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Assessment of COVID-19 Vaccination Uptake Among Healthcare Workers in Garowe, Puntland State, Somalia

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ABSTRACT

The emergence of SARS-CoV-2 led to a global crisis, prompting the development of COVID-19 vaccines. While initial vaccine candidates received WHO approval, vaccine acceptance varied globally. In Somalia, healthcare workers' acceptance remained unexplored. This study aimed to assess vaccination uptake among healthcare workers in Garowe, Puntland State, Somalia. This study employed a cross-sectional design to assess COVID-19 vaccination uptake among healthcare workers in Garowe, Puntland State, Somalia. Conducted over six months in Garowe City, the study included physicians, nurses, midwives, pharmacists, and lab technicians from public and private hospitals. Employing a multi-stage randomized sampling technique, data was collected via structured questionnaires and analyzed using SPSS version 22.0. The analysis included descriptive statistics, chi-square tests, and logistic regression. Factors like age [$\chi2$=0.398], sex [$\chi2$=2.162], marital status[$\chi2$=0.487], and living status [$\chi2$=0.170] displayed no significant association [$p>0.05$] with vaccination status. However, education [$\chi2$=7.435*], knowledge about vaccine efficacy against different variants of covid-19 [$\chi2$=12.704*], vaccine administration to individuals with health conditions[$\chi2$=6.472*], understanding of vaccine mechanisms [$\chi2$=7.584*], perceived effectiveness[$\chi2$=64.872*], and concern about adverse effects[$\chi2$=9.145*] are significantly associated [$p<0.05$] with vaccination status. Notably, despite initial significance, adjusted models showed varying associations. This research highlighted nuanced factors influencing vaccination uptake among healthcare workers. Demographics did not directly affect vaccination status, emphasizing the importance of awareness, confidence, and specific vaccine knowledge. Tailored educational programs and targeted interventions could enhance vaccine acceptance among healthcare professionals, necessitating ongoing monitoring and adaptation of strategies.

INTRODUCTION

Amidst the emergence of the SARS-CoV-2 virus in 2019, there was a notable absence of forewarning or proactive preparations for prevention and control. This virus belongs to the coronavirus family, akin to the agents responsible for severe acute respiratory syndrome (SARS) and Middle East Respiratory Syndrome (MERS) (Uddin et al., 2020). The outbreak of SARS-CoV-2 had far-reaching implications on health, society, and the economy, facilitated by asymptomatic or pre-symptomatic carriers who played a

pivotal role in rapid disease transmission. Within half a year, the infection had permeated every corner of the globe, resulting in the loss of millions of lives and immediate and enduring repercussions on people's well-being (Machhi et al., 2020). Multiple potential vaccines were developed to avert and mitigate SARS-CoV-2 infection, though regrettably posturing the loss of millions of lives (Lin et al., 2020; Shi et al., 2021). These SARS-CoV-2 vaccines were formulated through diverse laboratory trials utilizing various scientific methodologies (Amanat & Krammer, 2020; Wibawa, 2021). Approximately ten COVID-19 vaccine candidates, proven safe and effective, gained endorsement from the World Health Organization (WHO), including globally accepted choices like Pfizer/BioNTech BNT162b2 and Janssen's Ad26.COV2-S (Johnson & Johnson), and Oxford/AstraZeneca's AZD1222 (Jacob et al., 2021). Efficacy rates of around 95% were consistently demonstrated across different demographic groups, spanning age, gender, race, ethnicity, baseline BMI, comorbidities, and reduction of hospitalization (Figa et al., 2022; Polack et al., 2020).

Due to limited global vaccine availability, governments prioritized high-risk segments for initial immunization. This encompassed healthcare workers, elderly individuals, particularly those with underlying health conditions, and essential service providers (Kaur & Gupta, 2020). Healthcare workers, due to their direct or indirect exposure to COVID-19 patients, were at elevated risk of contracting the disease. A study that determined the acceptability of the COVID-19 vaccine conducted in Ghana among Healthcare workers showed that approximately 39% intended to receive the vaccine if available (Agyekum et al., 2021).

