Advances in Preventive Medicine and Health Care
Nor HW, et al. Adv Prev Med Health Care 4: 1035.
www.doi.org/10.29011/2688-996X.001035
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Research Article

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Lessons from Compliance to Covid-19 Infection Prevention and Control Measures Among Health Care Workers in Somalia: Making a Case to Improve Preparedness and Readiness for National Health Security in a Fragile Setting

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Citation: Nor HW , Nyagah LM, Ali AS, Karanja MJ, Afrah TA, et al. (2022) Lessons from Compliance to Covid-19 Infection Prevention and Control Measures Among Health Care Workers in Somalia: Making a Case to Improve Preparedness and Readiness for National Health Security in a Fragile Setting. Adv Prev Med Health Care 5: 1035. DOI: 10.29011/2688-996X.001035

Received Date: *20 September, 2022;* **Accepted Date:** *26 September, 2022;* **Published Date:** *29 September, 2022*

Abstract

Introduction: During infectious disease epidemics such as the COVID-19 pandemic, health care worker (HCW) infections can trigger and propagate hospital outbreaks. This is more prevalent in low-resource countries. This study determined the compliance to infection prevention and control (IPC) measures among HCWs exposed to COVID-19 in Somalia.

Methods: Using a cross-sectional survey design, a random sample of 398 COVID-19 exposed HCWs from 198 health facilities in 33 districts from all six administratve regions of Somalia were surveyed via a self-administered questionnaire. Respondents reported practices related to the application of IPC measures when caring for confirmed COVID-19 cases in facility settings. Using their responses, principal components analysis was used to categorize the HCWs as "low" or "more" IPC compliant. The independent association of different individual and sociodemographic factors with non-compliance to IPC measures was assessed using logistic regression.

Results: Over half (53.3%) of the respondents were male, and 63% married. Eight of ten HCWs had tertiary education, and nearly half (45.5%) were nurses. Doctors and midwives were 13.3% and 16.3%, respectively. Nearly two-thirds (61.4%) of HCWs had low compliance. On bivariate analysis, factors associated with low compliance were lack of testing, lack of exposure to direct care/contact or aerosol-generating procedures, and state/region where HCWs worked. At multivariate analysis, not being involved in direct care for COVID-19 patients (adjusted odds ratio (aOR) 10.4; 95% confidence interval (CI): 3.4–31.7), not being exposed to aerosol-generating procedures (aOR 2.7; 95% CI: 1.2–6.2) corelated to low compliance. Odds of low compliance were higher among HCWs who had not previously tested for COVID-19 (aOR) 2.4 (95% (CI) 1.0–5.6). HCWs from

Galmudug were independently associated with being less compliant (aOR 17.1 95% CI (2.6–113.7).

Conclusions: Low compliance to IPC measures among HCWs was associated with apparent low risk perception among HCWs. Institutionalizing IPC at facility level will improve HCW safety beyond COVID-19.

Keywords: COVID-19; Health care workers; IPC; Compliance; SARS-COV-2; Somalia

Introduction

Healthcare-associated infections (HAIs) are a major problem for patient and HCW safety, and prevention of disease transmission must be prioritized [1]. Health facilities create an environment where sick people congregate, providing many opportunities for micro-organisms to spread between patients, visitors, and HCWs. Transmission of infection within the hospital setting has been shown to occur through various interactions such as direct/face-to-face interactions and exposure to an aerosol-generating procedure, among others [1-4].

IPC measures, therefore, are a key pillar to a functioning health care system. The minimum requirements for IPC provides standards that should be practiced by all HCWs at the health facility level to assure maximum protection and safety to patients, visitors and healthcare workers based on the World Health Organization (WHO) core components for IPC programmes [5-7]. These include correct and consistent use of gloves, masks, shields, gowns, correct donning and doffing of personal protective equipment (PPE), and proper hand hygiene before and after procedures.

Stringent application of IPC measures has been shown to significantly reduce the spread of infectious diseases like Ebola in West Africa by reducing the magnitude of the disease and interrupting the chain of transmission of disease [8,9]. In January 2020, when WHO declared the COVID-19 outbreak a public health emergency of international concern, it also recommended a set of measures to mitigate its spread: hand washing, keeping a social distance, and observing respiratory hygiene [10].

