

**USE OF TELEMEDICINE IN IMPROVING ACCESS FOR
PREGNANT WOMEN TO HOSPITAL IN NAIROBI DURING
THE COVID – 19 PADEMIC (Mixed – Method Cross – Sectional Study)**

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the award of the degree of Masters of Medicine, in Department of Obstetrics
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2023

DECLARATION


This research dissertation is my original work and has not been presented elsewhere references to work don submitted for academic award in an institution or university.

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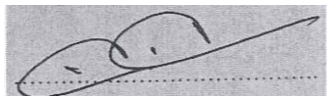
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LIST OF ABBREVIATIONS

ACOG – American College of Obstetrics and Gynaecologists

ANC- Antenatal clinic

BEmOC – Basic Emergency Obstetric Care

CEmOC – Comprehensive Emergency Obstetric Care

COVID-19: Corona Virus disease 2019

CHW- Community Health Worker

EPMM- Strategy to End Preventable Maternal Mortality

IDI – In-depth interview

KNH – Kenyatta National Hospital

UON- University of Nairobi

SHP- Skilled Health Professional

TBA- Traditional Birth Attendants

WFL- Wheels For Life

WHO- World Health Organisation

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ABSTRACT

Study Background: Maternal deaths are preventable if the three delays to accessing health care outlined by Thaddeus and Maine are actively addressed. These delays have been identified chronologically as delays in (I) the decision to access care, (ii) the identification of- and transport to a medical facility (delay in seeking healthcare), and the receipt of adequate and appropriate treatment (delay in receiving quality healthcare). The strides taken by the World Health Organisation and Local Governments to reduce the burden of maternal mortalities have been affected by the Covid-19 pandemic, and lockdown and travel restrictions to mitigate the spread of the Covid-19 disease with more deaths and pregnancy complications noted. Telehealth has emerged as a solution to ensure all women, especially the vulnerable, access teleconsultation from doctors and free transport from their homes to facilities. Wheels for Life is an initiative that began in April 2020 (at the core of Covid -19) to enable pregnant women to get care during curfew hours and 24 hours free consultation in 6 counties. The intervention handled more than 120,000 calls during the Covid 19 pandemic, with over 10000 women receiving telemedicine and over 2000 dispatched safely to a hospital.

Broad objective: To determine the utilisation, uptake and experience with telemedicine in reducing delays in access to maternal health services during the Covid 19 pandemic in Kenya from May 2020 to April 2021 in Nairobi County

Methodology: We used a partially mixed sequential quantitative-qualitative research to objectively determine the intervention's effectiveness by retrospectively analysing data from the intervention's database using forms. Our study population was the pregnant women, their caregivers and health care workers who interacted with the intervention during the Covid -19 pandemic within Nairobi County. We collected data retrospectively from intervention records and in-depth interviews were used to assess the views of the different stakeholders. i.e. the patients, taxi drivers, and health care workers. The quantitative analysis was analysed using descriptive analyses and qualitative analysis done using thematic deduction.

Utility of the study: We hope that our research can objectively show the usefulness of telemedicine and easily accessible emergency transport in improving maternal health care, especially during pandemics; moreover, that it can guide different policymakers in analysing the intervention for possible integration into the counties and national government health systems.

CHAPTER ONE: INTRODUCTION

1.1 Background

COVID-19 Disease, an infectious disease first identified in December 2019 in Wuhan, China(1), had single-handedly changed the global outlook of health and caused significant behavioural changes among us, the human species, in a war to curb its spread and eliminate it. (1,2) According to the Worldometer's Covid 19 data, as of the 6th of June 2021, COVID-19 had claimed the lives of 3.72 million people worldwide, with 173 million cases reported, despite the presence of vaccines for the last six months. (3)

However, the death toll of the COVID-19 virus went beyond the disease entity itself. A study by T. Robertson et al. estimated an increase of 9.8–44.7% in under-5 child deaths per month and an 8.3–38.6% increase in maternal deaths per month across 118 countries. They concluded that 60% of the estimated additional maternal deaths would be due to reduced provision of essential childbirth interventions such as parenteral administration of uterotonics, antibiotics, anticonvulsants, and clean birth environments. (4) The postulated increase in maternal mortality would worsen the already present challenges in maternal and under-5 child mortality globally. In 2017, the World Health Organization (WHO) estimated that approximately 810 women die daily during delivery. Their data showed that 94% of these deaths occurred in low and medium-income (LMIC) countries, and most of the deaths were preventable. (5) The WHO 2015 "strategy to End Preventable Maternal Mortalities(EPMM)" noted that even in the LMIC, most deaths occur in the vulnerable community and listed access to care as a critical component to achieving EPMM. (6) It is possible to reduce the burden of maternal deaths and prevent them if the country could address the three-delay model outlined by Thaddeus and Maine. These delays have been identified chronologically as delays in (I) the decision to access care, (ii) the identification of- and transport to- a medical facility (delay in seeking healthcare), and the receipt of adequate and appropriate treatment (delay in receiving quality healthcare. (7,8)

1.2 The Kenyan Context

The death toll from Covid 19 disease by the 19th of July 2021 was 3775, with 192,758 cases of COVID-19 reported in Kenya. The first Covid 19 case confirmed on the 12th of March 2020 brought a general state of anxiety in the country, with many fearing the disease. The Government

of Kenya responded by imposing a nationwide curfew from 7 pm- 5 am, which later was revised to 9 pm -4 am and then to 10 pm -4 am (now stopped) to reduce social interactions and curb the spread of COVID-19. The Government also instituted lockdowns in certain counties with high infection rates, including Nairobi County(9–11). This curfew limited public transport, including matatus, taxi services like Uber, Bolt, or motorcycles, and restricted free movement such as walking in public during night hours. The Covid-19 pandemic instilled widespread fear of health institutions as a source of the infection.

As per the Kenya Demographic and Health Survey 2014, the maternal mortality ratio in Kenya stands at 362 deaths per 100,000 live births(12) compared to the Sustainable Development Goals (SDG 3) aim of less than 70 per 100,000. (13). Consequently, Kenya has put in place measures to provide free maternal and early neonatal health care in public hospitals, focusing on free antenatal care and delivery in public health facilities to improve access to healthcare. These measures seek to reduce home deliveries and ensure labour is monitored and conducted safely in health facilities under the recommended Skilled Health Personnel (14,15). The Government has also equipped different health centres such as BEmOC and other CEmOC centres (16) to enable better delivery of maternal care.

Well-equipped and accessible health facilities are likely to reduce delays in seeking care (Type 1 delay) and provide good quality care at these facilities (Type 3 delay). (17) According to the World Health Organisation, the rationale of antenatal care is that, among others, skilled health care workers monitor high-risk pregnancies and teach about identifying danger and labour signs during the antenatal period. (18) Another critical factor of focused Antenatal care is that birth-preparedness and complications-preparedness plans are counselled upon and developed with the patient. (19) The Covid-19 scourge threatened to indirectly reduce or thwart the efforts done by County and National governments to reduce maternal morbidity and mortality.

A meta-analysis done by Chmielewska et al. on the effects of the COVID-19 pandemic on maternal and perinatal outcomes from available global data found there was “increased maternal mortality and stillbirth, maternal stress, and ruptured ectopic pregnancies during the pandemic compared with before the pandemic” and proposed one explanation of the adverse outcomes being reduced access to care(9)

Healthcare workers nationwide reported poor maternal and fetal outcomes during this period. Due to the curfew, expectant women who went into labour at night invariably lacked a mode of transport to hospital facilities, with a notable increase in home deliveries and admissions in the morning of pregnancy-related complications. Some women had to wait till morning to access emergency medical care with complications such as retained placentae and postpartum bleeding after home deliveries. Another repercussion noted was that level 5 and level 6 hospitals halted their antenatal clinics in favour of conversion to become COVID-19 dedicated centres because of their ICU capacity, while some faced issues such as hospital strikes. These hospitals usually deal with the most high-risk pregnancies due to the availability of trained Obstetricians and Gynecologists. A good example is Kenyatta National Hospital which takes care of many high-risk pregnancies in its antenatal clinic. ANC attendance reduced by 47.2% from 15127 in 2019 to 7149 in 2020 as clinics reduced and, at the height of the pandemic, completely stopped to prevent in-hospital Covid-19 transmission. (20) Most women lacked that patient-healthcare worker interaction that allowed them to be educated on the critical danger signs to watch out for in pregnancy. Lack of such knowledge would potentially mean an increase in the first delay due to ignorance, reducing health-seeking behaviour and the second delay if not solved. Studies also show that pregnant women purposely avoided hospitals as they knew they were among the vulnerable in society amenable to the disease. (21) The Institution of the curfew further worsened the anxiety among pregnant women should labour ensue during the night.

It is imperative to have systems to support pregnant women even during pandemics to avoid preventable deaths that are not directly related to Covid-19 infection or any other future pandemic. An innovative solution was needed in which expectant women could reach out to Doctors for consultation when need be, and a platform through which they could access emergency transport to hospitals should labour occur to promote health-seeking behaviour and ease access to health care to prevent maternal death,

We designed a novel programme dubbed “Wheels for Life” (WFL), which would allow pregnant women to access health information, teleconsultation, and when needed, transport to hospitals. By calling a toll-free number (1196), women are connected to a call centre where they can speak directly with Obstetrics and Gynaecology registrars at no cost. The teleconsultation facilitated counsel, triage, and appropriate referral to a health facility of the woman's choice through either

taxi or ambulance, depending on the woman's risk level. The intervention gained life through a multi-partner consortium with different stakeholders, including the University of Nairobi, The Ministry of Health, Amref, Kenya Healthcare Federation, Bolt and Telesky, and Rescue ambulances. “Wheels for Life” kicked off officially on the 28th of April 2020 and, by the 11th of July 2021, has served 122,365 people at the call centre, with 10,047 patients having gained teleconsultations from our registrars, 2,101 patients having received transport either through cabs or ambulances.