This hesitancy and subpar acceptance could be attributed to misinformation, lack of awareness, fear of side effects, and socio-cultural factors (Zewude & Habtegiorgis, 2021). In Israel, vaccine acceptance rates among healthcare providers varied—78% for doctors, 61% for nurses, and 75% for the general populace (Dror et al., 2020). A parallel study in the USA highlighted higher acceptance among healthcare professionals directly engaged with patients (physicians at 86.6%, nurses at 86.3%) compared to those with more indirect patient interaction (Green-Mckenzie et al., 2021). Moreover, a small fraction of healthcare providers, around 5.5%, displayed hesitancy toward COVID-19 vaccination (Castañeda-Vasquez et al., 2021; El-Sokkary et al., 2021). Given their elevated risk of infection, safeguarding healthcare workers became a paramount public health responsibility (Mulu et al., 2020).

Conversely, a Moroccan study revealed relatively higher acceptance rates of COVID-19 vaccination among healthcare workers, with willingness linked to job role, trust in COVID-19 information, and perceived disease severity (Khalis et al., 2021). Another study conducted in Egypt showed that 21% of Egyptian healthcare workers accepted the COVID-19 vaccination (Smith et al., 2021). In Somalia, the absence of domestic vaccine production led to reliance on international procurement, with limited available data on knowledge, acceptance, or hesitancy among healthcare workers regarding the COVID-19 vaccine. This study aims to bridge this gap and become the pioneering investigation into vaccine uptake among healthcare workers in Somalia, filling a knowledge void concerning COVID-19 vaccination in African healthcare settings.

METHODS

Study Design & Setting

This research employs a cross-sectional study design to assess the COVID-19 vaccination uptake among healthcare workers in the Garowe Puntland State of

Somalia. The study was conducted in two healthcare facilities in Garowe City, the capital of the Puntland State of Somalia. These facilities encompass public and private hospitals, where healthcare workers actively engage in patient care.

Study Period and Population

This study was conducted over 6 months (from April to September 2022) among healthcare providers working in public and private hospitals in Garowe City, the Puntland state of Somalia. The study population included physicians, nurses, midwives, pharmacists, and laboratory technicians in these healthcare facilities.

Sample size

The sample size is determined by applying the equation: $\mathbf{n} = \frac{\mathbf{z^2 p(1-p)}}{\mathbf{d^2}}$

Where n is the intended sample size, z is 1.96 at the 95% confidence interval, p is the vaccination uptake among healthcare workers, which is 76.0% - reported in a study conducted in 2021 in the Somali Region of Eastern Ethiopia (Wassihun et al., 2024) and d is the sampling error 0.05. So, $n=1.96^2\times0.76\times(1-0.76)/0.05^2$. The estimated sample size was 280 (n), as a result.

Sampling Strategy

This study applied a multi-stage randomized sampling technique. First, we selected Garowe City from other cities in Puntland purposively. In the second step, we randomly selected one public hospital and one private hospital from the other hospitals in the city. Finally, in the third step, the healthcare workers within the selected facilities were conveniently sampled (figure 1). For the selection criteria, all clinical workers who were working at selected hospitals and agreed to participate in this study were included, and non-clinical workers (guardians, cleaners, and accountants) in the selected hospitals and those who declined to participate were excluded from participation.

