Contact Tracing and Community-Based Surveillance for COVID-19 Using Health Assistants, Masindi District, Uganda, May 2020

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ABSTRACT

On 1 May 2020, the first COVID-19 community case was detected in Masindi District, Uganda. The index case, a policeman, reportedly had an extremely high number of contacts. Although central-level epidemiologists had previously conducted contact tracing in the country, this approach was considered unfeasible in this situation. Therefore, we set out to develop Health Assistants' (HAs) expertise in Masindi District to conduct active COVID-19 surveillance and compared the costs of deploying central-level and local-level responders. We worked with Masindi District Task Force to identify 31 Health Assistants (HAs), who were trained for 2 days on COVID-19 contact tracing and community-based surveillance (CBS). We established a CBS system involving local leaders and village health teams who supported the HAs to trace and monitor all contacts each day. We determined and compared response costs between use of 31 HAs and 10 central-level epidemiologists for this work. HAs identified 729 contacts and, each HA visited or telephoned 20-25 contacts daily for 14 days after their last exposure to the index case. Only 4 out of 729 (<1%) contacts were lost to follow-up. All the 729 contacts tested negative for SARS-CoV-2 on Day 14. The new CBS system received and investigated 531 separate community alerts for suspected cases, unlinked to the index case. Using HAs vs central-level epidemiologists reduced the 14-day response costs by 70% ($8,400 vs $2,500). Local training on contact tracing and CBS enabled a less costly approach to alert response, contact tracing, and control of COVID-19 at district level. Use of HAs to conduct contact tracing and CBS can increase community and district ownership of COVID-19 response.

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Introduction

COVID-19, a disease caused by severe acute respiratory syndrome coronavirus type 2 (SARS-CoV-2) [1], was first reported in Uganda on 21 March, 2020, in a traveler entering the country from Dubai [2]. For the next 6 weeks, all the cases reported in Uganda were identified among incoming travelers, contacts of travelers, or cargo truck drivers from neighboring countries [3]. During that period, nearly all surveillance efforts and contact tracing activities in the country were carried out by central-level epidemiologists based at the Ministry of Health in Kampala. This required frequent travel and constant activity from the central-level teams as they attempted to keep up with reported cases, and eventually became untenable.

On 1 May 2020, the first confirmed community case of COVID-19 (in a non-traveler with no known infected contacts) was identified in Masindi District, western Uganda. This first confirmed community case-patient was identified during random testing on 30 April in a rapid, country-wide COVID-19 assessment survey conducted in regions and subpopulations considered to be at high risk. This included police officers. At the Masindi District police station, five police officers were randomly selected from a list of 104 staff using random number tables. The case-patient was among the five tested. The case-patient reported having had a cough and flu-like symptoms from 22-25 April 2020. The case-patient had sought but had been unable to receive testing for COVID-19 at a local health facility. As a police officer who worked at the homicide department of the Masindi District Police Station, the case-patient was responsible for conducting arrests, processing crime suspects in court cases, and carrying out routine night highway patrols. In addition, the case-patient was also a police custodian, responsible for keeping the personal belongings of crime suspects and subsequently managing their release. Considering these widespread activities, the case-patient was projected to have had an extremely high number of contacts between 29 April to 2 May 2020.

The COVID-19 detection and response approach in Uganda at the time involved community-based surveillance, alerts (notification of a suspected case) through a centralized alert reporting system, confirmation of case status, and rapid response including patient isolation, contact tracing, contact quarantine, and contact follow-up and testing. At the time of the alert, Masindi District had staff but lacked, among other things, technical capacity to mount an effective COVID-19 contact tracing and community-based surveillance response. Specifically, local staff had neither training on contact tracing nor a functional community-based surveillance structure. To both practically assist with the case investigation and support the development of a district response system, a national rapid response team was deployed to Masindi District on 2 May 2020. We describe the process of developing local capacity to manage COVID-19 response efforts such as conducting follow-up and community-based surveillance and compared the costs of deploying central-level and local-level responders.

Methods

Outbreak setting

Masindi District is located approximately 200 km from Kampala, in mid-western Uganda. The district population is approximately 340,000, of which 110,500 reside in the municipality of Masindi. The police station in which the index case-patient in this report was identified was in Masindi municipality. The police station had 104 police officers and 34 inmates at the time the first case-patient was identified. In addition, staff from the police station were responsible for the supervision of several other police posts located in sub-counties of Masindi District. The index case-patient had visited one of those police posts.

