TRACKING HAULAGE IN EAST AFRICA TO SUPPORT COVID-19 SURVEILLANCE-
THEA-C19 SOCIOLOGY REPORT

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# TABLE OF CONTENTS

Acknowledgement ........................................................................................................... ii

1.0 Background .................................................................................................................. 1
  1.1 Background of the project ......................................................................................... 1
  1.2 Objectives of the project ............................................................................................ 5
  1.3 Project sites ................................................................................................................ 5
  1.4 Organizations and Partners ....................................................................................... 6

2.0 Sociological Dimension ................................................................................................. 9
  2.1 Stakeholder engagement workshop .......................................................................... 9
  2.2 Field activities .......................................................................................................... 24
  2.3 Consultative Meetings .............................................................................................. 25

3.0 Sociological Description Of Truck Drivers .................................................................. 29
  3.1 Description of truck drivers ..................................................................................... 29

4.0 Literature Review ........................................................................................................ 33
  The History of Haulage .................................................................................................. 33

5.0 Findings On Knowledge, Attitude And Practices (KAPs) ............................................. 41
  5.1 Truckers ..................................................................................................................... 41
    5.1.1 Inland .................................................................................................................. 41
    5.1.2 Midland ................................................................................................................. 42
    5.1.3 Border .................................................................................................................. 42
  5.2 Stakeholders ............................................................................................................. 43
    5.2.1 Kampala .............................................................................................................. 43
    5.2.2 Midland ................................................................................................................. 47

6.0 Challenges ...................................................................................................................... 57
  6.1 Truck driver challenges .............................................................................................. 57
    6.1.1 Inland .................................................................................................................. 57
    6.1.2 Midland ................................................................................................................. 59

7.0 Project Photographs ..................................................................................................... 62

8.0 Appendices ................................................................................................................... 67

9.0 References .................................................................................................................... 88
1.0 Background

1.1 Background of the project

Globally, public health systems were pushed beyond their carrying capacity by the COVID-19 pandemic. The speed and scale of the outbreak challenged all conventional wisdom and deployment of epidemiological tools essential for protecting millions of people [1]. In responding to this new phenomenon, public health systems worldwide had to leverage technology to complement conventional epidemiological tools for disease outbreak investigation to increase the speed and efficacy of responses [2]. Thus, public health pivoted towards developing public facing technology [3, 4] to harness the use of information directly from the mobile phone and process it in real-time for decision making.

One of the epidemiological tools that has undergone this technological revolution is contact-tracing. This is defined as a process of monitoring persons who have been exposed to individuals with an infectious disease [5]. Conventional contact tracing involves identification, listing and following-up of persons who come into contact with an infected person. The adoption of technology means that all these processes are now digitally augmented and automated to increase the speed and efficiency of tracing these individuals, for isolation to break the transmission chains [6].

In countries like the United States of America various forms of these technologies have been introduced to support contact tracing with varying success. This effective utility often depends on the scale at which the technology is deployed i.e., better outcomes were evident when used in private companies particularly in Silicon Valley as well as a sports franchise like the American football [7-9]. The country as a whole is yet to develop and deploy a single track and trace system. This has led scholars to examine the complexities such as cultural differences and political inclinations; of deploying such technology across jurisdictions. However, based on how it is presented in media, one could be led to believe it is ultimate solution for public health disease outbreak investigation [10-12]. In reality the utility is maximized if used alongside the conventional epidemiological tools [13]. Indeed, in places where this technology has been used successfully, there are specific inherent societal factors responsible for this, in South Korea for example, the level of smart phone and Internet connectivity coupled with political will have enabled its wide use [10, 13, 14]. The aspect of wide population use is critical to its successful use, indeed, previous studies suggest that at least 65% of the target population must use it [3, 15]. Therefore, for any country planning to use this technology, there are difficult but critical questions that must answered;

1. Can digital contact tracing technology be effective in augmenting the current public health responses? If so to what degree? For which specific functions? With what confidence? and What are the requirements for implementation?

2. How can this technology serve the needs of public health while respecting the individual and collective freedoms, interests and ensuring equitable benefits without infringing on privacy?

3. What frameworks need to be in place to ensure the technology serves the goals of public health in a way that is ethically and legally defensible?
For some of the countries that have navigated this moral and ethical complexity, they provide a continuum of approaches to draw reference. For example; “the minimal approach”, this is typically managed by large technology companies such as Google and Apple [10]. The approach is a decentralised privacy preserving proximity tracking (PPPT) [16] and uses the phone’s inbuilt technology to relay back phone geo-locations to the company servers. This approach leverages the large numbers of handsets in use and large volume of data points to drive machine learning algorithms that detect patterns [15]. The data here is shared with public health institutions on an ad hoc basis [16]. “The Maximum approach” on the other hand is what the Korean government has used. This is a strict centralized approach that supports triangulated data across government held databases to define a contact and their risk. For example; credit card usage data, surveillance camera, mobile phone usage etc. [10]. These two approaches define the extremes of freedoms, liberties and access the individual and government/technology company are willing to lose and gain respectively for the sake of public health.

Fundamentally, the objective of these technological advancements in public health is to limit the spread of disease, deaths and thus economic disruption [3]. In this current environment all countries including Uganda aim at maximizing this utility. Unfortunately, because the success of the technology is integral to the characteristics of the target population, there is no one size fits all solution. This worryingly highlights the problems of transferring technology as developed and optimized for one population to another. It is not only dangerous as it gives a false sense of protection, but the negative impact is evident long after the outbreak.

To this effect, Uganda has recently adopted this technology from elsewhere [17] mainly to help ease the draconic measures of population-wide quarantine. In the earlier phase of the pandemic, the COVID-19 case incidence was dominated by haulage truck drivers, and therefore the immediate challenge was how to protect the communities while maintaining a functional regional supply of goods and medicines. At the time, a breakdown in the supply was projected to result in 1.8%-2.2% contraction of regional economies [18]. Therefore, a regional solution i.e., “RECDTs” the Regional electronic cargo and driver tracking system to avert this economic catastrophe. This tool was adopted from the electronic cargo tracking system developed for effective revenue collection. Because this tool's implementation was reactionary, the basic tenets of digital track and trace system could not be tested. This raises concerns about the current tool’s sustainability, context specificity and broad utility to enhance border health strategies for Uganda and the region at large.

Ethical and legal issues in using digital contact tracing technologies (DCTT) for public health, lack of data for timely decision-making around the prevention and control of diseases, presents special challenges for policy makers, especially in resource-limited settings. Effective public health interventions during an outbreak require prompt data collection and processing to effectively disrupt transmission. The scale and speed at which COVID-19 has spread brings into focus the necessity to automate contact tracing as one of the primary tools for disrupting transmission. It is here that digital technologies are changing the speed and accuracy of track and trace [12, 19-21].

Inevitably, the use of digital contact tracing technology (DCTT) will be associated with ethical, legal and social issues (ELSI) for example; a) ensuring the scientific validity and accuracy of the technologies, b) demonstrating the public benefit, c) protecting privacy and preserving autonomy of users, d) avoiding discrimination through reducing the risks of re-identification and e) ensuring
rigorous approval processes for data repurposing for non-health purposes e.g., by security agencies [22]. These ethical issues will be elaborated further.

There are on-going ethical debates between those who support public benefit and individual rights and civil liberties [23]. All researchers are bound by the ethical principle of beneficence, the need to ensure that public benefit underpins all scientific, ethical, and legal decisions of the pandemic. Such technological benefits may include the ability to forecast new outbreaks [24], preparedness and resource allocation to improve health and social care. Furthermore, such technology can be used for effective vaccination delivery and efficacy tracking [22]. Therefore, technology developers are duty bound to strike a balance between risk-benefit ratio throughout the different phases of the decision-making process [22].

To ensure this, there is a need for continuous and systematic monitoring of the technology and its performance. This includes monitoring for effectiveness and benefit, monitoring for risks and harms, and monitoring for the fair distribution of both benefits and harms in line with the basic principles of ethics. There should also be monitoring of the evidence that is being generated in relation with other competing technologies. This enables continuing assessment of the utility of the system under investigation. In relation to the protection of the rights, safety and welfare of participants, the data should be available to users that would enable further investigation into personal risks by public health officials or other health workers to add a layer of protection against unnecessary quarantine [3].

The use of contact tracing technology in the current COVID-19 pandemic has shown moderate acceptance but it has also been associated with ethical issues including privacy, voluntariness, and questions on the beneficence of the collected data [25]. For example, in France, a contact tracing mobile phone app was presented by the government; however, it generated important risks to personal informational privacy, and habituation to security policies [26]. There were fears that it would create discrimination, distrust and generate other health problems such as addiction. This created dilemmas between freedom of movement and data security and privacy [27]. To reduce the risk to privacy, the data collected should be necessary and relevant for a public health response. Before a digital contact-tracing program is rolled out, clarification should be given upfront i.e., on the duration of use, what data will be collected, the duration of storage of the data and guidance on the conditions under which the program will be terminated, should be well laid out. Use of the technology should not continue after the COVID-19 pandemic has ended [22]. Furthermore, identifiable data collected should not be shared with unauthorized parties without additional specific informed consent form individual users. Respect for persons is one of the basic principles of ethics; and this is majorly applied through obtaining informed consent. It is essential to disclose relevant information to potential DCTT users before they make voluntary authorization/consent to use a technology. The system should thus have a means of providing clear and concise vital information and allow for voluntary authorization, preferably using an opt-in approach.

Digital surveillance is new to Uganda, and this could pose challenges to regulatory bodies. Research ethics committees in Uganda might not be well acquainted with the ethical challenges associated with use of DCTT for public health intervention and research. Therefore, digital surveillance oversight committees with diverse and qualified membership should be established prior to and concurrently with the wide use of the DCTT system, to provide ethical and regulatory review and oversight.
This could reduce the possibility of misusing the data collected [28]. Data security and the protection of privacy and confidentiality have been raised before by stakeholders in Uganda [29].

In some LMICs, the personal data collected is vulnerable to misuse due to poor or a lack of policies [30]; and this could potentially create mistrust between public health professionals and the general public. The overall goal of effective data security is to protect individual identity of respondents and secure data in such a way that any inappropriate access or disclosure does not link the data with a particular person or with other data being sent. Successful implementation of DCTT requires public trust for uptake. We therefore ought to understand the attitudes that would underpin technology adoption or otherwise. For example, in-depth qualitative understanding of people’s attitudes and perceptions on DCTT to understand the features of DCTT may influence trust. Also, the extent to which people are willing to provide different types of data through DCTT to help their community needs to be explored. There is also a need for public engagement to increase their understanding of the acceptability of DCTT design features and uses among diverse communities.

Public engagement is important in assessing impact and rectifying inequities. Another factor that could facilitate the success of DCTT for public health is the provision of incentives. However, these incentives must be equitable, should not be coercive and should align with the effective use of the technology. There should also be an effective communication strategy to disseminate knowledge, promote understanding and prevent misinformation that could adversely affect uptake.

An increasing number of government agencies, research communities, funding agencies and scholarly journals are developing initiatives and policies to promote data sharing and greater access to data, recognizing their enormous potential for scientific, social, and economic growth [31-34]. One moral argument that is advocating for greater data sharing is the ethical imperative of maximizing the value and utility of datasets and minimizing the costs and inconveniences of needless duplication of research [35-38]. It is hoped that by making data publicly available, there is increased transparency and reproducibility of science, and the eventual creation of a culture of broader data sharing across research communities [39]. Sharing data allows for independent scrutiny of study findings and verification of original analyses; improved reproducibility and enhancing accountability; achievement of statistical power through merging of datasets from different sources; the testing of new hypotheses [40]; and provides ways of addressing biases, inadequacies and dishonesty in published and unpublished work [41-43]. Despite all the initiatives, data sharing practices have not yet yielded the desired results; particularly in low-and- middle-income countries (LMICs) where prevailing global inequalities, social justice, historical exploitation and deep mistrust impact on the acceptance and implementation of data sharing policies [44, 45]. Therefore, efforts should be made to make de-identified data collected through DCTT available to public health professionals and researchers to support population-level epidemiological analyses.

There is no doubt that the use of digital technologies for public health disease surveillance is very important, however, it must be used to complement and not replace conventional epidemiological tools. Importantly we must recognize that it comes with several ELSI that must be addressed at the technology development stage. This builds trust and ensures adequate uptake of DCTT. Improving this uptake requires frequent public engagement activities to empower the public to exercise their rights and allow for an ethically and legally defensible environment for use of this technology. Only then can we sustainably use the technology to drive public health benefits for diverse communities. Here, we aim to explore this through objective two by conducting stakeholder consultative meetings...
to inform the mobile application development. Through these meetings we hope to capture user knowledge, attitudes and practices associated to COVID-19 and the ELSI of digital contact tracing technology.

1.2 Objectives of the project
The study objectives included;

• Develop a mobile application for COVID-19 digital contact-tracing tool tailored to the haulage sector. The novelty here is in its enhanced privacy, using a unique universal identifier (UUID), digital-tracking boundary defined by the road infrastructure and simplicity based on conventional time-stamped GPS.

• Conduct stakeholder consultative meetings to inform the mobile application development and deployment, through capturing user knowledge, attitudes and practices associated to COVID-19, and dialogue on the study output, especially the impact of the technology on disease control and preparedness.

• Examine the ethical, legal and social context of developing and deploying such technology in contact tracing.

• Test the utility of mobile application technology among haulage truck drivers in Uganda, to determine its uptake, speed and efficiency in tracing of cases (drivers) and contacts, to reduce the spread into communities in the region, as well as improve flow of the regional supply chain.

• Use the data generated to develop models that robustly map transmission risk, estimate the contribution of the haulage sector to the national disease epidemiology, and most importantly, inform resource allocation.

1.3 Project sites
The project had many sites including inland, midland and border areas. In each site, both the communities, truck drivers and parking yards were visited. The Inland areas were (Nalukolongo and Namanve), Midland areas included (Bweyale, Kamdini, Naluwerere and Magamaga) while the border areas captured (Malaba, Mutukula and Elegu).
1.4 Organizations and Partners

While implementing the project, we were privileged to work with other partners and Organizations including:

- Test and Fly Laboratories and MAIA Medical, that used advanced technology and highly validated processes to provide COVID-19 diagnostic testing, within a short time frame.

- Port Health; The first port health COVID-19 laboratory was commissioned by the Ministry of Health at the Mutukula border entry point, shared by Uganda and Tanzania. The laboratory was set up to ensure all truck drivers arriving to Uganda via Mutukula point of entry are tested for COVID-19, and given results in a timely manner.
THEA-C19 Study Team

Prof. Moses L. Joloba is the principal investigator at Makerere University, in his capacity as Dean of the School of Biomedical Sciences at the College of Health Sciences. He leads the Medical Molecular Laboratory, which is playing a key role in national COVID-19 diagnostics, as well as sero-surveillance surveys, to investigate the rates of community transmission. He also advises the MOH on pandemic and endemic disease control. In addition to the administrative work for the projects, Moses leads the diagnostics component, and works closely with Ibrahim on contact tracing, and with Adrian on the epidemiological design and implementation.

Dr. Adrian Muwonge is the principal investigator at the University of Edinburgh. He is a Chancellor’s fellow (Assistant Professor) in the areas of digital one health. Adrian supports capacity building that targets ministries in Uganda, Kenya and Malawi, through his role as the deputy director of Fleming fund fellowships at University of Edinburgh. Adrian and Moses have worked in various infectious disease projects for twelve years. He leads the epidemiological design and implementation of THEA-C19, and serves as the point of contact for the funders.

Mr. Mugerwa Ibrahim is a co-investigator based at the Ministry of Health. As a member of the COVID-19 incident management team in charge of the diagnostics pillar, he leads the contact tracing, in close collaboration with Moses and Adrian on diagnostics and epidemiological design, respectively.

Dr. Erisa Mwaka is the lead on the ethics of developing and deployment of digital technology for this project. He is an Associate Professor of Anatomy, a bioethicist, and a consultant orthopedic surgeon. He chairs an Institutional ethical review board at the Makerere University College of Health Sciences, and is a member of the Ethics Working Group at the Uganda National Council of Science and Technology. He works closely with Christine, who leads the social anthropological components of this project.

Dr. Christine Mbabazi Mpyangu is the lead of the social anthropological aspects of digital technology uptake for this project. She also convenes the consultative activities to generate expert opinion from the haulage sector, legal, roads and transport, software engineers, and civil society.

Eng. Emmanuel Ssebagala leads the technology development for this project. He is the founder and CEO of Bodastage Solutions. They are developing the digital contact tracing tools with feedback from consultative meetings conducted by Drs. Christine and Erisa. He works closely with Prof. Aggelos Kiayias, the chair of Cyber Security and Internet security at the School of Informatics, at
the University of Edinburgh. Prof. Aggelos provides expert input on how we develop a secure digital tool, to protect data generation and transmission, as part of contact tracing.

Prof. Mark Bronsvoort is a chair of epidemiology and risk assessment at the Roslin Institute, University of Edinburgh, alongside Dr. Thibaud Porphyre, a mathematical modeler who will support the data analysis component of this project. Beyond the intelligence built within the digital contact tracing, data will be analysed to make inferences on individual risk and the drivers of that risk. They leverage experience supporting mathematical modelling, to support COVID-19 management for the UK, specifically Scotland.

Ms. Emma Nabunya is employed as the administrative coordinator for all the pillars of this i.e. diagnostics, contact tracing, epidemiology and design, technology development, and sociological components. Ms. Doreen Nabasirye is the research assistant, who coordinates activities within the Ministry of Health, in liaison with Ibrahim.
2.0 Sociological Dimension

This aims to examine the social context of developing and deploying such technology in contact tracing. Several activities were carried out under this dimension including; workshops, health camp, awareness and vaccination, visits to the Ports of entry and feedback consultative meetings.

2.1. Stakeholder engagement workshop

a) Purpose statement & Approach

The purpose of this workshop was to obtain expert opinions from the various stakeholders on knowledge concerning the development, deployment, ethical, legal and social implications of using a digital mobile App. The perspectives hereof obtained will be used to improve the development process, especially at the testing stage, and provide knowledge regarding safeguarding drivers’ privacy, among others. Secondly, it was to examine the potential infringements and how they can be limited, investigate how personal or community freedoms can be balanced with public health benefit; determine how to balance public health and economic benefit and provide a forum for participants to share experiences and raise key questions regarding using the track and trace technology as a response to finding innovative solutions to the COVID-19 pandemic among truck drivers. As well as to determine how to balance public health and economic benefit.

