Research article

Compliance with measures among actors and lessons learnt in the management of COVID-19 institutional quarantine in Uganda

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A R T I C L E   I N F O

A B S T R A C T

Introduction: To support COVID-19 containment measures, several countries implemented quarantine protocols. This study determined the level of compliance to COVID-19 quarantine measures, associated factors, and lessons learnt in institutional quarantine management in Uganda.
Methods: This concurrent mixed methods study involved a cross-sectional survey among individuals who were in institutional quarantine and interviews with key informants, who were reached mostly through phone calls. Univariate, bivariate, and multivariable analysis were conducted to analyse quantitative data while qualitative data were analysed thematically with the aid of Atlas ti 7.
Results: Compliance with quarantine measures at the individual level was moderate at 65.4 %. Factors associated with high compliance with measures were: older age (above 40 years) [APR = 1.30 (95 % CI: 1.04–1.63)], spending 14–15 days in quarantine [APR = 1.39 (95 % CI: 1.00–1.92)] and reporting a high Ministry of Health compliance [APR = 1.33 (CI: 1.11–1.58)]. The positive factors included the availability of guidelines, inspection of facilities and training of personnel. The challenges were related to long turnaround time for results and provision of personal protective equipment (PPE).
Conclusion: Efforts to improve training, supervision and inspection of facilities, and provision of adequate PPE would improve compliance with quarantine measures.

1. Introduction

The Corona Virus Disease 2019 (COVID-19) pandemic has caused significant morbidity and mortality. As of October 16, 2022, 6.5 million deaths and over 621 million confirmed COVID-19 cases had been registered globally [1]. On the African continent, of the 9.34 million cases registered, 174,634 deaths had been reported within the same period. As a non-pharmaceutical intervention, quarantine

has been employed to support COVID-19 prevention and control efforts, especially in the initial phases of the pandemic [2,3]. During quarantine, at-risk persons are separated while following the recommended infection control measures to combat further disease spread within quarantine centres [4,5]. Implementation of quarantine measures during COVID-19 has targeted individuals suspected of exposure to severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) who are isolated in institutions or other places including their homes.

Uganda embarked on implementing self and institutional quarantine measures before it registered its first case of the disease on March 21, 2020. Institutional quarantine was introduced as a response to the reported non-compliance to self-quarantine measures and was initially restricted to those returning from countries deemed to have had a considerable risk for COVID-19 transmission. By the time the country closed its airport as part of broader lockdown measures on March 22, 2020, 2661 individuals had been placed in institutions mostly hotels and hostels, both in the country's capital and the airport city. Later in June 2020 when repatriation flights for citizens and residents were gradually allowed, returning individuals were required to undergo mandatory institutional quarantine at their cost except for a few who obtained slots in public government centres.

As a measure for the control of highly infectious diseases, compliance with quarantine measures is key to ensuring the protection of individuals, service personnel and the general public. However, a research gap remains regarding the extent of compliance with infection control and prevention measures within institutions and by various actors in the quarantine process, especially during the COVID-19 pandemic. Quarantine is an unpleasant experience with the change of environment, the unpredictability of the status of the disease, physical isolation from loved ones, and boredom among others causing negative effects among those who undergo it [6,7]. A recent rapid review reported that compliance with quarantine for previous infectious disease outbreaks ranged from 0 to 92.8 % [8]. Research from outbreaks of infectious diseases has shown that factors such as knowledge, social norms, perceived benefits of quarantine and perceived risk of the disease influence compliance to quarantine measures [8–10]. Practical issues such as running out of supplies or the financial consequences of being out of work also influence quarantine compliance [8]. Compliance with quarantine measures during epidemics is also much lower in situations where the public doesn't support its importance [10]. Coping in quarantine is another key factor in compliance. From previous research, individuals cope by activating their social network, communicating with family and friends, and having a telephone support line and access to social media among others [11,12].

Most of the previous literature is mostly focused on only compliance by individuals in quarantine [8,9,13] neglecting the role of other actors such as the quarantine facilities and responsible enforcement authorities such as the Ministry of Health (MOH). Other studies explored compliance with quarantine orders at the population level or among patients [8,9,11,13,14]. In this study, we determined the level of compliance to COVID-19 quarantine measures among persons in institutional quarantine, the quarantine facilities, and the Ministry of Health in Uganda. We also present the factors associated with compliance to measures among individuals and share lessons from the management of the quarantine process which should inform future efforts for improving institutional quarantine for COVID-19 and other pandemics.