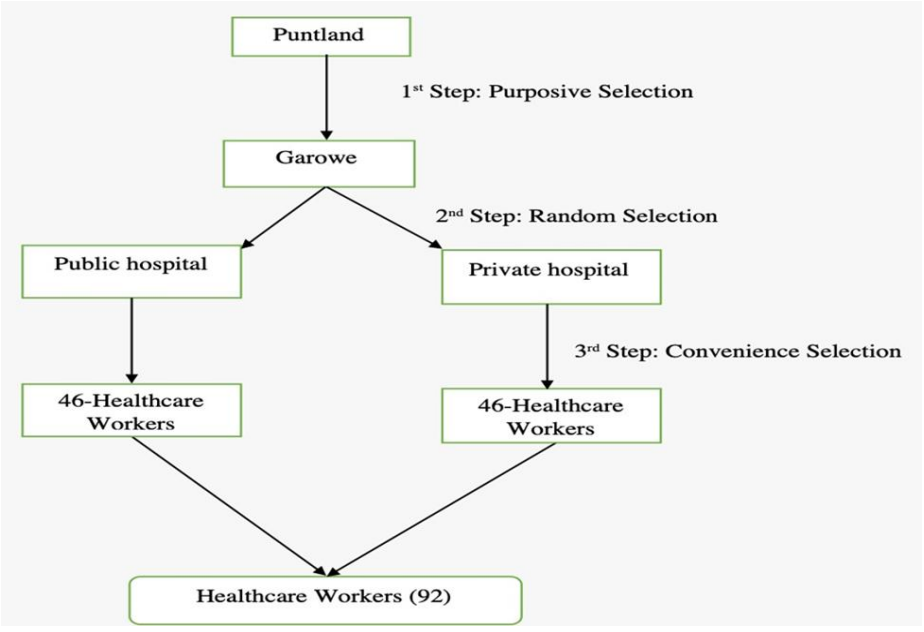

Figure 1: A multi-stage randomized sampling strategy

Data Collection

Data was collected through structured questionnaires administered in person. The survey questionnaire was made up of segments such as the participants' sociodemographic variables (age, gender, education level, marital status, health worker category, & living status), knowledge about the COVID-19 vaccine, status of vaccination and the healthcare worker's views of the COVID-19 vaccine. The questionnaires were also validated by pretesting before starting the data collection.

Data Analysis

The data collected was analyzed using IBM SPSS version 22.0. Descriptive statistics, chi-square, and binary logistic regression analyses were done; Pearson's chi-square was used to determine the association between the dependent variable (vaccination status) and independent variables (socio-demographic characteristics, & COVID vaccination-related variables). A multivariate binary logistic regression analysis was used to identify the determinants of intention to vaccinate. All variables were considered statistically significant at a 95% confidence interval ($p<0.05$).

Ethical Considerations

Ethical approval was obtained from the Ethical Review Committee for the Faculty of Medicine and Health Sciences, Frontier University Garowe, and Informed consent was obtained from each participant, ensuring their voluntary participation and confidentiality.

RESULTS

Approximately 69.6% of participants fell within 19-30 years of age, while 51.1% identified as female. The majority, comprising 83.7%, possessed a bachelor's degree or higher educational qualification, with 57.6% reporting unmarried status. In terms of occupational distribution, 21.7% represented the medical doctor category, while 78.3% comprised nurses, midwives, pharmacists, and laboratory technicians. Living arrangements indicated that 40.2% of respondents resided with their families. A significant 73.9% expressed a high level of confidence. Notably, 79.3% believed in the COVID-19 vaccine's ability to safeguard against different COVID-19 variants. Additionally, 69.6% affirmed the vaccine's safety for individuals with pre-existing health conditions, while 82.6% claimed an understanding of its mechanism. Regarding efficacy perception, 56.5% considered the COVID-19 vaccine effective. Concerningly, 90.2% expressed worry about the potential serious adverse effects of the vaccine (Table 1). Ultimately, 51.1% of respondents reported being vaccinated (Figure 2).

In this research, an analysis was conducted to examine the association between the vaccination status of respondents and various demographic and awareness-related factors. The study revealed that factors such as age ($\chi2=0.398$), sex ($\chi2=2.162$), marital status ($\chi2=0.487$), category of health worker ($\chi2=3.254$), living status ($\chi2=0.170$), and level of confidence ($\chi2=36.967$) did not show significant associations ($p>0.05$) with vaccination status. However, significant associations ($p<0.05$) were observed between vaccination status and certain factors. Education ($\chi2=7.435$*), knowledge regarding the efficacy of COVID vaccines against different variants of COVID-19 ($\chi2=12.704$*), administration of COVID vaccines to individuals with pre-existing health conditions

(χ2=6.472*), understanding of the mechanism behind COVID-19 vaccines (χ2=7.584*), perceived effectiveness of the COVID vaccine (χ2=64.872*), and concern regarding the potential adverse effects of the vaccine (χ2=9.145*) demonstrated significant associations with the vaccination status of respondents (Table 2).