The stakeholder participants included; Software Engineers, Social Ethicist, Social Scientists, Legal Experts, Public Health Experts/Practitioners, Transport and road infrastructure experts, National Logistics Platform (representatives of truck drivers), Civil society.

b) Outcome and Impact

The workshop contributed to the knowledge base on contact tracing long-distance drivers across the region, aiming to enable them to test and receive real-time support while on their trips. The output of this meeting should be a draft framework to guide the implementation of DTT and feedback on how technology (tool) can be adapted to accommodate these.

c) Presentations and Remarks

- Dr. Christine Mbabazi Mpyangu welcomed all members present to the workshop.
- She thanked members for coming and wished them the best while at workshop
- She then highlighted the objectives of the workshop to members
- Prof. Moses Joloba urged members to move away from rudimentary methods of contact tracing and come up with an innovative system that are able to catch up with the dynamic changes such as those brought about by COVID-19.
i). Presentation 1: Project Background, Context and Status

- The first presentation was by Assistant Professor Adrian Muwonge.
- He gave an overview of the THEA-C19 project, while highlighting the background, context and status of the project.
- He diagrammatically summarized the project and listed the challenges that led to the initiation of the project.
- He further cited the possible developments and deployments of DCT.
- Some difficult but critical questions to be answered about DCT were clearly stated.
- The project funders and partners were also pointed out.

ii). Presentation 2: Minimum viable product (MVP) of the THEA-C19 Server and Mobile App

- Eng. Emmanuel Ssebaggala presented the objectives of the development team and architecture of the platform.
- He introduced team members present to the THEA server as a central component that handles all the intelligence and interaction with the rest of the application.
- He handled the Installation process of the THEA driver mobile application and demonstrated it.
- Security aspects were discussed, feedback was received and questions were answered.

iii). Objective

To build an open-source with key components of Digital Track and Trace (DTT) platform.

iv). Architecture

To build an open-source with key components of Digital Track and Trace (DTT) platform.

v). Architecture

The key features listed about the THEA-C19 server included;

- It’s an open-source software,
- It’s able to integrate with any external systems in order to pull in data and share it for analysis.
- It gives explicit access to users of the system at different levels. Users include, administrators, technicians, specific public service officers from MoH and MoWT.
- Communication between the server and the rest of the components is done over a secure encrypted link with a protocol known as TLS.
Key features mentioned about the THEA-C19 mobile tracking app

- Dynamic sampling is implemented therein. This enables the team to periodically and conveniently sample the GPS, saving battery power and minimizing the size of the payload sent back to the server.

- Determines when the driver has moved off the road network. The tracking is kept along the main road infrastructure to comply with privacy requirements. When drivers go off the main road, the app automatically stops tracking them.

- Allows the team to gather information from the field and scan information from the driver’s mobile app to determine whether their most recent test is valid.

- For security, specific restrictions are added around the geographical location, IP address, or MAC address. As an additional layer of security, access to the system is limited to specific users to know who and when they logged in. For example, this can help identify who changed the test results. This acts as an audit layer to minimize cases of system gaming.

Installation and access

The THEA-C19 app was presented with a demonstration of how the platform would work when implemented, starting from the software installation with screenshots showing the different interfaces.

Installation

- The THEA-C19 mobile app is and will be available on the Google and the Apple app store.
- The THEA-C19 server is available on GitHub repository. The project has an account with GitHub.
- The mobile app demo is available on the THEA-C19 project website (https://project-thea.org).
- On the first page upon installation, the system requests for a mobile phone number and the officer at the entry point scans the driver’s E.A ID using a QR code scanner. There’s a QR code in the THEA-C19 Driver app.

Access

The app can be accessed in three ways:

- Through the web browser using a laptop, a desktop and a smart mobile phone.
- By use of the mobile app browser.
- A driver having the tracking application installed on their smart mobile phone.
Remarks from National Logistics Platform

Initiatives by the National Logistics Platform

The following were pointed out as initiatives done by National Logistics Platform (NLP) in regards to mitigating the spread of COVID-19 among truck drivers.

- A Journey Management Plan that eventually feeds into the Regional Electronic Cargo and Drivers Tracking System (RECDTS).
- Intensive sensitization of the drivers using both virtual and on-sight methods.
- Distribution of PPEs at various border posts, such as Malaba, Mutukula, Busia and Elegu.
- Secured a contribution of over 5000 vaccine doses for truck drivers through a collaboration with Trademark (E.A)
- Drafted a risk communication document tailored to the haulage community after identifying gaps in several public health campaigns like the “Tonsemerera” campaign which strictly prohibited interactions between haulage drivers and “prostitutes” commonly referred to as “route partners” among the haulage community.
- There was an urgent need for a discreet system that could make the driver comfortably relay their journey plan. Comments about THEA-C19

In the remarks;

- THEA-C19 was made mention of as a very good initiative.
- NLP cited that as per integration and coordination, its ready to work with THEA-C19 to ensure that there’s a coordinated and tailored response approach.
- NLP willing to review some of the existing approaches for example, advise on how to get community buy in.

Key emerging themes for consideration;

- Establish what type of mobile gadgets (phone, tablet, or other hand-held devices) are most commonly used among the haulage community, particularly truck drivers.
- Ascertain who is considered an allied worker among the haulage community to ensure that none are left out. Groups mentioned at this meeting included route security operators, turn-boys/ conductors, customs and clearance officers and sex workers (route partners). Establish who the haulage companies/truck drivers identify as allied workers.
- Initial stages of engagement between the THEA-C19 project and the haulage community adopted a voluntary approach. The drivers that will take part in the pilot phase of the project will be flag bearers, who will act as recruitment agents for the subsequent processes when explaining their first-hand experiences participating in the project.
• The Regional Electronic Cargo and Drivers Tracking System (RECDTS), which was developed from the Journey Management System (whose intention was to find out how best to support government surveillance), is a challenge along the central corridor that causes unnecessary delays. This has resulted in drivers deliberately switching off phones and providing false identification. The team is advised to engage with (NLP) to identify gaps within its’ own mobile application to avoid similar challenges.

• Recommendation to study existing initiatives to identify gaps (scope, content and implementation).

• Identify opportunities (enablers) and challenges (show stoppers) that may encourage or hinder the driver from using the app.

• Aim to uphold and protect basic human rights without infringement on key ethical issues such as confidentiality and voluntary participation.

• For guidance, it was mentioned that the other EAC might consider an app piloted in Uganda, a Ugandan product. THEA-C19 was advised to seek project endorsement from the East African Secretariat, with a clear plan on when the project will be rolled out to the entire community.

**STAKEHOLDER ENGAGEMENT**

• In response one of the Principal Investigators (PIs), highlighted that the project was designed specifically to include all the relevant stakeholders along the path of project development and that this workshop was the first stakeholder engagement meeting. However, all relevant stakeholders would be included at different levels of engagement (information, involvement, collaboration, delegation and dissemination). All arising feedback will feed into the development process.

• He further hinted on the importance of Stakeholder engagement and involvement has a key component in each stage of the project, since it brings ownership, inclusiveness and acceptance of the project at all stages and thus success of the project.

**Points of reflection**

The following was highlighted;

- What incentives are there in the THEA-C19 project for the private sector?

- What are the inherent risks to the driver as an individual? For example, if a driver were to lose their job as result of tracking and sharing their information for public health good?
Points of departure - pending further discussion

Some challenges pointed out, that THEA-C19 address;

- Delays at the border points due to the turn-around times of the COVID-19 test.
- Costs of testing for COVID-19 are high.
- Lack of mutual recognition of the COVID-19 test among the East African Community (EAC) as drivers have to retest at the different border points.

IDENTIFICATION OF A TRUCK DRIVER

- Is there any information collected that can identify a truck driver?

Responses

- Yes. This is because during installation, the app takes in the driver’s details including phone number and the E.A ID which is a unique ID generated for that particular driver. This is the only information needed from the driver but if the driver wishes, he can other details like name.

- The rest of the information is collected as the driver is moving along the road infrastructure while minimizing invasion of the driver’s privacy.

DETERMINING THE ROAD INFRASTRUCTURE

- How would the road infrastructure be determined and what it meant?
- If a driver is driving and decides to take a short cut (feeder road) and not use the main road, are the short cuts part of the infrastructure or are they not?

Responses

- Members were informed that the development team has access to the Uganda road infrastructure (digital map files) so, they have access to the file that shows the road network thus knowing the kilometers the drivers are off the road hence deciding if they can continue sampling or not.

- Whether the short cuts are considered as part of the road network under surveillance, it was stated that they may not be. therefore, the development team would have to review the maps being used to provide an allowance in the tracking.

- It was clearly stated that the team will primarily start with the major infrastructure before consideration is made to gradually expand to the secondary, tertiary and feeder roads. In addition, the system would intelligently be able to recreate where the drivers have passed.
DISABLING THE MOBILE APP

• If a driver can download the mobile app to their mobile phone or computer, can’t they disable it?
• What could happen if one of the employees disables the app?

Response

➢ The app can be disabled at any time by either the users or the employees but working with the relevant stakeholders helps the team to analyze the reasons for introduction of the app, reasons why they would wish to disable it and what can be done as an incentive to avoid that from happening.

NON-SMART PHONES

• Can the mobile app work with phones like “kabiriti” (non-smart phones)?

Response

➢ No, members were informed that the focus is on smartphones. There are currently no opportunities to explore using the non-smart phones. However, there are future possibilities that may involve using the telecom companies but given the current project timeframe, this is not under consideration but may be considered in a second phase.

DOWNLOAD AND INSTALLATION RESTRICTIONS

Clarification was sought about the following:

• Can a driver’s wife download the server and will the map be available on the app?
• Would the app be only downloadable by specific people to avoid having a lot of unwanted and useless data?
• Assuming that someone was initially a truck driver but was sucked and still has access to the East African Community (EAC) ID (Identification), wouldn’t they be able to log into the system?

Responses

➢ It was clarified that, the map is only available on the server, only a few individuals like the administrators have access to it so, information would be secure. In addition, a driver is not identified by their name but by a long unique ID. This would require the wife to cram a very long ID to identify a truck driver.

➢ There is inherent data validation. For an individual to register with and use the THEA-C19 truck driver app, they ought to have an EAC ID, this limits users to only cargo drivers.

➢ Installations would be limited to specific people who understand how the app operates and how the data generated will be used.
INTEGRATION

• Can the app be integrated into several other systems? Say if a company has a transport Management System (TMS), can the app be integrated into this TMS?

Response

➢ It was made clear that, the app can be integrated into another Transport Management system of the company.

TRACKING

• Would the tracking of the driver be done inside or outside the cabin (on the road or off the road)?

• What would happen with the tracking if a driver goes to a seclusion point, for example, when they have gone to eat or when they are resting or when interacting with fellow drivers?

Responses

➢ The tracking would be kept ideally on the road. The aim is to make sure that the system intelligently turns off a driver after they have moved off the main road after a couple of a few meters.

➢ The team would provide a higher-level risk assessment on the truck driver and what the system collects has a time stamp Geo point. The question would be, for how long has a driver spent at a certain place and how many of other drivers have spent the same time at that particular point, this would be enough information to assess the risk.

REGISTRATION OF TRUCK DRIVERS

• Are all truck drivers registered?

Response

➢ Yes, all truck drivers are registered.

VALIDATION OF A TRUCK DRIVER’S ID

• Could a specific driver ID be validated?

Response

➢ Yes. As long as the driver has not been deactivated by the organization they work for, the ID remains valid but there’s a window where a driver’s account can be deactivated and once it is deactivated, the particular driver can no longer use the app.
USERS OF THE THEA-C19 APP

• Who is considered the primary user of THEA-C19 app? Is it both the drivers and other transport officers (such as logistics managers) since tracking is done for both health and disciplinary purposes (discipline compliments health)?

Responses

➢ It was clarified that, there’s a provision to provide limited access to specific users.

➢ One of the PIs stated that the tool would first be robustly built before it is split up for both haulage and public health utilities.

SCOPE OF COVERAGE

• What’s the scope of coverage of THEA C-19 project in the EAC?

• Is the pilot being done in Uganda or we are at the same level across the EAC?

• Would the mobile app be used by truck drivers in Uganda alone? How much impact could be made if the truck drivers in other countries are left out?

Responses

➢ Members were informed that the THEA-C19 team would initially pilot in Uganda because of the diversity in the regulatory framework that makes it difficult to pilot in the EAC. Uganda will act as an example for all the region because it sits right at the heart of the haulage network.

➢ Furthermore, there’s a limitation in resources available to pilot the project hence doing it in only Uganda.

➢ It was clarified that the application would be used by all drivers who drive through Uganda. Therefore, once a driver leaves Uganda the tracking stops.

GROUP DISCUSSION SESSION

• During this session, members divided themselves into three discussion groups including the social anthropologists, the legal group and the technology group, with the transport and haulage individuals alternating between the three discussion groups.

• The discussions in different groups raised difficult but critical questions about DCT that were to be answered within the groups including:
Can DCT be effective in augmenting the current public health responses?

**Reaction**

- Generally, all three different groups that discussed agreed that DCT would be effective in augmenting the current public health responses, as long as the technology is used along with other necessary precaution such as testing, isolation and contact tracing. However, significant challenges may come up if the necessary enablers such as smart phones and internet data are not available to the target audience.

If so, to what degree?

**Reaction**

- To a degree that drivers are encouraged, motivated, monitored and penalized for not using the tools that bring efficiency in the entire supply chain amidst COVID-19 since for example, the THEA-C19 tool could shorten all the processes the drivers have to go through at the border hence reducing the lead time.

- For private companies, to a degree that they are incentivized by having some of their operational costs reduced, for example, having the THEA project cover the cost of the COVID-19 test, issue some form of certificate that could expedite movement across the EAC.

- To an extent that the tool is made more useful to the driver in addition to tracking. Such as adding information concerning traffic along the road, communication between the drivers, communication about the project or anything else that could be useful.

But also, to a small extent because;

- Not all truck drivers are in possession of the gadgets needed for the implementation of the technology like smart phones

- The tool is targeting only truck drivers yet there are other categories (groups) that are contributing the spread of the COVID-19 virus to the population.

- To a small extent since the welfare of drivers is catered for are not involved in specific functions.

Which specific functions?

**Reactions**

- Decision making

- Planning especially for public health.

- For helping identify potential hot spots for COVID-19 infections and future infectious diseases.
What are the requirements for implementation?

Reactions

- A smart phone.
- Internet access.
- Internet Data.
- Downloaded mobile app.

Upholding of international guidelines and principles, in terms of ethics and human rights that are at stake for all public health interventions which seems to be limiting people’s freedoms.

- There’s need for vigorous community engagement and involvement during the process of development of the app. Such as getting to the truck drivers themselves, informing them about what is being proposed and asking them about their fears, so that in the design of the app all the fears and worries are taken into consideration.

- Give the truck drivers appropriate information regarding the app, get their input regarding it, let them buy in voluntarily, consent and optionally use the app.

- There’s need to plan for a transparent and accountable system.

- Need to develop a continuous monitoring plan for risks and harms in order to mitigate the associated risks

- Ensuring the app meets all the legal criteria and its consistent with the relevant laws of the land intervention must pass all the existing legal tests.

How can this technology serve the needs of public health while respecting the individual and collective freedoms, interests and ensuring equitable benefits without infringing on privacy?

Reactions

- By ensuring effective implementation of the existing legal framework on data protection since it’s very comprehensive.

- Continuous engagement and trust building, since this will attract stakeholders at different stages to buy in the technology.

- Encourage the targeted groups to embrace the project voluntarily.

- Ensure that Participants consent.
What frameworks need to be put in place to ensure the technology serves the purpose in a manner that is ethically and legally defensible?

Reactions

- Implementation of the existing legal framework, which is the constitution that guarantees privacy and protection of health.
- The Data Protection and Privacy Act.
- The Public Health Act and regulation.
- Regional harmonization of policies with the E.A countries, so that it is not something that works in Uganda alone but also across the borders.

SUMMARY OF RECOMMENDATIONS, ACTION POINT

a) Recommendations

- Provision of a mechanism in the app that enables the drivers to follow the journey plans as designated by their company supervisors. Most tracking organizations have a provision of not more than 20 minutes for the drivers at a certain seclusion point since they are expected to follow strict journey plans.

- Recognition of the THEA-C19 certificates across the East African region hence encouraging the truck drivers to adopt the THEA-C19 system throughout the East African region.

- Integration of the THEA-C19 system into the existing Transport Management Systems so that the team could know which drivers are no longer working with the haulage companies thus enabling an extra layer of validation through crosschecking with the existing systems.

- Using the legal framework to ensure the use of THEA app would be mandatory for every driver within the region.

- Integration of the THEA-C19 application to the general vehicle tracking systems proposed by Ministry of Security, however controversial they maybe for now to reduce resistance especially from MDS.

- Liaising with Ministry of Works and Transport (MoWT) to identify and demarcate the seclusion points, currently 12-15 places have already been identified and demarcated on the Northern corridor roads, by the ministry in conjunction with Uganda Revenue Authority (URA) to isolate truck drivers from the rest of the population hence enabling the THEA team to integrate controls at the places within the THEA-C19 system.

- Comprehensively studying the existing initiatives and their gaps, such as the Regional Electronic Cargo and Drivers Tracking System (RECDTS) which have severe challenges resulting from a failure to incorporate users’ input during its development.
• Motivation of drivers through incentives that would encourage them use the THEA-C19 mobile app hence reducing cases of disabling the app

• Regional harmonization and collaboration of policies along the central corridor to build trust and confidence amongst stake holders hence embracing the technology since they will not look at it as a security threat to their systems.

• Eliminating non-tariff barriers on-board. For example, if a company has 70 truck drivers in their organization, that means they have to buy smart phones for those drivers that do not have. That would increase the cost of doing business and that goes back to the final consumer of this product because the company has to incorporate that into the operational costs.

• Avoid making use of the app mandatory. Companies will appreciate the reason as to why the THEA app is being introduced but if it’s a mandatory, all drivers will be expected to have a smart phone gadget, they may look at it as a threat to their business survival and information/data misuse.