2. Materials and methods

2.1. Study area, design, and population

This concurrent mixed-methods study was conducted in Uganda, with an estimated population of 41.8 million in 2020 [15]. We used a cross-sectional survey design for the quantitative and a qualitative description [16] for the qualitative component. We selected individuals who had undergone institutional quarantine between July and August 2020 from a mix of private and public institutions. These individuals returned by repatriation flights with a pre-condition to undergo institutional quarantine prior to going back to their communities. Some improvements had also been made following lessons learnt during the first phase of quarantine in March and April 2020. The study population had been quarantined within the country's capital, Kampala and its contiguous Wakiso district. The qualitative description involved key informant interviews among those who had been involved in the institutional quarantine process.

2.2. Sample size and sampling

Sample size for the cross-sectional survey was determined using the Leslie Kish formula for cross-sectional studies [17] with the assumption of p of 50 % to obtain the maximum possible sample in the absence of a known compliance level, a precision 5 %, and a non-response rate of 20 %, yielding a sample size of 461. Quarantined adults were sampled using lists obtained from the MOH by month, which were cleaned, and half of the participants sampled from each, for interviews. Interviews were conducted at the end of each month on an ongoing basis. We selected 15 key informants using criterion purposive sampling, considering their unique roles in institutional quarantine management. These roles included surveillance, contact tracing, counselling, sample collection, quarantine centre management, or providing security. Each quarantine facility was assigned a surveillance officer who coordinated the day-to-day activities including taking temperatures, organising sample collection, and catering to other needs of the quarantined individuals. The laboratory team collected samples from the centres and transported them for analysis. Within quarantine centres, contact tracers listed contacts of identified cases and supported their monitoring while counsellors provided psychological support to the quarantined persons.

2.3. Data collection

The study was conducted from July to October 2020 with quantitative data collected mostly through phone calls and all

participants had completed their quarantine period and left the centre by the time of the interview. Eligible participants answered the study questionnaire during a 10 to 15-min phone interview in English or *Luganda,* the most widely spoken local language. Other participants were provided with a link to the mobile questionnaire designed in Kobo Collect through WhatsApp or email for self-administration. A follow-up was made to ensure that only those who were eligible responded to the survey online. Quantitative data were collected through a pretested semi-structured questionnaire designed based on the MOH quarantine guidelines [18] while qualitative data were collected using a key informant interview guide. For the key informant interviews, the research team made appointments with selected informants and conducted phone or in-person interviews in English that lasted between 45 min and 1 h. The interviews were conducted by five research team members (two female, three male) with master's level education and between 6
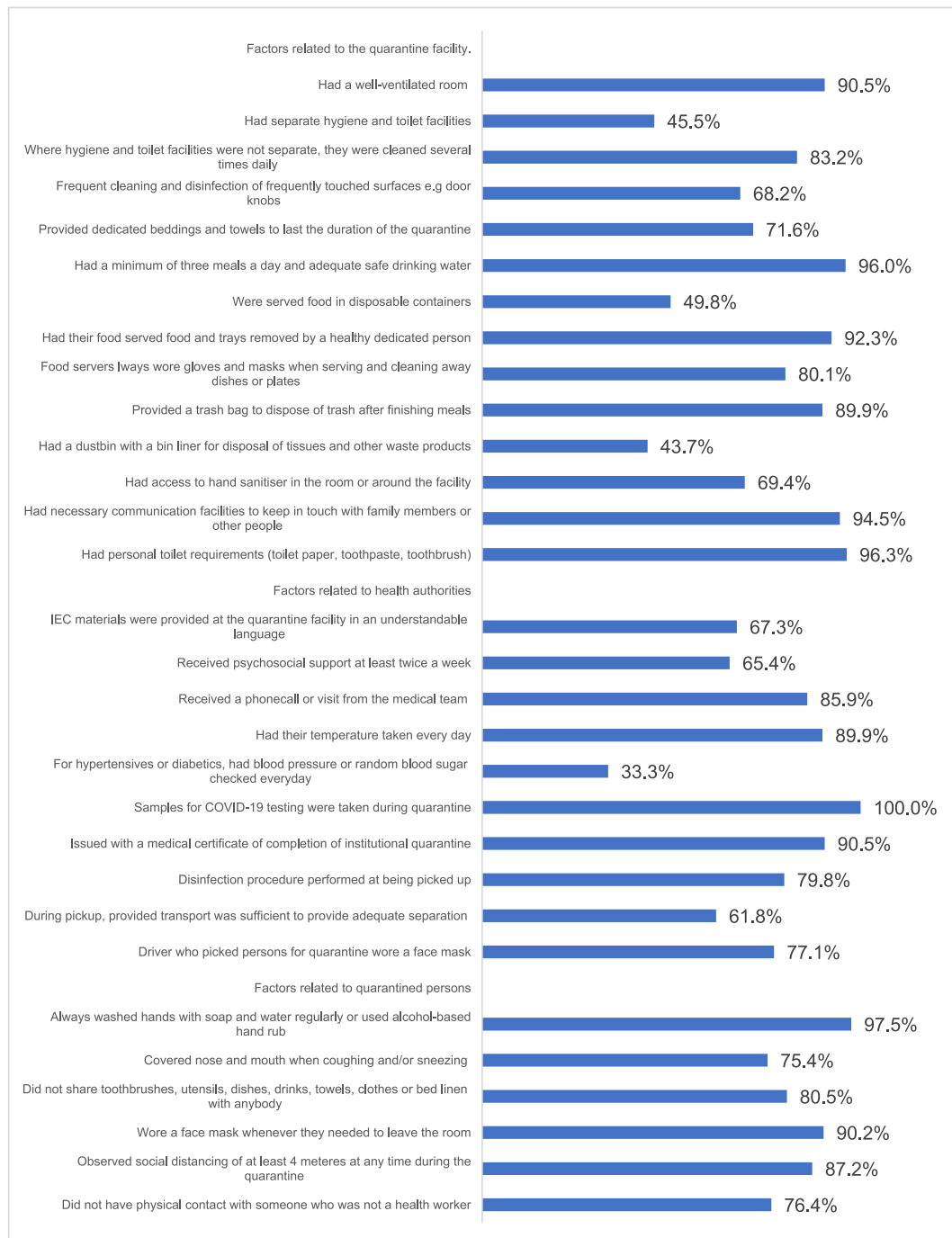