We used a partially sequential mixed-method study as our study design to give us a quantitative assessment of the role of the intervention in reducing maternal morbidity and a qualitative evaluation of the experience among different stakeholders, i.e. pregnant women, spouses, drivers, and health care workers who used the intervention. The objective of this study was to (i) describe the sociodemographic and clinical characteristics of the patients utilising the intervention (teleconsultation and emergency transportation) by descriptive analysis. (ii) To determine the time interval between emergency calls, transport vehicle dispatch, and hospital arrival via descriptive analysis. (iii) To describe any relations between travel distance, type of transport service and referral times with maternal and perinatal morbidity, and mortality, and assess the attitude and acceptability of the women, health care workers and taxi drivers towards the programme. The results would inform policy on the possible integration of such interventions at the community, county, and national levels to promote improved access to hospitals and thus better pregnancy outcomes.

1.3 Justification

Telemedicine is slowly becoming accepted as a method of interacting with and treating patients, but not many studies have been carried out, especially within the country. Most telemedicine models we had encountered did not have a combined platform that also provides emergency transport service, especially for obstetrics, and those studies with primarily quantitative or qualitative studies focused on facility-to-facility transfer. Moreover, as a country, there was no model for a pandemic response that mitigates indirect causes of death, especially in the obstetric field, yet as we know, labour waits for no man. It is imperative that we, as a country, put in place measures or interventions that will address disease-pandemic preparedness while still protecting the lives of pregnant women and children.

It was also essential as a medical fraternity to have digital inclusion in health by integrating aspects such as telehealth, especially in a population that can access mobile phones. Telemedicine can help quickly locate patients in times of need, improve pre-hospital care, and follow up on patients' post-hospital care. The thought that faster and easier communication with practitioners can improve health is not foreign. However, it is the knowledge that this would give patients a positive outlook on hospitals and health workers and promote better health-care-seeking behaviour that makes telemedicine very important.

This pilot study of the novel intervention in the country that utilises telemedicine to aid in reducing the first delay and provision of transport that aims to reduce the second delay of accessing care would give a lot of headway in considering the inclusion of telemedicine into health care systems. We hoped to provide an objective outlook on the impact of offering emergency obstetric transport to hospitals, especially during emergencies, with the added advantage of having home-to-facility transfer (as opposed to the usual facility-to-facility referral model) while using the qualitative arm to give a more in-depth insight into the challenges of accessing care, especially at night during pregnancy during the Covid 19 pandemic. The mixed-method study was selected as it offers objective insight by utilising quantitative aspects that analyse the intervention and outcomes while also giving insight from the patients, drivers, and healthcare workers who interacted with the intervention.

While Covid-19 has affected the entire country, and many mothers have utilised the intervention, Nairobi was chosen as a study site as it was the first to be involved with Covid- 19. It recorded the highest number of infections in the country and was the first location where the Government placed the lockdown. Transport at night and anxiety around it was also influenced by police brutality, especially in the beginning with widespread fear among pregnant women. Moreover, "Wheels For life" as an intervention was piloted in Nairobi county, and therefore, it was only prudent to have Nairobi county as our study site. In addition, because it is the country's capital city, it offers a robust mix of populations of different ethnicities and socioeconomic backgrounds. It thus provides the best study population while also giving a widespread, diverse and large sample size to study.

1.4 Research question:

What is the role of telemedicine in improving maternal health among pregnant women requiring emergency care by providing access to hospitals during the Covid 19 pandemic from May 2020 to April 2021 in Nairobi, and what were the experiences of stakeholders (women, taxi drivers, medical doctors and midwives) during that period of implementation?)

1.4.1 Qualitative Research Questions

1) To explore the experiences of the pregnant women, drivers, and health care workers who interacted with the intervention in its accessibility, acceptability, and dependability using in-depth interviews.

1.5 Quantitative Research Objective

1.5.1 Broad Objective

To determine the utilisation, uptake and experience with telemedicine in reducing delays in access to maternal health services during the Covid 19 pandemic in Kenya from May 2020 to April 2021 in Nairobi County

1.5.2 Specific objectives

- 1) To describe the sociodemographic and clinical characteristics of the patients utilising the intervention (teleconsultation and emergency transportation) by descriptive analysis.
- 2) To determine the time interval between emergency calls, dispatch of transport vehicle and arrival at the hospital via descriptive analysis.
- 3) To describe any relations between travel distance, type of transport service and referral times and maternal morbidity, mortality and perinatal mortality

CHAPTER TWO: LITERATURE REVIEW

2.1 Factors Affecting Utilisation of Health Services

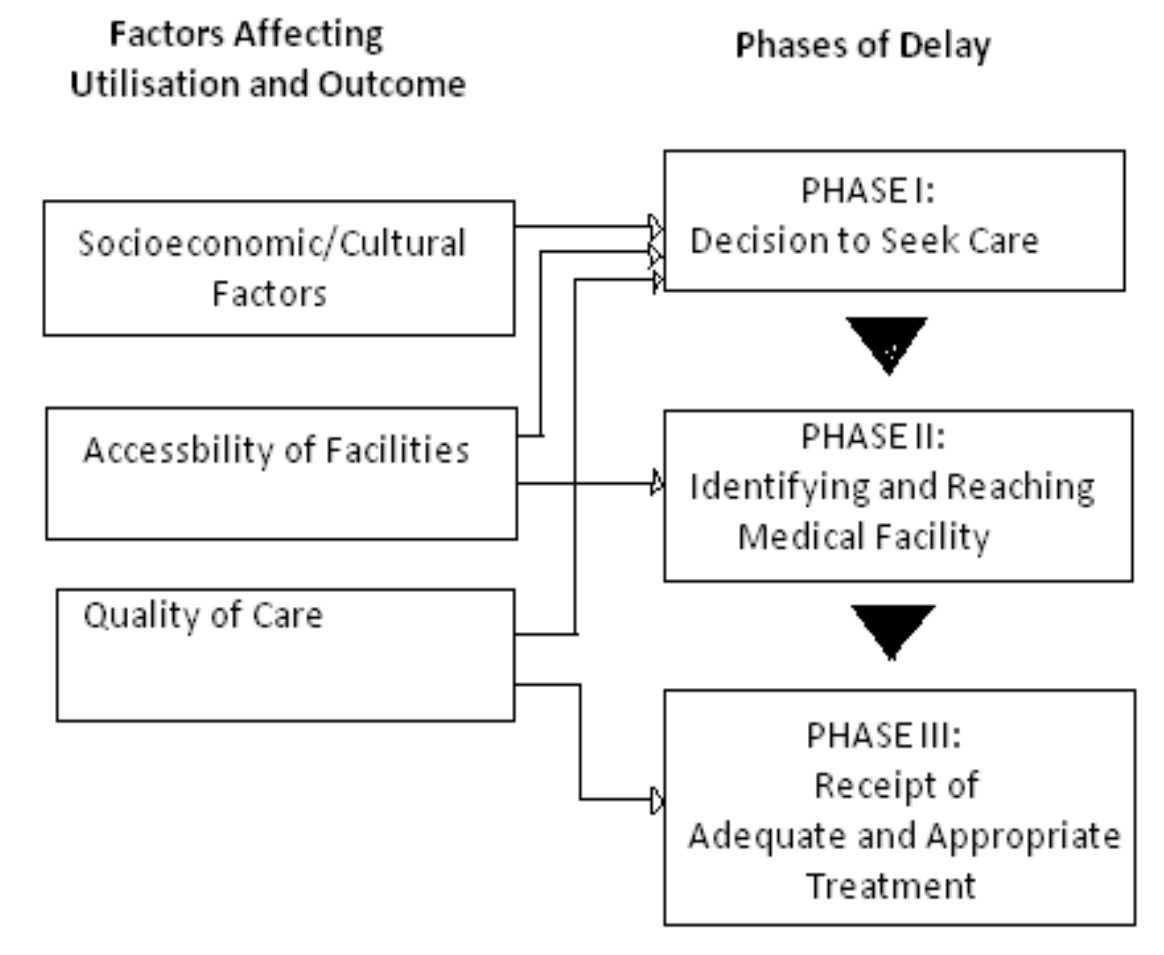


Figure 1: Adapted Thaddeus and Maine's "Three Delays Model" (from 1994 model)

As noted above in the theoretical adapted from Thaddeus and Maine, many pre-existing factors determine a pregnant woman's access to care. Personal factors include knowledge of pregnancy, personal attitude about healthcare, financial capability, educational level, availability of transport, and distance to available healthcare. Systemic factors include the availability of health care centres, good infrastructure, and skilled health personnel, among others. A literature review conducted by K4D by Fiona Raje in 2018 noted that among the three delays in accessing maternal care, the 2nd delay was the most significant as it involved the geographical location, distance from the hospital, and access to transport systems. Noting that many women do not

make any prior arrangements for transport in case of delivery, the study suggested a few transport systems, with those involving the local community bearing the most fruits. (22)

Telehealth and telemedicine are evolving to improve access to health care and aid in monitoring both low and high-risk pregnancies in many parts of the world. It has mainly been used in rural America to aid in getting video consultations with doctors and sharing lab results online for reporting and guidance, especially in the wake of the Covid-19 Pandemic. (23)

As noted earlier, the COVID pandemic disrupted health care, interfering with personal motivators such as people's trust in hospitals, citing them as a source of infection(21); there was reduced economic power noted with loss of employment in both the formal and informal sector (24), restricted movement and lack of public transport, especially with COVID restriction measures. Systemic barriers were on the rise as hospitals restricted patients to hospitals to reduce their exposure of patients to Covid-19(25). Many countries in the Western world resorted to telehealth to ensure continuity of essential care, especially in maternal health. (26)A qualitative study conducted by Madden et al. on telehealth uptake and provider attitudes found that "Accessing technology and performing visits, documentation, and follow-up using the telehealth electronic medical record were all viewed favourably by providers." (27). However, most of the services were primarily for antenatal care or postnatal review, and patients still struggled to get to a hospital in case of delivery or obstetric emergency, and only a few tried to combine telehealth and emergency medical transport

In addition, different countries have utilised other transport modalities, primarily for emergency care to avert the second delay, but few modalities are dedicated mainly to obstetric emergency transport systems. The uptake of telehealth in Africa, especially in Kenya, has been limited, with the private sector showing a better uptake of the same. However, some countries have modelled designs or approaches to improve access to health care through emergency transport, especially during pregnancy complications, with good examples in Nigeria, Uganda, Burundi, and India. Few countries like Ghana(28) and Ethiopia(29) have had models showing positive results.