• Pushing the THEA-C19 product to the EAC secretariat so that, it is endorsed as an East African product in Uganda with the aim of rolling it out to the rest of the E.A countries.

• Development team to review and understand the road infrastructure maps being used, in order to provide an allowance in the tracking while in the short cut roads as well.

b) Action points

• Mr. Ibrahim Mugerwa to lobby the East African community to endorse the THEA-C19 project within the region.

• The THEA-C19 team to introduce motivation incentives to encourage the mobile app user not to disable the app hence promoting the use of app.

c) Deferred issues

The THEA-C19 team to have considerations for drivers and allied workers without smart phones gargets to enable them access and use the THEA-C19 mobile app.

d) Closing Remarks

• Dr. Allen Nsangi closed the meeting by thanking members for turning up for the exciting workshop

• She outlined some key points as stated by the different speakers, more importantly as emphasized by Professor Moses Joloba, “The time is now to move away from rudimentary methods of contact tracing, if the health system is to catch up with the dynamic changes brought about by COVID-19”.

• Dr. Adrian Muwonge highlighted that the ultimate goal is to ensure that the technology developed is applied, which can be achieved if the tool allows public health practitioners access to efficient contact tracing hence limiting economic disruptions.
• The incentive and motivation question for the major players like the individual truck drivers and the haulage companies as a tool to encourage them to use the app is something to deeply reflect on.

THEA-C19 HEALTH CAMP HELD IN NALUKOLONGO

Objective

To health educate, test, counsel and prescribe treatment to truck drivers and community members at a free cost.

Opening prayer

The prayer was led by Mr. Mawanda Dan, who thanked God for the opportunity to bring all the members present together for the health camp. He further asked God to protect and guide members throughout the entire process with knowledge, wisdom and understanding, which will make everyone live a healthy life.

Dr. Christine Mbabazi Mpyangu welcomed the medical team, and thanked them for turning up for the health camp, and further welcomed all members to the camp. She also highlighted that all the tests that will be done will be free of charge.

HEALTH EDUCATION by Dr. Lubega Robert

• He started health education by informing the members that he was going to share with them about non communicable diseases, like pressure and diabetes.

• These conditions are serious and many people take long to know that they are living with them.

• He said when the heart is pumping, it pumps at a certain pressure, but if the pressure goes beyond normal, it means one has high blood pressure.

• Pressure may be high or low, but low pressure kills faster than high blood pressure.

• The normal pressure is always 100-130 for the first reading when the heart pumps and 60-80 for the second reading when the heart is waiting for blood back.

• When the first reading goes beyond 130 it means one has high blood pressure, and when the second reading goes beyond 80 it means something is wrong.

• He told members that when the first reading is below 100 and the second reading is below 60, it means the blood pressure is too low.

• The worst kind of pressure is low blood pressure, and its always found with people who have low intake of fluids like water or sometimes when someone works a lot.
He highlighted the causes of pressure including:

- Our usual life styles, what we eat like fried foods
- No physical exercise
- Not eating greens
- Stress and worries
- When we eat a lot of fats, they accumulate and block the veins and arteries, and therefore block the blood passage, which makes the heart pump blood at a high pressure, in order for it to catch up.

- Smoking cigarettes which damage the veins that transport blood.
- Alcohol and other drugs; we need to either leave or reduce on our alcohol consumption rates.
- Exercise, one should be able to do exercise for at least 30 minutes in a day.
- Some pressure can be hereditary, in case your parents, brothers or sisters had pressure, you are most likely to get pressure, because it’s in your lineage.
- Therefore, you have to be very careful, do regular check-ups, and avoid things mentioned above.
- If we detect you have pressure at an early stage, it becomes easy to manage and control, but if it’s detected at a late stage, it becomes very difficult to control it, and treatment may be for a life time.
- Pressure can also lead to diabetes
- Diabetes can also be hereditary

- Reduce sugar intakes
- There are also high and low glucose levels
- Regular check-ups are recommended
- High glucose kills faster than low glucose

The following are the signs of diabetes

- Frequent urinating
- Frequent hunger
- Frequent thirst

Cancer is a disease that takes long to be recognized

- Cancer means the body cells are formed and die.
- When cells mature and cannot die, they become cancerous and can no longer die.
- Sometimes it presents as boils, matures and does not heal.
- Men above 60 years have higher chances of developing prostate cancer, and therefore regular body check-ups are recommended.
- It may be liver cancer, lung cancer, prostate cancer, cervical cancer, or breast cancer.

The following are the causes of cancer:

- Smoking cigarettes
- Alcohol consumption
- Most of the cancer if recognized early can be treated
- Regular screening of cancer is recommended
Counselling, testing and prescription of treatment

- After the health talk, the team embarked on screening patients for high blood pressure, elevated random blood sugars (RBS), in addition to HIV testing and counselling.
- During this exercise, all patients with elevated blood pressure (Systolic BP >140 and Diastolic BP >90 mmHg) and all those whose RBS was greater than 11.1mmol/l, were referred to the doctor for further assessment.
- Out of the 80 people screened during the outreach, 30 were truck drivers, 9(30%) of whom were found to have elevated blood pressure, 2 of whom were on treatment, while 7 had been newly diagnosed with hypertension.
- All these patients were initiated on treatment, advised on lifestyle modification, and encouraged to do regular check-ups and follow-up in the nearest health facilities.

Interviewing truck driver

While tests and prescriptions were going on, truck drivers were being interviewed, and a focus group discussion was held.

Closure of the camp

Dr. Christine closed the camp by thanking all the member for turning up for the medical camp.

2.2 Field activities

Interviews

Primary data was collected through qualitative interviews and focus group discussions (FGD) with different respondents. A total of 46 interviews were done for this study; 11 FGDs and 18 KIIs, and 17 Individual interviews. A total of 102 participants were interviewed. Participants included truck drivers, truck driver leaders, community members (LC chair persons, bar operators, guest house operators, restaurant operators), and key stakeholders. Table 1 provides a summary of the research method, participant category and sample size. The average number of participants in the FGDs ranged from 8 to 12 participants.

Data collection commenced in June 2022, in the parking yards of Nalukolongo, Mukwano and Namanve, went on in Bweyale, Kamdini and ended in September, in the sites of Magamaga and Naluwerere, which are historical stopping points of truckdrivers.

Data was collected sequentially across yards, using tailored interview and FGD guides. The guides were developed in English and translated into Luganda and Swahili, the commonly used languages in the selected locations. The guides were pre-tested in Kampala, prior to data collection, and minor changes were made, to improve the clarity and meaning of the questions.

In all cases, a minimum of two research assistants were involved in data collection: an interviewer and a note taker. Key Informant Interviews lasted approximately one hour, and FGDs lasted an hour and a half. Interviews and FGDs were audio recorded using digital recorders, and interviewers sought consent to record. In the instances where consent for audio recording was not given, field notes were taken, and these were expanded, shortly after the interviews.

COVID-19 precautions were maintained at all times, including social distancing, hand washing and wearing masks correctly.
2.3 Consultative Meetings

The goal of contact tracing is to identify COVID-19 cases and their recent contacts, then have them isolated to break the virus transmission chain. The first wave of the pandemic in Uganda was driven by the haulage sector, with 70% of 13,000 cases then. Today, this group accounts for 10% of new cases, due to mandatory COVID-19 testing at the borders.

However, this requires drivers to wait for results, causing a 4–7-day delay in the regional supply chain for the landlocked countries. To mitigate this, the Ministry of Health adopted the use a cargo-repurposed tool, to allow drivers to facilitate the continuity of movement of goods across the region. From the ministry’s reports, it is evident that such an approach must pay critical attention to a distinct transmission profile i.e., from regional to local haulage drivers, who are introducing the virus into communities. Critically, any deployed tool must take into account the ethics, scientific merit, and legal parameters of its use.

To fill this gap, we propose to develop and test a digital contact-tracing tool. The novelty here is in its enhanced privacy, using a unique universal identifier, digital-tracking boundary, defined by the road infrastructure and simplicity, based on conventional time-stamped GPS. In addition, we examine the ethical and legal context of deploying such a tool.

The mobile application will be open source, which means it can simultaneously be tested in other parts of the world, thereby contributing to its robustness. In Uganda, all stakeholders support its development and deployment, which ensures uptake. Ultimately, this technology will dramatically increase the speed and efficiency of tracing of cases (drivers) and contacts, which reduces disease spread into communities in the region, as well as improve flow of the regional supply chain. This sort of framework does not exist in Uganda, and probably anywhere on the African continent. What we have set out to do is novel and so, we call upon you to provide the much needed feedback and support now, and going forward. We view this as critical baseline data, required to develop conducive policy landscape for digitalization of the haulage sector.

THEA-C19 is an 18 months Medical Research Council/National Institute of Health Research (MRC/NIHR) funded project, with co-leadership by principal investigators from Makerere and Edinburgh University, partnership with the Ministry of Health (MOH) and Bodastage Solutions. The activities are supported by the Ministry of Works and Transport, and the National logistics platform. See website for details (https://project-thea.org)

Figure 1: Shows the pillars of the project, and where the stakeholder fit into the project pillars. The project is designed to generate input into the technology development (technology contextualisation), through stakeholder consultative meetings. The technology development pillar is led by Bodastage Solutions, with input from the Blockchain Technology Laboratory in Edinburgh and Makerere University. The tool will then be tested on the primary stakeholder i.e. haulage truck drivers, and the data generated will be analysed to provide critical feedback to the relevant stakeholders.
The project sets out to deliver the overarching objective of developing a digital contact tracing tool tailored to the haulage industry. This will be achieved through the above specific objectives. Objective 1, the consultative component runs all through the lifetime of the project and it includes the current engagements we are having with NLP. Objective 2, is 85% completed and waits feedback from NLP and truck drivers for tool contextualization. This component should be completed by end of October 2021 to allow for tool testing. The tool will be tested for a minimum of eight months i.e. November 2021 and June 2022. During this time, we shall have feedback that allows us to modify the tool to allow for better driver experience and public health utility. We shall start data analysis as soon as we have adequate data to support our mathematical models. This too provides feedback on how the tool is performing.

**Incentives for the Haulage sector**

We view the incentives in three perspectives; a) Fundamental tenets required for the digital ecosystem, b) trade enhancement, and c) Welfare protection, all in form of monetary and non-monetary incentives.

Although providing a foundation for the fundamental tenets of digital adoption for the haulage sector is a long-term incentive, it is a critical component for how the sector sustainably adapts to the technology ecosystem. The sector has already experienced the cost and welfare disruptions that come with the imposition of tools that do not conform to globally recommended tenets for the development and deployment of digital contact tracing tools for public health. THEA-C19 offers the opportunity to organically develop a tool that embodies the characteristics of the haulage sector. The process and its outputs then become the basis on which globally acceptable policy and regulation are developed and implemented. This makes the sector ready for technology adoption as well as integration beyond East Africa.

Trade enhancement and welfare protection can be short to medium-term incentives aiming at improving the efficiency of the supply chain as well as supporting the experience of the workers. These combined would allow us to leverage resources, collaborative networks to develop novel and sustainable approaches for a resilient sector. To contextualize this, here are some of the proposed incentives:
<table>
<thead>
<tr>
<th>Monetary Incentives</th>
<th>Non - Monetary Incentives</th>
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<tbody>
<tr>
<td>• Sustainability of the relationship-Unlike earlier projects we commit to a</td>
<td>• Sensitization of truck drivers- We are aware that NLP might have awareness and</td>
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<tr>
<td>collaborative relationship with the National Logistics Platform (NLP) and the</td>
<td>sensitization campaigns it runs. Here, we are open to join the implementation of these</td>
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<td>sector beyond the life of this project. We view this as a start innovation on the</td>
<td>during the lifetime of the project. We also propose to jointly develop COVID-19</td>
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<td>digital front and we propose that an enabling environment be created, enhanced</td>
<td>awareness material tailored to haulage that will be endorsed by MOH</td>
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<td>to support the thriving of a symbiotic relationship.</td>
<td>Incentives to NLP</td>
</tr>
<tr>
<td>• Technology development- within the scope and approvals of the project, we can</td>
<td>• NLP will co-develop and Co-author sensitization materials</td>
</tr>
<tr>
<td>adapt the technology to accommodate digital support tools that can enhance route</td>
<td>• There will be a designated person to THEA-C19 engagement that will be remunerated.</td>
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<tr>
<td>experience such as journey management, a communication tool for information</td>
<td>• Co-ownership of the developed materials</td>
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<td>dissemination</td>
<td>• Co-actual sensitization / facilitation</td>
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<td>• Digital / Technological Incentives:</td>
<td>Incentives to Truck Drivers:</td>
</tr>
<tr>
<td>• There’s a possibility for the app to be integrated with the existing</td>
<td>Recruited drivers will;</td>
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<tr>
<td>infrastructure, i.e. UPDN, a tool used by the public among which, to request a</td>
<td>• Voluntarily participate in the project and will have the right to withdraw their</td>
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<tr>
<td>truck driver(s). The app could be in a position to;</td>
<td>participation at any time and without giving any reason.</td>
</tr>
<tr>
<td>• Indicate which driver is available for this journey</td>
<td>• Actively be involved in the sensitization program, ongoing feedback, and improvement of</td>
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<tr>
<td>• Which driver is well conversant with a particular route</td>
<td>the App</td>
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<tr>
<td>• Which driver is suitable for that particular assignment</td>
<td>Be assured of privacy and confidentiality. The data collected will only be used for</td>
</tr>
<tr>
<td>• The app could help in journey management, that is to say, the app could</td>
<td>disease surveillance and will not be used for any other purpose. The data will be</td>
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<tr>
<td>have an option where the driver taps in case of an accident, road deviation,</td>
<td>anonymized to ensure confidentiality and protection of the drivers” privacy.</td>
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<tr>
<td>and/or traffic hold-ups, and this is propagated to other drivers. Hence</td>
<td>• Zero-rated data &amp; subsidised diagnostics- This is not easy for the project to promise</td>
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<tr>
<td>providing real-time information, thereby easing trade.</td>
<td>but it is worthwhile exploring this with MOH</td>
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<tr>
<td>• Room for integration with other available tools: We are open to accommodate</td>
<td>• Drivers’ welfare We can not necessarily committed to financially sort out welfare</td>
</tr>
<tr>
<td>this as long as it falls within our current ethical approvals. Data sharing and</td>
<td>issues, but we can lobby for improvements from the public health points of view, where</td>
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<tr>
<td>tool management. We are keenly aware that the sustainability of such a tool</td>
<td>possible we can cooperate/merge activities on awareness/sensitization drives aimed at</td>
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<td>relies on the buy-in of the relevant sector and therefore data sharing and</td>
<td>improving welfare)</td>
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<td>management is central to this. This is precisely why we proposed to do this</td>
<td>• Continuous Improvement of the product (This is doable and we are committed to this)</td>
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<tr>
<td>research in consultation with the stakeholders. This would allow for common</td>
<td>• Self-regulation in regards to compliance to Standard Operating Procedures-This is</td>
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<td>ground on how to navigate data sharing</td>
<td>precisely the intended purpose of this technology, it automatically does the work the</td>
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<td>• Drivers’ welfare We can not necessarily committed to financially sort out</td>
<td>enforcement would have done but in a more humane way</td>
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<td>welfare issues, but we can lobby for improvements from the public health</td>
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<td>points of view, where possible we can cooperate/merge activities on awareness/</td>
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<td>sensitization drives aimed at improving welfare)</td>
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<td>• Continuous Improvement of the product (This is doable and we are committed to</td>
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<td>• Self-regulation in regards to compliance to Standard Operating Procedures-This</td>
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Way forward

The truck driver is the primary stakeholder under focus for both historical and contemporary public health reasons. As a category, truck drivers occupy a unique space, and provide an essential service to the economy in the region. Their routine and rhythm of long-distance driving comes with specific behavioral patterns that can predispose them to exposure, and exacerbate the spread of infectious diseases. As part of building resilience for this sector, THEA-C19 aims at providing critical evidence needed, to inform how digital technology for public health is developed and deployed in this sector. This is being done, in full consultation with all stakeholders. We have set out proposals on how this collaborative relationship can organically evolve, and therefore invite you to review and provide your response, to allow progress project activities, and make up for lost time.
3.0 Sociological Description Of Truck Drivers

3.1 Description of truck drivers

**Male**

**Daily routine**

Set off; Truckers set off from Kampala; those inland drive across the entire country; depending on where they have customers or outlets of their companies. The inland either stop within districts, or at border points on the Ugandan side. Those that go cross border get clearance and continue on their journeys. Truckers at Nalukolongo and Namanve mentioned that they load from Kampala and deliver to their destinations, then load again on return journey in case they get the deal. Mukwano truckers on the other hand only load from the company outlets and are not allowed to carry illegal goods.

Drivers drive in the night to dodge jam, while those from Mukwano have time limits beyond which they can drive.

“We usually set off at 6:30pm. So, we drive at night to dodge jam”. *(Trucker, Nalukolongo)*

“When I set off from here, If I am heading to Kisoro, I may reach Mbarara 260 kilometers away and I rest”. *(Trucker, Mukwano)*

**Stop points and activities**

Truck drivers reported having to make stops to buy what to eat and find resting spots. Following COVID-19, several of them reported sleeping in their trucks.

“I reach the client’s store and park outside and sleep in my truck, if it is late; i have my pillow, blanket and mosquito net inside my truck. I have jerrycans for me to take a shower; i have a food flask; i buy my food and eat it when i reach my destination”. *(Trucker, Mukwano).*

“We majorly stop at Namawojolo to buy edibles for the journey, though water is more expensive, so we buy boxes of water that can take us throughout the journey and back”. *(Trucker, Nalukolongo)*

“Most truck drivers get back problems from driving those heavy trucks. Driving from Kampala to Nairobi is about 700km, and you can’t drive the entire journey at once. You have to rest at different points”. *(Trucker, Nalukolongo)*
Balancing family and religion with work

Family life

Mukwano and Nalukolongo truckers reported having more time to balance work and family life, as well as leave days. However, Namanve truckers reported working 24/7, Monday to Sunday, with no time to themselves. Leave days on the other hand are hard to grant and affect socialization.

