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Awareness and associated with the practice of routine medical examination among market food handlers in Dar es Salaam, Tanzania

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ABSTRACT

Most foodborne diseases (FBDs) occur due to unhygienic and unsafe food practices among food handlers. Routine medical examination (RME) is one of the recommended methods to prevent the occurrence of FBDs. This study aimed to determine the awareness, practice, and factors associated with the practice of RME among market food handlers. In 2022, a community-based cross-sectional study was conducted among 232 market food handlers in Dar es Salaam, Tanzania. A questionnaire was used to collect information on social-demographic, awareness, and practice of RME among food handlers. Of 232 study participants, 202 (87.1%) were female, and 128 (55.2%) were married. Food handling was the primary occupation for most 218 (94.0%) participants, and 112 (48.3%) had less than five years of working experience. The Majority, 211 (90.9%) and 192 (82.8%) of participants knew about FBDs and RME, respectively. The overall awareness of RME services was 162(69.8%), and 168 (72.8%) had ever undergone RME. Duration of work as a food handler (AOR= 3.9, 95%CI= 1.120-13.493), participation in food hygiene training (AOR= 4, 95%CI = 1.501-10.618), and being aware of the RME services (AOR= 21, 95%CI= 8.454-52.246) were factors associated with good RME practice. Food handlers showed good awareness of FBDs and satisfactory knowledge and practices on RME. Adherence to RME was influenced by work experience, hygiene training, and awareness of RME services. Findings should be interpreted cautiously, as the tool used was not validated for the Tanzanian context. We recommend local validation of the tool and qualitative studies to explore barriers and facilitators of RME among food handlers.

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1. Introduction

Foodborne diseases (FBDs) are a significant cause of morbidity and mortality worldwide (1,2). Globally, between 20% and 70% of FBDs stem from contaminated food, primarily from food handlers (3–7). It is estimated that 10% of the population falls ill and 420,000 people die annually due to FBDs (1,8). The

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highest incidence of FBDs is reported in Asia and Sub-Saharan Africa (SSA) (9,10). Food hazards contribute to 600 million cases of FBDs annually and an additional 33 million disability-adjusted life years (8,10,11).

The most common FBDs are diarrhoea, typhoid, cholera, dysentery, and shigellosis (12,13). FBDs may progress to other serious diseases such as kidney failure, liver failure, reactive arthritis, brain and neurological disorders, and, ultimately, fatalities (1,7,14,15). The primary microorganisms identified as the causative agents of these FBDs include *Salmonella*, *Campylobacter* species, *Moraxella* species, *Acinetobacter* species, *Pseudomonas* species, *Clostridium perfringens*, *Listeria*, *Staphylococcus*, *Bacillus*, *Norovirus*, and *Escherichia coli*. Also, parasites like *Ascaris lumbricoides*, *Giardia lamblia*, *Entamoeba histolytica*, and *Blastocystis hominis* contribute to FBDs (7,16–18).

FBDs result from food contamination, which may occur during food production, delivery, and consumption (14). Unsafe food handling practices of food handlers contribute significantly to the emergence and spread of FBDs (1,14,19,20). For instance, the most famous notorious case of "Typhoid Mary," a food handler who was a chronic typhoid carrier, caused 1300 cases of typhoid fever (19,21). Thus, the good health status of food handlers is crucial in preventing FBDs. This can be achieved through the RME of food handlers, which goes hand in hand with food safety knowledge, attitude, and practices (7,11,13,19,20,22,23). With urbanization, fast technological advancement, and lifestyle changes, there is a rapid increase in food handlers in many countries (13,24).

Most countries mandate food handlers' RME to safeguard the consumers' health and safety and ensure that food does not pose a significant risk of causing FBDs. The requirements for food handlers' medical examination include chest examination to exclude tuberculosis, Widal test for typhoid, stool examination, examination of skin diseases, physical examination of the throat, and in males, examination of external genitalia for venereal diseases (21,25). Lack of food safety knowledge and improper food handling procedures are the factors reported to influence food safety practices (26–28).