Global data has shown that healthcare workers were at higher risk of COVID-19 infection compared to the general population, with an estimated 14% of infections reported among healthcare workers [11-13]. Prevention of COVID-19 infections in health care settings requires a multipronged integrated approach to infection prevention, occupational health and safety measures, and adherence to the same [14]. The ability to respond to COVID-19 as well as other disease outbreaks is also dependent on the socio-economic and political stability of a country. Earlier in the pandemic, there was a global shortage of PPE and other essential commodities [15]. African countries were more affected due to their over-reliance on the importation of these commodities. Somalia is considered one of the most fragile and vulnerable countries in the world suffering from protracted conflicts and political instability for more than three decades. The result of this long-term hardship has been underinvestment in health and social services and hence weakened and fragmented health systems. The protracted conflict has also led to the migration of its skilled health work force making the country's health system as the second most fragile in the world [16] . The current health workforce density in Somalia (0.34 healthcare workers per 1000 population) is substantially lower than the density needed for universal health coverage: 4.45 healthcare workers per 1000 population by 2030 [17,18]. Having limited health workforce and fragmented healthcare system, the country struggles to provide basic and comprehensive health care services to its large number of people [19]. In the event of a widely spreading epidemic or pandemic causing substantial human-to-human transmission and in the event when healthcare associated outbreaks continue to propagate infecting large number of unprotected healthcare workers, the health system may eventually collapse causing the health care facilities to close down its operation owing to absentee of healthcare workers. This has been observed in the outbreak of Middle East Respiratory Syndrome coronavirus (MERS-CoV) in various wealthy countries of the Middle East having strong health system [20]. A weakned health system, severe shortage of health workforce coupled with other logistic and supply chain challenges can pose a threat to national health security of any country in the event of a pandemic or epidemic when its health systems collapse owing to large number of health workforce becoming infected in hospital settings owing to unprotected exposure to the epidemic or pandemic virus. Somalia recorded its first case of COVID-19 on 16th March 2020, and community transmission was triggered by a health care worker who had been infected during screening at a facility [21]. By October 2020, when this study was conducted, Somalia had recorded 3800 confirmed COVID-19 cases and 98 deaths [22].

We assessed the extent to which HCWs in select facilities in Somalia were complying to IPC guidelines and factors associated with failure to comply. Documenting these lessons will inform future efforts to improve infection prevention within health facilities beyond the pandemic.

Methods

Study setting and population

This was a cross-sectional study conducted in Somalia between September and October of 2020. Mogadishu is the capital city

where most institutions and large health facilities responding to COVID-19 are located. We collected data from all the 17 districts of the Banadir region where Mogadishu is located and in four out of the five states of Somalia; Galmadug, Hirshabelle, South West, and Jubaland, where most health facilities are situated. After the states, Somalia has 18 regions at the second administrative level. For each of the four selected states, two regions were chosen randomly, and in turn, two districts in each of the selected regions were randomly selected giving a total of 16 districts while all the 17 districts of Banadir region were selected, giving a total 33 districts. From the 33 districts a total of 199 health facilities and 398 HCWs (two from each facility) were sampled for the study.

Definition of terms

HCW: Any member of staff working in a health facility involved in the provision of care or staff who had contact with the patient or their bodily fluids or potentially contaminated items or surfaces, including cleaning and laundry personnel, administrative staff, cleaners, ambulance, transport staff, and security guards.

Compliance with PPE protocols: *Wearing PPE is always in line with IPC guidelines to prevent infection from COVID-19. Those who failed to comply with IPC measures were classified as low compliance HCWs.*

Data collection and management

We administered individual HCW-level questionnaires to HCWs to assess their practices and compliance with IPC measures while in contact with a COVID-19 patient. Data was collected via mobile devices using the Open Data Kit (ODK) platform (Get ODK Inc.). Data were then converted to a comma-separated version for importing into the statistical software for analysis.

Outcome measure

We developed the outcome measure of compliance from the Likert scores ranging from 4 to 1 "Always" and "Rarely") captured in the ten compliance variables (use of gloves, masks, shield, gown, and aprons; following protocols; hand hygiene following touching or exposure to aseptic material or fluids; and decontamination of surfaces). To develop the composite score, we used principal components analysis to identify influential components. Components that had Eigenvalues greater than 1 were considered significant. We further examined the factors to be retained using a scree plot and kept two that did not have big breaks between them and had Eigenvalues >1. We then created a composite score and generated quintiles from the score by using the xtile command in Stata (StataCorp LLC, College Station, TX). From these quintiles, we assigned two categories; "more compliant" for respondents who fell in the 4th and 5th quintiles. Since our interest was in determining non-compliance, we categorized the respondents in the 1st to 3rd quintile as "low compliance."