Fig. 1. Compliance with different quarantine guidelines among facilities, health authorities and quarantined persons.

and 12 years' experience in conducting qualitative research interviews. The key informant interviews were audio-recorded with participant consent and later transcribed verbatim.

2.4. Data management and analyses

Quantitative data entered in Kobo Collect were downloaded as a Microsoft Excel file and exported into Stata 15.0 (Stata Corp, Texas, USA) statistical software for cleaning and analysis. Univariate, bivariate, and multivariable analyses were conducted. For knowledge regarding quarantine, a composite variable of the overall score was created. We categorised participants who answered four of the five questions correctly as having high knowledge and the rest as low knowledge, following Bloom's cutoff of 80 % as used in previous studies [19,20]. The dependent variable for the analysis was compliance with quarantine measures by individuals. We defined compliance as adherence to or conforming with the established quarantine guidelines as instituted by MOH. We assessed compliance using a list of 30 questions about compliance by the quarantine facility (14 questions), Ministry of Health (10), and individuals (06) with results analysed descriptively and presented in Fig. 1. The questionnaire (S1 questionnaire) asked respondents about their compliance to several measures such as mask wearing, handwashing, cough etiquette, and the services they received from the MOH and quarantine facility among others with 'Yes' and 'No' options. For advanced analysis and to form the outcome variable, individuals who reported compliance to at least five of the six individual measures (over 80 %) were deemed highly compliant and assigned '1'. As the outcome variable was relatively prevalent which could have impacted the standard errors [21,22], we estimated the association between the independent variables with compliance using modified Poisson regression analysis. Following bivariate analysis, all factors were input in the multivariable model to control for potential confounders and a backward analysis run with variables eliminated based on their p-values and/or biological plausibility. We also adjusted for clustering at the quarantine facility level. We assessed multi-collinearity among independent variables using the Pearson correlation coefficient and for pairs of variables with a co-efficient of >0.4 and p-value <0.05, only one was included in the multivariable model. The measure of association used was prevalence ratios and a $p < 0.05$ was deemed statistically significant.

To analyse the qualitative data, all study transcripts were read by two members of the research team (RN and GN) team who independently generated and harmonised a codebook that was informed by the interview guide. They coded the transcripts deductively at the semantic level using Atlas ti 7 with any emergent codes added to the developed codebook. Thematic analysis following the

Table 1
Socio-demographic characteristics of study participants.