Tanzania has a food safety policy, regulations, and guidelines that direct how food should be handled from production to consumption. Two regulatory authorities that oversee and enforce the proper handling of food in Tanzania are the Tanzania Bureau of Standards (TBS) and the Tanzania Medicines and Medical Devices Authority (TMDA) (29,30). The Tanzania regulation for registration and licensing of food premises guides the personnel who handle food business that he/she should ensure thorough medical examinations for food handlers are carried out before employment. After every six months, the medical examination records for each worker shall be kept properly and accessible for inspection. The records shall be maintained for at least two years, and there shall be properly trained personnel from a recognized Institution. (29). However, despite food safety policies, regulations, and guidelines, FBDs are yet a challenge in Tanzania, similar to other low- and middle-income countries (LMICS), and studies report suboptimal uptake of routine medical examination (RME) services (1,9). The question of this study is why the uptake of RME is suboptimal. This study aimed to determine the

factors associated with the practice of RME among market food handlers in Dar es Salaam, Tanzania.

2. Materials and Methods

2.1. Study setting

The study was conducted in Dar es Salaam CityCity Council, Tanzania. Dar es Salaam city council was selected purposively owing to its high population density and a significant number of food handlers (estimated to be 2648) out of the five Municipalities of Dar es Salaam region.

2.2. Study design

This was a cross-sectional study conducted between May and June 2022 in Dar es Salaam, Tanzania. Since studies on food handlers with RME and FBDs occurrence are few, the cross-sectional study design was opted for due to its ability to assess the prevalence, behavior, or characteristics of a certain subset of the population at a single point in time. The latter generates a hypothesis for further longitudinal or experimental study (s).

2.3. Recruitment of study participants

The study involved food handlers aged 18 years and above in the marketplaces of Dar es Salaam city council. A multistage sampling technique was employed for the selection of study participants. The first stage was the selection of the region, where Dar es Salaam region was purposefully chosen due to its substantial population and the highest number of food handling activities. The second stage was a selection of Municipality/District, where Dar es Salaam city council was selected purposefully. The third stage was the selection of wards; four out of 36 wards were randomly selected. The fourth stage was the selection of markets; in each of the selected wards, one market was randomly selected. Lastly, all participants who were available on the day of the interview were recruited in each market.

2.4. Sample size and sampling technique

A total of 232 food handlers were enrolled to participate in this study. The study sample size was estimated using the formula for cross-section survey: $n=(Z^2P(100-P))/\varepsilon^2$, whereby n=expected minimum number sample size, Z=confidence interval of 95% which is 1.96, ε=margin error of 5%, P=83.3%, a proportion from a previous study on medical examination among food handlers conducted in Uganda (13). Considering a 10% non-respondent rate, a total sample size of 237 was obtained. However, during data collection, we managed to enroll 232 food handlers, which is 97.89% of the estimated sample size. Besides, participants were enrolled consecutively.

2.5. Data collection procedure

We used a structured questionnaire adapted from a study conducted in Uganda (13) and modified to suit the Tanzanian context based on the investigator's expertise and research experience. The questionnaire comprised three sections. The first section captured socio-demographic information, including age, sex, education level, marital status, primary occupation as a food handler, duration of work, and average monthly income.

The second section assessed awareness of FBDs and RME services. Awareness of FBDs was evaluated through three questions: general awareness, examples

of FBDs, and their signs and symptoms. Each question was analyzed separately. Awareness of RME services was assessed using five questions covering knowledge of RME, service locations, associated costs, and whether RME can prevent FBDs. Each correct response was scored as 1, and a total awareness score was calculated per participant. A histogram plotted with a normal distribution line revealed skewed data, indicating the median as the appropriate measure of central tendency. Participants scoring below the median were classified as having poor awareness of RME services, while those scoring at or above the median were considered to have good awareness.

The third section focused on RME practices. Participants were asked whether they had ever undergone a medical examination, the number of times in the past 12 months, and the type of facility attended (public or private). Those who had never attended were asked to provide reasons.

The questionnaire was translated into Kiswahili, the predominant language in Tanzania, and face-to-face interviews were conducted by two trained research assistants.

2.6. Data analysis

Data were entered into MS Excel software for cleaning and then transferred into Statistical Package for Social Sciences (SPSS) software version 23 for analysis. Findings are summarized using frequency and percentages. A Pearson chi-square test was used to screen for factors associated with good RME practice, followed by a stepwise binary logistic regression model. A p-value of less than 0.25 was used to build a model, and variables were considered factors with a p-value of less than 0.05 in the multivariate analysis.