Identification of Health Assistants

The COVID-19 District Task Force recommended using Health Assistants (HAs) to support contact tracing and community-based surveillance activities. HAs are a cadre of health workers who hold certificates in Environmental Health Science

obtained from post high school institutions. They are paid monthly salaries by the government and posted at parish-level (second-smallest administrative unit in Uganda) health facilities, each serving 5-8 villages. They perform community-based health preventive activities, act as a formal link for community members to health facilities and give technical support and supervision to village health team members (VHTs). VHTs are 3-5 voluntary non-institutionally trained (no formal health training) health workers chosen from each community (village) to support, empower and mobilize communities to take part in the decisions that affect their health and strengthen the delivery of health services at household level [4]. All 31 HAs from the district were utilized for the activities.

Training of Health Assistants on contact tracing and community-based surveillance

We conducted face-to-face training of HAs in Masindi for 2 days on contact tracing, using WHO guidelines. Brainstorming exercises and role plays were conducted to enhance learning of HAs. During this training, a contact was defined as per the WHO interim guidance on contact tracing [5]. A contact was defined as a person who had any of the following experiences with a confirmed COVID-19 index case-patient, from two days before the onset of the symptoms or when a case-patient had his or her sample taken, until the date of their last exposure to the case-patient. Exposure was defined as being within approximately 2 meters (6 feet), being in a room for a prolonged period of at least 15 minutes while not wearing recommended full personal protective equipment (i.e., gowns, gloves, respirator, eye protection), or having direct contact with infectious secretions (e.g., respiratory droplets) while not wearing recommended personal protective equipment. Brief interactions were not considered 'contact'. We highlighted key procedures on how to list and follow-up contacts. Contacts were listed from 20 April to 2 May 2020 when the case-patient was isolated for management.

We further trained the HAs on community-based surveillance, which is the systematic search, detection and reporting of public health events within a community by community members [6]. This training provided information about the benefits of a functional community-based surveillance system, a community case definition for COVID-19, and how to set up and manage a community COVID-19 alert system. Reports were received directly or through VHTs and Local Council One leaders (lowest level, elected council leaders). In addition, the HAs were informed of the daily reporting channel of all activities (i.e. to the district surveillance focal person). Lastly, all trained HAs were instructed on personal protection from COVID-19 and other infectious pathogens as per WHO´s interim guidance on rational use of personal protective equipment for COVID-19 [7].

Costing the COVID-19 response in Masindi District, Uganda, May 2020

We calculated the costs of all the activities carried out using the HAs, and compared them to what the costs would have been if we had only used central-level health workers. The costs included safari day allowances (allowance given to an officer for working outside his or her office but within their district of appointment and for meals) and fuel costs for HAs. When central-level health workers and drivers were involved, the implementation costs were calculated based on per diem and fuel costs.

Availability of data and materials

The datasets upon which our findings are based belong to the Uganda Public Health Fellowship Program. For confidentiality purposes, the datasets are not publicly available. However, the data sets can be availed upon reasonable request from the corresponding author and with permission from the Uganda Public Health Fellowship Program.

Ethical Considerations

This was a public health emergency, and the Ministry of Health (MoH) gave the directive to conduct epidemiological investigation and response on persons with SARS-CoV-2 infection in the country. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy[§]. We sought verbal consent from the case-patient and contacts. During data collection (contact listing and follow-up), respondents´ data was kept confidential. Information was stored in password protected computers and was not shared with anyone outside the investigation team. As this was a public health emergency, disclosure of patient

information for the purposes of contact tracing was limited to the assigned HAs.

[§]See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. [§]241(d); 5 U.S.C. [§]552a; 44 U.S.C. [§]3501 et seq.

Results

Contacts traced during COVID-19 outbreak, Masindi District, Uganda, May 2020

On 2 May, 2020, the central-level health workers and HAs conducted a telephone interview with the case-patient to identify contacts. We asked the case-patients to provide a detailed list of visitors, friends, residents, workmates, witnesses, complainants, and crime suspects with whom the case-patient had interacted within less than 2 meters during the relevant time period (20 April to 2 May 2020). The case-patient also provided phone numbers of contacts and places visited, including bars, roadblocks, other police stations, shops and restaurants, and social contacts´ homes, during the same time period. In addition, we interviewed the officer-in-charge at Masindi police station to understand the duties of the case-patient during the exposure period and obtained relevant police documents for review. We reviewed police records to identify the people who had interacted with the case-patient during the execution of the case-patient´s duties.