Characteristic	Frequency (%)
Overall	327 (100)
Sex	
Male	179 (54.7)
Female	148 (45.3)
Age category (mean (SD))	34.7 (±10.2)
19–30	134 (41.0)
31–40	112 (34.2)
Above 40	81 (24.8)
Education level	
Primary	20 (6.1)
Secondary	109 (33.3)
University	180 (55.0)
Missing	18 (5.5)
Marital status	
Never married	102 (31.2)
Currently married/living with a partner	190 (58.1)
Divorced/separated/widowed	17 (5.2)
Missing	18 (5.5)
Occupation	
Works with private or international organisation	83 (25.4)
Business	111 (33.9)
Others[a]	96 (29.3)
Missing	37 (11.3)
Ownership of facility	
Public institution	166 (50.8)
Private institution	161 (49.2)
Type of facility	
Hotel	127 (38.8)
Hostel	146 (44.6)
School dormitory	49 (15.0)
Other (barracks, hospital)	5 (1.5)
Days spent in quarantine	
14–15	110 (33.7)
16–17	159 (48.8)
18+	57 (17.5)

[a] *Casual labourer, security personnel, student, unemployed.*

steps by Braun and Clarke [23] was used to synthesize and group the codes into categories, and then study themes. The study themes and sub-themes were reviewed and refined with input from the study team and then finalised. Typical quotes from the transcripts are presented to support the synthesised findings.

3. Results

3.1. Socio-demographic characteristics of respondents

We obtained records of 870 persons. Among these, 539 were eligible for the survey, but 327 (60.7 %) responded to the questionnaire. Over half of the study participants were male (54.7 %), had at least a university education (55.0 %) and were married or living with a partner (58.1 %). The ratio of study participants from public and private quarantine facilities was 1:1, and a third 110 (33.7 %) spent 14–15 days in quarantine, with the rest staying longer (Table 1).

3.2. Perception of risk and knowledge regarding quarantine

One in four of the study participants believed they were at risk of contracting COVID-19 from within the quarantine facility. Regarding participant knowledge about the importance of quarantine, some participants thought quarantine was for those ill with COVID-19 (22 %), more than half did not agree that quarantine is intended to facilitate early detection of ill health due to COVID-19 (56.0 %) and others thought quarantine was for only travellers from other countries (17.4 %). Overall, 234 (71.6 %) of the respondents had high knowledge (Table 2).

3.3. Compliance with quarantine measures by the facility, ministry of health, and quarantined individuals

We assessed compliance with several measures by the MOH, hosting facilities, and quarantined individuals. For the facilities, compliance was high for the provision of personal toilet requirements (96.3 %) and at least three meals and drinking water (96.0 %). Conversely, minimal compliance was noted for the provision of bin liners for disposing of waste within the room (43.7 %) and separate toilet and hygiene facilities (45.5 %). MOH was most compliant with obtaining samples from quarantined persons (100 %) and issuing them with a medical certificate of completion of quarantine (90.5 %). However, MOH was least compliant with checking clients' blood pressure and blood sugar (33.3 %) for those who were hypertensive or diabetic and provision of psychosocial services at least twice a week (65.4 %) to quarantined individuals. At the individual level, they reported always washing their hands regularly (97.5 %) and wearing a face mask whenever they were leaving their rooms (90.2 %). On the other hand, compliance was lowest for maintaining respiratory hygiene (75.4 %) (Fig. 1).

3.4. Factors associated with individual compliance with quarantine measures

Overall, compliance with quarantine measures at the individual level was moderate at 65.4 % (214/327). The factors associated with compliance with prescribed quarantine measures among individuals were: older age (above 40 years), spending 14–15 days in institutional quarantine, being quarantined in a public facility, and reporting a high MOH compliance to measures (Table 3). Individuals who thought they were at risk of contracting COVID-19 had lower compliance with measures (p = 0.001).

3.5. Coping measures while in institutional quarantine

We assessed the measures that individuals used to cope during their stay in quarantine. Respondents reported diverse ways adopted to cope, including interacting with family members (38.4 %), exercising (30.0 %) and watching television (13.4 %) (Fig. 2).

4. Lessons in the management of the institutional quarantine process

Stakeholders shared several lessons highlighting successes and challenges in the management of the process organised around six sub-themes as summarised in Table 4. The sub-themes are: preparation of quarantine centres, COVID-19 testing, linkage to health

Table 2
Knowledge of quarantined persons on the importance of quarantine.