2.7. Ethics and consent

Ethical approval was granted by the Muhimbili University of Health and Allied Sciences (MUHAS) - Research and Ethics Committee (REC) with reference No (MUHAS - MUHAS-REC-05-2022-1170). Permission to collect data from the food handlers was received from the Dar es Salaam city council. Written Informed Consent was obtained from the study participants after explaining the study's aim and what it means to participate in the study. A statement to request participants' permission to publish the findings was included in the written informed consent. Data were collected in line with the requirements of the Declaration of Helsinki.

3. Results

3.1. Socio-demographic characteristics of the study participants

A total of 232 participants were enrolled in this study, of which 202 (87.1%) were female and 159 (68.5%) were aged between 25 – 44 years. The majority, 128 (55.2%), were married or cohabiting, and 144 (62.1%) had attained primary school education. The majority, 218 (94.0%) of the study participants, mentioned food handling as their main occupation, with 112 (48.3%) having 1 – 5 years of working experience. The majority, 110 (47.4%), earned an average monthly income of 8 – 54 USD, Table 1.

Table 1. Socio-demographic characteristics of study participants

Variables	n (%)
Age category (years)	**(n=232)**
< 24	36 (15.5)
25 - 34	91 (39.2)
35 - 44	68 (29.3)
45 - 54	29 (12.5)
> 55	8 (3.5)
Sex	
Female	202 (87.1)
Male	30 (12.9)
Education level	
No formal education	16 (6.9)
Primary	144 (62.1)
Secondary	62 (26.7)
Above secondary	10 (4.3)
Marital status	
Never married	67 (28.9)
Married or cohabiting	128 (55.2)
Widowed	7 (3.0)
Divorced or separated	30 (12.9)
Food handling as a main occupation	
Yes	218 (94.0)
No	14 (6.0)
Duration of work as a food handler (years)	
< 1	38 (16.4)
1 - 5	112 (48.3)
> 5	82 (35.3)
Average monthly income (USD)	

8 - 54	110 (47.4)
55 – 106	76 (32.8)
107 - 167	34 (14.6)
> 167	12 (5.2)

Table 2. Shows awareness of food-borne diseases and routine medical examination services among food handlers.

Variables	**n (%)**
Awareness of food-borne disease	
Awareness of any food-borne diseases? (n = 232)	
Yes	211 (90.9)
No	21 (9.1)
Awareness of diseases categorized as Food-borne diseases (n = 211)	
Cholera	76 (36.0)
Diarrhea	67 (31.7)
Typhoid	24 (11.4)
Dysentery	44 (20.9)
Awareness of Signs of food-borne diseases (n =211)	
Abdominal pain	70 (33.2)
Diarrhea	68 (32.2)
Vomiting	43 (20.4)
Fever	30 (14.2)
Have you ever participated in any food hygiene training? (n = 232)	
Yes	86 (37.1)
No	146 (62.9)
Awareness of the routine medical examination services	
Awareness of routine medical examination	
Yes	192 (82.8)
No	40 (17.2)
Aware that medical examination prevents food-borne diseases	
Yes	206 (88.8)
No	26 (11.2)

Know places for undergoing routine medical examination	
Yes	179(93.2)
No	13 (6.8)
Aware of the cost associated with routine medical examination	
Yes	172 (89.6)
No	20 (10.4)
Are you aware of the penalty if you don't comply with the routine medical examination?	
Yes	107 (46.1)
No	125 (53.9)
Overall awareness of the routine medical examination services	
Good	162 (69.8)
Poor	70 (30.2)