Data analysis

We carried out exploratory analysis where discrete variables were summarized with frequencies and percentages while continuous variables were summarized using measures of central tendency and dispersion such as mean, median, mode, standard deviation, and inter-quartile ranges. We carried out a bivariate logistic regression model to identify factors associated with the respondents being of low compliance. Factors that had a significance of <0.1 were included in the multivariate model to identify factors that were independently associated with low compliance. We analyzed the data using Stata version 14.2 for Windows.

Ethical considerations

This study was approved by the Ministry of Health and Human Services of the Federal Republic of Somalia. Consent was sought from all participants before enrolment in the study.

Results

A total of 398 HCWs participated in the study; of these, 150 (37.7%) were from the Banadir region. Two hundred and twelve (53.3%) HCWs were male, 249 (62.6%) were married, and 347 (87.19%) had university training. There was a higher proportion of married females workers than males (p=0.0003). Almost half of the female HCWs were between 25–30 years compared to 40.1% of their male counterparts (p<0.001). There were five times more female medical doctors than their male counterparts, whereas nearly all midwives in the study were male – a third of the male HCWs were midwives (p<0.0001). Most HCWs were involved in direct clinical care: 53 (13.3%) as doctors, 185 (46.5) as nurses, 65 (16.3%) as midwives, and 40 (10.05%) as laboratory personnel (Table 1).

Nearly half (43%) of the HCWs reported having had contact with COVID-19 patients in four ways: 116 (30.4%) through direct care, 139 (37%) through face-to-face contact, 87 (22.7%) being present during aerosol-generating procedures, and 108 (29%) through direct contact with the environment where COVID-19 patients were receiving care.

Characteristics	Total, n/n (%)	Male (%)	Female (%)	p-value
Total	398(100%)	186(46.7%)	212(53.3)	
Age				<0.0001
Below 25	90 (22.84)	62 (33.88)	28 (13.27)	
25–30	144 (36.55)	63 (34.43)	81 (38.39)	
31–39	115 (29.19)	33 (18.03)	82 (38.86)	
40+	45 (11.42)	25 (13.66)	20 (9.48)	
Education				0.1146
No schooling/primary	4 (1.01)	4 (2.15)	0 (0)	
Secondary	28 (7.04)	14 (7.53)	14 (6.6)	
Vocational	19 (4.77)	11 (5.91)	8 (3.77)	
University	347 (87.19)	157 (84.41)	190 (89.62)	
Marital status				0.0003
Married	249 (62.56)	99 (53.23)	150 (70.75)	
Single	149 (37.44)	87 (46.77)	62 (29.25)	
State				0.2642
Banadir	150 (37.69)	80 (43.01)	70 (33.02)	
Galmudug	44 (11.06)	20 (10.75)	24 (11.32)	
Hirshabelle	74 (18.59)	30 (16.13)	44 (20.75)	
Jubaland	52 (13.07)	20 (10.75)	32 (15.09)	
South West	78 (19.6)	36 (19.35)	42 (19.81)	
Region				0.0343
Banadir	150 (37.69)	80 (43.01)	70 (33.02)	
Bay	36 (9.05)	12 (6.45)	24 (11.32)	
Galgadud	24 (6.03)	12 (6.45)	12 (5.66)	
Gedo	21 (5.28)	9 (4.84)	12 (5.66)	
Hiran	45 (11.31)	13 (6.99)	32 (15.09)	
Lower Juba	31 (7.79)	11 (5.91)	20 (9.43)	
Lower Shabelle	42 (10.55)	24 (12.9)	18 (8.49)	
Middle Juba	20 (5.03)	8 (4.3)	12 (5.66)	
Middle Shabelle	29 (7.29)	17 (9.14)	12 (5.66)	
Cadre				<0.0001
Medical doctor	53 (13.32)	9 (4.84)	44 (20.75)	
Nurses	185 (46.48)	86 (46.24)	99 (46.7)	

Midwives	65 (16.33)	62 (33.33)	3 (1.42)	
Laboratory/phlebotomists	40 (10.05)	13 (6.99)	27 (12.74)	
Other	55 (13.82)	16 (8.6)	39 (18.4)	
Exposure				0.3186
Not exposed	227 (57.04)	111 (59.68)	116 (54.72)	
Exposed	171 (42.96)	75 (40.32)	96 (45.28)	

Table 1: Characteristics of interviewed HCW by sex, Somalia 2020.