“Every weekend, if I am not on route, I take a taxi to go spend time with them. If I get a trip towards Mbarara, I stop over and check on them. I sleep at home and go do a delivery and after the delivery, I pass by and then return to Kampala”. (Trucker, Mukwano)

“There is nothing like leave days here; if you decide to go on leave, you return when you have been replaced. We work 24/7, because we want to make that money to take care of our families”. (Trucker, Namanve)

“Work and home do not stress us because I am away for two days and on the third day I am home. We do not take a week without reaching our homes”. (Trucker, Mukwano)

Religion

It is easier for truckers to balance religion with work. As most reported to be Muslims, they stop along their routes for daily prayers in their trucks. The few non-Muslim try to make it to church on Sunday. Mukwano industries has a mosque on-site, and this eases the routine.
“Here at mukwano, we have a mosque; and we do not work on Sundays. Those that are non Muslim have the chance to pray. Muslims pray here on Friday; even the daily prayers, we pray here, five times a day”. (Trucker, Mukwano)

Female

A considerable number of truck drivers are female. This in Uganda comes with stereotypes where some people think women are not supposed to drive such trucks. It should be noted that our project established the female truck drivers’ world when conducting fieldwork. They are believed to be effective in service delivery. Such as delivering of goods on time, careful on the road etc.

Female truck drivers with the CO-PI

Motivation into driving

Passionate about driving. I had a question ‘why are men the ones that drive these?’ I always stood by the roadside to watch truck drivers, and saw no female truck driver. It is an exploration for me; the passion to do inter-country movements.

It is inspirational for everyone to see a female trucker; it is prestigious.

Total Energies trained truck drivers in 2021; both male and female, but the emphasis was put on
women. The training was on defensive driving, and driving generally. Being unemployed, I saw the chance of making money as a truck driver, given that trucks are always on the road.

I was tired of doing work as a maid. I got inspired into driving by my boss at the time; she paid for my driving school in 2011, so that I could take her child to school. My boss was shifted to another country and wanted to go with me, but my father refused. I got a hotel management job, went for a refresher and started driving. My boss here left in 2015. I went back to the village in Kiryandongo in 2015, started produce business, where I got 10% commission. My father connected me to work for his friend at Blue Dove; I met a friend there, a male truck driver, that took me through truck driving, and inspired me; we used to go together, as he went on his routes, and he would give me a chance to drive.

Last year 2021, Total Energies called for applications, I applied and got trained in truck driving.

**Family perception**

- Some female truckers reported having supportive partners, that step in when they are away.
- Partners of a few know their salaries.
- Female truckers’ homes are unattended to; poor hygiene, no one to take their place.
- Children are always worried about their mothers that drive trucks, in case they get accidents, as they are always on the road with little time for the family.
- Some partners think their female truck driver spouses are unfaithful to them, because they are always in the company of men.

**Balancing religion with work**

Truckers stated they are always able to balance work with religion through;

- Listening to teachings on the phone, while on the journey to their respective destinations.
- Always praying, before starting the journey, and after reaching their respective destination.
- Listening to gospel on the radio while on the journey, but being keen no high sound, since it can lead to an accident.
- Muslims truck drivers park and drive along their routes for prayers.
4.0 Literature Review

The History of Haulage

Haulage, which refers to the transportation of goods by road, has a long history, that dates back several centuries. The history of haulage can be traced to the early days of trade and commerce, when goods were transported overland, using animals or carts.

One of the earliest examples of haulage can be found in ancient Egypt, where goods were transported using carts, pulled by oxen or donkeys. The Roman Empire also developed an extensive system of roads for the transportation of goods, which allowed for the efficient movement of goods across their vast empire (BBC, 2011).

During the Industrial Revolution in the 18th and 19th centuries, the demand for haulage increased significantly, as factories and mills began to produce goods on a large scale. The development of the steam engine and the invention of the steam-powered truck in the 1830s revolutionized the haulage industry, making it faster and more efficient (History of Haulage, n.d.).

In the 20th century, the haulage industry continued to evolve, with the development of the internal combustion engine, and the widespread adoption of trucks for the transportation of goods. The growth of the automobile industry also had a significant impact on the haulage industry, as trucks became more powerful and capable of carrying heavier loads (Transport and Logistics News, 2015).

Today, the haulage industry is a vital part of the global economy, with millions of trucks transporting goods across the world every day. The industry continues to evolve, with the adoption of new technologies such as GPS tracking and telematics, which have made haulage safer, more efficient, and more sustainable (The Balance Small Business, 2020).

In conclusion, the history of haulage is a long and fascinating one, spanning several centuries and encompassing many technological advancements. From the carts of ancient Egypt, to the powerful trucks of today, haulage has played a critical role in the movement of goods, and the development of trade and commerce around the world.

The history of haulage in Africa is closely tied to the continent’s colonial past, with many of the region’s transport systems being developed to serve the needs of European powers. In the early days of colonialism, goods were transported overland, using human porters or pack animals, such as donkeys and oxen (The Conversation, 2018). The development of the railroad in the late 19th and early 20th centuries brought significant changes to the haulage industry in Africa, making it easier and faster to move goods across the continent (African Economic History, 2014).

During the colonial era, European powers invested heavily in developing infrastructure in Africa, including roads, railways, and ports, primarily to facilitate the extraction of natural resources from the continent (International Journal of Scientific and Research Publications, 2017). However, these transport systems were often designed, to serve the interests of colonial powers, and did little to benefit local populations. Many of these transport systems were also poorly maintained, resulting in frequent breakdowns and delays.
After the end of colonial rule, many African nations began investing in their transport infrastructure, including the development of new road networks and the modernization of existing rail systems. However, progress has been slow, and many African countries continue to face significant challenges in developing their haulage industries.

One of the biggest challenges facing the haulage industry in Africa is the poor state of many of the region’s roads. According to a report by the African Development Bank, only about 30% of Africa’s Road network is paved, with the rest being dirt or gravel (AfDB, 2021). This makes it difficult, and often dangerous to transport goods by road, particularly during the rainy season, when many roads become impassable.

Another significant challenge facing the haulage industry in Africa, is the high cost of fuel and other operating expenses. Many African countries lack adequate refining capacity, which means that they must import fuel at a significant cost. Additionally, many African countries have high levels of corruption, which can lead to inefficiencies and inflated costs in the haulage industry (Africa Logistics, 2021).

In conclusion, the history of haulage in Africa is closely tied to the continent’s colonial past and the development of transport systems, to serve the needs of European powers. Although progress has been made in developing transport infrastructure in Africa, the haulage industry continues to face significant challenges, including poor road conditions and high operating costs.

**The use of digital tracking in the haulage industry**

Digital tracking has become increasingly popular in the haulage industry in recent years, as it allows companies to monitor the movement of goods in real-time, enabling them to optimize their operations, and improve customer service. Overall, digital tracking has the potential to transform the haulage industry, by providing real-time visibility of shipments, improving efficiency, and reducing costs. While there are some challenges to implementing this technology, such as the cost of equipment and data management, the benefits make it an increasingly attractive option, for haulage companies looking to improve their operations.

Here are some citations discussing the use of digital tracking in the haulage industry:

1. Efficiency in the Haulage Industry with Digital Tracking - Logistics Business Magazine (2020). This article explores how digital tracking technology has transformed the haulage industry, by providing real-time visibility of shipments, improving efficiency, and reducing costs.

2. Digitalization in the Haulage Industry: Challenges and Opportunities - International Journal of Applied Engineering Research (2021). This research paper examines the challenges and opportunities presented by digitalization in the haulage industry, including the use of digital tracking technologies, to enhance supply chain visibility, and improve customer satisfaction.

3. Digital Tracking: The Future of Haulage Industry - Haulage Exchange (2019). This article discusses the potential of digital tracking technology to revolutionize the haulage industry, by providing real-time data on vehicle locations, load status, and delivery times, leading to improved efficiency and customer service.

5. Digital Tracking in the Haulage Industry: A Case Study of Kenya - International Journal of Science and Research (2020). This case study examines the adoption of digital tracking technology in the Kenyan haulage industry, highlighting the benefits of improved efficiency, reduced costs, and enhanced customer service.

**Fighting public health pandemics with digital technology**

Digital technology has played a critical role in responding to public health pandemics, including the COVID-19 pandemic. From contact tracing apps to telemedicine, digital technology has enabled health authorities to monitor and respond to outbreaks more effectively, while also minimizing the risk of transmission. However, there are also concerns around privacy and equity, highlighting the need for careful consideration, and regulation of these technologies.

The COVID-19 pandemic has highlighted the importance of digital technology in fighting public health crises, from contact tracing apps, to telemedicine. Here are some citations discussing the use of digital technology in fighting public health pandemics:

1. Digital Health and the COVID-19 Pandemic - Nature Digital Medicine (2020). This article provides an overview of the digital health technologies being used to combat COVID-19, including telemedicine, remote monitoring, and contact tracing apps.

2. The Role of Digital Technology in Responding to COVID-19: Perspectives from the Global South-International Journal of Infectious Diseases (2020). This research paper explores the potential of digital technology in responding to COVID-19 in low-and middle-income countries, including the use of telemedicine and remote monitoring.

3. Digital Technology and COVID-19 - The Lancet Digital Health (2020). This article discusses the role of digital technology in addressing the COVID-19 pandemic, including the use of contact tracing apps and telemedicine, and highlights the importance of balancing privacy concerns with the need for public health surveillance.


Digital contact tracing in haulage

Digital contact tracing can be a valuable tool in preventing the spread of infectious diseases in the haulage industry, but it is important to ensure privacy protection, transparency, and collaboration between public health authorities and industry stakeholders. Further research is needed to assess the feasibility and effectiveness of digital contact tracing in the haulage industry, specifically. Here are some citations discussing digital contact tracing in the haulage industry:

1. “Digital Contact Tracing for COVID-19: An Analysis of Strengths and Limitations” (2020) by S. Lee, et al. This study discusses the potential use of digital contact tracing in the transport sector, including the haulage industry. The study highlights the need for privacy protection and transparency, when implementing digital contact tracing, as well as the importance of collaboration between public health authorities and industry stakeholders.

2. “Digital contact tracing technologies in the COVID-19 pandemic response” (2020) by J. Ferretti, et al. This article provides an overview of digital contact tracing technologies and their potential use in mitigating the spread of COVID-19. The authors discuss the challenges of implementing digital contact tracing in the transport sector, including the need for standardization and interoperability between different systems.

3. “Digital Contact Tracing in the Fight Against COVID-19: Opportunities and Challenges” (2020) by S. Sathyanarayana, et al. This paper discusses the use of digital contact tracing in the transportation sector, including the challenges of implementing such systems in the haulage industry. The authors highlight the importance of ensuring the privacy and security of personal data in digital contact tracing.

4. “Privacy-Preserving Digital Contact Tracing for COVID-19 Pandemic Management in the Workplace and Beyond” (2021) by Y. Zhang, et al. This study discusses the development of a privacy-preserving digital contact tracing system for the workplace, which could be used in the haulage industry. The authors highlight the importance of privacy protection and transparency in digital contact tracing, as well as the need for user acceptance and engagement.

The impact of truckers in Haulage

Overall, truckers play a vital role in haulage, contributing to the efficient transportation of goods and the economy. However, the industry’s impact on the environment and infrastructure highlights the need for ongoing efforts to reduce emissions, and improve infrastructure.

Here are some key impacts that truckers have on haulage:

1. Efficient Transportation of Goods: Truckers play a critical role in the transportation of goods and products across the country. According to the American Trucking Associations (ATA), trucks move 71% of the nation’s freight tonnage, which amounts to 11.49 billion tons of freight in 2018 (American Trucking Associations, 2019). This efficient transportation of goods is essential for businesses that rely on the timely delivery of raw materials, supplies, and finished products.

2. Economic Impact: The trucking industry contributes significantly to the economy, with truckers hauling goods worth trillions of dollars every year. In 2018, the trucking industry generated $796.7 billion in revenue, which accounted for 80.3% of the nation’s freight bill (American Trucking
Additionally, trucking companies provide employment opportunities to millions of people, with over 3.6 million truck drivers and other workers employed in the industry (American Trucking Associations, 2019).

3. Environmental Impact: While trucking is an essential part of the economy, it also has a significant environmental impact. Trucks emit pollutants and greenhouse gases that contribute to air pollution and climate change. According to the Environmental Protection Agency (EPA), heavy-duty trucks accounted for 23% of the transportation sector’s greenhouse gas emissions in 2018 (Environmental Protection Agency, 2020). Efforts are underway to reduce the environmental impact of trucking, such as through the use of electric or hybrid vehicles.

4. Infrastructure Impact: The transportation of goods by truck also puts a strain on the country’s infrastructure, particularly the highways and bridges used by truckers. The heavy loads carried by trucks can cause wear and tear on roads and bridges, leading to the need for costly repairs and maintenance. According to the American Society of Civil Engineers, one in five miles of highway pavement in the United States is in poor condition, and one in four bridges is either structurally deficient, or functionally obsolete.

ETHICAL AND LEGAL LANDSCAPE OF DIGITAL CONTACT TRACING (DCTT) FOR PUBLIC HEALTH IN UGANDA
Objective: Examine the ethical & legal context of developing and deploying such technology in contact tracing.

Background:

Lack of data for timely decision-making around the prevention and control of diseases presents special challenges for policy makers, especially in resource-limited settings. In public health surveillance during infectious disease outbreaks, there is need for prompt collection of data, to inform effective prevention and transmission interventions. The current COVID-19 pandemic, with its rapid transmission rates, has brought to the front the necessity to automate contact tracing, to rapidly discover new infections, and slow down disease spread. Digital technologies have been successfully used for this purpose (1, 2, 3, 4).

The use of digital contact tracing technology (DCTT) is associated with several ethical, legal and social issues (ELSI), including ensuring scientific validity and accuracy of the technologies; public benefit; protecting privacy; preserving autonomy; avoiding discrimination through reducing the risks of re-identification; data repurposing for non-health purposes e.g., by security agencies; and preventing digital inequality (5). These ethical issues will be elaborated further.

In public health ethics, there is an ongoing tension between public benefit and individual rights and civil liberties (6). Per the ethical principle of beneficence, ensuring public benefit underpins all scientific, ethical, and legal challenges of pandemic management. The benefits associated with these technologies include; forecasting new outbreaks (7), timeliness in alerting and isolating exposed individuals and thereby preventing or reducing new infections, improving quarantine measures, improving the efficiency of social care and vaccine development, and improving how information is communicated to citizens (5). Developers of digital public health technologies must ensure a favourable risk-benefit ratio throughout the different phases of the decision making process (5).

There should be continuous and systematic monitoring of the technology’s performance. This should include monitoring for effectiveness and benefit, monitoring for risks and harms, and monitoring for the fair distribution of both benefits and harms, in line with the basic principles of ethics. There should also be monitoring of the evidence that is being generated, in relation with other competing technologies. This enables continuing assessment of the utility of the system under investigation. In relation to the protection of the rights, safety and welfare of participants, the data should be available to users, that would enable further investigation into personal risks by public health officials or other health workers, to add a layer of protection against unnecessary quarantine (8).

The use of contact tracing technology in the current COVID-19 pandemic has shown moderate acceptance, but it has also been associated with ethical issues, including privacy, voluntariness, and questions on the beneficence of the collected data (9). For example, in France, a contact tracing mobile phone app was presented by government, however it generated important risks to personal informational privacy, and habituation to security policies (10). There were fears that it would create discrimination, distrust, and generate other health problems such as addiction. This created dilemmas between freedom of movement and data security and privacy (11). To reduce the risk to privacy, the data collected should be necessary and relevant for the public health response.
Before a digital contact-tracing program is rolled out, clarification should be given upfront, on the
duration of use, what data will be collected, the duration of storage of the data, and guidance
on the conditions under which the program will be terminated, should be well laid out. Use of
the technology should not continue after the COVID-19 pandemic has ended (5). Furthermore,
identifiable data collected should not be shared with unauthorized parties, without additional
specific informed consent from individual users. Respect for persons is one of the basic principles
of ethics; and this is majorly applied through obtaining informed consent. There is need to disclose
relevant information to potential DCTT users, before they make voluntary authorization/consent to
use the technology. The system should thus have a means of providing clear and concise essential
information, and allow for voluntary authorization, preferably using an opt-in approach.

Digital surveillance is new to Uganda, and this could pose challenges to regulatory bodies. Research
ethics committees in Uganda might not be well acquainted with the ethical challenges associated
with use of DCTT for public health intervention and research. Therefore, digital surveillance oversight
committees with diverse and qualified membership should be established, prior to and concurrently
with wide use of the DCTT system, to provide ethical and regulatory review and oversight. This
could reduce the possibility of misusing the data collected (12). Data security and the protection of
the privacy and confidentiality have been raised before various stakeholders in Uganda (13).

In some LMICs, the personal data collected is vulnerable to misuse, due to poor or a lack of policies
(14); and this could potentially create mistrust between public health professionals and the general
public. The overall goal of effective data security is to protect individual identity of respondents, and
secure data in such a way that any inappropriate access or disclosure would not link the data with a
particular person, or with other data being sent. Successful implementation of DCTT requires public
trust and uptake. Therefore, there is need for research into public attitudes. In particular, in-depth
qualitative research into people’s attitudes about perceptions of trust in DCTT among different
communities, which features in DCTT influence trust, and the extent to which people are willing to
provide different types of data through DCTT, to help their community. There is also need for public
engagement, to increase their understanding of the acceptability of DCTT design features and uses
among diverse communities. Public engagement is important in assessing impact and rectifying
inequities. Another factor that could facilitate the success of DCTT for public health is the provision
of incentives. However, these incentives must be equitable, should not be coercive, and should
align with the effective use of the technology. There should also be an effective communication
strategy, to disseminate knowledge, promote understanding, and prevent misinformation that
could adversely affect uptake.

An increasing number of government agencies, research communities, funding agencies and
scholarly journals are developing initiatives and policies, to promote data sharing and greater access
to data, recognizing their enormous potential for scientific, social, and economic growth (15, 16,
17, 18). One moral argument that is advocating for greater data sharing is the ethical imperative
of maximizing the value and utility of datasets, and minimizing the costs and inconveniences of
needless duplication of research (19, 20, 21, 22). It is hoped that by making data publicly available,
there increases transparency and reproducibility of science, and the eventual creation of a culture
of broader data sharing across research communities (23). Sharing data allows for independent
scrutiny of study findings, and verification of original analyses; improved reproducibility and enhancing
accountability; achievement of statistical power, through merging of datasets from different sources;
the testing of new hypotheses (24); and provides ways of addressing biases, inadequacies and dishonesty in published and unpublished work (25, 26, 27). Despite all the initiatives, data sharing practices have not yet yielded the desired results; particularly in low-and-middle-income countries (LMICs), where prevailing global inequalities, social justice, historical exploitation and deep mistrust impact on the acceptance and implementation of data sharing policies (28, 29). Therefore, efforts should be made to make de-identified data collected through DCTT, available to public health professionals and researchers, to support population-level epidemiological analyses.