In Northern Nigeria, it was noted that transport was unavailable at affordable rates for women in obstetric emergencies. As a response, in 1993, local transport owners were approached, and drivers were sensitised and trained for emergency response. A revolving emergency fuel fund was established, and pregnant women would be offered service to hospitals for maternal

emergency services. A study conducted and published in 1997 of the programme by Shehu et al. found that the initiative improved access, with 29 women in his research benefiting from hospital transfer with obstetric cases and many transferred for non-obstetric patients. (30)

While this project was an outstanding effort at establishing access, the community integration was minimal, and therefore, many still preferred traditional birth attendants. There was no link to ambulances should dire complications arise, and of the 29 cases transported, one patient succumbed. Their mean occurrence to treatment time was 9 hours, and more non-obstetric cases utilised the service than obstetric cases. Eventually, the defaulting of contributions by the community led to the depletion of the emergency fund, and the initiative failed. The transport cost was roughly USD 278, of which the project fund financed 72%. Another limitation was the lack of cohesiveness with the health sector; calls would come directly to the drivers who would present on availability, and no medical personnel would guide in the process or during transit. (30)

In 2006, a government and donor-led Emergency Transport Scheme (ETS) began dubbed "The Partnership for Reviving Routine Immunization in Northern Nigeria; Maternal New-born and Child Health Initiative (PRRINN-MNCH)." (31). The initiative aimed at "increasing skilled health personnel delivery from 39% to 52%." In the initiative, community bus drivers were recruited and taken through a 4-day training on basic medical aid and then called by the community in case of an obstetric emergency. DFID has since initiated a new approach to the effort, running from 2014-2019 dubbed "The Maternal New born and Child Health 2 (MNCH2) Programme", attempting to scale the efforts earlier done in northern Nigeria. MNCH2 is adding focus – integrating ETS with various demand creation efforts to "increase utilisation of maternal and child health services by community integration." Limited research was conducted on the impact of the above model, but the community reported satisfaction with the model and emphasised continuing such programmes. A qualitative study carried out by Oguntude et al. in 2018 found that the community had a better understanding and willingness to utilising Emergency Transport Schemes that had community integration, including demand creation of the service such as men and women support groups and inclusions of the TBAs (32)

According to "Ethiopia's 2012 Road Map for Accelerating the Attainment of the Millennium Development Goals Related to Maternal and new-born Health", (33) Ethiopia has provided four-

wheel-drive ambulances in every rural District (areas covering around 150 000 people) that link patients from local health posts to health centres. The provision has made the ambulances available on a 24-hour, 7-day basis for transferring any woman in labour or experiencing other obstetric difficulties to appropriate health facilities. Pregnant women can call ambulances when needed by the use of mobile phones. A quantitative observational study in 2016 by Hagos Godafey et al. found that uptake of free four-wheeled ambulances in Ethiopia had halved the mortality rate in the districts where ambulances had been well received. (29) While the study has limitations, it cannot directly correlate the reduction of mortalities to the introduction of ambulances, but it is worth noting that the reduction was only noted where the ambulances were introduced, showing a strong correlation.

A study that was done in Burundi in the Kibwezi region on the use of a VHF (Very High Frequency) radio communication system to call ambulances for obstetric referrals from health centres to the EmonC centre found that "setting an effective communication and transport system improved obstetric outcome by reducing the obstetric complications." It also noted an increased number of caesarean sections to mitigate the complications." In the study time, only one mortality was seen; thus, the study may not be adept at showing a reduction in maternal mortality rate, but the reduced number of pregnancy-related complications was correlated to cost and found that the intervention "was a cost-effective method of improving maternal health." (34)

One thing noted from this is that the study focused on a facility-to-facility referral that used three designated ambulances, and all patients transferred to one CEmOC facility, the only available one in the area, hence ease of gathering neonatal and maternal outcomes. While there was no use of telemedicine as the patients had no interaction with the referral centre via the phone, it provides a reasonable basis of comparison for their transport model.

It is challenging to discuss ambulances, provision of access, and distance travelled by patients without discussing the distance and travel time covered. In 2009 the WHO recommended that BEmOC and CEmOC be available within two to three hours for most women. (16) A study by Banke Thomas et al. done in Lagos, Nigeria, comparing estimated times using models, Google maps and actual travel time, found that while estimated model times were within two hours within the city of Lagos, exact travel time would take longer than the 2 hours to arrive at the facility excluding external/ patient personal travel difficulty(35). It also found that there was

more than a 60 mins delay between arrival at the facility and receiving the intervention time in some cases. 2 Hours can sometimes mean life and death to patients who we can lose even within minutes.

In Kenya, a qualitative study conducted in 2019 in Western Kenya by Onono et al. used mobile phones to sensitise expectant women on the need for their antenatal visits through continuous text reminders to enrolled study participants during the pregnancy. It would link them to health care consultation through a programme dubbed m-access. They would also be linked to transport in registered motorcycles in case of any need through the same platform. (36) The study on the programme found that it "promoted better uptake of health facility delivery, promoted customer satisfaction and provided fast access to hospitals when in labour. (37). Although this study did not have a quantitative aspect of analysis, it offers a sound basis of analysis as we evaluate the views of our key informants.

2.2 Conceptual Framework

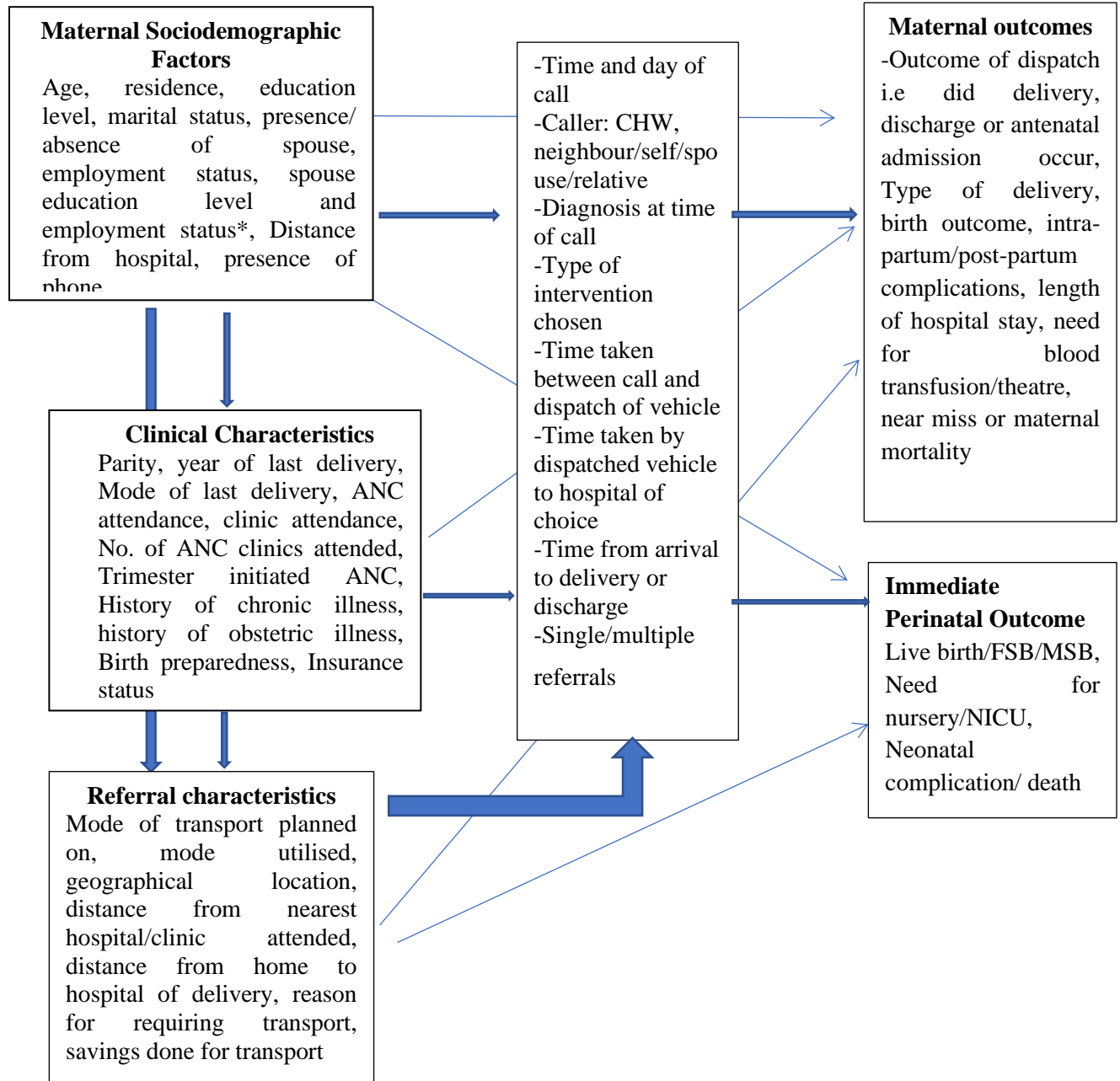
2.2.1 Narrative

2.2.2 Figurative

Independent Variables

Intervention Variables

Dependent Variables



CHAPTER THREE: METHODOLOGY

3.1 Study Design

The study was a partially sequential mixed-method cross-sectional study that was done retrospectively utilising quantitative and qualitative methods over a study period of 1 year (May 2020-April 2021).

