaka region, and above all it has the best services for the NCDs. The fact that these people don’t have enough resources to take them to the nearest private hospital, they end up moving long distances to reach the hospital where services are free. According to Nawagi (2018), private hospitals are money minded, coupled with lack of specialized services for the elderly (Nawagi et al., 2018). This definitely calls for traveling long distances to reach the hospital.

The available special services were the dedicated clinical days for elderly people, to cater for NCDs, in some of the private and government hospitals. The interview conducted by clinical officer for hypertension and diabetes revealed that, clinics are conducted on a weekly basis at MRRH. Each patient is given one day in a month to go for checkup, following the days of clinics. To my understanding, these services are not adequate to frequently monitor the elderly people with NCDs, since these people are always under the weather. They need a stable and frequent monitoring system, to enable them maintain a good life. This was backed up by Khemapech, where he emphasized that a lot of effort is required to automate medical services, to improve on regular monitoring of the elderly people and set up warning systems in order to eradicate feasible injuries and loss of lives for the elderly people (Khemapech et al., 2019). Most of the developed countries have various special services for their elderly people. For instance, they have dedicated health workers for each and every elderly patient, to ensure that they are always in good medical conditions. Literature showed that, the current special services in various countries use smart health (wearable technology), to continuously monitor the elderly people. The government of Uganda should devise all possible means to ensure that elderly people are not left behind concerning smart health, so that they can live longer, healthy and happily.

6.2 Chronic diseases among the elderly.

The interviews conducted in various hospitals indicated that NCDs were the deadliest diseases among the elderly

people, and the most common ones were hypertension(HTN) and diabetes. High blood pressure and related stroke were reported highest at 35.4% by the elderly, while a wide range of combined other diseases or ill health conditions constituted a small percentage to the rest of the results. These included pains of the back, legs, neck, eyes, diabetes, different forms of allergies, ulcers, HIV/AIDS, cancer etc. Health workers also confessed that High blood pressure was the greatest threat to the elders. Almost all the health workers were in agreement on this matter. Literature also indicates that hypertension is the most common NCDs and call for other complications like stroke, heart attack, kidney failure, to mention but a few. It was found out that almost 54% cases of stroke and 47% cases of coronary heart disease in the whole world are characterized with HTN. Above all, the uncontrolled HTN is accompanied with increased mobility which has increased mortality among elders (Musinguzi et al., 2015).

The rapid increase in HTN, have increased a huge burden to the health sectors in sub-saharan Africa, which calls for advanced treatment, in order to save people's lives (Shiri et al., 2021). The available pharmaceutical control of HTN is not sufficient enough to manage this huge problem, more so, for the poor people, who are already struggling with other NCDs (Musinguzi et al., 2015). It was revealed that, NCDs are not easy to predict during the infancy stage, because they are not acute. Symptoms come when the NCDs have reached maturity stages. Therefore, there is a need to find a mechanism of overcoming such issues among the elderly people

Besides, the internet of things (IoT) services can help in the monitoring, early detection, prevention and treatment of several illnesses (Majumder, 2017), Such as pulmonary diseases, diabetes, heart disease, cancer, seizures, among others. These diseases in most cases they require consistent monitoring of body actions, and therefore, such people need to be under a consistent watch (Elkhodr, 2016).

On the other hand, the hospital receives a lot of patients, and they fail to give them good services due to overwhelming numbers. According to Nawagi (2018), health centers are difficult to approach, because of poor health service delivery in public facilities due to scarce resources (Nawagi et al., 2018). The drugs are in scarcity, which means that the hospital always experience stock outs. So patients rarely find drugs in public hospital, and consequently, they end up telling patients to buy drugs by themselves, of which they cannot afford the drugs, and end up missing the dose. Consequently, they develop other complications.

Research showed that, most of the patients received are out patients, who have to travel from their homes to go and meet the doctors. The reason for the increased number of elderly patients in the hospital and ward in particular, is the fact that the elderly people have a lot of complicated diseases. This was justified by the medical officer in charge of OPD, that elderly people always have multiple complications. If they fail to respond to the medication, they are retained in the ward so that they can be monitored frequently by the health workers. A lot of effort is required to automate medical services, to improve on regular monitoring of the elderly people and set up warning systems in order to eradicate feasible injuries and loss of lives for the elderly people (Khemapech et al., 2019). Wearable technology therefore comes in to solve such problems.

6.3 Monitoring system used in health Centre.

Some of the hospitals in Masaka like Kitovu hospital have tried to put up some monitoring systems for their patients. For instance, they save phone contacts for all their patients and make a fall up of their patients whenever they are away from the hospital. According to health workers in Masaka, very few hospitals had monitoring systems and these largely inclined on phone calls and text messages. Others had special days (clinical days), where elderly patients were assigned days to visit the health centers for NCDs services. This is largely the most prevalent to most of the hospitals and considered a special service to elderly patients in greater Masaka. Literature showed that, the Ugandan way of managing remote health, is done by using mobile applications as an interface for easy communication, using sms to update the patients. Various tools like mobile phone, text and multimedia messages, voice over internet protocols, are used to enhance communication between health workers and patients (Kiberu, Mars, & Scott, 2017).

Alternatively, when the elderly patients face challenges, they themselves call the health workers to come to their rescue. One of the health worker put it that, the elderly people are monitored well when they are at the hospital than when they are away from the hospital, and their lives are better when they are at the hospital than when they are at home. Literature showed that, most elderly patients get well when they are in hospital than when they are at home. This is because at home, nobody is there to check on them whenever they get complications. However, consistent monitoring is always available when the patients are admitted. This monitoring systems seems expensive and unfriendly to stay in the hospital for so long. However, there is a strong belief that wearable technology and smart health can do a better job in monitoring the elderly people wherever they are.

7 Conclusions

The collected data implied that, most of the elderly people are associated with at least one NCD, and most of the available health centres are not giving services for NCDs. This forces the elderly people to travel long distances

to meet health services. Research showed that most of the elderly people resort to MRRH where they can get free services for NCDs. For those few elderly people who can afford private services go to private hospital where there is limited congestion. Although the services in such hospitals are swift, they are as well costly. On the other hand, MRRH seems to be giving free services, but there is a lot of congestion, and service providers are few, which result into delays in giving services to the elderly people. This means that the patients are over delayed in the hospital.

Transport means is a big hassle since most of them resort to motorcycles which seem to be the most convenient and accessible transport means. Most of the elderly people stay deep in villages where taxes (vehicles) can't reach them. Literature indicated that, most developed countries have embraced the wearable technologies to improve on the wellbeing of the elders in their countries. The adoption of wearable sensor systems is renowned to play a great role in fighting against NCDs. These sensors can afford early detected of NCDs, and preventive actions can be taken in order to avoid deterioration of the elderly people. The sensor can also be of great important for both the individual being monitored and the professional caregiver, that is not only to measure and follow trends, but also to give support in the form of advice on how to manage the disease (Kristoffersson & Lindén, 2020).

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