

Coronavirus Pandemic

Assessing the capacity to implement the international health regulations to control COVID-19 at points of entry in Eswatini

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Abstract

Introduction: Significant challenges to implementing international health regulations (IHR) at points of entry (PoEs) have been highlighted by the coronavirus disease 2019 (COVID-19) pandemic. Better assessment of the capacities of the PoEs may promote focused interventions. This study aimed to assess the capacities and practices at PoEs.

Methodology: A self-filled questionnaire based on the World Health Organization (WHO) Joint External Evaluation Tool was distributed to frontline workers at four major PoEs. A total of 368 questionnaires were distributed and 308 were completed. Online interviews were conducted with key informants (n = 16). The capacity of PoE was scored by referencing the WHO checklist for core capacity requirement, and categorized into limited, partial, or full capacity. Pearson's Chi square test was used to compare differences among PoEs. Qualitative data was thematically analyzed.

Results: The majority of the 308 participants in the survey were from Ngwenya (59.4%). Approximately 68% were government employees, and 81% had more than 2 years of experience. Participants reported shortage of resources, such as medical facility (30.5%), staff (37.7%), gloves (47.7%), masks (48.4%), and isolation room; and inconsistencies in practices such as record keeping, reporting cases, and quarantine measures. The overall capacity for IHR implementation was limited, with the airport PoE showing partial capacity and the three ground PoEs having limited capacity.

Conclusions: The capacity to implement the IHR at Eswatini PoEs was limited. The results suggest the need to allocate resources to PoEs and to enhance training on practices regarding case handling, reporting, and record keeping.

Key words: COVID-19; IHR 2005; implementation; point of entry; World Health Organization.

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Introduction

Infectious diseases are a growing global concern that continuously affect the world due to population mobility. These diseases know no boundaries and can spread rapidly, underscoring the importance of health and security. Countries are increasingly interconnected and interdependent as a result of the highly mobile world and this facilitates the rapid spread of infectious diseases [1]. The novel coronavirus disease 2019 (COVID-19) pandemic has had an unprecedented global impact on all cross-border travel, with significant public health and economic effects. According to the World Health Organization (WHO), over 100 million cases and 2 million deaths have been reported worldwide as of 2021 [2]. The novel coronavirus disease 2019 (COVID-19) pandemic has brought a negative impact on all cross-border travel, and the public health and economic effects have been unprecedented relative to other emerging infectious

diseases [3]. The novel virus was first detected in December 2019, in Wuhan, China; and subsequently spread globally, leading to fatalities. COVID-19 is characterized by fever, dry cough, malaise, fatigue, shortness of breath, weakness, and dyspnea. Global concern about the emerging virus has been greatly escalated because of its extraordinary capacity for rapid transmission through contact with contaminated individuals [4].

International health regulation (IHR) is a legal binding instrument designed to improve global health security to prevent the cross-border spread of infectious diseases in 196 countries of which 194 are WHO member states [5]. The WHO member states are obligated to implement IHR, since they are signatories to the IHR and are expected to respond immediately and effectively to any public health emergency of international concern (PHEIC) [2]. WHO declared COVID-19 as a PHEIC on 30 January 2020 [6]. The

IHR aims to prevent, safeguard, control, and protect public health against the worldwide spread of sickness; while preventing superfluous obstruction of global traffic and trade [7]. The IHR have implemented a global surveillance and reporting system to control infectious diseases, by establishing national mandatory controls to prevent disease and placing limits on individual rights, state sovereignty, and commercial interests [8].

IHR core capacities at points of entry (PoEs)

According to WHO, implementation of IHR is a lengthy process that calls for nations to develop and strengthen specific national public health capacities, identify priority areas for action, and strengthen them as needed over time at PoEs [9].

Several studies showed that countries with better implementation of IHR have in general lower incidence and mortality rates of COVID-19 and that the importation of infections can be prevented by screening at PoEs [10]. Simultaneously, another study pointed out that lack of pandemic preparedness, including shortage of personal protective equipment (PPE), enforcing social distancing, and staff shortage, were some of the challenges faced by countries in implementing IHR during the COVID-19 pandemic. Another study revealed that IHR implementation needs to become a priority at the highest level of government and be placed in the context of building a strong health system in an approach that is backed by the government to improve its compliance [11,12].

A review on potential technological strategies to control the COVID-19 pandemic stated that IHR is an important tool in public health interventions, especially during health emergencies; but most countries faced limitations in its implementation during the COVID-19 pandemic. Strengthening the Global Health Security Strategy, updating the IHR to meet current challenges, and strengthening the commitment of countries and governments to adhere to its resolutions are key lessons [13]. Furthermore, a report on lessons learned and recommendations for any future pandemic defined the healthcare system as an area that calls for more investment to reduce health system disparities, strengthen national health, and strengthen cross-border health cooperation by introducing surveillance plans on emerging health threats and legislation on new health threats [14].

Operations at PoEs in Eswatini during COVID-19

Eswatini employed preventive measures on COVID-19 since February 2021, with the

implementation of COVID-19 Regulations 2020. These regulations stated that all citizens returning to the country were allowed to test at PoEs (only those with medical facilities onsite) using antigen-detecting rapid diagnostic tests (Ag-RDTs); whereas the other travelers, except for returning Swazis, were required to produce reverse transcription polymerase chain reaction (RT-PCR) test results that were not older than 72 hours. Travelers with severe symptoms were transported by emergency medical services to COVID-19 treatment sites, whereas those with mild symptoms were advised to adhere to strict COVID-19 precautions [15]. It is questionable whether Eswatini PoEs were compliant with these regulations as significant challenges to the global implementation of the IHR at PoEs became evident during the COVID-19 pandemic. Given its high-risk status and as an IHR signatory, Eswatini faced difficulties in complying with these regulations because of limited capacity, resource constraints, and institutional factors. Despite the vital role PoEs played in preventing the spread of infectious diseases, there were shortcomings in IHR core capacities at these PoEs in Eswatini. Better appreciation and assessment of the problem would help in identifying faults in the current system, enhance public health responses to COVID-19 and other public health emergencies of international concern that may emerge in the future, promote the creation of focused interventions, and advance IHR implementation at PoEs in Eswatini.