Knowledge prompt	Yes (%)	No (%)
Quarantine is for those who are ill with COVID-19	72 (22.0)	255 (78.0)
Quarantine helps protect members of the community from contracting the disease	283 (86.5)	44 (13.5)
Quarantine helps to separate those who may have been exposed to COVID-19 from others	280 (85.6)	47 (14.4)
Quarantine is intended to facilitate early detection of ill health due to COVID-19	144 (44.0)	183 (56.0)
Quarantine is only for travellers from other countries	57 (17.4)	270 (82.6)
Overall knowledge		
Low	93 (28.4)	
High	234 (71.6)	

Table 3
Factors associated with individual compliance to COVID-19 measures.

Characteristic	Compliance (%)	Prevalence Ratio (PR) (95 % CI)	p-value	Adjusted PR (95 % CI)	p-value
Overall	214 (65.4)				
Sex					
Female	92 (62.2)				
Male	122 (68.2)	1.09 (0.88–1.36)	0.408	1.01 (0.85–1.20)	0.908
Age category (years)					
19–30	79 (59.0)				
31–40	69 (61.6)	1.04 (0.85–1.29)	0.679	1.03 (0.91–1.17)	0.614
Above 40	66 (81.5)	1.38 (1.14–1.68)	**0.001**	1.29 (1.07–1.55)	**0.007**
Education level (n = 309)					
Primary	12 (60.0)				
Secondary	61 (56.0)	0.93 (0.79–1.09)	0.393	0.89 (0.69–1.16)	0.410
University	125 (69.1)	1.16 (1.03–1.30)	0.017	0.99 (0.81–1.19)	0.889
Marital status					
Never married	62 (60.8)				
Currently married/living with a partner	130 (68.4)	1.12 (0.91–1.39)	0.280		
Divorced/separated/widowed	9 (52.9)	0.87 (0.53–1.44)	0.590		
Occupation (n = 290)					
Works with private or international organisation	60 (72.3)	1.42 (1.07–1.88)	0.016		
Business	78 (70.3)	1.38 (1.21–1.57)	**<0.001**		
Ownership of facility					
Private	112 (69.6)				
Public	102 (61.4)	.88 (0.756–1.04)	0.146	1.17 (1.03–1.34)	0.018
Type of facility					
School dormitory	30 (61.2)				
Hostel	83 (56.8)	0.93 (0.76–1.13)	0.461		
Hotel	97 (76.4)	1.25 (1.13–1.38)	<0.001		
Days spent in quarantine					
18+	28 (49.1)				
16–17	105 (66.0)	1.34 (0.89–2.03)	0.158	1.18 (0.88–1.59)	0.264
14–15	80 (72.7)	1.48 (1.04–2.11)	**0.029**	1.35 (1.06–1.71)	**0.013**
Thought was at risk of contracting COVID-19 within quarantine facility					
No	142 (72.1)				
Yes	72 (55.4)	0.77 (0.68–0.87)	**<0.001**	0.72 (0.64–0.82)	**< 0.001**
Received information or briefing on how to conduct self in quarantine					
No	53 (65.4)				
Yes	161 (65.4)	1.00 (0.81–1.23)	0.998		
Institutional compliance with COVID-19 measures					
Low	109 (57.4)				
High	105 (76.6)	1.33 (1.14–1.56)	**<0.001**		
Ministry of Health compliance with COVID-19 Measures					
Low	86 (56.9)				
High	128 (72.7)	1.28 (1.11–1.47)	**0.001**	1.28 (1.18–1.39)	**<0.001**
Overall knowledge about quarantine					
Low knowledge	57 (61.3)				
High knowledge	157 (67.1)	1.09 (0.94–1.27)	0.229	1.05 (0.91–1.21)	0.494

services, coordination of the quarantine process, compliance with measures and the MOH personnel welfare.

4.1. Successes

In preparation of quarantine centres, the key successes were: the provision of MOH guidelines, advance inspection of facilities, and training of centre personnel and MOH teams. The sample collection team was usually available to collect samples from quarantine centres and the laboratory system was streamlined to integrate COVID-19 test results across laboratories to reduce delays. Some hotels provided their personnel with sufficient personal protective equipment (PPE) and accommodated them, especially during the COVID-19 lockdown. Also, the army and police provided security at the quarantine centres to support compliance with measures.