There was a high level of non-compliance with COVID-19 IPC measures, especially in using shields, and most respondents (77.3%) complied with the use of gloves (Figure 1).

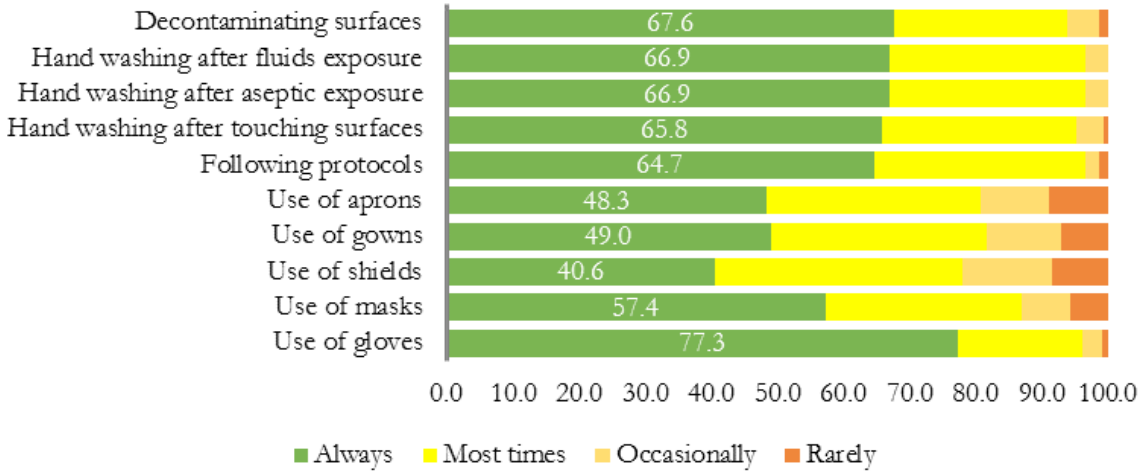

Figure 1: Compliance with various aspects of COVID-19 IPC measures, Somalia 2020.

We observed a variation in compliance levels across different PPE items and IPC measures. The consistent use of gloves was high at 77% and 57.4% for face masks. Less than half of the HCWs used aprons, gowns, and shields consistently. Practices like decontamination of surfaces and handwashing were observed consistently by over 65% of the HCWs.

Factor*s*	**Low compliance**	**OR† (95%CI)**	**aOR‡ (95%CI)**
Total	105 (61.4)	---	
Sex			
Male	45 (60)	ref.	
Female	60 (62.5)	1.1 (0.6–2.1)	
Age			
Below 25	25 (62.5)	1.2 (0.5–2.8)	
25–29	39 (62.9)	1.2 (0.5–2.6)	
30–39	27 (58.7)	ref. (.-.)	
40+	14 (60.87)	1.1 (0.4–3)	
Schooling			
No schooling/primary	2 (100)	(omitted)	
Secondary	6 (54.55)	1.2 (0.2–6.7)	
Vocational	5 (50)	ref. (.-.)	
University	92 (62.16)	1.6 (0.5–5.9)	
Marital status			
Married	63 (60.58)	ref.	
Single	42 (62.69)	1.1 (0.6–2.1)	
State			
Banadir	45 (66.18)	7.8 (3–20.6)***	**4.9 (1.6–15.3)**
Galmudug	13 (86.67)	26 (4.7–142.8)***	**17.1 (2.6–113.7)**
Hirshabelle	7 (20)	ref.	
Jubalan*d*	21 (77.78)	14 (4.1–47.8)***	**6.9 (1.6–29.2)**
South West	19 (73.08)	10.9 (3.3–36.0)***	**6.1 (1.4–27.2)**
Cadre			
Medical doctor	18 (69.23)	2.5 (0.9–7.4)*	
Nurses	37 (56.06)	1.4 (0.6–3.3)	
Midwives	16 (47.06)	ref.	
Laboratory/phlebotomists	12 (70.59)	2.7 (0.8–9.3)	
Others¶	22 (78.57)	4.1 (1.3–12.7)	
Ever tested for COVID-19			
Yes	41 (50.62)	ref.	
No	64 (71.11)	2.4 (1.3–4.5)***	**2.4 (1.0–5.6)**