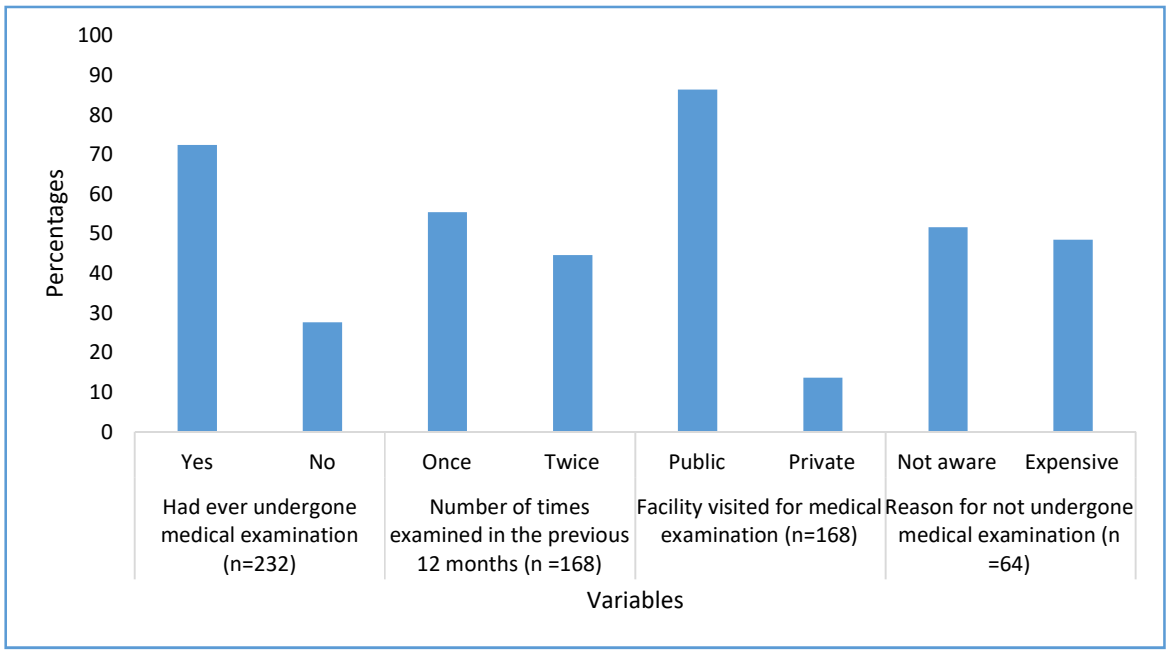

Figure 1. Shows the practice of routine medical examination among food handlers

Table 3. Factors associated with the practice of undergoing routine medical examination among food handlers

Variable	Ever undergone medical examination (%)		P-value	COR (95% CI)	AOR (95% CI)
	Yes	No			

Age (years)					
18 - 24	21 (58.3)	15 (41.7)		Ref	Ref
25-34	62 (68.1)	29 (31.9)	0.077	1.53(0.69-3.39)	0.4(0.107-1.738)
35 - 44	55 (80.9)	13 (19.1)		3(1.23-7.41)	0.8(0.147-4.096)
45 - 54	24 (82.8)	5 (17.2)		3.4(1.07-11.04)	0.7(0.007-2.055)
> 55	6 (75.0)	2 (25.0)		2.1(0.379-12.112)	0.1(0.124–1.382)
Sex					
Female	149 (73.8)	53 (26.2)		Ref	Ref
Male	19 (63.3)	11 (36.7)	0.233	0.6(0.274-1.376)	0.4(0.124-1.382)
Marital status					
Never married	38 (56.7)	29 (43.3)		Ref	Ref
Married or cohabiting	101 (78.9)	27 (21.1)	0.008	2.9(1.500-5.432)	2(0.699-5.538)
Widowed	6 (85.7)	1 (14.3)		4.6(0.522-40.162)	2.6(0.119-58.351)
Divorced or separated	23 (76.7)	7 (23.3)		2.5(0.946-6.644)	2.3(0.456-11.425)
Education level					
No formal education	8 (50.0)	8 (50.0)		Ref	Ref
Primary education	109 (75.7)	35 (24.3)	0.186	3(1.088-8.912)	2.9(0.536-16.01)
Secondary education.	44 (71.0)	18 (29.0)		2.4(0.795-7.514)	1.8(0.291-10.56)
Tertiary education	7 (70.0)	3 (30.0)		2.3(0.439-12.398)	0.7(0.053-10.32)
Food handling is the main occupation					
No	165 (75.7)	53 (24.3)	0.000	Ref	Ref
Yes	3 (21.4)	11 (78.6)		11.4(3.069-42.458)	5.4(0.571-51.63)
Duration of work as food handler (years)					
< 1	13 (34.2)	25 (65.8)	0.000	Ref	Ref
1-5	87 (77.7)	25 (22.3)		6.7(2.994-14.959)	3.9(1.120-13.49)*
> 5	68 (82.9)	14 (17.1)		9.3(3.862-22.592)	2.9(0.650-12.776)
Average monthly income (USD)					
8 - 54	76 (69.1)	34(30.9)			
55 – 106	57(75)	19(25)	0.595		
107 - 167	27(79.4)	7(20.6)			
> 167	8(66.7)	4(33.3)			
Awareness of any food-borne diseases					
No	156 (73.9)	55 (26.1)	0.101	Ref	Ref
Yes	12 (57.1)	9 (42.9)		2.1(0.850-5.323)	0.6(0.113-3.286)
Have you ever participated in any food hygiene training?					
No	75 (87.2)	11 (12.8)	0.000	Ref	Ref
Yes	93 (63.7)	53 (36.3)		3.9(1.897-7.960)	4(1.501-10.618)*