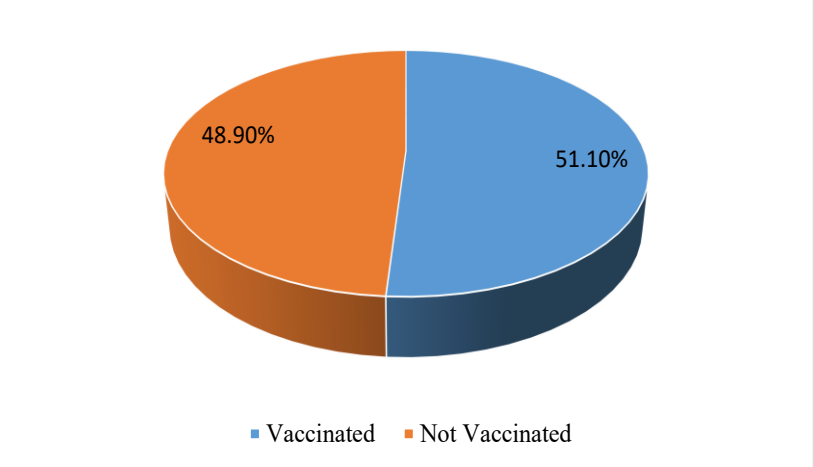

Figure 2: COVID-19 Vaccination Status among the Healthcare Workers (n=92)

Characteristics	Categories	Frequency	Percent
Age (years)	19-30	64	69.6
	≥31	28	30.4
Sex	Male	45	48.9
	Female	47	51.1
Education	Diploma	15	16.3
	Bachelor or above	77	83.7
Marital Status	Married	39	42.4
	Unmarried	53	57.6
Category of health worker	Doctor	20	21.7
	Other	72	78.3
Living Status	With family	37	40.2
	Others	55	59.8
Level of Confidence	High	68	73.9
	Low	24	26.0
Covid vaccine protect different variants of COVID-19	Yes	73	79.3
	No	19	20.6
COVID vaccine to people with existing health conditions	Safe	64	69.6
	Not Safe	28	30.4
Had idea how the COVID vaccine works	Yes	76	82.6
	No	16	17.3
The COVID vaccine's effectiveness	Effective	52	56.5
	Less Effective	40	43.4
Concerned about the serious adverse effects of the vaccine	Yes	83	90.2
	No	9	9.8

Table 1 Socio-demographic characteristics, knowledge, and status of COVID-19 vaccination (n=92)

Characteristics	Categories	Vaccination Status [Vaccinated (n=47; 51.1%); Not Vaccinated (n=45; 48.9%)]		X^2 value
		Vaccinated n(%)	Not-Vaccinated n(%)	
Age (years)	19-30	32 (34.7)	32 (34.7)	0.398
	≥31	16 (17.3)	12 (13.0)	
Sex	Male	27 (29.3)	18 (19.6)	2.162
	Female	21 (22.8)	26 (28.2)	
Education	Diploma	3 (3.2)	12 (13.0)	7.435*
	Bachelor or above	45 (48.9)	32 (34.7)	
Marital Status	Married	17 (18.4)	22 (23.9)	0.487
	Unmarried	26 (28.2)	27 (29.3)	
Category of health worker	Doctor	14 (15.2)	6 (6.5)	3.254
	Other	34 (36.9)	38 (41.3)	
Living Status	With family	41 (44.5)	38 (41.3)	0.017
	Others	7 (7.6)	6 (6.5)	
Level of Confidence	High	33 (35.8)	3 (3.2)	36.967
	Low	15 (16.3)	41 (44.5)	
COVID vaccine protect different variants of COVID-19	Yes	45 (48.9)	28 (30.4)	12.704*
	No	3 (3.2)	16 (17.3)	
COVID vaccine to people with existing health conditions	Safe	39 (42.3)	25 (27.1)	6.472*
	Not Safe	9 (9.7)	19 (20.6)	
Had idea how the COVID-19 vaccine works	Yes	9 (9.7)	20 (21.7)	7.584*
	No	39 (42.3)	24 (26.0)	
The COVID vaccine's effectiveness	Effective	8 (8.6)	42 (45.6)	64.872*
	Less Effective	38 (41.3)	4 (4.3)	
Concerned about the serious adverse effects of the vaccine	Yes	37 (40.2)	40 (43.4)	9.145*
	No	9 (9.7)	6 (6.5)	

** Statistically significant (p<0.05)*

Table 2 Association between the dependent variable and independent variables (n=92)