> *We were trained by experienced professionals from Butabika hospital [National mental health referral facility]. So, in situations where the quarantined persons were aggressive, we asked to reschedule meetings and talked to them when they were willing. We also had security just in case a traveller became violent, but this never happened. We sought advice from colleagues and discussed among ourselves the most tricky situations for solutions.* (Counsellor)

> *The hotel provided everything that I needed including masks and aprons, and during the COVID-19 lockdown, I was accommodated within the premises. It is only recently that I started going back home after work.* (Hotel service personnel)
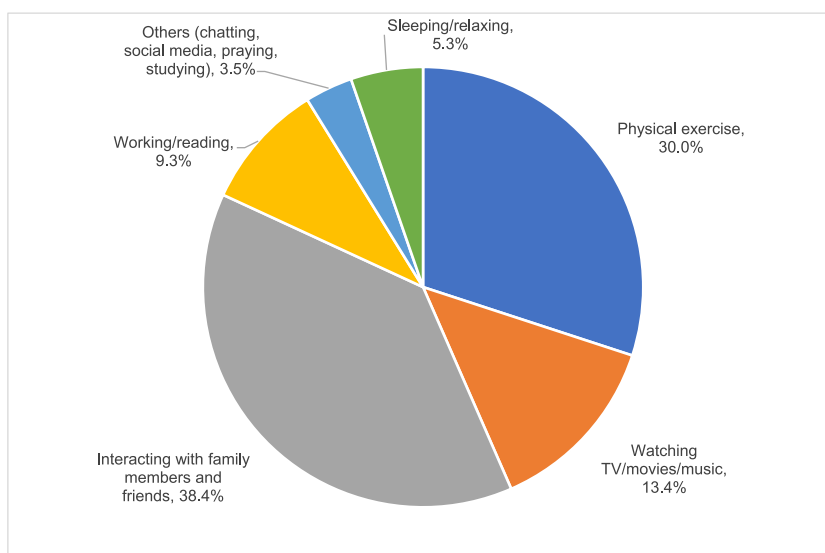
Fig. 2. Coping measures among quarantined persons in institutions in Uganda.

4.2. Challenges

The quarantine guidelines were not widely disseminated to stakeholders and the preparatory activities and monitoring of facilities had gaps. Key informants reported that the turnaround time for test results was long, leading to extended stays at facilities. There were also no designated health facilities to provide health care to the quarantined persons in case of need.

"This [long turnaround time for results] has grossly affected the time travellers stay in quarantine sites. Some people are staying for 16, 17 or 18 days waiting for their results before they are discharged and yet travellers are paying for their stay … This is expensive." (Medical Officer)

"There are no facilities to care for the COVID-19 quarantined persons. Recently we had a case of a traveller who needed dental services and we moved from several private health facilities to the national referral hospital and back to private ones. Later after a few days, the person was found to have COVID-19 and we had to quarantine all health workers who got into contact with the traveller." (Medical Officer)

PPE including masks and gloves, as well as screening equipment such as temperature guns were inadequate. The MOH personnel also reported transport challenges in supporting the quarantine process, and they had a high workload necessitating extended hours.

We were invited by the Ministry of Tourism to the COVID-19 task force to share experiences and learn from what other quarantine facilities were doing. We were just sharing experiences on prevention. There was no training, no PPEs and we had to train our staff afterwards. (Hotel manager)

5. Discussion

This study explored compliance with COVID-19 measures among actors and lessons in the management of institutional quarantine in Uganda. Compliance varied for many measures by the quarantine facility and MOH. The study established that 65 % of individuals in institutional quarantine complied with at least 80 % of the COVID-19 prevention and control measures. The factors associated with compliance to measures at the individual level were older age (above 40 years), spending 14–15 days in institutional quarantine, being quarantined in a public facility, and reporting a high MOH compliance to measures. The study also highlights successes and challenges in preparing quarantine centres, COVID-19 testing, linkage to health services, coordination of the quarantine process, compliance with measures, and the MOH personnel welfare.