Therefore, this study was conducted to (i) assess the capacities and practices among frontline workers at designated PoEs, (ii) assess the resources allocated for COVID-19 control and prevention among managers at PoEs, and (iii) describe institutional factors associated with the implementation of IHR core capacities. The result may provide a basis for better implementation of the recommendations of IHR 2005 in countries with limited resources [7].

Methodology

Study design and setting

The study took place at 4 designated PoEs, from each administrative region of Eswatini (Ngwenya, Lavumisa, and Lomahasha border posts; and the major airport, King Mswati III International Airport (KMIII)). These PoEs were operational during the country's partial lockdown and are considered major PoEs for these administrative regions.

A cross-sectional study utilizing a mixed-method approach was used. The quantitative part was a self-filled paper questionnaire-based survey targeting PoE

frontline workers from all stakeholders [Eswatini Revenue Services (ERS); Ministry of Home Affairs (MoHA); Royal Eswatini Police Services (REPS); Ministry of Health (MoH); and Tourism, Agriculture, and Cleaning Agents]. The questionnaire and interview guide were developed based on a conceptual framework developed for emerging infectious diseases (EID) preparedness where some questions were adopted from the WHO Joint External Evaluation Tool and others from published papers that we reviewed. The study targeted all frontline workers who were more than 18 years old, had completed high school education, and had at least 1 year of work experience; 308/368 participated in the survey.

The qualitative part of the survey was done through online interviews with PoE managers /heads of departments from key stakeholders (ERS, MoHA, REPS, and MoH) who had at least 1 year of work experience.

Quantitative measurements and data analysis

The questionnaire was organized according to a framework, and most of the questions were adopted from previously published papers and the WHO Joint External Evaluation Tool [16–20].

The conceptual framework consisted of 6 core constructs, 4 of which formed the hardware and 2 formed the software part. The hardware focused on material resources and structures, including surveillance, workforce, infrastructure and supplies, and communication mechanisms. The software part focused on human and institutional relationships, that direct behavior and support interactions between system actors and constituent elements (governance and trust) [16]. The questionnaire contained 4 sections: socio-demographic characteristics of the participants, perceived PoE capacities, resources and practices, and trust and governance. The questionnaire was pretested at the Matsamo Border on 21 frontline workers from all departments. A Likert scale was used, the responses indicating compliance with the IHR were coded as “1” and the non-compliant responses as “0”. For example, for the question “does your designated PoE have adequate staff to allow the prompt assessment and care of ill travelers”, the desirable answer was “yes”. In the case of questions with ‘yes’, ‘no’, and ‘I don’t know’ responses, “yes” was coded as “1” and “no”/“I don’t know” were coded as “0” [19]. The overall implementation of IHR was scored by summing up the responses from frontline workers. This score was compared with the WHO “checklist for core capacity requirements for designated airports, ports and ground

crossings” and the PoE’s capacity was categorized into “limited capacity = score < 50%” (0 points), “partial capacity score = 50–80%” (0.5 points), and “full capacity = score > 80%” (1 point) [2]. In the case of the score on whether it was possible to keep a safe distance at one PoE, zero points were assigned if less than 50% of workers answered positively. Measures of frequency and percentage were used to analyze socio-demographics. Pearson’s Chi square was used to test for significant differences and identify institutional factors associated with IHR. All inferential tests were rendered statistically significant at a *p* value of ≤ 0.05 . Data was analyzed using STATA V15 (StataCorp LLC, College Station, TX, USA).

Qualitative analysis

The key informants were purposefully selected for online interviews using an interview guide which was based on the framework and the WHO Joint External Evaluation Tool as described above [20]. Audio recorded data was transcribed verbatim, codes were created, reviewed, and combined into themes that were organized according to the sections of the interview guide using NVivo 12 (Lumivero, Denver, CO, USA). The results were reported thematically with occasional participants’ quotations.

Ethical considerations

This study was approved by the Eswatini Health and Human Research Review Board with protocol reference number; EHHRRB043/2021, dated 18 August 2021. Written and verbal consent was obtained from all participants.

Results

Participants

A total of 308 (out of 368 contacted) frontline workers filled out the questionnaires, with an overall response rate of 78.3 % (Ngwenya 95.3%, Lavumisa 75%, Lomahasha 88.6%, and KMIII 54.4%) for the quantitative part and 88.8 % for a qualitative part (Table 1). A fairly large proportion of respondents were from Ngwenya (59.4%). Nearly 67% (207/308) were aged below 40 years, and half of the respondents were females (50.3%). Roughly 51% had undergraduate degrees and 67.5% were government employees who mostly worked for MoH, MoHA, REPS, and Agriculture. Many had more than 5 years of working experience (54.9%), and mostly (62.3%) worked indoors and in close contact with travelers (Table 2).

Table 1. Number of key informants per department and response rates from each point of entry (PoE).