Involved in direct care			
Yes	55 (47.41)	ref.	
No	48 (90.57)	10.6 (4.0–28.7)***	**10.4 (3.4–31.7)**
Exposure: face-to-face contact			
Yes	81 (58.27)	ref.	
No	21 (72.41)	1.9 (0.8–4.5)	
Exposure: direct aerosol			
Yes	41 (47.13)	ref.	
No	62 (76.54)	3.7 (1.9–7.1)**	**2.7 (1.2–6.2*)***
Exposure: direct contact			
Yes	58 (53.7)	ref.	
No	43 (72.88)	2.3 (1.2–4.6)**	1.2 (0.5–3.0)

† Odds ratio; ‡**Adjusted odds ratio;** Significance level in bivariate analysis *** p<0.01, ** p<0.05, * p<0.1; ¶Non-clinical cadres such as cleaners, laundry staff, and ambulance drivers

Table 2: *Factors associated with non-compliance with IPC measures, Somalia 2020*

Overall, 61.4% of the HCW had low compliance. In bivariate analysis, factors associated with low compliance were testing for COVID-19, lack of involvement in direct care or contact, face-to-face exposure with a contact, or lack of exposure to aerosol-generating procedures and state/region from where the HCWs were working (Table 2). HCWs from Galmudug were independently associated with being less compliant (aOR 17.1 95% CI (2.6–113.7). Jubaland and South west states health workers had six times more odds of being less compliant (aOR 6.9 (95% CI: 1.6–29.2) and (aOR 6.1 (95%CI: 1.4–27.2) respectively.

HCWs who had not tested for COVID-19 had higher odds of having low compliance, aOR 2.4 (95% CI: 1.0–5.6). Further, those who had never been involved in direct care or in an aerosol-generating procedure had higher odds of having low compliance (aOR 10.4 (95% CI: 3.4–31.7) and (aOR 2.7 (95% CI: 1.2–6.2) respectively.

Discussion

This is the first study of its kind from Somalia and possibly from any other sub-Saharan African country where the compliance to infection prevention and control measures amongst health care workers who were exposed to COVID-19 in Somalia was determined. The study also looked at the predictive factors for low compliance amongst the healthcare workers in a fragile setting which might have policy implications for improving epidemic and pandemic preparedness and readiness, an essential prerequisite for national health security. Our study found that the majority of the HCWs surveyed had low compliance to standard IPC measures.

In our study, compliance varied per PPE, with gloves and masks being used more consistently than face shields and aprons. Similar global studies have attributed high compliance to masks and gloves to high accessibility [23]. Other possible explanations could be because gloves have been routinized in health care settings before COVID-19 due to other infectious diseases and the masking mandates for the general population during the pandemic. Although at the time when this study was conducted, the use of masks was universal, there were major global shortages for all COVID-19 supplies following supply chain disruptions due to travel bans among other factors [18,25,26].

We observed poor compliance to IPC measures associated with self-reported lack of exposure to COVID-19 patients. A similar study conducted in Ghana found pharmacists to have low compliance to IPC measures, and this was attributed to the minimal direct contact the pharmacists have with patients in their line of work [26]. Although we did not assess the perception of risk, the significant association between low compliance and lack of exposure could be attributed to it. A study conducted in Ethiopia found that HCWs who perceived themselves to be at lower risk neglected some IPC measures [27,28]. HCW attitude, closely linked to perceptions, has also influenced how HCWs adhere to IPC measures [28-31].

HCWs who had tested for COVID-19 were more likely to be compliant compared to those who had not previously tested. As with other infectious diseases, such as HIV and tuberculosis, testing has been shown to influence preventive behavior. Studies conducted in Africa and Europe found that HIV testing and increased knowledge of status were associated with behavior change [32-33]. Access to testing for COVID-19 was faced with challenges of shortage of testing kits and reagents across the globe, but a more severe shortage was observed in African countries where less than 1% of their populations were tested [24]. Routine analysis of Somalia COVID-19 data showed that Somalia had conducted less than 1% cumulative tests in the general population.