No significant association was found between age and vaccination status, both in an unadjusted model [OR (95%CI) =1.333 (0.545-3.262)] and after adjustment [OR (95%CI) =0.830 (0.131-5.249)]. Similarly, the sex of the respondents did not show a significant association with vaccination status in both unadjusted [OR (95%CI) =0.538 (0.235-1.233)] and adjusted models [OR (95%CI) =0.518 (0.124-2.174)]. Initially, educational level showed significance in the unadjusted model [OR (95%CI) =0.178 (0.046-0.682*)]. However, after adjustment, this association was no longer significant [OR (95%CI) = 0.467 (0.078-2.812)]. No significant association was observed between marital status and vaccination status, both in unadjusted [OR (95%CI) =0.744 (0.324-1.708)] and adjusted models [OR (95%CI) =0.773 (0.137-4.370)]. Initially, the category of health worker did not show significance in the unadjusted model [OR (95%CI) =0.383 (0.133-1.109)]. However, after adjustment, doctors showed a higher likelihood of being vaccinated [OR (95%CI) =3.498 (0.483-25.363)] compared to other health workers, although this was not statistically significant. There was no significant association between living status and vaccination status, observed in both unadjusted [OR (95%CI)

=1.081 (0.333-3.506)] and adjusted models [OR (95%CI)=0.467 (0.66-3.311)]. A significant association was observed between high confidence levels and vaccination status in both unadjusted [OR (95%CI) =0.033 (0.009-0.125*)] and adjusted models [OR (95%CI)=0.024 (0.004-0.154*)]. Knowledge regarding the protection of COVID vaccine against different variants of COVID-19 was significantly associated in both unadjusted [OR (95%CI)=0.117 (0.031-0.437*)] and adjusted models [OR (95%CI)=0.137 (0.021-0.888*)]. Based on the awareness of COVID vaccine to people with existing health conditions, initially significant association was found in the unadjusted model [OR (95% CI) = 0.304 (0.119–0.776*)], this association lost significance after adjustment [OR (95%CI)= 0.547 (0.132–2.262)]. Initially, having an idea about how the COVID-19 vaccine works showed significance in the unadjusted model [OR (95%CI)= 3.611 (1.415-9.214*)]. However, after adjustment, this association became non-significant [OR (95%CI) = 2.256 (0.568–8.966)], although those with an understanding were more likely to be vaccinated than their counterparts (Table 3).

Variables	Categories	Unadjusted Model		Adjusted Model	
		OR	95% CI	OR	95% CI
Age (years)	19-30	1.333	0.545-3.262	0.830	0.131-5.249
	≥31	Ref		Ref	
Sex	Male	0.538	0.235-1.233	0.518	0.124-2.174
	Female	Ref		Ref	
Education	Diploma	0.178	0.046-0.682*	0.467	0.078-2.812
	Bachelor or above	Ref		Ref	
Marital Status	Married	0.744	0.324-1.708	0.773	0.137-4.370
	Unmarried	Ref		Ref	
Category of health worker	Doctor	0.383	0.133-1.109	3.498	0.483-25.363
	Other	Ref		Ref	
Living Status	With family	1.081	0.333-3.506	0.467	0.66-3.311
	Others	Ref		Ref	
Level of Confidence	High	0.033	0.009-0.125*	0.024	0.004-0.154*
	Low	Ref		Ref	
COVID vaccine protect different variants of COVID-19	Yes	0.117	0.031-0.437*	0.137	0.021-0.888*
	No	Ref		Ref	
Covid vaccine to people with existing health conditions	Safe	0.304	0.119-0.776*	0.547	0.132-2.262
	Not Safe	Ref		Ref	
Had idea how the COVID-19 vaccine works	Yes	3.611	1.415-9.214*	2.256	0.568-8.966
	No	Ref		Ref	

OR = Odds Ratio; CI = Confidence Interval; Ref=Reference

Table 3 Unadjusted and adjusted analysis (binary logistic regression) of the dependent (Vaccination Status, Vaccinated or Not Vaccinated) and independent variables

DISCUSSION

The most efficient way to prevent and control COVID-19 disease is by vaccination. Since healthcare workers are a high-risk demographic and immunization within this group likely lowers the transmission of COVID-19 in healthcare settings, they are essential to the success of COVID-19 vaccination efforts. Furthermore, healthcare professionals are seen by the public as reliable sources of knowledge about the COVID-19 vaccine, and their views toward vaccination will influence others.