PoE department	PoE			
	Ngwenya n (%)	King Mswati III int. airport n (%)	Lavumisa n (%)	Lomahasha n (%)
Ministry of Health	2 (100)	2 (100)	1 (100)	1 (100)
Ministry of Home Affairs	1 (100)	1 (100)	1 (100)	1 (100)
Eswatini Revenue Services	1 (100)	1 (100)	1 (100)	1 (100)
Royal Eswatini Police Services	1 (100)	0 (0)	0 (0)	1 (100)
Response rate	5/5 (100%)	4/5 (80%)	3/4 (75%)	4/4 (100%)
Overall response rate	88.8%			

IHR core capacities for designated PoEs

On-site medical facilities were reported at KMIII and Ngwenya, while the others used nearby government health facilities. Most (90.3%) at KMIII and about half (53.0%) at Ngwenya reported that there was adequate staff (Table 3). When asked about reporting COVID-19 cases, most (75.3%) respondents indicated that there

Table 2. Socio-demographic characteristics of participants (N = 308).

Variable	n	%
PoE		
KMIII	31	10.06
Lavumisa	63	20.45
Ngwenya	183	59.42
Lomahasha	31	10.06
Age (years)		
< 40	207	67.21
≥ 40	101	32.79
Gender		
Male	153	49.68
Female	155	50.32
Religion		
Christianity	297	96.43
Other	11	3.57
Education		
Basic education	151	49.03
Undergraduate	157	50.97
Employer		
Government	208	67.53
Non-government	100	32.47
Department		
Agri	32	10.39
ERS	98	31.82
MoH	32	10.39
MoHA	98	31.82
REPS	45	14.61
Tourism	3	0.97
Position		
Ordinary officer	268	87.01
Supervisor	40	12.99
Length of service		
< 2 Years	58	18.83
2–5 Years	81	26.30
> 5 Years	169	54.87
Close contact		
Always	200	64.94
Often	49	15.91
Sometimes	44	14.29
Rarely	10	3.25
Never	5	1.62
Work		
Indoor	192	62.34
Outdoor	116	37.66

Agri: agriculture; ERS: Eswatini Revenue Services; KMIII: King Mswati III international airport; MoH: Ministry of Health; MoHA: Ministry of Home Affairs; PoE: point of entry; REPS: Royal Eswatini Police Services.

was no referral system, and many (46.4%) did not keep records of travelers with suspected/confirmed COVID-19; and 45.1% stated that there were no quarantine spaces. 184 respondents said travelers waited for less than 6 hours before being transferred to a medical facility, and the airport was the PoE with the most resources.

These responses were confirmed by interviews. The interviewees stated that the government was in the process of putting a system in place by constructing on-site clinics and deploying health professionals and transport with emergency medical services (EMS). Examples of the responses that varied according to sites are:

“There is a tent where all travelers from high-risk countries are first attended before going into the main arrival hall. If there is a suspect of COVID-19, he/she is referred to the health department where there are qualified health practitioners including nurses” (Key Informant 4, Airport).

“Here at the border, we do not have enough trained staff, equipment, and even isolation rooms as stipulated in the IHR” (Key Informant 13, Ngwenya).

Resources and practices

The PoEs had varied practices in terms of wearing masks, washing hands, and having a barrier (Table 4). For example, only a minority of Lomahasha workers reported that they had access to PPEs like gloves (16.1%) and N95 masks (0%); however, a high percentage reported practicing good hygiene; using sanitizers; and received training on fitting, use, and disposal of PPE. Therefore, some practices could be enforced under resource limitations. On the other hand, airport workers reported having enough gloves (48.4%), but they did not always have good practices such as training on identifying ill travelers (35.5%) and advising travelers to self-isolate (9.7%).

Key informants reported differently on the availability of PPEs

Some of the responses from the key informants are as follows:

“That’s a challenge because some PPE like masks we buy for ourselves; its only sanitizer that we requisition but we do have them in bulk” (Key Informant 12, Ngwenya).

The informants also mentioned somewhat inconsistent practices of screening travelers, and varying degrees of compliance to good practices like cleaning, washing hands, social distancing, and disinfection, after a confirmed case. There was shift staggering and temporary closure. Most informants thought that the government had good policies to curb the COVID-19 spread, but the conditions may make compliance difficult.

“I think Eswatini has policies that are good but the problems lie within each individual. Some people are failing to comply with what the government is saying” (Key Informant 7, Airport).

Trust and governance

Regarding the government’s coordination and policies, 20% respondents disagreed or strongly disagreed that COVID-19 prevention was well-coordinated and there were good policies to curb the spread; although 40% were neutral (Table 5). This is reflected in the question on trust, and about half of the respondents said that they trusted the government.

Table 3. Responses on comparisons of capacities of International Health Regulations (IHR) per point of entry (PoE).