Overall awareness of the routine medical examination services					
Poor	146 (90.1)	16 (9.6)	0.000	Ref	Ref
Good	22 (31.4)	48 (68.6)		19.9(9.673-40.977)	21(8.454-52.25)*

*Factors showing statistically significant on multivariate regression analysis, COR = Crude odds ratio, AOR = Adjusted odds ratio, CI= Confidence Interval

3.2. Awareness of food-borne diseases and RME services among participants

Out of 232 participants, 211 (90.9%) were aware of FBDs, 76 (36.0%) and 67 (31.8%) were aware that cholera and diarrhea are examples of FBDs, respectively, while abdominal pain 70 (33.2%), and diarrhea 68 (32.2%) was the commonly mentioned sign. Overall, 162 (69.8%) of the food handlers were aware of RME services. Specifically, 192 (82.8) are aware of RME, 179 (93.2%) are aware of places for undergoing RME, 172 (89.6%) know the cost associated with RME, 107 (46.1%) are aware of the penalty if you don't comply with RME, and 206 (88.8%) know that RME prevents FBDs. Besides, the majority of participants, 146 (62.9%), have not participated in any food hygiene training, Table 2.

3.3. Practices of RME among the study participants

Of the 232 participants, 168 (72.8%) had ever undergone medical examination. Of 168, 93 (55.4%) underwent medical examinations once yearly, and 145 (86.3%) visited public health facilities for medical tests. Of 64 who had never undergone medical examination,33 (51.6%) reported not being aware as the main reason for not taking the service, **Fig 1**.

3.4. Factors associated with the practice of undergoing RME among food handlers

Association of different factors with practice of undergoing RME among food handlers in multivariable regression analysis showed that duration of work as food handler [AOR=3.9, 95% CI= 1.120-13.493), participation in food hygiene training (AOR=4, 95% CI= 1.501-10.618), and overall awareness of the RME (AOR=21, 95% CI= 8.454-52.246) were significantly associated with the practice of food handler to undergo RME, table 3.

4. Discussion

We aimed to determine awareness, practice, and factors associated with the practice of the RME among market food handlers in Dar es Salaam, Tanzania. The study found that the majority of food handlers are aware of FBDs (90.9%) and RME services (69.8%). Specifically, most of the food handlers are aware of RME, the place to undergo RME, the associated costs, penalties associated with failure to comply with RME, and the benefits of undergoing RME. The majority (72.4%) of study participants reported undergoing RME regularly, and not being aware was reported as the main reason for not undergoing RME. Duration of work as a food handler, participation in food hygiene

training, and overall awareness of the RME services were the factors associated with RME practice.

The observed good awareness of FBDs and RME services in our study is consistent with the studies conducted in Ghana, Ethiopia, and Uganda (7,13,26,31). As found in this study, findings from other studies support that most food handlers know examples of FBDs, and some are aware of the signs/symptoms. Besides, this study found that food handlers are aware of the places to undergo RME, cost-related, and they know that RME prevents the occurrence of FBDs. The findings are in line with what was reported in Uganda, whereby 83.3%, 77.8%, and 67.8% of food handlers know that medical examination prevents FBDs, where to undergo tests, and the related costs, respectively (13). The demonstrated high knowledge could be due to the presence of regulations and guidelines that require anyone working as a food handler to undergo RME as a strategy to prevent FBDs (29,30). According to the regulation of food handling, failure to undergo medical examination regularly among food handlers will lead to a penalty or withdrawal of the business license.