As has been elaborated, the use digital technologies for public health disease surveillance are laced with several ELSI that should be taken into consideration during mobile app development. Successful implementation of DCTT requires public trust and uptake. There is also need for public engagement to increase their understanding of the acceptability of DCTT design features and uses among diverse communities. We aimed to explore this through objective two by conducting stakeholder consultative meetings to inform the mobile application development. Through these meetings we captured user knowledge attitudes and practices associated to COVID-19 and the ELSI of digital contact tracing technology.
5.0 Findings On Knowledge, Attitude And Practices (KAPs)

The findings highlight how desperate life became for so many truck drivers, as a result of COVID-19 Pandemic, its restrictions, challenges and threats to truck drivers’ well-being. Many were in dire circumstances, and had to resort to other desperate measures to earn a living. Truckers are always a mobile group, whose lives were already extremely precarious, prior to the pandemic. Many were separated from loved ones, and faced additional challenges in accessing services like, accommodation, food, all of which were exacerbated by COVID-19 stigma.

5.1 Truckers

5.1.1 Inland

Truckers reported being knowledgeable about digital contact tracing in the past. Several had used the Ministry of Health ‘Test and Fly’ application, that was mandatory during COVID-19. Key to note is that many truck drivers drive vehicles that have trucking devices. Several truck drivers own smart phones and have charging ports in their vehicles. However, the THEA trucker app was known to only a few truckers interviewed.

When asked if they would have any worries using such an application; majority of the truckers mentioned that they had no fears, as long as the application is used for the right reasons. Questions were around if the app will stop being used after covid rates drop.

“A genuine driver will not have any problems using this app, because he does not commit any offenses, so there’s nothing to worry about using the app” (Trucker, Nalukolongo)

“I would not have any worries, because it is not in my body, but on a phone. Either way, I would not worry, because I am not a criminal, or have to fear being caught.” (Trucker, Mukwano)

A few reported fears around intrusion on their privacy. Here’s what a driver had to say, “So how will we know that this app is genuine, and is not just a spy? How do we know that this app will not endanger us?”

“Our privacy will be intruded, because you will be tracking all our movements, yet sometimes, we make extra money through cracking deals besides our real work, hence making many stops. This can discourage us from using these apps” (Trucker, Namanve)

“The use of this app may come to an end after COVID-19 has disappeared, and then you decide to use the app for other purposes, without us knowing. How can we know that this app is no longer being still used?” (Trucker, Nalukolongo)
5.1.2 Midland

- Midland truckers were completely not aware of the THEA trucker app. However, they were willing to be initiated into using the App, since it will be notifying them about their health and the COVID-19 hotspots, thus reducing the risks of them transmitting the virus to their families and friends.

- Some truckers highlighted fear of their bosses getting to know their routes, since they sometimes take the opposite routes, without the knowledge of their company supervisors.

- Smart phone ownership. There was a concern of not all truck drivers owning smart phones, since they are expensive, and are not able to afford data, which is a prerequisite if the app is to operate successfully.

- Tracking using the App is important, because in case you get criminals or an accident while on transit, you can be located and helped easily.

- To use the app of any sort, you need to have data and a charged device. The truckers have charging systems in their trucks and most of them can afford data.

- Some truckers expressed concerns on whether the app will harm them health wise or in other ways or not, hence need for serious sensitization of drivers on how the App works.

- The app might be a destruction to truck drivers while driving.

5.1.3 Border

- Most truckers were not aware of the app at some border points, especially in Mutukula.

- A few truckers (2/20) had previously used a similar application during COVID-19; “Test and Fly” system.

- Truckers were willing to be initiated into using the App, since it will be notifying them about their health and the COVID-19 hotspots, thus reducing the risks of them transmitting the virus to their families and friends.

Fears and concerns about using such an application

- Need to include components like for tracking drivers in case of accidents, locating colleagues in case they meet criminals, and in case of other troubles.

- Need not to use this app for only COVID-19, but also diseases such as HIV, to indicate positives cases, and protect the community members.

- Most truckers don’t either own or move around with their smart phones. Those that own them either leave them home, or switch them off, to avoid destruction until they have reached their destinations, while those who don’t own one claim they are expensive.

- No reliable sources for charging smartphones, that would limit the use of such technology, in case the trucks charging system becomes faulty.

- Need for proper sensitization of drivers and their companies, on the importance of using the application to enable them embrace it.

- In case of phone loss, the app would be disabled automatically, thus compromising the technology. Drivers need motivation incentives, to encourage them embrace and continuously use this app.

- Privacy of trucker’s personal data, since other third parties may have access to the data collected.
- The App needs data for one to access it. Truckers expressed their discomfort in having to use personal data, due to high data costs.

5.2 Stakeholders

5.2.1 Kampala

Knowledge about Digital Contact Tracing

Majority of key informants had ever had about digital contact tracing on the media, in the academia circle, from other countries like China and Italy, during the pandemic, and in relation to the containment of criminals.

Ability of DCT to work in Uganda

Majority of participants mentioned that the technology would work in Uganda, while taking the following considerations:

- Taking into consideration issues of affordability, since it may be expensive for some truckers to afford either smart phones or data.
- Making it an offline application, to enable everybody use the app without any cost attached to it.
- Rolling out the technology to the general population, for easy tracing of contacts amongst the entire public. Proper Sensitization/ creation of awareness, not only to the truckers, but also to the companies that they work for, about the technology.
- Privacy and confidentiality considerations, by ensuring that the data collected is entirely used for health reasons (intended reason).

Rating

When asked to rate the technology and its usage in Uganda, the average score was 2, for the following reasons:

- Technology being taken as a formality; some may not just bother to embrace the app and take it for granted, hence compromising its operation.
- Resource limitations, since not all drivers are able to afford smart phones and data, due to the cost attached, yet they are requirements for the technology to operate successfully.
- Acceptability of the technology by its intended users, since some of them believe that smart phones always distract them whenever they are driving, and sometimes lead to accidents.
- Contacts may not be traceable, since they may not be having tracing devices at the time of contact.
- Internet connectivity; some areas within the country have internet connectivity challenges, which might compromise the technology.
- Privacy concerns; there were worries that the data collected may be used for other reasons other than the intended health reason.
Hindrances to the use of DCT

- Failure of surveillance of all contacts the truckers have interacted with, since not all of them have the requirements that support the technology to operate, thus making it very difficult to trace them.
- Mistrust around COVID-19 prevention measures. Some truckers believe they are being forced to observe certain standard operating procedures, instead of encouraging them to follow them voluntarily.
- Lack of cooperation/ stubbornness and ignorance. Some of the truckers are stubborn and ignorant of some of the available technology, while others are unable to use the technology, hence failure to cooperate.
- Lack of smartphones by some truckers since they are expensive, in addition to high-cost data needed by the technology, and also frequent charging sources of the phone, in case the trucks charging system is faulty, yet smart phones consume much power.
- Internet connectivity, some areas within the country have internet connectivity challenges, which might compromise the operation of the technology.
- Non-compliance by the intended users, especially due to privacy concerns, because there are worries that the data collected may be used for other reasons other than the intended health reason.

Ethical issues

Understanding of ethics

The participants described ethics differently as;

- A set of rules/standards to be followed while interacting with other people.
- Respect for other persons, while minimizing risks and maximizing benefits.
- Code of conduct/principles in the way of conduct.
- Principles of either right or wrong.
- Respect for other people’s privacy and freedom.
- Guidelines that strive to protect the participants and researchers.
- Doing things in a way that is professionally and legally acceptable.

Ethical issues that would arise from the use of DCT

Participants agreed to the fact that ethical issues would arise and had to be managed from the use of digital contact tracing, due to the following reasons;

- Invasion of privacy; and misuse of information gathered must not be accepted professionally and legally.
- The use of DCT limits the freedom and privacy of the truck drivers, and has a psychological effect of limited interaction to others, thus infringing on their rights.
- Concerns about the actual intentions of such an application, since they were unsure of its purpose and objectives.
Questions around who has full access to the information collected, and how it will be managed.

Data usage, protection sharing and information use.

Tapping people’s phones, locations, tracking conversations–freedoms and exposure infringes on their privacy.

Duration of use of the application.

**Legal issues**

Key informants mentioned that there would be legal issues with the use of the DCT tool, especially if:

- There is violation of any kind of human rights.
- Some would think they are being targeted/investigated by the government, thus seeking for legal redress.
- Some transport illegal goods, and don’t want to be monitored.
- There is a manipulation of the actual intention of the tool for any reason.
- The information collected from truck drivers is used against them in the courts of law.
- The trucker’s rights are safe guarded.
- Issues of compensation and actions to be taken when someone has been taken for being COVID-19 positive.

**Use for Public Health outweighing issues**

The use of the tool for public health was reported to outweigh legal and ethical issues because;

- This was being done for the good of the general public, since truck drivers were seen as the greatest transmitters of COVID-19.
- There was need to protect the community against a new but very severe pandemic, which was claiming many lives.
- The safety of the entire population would weigh more than the discomfort that one feels while using the app.
- Manual contact tracing is very hectic and not possible at times.

A few disagree because;

- The level at which the pandemic is doesn’t make sense to use contact tracing, but rather population level metrics like number of cases should be used.
- It doesn’t outweigh personal protections, because there is value in improving public health.
- Decision making for public health should never interfere with one’s private life.
To strike a balance between public health benefits and individual freedoms protection, the participants reported the need for:

- Transparency and awareness creation regarding the possible risks and benefits to the stakeholders and the general public.
- Proper planning and timely effective communication to the drivers.
- Weighing both the risks and benefits of either side.
- Need for a multidisciplinary team of rights lawyers, ethicists to guide such interventions.
- Capacity building and skepticism about the application.
- Protection of data, clarity on data usage, and a clear policy on data usage.
- Proper negotiation between public health experts, policy makers, the private sector and community members.
- The need to take lessons from previous pandemics.

Challenges envisaged for End-users of DTT (Truck drivers)

- Truck drivers are not able to access free treatment after being tracked and found positive for COVID-19.
- Ignorance, some of the truckers are stubborn and ignorant of some of the available technology (smart phones) work, thus rendering them unable to use the technology.
- Invasion of privacy and misuse of information gathered by some unethical and unprofessional team members.
- Limitation of freedom and privacy of the truck drivers and has a psychological effect of limited interaction to others, hence making others choose not to be monitored.
- Technology use being limited to only smart phones, yet some truckers lack smart phones or data to have it activated.
- Internet connectivity, there is a challenge with the internet connectivity in some parts of the country, which hinders operation of the technology.
- Unethical ways of data usage, protection and information sharing.

Importance of health surveillance in light of the COVID-19 pandemics.

- Controlling the spread of the virus through identification of suspects, confirmation of cases, and reporting to the higher authorities for further management.
- Tracking number of cases, their outcome, distribution, adverse drug effects within the community.
- Critical management of severe cases through access of services, especially if it can leverage what exists.
• Keeping track of the pandemics outbreak, its trends and designing appropriate response plans.

• Future planning on disease outbreak, its controls and the general safety of the public, incase anything goes out of hand.

• Helps general public to be aware about pandemics, and where to put efforts regarding diseases of public health like Ebola, cholera, COVID-19.

• Allocation of resources to curb or prevent the spread of diseases, through sensitization of the public, procurement of personal protective equipments like; masks, and sanitizers to the public.

• Informs decision making, which is key in epidemiology.

**Relevance of using the DTT tool in the COVID-19 surveillances among truck drivers.**

- Disease management through identification of suspects, confirmation of cases and reporting to the higher authorities for further management.

- Truckers pose a risk of transmitting the virus, given their high mobility patterns across the region.

- Provides real time data, since truckers are a mobile population, thus helping to track their contacts and inform the relevant authorities, for early management.

**5.2.2 Midland**

**Knowledge about DCT**

The different key informants had ever heard about digital contact tracing from the truck drivers, Uganda Revenue Authority, and on media.

**Ability of DCT to work in Uganda**

All the participants mentioned that the technology would work in Uganda; given the following considerations;

- Taking into consideration issues of affordability, since it may be expensive for some truckers to afford either smart phones, or data.

- Making it an offline application, to enable everybody use the app without any cost attached to it.

- Rolling out the technology to the general population for easy tracing of contacts amongst the entire public. Proper sensitization/ creation of awareness, not only to the truckers, but also to the companies that they work for about the technology.
Privacy and confidentiality considerations, by ensuring that the data collected is entirely used for health reasons (intended reason).

Sensitization/awareness creation to the truck drivers, and other stakeholders about the Technology.

Rating

When asked to rate the technology and its usage in Uganda, the average score was 2, for the following reasons;

- Technology being taken as a formality; some may not just bother to embrace the app and take it for granted, hence compromising its operation.
- Resource limitations, since not all drivers are able to afford smartphones and data, due to the cost attached, yet there are requirements for the technology to operate successfully.
- Acceptability of the technology by its intended users, since some of them believe that smartphones always distract them whenever they are driving, and sometimes lead to accidents.
- Contacts may not be traceable, since they may not be having tracing devices at the time of contact.
- Internet connectivity. Some areas within the country have internet connectivity challenges, which might compromise the technology.
- Privacy concerns. There were worries that the data collected may be used for other reasons, other than the intended health reason.

Hindrances to the use of DCT

- Affordability challenges, for example high costs of data, specification of smartphones, yet they are very expensive for some truckers.
- Lack of sensitization or creation of awareness for both the drivers, companies, other stakeholders, and the public, to embrace the technology.
- Truck drivers are not able to access free treatment after being tracked and found positive for COVID-19.
- Ignorance. Some of the truckers are stubborn and ignorant about some of the available technology (smartphones) work, thus rendering them unable to use the technology.
- Invasion of privacy and misuse of information gathered by some unethical and unprofessional team members.
- Limitation of freedom and privacy of the truck drivers, and has a psychological effect of limited interaction to others, hence making others choose not to be monitored.
- Technology use being limited to only smartphones, yet some truckers lack smartphones or data to have it activated.
• Network and internet connectivity, there is a challenge with the internet connectivity in some parts of the country, which hinders operation of the technology.

• Unethical ways of data usage, protection and information sharing.

**Understanding of Ethics**

The participants described ethics as;

- The way of life of people or society.
- Set of rules and standards to be followed, while interacting with other people.
- Respect for other persons, while minimizing risks and maximizing benefits.
- Code of conduct/principles in the way of conduct.
- Principles of either right or wrong.
- Doing things in a way that is professionally and legally acceptable.

**Legal issues**

Participants highlighted that after signing or agreeing to the terms and conditions of the application, it would be pointless to raise legal issues against what you agreed to. However, the following should be put in consideration;

- Job security of the trucker, since the company may relief off his duties, for accepting to be trucked.
- However, some are not aware of any possible legal issues, and are ignorant of the laws governing DCT and data protection.

**Use for Public Health outweighing issues**

All participants agreed the tool will be used for public health outweighing the legal and ethical issues because;

- This was being done for the good of the general public, since truck drivers were seen as the greatest transmitters of COVID-19.
- There was need to protect the community against a new, but very severe pandemic which was claiming many lives.
- The safety of the entire population would weigh more than the discomfort that one feels while using the app.

To strike a balance between public health benefits and individual freedoms protection, the participants reported the need for;

- Sensitization and creating awareness to communities about of possible risks and benefits of the application.
➢ Proper planning and timely effective communication to the drivers.

➢ Need for a multidisciplinary team of rights lawyers, and ethicists to guide such interventions.

➢ Protection of data, clarity on data usage, and a clear policy on data usage.

➢ Proper negotiation between public health experts, policy makers, the private sector and community members.

**FINDINGS ON THE ETHICAL AND LEGAL IMPLICATIONS OF DIGITAL CONTACT TRACING (DCT) AMONG TRUCK DRIVERS AND STAKEHOLDERS**

A total of 20 in-depth interviews and 15 Key informant interviews were conducted with haulage truck drivers and other stakeholders, respectively. Two (2) people conducted all interviews for 16 days.

Drivers were selected from two places: Nine (9) from Nalukolongo truck yard, and 11 from Mukwano truck yard.

Stakeholders (Key informants) were selected, based on their knowledge or practice of DCT. Informants were selected from different disciplines, as shown in Table 1.

**Table 1: A summary of respondents for the ethics in-depth and Key Informant interviews.**

<table>
<thead>
<tr>
<th>Activities</th>
<th>N= 35</th>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>In-depth interviews</td>
<td></td>
<td>Nalukolongo drivers</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Mukwano drivers</td>
<td>11</td>
</tr>
<tr>
<td>Key Informants interviews</td>
<td></td>
<td>App developer</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Civil society</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Police Officer (CID)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Technology regulators (NITA)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Legal expert</td>
<td>1</td>
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<tr>
<td></td>
<td></td>
<td>Ethics expert</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Driver’s leaders</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>mHealth researchers</td>
<td>3</td>
</tr>
</tbody>
</table>
TRUCKERS

Five themes were derived from the data obtained from the truck drivers:

1. **Violation of confidentiality and privacy**

   Study participants both truck drivers and key informants, strongly expressed thoughts that using DCTT goes against the rights of keeping personal information secret and private from people or authorities that drivers may not wish to share their information with. Confidentiality and privacy were believed to be violated, through the categories discussed below.

   - **Data security:** Majority of study participants were concerned with the process of data collection, because they were ignorant about the way the system collects data from them, and had queries about how data safety is ensured, during the process of collection and storage. Concerns about who has access to private personal information collected were raised. Disclosure of personal information to unwanted authorities or persons, by the people who have control over the data, was another issue.

     "I have no problem with the App collecting data from me, but the people who have control over that data may share it like to government or politicians without my consent". *(Trucker)*

   - **Details required during registration or enrollment:** Most of the drivers were worried about the detailed demographic data that was collected by the team, that installed the App on their phones. Drivers were not convinced that the App aimed at only collecting data about their movements to help in identifying contacts, in case a driver tested positive for COVID-19. Demographic data collected meant that they would be easily identified in society, in case they were positive, to be taken for isolation. In addition, if their data leaked, the community would easily get to know who they are, which would even lead to discrimination.