Variable	Total (%)	PoE				p value
		KMIII n (%)	Lavumisa n (%)	Ngwenya n (%)	Lomahasha n (%)	
	308 (100)	31(10.06)	63(20.45)	183(59.42)	31(10.06)	
Medical facility						< 0.001**
Yes	294 (69.48)	31 (100)	0 (0.00)	183 (100)	0 (100)	
No	94 (30.52)	0 (0.00)	63 (100)	0 (0.00)	31 (100)	
I don’t know	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	
Adequate staff						< 0.001**
Yes	130 (42.21)	28 (90.32)	0 (0.00)	97 (53.01)	5 (16.13)	
No	116 (37.66)	3 (9.68)	63 (100.00)	36 (19.67)	14 (45.16)	
I don’t know	62 (20.13)	0 (0.00)	0 (0.00)	50 (27.32)	12 (38.71)	
Records keeping						< 0.001**
Yes	133 (43.18)	28 (90.32)	25 (39.68)	68 (37.16)	12 (38.71)	
No	143 (46.43)	3 (9.68)	31 (49.21)	92 (50.27)	17 (54.84)	
I don’t know	32 (10.39)	0 (0.00)	7 (11.11)	23 (12.57)	2 (6.45)	
Reporting cases						0.010*
Always	73 (23.70)	11 (35.48)	16 (25.40)	40 (21.86)	6 (19.35)	
Often	22 (7.14)	0 (0.00)	2 (3.17)	17 (9.29)	3 (9.68)	
Sometimes	100 (32.47)	8 (25.81)	18 (28.57)	61(33.33)	13 (31.94)	
Rarely	60 (19.48)	6 (19.35)	7 (11.11)	44 (24.04)	3 (9.68)	
Never	53 (17.21)	6 (19.35)	20 (31.75)	21 (11.48)	6 (19.25)	
Resources						< 0.001**
Always	9 (2.92)	3 (9.68)	0 (0.00)	6 (3.28)	0 (0.00)	
Often	39 (12.66)	28 (90.32)	0 (0.00)	11 (6.01)	0 (0.00)	
Sometimes	95 (30.84)	0 (0.00)	9 (14.29)	80 (43.72)	6 (19.35)	
Rarely	76 (24.68)	0 (0.00)	16 (25.40)	59 (32.24)	1 (3.23)	
Never	89 (28.90)	0 (0.00)	38 (60.32)	27 (14.75)	24 (77.42)	
Referral system						0.001**
Yes	97 (31.49)	12 (38.71)	19 (30.16)	59 (32.24)	11 (35.48)	
No	232 (75.32)	0 (0.00)	25 (39.68)	51 (27.87)	24 (45.26)	
I don’t know	121 (39.29)	19 (61.29)	19 (30.16)	72 (39.34)	11 (35.48)	
Isolation room						0.217
Yes	2 (0.65)	0 (0.00)	0 (0.00)	2 (1.09)	0 (0.00)	
No	232 (75.32)	22 (70.97)	55 (87.30)	130 (71.04)	25 (80.64)	
I don’t know	74 (24.03)	9 (29.03)	8 (12.70)	51 (27.87)	6 (19.35)	
Safe environment						0.004*
Yes	276 (89.61)	31 (100.00)	48 (76.19)	167 (91.26)	30 (96.77)	
No	24 (7.79)	0 (0.00)	12 (19.05)	11 (6.01)	1 (3.23)	
I don’t know	8 (2.60)	0 (0.00)	3 (4.76)	5 (2.73)	0 (0.00)	
Quarantine						0.004*
Yes	81 (26.30)	15 (48.39)	16 (25.40)	43 (23.50)	7 (22.58)	
No	139 (45.13)	4 (12.90)	31 (49.21)	85 (46.45)	19 (61.29)	
I don’t know	88 (28.57)	12 (38.71)	16 (25.40)	55 (30.05)	5 (16.13)	
Waiting period						< 0.001**
< 6 hours	184 (59.74)	30 (96.77)	33 (52.38)	97 (53.01)	24 (77.42)	
6–12 hours	99 (32.14)	1 (3.23)	14 (22.22)	77 (42.08)	7 (22.58)	
12–24 hours	14 (4.55)	0 (0.00)	9 (14.29)	5 (2.73)	0 (0.00)	
> 24 hours	11 (3.57)	0 (0.00)	7 (11.11)	4 (2.19)	0 (0.00)	

**p value < 0.001; *p value < 0.05; KMIII, King Mswati III international airport.

Table 4. Resources and practices on the prevention of coronavirus disease 2019 (COVID-19) at each point of entry (PoE).

