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Original Article

Occupational Exposure to Blood and Body Fluids Among Health Care Professionals in Bahir Dar Town, Northwest Ethiopia

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ABSTRACT

Background: Health care professionals (HCPs) are at high risk of contracting blood-borne infections due to their occupational exposure to blood and body fluids (BBFs). The incidence of these infections among HCPs are higher in low income countries such as Ethiopia. The aim of the study was to investigate the extent of occupational exposure to BBFs and its associated factors among HCPs in Bahir Dar town, Ethiopia.

Methods: A cross-sectional study was used from October 1, 2012 to October 30, 2012. Three hundred and seventeen HCPs were included in the study using a simple random sampling technique. The data were collected using a structured questionnaire and analyzed using SPSS version 16. Bivariate and multivariate analyses were used to identify the factors related to exposure to BBFs.

Results: Two hundred and nine (65.9%) HCPs were exposed to BBFs in the past year, of which 29.0% were needlestick injuries. Work experience [adjusted odds ratio (AOR) 4.13, 95% confidence interval (CI) 1.56–10.91], inconsistent use of gloves (AOR 1.98, 95% CI 1.04–3.43), and not complying with standard precautions (AOR 1.80, 95% CI 1.00–3.22) were the factors associated with occupational exposure to BBFs.

Conclusion: A high proportion of HCPs was exposed to BBFs in this study. Occupational exposure to BBFs was determined by the use of gloves and not complying with standard precautions. Ensuring the availability of gloves, training about standard precautions, and motivation of HCPs to implement standard precautions should be emphasized to avoid such exposures.

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1. Introduction

Health care professionals (HCPs) are at risk of occupational exposure to blood and body fluids (BBFs), which is a major risk factor in the transmission of infections such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), and hepatitis C virus (HCV) through percutaneous and mucocutaneous routes [1–3]. The Centers for Disease Control and Prevention have proposed standard precautions (SPs), which are a series of procedures for preventing occupational exposure and for handling potentially infectious materials such as BBFs. HCPs are advised to practice SPs, such as: observing regular personal hygiene; using protective barriers, e.g. gloves and gowns, whenever there is contact with the mucous membranes or BBFs of patients; and disposing of sharps and other clinical waste correctly [2–4].

The occupational risk of exposure to BBFs and needlestick injuries not only affects the safety and wellbeing of HCPs, but also compromises the quality of health care delivered [5]. HCPs in operating, delivery, and emergency rooms and in laboratories have an enhanced risk of exposure and they experience significant fear, anxiety, and emotional distress, which can sometimes result in occupational and behavioral changes [6,7].

Blood-borne infections such as HCV, HBV, and HIV are the most serious and constitute the major threats in the workplace [8]. The World Health Organization estimates that, of the 35 million HCPs worldwide, three million experience percutaneous exposure to blood pathogens each year, of these exposures: two million HCPs were exposed to HBV; 0.9 million to HCV; and 170,000 to HIV. As a result of these exposures, 150,000 HCPs contracted HCV, 70,000 contracted HBV, and 500 contracted HIV per year [8]. More than

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90% of these infections occurred in developing countries, especially those in sub-Saharan Africa, which account for the highest prevalence of HIV-infected patients in the world and report the highest incidence of occupational exposure to these viruses [2,3,6,9].

Published work indicates that SPs are effective in preventing both occupational exposure to BBFs and their associated infections [3,10,11]. In both developed and developing countries, occupational surveillance to assess and monitor the health hazards of HCPs and their compliance with SPs are used to prevent and control occupational and nosocomial infections [11].

Findings from developed and developing countries have shown that there is no uniform adherence to SPs by HCPs [3,12–14]. For instance, in India almost two-thirds (64.0%) [15], in Malaysia three-quarters [16], and in Nigeria only 38.8% of HCPs had a good knowledge of the practice of universal precautions [17]. About 80.8% of HCPs in eastern Ethiopia reported that they regularly follow SPs; 20.2% of HCPs were exposed to BBFs in the past 12 months and about 44.8% of HCPs reported that they were dissatisfied with the supply of infection-prevention materials [18].

The prevalence of blood-borne infection is high in the developing world [19]. Occupational exposure to BBFs among HCPs in high income countries has been well documented, which is essential for designing a range of preventive interventions. However, exposure in low income countries is less well documented.