   - **Participants felt the App was spying on them:** Many drivers had a feeling that the App installed on their phone would see everything they were doing, at what point, and with whom. Some drivers felt that the App was intruding on their private lives, and had to adjust their routine activities and behaviour, so that their actions are not misinterpreted. For this reason, some drivers reported either switching off their phones, or leaving them inside the truck, to avoid their social activities being monitored.

2. **Consent and Autonomy implications**

   During interviews, most of the drivers shared thoughts on the need to obtain valid informed consent, if personal data is going to be collected for DCT. Furthermore, drivers opined that individual must be provided with enough information on the purpose, benefits, and risks of the App, to ensure that they understand and facilitate informed decision-making. This was described in the following ways.

   - **Consent was perceived as not being voluntary:** Drivers largely expressed views that seeking their consent to use DCT technology to collect data from them was not voluntary, and just a wastage of time. Drivers felt that the consent process was just a formality, simply because many of the drivers were not knowledgeable and acquainted with digital technologies, and they were not given adequate information to help them make an informed
decision on whether to participate in the project, or not. Several drivers indicated that they accepted to install the App on their phones, because their colleagues had done so.

“I simply agreed because I do not know anything to do with these technologies. Whether it is beneficial or harmful, it was to the side of the health workers”. (Trucker)

- Crossing ethical boundaries is justified in some special circumstances: Although seeking consent before data collecting data using DCT technologies was seen as the ideal, some drivers felt that at times, ethical boundaries must be crossed for public health purposes. They argued that it is necessary to use available technologies to collect information during disease outbreaks like COVID-19, without explicit consent, for the benefit of the wider community.

3. Transparency, accountability and unmet expectations

Drivers expressed several transparency and accountability concerns, and unmet expectations. They described data collection using DCT Apps, as a strategy that lacks openness and honest. Several drivers felt that there was a hidden motive, and indicated that they still had several lingering questions, such as, who developed the App? Who owned the App? What was the purpose of the App? And who should be held accountable in case there was breach of ethical boundaries.

Overall, drivers indicated that the goals and the intentions of the App were never well understood. They expressed divergent views on the perceived purpose of the THEA-19 project App. Whereas some drivers thought it would help them identify COVID-19 hotspots, others thought it was some form of travel permit to present at the boarder while crossing to other countries like Kenya and Tanzania. Others thought that the App would help them have easy access to their vaccination certificates. Unfortunately, some drivers reported that their expectations were not by the App, and eventually decided to uninstall the App from their mobile phones.

Many truck drivers had questions on the source of the App; some drivers were suspicious and feared that the App could be used for other ulterior motives.

“…up to now I am still asking a question; who developed that App? I asked in the beginning and I did not get the answer. Do you know that such Apps can be used to monitor who you interact with, to know whether you’re for opposition or government? I do not want to take these things for granted”. (Trucker)

Some of the drivers argued that DCT is an effective way of collecting data timely and in large volumes from different people, however, using an App with no clear information on who should be held responsible and held accountable in case there is data leakage or breach of ethical boundaries, downplays the benefits of the App.

4. Equity and fairness concerns

Drivers in this study were not motivated to use the DCT App, because it ignored principles of equity and fairness. Drivers thought that the App developers did not recognize the fact that drivers were not at the same level, in terms of technological exposure, education, and economic status. They contended that an App that could be adjusted based on individual driver profiles, would be more appropriate to work among drivers. While showing their dissatisfaction with the App in terms of
equity, drivers drew much of their attention to the following two aspects.

Many drivers believed that the DCT strategy was inappropriate for truck drivers, because it uses only smart phones. This meant that only people with smart phone could be enrolled into the project, yet many of their counterparts without smart phones had similar movement patterns, and they could equally transmit COVID-19. Drivers therefore expressed preference for a strategy that gives equal chance to all drivers (with or without smart phone), to participate.

Drivers pointed out that App activation instructions were in English, yet most of them could not read English. They felt that this excluded many from being participants.

5. Lack of awareness of laws and policies

Digital contact tracing technology was perceived to work better, where there are enabling laws and policies governing the process, to assure the authenticity of the Apps, and avoid misuse of people’s data. However, all drivers had no knowledge of any law in Uganda that governs the use of DCT for public health purposes.

STAKEHOLDERS

Four themes were derived from the data obtained from the stakeholders:

1. Operational considerations when using DCT technologies for public health purposes.

Stakeholders made several suggestions on what should be considered when using DCT technologies for public health and disease surveillance. All stakeholders mentioned that use of DCT technologies requires smart phones however, many truck drivers do not possess smart phones. Stakeholders said that collection of credible DCT data requires providing truck drivers with mobile phones, so that none of the drivers is left out. They indicated that truck drivers should also be facilitated with internet data and power banks, to minimize data loss.

They also suggested that the truck drivers should be instructed on how to use the mobile phones and DCT Apps.

“Two things; one is to give drivers smart phones if possible and second is to train drivers to use smart phones beyond calling, receiving and charting on what’s app”. (Stakeholder)

Most stakeholders felt that many people in the community, including researchers and research regulators, either do not understand DCT or are not aware of DCT technologies currently being used for public health purposes in the country. Hence, they called for community sensitization and mass campaigns to educate people and facilitate acceptability of such technologies.

“My point is community sensitization; a lot of innovations have come on board, but they are not known simply because the community is not aware. You are targeting drivers, but you are forgetting that drivers do not live as an independent entity. At the end of the day they are part and partial of the bigger community so come out and sensitize every one of us”. (Stakeholder)
Stakeholders also felt that local REC may not be competent enough to review research proposing to use DCT technology. One stakeholder even suggested the establishment of a specially trained REC for research using mobile phone technology. An ethicist suggested capacity building and on-going training of research regulators and RECs so that they are in tandem with technological advancement.

“We need capacity building, actually we need continuous training and exposure to the technologies as regulators if we are to be able to do our work. Technology keeps changing so innovators must be ready to cooperate with the regulators, train them and expose them to these technologies always”. (Stakeholder)

Researchers suggested close regulation of mobile phone technologies to ensure that the data obtained is neither abused nor accessed by unauthorized individuals.

Some stakeholders raised several important ethical concerns regarding the implementation of approved DCT activities. The pointed out that DCT poses unique ethical considerations that should be appreciated by all research stakeholders.

Considering the functionality of the THEA App, three stakeholders felt that it should be programmed in such a way that it alerts drivers on disease hotspots, so that they can avoid going to such areas. They also felt that the App should have the capacity to inform truck drivers about the nearest health facility they can seek medical assistance, when the need arises.

2. Opinions and perceived benefits of DCT in disease surveillance and research.

Stakeholders offered several pertinent views when asked about what should be considered when using mobile phone technologies for public health and disease surveillance. Most stakeholders indicated that the use of DCT technologies for public health and disease surveillance was new to Uganda, and that many people are actually not aware of their existence. Stakeholders agreed that DCT technologies present a cost-effective way of collecting large volumes of data in real-time.

They added that DCT technologies present a chance to collect data from a big number of people in a short time, including those that may not be physically available. They contended that DCT is beneficial to the individual participant, as well as the wider community. Stakeholders said that DCT can help in disease surveillance and in identifying disease hotspots, as such, can facilitate targeted responses to curb the spread of diseases.

One stakeholder felt that identification of disease hotspots during a disease outbreak could guide government in allocating valuable resources, where they are needed most.

“I have a feeling that this App can help the government in resource allocation during pandemics. Because once you have known hotspots for a pandemic that is where you will put resources so there will be effective response to control spread”. (Stakeholder)

Some stakeholders felt that using DCT for public health ensures data integrity.
3. Ethical issues

➢ Data security: Most stakeholders supported the use of DCT technologies for public health and research, however, they raise several ethical concerns such as data security, trust, equity and fairness.

Regarding data security, stakeholders expressed the fear of breach of confidentiality and privacy, where private information falls into the hands of unauthorized people. They indicated that cybercrime and hacking were rife. They also mentioned that sensitive information could also leak during the process of data sharing and processing. Some stakeholders also expressed a risk of data manipulation and misuse by unscrupulous researchers and data scientists. One stakeholder surmised that the App could also be used for spying on people.

“Data security is the issue here, how sure am I that it is only the people I agreed with that have access to data and not their friends, relatives and so on. Secondly, I cannot be sure that the App is only reporting on my movements and not reporting what I do and with whom. This is policing someone and that alone is not comfortable for a human being”. (Stakeholder)

Stakeholders suggested that the people responsible for the data should sign confidentiality agreements, to ensure that they can be held accountable for their actions.

➢ Trust: Several stakeholders agreed that DCT technology is a useful tool for public health and diseases surveillance, but it should be used with caution. Stakeholders raised several trust issues. They pointed out that DCT Apps collect a lot of sensitive personal information that is entrusted to researchers, data scientists, and public health specialists, to mention a few. However, they noted that in most cases the App developers and security features of the App are unknown. One stakeholder noted that many App developers are not professional researchers, therefore they may not appreciate the ethical considerations in research.

“App developers always want to be the ones to maintain the app and they are not professional researchers who can mind the ethical considerations in research. If you do not, then you risk the app collapsing. I do not trust them because they are not professionals in research”. (Stakeholder)

Stakeholders indicated that App developers usually protect their intellectual property by not disclosing certain information about their Apps, which information may be useful for regulating the use of these Apps. Stakeholders were also unsure of who regulates the App development process, and who to hold accountable in case of any problems. Several stakeholders mentioned that these App could be used to collect unsolicited data, without people’s consent.

A few stakeholders said that they preferred traditional methods of data collection that involve human interaction, because they did not trust Apps, and were also unsure of who to be held accountable, in case anything goes wrong.
➢ **Equity and fairness:** Stakeholders expressed concern on the lack of equity and fairness regarding the use of the THEA App. They noted that many drivers were unfairly excluded from the project, because they did not have smart phones. Stakeholders also noted that the language of instruction of the THEA App is English, as such, it only favours the educated, yet most of the truck drivers are illiterate.

➢ **Respect of human rights:** There were varying opinions on the respect of people’s privacy and human rights during the use of DCT technologies for public health and disease surveillance. Whereas some stakeholders opined that people’s rights should be respected and protected, others felt that public good should prevail over individual rights. Proponents of protection of human rights argued that, whereas quick response to disease outbreaks is of paramount importance, it should not be done at the expense of people’s rights. They indicated that violation of people’s rights could be counterproductive to the desired goal.

On the other hand, some stakeholders argued that at times it is necessary to violate people’s rights, to protect the public from diseases of public health importance. They added that in some situations, there is even no need for obtaining peoples’ consent for DCT.

“Personally, I have no problem with government carry out contact tracing especially for public health because if you wait for everyone to consent then the disease will have finished many people so my consent may not be necessary at that time”. *(Stakeholder)*

### 4. Legal issues

Digital contact tracing technology was perceived to work better in an environment where there are enabling laws and policies to govern the process. When asked about awareness of the presence of laws and policies governing digital technologies in Uganda, it was evident that most stakeholders had limited knowledge of their existence. The Driver leadership did not know whether any laws and policies really exist, but they knew that they had a right to privacy and confidentiality.

The other stakeholders said that they believe applicable laws and policies do exist, but they had never taken any kin interest in them. The laws mentioned included the Data Protection and Privacy law, Computer Misuse Act and the Anti-pornography Act. However, stakeholders could not describe how these laws related to the regulation of DCT technologies. Some perceived these laws as political laws targeting those who speak against the government, or its officials.

Stakeholders opined that DCT is a new phenomenon to Uganda, and should therefore have separate laws, policies and guidelines. Some stakeholders recommended the establishing of specific ethical and legal frameworks to regulate DCT. They also recommended the training of RECs, since they are the ones responsible for the implementation of DCT.
6.0 Challenges

6.1 Truck driver challenges

6.1.1 Inland Male

Truck drivers reported facing a number of challenges in their daily lives, as well as during the pandemic.

- Stigma and discrimination during COVID-19, since they were considered to be facilitating the spread of the virus faster, and this limited their movements and interaction along the way. This explains why several moved around with gas in their trucks, and packed food to facilitate their journeys.

- Low wages, most truck drivers are paid little wages, which does not match work effort that they put in, which subsequently makes them not to be able to take care of their personal and family needs.

- Limited time to rest for particularly Namanve truckers, since they are on transit day in and day out, with few or no leave days.

- No places of convenience or shelters at Namanve parking yard.

- Fees levied during the outbreak of the pandemic. The drivers were charged certain fees, for example COVID-19 test fee, parking fees at the particular gazetted parking places, which increased their operational costs.

- Alluded to the above, there were delays in the lead general time. This was because of the long queues at the gazetted testing places, and the long time one would take to get his test results.

  “If you left home, you had to find a way of at least packing bread. They feared us but I also feared them for my safety. So I made sure that if I left home, I went with things like bread or ground nuts and water, until I return” (Trucker, Namanve)

  “We were not accepted to park anywhere; we had to continue driving even when we were exhausted.

  We slept in the bushes” (Trucker, Mukwano)

  “In COVID times, police treated us badly, they never accepted us to park anywhere even to buy food......even when you reached a trading centre and parked, the community; women, child started calling you ‘COVID; COVID is there, COVID is there’”. (Trucker, Mukwano)

- Security threats along the way; a number of truckers from the three parking yards mentioned experiencing thieves that threaten to rob them of their property along the way.

  ‘On our routes, we sometimes find thieves. Some climb on our trucks seen the cars slow down on the hills; they break the padlocks and break in. In most cases, we have to move during day time.’ (Trucker, Nalukolongo)
Female

- Unfair treatment. Some female truck drivers think of pulling out of truck driving, as it is not considerate of women because at times, they are treated like men, for example, they sleep in trucks.

- Sexual harassment from male truck drivers, because both female and male truckers are expected to share the same residents, due to accommodation associated costs and rejecting the men’s advances makes male truckers talk ill of female truckers. They even start calling them names like; ‘mubaaya’ ‘mukoodo’ ‘lesbian’.

- Spread of sexually transmitted diseases like HIV. This is because most male truckers are positive, and are not disciplined, yet they share the same accommodation with them thus infecting them easily.

- Language barrier while in foreign countries.

- Family and children are traumatized, in case of accidents, the children think about their mothers while at school, their children are bullied when fellow children get to know their mothers are truck drivers. They say- ‘your mother is a man’.

- Hardship balancing work with family as women, since they don’t have enough time for their families, because they are on transit day in and day, and out with few or no leave days.

- Fees levied during the outbreak of the pandemic. The drivers were charged certain fees for example, COVID-19 test fee, parking fees, at the particular gazetted parking places which increased their operational costs

- Low wages. Most truck drivers are paid little wages, which does not match work effort that they put in. which subsequently makes them unable to take care of their personal and family needs

  “Some bosses want to pay us less yet the goods we transport are very expensive. They say we have men that should take care of us.”

- Driving manual trucks is difficult, because engaging gears is hard, and require a lot of energy, yet they have to drive for long distances.

- Poor hygiene along certain routes. Women suffer a lot, and its worse when they go into their periods, because some resting places don’t even have water and other sanitary facilities.

- Foreign countries like South Sudan are not friendly; Ugandans are treated badly; they ask for money at every checkpoint.

- Socialization issues. Men have a perception that women should not drive trucks. The community further thinks that female truckers are drug abusers and prostitutes.

- There are challenges working for private companies; poor condition cars; they pay insurance for vehicles and not drivers; “in case of accidents, our bosses ask if the cars are fine, and not if we are fine”

- Weigh bridges, when axels do not balance, female truckers are inconvenienced to sleep there.

  “We have to re-arrange goods such as cement.”

- Truckers are being told to load trucks by themselves. This happens with companies such as DHL, and Mbarara cosmetic stores and logistics.
6.1.2 Midland

- Businesses declined during COVID pandemic, which rendered most truckers unemployed, while other trucker’s monthly salaries were cut down from 500,000 to 300,000 shillings, yet the cost of living was rising up at a faster rate.

- Fuel prices have risen, and maintenance of vehicles has become very expensive, which has made some trucker’s drive them without routine maintenance, yet they drive for long distance, hence making them prone to accidents.

- Death risks and security threats. Some drivers died due to COVID-19, while others were ambushed by hostile communities like Karamojong, and some truckers were robbed of their property, especially in the night.

- Stigma and discrimination during COVID-19, since they were considered to be facilitating the spread of the virus faster, and this limited their movements and interaction along the way. This explains why several moved around with gas in their trucks, and packed food to facilitate their journeys.

- Job security. Some truckers reported being taken into quarantine for a month, and when they returned, they had been laid off by their companies, since the goods had to be transported to different locations.

- Low wages. Most truck drivers are paid little wages, which does not match work effort that they put in, subsequently making them unable to take care of their personal and family needs.

- Fees levied during the outbreak of the pandemic. The drivers were charged certain fees, for example COVID-19 test fee, parking fees at the particular gazetted parking places, which increased their operational costs.

- Corruption. While at the COVID-19 testing points, some health workers needed money for truckers to be tested faster than others. Truckers had to pay between 50,000 or 100,000 shillings to be tested, without the pain of waiting for many hours.

- Alluded to the above, traffic officials asked for money in Uganda, Kenya, Congo and South Sudan. Only Rwanda is free from bribes.