3.2 Study Site and Setting

According to the 2019 census, Nairobi City has a population of 4,397,073, while the metropolitan area has a population of 9,354,580. It offers a robust mix of populations of different ethnicities and socioeconomic backgrounds and records high population growth due to urban migration and high birth rates. Economically, it has a wide distribution of people, including international embassies and the UN, wealthy and middle class, and densely populated lower income and informal areas and slums. Unemployment is estimated at 40% within the city, mainly in the high-density, low-income areas of the city. The majority of the slums have poor access to health services, poor road infrastructure, stolen electricity, and insecurity.

There are various hospitals of different types, i.e. public, private, and faith-based, all with varying levels/qualities of care. The three major public hospitals that can cater to high-risk pregnancies and deliveries by acting as referral centres are Mama Lucy Kibaki Hospital along Kayole Spine Road, Pumwani Hospital on General Matheng road and Kenyatta National Hospital and nine sub-county hospitals (level 4 and level 3) namely Kayole 1 and 2 health centres, Eastleigh health centres, Mbagathi level 4, Kibera AMREF health centre, Kibera South health centre, Langata centre, Makadara, Bahati, Mathare North Kahawa west Baba Dogo, Korogocho, Marurui, Dandora 2, Mukuru Njenga, Embakasi Mutuini Sub county Westlands Kangemi and Ngara health centres distributed across the sub-counties. These hospitals or health centres are considered by policymakers when deciding the ratio of hospitals to patients and whether facilities are within less than 2 hours of travel time. Before the Wheels for Life intervention, there was no established emergency obstetric toll-free line within the county, and we ensured that the intervention did not influence the patients' choice in a health care facility as they were left at liberty to decide their hospital of choice.

Nairobi was the first to be affected with Covid- 19, recording the highest number of infections in the country and was the first location where the Government placed the lockdown. Lack of transport at night and anxiety around late night travel was also influenced by police brutality, especially in the beginning with widespread fear among pregnant women. Wheels For Life as an intervention was piloted in Nairobi county due to ease of implementation among the partners and operated in this manner for five months before any scale up to Nakuru, Uasin Gishu Kiambu, Nyeri and Machakos counties.

3.3 Study Population

Gravid Women at any gestation who called the Wheels for life initiative for either consultation or transport service from Nairobi County shall be enrolled into the programme and shall form our study participants. We shall only analyse those who required dispatch.

3.3.1 Inclusion Criteria

Women were eligible to participate in the study if they were 15 years or older and had called the toll-free number seeking obstetric care from Nairobi County from May 2020 to April 2021 and had requested dispatch from their homes to the facility. The women who presented with Obstetrics emergency such as mothers in labour. This would present with symptoms such as:

1. Regular contractions that had occurred at a regular interval, e.g. every 20 minutes, and that last for more than five seconds
2. Drainage of Liquor – a fluid that is clear (or otherwise stained) that had a sudden gush or that requires pad changes
3. Any onset of vaginal bleeding at any gestation
4. Reduction of movements as perceived by the mother (outside of the regular fetus pattern)
5. Any woman with a previous caesarean delivery with the onset of any of the above
6. Any sudden onset pain on either iliac fossa associated with amenorrhea or known pregnancy
7. Any woman who had delivered at home while waiting for transport or due to lack of means
8. Any woman with a history suggestive of ongoing miscarriage

3.3.2 Exclusion Criteria

1. Patients who called with antenatal or postnatal queries not requiring transport
2. Transport that was required for neonates
3. Incomplete data even after phone calls
4. Patients who decline consent for qualitative interviews

3.4 Sample Size and Sampling Procedure

Convenience sampling- all Mothers who called seeking transport/dispatch

3.5 Study Procedure

A toll-free number, 1196, was made available that patients could call at any time. Call agents manned the 1196 call at the call centre (Telesky) that's located in the city. They would filter patients from general enquiries and divert the call to Obstetrics and Gynaecology residents from the University of Nairobi who were on call to handle and triage any patient queries. Consultation was offered on antenatal and postnatal questions, emphasising physical clinic attendance should symptoms persist or call back immediately if it worsens for transfer to a health facility. According to the triage level, taxis (for urgent but not emergency needs) or ambulances (emergencies) are dispatched from their homes to hospital facilities through a system. The patient would receive an auto-generated text to let them know the taxi driver who has accepted the trip, thus enabling communication. In emergency cases, an ambulance would be dispatched to the patient's location, and the hospital informed that the patient would be on their way. The driver in transit then communicates their arrival to the doctor and the system also shows a completed trip. The patient then either calls back to report or is called back within a five to seven-day window for further questions with stress placed upon the patient's experience with the programme.

At the first contact point, the doctor conducts a simple survey as part of history taking that gets the biodata of the patient, gestation, clinical symptoms, and records the desired hospital and possible diagnosis. (Tagged on the annexe).



Figure 2: Wheels for Life Patient Journey

3.6 Ethical Considerations

1. Authority will be sort from the KNH- UON ethics team to be able to conduct this study and analyse the data
2. All Pregnant mothers were made aware that their clinical history would be recorded at the first contact and during the time of postnatal follow up and gave verbal consent over the phone.
3. Principles of confidentiality and privacy of information will be maintained throughout the research process.
4. Data will be anonymised and key patient identifiers like names, phone numbers, residence and age among others will be de-identified
5. Verbal consent will be sort by the participant while conducting qualitative interviews due to use of Phone interviews.

3.7 Data Variables

3.7.1 Independent variables

Maternal Sociodemographic Factors e.g. Age, residence, education level, marital status, presence/ absence of spouse, employment status, spouse education level and employment status*, distance from hospital, presence of phone

Clinical Characteristics e.g. Parity, year of last delivery, Mode of last delivery, ANC attendance, clinic attendance, No. of ANC clinics attended, Trimester initiated ANC, History of chronic illness, history of obstetric illness, Birth preparedness, Insurance status.

Referral characteristics e.g. Mode of transport utilised, geographical location, distance from nearest hospital/clinic attended, distance from home to hospital of delivery, reason for requiring transport, savings done for transport

3.7.2 Intervention variables

-Time and day of call

-Caller: CHW, neighbour/self/spouse/relative

-Diagnosis at time of call

-Type of intervention chosen

-Time taken between call and dispatch of vehicle

-Time taken by dispatched vehicle to hospital of choice

-Time from arrival to delivery or discharge

3.7.3 Dependent Variables

Maternal outcomes e.g. Outcome of dispatch i.e. did delivery, discharge or antenatal admission occur, type of delivery, birth outcome, intra-partum/postpartum complications, length of hospital stay, need for blood transfusion/theatre, near miss or maternal mortality.

Immediate Perinatal Outcome e.g. Live birth/FSB/MSB, Need for nursery/NICU, Neonatal complication/ death

3.8 Data Collection

We shall be collecting quantitative data retrospectively by looking into the intervention records of these calls recorded in the past year. In the event of any incomplete information, patients or their partners will be called for further questions. Ambulance and cab records and those of the call center shall also be correlated and analysed for better understanding.

A sample of these patients shall then be chosen to conduct qualitative interviews on their experience. Health care workers at the health center will also be chosen based on how often patients were transferred to their facilities and call center based on the level of care they give, and interviews conducted using open-ended questions. The qualitative study will be done using in-depth interviews (IDIs) as the primary data collection method to obtain the lived experience of the individual women from their perspective. All interviews will be done in English or Kiswahili, depending on the preference of the patient. A semi-structured In-Depth Interview guide with open-ended questions will be used to elicit reflections on what the women saw as barriers and enablers in accessing the maternal health services, perceived negative or positive impact of the intervention, and comparisons between their previous lived experiences (if multipara) and the current experience while receiving the intervention. Patient's interviews will be conducted via phone calls that will be recorded and transcribed and then undergo thematic analysis to outline the various themes highlighted by the women as the challenges and positive outcomes they perceived and to identify points of care that would need more attention. Drivers and health care workers would also undergo in-depth interviews to get a wholesome perspective on the care given and understand challenges they faced while serving the pregnant women while giving access to hospitals.

3.9 Data Management and Analysis

All data will be collected and stored safely in password protected, data encrypted cloud storage. Data will be analysed using Redcap or SPSS as per the biostatistician. After data collection, phone conversations and audio recording will be transcribed and data read and categorised into meaningful units that will be consequently coded using NVivo software. Analysed data will be presented in written reports, frequency tables, pie charts, and graphs.