This study aimed to assess the COVID-19 vaccination uptake among healthcare workers in Garowe. Several parallels exist between this study and prior investigations

concerning healthcare worker attitudes toward COVID-19 vaccination. The socio-demographic characteristics and COVID-19 vaccination uptake rates among respondents align with trends seen in comparable studies among healthcare personnel in various global settings (Shekhar et al., 2021; Smith et al., 2021). For instance, the predominant acceptance rate among healthcare workers reported in this study (52.1%) echoes similar rates observed in studies conducted in diverse regions (Chen et al., 2021; Robinson et al., 2021).

The absence of significant associations between vaccination status and demographic factors such as age, sex, marital status, and living arrangements mirrors outcomes from earlier studies (Al-Mohaithef & Padhi, 2020; Saied et al., 2021). Similarly, the non-significant association between age and vaccination status aligns with several studies assessing vaccination acceptance among healthcare workers (Deml & Githaiga, 2022). However, contrasting results emerge regarding the association between educational level and vaccination status. While initial findings in this study suggested significance, the adjusted model showed no substantial association. This discrepancy deviates from some earlier studies where higher education levels correlated with increased vaccine acceptance (El-Elimat et al., 2021).

Moreover, the notable association between healthcare worker categories and vaccination status, despite lacking statistical significance after adjustment, resonates with previous research highlighting variances in vaccine acceptance among different healthcare professional groups (Elharake et al., 2021). The significant associations observed between vaccination status and factors such as confidence levels, knowledge about vaccine efficacy against variants, and awareness of vaccine administration to individuals with pre-existing conditions corroborate findings from analogous studies (Al-Qerem & Jarab, 2021; Nguyen et al., 2020). However, discrepancies emerge regarding the association between understanding the vaccine's mechanism and vaccination status. While an initial significant association was observed, it lost significance after adjustment. This contrasts with studies where a comprehensive understanding of vaccine mechanisms consistently correlated with higher vaccination uptake (Gagneux-Brunon et al., 2021). This study's findings align with several aspects of previous research on healthcare worker attitudes toward COVID-19 vaccination, particularly in associations between vaccination status and confidence levels, knowledge about vaccine efficacy, and awareness of specific vaccine-related information. However, variations in the significance of factors such as educational level and understanding of vaccine mechanisms highlight the complexity and context-specific nature of vaccine acceptance determinants among healthcare workers.

LIMITATIONS

The limitations of this study include selection bias, as healthcare workers who participated may differ from non-participants, and the cross-sectional design, which only captures a snapshot in time and does not establish causality.

CONCLUSION

The research underscores the multifaceted nature of factors influencing vaccination uptake. While certain demographic characteristics displayed no direct correlation, nuanced aspects of awareness, confidence, and specific knowledge about the vaccine emerged as critical determinants of vaccination status. This highlights the importance of targeted educational initiatives, bolstering confidence, and disseminating

comprehensive information to improve vaccine acceptance and uptake rates across diverse demographics, including healthcare professionals. Further studies could delve deeper into the nuanced patterns observed, aiding in the formulation of more precise strategies for enhancing vaccination rates and combating vaccine hesitancy.

What is already known about this topic:

- Demographic factors have been studied for their influence on vaccination uptake.
- Vaccine hesitancy is a complex issue influenced by various social and psychological factors.
- Educational campaigns have shown some impact on improving vaccine acceptance.

What this study adds:

- Identifies nuanced aspects like awareness, confidence, and specific knowledge as critical determinants of vaccination status.
- Highlights the need for targeted educational initiatives addressing these nuanced factors.
- Calls for further research to explore detailed patterns aiding in formulating precise strategies to combat vaccine hesitancy and enhance vaccination rates.

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AUTHOR CONTRIBUTIONS

Ahmed M. Said contributed to the conception and design, data collection, analysis, and drafting of the article and review. **Abul H. Bakibillah** contributed to the design and drafting of the article. **Abbas A. Mohamed** contributed to in design and revision of the article. **Abdullahi I. Janay** contributed to Data analysis and reviewing the final manuscript. **Faisal Muhammad** contributed data analysis, and interpretation and also did the final revision of this manuscript. All the authors read and approved the final version of the manuscript.

DECLARATION OF COMPETING INTEREST

The authors declare that they have no known competing interests.

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