This study observed that the majority (72.8%) of the food handlers undergo medical examination regularly. The findings are consistent with what was observed in Uganda in which 78.9% of the assessed food handlers reported undergoing medical examination regularly (13). However, our findings are higher compared to what was reported in Ethiopia, where only 50.5% of the food handlers attended medical examinations (32). The differences in findings between studies can be due to differences in sample size, study settings, and efforts made by the responsible authorities to ensure food handlers are aware and that they undergo RME. In addition, health-seeking behaviors vary between populations of different nationalities and ethnicities (33). Studies report that the provision of regular training influences food handlers to undergo RME (34). The latter is true as 51.6% of participants who did not undergo RME in our study claimed not to be aware of the reason for never undergoing RME. Besides, those attending training were found as a factor associated with the practice of RME among food handlers. The findings are in line with a study conducted in Ghana in 2020, which found that the odds of good hygiene practice of food safety were 6 times more likely for street food handlers who attended training (35). Furthermore, our study found that being aware of RME and working as food handlers for more than one year were associated with the practice of undergoing medical examination. The findings are in line with what was reported in India and Uganda, which found that working experience and knowledge influence RME among food handlers (13,36). The factors are supported by the health belief model, which describes that knowledge influences perception, which changes the practice and behavior of a particular society (37). Therefore, to increase adherence to RME among food handlers, responsible authorities should use different platforms such as television, radio, and social media to raise awareness.

Limitations of the study

This study has several limitations. First, as a cross-sectional design, it cannot establish causal relationships between independent variables and the outcome of interest. However, it is useful for generating hypotheses to be explored in future longitudinal

studies. Second, the study relied on participants who were available at the time of data collection. Due to the nature of the target population and the limited sampling frame, convenience sampling was used. This may limit the generalizability of the findings, as the sample may not fully represent the broader population of food handlers. Third, the use of interviewer-administered questionnaires may have introduced social desirability bias, particularly in responses related to RME practices. Fourth, the data collection tool was adapted from a study conducted in Entebbe Municipality, Uganda. While both Entebbe and Dar es Salaam are commercial cities with similar economic activities and are geographically located in East Africa, there are contextual differences, such as language and cultural practices. The original study was conducted in English and Luganda, whereas Kiswahili is the primary language in Tanzania. Differences in food culture and other contextual factors may have affected the reliability and validity of the tool in this setting. We recommend that future studies validate adapted tools within the specific local context prior to data collection. Lastly, the quantitative nature of the study limited deeper exploration of food handlers' knowledge, practices, and the barriers or facilitators to RME. To gain richer insights, we recommend future qualitative research to complement and expand on these findings. Therefore, the study findings should be interpreted with caution.

5. Conclusion

Our findings indicate that food handlers possess good awareness of FBDs and demonstrate satisfactory awareness and practices regarding RME. Key determinants of adherence to RME practices among food handlers include duration of work as a food handler, participation in food hygiene training, and awareness of RME services. To ensure compliance with RME requirements, it is essential to strengthen sensitization efforts, provide regular training, and enforce relevant laws effectively.

FBD: Foodborne disease, LMICs: Low middle-income countries, RME: Routine Medical Examination, TBS: Tanzania Bureau of Standards, TFDA: Tanzania Food and Drug Authority, TMDA: Tanzania Medicines and Medical Devices Authority and WHO: World Health Organization.

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Author's contributions

FK: Conceptualization revision, data collection, resource, critical revision, and editing manuscript. LBM: conceptualization of the study, mentorship, and critical review of the manuscript. EGP, EY, NK, TM, JM, DK, and JMT data curation, data validation, data analysis, data interpretation, writing, editing, and revision of manuscript. MK: Data curation, data validation, data analysis, methodology, writing an original manuscript draft, critical revision, and editing of the manuscript. NS: Conceptualization revision, project administration, mentorship, resource, writing, critical revision, and editing manuscript. All authors approved the final version of the manuscript.

Declaration of competing interest

The authors declare no conflict of interest.

Data availability

The datasets used to support our study findings are available from the corresponding author upon request.

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