Variable	Total (%)	PoE				p value
		KMIII	Lavumisa	Ngwenya	Lomahasha	
	308	31 (10.06)	63 (20.45)	183 (59.42)	31 (10.06)	
COVID-19 Test						0.004**
No	67 (21.75)	5 (16.13)	25 (39.68)	31 (16.94)	6 (19.35)	
Yes (negative)	152 (49.35)	20 (64.52)	16 (25.40)	101 (55.19)	15 (48.39)	
Yes (pending)	3 (0.97)	1 (3.23)	1 (1.59)	2 (1.09)	0 (0.00)	
Yes (positive)	86 (27.92)	6 (19.35)	21 (33.33)	49 (26.78)	10 (32.26)	
Wearing of mask						< 0.001**
Always	139 (45.13)	23 (74.19)	18 (28.57)	88 (48.09)	10 (32.26)	
Often	60 (19.48)	6 (19.35)	10 (15.87)	34 (18.58)	10 (32.26)	
Sometimes	93 (30.19)	2 (6.45)	23 (36.51)	57 (31.15)	11 (35.48)	
Rarely	16 (5.19)	0 (0.00)	12 (19.05)	4 (2.19)	0 (0.00)	
Washing hands						0.081
Always	164 (53.25)	15 (48.39)	25 (39.68)	105 (57.38)	19 (61.29)	
Often	100 (32.47)	16 (51.61)	24 (38.10)	53 (28.96)	7 (22.58)	
Sometimes	37 (12.01)	0 (0.00)	11 (17.46)	22 (12.02)	5 (16.13)	
Rarely	6 (1.95)	0 (0.00)	3 (4.76)	3 (1.64)	0 (0.00)	
Never	1 (0.32)	0 (0.00)	0 (0.00)	1 (0.55)	0 (0.00)	
Safe distance						0.832
Always	119 (38.64)	8 (25.81)	28 (44.44)	71 (38.80)	12 (38.71)	
Often	100 (32.47)	11 (35.48)	19 (30.16)	61 (33.33)	9 (29.03)	
Sometimes	65 (21.10)	10 (32.26)	11 (17.46)	35 (19.13)	9 (29.03)	
Rarely	16 (5.19)	1 (3.23)	3 (4.76)	11 (6.01)	1 (3.23)	
Never	8 (2.60)	1 (3.23)	2 (3.17)	5 (2.73)	0 (0.00)	
Physical barrier						0.005*
Always	72 (23.38)	5 (16.13)	24 (38.10)	38 (20.77)	5 (16.13)	
Often	61 (19.81)	8 (25.81)	14 (22.22)	36 (19.67)	3 (9.68)	
Sometimes	55 (17.86)	5 (16.13)	8 (12.70)	35 (19.13)	7 (22.58)	
Rarely	33 (10.71)	8 (25.81)	4 (6.35)	20 (10.93)	1 (3.23)	
Never	87 (28.25)	5 (16.13)	13 (20.63)	54 (29.51)	15 (48.39)	
Having enough gloves						< 0.001**
Yes	88 (28.57)	15 (48.39)	19 (30.16)	49 (26.78)	5 (16.13)	
No	147 (47.73)	9 (29.03)	44 (69.84)	75 (40.98)	19 (61.29)	
I don't know	73 (23.70)	7 (22.58)	0 (0.00)	59 (32.24)	7 (22.58)	
Having enough masks						< 0.001**
Yes	100 (32.47)	19 (61.29)	18 (28.57)	58 (31.69)	5 (16.13)	
No	149 (48.38)	6 (19.35)	43 (68.25)	79 (43.17)	21 (67.74)	
I don't know	59 (19.16)	6 (19.35)	2 (3.17)	46 (25.14)	5 (16.13)	
Having enough N95 masks						< 0.001**
Yes	27 (8.77)	2 (6.45)	3 (4.76)	22 (12.02)	0 (0.00)	
No	186 (60.39)	14 (45.16)	58 (92.06)	90 (49.18)	24 (77.42)	
I don't know	95 (30.84)	15 (48.39)	2 (3.17)	71 (38.80)	7 (22.58)	
Having enough sanitizer						0.015*
Yes	277 (89.94)	29 (93.55)	53 (84.13)	164 (89.62)	31 (100)	
No	23 (7.47)	0 (0.00)	10 (15.87)	13 (6.01)	0 (0.00)	
I don't know	8 (2.60)	2 (6.45)	0 (0.00)	3 (1.64)	0 (0.00)	
Having enough face shield						< 0.001**
Yes	54 (17.53)	7 (22.58)	5 (7.94)	38 (20.77)	4 (12.90)	
No	166 (53.90)	8 (25.81)	56 (88.89)	80 (43.72)	22 (70.97)	
I don't know	88 (28.57)	16 (51.61)	2 (3.17)	65 (35.52)	5 (16.13)	
Having enough gown/aprons						< 0.001**
Yes	46 (14.94)	6 (19.35)	3 (4.76)	35 (19.13)	2 (6.45)	
No	168 (54.55)	8 (25.81)	57 (90.48)	81 (44.26)	22 (70.97)	
I don't know	94 (30.52)	17 (54.84)	3 (4.76)	67 (36.61)	7 (22.58)	
Having enough disinfectants						0.008
Yes	212 (68.83)	30 (96.77)	46 (73.02)	116 (63.39)	20 (64.52)	
No	37 (12.01)	0 (0.00)	7 (11.11)	28 (15.30)	2 (6.45)	
I don't know	59 (19.16)	1 (3.23)	10 (15.87)	39 (21.31)	9 (29.03)	
Training on fitting, use disposal						< 0.001**
Yes	172 (55.84)	12 (38.71)	17 (26.98)	115 (62.84)	28 (90.32)	
No	127 (41.23)	18 (58.06)	42 (66.67)	67 (36.61)	0 (0.00)	
I don't know	9 (2.92)	1 (3.23)	4 (6.35)	1 (0.55)	3 (9.68)	
Training on identifying cases						0.048*
Yes	129 (41.88)	11 (35.48)	28 (44.44)	79 (43.17)	11 (35.48)	
No	164 (53.25)	19 (61.29)	35 (55.56)	95 (51.91)	15 (48.39)	

I don't know	15 (4.87)	1 (3.23)	0 (0.00)	9 (4.92)	5 (16.13)	
Training on reporting case						< 0.001**
Yes	206 (66.88)	31 (100.00)	62 (98.41)	97 (53.01)	16 (51.61)	
No	92 (29.87)	0 (0.00)	0 (0.00)	79 (43.17)	13 (41.94)	
I don't know	10 (3.25)	0 (0.00)	1 (1.59)	7 (3.83)	2 (6.45)	
Training on handling cases						0.485
Yes	104 (33.77)	9 (29.03)	20 (31.75)	62 (33.88)	13 (41.94)	
No	190 (61.69)	22 (70.97)	40 (63.49)	113 (61.75)	15 (48.39)	
I don't know	14 (4.55)	0 (0.00)	3 (4.76)	8 (4.37)	3 (9.68)	
Availability of guidelines						0.136
Yes	99 (32.14)	11 (35.48)	18 (28.57)	55 (30.05)	15 (48.39)	
No	147 (47.73)	16 (51.61)	34 (53.97)	83 (45.16)	14 (45.16)	
I don't know	62 (20.13)	4 (12.90)	11 (17.46)	45 (24.59)	2 (6.45)	
Advice self-isolation						< 0.001**
Always	104 (33.77)	3 (9.68)	30 (47.62)	65 (35.52)	6 (19.35)	
Often	50 (16.23)	4 (12.90)	6 (9.52)	37 (20.22)	3 (9.68)	
Sometimes	55 (17.86)	2 (6.45)	7 (11.11)	38 (20.77)	8 (25.81)	
Rarely	36 (11.69)	16 (51.61)	2 (3.17)	15 (8.20)	3 (9.68)	
Never	63 (20.45)	6 (19.35)	1 (28.57)	28 (15.30)	11 (35.48)	
Frequency of cleaning						0.170
Yes	255 (82.79)	29 (93.55)	56 (88.89)	147 (80.33)	23 (74.19)	
No	40 (12.99)	2 (6.45)	7 (11.11)	25 (13.66)	6 (19.35)	
I don't know	13 (4.22)	0 (0.00)	0 (0.00)	11 (6.01)	2 (6.45)	
Belief						0.004*
Yes	150 (48.70)	22 (70.97)	35 (55.56)	77 (42.08)	16 (51.61)	
No	122 (39.61)	3 (9.68)	25 (39.68)	84 (45.90)	10 (32.26)	
I don't know	36 (11.9)	6 (19.35)	3 (4.76)	22 (12.02)	5 (16.13)	