3.10 Study Limitations

Being a retrospective study, a lot of the quantitative data will be dependent on data collected during the time of first contact. Study participants will be called where incomplete data is noted. Recall bias especially with the participants recruited for the qualitative arm – we will try and select a calm time for the patient where they are able to give an hour or so for recollection purposes and create a safe space for talking.

3.11 Budget and Budget Justification

Description	Quantity	Cost/unit	Conversion	No. of units	Amount
Ethics					
KNH-UON ERC		KES 2,000.00		1	2,000.00
Research References					
uptodate	1	\$ 99.00	KES 105.00	1	10,395.00
Data collection					
REDCAP					
Otter.ai (transcribes conversations)	1	\$ 360.00	KES 105.00	1	37,800.00
Stationery and Equipment					
Printed questionnaires(qualitative)	50 questionnaires	KES 10.00		3	1,500.00
Consent forms	50 questionnaires	KES 10.00		3	1,500.00
Thesis Printing	50 pages	KES 10.00		3	1,500.00
Recorder (voice recorder)					

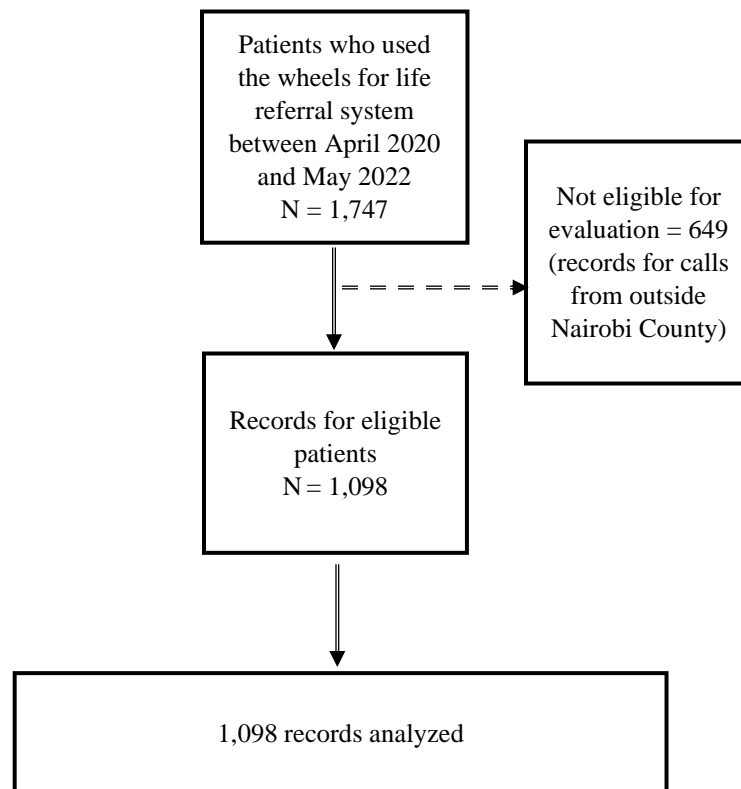
					-
Airtime		KES 2,000.00		10	20,000.00
128GB SD card		KES 6,800.00		6	40,800.00
Data analysis					
NVIVO (qualitative analysis)		\$ 598.00		105	62,790.00
Personnel					-
Technical Advisor - Quantitative		KES 50,000.00		2	100,000.00
Technical Advisor- Qualitative		KES 50,000.00		2	100,000.00
Research Assistant		KES 50.00		2000	100,000.00
Data collectors		KES 250.00		150	37,500.00
Transport	10 people	KES 500.00		8 trips	40,000.00
Biostatistician (Quantitative)		KES 40,000.00		1	40,000.00
Biostatistician (Qualitative)		KES 40,000.00		1	40,000.00
				TOTAL	KES 635,785.00

3.12 Study Time Frame

STUDY TIMELINE	August 2021 – February 2022	Mar – 22	Apr- 22	May- 22	Jun - 22
Proposal development					
Ethical review					
Data collection					
Data analysis & report writing & Presentation					
Presentation					

CHAPTER FOUR: RESULTS

Analysis for the data was done using SPSS version 23. A record for a total of 1,747 patients who used the wheels for life referral system between April 2020 and May 2022 were entered into the software for cleaning and coding. A total of 649 entries were removed from the system as they were calls received from outside Nairobi County. Data for 1,098 patients was analyzed and is presented as below.



Sociodemographic characteristics of the patients utilizing the wheels for life referral system between March 2020 and May 2022 in Nairobi County

As shown in table 1, most of the calls were made during the night, 1053 (96%) compared to the day. The calls that were made were mostly by patients who were at home, (1084, 98.7%). The patients were mostly female (1058, 96.3%). The average age for the patients was 25 years (SD 3.4). Most of the patients (981, 89%) were taken to hospital for further management, with less

than 1% treated at the scene or taken back home. The vehicle type that was commonly used was a BLS type (674, 61.3%), followed by medical taxi (364, 33.1%); only 1 case used ALS and medical motorbike each. Of the 981 patients that were taken to hospital, a majority were taken to a level 4 hospital (599, 61.1%), 205 (20.8%) were taken to level 6 hospital while 177 (18.1%) were taken to level 3 facilities.

Table 1: Sociodemographic characteristics of the patients utilizing the wheels for life referral system between March 2020 and May 2022 in Nairobi County

Characteristic	Value	Proportion
Time of the call		
Day	45	04
Night	1053	96
Place of call		
Home	1084	98.7
Health facility	10	01.0
Road side (by police)	04	0.3
Mean age of the patient (SD)		
	25.09 (3.4)	
Sex of the caller		
Male	30	02.7
Female	1058	96.3
Blank	10	01.0
What happened to the patient		
Treated at the scene	07	0.6
Taken to a health facility	981	89.0
Refused intervention (at the scene)	02	0.2
Taken home/workplace	02	0.2
Blank	106	10.0
Vehicle type		
ALS	01	0.1
BLS	674	61.3
Medical Motorbike	01	0.1
Medical Taxi	364	33.1
Blank	58	5.4
Level of hospital taken to (981)		
Level 3	177	18.1
Level 4	599	61.1
Level 5	205	20.8

Clinical characteristics of the patients utilizing the wheels for life referral system between March 2020 and May 2022 in Nairobi County

The clinical characteristics of the patients were documented as shown in table 2. At the point of encounter with the patient, triaging was done and a colour code using green (mild), yellow (moderately severe) and red (severe) assigned before being transferred to the health facility. A majority of the patients were colour coded yellow (704, 64.1%), 256 (23.3%) were assigned red while 138 (12.6%) were assigned green. The type of transfer was classified as either medical or rescue with most of the transfers being classified as medical (852, 77.5%). Out of the 804 women who were reached post admission, the complication rate was 1%.

Table 2: Clinical characteristics of the patients utilizing the wheels for life referral system between March 2020 and May 2022 in Nairobi County

Characteristic	Value	Proportion
Triage code		
Green	138	12.6
Yellow	704	64.1
Red	256	23.3
Type of Transfer		
Medical	851	77.5
Rescue	219	20.0
Blank	28	02.5
Medical outcomes		
No complications	797	99
Presence of complications	07	1.0

The time interval between emergency calls and dispatch of transport vehicle for the patients who used the wheels for life referral system between March 2020 and May 2022 in Nairobi County

The average time taken between receiving the call by the Wheels for Life team and calling the taxi was 2mins (SD 0.4) while the average time taken between the dispatch of the vehicle to arrival at the point of the call was 41 minutes (SD 3.4).

Mean time (in minutes) between call and dispatch of the taxi (SD)	2 (SD 0.4)
Mean time (in minutes) between dispatch of the taxi and the time of arrival at the point of call (SD)	41 (SD 3.4)

Relationship between type of transport service and referral times and maternal morbidity, mortality and perinatal mortality

There is no statistically significant association of either using ALS/BLS or medical bike/taxi, time of referral and triage colour coding on non-favourable maternal – fetal outcomes (p, 0.67, 0.17 and 0.63 respectively).

Characteristic	Maternal fetal outcomes		Chi Square	P value
	Not Favourable	Favourable		
Type of transport				
ALS/BLS	04	517	0.18 (0.06-1.12)	0.67
Medical Bike/Taxi	03	280		
Referral time				
Night	06	765	1.86 (0.08-2.77)	0.173
Day	01	32		
Triage code				
Green	02	136	-	
Yellow	07	697	0.23 (0.04-0.19)	0.634
Red	03	253	0.06 (0.02-0.04)	0.814

Qualitative Data Analysis

Introduction

Feedback

An analysis of the feedback from patients as well as other stakeholders who were part of the WSL intervention reveals various themes including appreciation but also a number of cases where they faced some frustrations. We first look at the appreciation theme. The frustrations will be captured in the next sections under the various delays.

Appreciation

First from patients and their caregivers who benefited from the WSL intervention

An example is a spouse whose wife was picked up via rescue cab on 8/8/2021 at 4:40pm and taken to a leading private hospital in Nairobi upon which she delivered successfully via C/S. During a follow-up a few days after the delivery and discharge, the spouse noted that at that time when they requested for the service, it was given in a very prompt manner. The wife was recovering well from the C/S and the child was doing quite well.

This was the same case with another mother in Nakuru who had been picked up by an ambulance and taken to a private hospital whereupon she successfully delivered via C/S. during followed, the sister was very grateful and thankful that her sister was helped in good time.

A similar case involved a pregnant lady also in Nakuru who had experienced false labour and called up for a rescue cab to be taken to hospital. Perhaps due to anxiety, they cancelled the rescue taxi while it was on the way to their house and instead used their own means to get to hospital. After examination, she was informed that it was false labour and asked to go back when labour starts. The lady was very happy about the WFL particularly by the speed of the response. She was also very pleased at how she was handled by the doctor on phone who received her distress call. She promised to tell her friends about the service.