With support from the district health office, radio announcements were made by the HAs, requesting members of the public to volunteer themselves to the nearest health authorities if they knew that any of their relatives or colleagues or friends had been isolated for COVID-19 in Masindi at that time. In addition, the HAs made phone calls to the identified contacts and further conducted home visits to collect contact details and linked them to the quarantine management team where necessary.

HAs also counselled the contacts and emphasized precautions and rationale for contact tracing. Confidentiality of the contacts´ information was maintained and managed by the HAs, who had sworn to uphold professional ethics.

The HAs listed a total of 729 contacts. The entire police barrack, which comprised 323 contacts, was quarantined together on 2 May 2020; another 125 contacts were taken to institutional quarantine centers for monitoring on 3 May 2020. The remaining 281 contacts were listed on 4 May 2020, and asked to stay at home in self-quarantine because the institutional quarantine centers were full to capacity.

Follow-up of contacts during COVID-19 outbreak in Masindi District, Uganda, May 2020

Because most contacts could not remember their exact dates of the last contact with the index case-patient, the HAs opted to follow-up all the contacts for 14 days from the date the case-patient was taken for isolation (2 May 2020). In addition, most contacts reported having closely mixed with each other at quarantine centers and police stations.

Each HA was assigned 20 to 25 contacts to follow-up each day using the Ministry of Health´s COVID-19 follow-up form. The team either visited or telephoned the contacts to ascertain whether they had developed signs and symptoms from 2-16 May 2020. As a measure of compliance with COVID-19 control standard operational procedures (SOPs), frequent use of sanitizers, physical distancing of 2 meters, and use of PPE was adhered to by the follow-up team. Adherence to the SOPs was monitored by the central-level health workers and other district supervisors during contact follow-up field activity. All the home visits with the contacts were held in an open environment (outside). Because of inadequate supply of infrared thermal scanners for temperature readings, only 11 HAs were given scanners, and the remaining 20 collected data on self-reported fever.

HAs also left their contact information with the Local Council One leaders and the contacts being followed up to facilitate rapid reporting of COVID-19 like symptoms. After obtaining consent, the HAs obtained a reliable telephone number for each contact and an alternative number from one of their household members. Contacts who were not found at their homes at any time during the 14 days were actively sought by asking the household members about their whereabouts. Those who had relocated were assigned to another HA nearer to that new place of location.

HAs reported to the District Surveillance Focal person daily, specifically highlighting the number of contacts followed-up, those lost to follow-up, and those whose signs and symptoms were related to COVID-19. Of the 729 contacts followed-up, only (n=28) developed COVID-19 related signs and symptoms, and were isolated at the district hospital and immediately sampled for COVID-19 Real-Time Reverse Transcription Polymerase Chain Reaction (RT-PCR) testing. Additionally, as part of the protocol (routine) all the 729 contacts identified were tested for COVID-19 using RT-PCR at the start and end of the quarantine period. Fortunately, none tested positive during routine quarantine and COVID-19 symptom onset test.

The listed contacts were meant to be followed up for 14 days; however, no follow-up occurred during the first 3 days, as we built the contact tracing and community-based surveillance system. The proportion of contacts followed-up by either home visits or phone calls increased from 94% on day 4 to almost 100% by day 14. As the HAs became more familiar with the homes and the contacts, the proportion followed-up by only home visits gradually increased from 43% to 94% (Figure 1). Four (0.55%) were lost to follow-up between Days 9 and 13 (Table 1).

Activating community-based surveillance during COVID-19 outbreak in Masindi District, Uganda in May 2020

After conducting contact tracing and quarantine from 2-4 May 2020, the trained HAs activated and functionalized a community-based surveillance system in Masindi from 5-16 May. To accomplish this, the HAs reached out to the VHTs and Local Council One leaders to educate them on the urgent need to control COVID-19 by opening channels for reporting of any suspected cases to the district health authorities thus building a surveillance system.