**p value < 0.001; *p value < 0.05; KMIII, King Mswati III international airport.

Table 5. Participants' responses regarding governance and trust, comparison among points of entry (PoEs).

Variable	Total n (%)	PoE				p value
		KMIII n (%)	Lavumisa n (%)	Ngwenya n (%)	Lomahasha n (%)	
	308	31(10.06)	63(20.45)	183(59.42)	31(10.06)	
Coordination						< 0.001**
Strongly agree	14 (4.55)	0 (0.00)	4 (6.35)	7 (3.83)	3 (9.68)	
Agree	111 (36.04)	9 (29.03)	27 (42.86)	67 (36.61)	8 (25.81)	
Neutral	118 (38.31)	21 (67.74)	14 (22.22)	66 (36.07)	17 (54.84)	
Disagree	39 (12.66)	0 (0.00)	6 (9.52)	30 (16.39)	3 (9.68)	
Strongly disagree	26 (8.44)	1 (3.23)	12 (19.05)	13 (7.10)	0 (0.00)	
Good policy						0.024*
Strongly agree	4(1.30)	0 (0.00)	0 (0.00)	3 (1.64)	1 (3.23)	
Agree	91(29.55)	7 (22.58)	20 (31.75)	52 (28.42)	12 (38.71)	
Neutral	123 (39.94)	18 (58.06)	19 (30.16)	71 (38.80)	15 (48.39)	
Disagree	60 (19.48)	5 (16.13)	9 (14.29)	43 (23.50)	3 (9.68)	
Strongly disagree	30 (9.74)	1 (3.23)	15 (23.81)	14 (7.65)	0 (0.00)	
Trust travelers						< 0.001**
Yes	80 (25.97)	13 (41.94)	26 (41.27)	38 (20.77)	3 (9.68)	
No	181 (58.77)	12 (38.71)	25 (39.68)	116 (63.39)	28 (90.32)	
I don't know	47 (15.26)	6 (19.35)	12 (19.05)	29 (15.85)	0 (0.00)	
Trust government						< 0.001**
Yes	153 (49.68)	25 (80.65)	25 (39.68)	81 (44.26)	22 (70.97)	
No	122 (39.61)	3 (9.68)	38 (60.32)	79 (43.17)	2 (6.45)	
I don't know	33 (10.71)	3 (9.68)	0 (0.00)	23 (12.57)	7 (22.58)	
Trust management						0.003*
Yes	187 (60.71)	24 (77.42)	41 (65.08)	103 (56.28)	19 (61.29)	
No	88 (28.57)	2 (6.45)	22 (34.92)	60 (32.79)	4 (12.90)	
I don't know	33 (10.71)	5 (6.13)	0 (0.00)	20 (10.93)	8 (25.81)	

**p value < 0.001; *p value < 0.05; KMIII, King Mswati III international airport.

Table 6. Overall International Health Regulations (IHR) implementation score for each point of entry (PoE).

Capacity	Overall	KMIII	Lavumisa	Ngwenya	Lomahasha
Medical facility on-site	0.5	1	0	1	0
Adequate staff	0	1	0	0.5	0
Records keeping	0	1	0	0	0
Reporting cases	0.5	0.5	0.5	0.5	0.5
Resources (personnel, PPE, equipment)	0	1	0	0.5	0
Referral system (transport for ill travelers)	0	0	0	0	0
Availability of isolation rooms	0	0	0	0	0
Safe environment for travelers	1	1	0.5	1	1
Quarantine for suspect cases	0	0	0	0	0
Waiting period after diagnosis	1	1	0.5	1	1
Coordination	0	0	0.5	0	0
Dissemination of information	1	1	1	1	1
Always wearing PPE	1	1	1	1	1
Washing hands	1	1	1	1	1
Safe distance	1	1	1	1	1
Physical barrier	0.5	0.5	0.5	0.5	0
Having enough gloves	0	0	0	0	0
Having enough masks	1	1	1	1	0
Having enough N95 masks	0	0	0	0	0
Having enough gowns/aprons	0	0	0	0	0
Having enough face shields	0	0	0	0	0
Having enough sanitizers	1	1	1	1	1
Having enough disinfectants	0.5	1	0.5	0.5	0.5
Training on fitting, use, and disposal of PPE	0.5	0	0	0.5	1
Training on the identification of ill travelers	0	0	0	0	0
Training on handling cases	0	0	0	0	0
Training on reporting cases	0.5	1	1	0.5	0.5
Advice on self-isolation	0.5	0	0.5	0.5	0.5
Frequency of cleaning	1	1	1	1	0.5
Availability of Contingency plan, SOPs, guidelines	0	0	0	0	0
Total	12.5/30	16/30	11.5/30	14/30	10.5/30
Percentage	41.7	53.3	38.3	46.7	35.0
Category	LC	PC	LC	LC	LC

The analysis used World Health Organization (WHO) evaluation categories to indicate the capacity of each PoE; LC, limited capacity (score < 50%); PC, partial capacity (score 50–80%); full capacity (score > 80%). KMIII, King Mswati III international airport; PPE, personal protective equipment.