Such was the case for a patient who was transferred to a leading public hospital in Nairobi in the wee hours of the morning, 4.30 AM via a rescue ambulance and delivered within 15 minutes of arrival. At the end of it all, the patient was very grateful for the service she received.

Other examples drawn from Nairobi

As part of the data collection, we did a few follow up cases of patients who had benefitted from the WFL service to establish how they experienced the service at the time. One such is a pregnant mother in Nairobi who experienced asthma attack at 8 PM in June 2021. She asked her daughter to call the service upon which an ambulance was immediately sent to her home. When the ambulance arrived, she was given first aid and stabilized. It was determined that there was no need to take her to hospital, but she was advised to go to her usual clinic the following day for follow up. This was done and it was established that she was ok. At the time, she was eight months pregnant, and she went ahead to have a normal delivery a month after at the same clinic

without any complications. She was very grateful about the WFL service as seen in following quote:

“My daughter explained my situation at the time to the WFL service and within a few minutes an ambulance came around to my house and I was really treated well. I am very grateful and may God really bless your wonderful service to pregnant women”.

Source: Interview with a beneficiary of the WFL service – June 2022

Another case also drawn from Nairobi entailed a pregnant lady that went into labour at 2 AM in the morning. She called the WFL service and within 30 minutes, an ambulance was at her door and she was on her way to a public referral hospital. For this she was very grateful as can be seen from this quote below:

“When I called the service, I was told to wait for a few minutes, and someone will call back. After five minutes someone called and I was asked how I was feeling. I explained my situation. When I told them about my location, I was informed that within 30 minutes, they would be at my house. True to their word, within 30 minutes they called me informing that they were they had arrived. We left immediately and within like 15 minutes, we had arrived at the hospital. It is just that I was under a lot of pain, so the journey felt like it was forever but in reality, we arrived very fast”.

Source: Interview with a beneficiary of the WFL service – June 2022

Once they arrived at the hospital, she was not taken to theatre because it was determined that she had not dilated sufficiently. She was taken to the theatre several hours later and delivered through CS as she still had not dilated sufficiently. Due this delay, the new-born had to be taken to the nurse for management and they stayed in the hospital for six more days before they were discharged.

Yet another case involved a pregnant mother who started bleeding plus high blood pressure at 7 months of pregnancy. She was managed at the local clinic during the day. However, at night, her condition worsened. She tried calling for a taxi to be taken to hospital but due the curfew, none accepted. It was at this point that her friend told her about the WFL service and gave her the number. When she called the service, she was triaged on phone, and it was resolved she needed to be taken to a hospital. An ambulance was sent and within 15 minutes it was at her location. When they arrived at the hospital, she was well received and admitted for observation. She had the following to say in appreciation:

“Yes, the ambulance arrived on time. Upon arrival at the hospital, I was attended on immediately. You know how services at public hospitals can be delayed”.

Source: Interview with a beneficiary of the WFL service – June 2022

The following day, she underwent a successful CS bearing twins – boy and girl. Since she had not yet attained a full term, the girl was underweight (1.8 kgs) and stayed under observation in a nursery for three weeks before they could be discharged. At the point of the interview in June

2022, the children were eleven months and were both doing well. Additionally, they have all received the necessary vaccinations.

Yet another case of appreciation involved a mother whose water broke at 11 PM. After failing to procure a taxi due to the curfew restrictions she called up the WFL service and was promptly assisted. A cab picked her up and took her to hospital where she successfully delivered. She had the following to say about the service:

“The customer service was very good. In fact when I called to request for transport, they came without any delay. So the service was excellent and I can’t complain of anything”.

Source: Interview with a beneficiary of the WFL service – June 2022

A slightly different case involved a mother who was distressed and called for help because her infant was passing whitish stool. An ambulance was dispatched, and the paramedics attended to the baby. She noted that the paramedic was very polite.

Among those who appreciated the service, there was yet another patient who indicated that after her delivery at the hospital, when she called the taxi gentleman who had taken her, she was informed that the service only caters for a one way trip. This is what she had to say about her experience:

“Ah okay something I would recommend that maybe you improve on. Okay there was a time I had the cab to pick me up, the driver was telling me that you only cater for a one way trip to the hospital. That would be a challenge to someone who is not able to get back to where they came from and again and perhaps they had not planned themselves accordingly. And maybe the baby was not delivered that day”.

Source: Interview with a beneficiary of the WFL service – June 2022

Feedback from other stakeholders

Hospital staff

This study also sought to hear feedback from staff of hospitals who were part of the WSL intervention. One such is a nurse from a private hospital from one of the Nairobi informal settlements – Dandora. She was very appreciative of the intervention noting that it saved many lives who were threatened by the then Covid-19 situation particularly the curfew restrictions at night. She said the following about the intervention:

“The service was so good because first thing in case of the referral the patient used to reach the destination or the hospital of referral on time, so we used to save lives of these particular patients because maybe it was a complicated case and then you’ve referred. You know with an ambulance it’s different from a taxi because there are ambulance services inside”.

Source: Interview with a staff from one of the hospitals which was part of the WFL service – June 2022

She also noted that the fact the WSL service met the costs was a big relief for patients who would have otherwise not afforded it. Similarly, the referral system in place was very important for them.

“It assisted us a lot because like the other services they are normally charged and they are very expensive, there are patients who cannot afford the normal prices which charge 5000 to 6000 regardless of the destination. So, it was really good because it was bailing out patients. Additionally, we also benefited by being able to refer critical patients at the right time”.

Source: Interview with a staff from one of the hospitals which was part of the WFL service – June 2022

Regarding the ambulance service, she had the following to say:

“I think on my side it was so helpful to the facility, first because of the accessibility to the ambulance, it was reliable. And also the ambulance it was equipped. When you refer, it was even equipped with nurses. They can even take the patient; though our nurses had to accompany them because of the report and all that. But still, it was a very good impact to the facility”.

Source: Interview with a staff from one of the hospitals which was part of the WFL service – June 2022

Taxi drivers

Similar sentiments of appreciation regarding how the service worked were also noted by a driver who was part of the WSL intervention. When we sought feedback from him on how he experienced it, he was very proud to have participated and, in the process, saved lives.

“I felt good. When you know you’re saving a life because two of them I was called from home in the middle of the night because I stay around Mbagathi Way, opposite Memorial. Two of them were inside Kibera, Soweto. I had to risk going there, alone, in the middle of the night. I got there and found that lady didn’t have any other option. It was great enough; it was fulfilling enough. I love kids so when you know it’s about a kid’s life...”

Source: Interview with a driver who was part of the Bolt team during the WSL intervention – June 2022

The driver noted that he had a few run-ins with police men manning curfew time roadblocks at night. At such times, he reached out to the WSL doctor on call and he would be bailed out. However, he noted that sometimes such doctors would be handling several cases and, in the process, overwhelming them. As feedback for improvement, he recommended that there is need to dedicated staff handling the communication with drivers since in most cases the drivers would be in handling emergencies and cannot afford delays.

Delays

First delay

There were several cases of first delay observed during the study period. We highlight a few cases below.

The first one involved a patient from Lower Solai in Nakuru who had experienced distress and called a rescue ambulance at 2203 hours. When she made the first call, it was agreed that she is taken to a particular hospital within Solai. However, the spouse called a while later and asked to be taken to a different hospital also within Solai. When the rescue ambulance reached their location, the patient was unreachable. When the spouse did a follow-up, they were advised to visit a health facility without delay.

Another case was brought up by one of the doctors on duty at the time her call came through. The doctor found it very frustrating that after booking a taxi ride for the lady, she didn't pick up her call once the driver arrived at her location. See the following quote from the frustrated doctor:

“Very frustrating booking a bolt ride for a mother... driver goes all the way... then when the driver arrives the mother doesn't pick up the call. I called her too she didn't pick. Later she cut and switched off her phone. Driver called me back very frustrated after being made to drive at 4.00 am to help a stubborn person...Okay this is really a very frustrating kind of a moment!”

Source: Feedback from doctor on duty at the time of incident – May 2020

Another doctor reported that around the same time, she also witnessed a similar situation as seen in the quote below:

“On Friday something almost similar happened. The lady totally refused to pick my call. I called the call centre and asked for an alternative number. They were able to get the husband's number and even talked. When I called the husband, mteja!”

Source: Feedback from doctor on duty at the time of incident – May 2020

Second delay

Two cases of second delay were occasioned by patients who called in from areas that were not being covered by the WFL program at the time. The first involved a patient from Homabay County who had gone to deliver at local clinic but was referred to a public hospital. She therefore called for an ambulance to facilitate this. As this was not possible, she was taken to an elderly woman by neighbours and was helped to deliver successfully. Later on, during follow-up, she was advised to visit a hospital for review of herself plus the baby. She was also advised regarding child immunization though she noted that she didn't have finances at the time. While

the patient appreciated the help she received over phone, she indicated that it would have been much more helpful if the service was available in her county and therefore she would have been transferred to hospital.

The second case involved a case from Tharaka Nithi County who was in distress and called for a rescue car to be taken to hospital. Unfortunately, since the service was not available in her county, she could not benefit from the same and in the process lost her baby as seen in the quote below.

“Patient X says that NO car arrived to take her to hospital after calling several times. She bled a lot and lost her baby. She is upset that she lost her baby and that no car was sent to her.”

Source: Feedback from doctor on call at the time

The other cases were all from Nairobi.