There is a paucity of information in Ethiopia describing occupational exposures to BBFs and associated factors. Credible evidence is paramount in designing strategies and in taking action-based interventions. Such information would also be useful in identifying any gaps that might need further attention in the implementation of infection-control practices for different organizations and in providing feedback to these groups about improving safe practices. Therefore the aim of this study was to determine occupational exposure to BBFs and associated factors among HCPs in Bahir Dar town health care facilities.

2. Materials and methods

2.1. Study design and area

A cross-sectional study design was used from October 1, 2012 to October 30, 2012 to investigate the extent of occupational exposure to BBFs and associated factors among HCPs in Bahir Dar town health care facilities. The study was conducted in Bahir Dar town, the capital city of Amhara Regional State, which is 565 km from Addis Ababa in northwest Ethiopia. At the time of the study there were two hospitals in the town (one government referral hospital and one private hospital), four health centers, four government clinics, two nongovernment clinics, and 34 private clinics [20]. A total of 693 HCPs worked in the town during the study period [21]. The study population consisted of all the HCPs working in health care facilities in Bahir Dar town. HCPs who were involved in curative care services and had a direct contact with BBFs (nurses, health officers, health assistants, medical doctors, laboratory technicians, and dentists) were included in the study.

2.2. Sample size, sampling procedure, and technique

The sample size of this study was determined using a single proportion formula $\{n = [(Z\alpha/2)^2\ p\ (1 - p)]/d^2\}$ where $Z\alpha/2 = 95\%$ level of confidence (1.96), $p =$ proportion of occupational exposure to BBF in previous study (28.8%) [18] and $d =$ margin of error (0.05). By considering a 5% non-response rate, the final sample size of the study was 332. Health care facilities were first stratified into hospital, health center, higher clinics, medium clinics, and lower clinics by considering the type of health care services. A stratified random sampling technique was then used to determine the proportion of HCPs from each health care facility. The simple random sampling technique was used to select eligible study participants from the registration book of the City Administration Health Office.

Table 1
Socio-demographic characteristics of health care professionals in Bahir Dar town, northwest Ethiopia, October 2012

Variable	No (%) of subjects ($n = 317$)
Sex	
Male	121 (38.2)
Female	196 (61.8)
Age group (y)	
≤24	65 (20.5)
25–27	94 (29.7)
28–32	99 (31.2)
≥33	59 (18.6)
Educational qualifications	
Certificate	5 (1.6)
Diploma	226 (71.3)
Degree	81 (25.6)
Specialist	5 (1.6)
Job category	
Nurse	190 (60.0)
Laboratory technologist	61 (19.2)
Health officer	22 (6.9)
Medical doctor	10 (3.2)
Midwife	23 (7.3)
Other	11 (3.5)
Department of work	
Outpatient department	76 (24.0)
Injection and dressing room	45 (14.2)
Surgical ward	25 (7.9)
Operating theatre	9 (2.8)
Pediatric ward	11 (3.5)
Gynecology ward	30 (9.5)
Medical ward	14 (4.4)
Antiretroviral therapy clinic	47 (14.8)
Laboratory	25 (7.9)
Other	35 (11.0)
Work experience (y)	
≤2	70 (22.1)
3–5	126 (39.7)
6–9	46 (14.5)
≥10	75 (23.7)
Type of institution	
Private	105 (33.1)
Public	212 (66.9)
Hospital	108 (34.1)
Health center	105 (33.1)
Clinic	97 (30.6)
Laboratory	7 (2.2)

2.3. Data collection tool

A self-administered questionnaire was used to collect the data. The questionnaire had three parts. The first part covered socio-demographic characteristics, the second part covered behavioral and working environment variables, and the third part covered the occupational exposure of HCPs to BBFs. An HCP was categorized as exposed to BBFs if the HPC had a history of one or more of a needlestick injury, sharps injury, or a splash of BBFs onto their mucous membranes or skin. Four data facilitators were recruited for the data collection process. One day of training was given to the data facilitators about how to distribute the questionnaire and collect data from the study participants.