In addition, the majority stated that the government was getting first-hand information and COVID-19 updates; and a sizeable proportion of respondents trusted the government and management, particularly those from KMIII. However, there was less trust in travelers; roughly 59% did not trust travelers and Lomahasha had the highest percentage (90.3%) of respondents who did not trust the travelers.

Varied responses from workers were again observed during the interviews. Although some of these variations reflected individual differences in compliance; in general, it revealed the weakness at the institutional level. For example, in responses to the questions on standard operating procedures (SOPs) and guidelines for emergency contingency plans, some reported that SOPs were functional, while others said that they were under development. The respondents also had different opinions on how strictly the guidelines were followed. As for coordination among different stakeholders, most officers reported that it was good while a minority had some reservations.

“Mmm...yes there is coordination to a certain extent ...there is no time when I needed help and I was never assisted; they did assist in those ways they could. So, it’s not that good and it’s not bad, but in the middle” (Key Informant 10, Lomahasha).

Overall assessment of IHR implementation

The responses from each PoE were summarized into overall scales, which were categorized into limited, partial, and full implementation, based on WHO evaluation categories. The category of ‘limited capacity’ was a score of less than 50% and was assigned 0 point. The category ‘partial capacity’ received a score of 50–80%, and was assigned 0.5 point. Finally, the category ‘full capacity’ received a score > 80%, was assigned 1 point [2]. Our findings revealed that PoEs in Eswatini had limited capacity as the overall implementation of IHR at PoEs was limited (41.7%) for all the PoEs that participated in the study. This means that the capacity was in its developmental stage, as certain undertakings had been accomplished and some were still in progress [2]. Although, there were

variations among the PoEs analyzed, the airport had partial capacity (53.3%) and the ground crossing had limited capacity. Among the ground PoEs, Ngwenya, in terms of having capacities and resources, was better than Lavumisa and Lomahasha. Lomahasha had better practices compared with the other PoEs, despite the limited resources (Table 6).

Challenges faced by border staff

In addition to responding to the questionnaire, the key informants also provided their observations on the difficulties in implementing the IHR. These difficulties may be summarized into the following points: (1) Travelers used unlawful means to cross the border. Many officials from ground crossings reported that they received forged RT-PCR reports because tests were not affordable; and travelers used the informal crossings to evade examination, or even tried to bribe the border staff. An informant pointed out that ordinary people could not afford RT-PCR tests. (2) Exemption of truck drivers: Truck drivers were exempted from producing COVID-19-negative results. However, they traveled far, and had a high possibility of contracting COVID-19 and bringing it into the country. (3) Lack of communication: During the pandemic, stakeholder and bilateral meetings discussing administrative and operational issues were rarely held because of the compliance with COVID-19 regulations and national guidelines provided by the Ministry of Health which prohibited gatherings. As a result, most health issues regarding COVID-19, were not communicated with stakeholders and counterparts; similar to the way health issues were communicated before the pandemic. For example, PoEs needed to be informed as to how to deal with the lack of isolation rooms or follow-up of PCR-positive travelers. (d) Unavailability of drugs: The nurses reported shortage of some drugs and had to wait for long after making a requisition. (e) Unknown fear during COVID-19 waves: The border staff had close contact with travelers and were engulfed with fear. (f) Language barrier: More than 80% of the participants mentioned that travelers passing through Lomahasha and the airport did not speak nor understand English. (g) Unavailability of fuel: Lack of fuel for government vehicles used to ferry ill travelers and transport border staff. (h) Sanitary facilities: Officers reported that public toilets were far and inaccessible for very sick travelers; the shortage of running water made it difficult to use the toilets.

Discussion

Main findings of this study

The study concluded that the overall implementation of IHR at PoEs was limited (41.7%), with a score of less than 50% denoting that the attributes of the capacity necessary for IHR implementation were not in place (Table 6). The results were similar to that reported from other African countries (average 44%) which were generally lower than European countries (average 75%) [10]. Some countries like Taiwan were able to achieve full IHR implementation, demonstrating that the scoring system is indicative of resources and managerial expertise [21]. Based on the findings of our study, we can conclude that the government has developed a system, which includes having medical facilities at major PoEs; but these facilities and resources were unavailable at some PoEs at the time of the study.

The findings revealed limited supply of resources like PPE from government departments, and border staff would sometimes have to buy these supplies for themselves. Similarities were also found with other studies which revealed inadequate allocation of funds such as in Tanzania [5] and shortage of PPE [11]. These findings indicate that developing countries are struggling to meet IHR requirements, as was also seen in Yemen where the overall IHR score was poor [22]. Reports have indicated that middle-income-countries like Myanmar struggled to implement IHR consistently because of constrained resources and lack of focus in public health, when faced with contending needs [23].

In this study, we also identified the unavailability of isolation rooms, communication channels, and training. Interestingly, the airport scored high in capacities and resources because the airports have to adhere to the International Civil Aviation Organization standards. The results also indicate that there is an interconnectedness between the software and hardware components, stressing the crucial role of the software components (governance and trust). Our observations indicate that the staff trusted their management, which encouraged the staff to improvise some arrangements to overcome the shortage in transportation, particularly at ground crossings; and buy themselves masks. The important role of government officials was supported by a study showing that improved governance mechanisms were associated with positive health outcomes [23].