The first was a patient from Pipeline in Nairobi who had been taken a private hospital but then referred to a public hospital within the neighbourhood. She called and requested an ambulance to facilitate this. She later on cancelled the request and found other means of transport to the hospital where she was admitted and later on discharged due to false labour. On follow up, the patient complained about the service as seen in the quote below:

“Patient complaining that the process was too lengthy and we need to improve the service, she was questioned at the call-centre and then by the doctor and rescue, feels in times of an emergency she should just have been dispatched directly to the doctor and then the vehicle.”

Source: Feedback from doctor on call at the time

Two other cases also cited delays in getting the requested transport assistance. In both cases they opted to use their own transport to the hospital facilities. The first is in Donholm while the second in Kawangware. In the case of Kawangware, by the time the ambulance was arriving, the patient had already delivered. The patient had opted to use a motorcycle.

Feedback from the doctors manning the WFL service also pointed out various cases where they experienced challenges with the taxi service. In some cases, drivers would pick up a ride but then cancel it noting that the distance was far or that the location is insecure or that he would face challenges with the security personnel due to the curfew restrictions. In other cases, drivers would take up the ride but don't go to the patient at all as seen from this feedback from one doctor.

“I had an issue with a reluctant driver who decided not to pick a patient and never gave feedback. Noted when more than 17 minutes had expired without him contacting the beneficiary despite having spoken to him and forwarded the client's contacts. In order to improve beneficiary experience with cab transportation, we should review potential solutions given it's been a recurrent sore spot”.

Source: Feedback from doctor on call at the time – July 2020

In all cases, this led to wasting the patients' precious time. Similarly, such actions denied other potential drivers who could have been of help. In other cases, the taxi drivers demanded to be paid by the doctors on duty yet they had been booked to be paid by the WFL service.

Third delay

This case involved a mother in Eldoret town who was taken to a mission by a cab rescue but on observation at the hospital she was sent back home as it was false labour. ***Later on, she went to a different hospital for delivery using public transport van (a matatu).*** On follow up, the mother reported that she and her child were both doing fine and did not have any complaints. She had used the Linda Mama insurance to clear her bill. She was very grateful for the help she received from the Wheels for Life program. for delivery.

Another case of third delay was presented by a patient from Kayole in Nairobi and who was referred to a level four public hospital within the neighbourhood as she had severe oligohydramnios and NRFS (on U/S). On arrival at the public hospital, she was asked to queue despite presenting her referral letter. She therefore called the WFL service requesting for an ambulance to transfer her to a public referral hospital. However, she was counselled and convinced to be seen at the current facility since she was there. The WFL team also reached out to two staff at the facility's labour ward who took up her case.

Another case involved a police case where the policemen from Industrial Area reported that a mother from Mukuru Kwa Reuben informal settlement had threatened the life of her new-born. The neonate was taken to the police station for rescue and then taken to hospital for assessment. On follow-up at the public hospital from within the vicinity, it was established that the mother and child were still admitted at the hospital and were doing well. On further assessment, the police officer in charge of the case determined that the mother was underage, 16 years. The police were actively seeking out the man who had impregnated her for prosecution. A letter to this effect had been written by one of the top officers at the Mukuru Kwa Njenga station, Makadara Division.

Another case in this category entailed a patient also drawn from a Nairobi informal settlement, Sinai. Her mother called on her behalf reporting that the patient had lower abdominal pains and had been taken to a nearby facility within with the informal settlement. Due to foetal distress, she was advised to seek help from a better equipped facility. However, no ambulance was offered to transfer her. It is at this point that WFL was called upon which a rescue ambulance was dispatched to take her to a public referral facility. This was done and on follow up a few days later, it was established that the patient delivered successfully, and the mother and baby were both doing well. She had used the Linda Mama insurance scheme to pay for the hospital expenses.

The other case entails a patient whom we have already reported under the thematic section covering cases of appreciation from WFL service beneficiaries. After the onset of labour pains at

2 AM at night, she requested for transport which was duly provided, and she was taken to a public referral hospital. However, she had to wait until many hours later on before she could undergo CS. The cause of the delay was the determination that she had not dilated sufficiently. Meanwhile the unborn baby experienced distress and after delivery they had to be admitted and managed for six days before discharge.

“When we arrived at the hospital, it was 2 AM going to 3 AM. I was in a lot of pain for a very long time. So what happened is that I had not dilated sufficiently. I had to wait until the following morning to undergo the CS”.

Source: Interview with a beneficiary of the WFL service – June 2022

Follow-up interviews with staff from the participating health facilities also reveals challenges with securing referrals for their patients to public health facilities. This was highlighted as one of the big challenges experienced with the WSL service at the time.

“...the big challenge was the referral. You want to take a patient who has to be referred. We had problems with the referral facilities. You could call a facility and they would tell you they are not receiving any patient because their capacity is full. We are not receiving any patients; we are full. And this is a critical patient who needs an attention and an immediate attention.

Those were the big challenges. So we would even refer without telling the hospital that we are referring there. But still we had to refer there because that's the referral facility and maybe that's where is near us”.

Source: Interview with a staff from one of the hospitals which was part of the WFL service – June 2022

Referrals to private hospitals were not an option due to costs.

“Then you take the patient there and maybe after that you get neonatal asphyxia and maybe the baby needs the incubator or NBU then they are like our NBUs are full even the top referral hospitals near us are full. These patients cannot afford to go to private facilities when you call the private facility, they need some deposit maybe 10,000 the patient doesn't have money. Maybe was a Linda Mama patient so just coming for free services through the Linda Mama _those where most of the challenges that we used to get through the Covid 19 Period”.

Source: Interview with a staff from one of the hospitals which was part of the WFL service – June 2022

On how the service could be improved, the staff noted that it would better to increase the number of ambulances available. She indicated that on a number of times, their requests for the same would be turned down due to unavailability.

CHAPTER 5: DISCUSSION

The World Health Organization in 2015 advocated the use of strong cost-effective, informed and population tailored emergency systems that can prevent delays at critical time points as improving access to emergency care, by minimizing the three main types of delay in the delivery of such care, has the potential to reduce mortality in every field, system and population. It proposed patient education, toll-free lines, emergency transport and friendly and timely health care as possible means. (7) We utilised some of the proposed interventions as proposed by the policy paper including the use of telemedicine to improve access to primary care hence reducing travel distance and time taken before care is sought, with most questions asked at home and dealt with from home. Patients and health care workers agreed that this was a reliable and readily accessible tool. Use of transport improved second delay and giving it free removed the cost barrier to the patient. However, we note the issues of sustainability and need for integrated hospital system management to improve patient follow up as had been highlighted by the policy as possible challenges

Our study population had a mean age of 25 with the youngest being 10 and the oldest 49 which was comparable to their study.

In the qualitative arm, we found that most pregnant women felt that health was not accessible especially at night during curfew comparable to their study but they were grateful to have an intervention they could call and get help. Those in counties outside our catchment area stated to have their desire to have it with one having home delivery and another losing their baby.

“Patient X says that: NO car arrived to take her to hospital after calling several times. She bled a lot and lost her baby. She is upset that she lost her baby and that no car was sent to her.”

This was comparable to other studies such as those found by Oluoch et al where The mean age of this study done within Embakasi was 28 and highlighted the concerns that women had about access to care during the first phase of the pandemic.

Women talked of reduced access to care due to curfew restrictions, reduced transport, fear of hospitals and the lack of partner support and reduced economic power with one women stating “...when my labour started, I went to the hospital with my cousin and neighbour but could not be allowed in. Unfortunately, this was

way past curfew hours (7 pm). However, they couldn't go back to the home and had to stay at the hospital. I had to pretend that I couldn't walk so that the watchman could allow them to help me walk back to the hospital building. After I went inside the maternity they were not allowed inside.” (Respondent #40)

Hagos et al found that uptake of free four-wheeled ambulances in Ethiopia had halved the mortality rate in the districts where ambulances had been well received (29). The mean distance travelled per delivery was 37km with more patients taken to a district hospital rather than a health centre while in our case the mean distance travelled by our vehicles was 9.8 km ranging from (0.3km to 80.81km) which was significantly lower. This could be explained by the fact that most of their data is drawn from rural districts where health facilities and distance are a challenge.

The highest percentage of ambulances utilised in the Ethiopian intervention was 47.0% while our results showed that our ambulance utilisation was 61.3%. We can attribute the difference to the first delay that led to late calls by patients, lack of cabs at night during the curfew hours (96% of our calls) due to security reasons especially within the slum area, police restrictions and lack of curfew passes as suggested by our qualitative arm.

The Pregnancy-related mortality was significantly lower both in the local areas using ambulances (MMR 202, 95%CI 135–291 vs 468, 95%CI 293–709; $P = 0.006$) and in the local areas covered by mobile telephone networks (MMR 209, 95%CI 141 to 299 vs 447, 95%CI 277–683; $P = 0.014$). As we lacked a comparison group, it is difficult to infer the reduction of mortality directly attributed to our intervention, but we saw only 1 maternal mortality within Nairobi which was attributed to late call by the patient and APH. Of note however we noted 99% of the 1078 women transported had favourable pregnancy outcomes

The Ethiopian Study was an operational assessment study that was descriptive in nature with a large population of patients to bring into the pool and its main focus was the use of ambulances. It lacked the use of locally available taxis that our intervention used with good outcomes and also the use of telemedicine with doctor's triage at the centre such as was in our study. While it served as a good benchmark for a transport intervention, it lacked the insight provided by our qualitative arm making the mixed method study more inclusive.

