Cost effectiveness and decision analysis for evaluation of the national airport screening options in COVID-19 surveillance in Uganda, 2020

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Executive Summary

Early during the COVID-19 outbreak, various approaches were utilized around the world to preventing introduction of COVID-19 from incoming airport travellers. However, the costs and effectiveness of airport-specific interventions had not been evaluated. We evaluated different policy options for COVID-19-specific interventions at Entebbe International Airport to inform decision-making in future similar situations. Screening all incoming travellers for symptoms, testing symptomatic persons, and isolating positives (Option 2) was the most cost-effective option for airport interventions against COVID-19. Higher prevalence of infection among incoming travellers increased cost-effectiveness of airport-specific interventions. This model may be used to evaluate prevention options at the airport for COVID-19 and other diseases with similar requirements for control.

Introduction

The increase in global air travel provides countless opportunities for infections to spread, both to passengers on the plane and also to the community after arrival (1). Since the advent of the SARS-CoV-2 pandemic, multiple interventions were employed in countries around the world to limit or slow the introduction of SARS-CoV-2 by air travellers from highly-affected areas. These approaches included obligatory quarantine policies for travellers, and border closures, and instituted local or national lockdowns (2). These strategies have varied across nations, with varied levels of sustainability, consideration of the resources of health care systems, and acceptability to the community (3). While no country has succeeded in maintaining

an entirely COVID-19-free state, interventions aimed at travellers (2) almost certainly managed to delay or reduce the impact of the epidemic in multiple countries (3, 5).

Uganda has a single large international airport (Entebbe International Airport (EBB)) through which the vast majority of international air travel occurs in the country. Although its three smaller domestic airports do receive a few short-range flights from nearby neighbouring countries, 63% of incoming international travellers entering Uganda enter through EBB.

Since the early case of COVID was reported in Uganda on February 2020, a number of control measures were implemented at the airport such as IPC, installed hand sanitizer stations, queue separators to keep people from crowding while they waited. In addition, the MoH did risk mitigation by mapping out travellers from high at-risk countries, this managed to reduce and contain the disease, however with unlimited traveling through other points of entries, the cases kept increasing.

COVID-19 will cease to be a travel-associated threat once vaccines become widely available and used. However, future epidemics during which airport-specific interventions will again become relevant are all but certain: screening for Ebola Virus Disease was still in place at EBB when COVID-19 screening began in February 2020. Despite this, there have been relatively few studies on the cost-effectiveness of preventive interventions for COVID-19. We compared the cost-effectiveness of different policy options for COVID-19-specific interventions at EBB to guide decision-making by national stakeholders during this and future epidemics.

Context and importance of the problem

Policy Option 1: No intervention. Under this policy, there is no screening at the airport and no quarantine or isolation associated with persons entering at the airport. Incoming travellers may require isolation or quarantine, but not through any program affiliated with the airport. This is what would occur in the absence of a public health threat, where a proportion of incoming travellers might be ill and seek diagnosis or treatment at their own expense.

Policy Option 2: Mandatory symptom screening for all, testing only the symptomatic. Under this policy, all persons would be screened at the airport for symptoms consistent with COVID-19 disease (with the prevalence of symptomatic person's dependent on the array of symptoms chosen for screening). Any incoming travellers identified as symptomatic would undergo required testing and persons testing positive would require isolation.

Policy Option 3: Mandatory quarantine for all, symptom screening testing for all, and Isolating the positives. Under this policy, all incoming travellers would undergo institutional quarantine for 14 days, there would be close symptom monitoring/follow up then testing would be done, if a person turns out positive, they would be transferred to an isolation unit.

Outcomes

The primary outcome measured was the incremental cost-effectiveness ratio (ICER) per COVID-19 case prevented. Secondary outcomes included expected value per incoming traveller at EBB, cases identified through the airport programme, cases that end up in the community, case counts after a single generation of cases from infected travellers entering the community, and the average costs per estimated traveller for each policy option.

Methods

We used a multiple criteria decision analysis to compare three different airport interventions for costs and impact on case counts over a two-week time horizon, with the primary outcome of cost per case averted. We took the government perspective.

Results

At a prevalence of 5% for COVID-19 among the incoming travellers, a total of 3,375, cases go through airport (for each of the option), a total of 1,369 will be identified by policy option 2, and 2,363 for policy option 3, a total of 12,150 1st generation cases will be identified for option 1; 5,722 for option 2 and 3,195 for option 3. After decision

tree analysis, the expected value for undertaking policy option 2, was $ 24, policy option 3 was $ 856 per person traveller going through the airport (Table 2)

Table 2: Cost effective analysis for the three policy options for the airport screening 2020, Uganda

Outcome	Option 1: No Screening No Testing	Option 2: Mandatory symptom screening for all, testing only the symptomatic	Option 3: Mandatory quarantine and Testing for all
Cases that come in through airport	3375	3375	3375
Cases identified through the airport Program		1,369	2,363
Infected who end up in the community		2,006	1,013
Number of 1st generation cases	12,150	5,722	3,195
Expected value	-	$24	$856
Total Costs (US$)		$1,585,159	$58,417,300
IC		$1,585,159	$58,417,300
Cases averted	----	6,428	8,955
ICER cost/case averted*	----	$247	$6,524
Average cost		$277	$18,281

ICER: Incremental cost-effectiveness ratio, ICER = (Costs2-Costs1)/(Effectiveness2-Effectiveness1).

While comparing option 2 & 3 to option 1(no airport screening & testing), a total of 5,722 1st generation cases were identified with option 2, and 3,195 with option 3. Option 2 helped in averting a total of 6,428, cases and option 3 a total of 8,955 cases. The total cost for implementation of this option 2 was $1,585,159 for option 3 Intervention was $58,417,300 option 2 resulted in an Incremental cost-effectiveness of $247 per case averted, option 3 $6,524 per case averted.

The average cost for each person undertaking option 2 and option 3 were $ 277 and $18,281 respectively (Table 2)

Policy Implications

First, the varying costs of testing, and the increase in the prevalence of COVID-19 could influence the cost-effectiveness ratio of with option 2 in this study. A study (quilty, B) showed that the effectiveness of entry screening is largely dependent on the effectiveness of the exit screening in place, could only detect 53 (95% CI: 35–72) instead of ninety infected travellers if no exit screening was in place, in addition, the wider use of Option2 in COVID-19 detection is an adopted national strategy, setting an appropriate and effective screening is a necessary first step.

Second, the wider use of Option 2 needs to be discussed in conjunction with ethical considerations, such as consequences of incorrect results (e.g., false positives), airport screening protocol violation, whether or not to use is it as single strategy will need to be supplemented by these measures like recordkeeping to aid contact tracing, risk communication for this policy option to be effective

Critique of policy options

The World Health Organization through the International Health Regulations (IHR) recommends strengthening capacities to detect, assess, notify, and report events (4). This requires a surveillance system in place to collect information which Uganda has already developed. Additionally, the regulation requires the country to have prompt mechanisms to quickly detect surges or disease outbreaks which is still weak due to the slow analysis of all surveillance data.

Policy recommendations

This study was a step towards determining associated costs of controlling disease outbreak, therefore, implementation of mandatory symptom screening for all, testing only the symptomatic incoming travellers' strategy should be prioritized. Nevertheless, any future respiratory infectious disease outbreak caused by SARS-COV-2 or any unknown respiratory pathogen, will likely require similar control measures.

References

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