For quarantine facilities, there was high compliance with MOH requirement of providing personal toilets requirements and, at least three meals and drinking water. However, little attention was paid to providing bin liners for disposing of waste within rooms possibly because hotel personnel collected most waste from the rooms. The lack of separate toilet and hygiene facilities was reported for public quarantine centres where these were shared. MOH complied with issuing completion certificates and COVID-19 sample collection as these were usually required before the discharge of individuals from quarantine centres. There was however low compliance with blood pressure and blood sugar monitoring for hypertensive and diabetic patients and the provision of psychosocial support. For individuals, there was high compliance with washing hands regularly which could have been influenced by the high knowledge levels recorded in the study. Most quarantined persons also reported wearing a face mask whenever they were leaving their rooms possibly

Table 4

Summary of what went well and gaps in the institutional quarantine.

Sub-themes	Successes	Challenges
Preparation of Quarantine centres	• MOH provided guidelines for management of the quarantine process including requirements of quarantine facilities and quarantined persons. • MOH inspected selected facilities and conducted training for their personnel. • MOH trained personnel including laboratory technicians, counsellors, surveillance officers and contact tracers, among others.	• Some quarantine facilities and quarantined persons were unaware of the guidelines. • Some quarantine facilities did not receive advance inspection and their personnel were not trained. • Monitoring of quarantine facilities and their supervision was minimal. • Limited preparation of persons to be quarantined regarding expectations and measures to comply with.
COVID-19 testing	• Sample collection team was available to collect samples from quarantine centres. • Streamlined laboratory systems that integrated COVID-19 test results across laboratories and provided access to results to Surveillance Officers in charge of quarantine facilities reduced delays in obtaining results. • All quarantined persons were able to obtain a COVID-19 test before discharge and were provided with a certificate. Quarantine facility personnel and security were frequently tested for COVID-19.	• The turnaround time for results was long and delays in obtaining test results led to extended quarantine periods. • Data entry errors occurred in the names and other variables including test details at the start of the quarantine intervention.
Linkage to health services for the quarantined	• Ambulance services were available to transport quarantined persons to access health care.	• Lack of designated health facilities for quarantined persons and most facilities being unwilling to offer services to those quarantined.
Coordination of the quarantine process	• Responsiveness of MOH to resolve issues arising from quarantine such as extension of quarantine days. • Some hotels provided their personnel with sufficient PPE. • Some quarantine facilities and security personnel were accommodated within the same facilities reducing their contact with the public.	• Stigma of the quarantined persons and facilities by the local community and the general public. • Communication gaps among stakeholders including MOH with quarantined persons and hotels including changes in quarantine protocol. • Insufficient PPE including masks and gloves such as for the sample collection teams. • Inadequacies of other equipment including temperature guns, sanitisers, and gloves. • Poor coordination of data collection and poor tracking of quarantined persons. • Transport challenges experienced by MOH personnel including surveillance officers, contact tracers and sample collection teams in supporting quarantine process.
Compliance with measures	• Army and police provided security and ensured compliance with measures in quarantine.	• Low willingness to comply with quarantine measures among the quarantined persons. • Quarantine facilities' failure or unwillingness to comply with all required measures.
MOH personnel welfare	• High passion and dedication to conduct their roles and responsibilities in surveillance and contact tracing. • MOH regularly incentivised their personnel with non-financial incentives such as meals, milk, and sugar which motivated them.	• Lack of central accommodation for MOH personnel who were engaged in the quarantine and contact tracing roles who continued to interface with their families and the public. • Low facilitation for work and delays in its allowances affected morale and motivation. • High workload and extended working hours for the MOH personnel including surveillance officers, contract tracers, and laboratory personnel.

due to the enforcement of this by the security at the centres. However, compliance with covering the nose and mouth while coughing or sneezing was low.

In this study, compliance with measures by individuals was moderate at 65 %. In previous infectious disease outbreaks, compliance with quarantine ranged from 0 to 92.8 % [8]. The factors associated with compliance with COVID-19 quarantine guidelines were older age, fewer days spent in quarantine, being quarantined in a public facility, and reporting a high MOH compliance. The association with older age could have been explained by their high susceptibility to COVID-19 as emphasized at the beginning of the pandemic. Age variations in compliance with COVID-19 quarantine measures have been reported elsewhere in the USA [24], China [25], Pakistan [26] and Ecuador [27]. Previous research has shown that a person's knowledge about COVID-19 including its transmission and symptoms, quarantine protocols, perceived risk of the disease and benefits of quarantine increased the likelihood of compliance with the measure [8,28]. In this study, however, we did not find an association between knowledge and compliance with measures. On average, most persons stayed in quarantine for more than the MOH-prescribed 14 days and we found that those who left within this time reported higher compliance to measures. The reasons for the extended stay in quarantine centres such as delays in testing, providing test results or discovery of new cases could have created frustration and dissatisfaction among individuals affecting their compliance with measures. Indeed, in our earlier study, longer days spent in quarantine was a key determinant of negative quarantine experience also influenced by the compounding quarantine costs [29]. Compliance was notably higher among those who were in public than private quarantine facilities which could have been due to the stricter enforcement of measures by security personnel in the