Our study found a mean dispatch time of 2 minutes And a dispatch to arrival time of 42 mins which was comparable to the google maps estimation and actual drive time and less than 2 hour travel time by WHO and was also comparable to the study by Banke-Thomas et al that found The mean and median time taken was 5 and 6 min (cost- friction surface approach), 11 and 13 min (OSRM) and 40 and 48 min (Google Maps) Driver 1: median 50 min, mean 57; driver 2: median 52, mean 62) (Google Maps), In this study they modelled the estimated distance time used by patients and compared to Google maps, open source maps and actual drive time.(35)

KEY FINDINGS AND CONCLUSION

1. First, second and third delays are constantly present in the community and were worsened by the pandemic.
2. Medical taxis can be used to improve maternal health care in urgent but non-emergency cases and there is no statistical difference in sending an ambulance or a cab
3. Patients who used the intervention had a 99% favorable pregnancy maternal and perinatal outcome
4. The qualitative arm highlighted the desire for presence of an Obstetric toll-free teleconsultation and emergency Obstetric transport is needed and was found useful by all stakeholders to improve their outcomes and improve maternal care
5. The stakeholders felt that use of the intervention reduced pregnancy complications (highlighted by 99% favorable pregnancy outcome) but a comparative study is needed to calculate statistical significance

RECOMMENDATIONS

- Interventions such as Wheels for life can be used during pandemics to mitigate the indirect effects on maternal care such as increased second delay
- There is need for future comparative analytic studies to be done on these and similar interventions which could include the cost-analysis of the intervention for better decision making by maternal health policy makers and academia.

Study strengths

It is among the initial studies (to the best of our knowledge) focusing on telemedicine, emergency transport and travel distance time analyzed through a mixed method study

showing how they can be used to reduce pregnancy complications. Our study was conducted during the Covid-19 pandemic in conditions that can only be found during a pandemic, thus the results can allow us to prepare for future pandemics and also in areas known to have periodic epidemics of certain disease or places with higher maternal mortality burden

Study Limitation

Being a retrospective study, a lot of the quantitative data was dependent on data collected during the time of first contact. We lacked an initial structured documentation process which led to collection of a lot of scattered unstructured data hence not used for the pilot study. We also encountered recall bias especially with the participants recruited for the qualitative arm.

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ANNEXES

Annex 1: Informed Consent

Annex 2: Data Collection Tools

Annex 2.1 Quantitative:

https://docs.google.com/forms/d/e/1FAIpQLSc78owqcS8Gnw0_9aAQGFVpD8qhNHsRj7Wk7ZOKii78G13Rlg/viewform?usp=pp_url

Annex 2.2 Qualitative

WFL Qualitative Questionnaire

We are conducting qualitative research to explore the experiences that our pregnant women had while interacting with the intervention "Wheels for life", especially with the Doctors and at the transport level. This study needs to be conducted so that we can see areas that we can improve the service as we understand the acceptability, accessibility, and dependability of the intervention. The results will help us improve the programme and promote it to policymakers for sustained care.

1. Kindly share your experience during your pregnancy and during the day of your delivery?
2. Kindly share your age, marital status, education level, and employment status?
3. How would you describe being pregnant during the Covid 19 pandemic?
4. Would you say you were prepared for the pregnancy and the delivery?
5. What was your biggest challenge during the pregnancy and at the time of delivery?
6. What happened the day you reached out to 1196 for help?
7. Kindly share your experience with the Wheels for life (1196) intervention
8. How did you feel about your interaction with Wheels for Life intervention?
9. How would you describe how you were handled by the over the phone doctor and the transport service?

Drivers

We are conducting qualitative research to explore the experiences that our taxi drivers had while interacting with the intervention "Wheels for life", especially with the Doctors and at the

transport level. This study needs to be conducted to see areas that we can improve the service as we understand the acceptability, accessibility, and dependability of the intervention. The results will help us in improving the program and promoting it to policymakers for sustained care.

1. How was your experience transporting a pregnant mother to the hospital during curfew hours in the Covid-19 era?
2. How did the experience make you feel about yourself as a person?
3. What were your greatest fears while transporting the pregnant woman?
4. What were your greatest challenges?
5. What was your greatest motivation to transport the pregnant women?
6. What do you wish the public or the pregnant women knew when you give your time to the pregnant women?
7. What would help make the service/ experience even better for you as a driver and pregnant women?
8. Would you be willing to keep offering your time and service for such interventions?

Health care workers (Obgyn Registrars)

We are conducting a partially sequential mixed method research to explore the experiences that our pregnant women, taxi drivers, health care workers, and the ob-gyn Registrars had while interacting with the intervention “Wheels for life” especially with the Doctors and at the transport level. This study needs to be conducted to see areas that we can improve the service as we understand the acceptability, accessibility, and dependability of the intervention. We would like also to determine if the intervention has helped improve maternal health care by preventing maternal morbidity and mortality. The results will help us in improving the programme and promoting it to policymakers.

1. How has been your experience using telemedicine to treat patients?
2. Do you think this is something that can be adapted as part of antenatal and postnatal reviews?
3. What do you wish the public knew about pregnancy and this intervention?
4. What has been your greatest challenge so far in the intervention?
5. How do you think we can improve the intervention?

Health care Workers (Health care centres)

We are conducting a partially sequential mixed method research to explore the experiences that our pregnant women, taxi drivers, health care workers, and the ob-gyn Registrars had while interacting with the intervention "Wheels for life" especially with the Doctors and at the transport level. This study needs to be conducted to see areas that we can improve the service as we understand the acceptability, accessibility, and dependability of the intervention. We would like also to determine if the intervention has helped improve maternal health care by preventing maternal morbidity and mortality. The results will help us in improving the programme and promoting it to policymakers.

1. Have you received any pregnant mothers that have come in through wheels for Life?
2. What has been your experience with patients transported by Wheels for Life?
3. How else have you interacted with Wheels for Life as an intervention?
4. Would you like to see the intervention continue past the Covid-19 pandemic? If so, why?
5. In your opinion, has the intervention helped to reduce maternal morbidity?
6. Has the intervention helped to make your work easier? If so, How?

Annex 3: Dummy Tables

Table 1: Baseline Social Demographic Characteristics

	Frequency	Percentage
1. Age		
15-24		
25-30		
30-35		
36-40		
40-49		
Mean \pm SD		
2. Marital status		
Single		

Married
Divorced
Separated
3. Level of Education
Primary
Secondary
Tertiary
4. Employment status
Self-employed
Salaried employed
Unemployed
5. Geographic Location

Table 2: Baseline Obstetrics Characteristics

	Patient	WHO	P-Value
ANC facility attended			
Other facilities			
Number of ANC visits			
<4			
≥4			
ANC centre attended			
Distance from their residence			
Gestational age at delivery			
Mean ± SD			
Gestational age determination at time of call by dates/ ultra-sound			
History of Covid 19 infection			
Yes			
No			
History of chronic co-morbidity			
Yes			
No			
Co-morbidity			
HIV			
Diabetes			
HTN			
Anaemia			
PROM			
Asthma			
PET			
DVT			
PPROM			
Epilepsy			
None			
Type of caller at distress call			
Pregnant woman/Patient			
Spouse			

Relative
 Neighbour
 Community Health Worker

Place of delivery

Home
 On the Road
 Cab/Ambulance
 Hospital

Distance from patient's residence

Presence of Skilled Health Worker

Yes
 No

Type of Delivery Done

SVD
 Elective CS
 Emergency CS

Pregnancy Outcome

Live birth
 Fresh Still Birth
 Macerated Still Birth

Pregnancy Complication

Prolonged hospital stay
 ICU/HDU admission
 Any blood transfusion
 PPH
 Perineal tear
 Fistula/ incontinence

Table 3: Transport Time versus Fetal Outcome

Time from distress to transport arrival	Time from ambulance call-out to arrival at the hospital	Delivery of neonate	Delivery of stillbirth/ dead within first 24hours
<1hour			
1-2hours			
2-3 hours			
>3hours			

Table 4: Distance to Health facility and maternal outcome

Distance to Health facility	Maternal Outcome: Pregnancy related complication
<15km	
15km-30km	
>30km	

Table 5: Transport versus Admission outcome

Transport	Admission Outcome		
	Delivery	Antenatal admission	Discharge
Cab			
Ambulance			
Self			



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3rd June, 2022

Dr. Jemimah Muthoni Kariuki
Reg. No. H58/35671/2019
Dept. of Obstetrics & Gynecology
Faculty of Health Sciences
University of Nairobi

Dear Dr. Kariuki,

RESEARCH PROPOSAL: USE OF TELEMEDICINE IN IMPROVING ACCESS TO MATERNAL HEALTH CARE IN NAIROBI DURING THE COVID-19 PANDEMIC; A MIXED-METHOD CROSS-SECTIONAL STUDY (P269/03/2022)

This is to inform you that KNH-UoN ERC has reviewed and approved your above research proposal. Your application approval number is **P269/03/2022**. The approval period is 3rd June 2022 – 2nd June 2023.

This approval is subject to compliance with the following requirements;

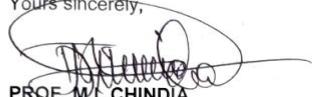
- i. Only approved documents including (informed consents, study instruments, MTA) will be used.
- ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by KNH-UoN ERC.
- iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to KNH-UoN ERC 72 hours of notification.
- iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH-UoN ERC within 72 hours.
- v. Clearance for export of biological specimens must be obtained from relevant institutions.
- vi. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. Attach a comprehensive progress report to support the renewal.
- vii. Submission of an executive summary report within 90 days upon completion of the study to KNH-UoN ERC.

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This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism.

For more details consult the KNH- UoN ERC website <http://www.erc.uonbi.ac.ke>

Yours sincerely,



PROF. M.L. CHINDIA
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