HAs shared COVID-19 community case definition with the local leaders to know what to look for and left their phone numbers with them to report any persons who met the community case definition. The VHTs and Local Council One leaders sensitized and encouraged the members of the public to self-report signs or symptoms related to COVID-19 to them. During 5-16 May 2020, a total of 531 community alerts (people with flu-like symptoms who were not contacts to the index case-patient), all unlinked to the index case-patient, were collected and immediately investigated by the HAs. Samples were taken from all the community alerts; none tested positive for COVID-19 by RT-PCR.

District surveillance focal person, HAs, local leaders and VHTs structures ensured the continuity of its community-based surveillance operations since it was integrated into the district routine surveillance system.

Response costs incurred during the COVID-19 outbreak in Masindi District, Uganda in May 2020

The estimated total cost of doing contact tracing and community-based surveillance if the central-level team had been used was $8,388 while the costs for using the HAs was $2,513 (Table 2).

Discussion

Ensuring coverage of public health needs during sudden surges of activity, such as during public health emergencies, can be challenging, especially when centralized public health activities are the default approach. We describe our initial approach to decentralization of public health surveillance and contact tracing in Uganda during the COVID-19 outbreak. As a result of this approach, local-level responders (health assistants) were able to capably conduct contact tracing activities and facilitate community-based surveillance at a reduced cost and effort, compared to the deployment of central-level health staff during the COVID-19 outbreak in Uganda.

Health Assistants in Uganda have a broad array of skills that make them particularly appropriate for disease prevention and outbreak response [8], including community mobilization, simple diagnosis (such as for malaria using rapid diagnostic tests (RDTs), outbreak investigation, and basic biostatistics [8]. This facilitated our building the capacity of HAs to meet the needs of COVID response in a short time at low cost. The approach of using HAs is closely related to one that Germany adopted in which the responsibility of COVID-19 contact tracing, outbreak investigation and management was left to the local authorities at the

city or county level [9]. In fact, when the local health authorities in Germany were overwhelmed by contact tracing activities, local civil servants were redeployed to support contact tracing activities, which additionally fostered ownership of the outbreak by the community. Other countries, including Uganda, could replicate this approach using HAs since it can also align with their other community health roles. However, this approach requires supporting the local governments financially to carry out such activities. It also requires the Ministry of Health or central-level institutions to take up the responsibility of capacity-building and coordinating the efforts of local governments in contact tracing or outbreak investigation and management. The local nature of the HAs described in this paper may also have facilitated the ability to follow up with local contacts more effectively. In a setting such as Uganda, where communities are tight-knit and trust of local health staff is paramount, using HAs who have community trust as well as knowledge of the terrain, language, and culture can be critical to a successful health initiative [8, 10]. Although the contacts were not followed up as expected in the first three days because the HAs were being mobilized and trained, subsequent follow-up rates approached 100%. It is unlikely that this could have been done as efficiently by persons unfamiliar with the area or with the communities.

Only four out of the large number of contacts were lost to follow-up; all were among those asked to self-quarantine at home. Challenges of self-quarantine in this setting included the stigma of having healthcare workers visiting homes and high rates of poverty. Poverty prevents many people from staying home thus not being involved in income-generating activities for extended periods of time [11]. Even when efforts were made to involve the local leadership to ensure that all contacts adhered to self-quarantine regulations, the contacts lost to follow-up went to stay elsewhere. Shortfalls during adherence to quarantine regulations and practices such as close contact with each other, and non-observance of hand hygiene could increase opportunities for COVID-19 to spread. Innovative ways of tracking contacts, such as digital contact tracing, would have allowed more privacy during contact follow-up [12]. Digital contact tracing involves using mobile telephone applications through Bluetooth and application programming interfaces (APIs) supported by Google and Apple to enable the connection between mobile devices in close proximity and assigning of unique codes for the contacts [12]. When a person tests positive, public health authorities can easily download the unique codes and link up with the contacts immediately. Contacts could then also provide information required during contact tracing through this approach [12]. However, digitized contact tracing could be a challenge in Uganda due to low rates of smartphone ownership, unwillingness to use a digital contact tracing app among the population, and poor mobile network speeds [13].