The geographical disparities in compliance, in that HCWs from Galmudug were independently associated with being less compliant, could be attributed to inequities and unequal distribution of health workforce and other healthcare resources in the country. Galmudug is a newly established federal member state and large part of the state is not accessible, many health facilities in the state are severely understaffed or manged by informal cadre of health workforce. The governance and oversight structure of local health authorities are also rudimentary in these newly established states owing to the absence of skilled health maangers and practitioners having adequate knowledge on IPC practices and broader health system issues. Lack of IPC supplies could also have contributed to such low compliance amongst healthcare workers in Galmudug state. Such low compliance has also been observed in all newly established federal member states such as Jubaland and Southwest state. Compliance did not differ significantly by age, gender, or education. Contrary to our findings, other studies in COVID-19 and non-COVID-19 settings have shown that compliance to IPC measures correlates to the health care workers gender, cadre, knowledge, and years of service [10,27,33-35]. This underscores the need for all HCWs to exercise strict IPC measures, especially during a pandemic.

Other studies, which are different in methodological approach than ours, have assessed compliance through observation or self-report, and either of these methods may produce varying results. This could explain the variation observed across many studies, with some documenting high compliance and others low compliance [26,37-39]. A study conducted in Somalia in September 2020 found that HCWs comprised over 5% of reported COVID-19 cases [19], and the low compliance to IPC measures among HCWs observed in this study also supports and explains this. IPC measures remain an important capacity attribute for International Health Regulations (IHR) (2005). Somalia is ranked 193 out of 195 countries on the Global Health Security Index [40]. The country's current capacity with regard to IHR and health emergency preparedness index (a measure of IHR core capacity) is 31 out of 100 (i.e. at level 1 out of a maximum level 5) [41] indicating large gaps in the core capacities to prevent, detect and fully respond to public health threats in the country [42]. In this age of globalization and the emergence of new and resurgent communicable diseases with high potentials for human-to-human transmission (e.g. Ebola virus disease, Marburg virus disease, Middle East Respiratory Syndrome and COVID-19) and the increasing global effects of known diseases (e.g. influenza and other respiratory diseases), it is important for the country to rebuild its health system with strong focus on infection prevention and control in health care facilities. The findings of our study can be a convincing argument to develop a programme for IPC and a cadre of IPC practitioners deployed in all primary and secondary health care facilities ensuring high standards of compliance for IPC practices by all cadres of health workforce in the country. The IHR (2005) requires that each country has a minimum capacity to rapidly detect, respond to and control public health emergencies and thereby keep its population safe, protects other countries from the spread of illness, and ensures global health security.

Limitations

The assessment relied on self-reported adherence to IPC measures and testing for SARS-COV-2. As we did not assess the reasons for compliance or lack thereof, we cannot associate our findings to either structural factors such as availability or access to PPE or individual characteristics such as HCW risk perceptions or attitudes toward IPC.

Conclusion

The study found a strong association between the apparent lack of exposure and poor compliance to IPC measures indicating poor attitude and low perception of risk among HCWs. The lack of variation in compliance by age, gender, education, and cadre underscores the need for all HCWs to adhere to the IPC guidelines. Compliance with IPC measures should be routinized in health care settings irrespective of diagnosis and exposure.

Somalia is establishing a Field Epidemiology Training Program (FETP) whose primary focus is to build surveillance and outbreak response capacity among its frontline health care workers. IPC is a critical component of outbreak response, and FETP provides an opportunity to institutionalize it in the health care system. The findings from this study will inform the country's efforts to enhance IPC in the health care system.

Conflict of interest: *All authors declare no conflict of interest*

Acknowledgement: *This work was supported by the Alliance for Health Policy and Systems Research, World Health Organization. The Alliance is supported through both core funding as well as project specific designated funds. The full list of Alliance donors is available here: https://www.who.int/alliance-hpsr/partners/en/.*

Disclaimer: The authors are themselves alone responsible for the views expressed in the article. This article does not represent the views, decisions, or policies of the Alliance for Health Policy and Systems Research.

Funding: This study was supported by the World Health Organisation, Somalia

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