2.4. Data quality assurance

The completeness of questionnaires was checked every day by the supervisors and principal investigators. Incorrectly filled or missed questionnaires were not included in the study. The study

was pretested in other towns and the questionnaire was further modified based on the feedback during pretesting.

2.5. Data analysis

The questions were coded and the data were entered and analyzed using SPSS version 16.0 software (SPSS Inc., Chicago, IL, USA). Descriptive statistics were used to describe the demographic data for HCPs. Frequency, mean, and standard deviation were used to summarize the data. The odds ratio (OR), *p* value, and confidence interval (CI) from bivariate and multivariate logistic regression statistics were used to identify predictors of occupational exposure to BBFs.

2.6. Ethical considerations

Ethical clearance was first obtained from the ethical clearance committee of the College of Medicine and Health Sciences, Bahir Dar University. Written consent was obtained from the City Administration Health Office and verbal consent from the study participants. Privacy and confidentiality were maintained throughout the study period; each questionnaire was number-coded without any personal identification.

3. Results

A total of 317 HCPs participated in the study and the response rate of the study was 95%. A total of 121 of the HCPs (38.2%) were men. The mean age of the respondents was 29 ± 6.7 years. The majority of the study participants (71.3%) had a diploma, 60% were nurses, 24% were working in outpatient departments, and 39.7% had 3–5 years' work experience. Two-thirds of the study participants (66.7%) were working in public institutions and 34% were working in the hospital (Table 1).

More than half of the study participants had used gloves during the last health care procedure and 71 (22.4%) had undergone training on occupational infection prevention. Half of the study participants (50.8%) reported that there was enough personal protection equipment (PPE) available over the past year. The presence of safety signs in the health care facilities was reported by 38.8% of the study participants. Almost 60% of the study participants (57.4%) reported that there were enough handwashing basins in their department of work and 62.5% washed their hands before and after any health care procedure or handling of wastes. A total of 178 (56.2%) study participants reported that there was an infection prevention committee in the health care facility, although 111 (35%) reported that the workplace was not safe for the prevention of occupational exposure to BBFs (Table 2).

A total of 141 (76%) study participants had been exposed to BBFs in their lifetime. In the past year, 209 (65.9%) participants had been exposed to BBFs and 45.7% of participants had been exposed to BBFs in the past 6 months. In this study, needlestick injuries over their whole professional career, in the past year, and in the past 6 months were reported by 49.5%, 29.0%, and 14.8% of HCPs, respectively (Table 3). Of the HCPs occupationally exposed to BBFs in the past year, the majority were nurses (62.2%) and the rest were laboratory technologists (17.7%), health officers (5.7%), midwives (10.0%), medical doctors (1.4%), and others (2.9%) (Table 4).

The reasons for occupational exposure to BBFs were: the sudden movement of a patient during blood sampling or during the intramuscular or venous injection of drugs (34.4%); during childbirth (26.2%); during the handling of specimens (21.5%); during recapping of samples (13.6%); during the handling and collection of waste (10.1%); and due to a lack of PPE (15.5%) (Fig. 1).

Table 2
Individual and institutional factors affecting prevention of occupational exposure to blood and body fluids among health care professionals in Bahir Dar town, northwest Ethiopia, October 2012

Variable	No (%) of subjects ($n = 317$)
Wearing of gloves during the last health care procedure	
Yes	172 (54.3)
No	145 (45.7)
Training on prevention of occupational infection	
Yes	71 (22.4)
No	246 (77.6)
Availability of PPE throughout the year	
Yes	156 (49.2)
No	161 (50.8)
Presence of safety signs in health care institution	
Yes	123 (38.8)
No	194 (61.2)
Presence of enough handwashing facilities in department or ward	
Yes	182 (57.4)
No	135 (42.6)
Washing of hands before and after any health care procedure or handling of waste	
Yes	198 (62.5)
No	119 (37.5)
Presence of an infection prevention committee in health care institution	
Yes	178 (56.2)
No	139 (43.8)
Workplace safety for prevention of occupational exposure to blood and body fluids	
Yes	206 (65.0)
No	111 (35.0)
Compliance with standard precautions	
Yes	112 (35.3)
No	205 (64.7)

PPE, personal protection equipment.