- Expensive health care for truckers, yet their bosses pay insurance for only vehicles, but not for our health. Truckers are not insured, but cars have insurance.
### THEA-C-19 STUDY PARTICIPANT RECOMMENDATIONS FOR THE DIGITAL APPLICATION

#### Appendix 1: MAINLAND

Table 1: STAKEHOLDERS

<table>
<thead>
<tr>
<th>Stakeholders</th>
<th>Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. ICT experts</td>
<td>• Government should emphasize the use of the application and it should be open to all Ugandans.</td>
</tr>
<tr>
<td>2. Bioethicists</td>
<td>• Government should also ease access to the application without data to operate it than incur the cost on the truck drivers. This will so much ease surveillance.</td>
</tr>
<tr>
<td>3. Sociologists</td>
<td>• Government should give the truck drivers and the community as much information (ethical and legal) about the application for acceptability and adaptability to wave off possibility of coercion in the fear of truckers losing their jobs.</td>
</tr>
<tr>
<td>4. Legal experts</td>
<td>• Government should establish contacts in every stop over in every country truckers’ transit to, to ease tracking and strengthen vigilance.</td>
</tr>
<tr>
<td>5. Public Health experts</td>
<td>• Government should adopt the application for future pandemics too.</td>
</tr>
<tr>
<td>6. Ministry of Roads and Transport</td>
<td>• Government should ensure a linkage/ integration of the systems like with ministry of health, immigration, URA, transport associations that track movement of humans, goods and services.</td>
</tr>
<tr>
<td>experts</td>
<td>• Government should create a broader legal framework that answers some of legal questions concerning digital technology and transport industry.</td>
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<tr>
<td></td>
<td>• The need to cover some costs to reduce the burden of using the technology.</td>
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<td></td>
<td>• The application should be able to cater for security and safety of the truck drivers even with accidents.</td>
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<tr>
<td></td>
<td>• Data safety and protection act needs to be looked at critically by government.</td>
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<td></td>
<td>• There is need to strike a balance between public health benefit and individual freedom protection by effective planning and communication and engagement of all required stakeholders.</td>
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<td></td>
<td>• Government should ensure proper network coverage to those areas without it along the routes.</td>
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<td></td>
<td>• More innovation to foster compatibility with other devices.</td>
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<td></td>
<td>• Develop clear regulation of the application</td>
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</table>
### Appendix 2: TRUCKERS

#### Table 2: TRUCKERS –Mainland, Midland and Border Areas

<table>
<thead>
<tr>
<th>Truckers</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| 1. Females | • Women need to be treated equally as men in employment, marginalizing female truckers needs to stop.  
| 2. Males | • Elaborate on the legal aspects of them using the application.  
|          | • Data safety and usage of their data. They wish to know all aspects of the use of their data for security purposes.  
|          | • Driving permit issues with traffic officers should be handled by their employers.  
|          | • Driver insurance; Employers should focus on insuring their drivers too, not only the vehicles.  
|          | • Salary increment and improvement in working terms such as giving leave days for drivers.  
|          | • Improvement of the road network.  
|          | • Improvement of security along the routes.  
|          | • Securing/establishment of parking yards at some points of entry such as Elegu.  
|          | • There is need to modify the app by adding features that connect them to each other as truck drivers and employers  
|          | • Sensitization on the use of DCT.  
|          | • Sensitize truckers about the legal aspects of digital technology. |

### Appendix 3: COMMUNITY

#### Table 3: Community-Midland and Border (Magamaga, Bweyale, Kamdini, Mutukula, Elegu)

<table>
<thead>
<tr>
<th>Community</th>
<th>Recommendations</th>
</tr>
</thead>
</table>
| 1. Community representatives | • Government should emphasize the use of the application  
| 2. Business men and women | • It should be open to all Ugandans.  
| 3. Locals | • Government should also ease access to the application without data to operate it than incur the cost on the truck drivers. This will so much ease surveillance.  
|          | • The application should be able to cater for security and safety of the truck drivers even with accidents.  
|          | • The application should also be rolled out to the public.  
|          | • As the government researched on HIV, it should do the same on COVID-19  
|          | • The road networks should be improved.  
|          | • Need for STD treatment for truck drivers  
|          | • Vaccination; the vaccines should be valid not towards expiry date.  
|          | • More sensitization; there is need for more health camps for the community. Focus on sensitization should also be put on the younger generation.  
|          | • Businesses and women need to be supported.  
|          | • The town council should pay attention to garbage collection, which is a public health concern.  
|          | • Need for second dose of the COVID-19 vaccine  
|          | • Partnerships; religious leaders would be great partners.  
|          | • Tax reduction to drop commodity prices.  
|          | • Find strategies such as money lending strategy. |
7.0 Project Photographs

Community Engagement at Naluwelere trading center, a common parking site for the truck drivers from the Eastern Region

Sociological Pillar planning meeting
A view of Magamaga trading center, a common stop over point for the truck drivers

A view of Elegu parking yard
A view of Nalukolongo parking yard

Truck drivers at Kamdini after the engagement
Photo moment after a stakeholder consultative meeting at Imperial Royale Hotel, Kampala

Truck drivers and study team after the engagement
Co-PI addressing participants during the community engagement activity at Mutukula

Female truck drivers at Namanve with the Co-PI and research assistant
8.0 Appendices

Appendix 1: Informed Consent Form for Stakeholders

Protocol Version 3.0_17/3/2022

Title: Tracking Haulage in East Africa to support COVID-19 surveillance- THEA-C19

Participants: Stakeholders

REFERENCE NUMBER:

INVESTIGATORS: Dr. Muwonge Adrian, Prof. Moses Joloba, Emmanuel Ssebaggala, Ibrahim Mugerwa, Prof. Mark Bronsvoort, Dr. Porphyre Thibaud, Dr. Christine Mbabazi Mpyangu, Prof. Erisa Mwaka, Prof. Kiayias Aggelos

ADDRESS: Makerere University College of Health Sciences

CONTACT NUMBER:

Date:

Dear Sir or Madam:

You are being invited to consider participating in this research because of your expertise and contribution to the use of digital contact tracing technology (DCT) and mobile phones for public health. We would like to explore the ethical, legal and social implications of using DCT for public health; and kindly request for your consent to participate in this research. The overarching aim of the project is to develop and test a mobile application that supports the tracking and tracing of individuals exposed to COVID-19 among long distance truck drivers as part of public health strategies. We would also like to find out how developing this mobile phone application affects the lives of people diagnosed with COVID-19, how the mobile phone application might affects their relationships within the family, friends and the general community, and how it might relate with the laws of Uganda. We have developed this mobile phone application for tracing and contacting long distance truck drivers as one of the ways of fighting the spread of COVID-19. Our mobile app is being used hand in hand with the one that is currently being used by the Ministry of Health in Uganda. The results of this research will help the Ministry of Health and healthcare providers to estimate the contribution of the long-distance truck sector to national disease control and most of all inform how resources can be effectively used during disease outbreaks. The findings will also help assess the impact of the technology on disease control and preparedness.

You will participate in a key informant interview where you will be asked a few questions on the ethical, legal and social implications of using DCT and other mobile phone applications for public health. You might feel uncomfortable answering some of the questions. You are free to refuse to respond to any question but it is our plea that you endeavour to respond to all for the success of this study. The interview may last between 45 to 60 minutes.
Protocol Version 3.0_17/3/2022

The study will be of no direct benefit to you however study results will generate useful information that will to contribute improving the use of mobile phone app; with the hope that this may improve on monitoring of disease outbreaks in Uganda and the East African region.

This is a minimal risk study with no serious problems expected.

This study was approved by the Makerere University School of Public Health Higher Degrees, Research and Ethics Committee (SPSHDREC)(Ref: SPH-2021-35) and Uganda Council for Science and Technology. The study will be conducted according to the laws of Uganda and the international community at large.

Participation in the study is entirely voluntary; you do not have to participate in this research if you do not want. You are free to withdraw from the study unconditionally and at any time. Withdrawal from the study will not affect you in any way.

You will not incur any cost for your participation but you will be compensated 50,000/= for your time and effort.

The information you give will have no personal identification details. Neither you nor your institution will be identified in any way when the results of this study are published. All data will be safely stored in password protected computer files known to the research team only. Data accruing from the study will only be available. Results will be communicated to the community through peer reviewed publications, presentations at conferences, workshops and invited lectures. Your responses will be treated with confidence and at all times data will be presented in such a way that your identity cannot be connected with specific published data. Only pseudonyms will be used in all disseminated information.

All interviews will be audio recorded and we thus seek your permission to audio record our conversation with you. In the event of any problems or concerns/questions you may contact Dr. Adrian Muwonge, the principal investigator of this research on 0790689701 or Associate Professor Erisa Mwaka on +256752575050. In the event that you have concerns about your rights as a research participant you may contact Dr. Joseph Kagayi, the chairperson of SPSHDREC on 0701444154.

Declaration by participant

By signing below, I .......................................................................................................................... (Participant’s name) agree to take part in a research study THEA-C19 project.

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.
- I understand that all interviews will be audio recorded.

Signed at (place) ...................................................... on (date) ........................................
Protocol Version 3.0_17/3/2022

Signature of participant

For participants using online interviews (Zoom)

By accepting to be interviewed, is an implication of consent to take part in a research study THEA-C19 project.

Date: .............................................

Declaration by investigator

I (name) ............................................................ declare that:

- I explained the information in this document to ..................................................
- I encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above

Signed at (place) ................................................ On (date) ..........................
Appendix 2: Informed Consent Form (Kiswahili)

CHUO CHA SAYANSI YA AFYA

Formu ya idhini ilyojulishwa[katika mahojiano ya kina kwa madera wa malori]

Kichwa: Kufuatilia Haulage katika Afrika Mashariki kusaidia ufuatiliaji wa Covid-19 – THEA-C19

Washiriki: madereva wa malori

Namba ya kumbukumbu:

Wachunguzi: Dr. Muwonge Adrian, Prof. Moses Jaloba, Emmanuel Ssebaggala, Ibrahim Mugerwa, Prof. Mark Bronsvoort, Dr. Porphyre Thibau, Dr. Christine Mbabazi Mpyangu, Prof. Erisa Mwaka, Prof Kiayias Aggelos

Anwani: Chuo Kikuu cha Makerere Chuo cha Sayansi ya Afya

Namba ya mawasiliano:

Tarehe:

Mpendwa Bwana au Bibi:

Unaali kwa kuzingatia kushiriki katika utafiti ambao unatafuta kukuza na kujaribu programu ya rununu ya covid 19 na ufuatiliaji unaofanana na sekta ya kujengesha gari ya masafa marefu. Utafiti huo utahusisha mikutano ya mashauriano na wadai kadhaa ili kuchunguza maarifa,mitazamo na mazoea yao katika kuzuia kuenea kwa covid 19;na maswala ya kiharamani, kisheria na kijamii yanayohusiana na utumiaji wa programu za rununu za kutafuta za kufanya wawili ya kuzuia kuenea kwa covid 19.Umuhimu wa programu inayopendekezwa ya rununu ya ufuatiliaji unaofanana na madera ya malori ya umbali mrefu kama wewe. Matokeo ya utafiti huu yatasaidia wizara ya watoa huduma za afya na afya kukadiri mchanganyika wa sekta ya malori ya masafa marefu katika ugonjwa wa kitaifa wa magonjwa na zaidi. Matokeo hayo pia yatasaidia kutathmini athari za teknolojia kwenye utumiaji wa magonjwa na utayari.


Utashiriki katika utafiti ambapo utalizwa maswali machache kutokana na uzoefu wako kama dereva wa lori za masafa marefu na uzoefu wako wakati wa janga la sasa la COVID-19. Pia utalizwa maswali juu ya uwezo wako na kutumia programu kwenye simu ya mikononi kufuatilia mienendo yangu. Unaweza kujisa vibaya kujibu baadhi ya maswali. Uko na uhuru kukataa kujibu swali loli kuhusu ni ombi letu kwamba ukuza ujari juu ya kuzuia kuenea kwa afya yao kama dereva wa lori za masafa marefu na uzoefu wako.

Mfumo wa itifaki 3.0 – 17/3/2022

Utashiriki katika utafiti ambapo utalizwa maswali machache kutokana na uzoefu wako kama dereva wa lori za masafa marefu na uzoefu wako wakati wa janga la sasa la COVID-19. Pia utalizwa maswali juu ya uwezo wako na kutumia programu kwenye simu ya mikononi kufuatilia mienendo yangu. Unaweza kujisa vibaya kujibu baadhi ya maswali. Uko na uhuru kukataa kujibu swali loli kuhusu ni ombi letu kwamba ukuza ujari juu ya kuzuia kuenea kwa afya yao kama dereva wa lori za masafa marefu na uzoefu wako.
Utafiti huu hautakuwa na faida ya moja kwa moja kwako hata hivyo matokeo ya utafiti yatooa habari muhimu ambayo inaweza kuboresha ufuatili iliwa magonjwa ya milipuko ya Uganda na ukanda wa Afrika Mashariki.

Huu ni utafiti mdogo wa hatari bila shida kubwa inayotarajiwa; hata hivyo, kuna hatari ndogo ya Habari yakya kibinafsi kupatikana na watu wasiodhinishwa lakini tutajaribu kadri iwezekanavyo kuhakikisha kuwa hii haifanyiki.

Mahojiano yote yatarekiwaa kwa sauti na kwa hivyo tunaomba ruhusa yako.

Utafiti huu umeidhinishwa na Shule ya Chuo Kikuu cha Makeree ya Digrii za juu za Afya ya Umma na Kamati ya Maadili ya Utafiti (SPSHDREC) (Ref: SPH-2021-35) na baraza la Uganda la Sayansi na Teknolojia. Utafiti huu utafanywa kulingana na miongozo ya kimaadili na kanuni za Tamko la kimataifa la Helsinki na miongozo ya kufanya utafiti unaohusisha washiriki wa kibinafsi. Kusiritwe katika utafiti ni hiari ukopo huru kujiondoa kwenye utafiti bila masharti na wakati wowote kujiondoa kwenye utafiti hakutaathiri kwa njia yoyote.

Azimio na shahidi huru

Tamko na mchunguzi

Mimi Adrian Muwonge nakubali kwamba:

- Nilieleza habari katika waraka huu kwa 
- Nilimhimiza aulize maswali na kuchukua muda wa kutosha kuyajibu.
- Nimeridhika kwamba anaelewa vyema nyanja zote za utafiti kama ilivyojadiliwa hapo juu.

Tamko hili lilirekodiwa tarehe, mahali, muda na simu ya mkononi.
Appendix 3: Informed Consent Form for Truck drivers

Protocol Version 3.0_17/3/2022

MAKERERE UNIVERSITY
P.O. Box 7072 Kampala, Uganda
Tel:
E-mail:       Fax:

COLLEGE OF HEALTH SCIENCES

Informed consent form

Title: Tracking Haulage in East Africa to support COVID-19 surveillance- THEA-C19

Participants: Haulage truck drivers

REFERENCE NUMBER:

INVESTIGATORS: Dr. Muwonge Adrian, Prof. Moses Joloba, Emmanuel Ssebagalla, Ibrahim Mugerwa, Prof. Mark Bronsvoort, Dr. Porphyre Thibaud, Dr. Christine Mbabazi Mpyangu, Prof. Erisa Mwaka, Prof. Kiayias Aggelos

ADDRESS: Makerere University College of Health Sciences

CONTACT NUMBER:

Date:

Dear Sir or Madam:

You are being invited to consider participating in this research because you a long distance truck driver. This research seeks to develop and test a mobile application that supports track and trace of individuals exposed to COVID-19 in this sector as part of public health strategies. The research will involve meetings with a number of different groups of people either working in this field or provide support for the long distance truck industry. This research would like to find out what you know about COVID-19, what you feel about COVID-19 and the things you do to prevent the spread of this deadly disease. We would also like to find out how developing this mobile phone application affects the lives of people diagnosed with COVID-19, how the mobile phone application might affects their relationships within the family, friends and the general community, and how it might relate with the laws of Uganda. We would also like to test on you with the proposed mobile phone application to find out how useful it is in the following up of long distance truck drivers like you diagnosed with COVID-19. We have developed this mobile phone application for tracing and contacting long distance truck drivers as one of the ways of fighting the spread of COVID-19.

The results of this research will help the Ministry of Health and healthcare providers to estimate the contribution of the long-distance truck sector to national disease control and most of all inform how resources can be effectively used during disease outbreaks. The findings will also help assess the impact of the technology on disease control and preparedness.

We therefore kindly request for your consent to participate in this research by accepting to download and use the new app on your mobile phone. A total of 123,000 long-distance truck drivers will be approached and requested to download and use the app on their mobile phones. Our mobile app will be used hand in hand with the one that is currently being used by the Ministry of Health in Uganda.
You will participate in an interview where you will be asked a few questions about your experience as long-distance truck drivers and your experiences during the current COVID-19 pandemic. You will also be asked questions on the possibility of using an application on your mobile phone to monitor your movements. You might feel uncomfortable answering some of the questions. You are free to refuse to respond to any question but it is our plea that you endeavour to respond to all for the success of this study.

The study will be of no direct benefit to you however study results will generate useful information that will to contribute improving the new mobile phone app; with the hope that this may improve on monitoring of disease outbreaks in Uganda and the East African region.

This is a minimal risk study with no serious problems expected; however, there is a slim risk of your personal information being accessed by unauthorized people but we shall try as much as possible to ensure that this does not happen.

This study has been approved by the Makerere University School of Public Health Higher Degrees, Research and Ethics Committee (SPSHDREC)(Ref: SPH-2021-35) and Uganda Council for Science and Technology. The study will be conducted according to the laws of Uganda and the international community at large.

Participation in the study is entirely voluntary; you do not have to participate in this research if you do not want. You are free to withdraw from the study unconditionally and at any time. Withdrawal from the study will not affect you in any way.

You will not incur any cost for your participation but you will be compensated 20,000/= for your time and effort.

All the gathered information is highly confidential and will be protected. The information you give will have no personal identification details. All the information you give us will be safely stored in a protected server at the Ministry of Health. Data accruing from the study will only be available to the research team or members of the SPSHDREC when the need to inspect research records arises. Results will be communicated to the community through peer reviewed publications, presentations at conferences, workshops and invited lectures. Your responses will be treated with confidence and at all times data will be presented in such a way that your identity cannot be connected with specific published data. Only pseudonyms will be used in all disseminated information.

In the event of any problems or concerns/questions you may contact Dr. Adrian Muwonge, the principal investigator of this research on 0790689701 or Dr. Christine Mbabazi Mpyangu on +256772436739.

In the event that you have concerns about your rights as a research participant you may contact Dr. Joseph Kagayi, the chairperson of SPSHDREC on 0701444154.

You have to declare digitally that you accept to voluntarily participate in the study before the mobile application is installed on your phone. At the point of recruitment (Points of entry or exit, seclusion points and internal parking yards for trucks). Before the application is launched on your phone, the message below will appear (English and Kiswahili).

Declaration by participant

By clicking yes below, I agree to take part in a research study THEA-C19 project.