former. In this study, we found that compliance with quarantine measures at the individual level was higher for those who thought MOH also had high compliance to measures. This corroborated our earlier study findings that compliance to COVID-19 prevention and control measures by authorities, quarantine facility and other individuals influenced an individual's quarantine experience [29]. This places the onus on authorities to lead by example and spur confidence in individuals to comply to measures accordingly. The counter-intuitive finding that individuals who thought they were at risk of contracting COVID-19 from the centres had a significantly lower compliance to measures requires further exploration.

Regarding the management of the quarantine process, several successes, and challenges were spelt out. By putting in place guidelines early, MOH facilitated the quarantine process. However, efforts were needed to ensure the effective implementation of these guidelines. For successful quarantine management, there is a need to ensure that guidelines are put in place early, through a consultative process, and widely disseminated to all stakeholders with their roles and responsibilities clearly highlighted. Other factors that needed further emphasis in the planning and management of institutional quarantine include sufficient training of personnel, regular inspection and supervision of facilities and provision of PPE. Issues of turnaround time and discharge protocol were a challenge at the start of the quarantine process and mechanisms are needed to ensure that capacity is built to support the quick discharge of individuals to avoid impacting their psychological health [7,11]. Country authorities should also establish a clear mechanism for implementation, monitoring, and evaluation of quarantine guidelines to support quick feedback loops, action, and continuous improvement. It is also important for authorities to plan for access to healthcare for the quarantined to ease linking them to services as appropriate within the country's health system and ensure that sufficient protections are in place for health workers who would handle such cases. Logistical and human resource challenges also deserve attention to ease the work of responders and quarantine personnel to lessen the toll of their work on them. Beyond enforcement of measures by security agencies in quarantine, equal efforts are required by the health authorities in education and sharing information with those in quarantine to drive compliance with measures.

This study assessed compliance to quarantine measures across several actors unlike previous studies that focus only on quarantined individuals. This study was conducted after participants had left quarantine and we requested them to recall their experience in institutional quarantine centres. Because this could be subject to recall bias, we called study participants soon after they left quarantine. The other likely bias is social desirability as individuals were requested to report on their behaviours as these could not be observed. With awareness about the expected behaviour, some may have overstated the ideal and underreported the negative. We however reminded participants during interviews that the information was for research purposes and encouraged them to provide an accurate account. The study participants were mostly international travellers housed within quarantine centres in the capital city and major urban areas. Therefore, their characteristics such as literacy, conduct and experience may be different from those in other quarantine centres in the country, limiting generalisability. The collection of both quantitative and qualitative data also supported triangulation of the responses and informed concrete recommendations. Overall, this study contributes vital information that could support improvements in institutional quarantine for COVID-19 and other pandemics.

6. Conclusions

Compliance with measures by the quarantine facility, ministry of health and individuals varied. Among individuals in institutional quarantine, compliance was moderate with higher compliance predicted by older age, spending the stipulated days in institutional quarantine, being quarantined in a public facility, and reporting a high MOH compliance to measures. Efforts to improve training, supervision and inspection of quarantine facilities, and provision of adequate PPE would go a long way in improving quarantine compliance. There is also a need to ensure a streamlined discharge protocol including a shortened turnaround time for results.

Declarations

Data availability statement

The data underlying this article cannot be shared publicly due to the privacy of individuals that participated in the study. The data has not been deposited on into a publicly available repository but will be shared on reasonable request to the corresponding author.

CRediT authorship contribution statement

Rawlance Ndejjo: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Ronald Tibiita:** Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation. **Gloria Naggayi:** Writing – review & editing, Methodology, Investigation, Formal analysis, Data curation. **Richard Mugahi:** Writing – review & editing, Methodology, Investigation, Data curation, Conceptualization. **Simon P.S. Kibira:** Writing – review & editing, Supervision, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: RN, GN and RT spent time in institutional quarantine at the start of the COVID-19 restrictions in Uganda in March 2020.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.heliyon.2024.e24841.

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