3.1. Factors associated with occupational exposure to blood and body fluids in the past year

In bivariate logistic regression analysis, the work department, a shortage of PPE in the past year, the availability of enough handwashing facilities in the department of work, the length of work experience, occupation, wearing of gloves during the last health care procedure, and attitude to SPs showed statistically significant associations with occupational exposure to BBFs in the past year at a $p < 0.05$ (Table 4).

In multivariate logistic regression analysis, work experience, occupation, wearing of gloves during the last health care procedure, and not complying with SPs were significantly associated with occupational exposure to BBFs in the past year. Those HCPs who

Table 3
Occupational exposure to blood and body fluids among health care professionals in Bahir Dar town, northwest Ethiopia, October 2012

Variable	No (%) of subjects ($n = 317$)
Occupational exposure to blood and body fluids in your lifetime	
Yes	241 (76.0)
No	76 (24.0)
Needlestick injury in your lifetime	
Yes	160 (50.5)
No	157 (49.5)
Occupational exposure to blood and body fluids in past year	
Yes	209 (65.9)
No	108 (34.1)
Needlestick injury in the past year	
Yes	92 (29.0)
No	225 (71.0)
Occupational exposure to blood and body fluids in past 6 mo	
Yes	145 (45.7)
No	172 (54.3)
Needlestick injury in the past 6 mo	
Yes	47 (14.8)
No	270 (85.2)

Table 4
Factors associated with occupational exposure to blood and body fluids among health care professionals in Bahir Dar town, northwest Ethiopia, October 2012

Variables	Occupational exposure		Crude OR (95% CI)	Adjusted OR (95% CI)
	Yes	No		
Sex			0.90 (0.56–1.45)	
Male	78	43	1.00	
Female	131	65		
Age group (y)*				
≤24	51	14	2.01 (0.91–4.46)	
25–27	57	37	0.85 (0.43–1.67)	
28–32	63	36	0.97 (0.49–1.89)	
≥33	38	21	1.00	
Working experience (y)				
≤2	45	25	1.00	1.00
3–5	81	45	1.03 (0.54–1.96)	
6–9	31	15	0.91 (0.65–3.67)	
≥10	52	23	3.59 (1.47–8.77)†	4.13 (1.56–10.91)‡
Occupation				
Nurse	130	60	1.00	1.00
Laboratory technologist	37	24	0.71 (0.39–1.29)	
Health officer	12	10	0.55 (0.23–1.35)	
Midwife	21	2	4.85 (1.10–21.34)*	12.09 (1.50–97.72)
Medical doctor	3	7	0.20 (0.05–0.79)	
Other	6	5	0.55 (0.16–1.88)	
Department of work				
Outpatient department	50	26	1.00	
Dressing and injection room	26	19	0.71 (0.33–1.52)	
Surgical ward	17	8	1.11 (0.42–2.90)	
Operating theater	7	2	1.82 (0.35–9.40)	
Pediatrics ward	6	5	0.62 (0.17–2.24)	
Maternity ward	27	3	4.68 (1.30–16.90)	
Medical ward	10	4	1.30 (0.37–4.55)	
Antiretroviral therapy clinic	28	19	0.77 (0.36–1.62)	
Laboratory	17	8	1.11 (0.42–2.90)	
Other	21	14	0.78 (0.34–1.78)	
Shortage of PPE in the past year				
Yes	116	45	1.75 (1.09–2.79)*	
No	93	63	1.00	
Presence of enough handwashing facilities				
Yes	110	72	1.00	
No	99	36	1.80 (1.11–2.92)*	
Wearing of gloves during the last health care procedure				
Yes	103	69	1.00	1.00
No	106	39	1.82 (1.13–2.93)*	1.98 (1.04–3.43)*
Compliance with standard precautions				
Yes	65	47	1.00	1.00
No	144	61	1.71 (1.06–2.76)*	1.80 (1.00–3.22)*
Work place safety for infection prevention				
Yes	143	63	1.00	
No	66	45	1.55 (0.96–2.50)	

CI, confidence interval; OR, odds ratio; PPE, personal protection equipment.
*$p < 0.05$.
†$p < 0.01$.
‡$p < 0.005$.

had 10 or more years of work experience were 4.13 [adjusted OR (AOR) 4.13, 95% CI 1.56–10.91] times more likely to be exposed to BBFs than those who had experience of 2 years or less. Moreover, midwives were 12.09 (AOR 12.09, 95% CI 1.50–97.72) times more likely to have occupational exposure to BBFs than nurses (Table 4).