No contact among the 729 listed, including the 28 who developed signs and symptoms consistent with COVID-19, tested positive. In fact, no other cases were identified in Masindi until August 2020, and the district has remained one of the less-affected districts throughout the pandemic [14]. The reasons for the lack of spread from the index case-patient were unclear. It has been established that the spread of COVID-19 is not homogeneous: some persons spread to many people, while many people spread to no one [15]. The index patient in this situation may simply not have been highly infectious. Despite widespread contact testing, it is also possible that infection in some contacts went undetected; asymptomatic SARS-CoV-2 infection occurs and is relevant for transmission [16], [17]. From a practical standpoint, providing training and ensuring facilitation of local-level work is necessary, especially during a pandemic. However, such capacity should ideally be developed and strengthened during non-emergency periods. Masindi, as well as other districts receiving such training, may need to be revisited to ensure their capacity and activities continue.

The use of community-based surveillance systems to control the spread of COVID-19 in this situation can be a reliable alternative to standard, passive, health-facility based surveillance [18]. During the activities described in this report, we were able to set up an effective community-based surveillance system, defined as being able to organize local structures to rapidly (<12 hours) report and respond to alerts. However, effective community-based surveillance and contact tracing require constant community engagement [5]. Following the capacity building and mentorship of local responders and community structures, and integration of activities to district routine surveillance system, it´s believed that there

was sustainability of this community-based surveillance system in Masindi District. Although the system has not been revisited since its implementation, reviewing its activities periodically is important and could both promote consistent use and enable its expanded activities for other public health threats.

Using local-level responders reduced the contact tracing costs by over 70% in our evaluation, compared to using central-level epidemiologists. If local-level responders are at least as effective as central level responders in tracing contacts, this represents a cost-effective approach. The reduced costs are due to the smaller daily allowance provided to local vs. central-level responders, and the reduced fuel and accommodation costs of transporting central-level responders to the field. Beyond this, expanding local capacity through activities such those described here enables local innovation and ownership of response activities by districts, and reduces the burden on the central-level staff and resources. This represents a much more practical approach in a country with over135 districts than engaging the central-level response for all cases and outbreaks. Where possible, a local approach should be considered the preferred approach.

Limitations

While local responders were able to perform the required activities during our evaluation period, we could not directly compare the effectiveness of the central and local level responders in this activity. In addition, the community-based surveillance system was not re-assessed for its continuous effectiveness after the outbreak. Notably, the training costs of the local responders such as technical allowances and per diem for trainers, training logistics, supervision and transportation were not covered in this paper. In computing the costs considered in this paper, we assumed that the capacity of central or local responders had already been built during the non-emergency phase.

Conclusion

Building the capacity of local health assistants in Uganda enabled easier contact tracing and follow-up in Masindi District. The use of health assistants to conduct contact tracing and community-based surveillance activities could potentially increase community and district ownership of COVID-19 response. In addition, the use of HAs was a less costly approach to alert management and contact tracing. Given the long-lived nature of the COVID-19 pandemic and the possibility of expansion or additional waves of cases, the Ministry of Health could consider adopting the use of local-level responders such as HAs to accomplish the demands of COVID-19 contact tracing and community-based surveillance. In adopting the use of HAs, there is a need to build their capacity, support innovations in contact tracing, properly fund the activities, and monitor performance.

Competing interests

The authors declare no competing interest.

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Authors' contributions

Conceptualization and design, BOA, DK and AD, Acquisition, analysis, data interpretation, and the first draft of the manuscript, BOA.; contribution to analysis and interpretation of data, IA, GA and JN, Review of the paper to ensure intellectual content and scientific integrity, LB, DK, AD, ARA, and JRH, Supervision, DK and JRH. All authors have contributed to the write-up, proofread and agreed to the published version of the manuscript.

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Tables and figures

Table 1: The 14-days contact follow-up indicators for 729 contacts during COVID-19 outbreak in Masindi District, Uganda, May 2020

Table 2: COVID-19 Response costs of using central-level health staff versus Health Assistants during COVID-19 outbreak, Masindi, Uganda, May 2020

Figure 1: Follow-up of 729 contacts from 2 to 16 May 2020 during COVID-19 outbreak, Masindi District, Uganda

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Table 1: The 14-days contact follow-up indicators for 729 contacts during COVID-19 outbreak in Masindi District, Uganda, May 2020