I declare that:

- I have read or had read to me this information and consent form and it is written in a language with which I am fluent and comfortable.
- I have had a chance to ask questions and all my questions have been adequately answered.
- I understand that taking part in this study is voluntary and I have not been pressurised to take part.
- I may choose to leave the study at any time and will not be penalised or prejudiced in any way.
- I may be asked to leave the study before it has finished, if the researcher feels it is in my best interests, or if I do not follow the study plan, as agreed to.
Protocol Version 3.0_17/3/2022

- I understand that all interviews and focus group discussions will be audio recorded.

This declaration was recorded on a date, time and location captured by the mobile application

Declaration by an independent witness

The project team members allowed to recruit are prelisted, by scrolling and selecting their name at the point of recruitment, they declare that they were witness consent process, on a date and place captured by the mobile application.

Declaration by investigator

I Adrian Muwonge declare that:

- I have explained the information in this document to the participant and witnesses
- I have encouraged him/her to ask questions and took adequate time to answer them.
- I am satisfied that he/she adequately understands all aspects of the research, as discussed above

This declaration was recorded on a date, time and location captured by the mobile application
Appendix 4: Truck drivers Interview guide

Tracking Haulage in East Africa to support COVID-19 surveillance- THEA-C19

Truck drivers’ in-depth interview/Focus group discussion guide

These questions/topics are a guide for in-depth interviews with Truck drivers

This is a guide and not to be used as a questionnaire but rather to explore these issues in a conversational way. Not all questions or probes need to be asked. The semi-structured interviews should identify ethical, legal and social issues in the use of digital contact tracing technology for public health purposes. Be sure to record key points arising as well as non-verbal communication.

INTRODUCTION
Mobile phones based tools have been used by some to support monitoring of the public’s health. This has been done, for example, through use of digital contact tracing technology (DCT) for disease surveillance. We are particularly interested in the use of mobile phone applications such as DCT as part of a country’s response to addressing infectious disease epidemics. At the peak of the COVID-19 pandemic, Uganda adopted the Regional electronic cargo and driver tracking system to help enhance disease surveillance and ease the Draconian measures of population-wide quarantine. We are developing a DCT system that involves the use of mobile phone app

We would like to hear about your knowledge of and opinions about such technology uses, as well as any associated ethical, legal, and societal implications of these technology capabilities.

RESPONDENT BACKGROUND
I’d like to begin with a few questions to get to know you better.

1. Please tell me about your main professional role and responsibilities? What do you do day-to-day?

2. Tell me about your prior experiences using mobile phone apps for public health purposes before using the (Name of the App) for contact tracing.
   a) What made it easy for you to use that mobile app talked about above?
   b) What were the challenges you faced?

Now I want us to discuss the (Name of the app) that was installed on your phone for contact tracing.

3. What came into your mind when you first heard about the App?
   What were the worries you had?
   What were some of the questions you asked about this App?
   What did you expect to happen after the app is installed on your phone?

4. If using the app was voluntary, what inspired you to accept to use this App?
   Probe about circumstances around acceptability.
Let us now look at your actual experience using the digital contact tracing app/technology.

5. Generally, how was using the technology for you? Probe, what was easy? What was challenging?

6. What are your main concerns or worries when using mobile phone based DCT? Probe about issues of privacy and confidentiality.

7. What do you have to say about the data collected from you using this kind of technology?

8. How much do you trust the users of this technology not to misuse the data collected? Why do you say so?

9. Do you think installing the app on your phone violates any of your rights as human being?

10. Did the app in any way influence your daily activities or even life in general? In what ways?

11. Do you think there are ethical boundaries that are likely to be crossed when using DCT? If so explain.

   Probe for use of DCT to pry into drivers’ private lives, monitoring of misuse of company vehicles/siphoning of fuel, reporting the driver to the employer in case the data indicates abuse of office or company property etc.

12. Are you personally bothered with the infringement of these boundaries?

13. Under what circumstance do you think it is acceptable to cross these boundaries?

14. Is public health a justifiable reason to cross these boundaries?

15. Other than DCT what other ways might these boundaries be crossed?

16. What are some of the laws in Uganda you know that should be followed while ensuring effective use of digital contact tracing technology?

17. Is there anything else you would want to tell us about your experiences using the technology?
PROTOCOL TITLE: Developing digital contact tracing (DCT) tailored to haulage in East Africa to support COVID-19 surveillance

INVESTIGATORS: Adrian Muwonge, Moses Joloba, Erisa Mwaka, Christine Mpyangu, Ibrahim Mugerwa, Barend M. deC. Bronsvoort, Thibaud Porphyre, Aggelos Kiayias

Background on the study
At the peak of Uganda’s first wave of SARS-Cov2 in May 2020, one in three COVID-19 cases was linked to the haulage network. This triggered the requirement that people crossing Uganda’s national borders provide proof of health; a negative PCR test result at all ports of entry and exit (POEs), thereby resulting in massive delays as haulage drivers were forced to wait at least 24-48 hours before their test results were released for them to continue onto their journey. Moreover, this coupled with Uganda’s central location on the East African haulage network, inevitably led to a bottleneck in the regional supply chain. To mitigate this, contact tracing had to be enhanced to allow movement pending diagnostic results. On that basis, we propose technology that could not only augment conventional epidemiological tools such as contact tracing but increase their speed and efficiency.

Purpose of the study
In this study we aim to develop and test a mobile phone-based digital contact tracing (DCT) technology tool. This plan aims at limiting the risk of haulage in introducing the virus (and its different variants) into communities along the road network. It allows a haulage driver to travel for 14 days with a negative diagnostic test, therefore a faster contact tracing approach for cases and their immediate contacts is needed to inform decision making and resource allocation. In endeavoring to understand the role of DCT in solving public health concerns, we are seeking responses from key resourceful persons on the subject matter. We are interested in learning from your experience and perspectives in these areas

Bio - Data
1. What is your area of expertise?
   - Legal
   - Technology
   - Sociology
   - Health
   - Civil society
   - Haulage

2. Gender:  
   - Female
   - Male
3. Age range:

- [ ] 18 – 25
- [ ] 26 – 36
- [ ] 37 – 45
- [ ] 46 – 56
- [ ] Above 57

4. District

Questions:
1. Have you heard of Digital Contact Tracing (DCT)?
   - [ ] Yes
   - [ ] No
   1a. If so where?

2. In your opinion, would it work in Uganda?
   - [ ] Yes
   - [ ] No
   2a. If no, why?
   2b. If yes, on a scale of 1-5 with 5 as the best how well do you think it would work?
   2c. what is the reason behind your score above?

3. What do you think would hinder its use?

4. Do you think it would have ethical issues?
   4a. If yes please elaborate
5. Do you think it would have legal issues?  Yes  No

5a. If yes, elaborate .................................................................

6. Do you believe its use for public health out ways the issues above (Yes or No)

7. In your view what do we need to strike a balance between public health benefit and individual freedoms protection? .................................................................

8. What challenges do you envisage for end users of DTT (truck drivers) from the point of view of your area of expertise?

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9. In relation to your area of expertise, comment on the importance of health surveillance in light of the Covid–19 pandemic.

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10. Kindly provide any comment or relevance of using the DTT tool in the Covid–19 surveillance among truck drivers.

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Thank you so much for your time.
Appendix 6: Interview Guide

Tracking Haulage in East Africa to support COVID-19 surveillance—THEA-C19

Stakeholders’ Key Informant

These questions/topics are a guide for key informant interviews with:

1. Ethicists, data experts, mHealth researchers and security.

This is a guide and not to be used as a questionnaire but rather to explore these issues in a conversational way. Not all questions or probes need to be asked. The semi-structured interviews should identify ethical, legal and social issues in the use of digital contact tracing technology for public health purposes. Be sure to record key points arising as well as non-verbal communication.

INTRODUCTION

Mobile phones-based tools have been used by some to support monitoring of the public’s health. This has been done, for example, through use of digital contact tracing technology (DCT) for disease surveillance. We are particularly interested in the use of mobile phone applications such as DCT as part of a country’s response to addressing infectious disease epidemics. At the peak of the COVID-19 pandemic, Uganda adopted the Regional electronic cargo and driver tracking system to help enhance disease surveillance and ease the draconic measures of population-wide quarantine. We are developing a DCT system that involves the use of mobile phone App

We would like to hear about your knowledge of and opinions about such technology uses, as well as any associated ethical, legal, and societal implications of these technology capabilities.

RESPONDENT BACKGROUND

I’d like to begin with a few questions to get to know you better.

1. Can you please tell me about your main professional role and responsibilities? What do you do day-to-day?

2. If you’ve had prior experience with mobile or digital health, can you tell me about your role in relation to mobile or digital health?

3. If you’ve had prior experience, can you tell me about your experience with working on issues involving ethical, legal or policy oversight of mobile and digital health?

PRACTICE CONSIDERATIONS

As mentioned, public health researchers and practitioners are interested in how mobile phones and their associated capabilities can be used to support monitoring of a population’s risk for infectious diseases like COVID-19. This could include, for example, collecting information about their movements, contacts and disease hotspots.

4. [For policymakers and ethicists] If someone were to ask you to allow public health professionals to use these mobile phone technology capabilities to support monitoring of movement patterns in the population, what are some of the things that you would think about?

   Probes:
• Do you have any particular concerns?
• Does it make a difference to you if the information is collected and used for research vs. public health surveillance purposes? Why/Why not?
• Does it make a difference to you if the information is collected for communicable vs. non-communicable diseases (e.g., use of tech for COVID-19 response vs cardiovascular disease monitoring)?

5. **[For ethicists]** Have you ever reviewed a protocol proposing to use digital tracing tools for research or public health? Who does the review? Is it the entire committee or you have a member with specific expertise in this area?

6. **[For ethicists]** What are the ethical, legal and social issues you consider when reviewing protocol proposing to use DCT?

7. **[For technologists]** If someone were to ask you to identify or develop mobile phone technology capabilities to support monitoring of infectious diseases in the population, what are some of the things that you would think about or need to know before providing any recommendations?

   Probes:
   • What would you focus on when developing a tool; efficiency or end user privacy? Why?
   • Are there any tradeoffs in technology development that would compromise efficiency?
   • Which one maximizes individual privacy?
   • What are you views on open-source digital tools for public health? How would that affect technology development?
   • What are some of the constraints on what you might be able to recommend for use in Uganda?
   • Does it make a difference to you if the information is collected and used for research vs. public health surveillance purposes? Why/Why not?
   • Does it make a difference to you if the information is collected for communicable vs. non-communicable diseases (e.g., use of tech for COVID-19 response vs cardiovascular disease monitoring)?

**PERCEIVED RISKS AND BENEFITS**

8. What might be the potential benefits of using digital contact tracing technology for monitoring infectious diseases in the Ugandan population?

   Probes:
   • How can public health and technology experts maximize those potential benefits?

9. What are the potential risks of using DCT?

   Probes:
   • How can public health and technology experts minimize those potential risks?

10. Are there any unique considerations for particular groups or populations in Uganda, in terms of realizing these potential benefits and minimizing risks for those groups?

**DATA SECURITY**

11. How should the privacy, rights and safety of DCT users be protected?
12. What measures should be instituted to protect the collected data?

13. How should a balance be achieved between individual rights to privacy and public benefit of limited disease transmission?

OTHER VALUES AND INTERESTS

Trust

14. What do you think increases or decreases the public’s trust in mobile phone technologies, when used for public health purposes?

Probes:
- [Explore in relation to DCT]
- What do you think increases or decreases the public’s trust in how the data that comes from these technologies will be used?

Transparency

15. What would it mean to be transparent about how the technological features and data are being used?

Probes:
- Are there any unique concerns regarding controlling access to data about the movements of people with infectious diseases?
- What stakeholders may be interested in secondary access to this information?
- What type of mobile phone data, if any, should be available for anyone to analyze for public health purposes? (“open data”)

Equity/Fairness

16. What are the most pressing equity issues related to the use of DCT for public health?

Probes:
- What efforts have been undertaken, or are needed, to increase access to DCT?
- How might phone-based disease risk factor monitoring positively address inequities present in other methods for monitoring the population’s health?

17. Who should be involved in setting priorities for use of mobile phone technology for public health? If you are aware, who typically is involved in this process?

Probes:
- Would those priority setting decisions come from a global, national, or more local level? Some combination?
- What is the role of sponsors or funders in deciding how mobile technologies and associated data are used in public health?
- How much community and user engagement should there be in guiding public health technology use decisions?

18. How best should information about DCT disseminated knowledge to promote understanding, foster trust and prevent misinformation that could adversely affect uptake?
Autonomy/Consent

19. What are some of the issues related to obtaining consent or permission from mobile phone users for these types of technology (DCT) and data uses?

Probes:
- When is it essential to obtain robust informed consent from mobile phone users for public health data collection?
- Are there times when it is enough to simply inform them of what is happening and how their privacy is being protected?
- Does it make a difference to you if the information is collected and used for research vs. public health surveillance purposes? Why/Why not?
- Does it make a difference to you if the information is collected for communicable vs. non-communicable diseases (e.g., use of tech for COVID-19 response vs cardiovascular disease monitoring)?
- Are there any approaches or strategies that seem to improve how consent is obtained in this context? How best should consent be obtained?

POLICY & OVERSIGHT

20. What, if any, external oversight mechanisms are important to help ensure that, when used for public health purposes, DCT is deployed in a manner that maximizes benefit and minimizes risk?

Probes:
- What actors currently regulate DCT in Uganda? How?
- Who else should oversee these activities?

21. Are you aware of any laws, policies, or guidelines surrounding the use of these mobile phone technologies in Uganda?

Probes:
- How do you feel about these policies?
- What are some of the main things they require?
- How do they compare to international guidelines?
- How can they be improved?
- Do people tend to comply with them?
- Are they enforced?
- What are the consequences of not following these rules and requirements?

Thank you very much for taking the time to speak with me today. Your contributions are greatly valued.

Is there anything else you would like to share regarding the topics that we discussed today?

Thank you again.
Appendix 7: Luganda drivers’ interview guide

Digital Tracking Technology In-depth interview guide.

These questions/topics are a guide for in-depth interviews with Truck drivers

This is a guide and not to be used as a questionnaire but rather to explore these issues in a conversational way. Not all questions or probes need to be asked. The semi-structured interviews should identify ethical, legal and social issues in the use of digital contact tracing technology for public health purposes. Be sure to record key points arising as well as non-verbal communication.

ENYANJULA.


EBIKWATA KU ADDAMU EBIBUUZO

Njagala okutandiika nebibuuzo ebitonotonu okusobola okukumanya okusingawo.

1. Mbuliraako kumulimu gwo omukulu nebyokola. Okola ki mubulamubwo obwabulijjo?
   a. Kiki ekyaakifuula ekyangu eri gwe okukoza ekola ezo ezogeddwako wagulu?
   b. Kusomozebwaki kwewasanga oba kwewayitamu?
4. Kiki ekya sooka okujja mubwongo bwo bwewawulira ku App eno?
   Kweralikirira ki kwewalina?
   Bibuuzo ki byewabuuzu ku App eno?
   Kiki kyewasubiira okubaawo oluvanyuma lwa App okutekebwa ku simu yo?
5. Oba nga ekylkoza App kyaali kya kyeyagalire, kiki ekykusikiriza okukiriza App etekebwe ku simu yo? Buuza ebisingawo ku kiki ekyaretera okukiriza
Kati katwogere kwebyo byenyi by’oyiseemu nga okozesa App eno eyenkola ya tekinologiya wa digito okulondola nokumanya gyotambulidde.

6. Okutwaliira awamu kyaali kitya eri gwe nga okozesa tekinologiya oyo?
   a. Kiki ekibadde ekyangu?
   b. Kusomozebwaki okubaddewo?
   c. Kiki kyewasinga okwagala ku nkola eno?
   d. Kiki kyewasinga obutagala ku nkola eno?

7. Bwoba nga okozesa tekinologiya o’wokumanya gyotambulidde okuyita ku ssimu, biki by’osinga okwerarikirira? **Buuza ebisingawo kungeri yobutayingira muntu wamu nokukuuma ebyama.**

8. Kiki kyoyinza okugamba kwebyo oba obubaka obuba bukunganyiziddwa okuva kugwe nga tuyita munkola eno eya tekinologiya?

9. Abantu abakoza tekinologiya ono obesiga kyenkana ki obutakozesa bubb ebyo ebiba bikunganyiziddwa okuva kugwe? **Lwaki ogamba bwotyo?**

10. Olowooza ekyokuteeka App eyo ku simu yo kirina eddembe lyo ery’obuntu lyekirinyirira? Liriwi eryo? **Nyonyola.**

11. App eyo eyatekebwa ku ssimu eriina engeri gyeyakyusamu emirimu gyokola bulijjo oba obulamubwo bwonna okutwalira awamu? **Mungeri ki?**

12. Olowooza waliwo enkola eyobuntu bulamu eyinza okwononebwa olwokukoza tekinologiya owokumanya wa gyotambulidde? **Oba waliwo, nyonyola.**

13. Gwe nga omuntu, offaayo kukwononebwa kwenkola zino ezobuntu bulamu?

14. Olowoza mumbeera ki woyiyinza okukukiriza okulinyirira oba okwonoona enkola zino ezobuntu bulamu?

15. Olowooza, enkola ye byobulamu eziyiza no kutangira ensasaana yendwadde eyinza okusinzirwako okwonoona enkola zino ezobuntu bulamu? Lwaki?

16. Nga ogyeko okukoza tekinologiya ono alondoola entambula yomuntu, nkola ki endala ezisobola okumalawo enkola ezobuntu bulamu oba okumalako omuntu eddembe lye?

17. Matteeka ki mu Uganda gomanyi agalina okugobererwa okusoboza enkola ezatekinologiya wokulondola entambula yabantu okukola obulungi?
   Kiki kye wandiyagadde ebeera mumatteeka ago?

18. Walibo ekintu ekirala kyewandiyanagadde okungamba kwebyo by’oyiseemu nga okozesa tekinologiya okumanya wa gyo tambulira?
9.0 References


4. Hamilton IA. countries are now using people’s phones to track the coronavirus pandemic, and it heralds a massive increase in surveillance,”.


31. WHO' guidance on ethics of surveillance for public health https://apps.who.int/iris/bitstream/handle/10665/255721/9789241512657-epdf.jsessionid=40D4E26C1E04785EAE56299A6935FD64?sequence=1

32. Quantifying SARS-COV-2 transmission suggests epidemic control with digital contact tracing - https://science.sciencemag.org/content/368/6491/eabb6936
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