This study showed that those HCPs who did not wear gloves during the last health care procedure were 1.98 (AOR 1.98, 95% CI 1.04–3.43) times more likely to be occupationally exposed to BBFs than those who wore gloves during the last health care procedure. Similarly, those who were not complying with SPs were 1.80 (AOR 1.80, 95% CI 1.00–3.22) times more likely to have occupational exposure to BBFs than their counterparts (Table 4).

4. Discussion

The exposure of HCPs, including waste handlers, to BBFs during health care procedures has exposed them to various blood-borne diseases which, in turn, have had an impact on their families and the delivery of health care services in many countries, particularly developing countries with limited human resources.

In this study, 74% of HCPs reported occupational exposure to BBFs in their lifetime, which is comparable with findings from Iran (74%) and India (73%) [13,22]. However, this value is higher than in studies from China (66%), Serbia (66%), and Turkey (64%) [14,23,24]. A total of 50% of HCPs in this study reported that they had had needlestick injuries over their lifetime, which is lower than the findings in India (63%) [13]. However, this proportion is much higher than that in a study in Dire Dawa, Ethiopia [18]. This discrepancy may be due to variations in the study participants, the experience of HCPs, the health care setting, the availability of PPE in health care facilities, and on the job training about infection prevention. For example, in this study the participants were HCPs who were working in the town only, whereas the study in Dire Dawa included waste handlers and health care facilities in rural areas, which have a lower client flow than urban health care facilities.

In this study, occupational exposure to BBFs and needlestick injuries among HCPs in the past year were 66% and 29%, respectively, which is different from the Dire Dawa study [18]. This difference may be due to the variation in study area, the availability of PPE in health care facilities, and on the job training about infection

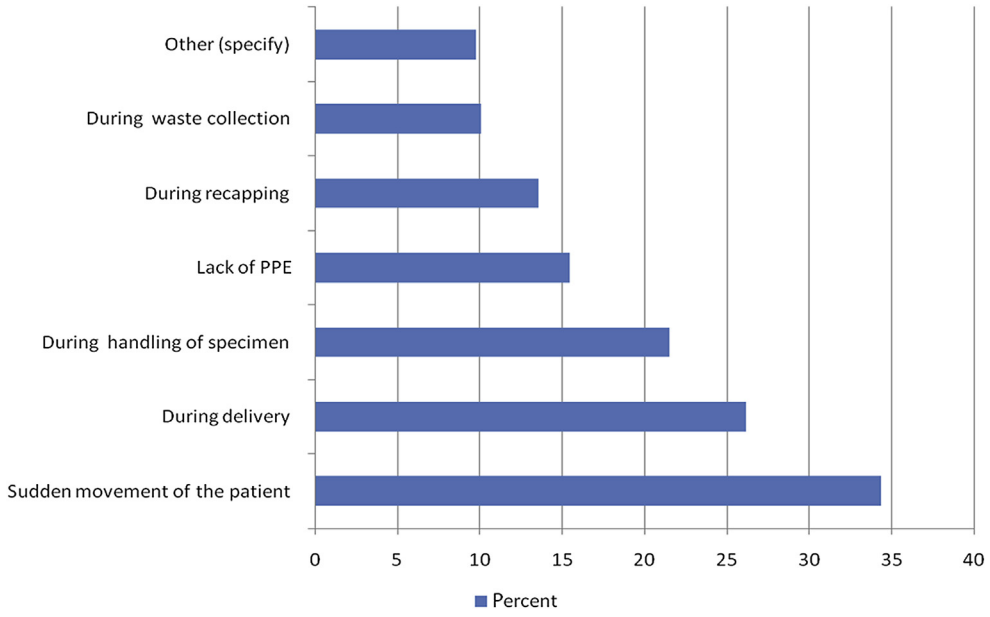

Fig. 1. Reasons for occupational exposure to blood and body fluids among health care professionals in Bahir Dar town, northwest Ethiopia, October 2012.

prevention. The setting of this study was urban health facilities, whereas in the Dire Dawa study both urban and rural health facilities were included. Similarly, in this study only 22% of the respondents had undertaken training, which is less than half the number in the Dire Dawa study (39%). Moreover, 51% of HCPs reported that PPEs were available throughout the year, lower than in the Dire Dawa study (62%) [18].