Indictor	**The 14-days of contact follow-up**													
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**
Cumulative # of contacts listed (n)	323	448	729	729	729	729	729	729	729	729	729	729	729	729
# of contacts in institutional quarantine (n)	0	0	0	123	123	124	125	125	125	125	125	125	125	125
# of contacts runaway in institutional quarantine (n)	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Contacts lost to follow up in home/ self-quarantine (n)	0	0	0	0	0	0	0	0	2	0	0	0	2	0
Contacts followed-up (home visit or phone call) (%)	0	0	0	94	96	96	97	97	100	100	99	99	99	99
Contacts followed-up by home visit only (%)	0	0	0	43	47	58	58	58	81	74	73	73	93	94
Contacts lost to follow up in institutional quarantine (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Contacts who developed signs and symptoms* (n)	0	0	0	0	0	0	0	4	7	7	4	2	3	2
Contacts who become confirmed cases (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New cases who are known contacts (%)	0	0	0	0	0	0	0	0	0	0	0	0	0	0

* No contact tested positive for COVID-19

Table 2: COVID-19 Response costs of using central-level health staff versus Health Assistants during COVID-19 outbreak, Masindi, Uganda, May 2020

Item	Qty	Unit cost (UGX)	Days	Total Cost (UGX)	Total Cost (USD)**
Allowance (per diem) – central-level, Ministry of health rate	5	160,000	15	12,000,000	3,158
Fuel (to district and within district)	2	60,000	15	1,800,000	474
Driver's allowance – central-level, Ministry of Health rate	2	160,000	15	4,800,000	1,263
Allowance (per diem) – central-level, public health Fellowship program rate	5	150,000	15	11,250,000	2,961
Driver's allowance – central-level, Public Health Fellowship program rate	1	75,000	15	1,125,000	296
Fuel (to district and within district)	3	60,000	15	2,700,000	711
Total cost for using central-level staff				31,875,000	8,388
Safari day Allowance (SDA) for Health Assistants	31	12,000	14	5,208,000	1,371
Fuel within district	31	10,000	14	4,340,000	1,142
Total cost for using Health Assistants				9,548,000	2,513

*** USD 1.00 = 3,800 UGX*

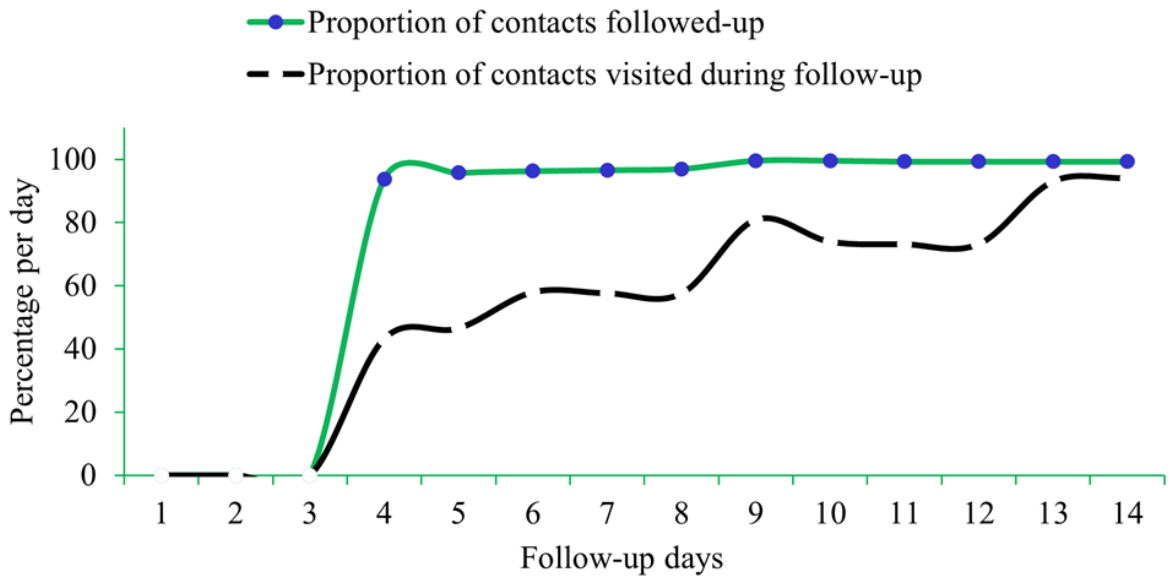

Figure 1: Follow-up of 729 contacts from 2 to 16 May 2020 during COVID-19 outbreak, Masindi District, Uganda