Countries vary in their capacities to deal with outbreaks [6]. Eswatini received the lowest score when the WHO Joint External Evaluation team assessed the IHR core capacities at PoEs. [24]. The government

Table 7. Factors associated with the implementation of International Health Regulations (IHR).

Variable	Practices		
	Wearing PPE (<i>p</i> value)	Hygiene (<i>p</i> value)	Social distancing (<i>p</i> value)
PoE	< 0.001**	0.081	0.751
Education	0.102	0.001*	0.169
Employer	< 0.001**	0.179	0.583
Department	< 0.001**	0.219	0.271
Position	0.507	0.018*	0.941
Length of service	0.188	0.385	0.148
Close contact	0.909	< 0.001**	0.928
Work	0.182	0.139	< 0.001**

**p* < 0.05; ** *p* < 0.001; PoE, point of entry; PPE, personal protective equipment.

deployed health staff at designated PoEs, but the numbers of health staff were not enough, and many health functions at the ports were not performed as stipulated by the IHR. The government made transport arrangements for ill travelers, although at times fuel was unavailable and the referred travelers had to use their own transport to go to medical facilities, especially at ground crossings which did not have medical facilities on site. In addition, SOPs and guidelines were still under development at the time of this study.

When it comes to the institutional factors associated with IHR implementation, it was revealed that having good practices, PoE type, type of employer, and department were associated with wearing a mask with significant *p* < 0.001, 0.001, and 0.002, respectively. Education, position of border staff, and close contact were associated with always washing hands (good hygiene), with a significant *p* value of < 0.001, 0.001, and 0.018, respectively. Lastly, work location (indoors or outdoors) was associated with keeping safe distances (*p* < 0.001; Table 7).

Public health implications

This study provided insights into the gaps in adherence to the IHR. Although it demonstrated that PoEs, except for the airport, were not fully resourced; differences among PoEs showed that practices at the site also mattered. This suggested that the PoEs would benefit from better training and management. For example, best practices under limited resources may be identified, and the experience may be shared among PoEs. The findings of this study may be used as foundation for better allocation of resources to prevent and manage cross-border health threats effectively. The insights of the study can also improve the state of readiness for future pandemics by making health systems more capable of managing new risks.

Recommendations

Based on our results, we have the following recommendations for policy makers and other relevant stakeholders.

- 1) Formulate policies that will support the implementation of IHR at PoEs, such as establishing clear chains of command and providing authoritative directives on practices.
- 2) Provide resources such as staff, PPE, transport, and fuel, at the PoEs so that all port health practices follow the IHR standards.
- 3) Provide adequate training for officers.
- 4) Set up isolation rooms at the PoEs so that ill travelers, including suspected and confirmed COVID-19 cases, can be isolated.
- 5) Establish proper procedures to facilitate documentation of cases and their management.

Conclusions

The aim of this study was to understand the extent to which capacities and practices at PoEs were compliant with the IHR during the pandemic. The results address this aim by providing a detailed evaluation of how PoEs complied with IHR, in terms of the adequacy of allocated resources and the impact of institutional factors. By identifying specific gaps and challenges, the study presented a clearer picture of the current state of PoEs in terms of IHR.

IHR capacities: The study revealed varying levels of compliance with IHR capacities among the different PoEs. Some PoEs, such as the one at the airport, demonstrated strong adherence to capacities; while ground crossings faced significant challenges because they lacked these capacities as stipulated under Annex 1 of the IHR 2005 [7]. The capacity of frontline workers in terms of practices and resources to implement IHR measures was inconsistent, highlighting a need for targeted capacity-building efforts due to limited resources and inadequately trained staff.

Resource allocation: The assessment of resource allocation showed that while some PoEs were well-equipped, such as the airport which has to adhere to International Civil Aviation Organization (ICAO) standards, ground crossings struggled with insufficient resources. As a result, this disparity impacted the ability

of PoEs to enforce COVID-19 prevention measures effectively.

Institutional factors: Institutional factors, including administrative support, were found to significantly influence the implementation of IHR. Those that were employed by the government struggled to have enough resources including PPE, and good practices, depending on the level of education, proximity to travelers, and the position held at the border.

Practical applications: Capacity building and training programs are needed for frontline workers at PoEs to improve compliance with IHR capacities and improvement in practices. In addition, proper resource allocation is needed to ensure that all PoEs are adequately equipped to manage health threats. Good policies influenced by policy makers and health authorities, that enhance global health security strategies and support IHR implementation at PoEs are needed. Moreover, the findings revealed that integrating institutional factors into the assessment of IHR implementation deepens the understanding of how institutional dynamics affect health security measures.

Our study revealed that factors other than resources, such as the leadership style of managers, can enhance implementation. Moreover, accessible and workable guidelines lead to good practices in less-resourced PoEs. A combination of these can benefit the morale and discipline, as observed at Lomasha and the airport. Heterogeneity among PoEs was revealed, and they were expected to be more consistent, as reported in Taiwan [21].

Limitations of the study

The study relied on self-filled questionnaires and phone-based interviews. Therefore, there could be potential self-selection of more devoted workers, and recall and social desirability biases in their responses.

Despite these, the relatively high response rate and voluntary responses in the mixed-method approach could lend confidence in the reliability of the observations. We can conclude that quantitative results complemented by qualitative results in the study showed that the PoEs had not yet fully implemented IHR. These findings may inform policy makers to formulate policies supporting IHR implementation, including provision for the government providing adequate staff, PPE, and transport to comply with the IHR standards.

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Authors' contributions

All authors contributed meaningfully to this work, HHM drafted the manuscript and SLH supervised the entire study.

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