Of the HCPs exposed, the majority of the respondents in this study (62%) were nurses, which is similar to a study from Taiwan [25]. Occupational exposure to BBFs in this study did not show a statistically significant difference across the HCPs, except for midwives. This finding is comparable with the Dire Dawa study [18]. However, in this study midwives were 12.09 times more likely to have occupational exposure to BBFs than nurses. This significant difference may be due to the difference in the number of nurses and midwives and the type of services that these professionals engaged in. Midwives usually work on the delivery ward, where splashes of BBFs are common.

In this study, 46% of respondents had had an exposure to BBFs in the past 6 months, lower than studies carried out in Tigray, Ethiopia (56%) and Greece (50.9%) [26,27]. This difference may be due to the study participants, the type of service given, and the nature of the department of work. For instance, in Greece, the study participants were nurses who were working in the emergency department of general hospitals, which has a higher risk of exposure to BBFs than other departments. The results of the Ethiopian findings were obtained in a hospital with a high patient flow and intensive health care services, whereas this study included HCPs working in health centers, which provide less intensive health care than hospitals.

The main reasons for occupational exposure to BBFs in this study were: a sudden movement of the patient during blood sampling or during the intramuscular or venous injection of drugs (34.4%); during childbirth (26.2%); during the handling of specimens (21.5%); during the recapping of samples (13.6%); during the handling and collection of waste (10.1%); or due to a lack of PPE (15.5%). These reasons are comparable with the reasons given in the Dire Dawa study [18].

Most published work recommends that training is given on using gloves in every procedure and other PPE material whenever necessary to prevent occupational exposure to BBFs and needlestick injuries. In this study, 54% of the study participants reported that they used gloves during the last health care procedure, which is lower than in the Dire Dawa study (85%) [18]. About 51% of HCPs reported that PPE was available throughout the year, lower than in the Dire Dawa study (62%) [18]. Those who did not wear gloves during the last health care procedure were 1.98 times more likely to be exposed to BBFs in the past year than other workers. This discrepancy could be due to on the job training and the accessibility of facilities and materials such as PPEs in the health care facilities. Only 22% of the respondents reported that they had undergone training on infection prevention in this study, which less than half the number in the study from eastern Ethiopia (39%) [18].

In this study, 42% of the participants reported inadequate handwashing basins in their department of work; in the Dire Dawa study inadequate handwashing facilities were reported by 65.8% [18]. This variation could be due to the attention given by health care administrators and regulatory bodies to the importance of good infrastructure in public and private health care facilities.

In this study, nearly 60% of HCPs had practiced more than half of the components of SPs; none practiced all the SPs. This finding is inconsistent with the study in eastern Ethiopia, where the practice of SPs was reported by 81% [18]. Similarly, 22% of respondents in this study reported that they had undergone training on infection prevention, which is different from the findings in India and eastern parts of Ethiopia. About 36% of HCPs in India and 39% of HCPs in eastern parts of Ethiopia took part in training on infection prevention and SPs [13,18]. Furthermore, only 35% of HCPs had a positive attitude towards SPs. Those who had a negative attitude to SPs were 1.80 times more likely to have occupational exposure to BBFs to than other workers. The reasons for this variation may be due to a lack of regular on the job training about SPs and infection prevention. The findings of this study show the limitations of cross-sectional study design, such as social desirability bias.

This study found a high proportion of occupational exposure to BBFs among HCPs in the study region. This exposure was determined by the availability of PPE in the facilities, the consistent use of gloves, and attitude towards SPs. Therefore training in infection prevention and SPs should be given to HCPs and PPE should be readily available in the department of work.

Conflicts of interest

The authors declare that there are no competing interests.

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Muluken Azage designed the research proposal, carried out the analysis and wrote the final manuscript. Gedefaw Abeje contributed by commenting on the proposal, preparing the instruments and commenting on the final manuscript. Both authors critically revised and approved the final manuscript.

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