

KNOWLEDGE AND PRESCRIBING PRACTICE OF PERICONCEPTIONAL FOLIC ACID AND ASSOCIATED FACTORS AMONG HEALTH PROFESSIONALS IN BOLE SUB CITY, ADDIS ABABA, ETHIOPIA

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ABSTRACT

BACKGROUND: Neural tube defects are a major public health concern, affecting approximately 200,000 neonates worldwide each year. Periconceptional folic acid supplementation effectively prevents these defects when prescribed accurately and initiated before conception. This study aimed to assess health professionals' knowledge and prescribing practices of periconceptional folic acid and identify associated factors

MATERIALS: A facility-based cross-sectional study was conducted in Bole Sub-City, Addis Ababa. Descriptive statistics summarized study variables. Binary logistic regression identified factors associated with appropriate periconceptional folic acid prescribing practice, with statistical significance set at $p < 0.05$.

RESULT: Nearly equal proportions of participants had good and poor knowledge regarding periconceptional folic acid use; however, prescribing practice was suboptimal, with 60.6% of healthcare professionals demonstrating poor prescribing practices. Factors significantly associated with higher odds of appropriate prescribing practice included professional background, with nurses (AOR = 2.84; 95% CI: 1.44–5.60) and public health work experience in non-governmental organizations (AOR = 2.52; 95% CI: 1.34–4.74), experience working in antenatal care clinics (AOR = 2.20; 95% CI: 1.07–4.53), prior training on folic acid (AOR = 2.85; 95% CI: 1.40–5.78), and training on neural tube defects (AOR = 12.60; 95% CI: 5.80–27.35).

CONCLUSION AND RECOMMENDATION: Despite relatively good knowledge of periconceptional folic acid use among health professionals, appropriate prescribing practices remained inadequate. Strengthening awareness of folic acid's role in preventing neural tube defects and implementing targeted, practice-oriented training particularly for midwives are essential to improve prescribing practices and reduce the burden of folate-preventable birth defects.

KEYWORDS: Folic Acid, Neural Tube Defects, Periconception Care, Prescribing Practices, Health Personnel, Knowledge, Attitudes, Practice, Maternal Health Services

(The Ethiopian Journal of Reproductive Health; 2026; 18; 17-28)

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INTRODUCTION

Neural tube defects (NTDs), including spina bifida, anencephaly, and encephalocele, are among the most common congenital anomalies and contribute substantially to foetal and neonatal morbidity and mortality worldwide¹⁻³. These defects arise from incomplete closure of the neural tube during the third and fourth weeks of pregnancy^{2, 3}. Globally, an estimated 200,000 neonates are affected annually, with the highest burden occurring in low- and middle-income countries⁴.

In Ethiopia, the true magnitude of NTDs remains uncertain due to the absence of a national birth-defect registry. However, hospital-based studies provide important insights into the national burden. A study conducted in two teaching hospitals reported an NTD prevalence of 6.1 per 1,000 births, highlighting a significant public health concern^{5, 6}. This burden underscores the urgent need for effective preventive strategies. Periconceptional folic acid supplementation is the gold-standard intervention for preventing NTDs and other congenital anomalies³. Evidence shows that daily intake of 0.4 mg folic acid during the periconception period can reduce first-occurrence NTD risk by up to 62%, while a higher dose (4 mg) can reduce recurrence by up to 72%⁷. In addition to preventing NTDs, folic acid supplementation reduces risks of cardiac, orofacial, renal, and limb anomalies, as well as adverse pregnancy outcomes such as low birth weight and perinatal mortality⁷. Despite strong evidence, periconceptional folic acid use in Ethiopia remains low, particularly at primary healthcare levels where most women access services⁶. Nurses, midwives, and health extension workers provide antenatal, postnatal, family planning, and immunization services critical opportunities for counseling and prescribing folic acid. Nonetheless, over three-quarters of Ethiopian women lack awareness of early folic acid supplementation and do not receive appropriate counseling^{8, 9}. Health professionals' knowledge and prescribing practices play a central role in determining women's awareness and utilization

of folic acid. While studies from high-income countries report adequate provider knowledge and adherence to supplementation guidelines, evidence from developing countries including Ethiopia demonstrates gaps in knowledge, dosing accuracy, and timing of folic acid prescription^{10, 11}.

Although global and national strategies emphasize preconception care and NTD prevention, limited data exist on Ethiopian health professionals' preparedness to implement these recommendations effectively. Therefore, this study aimed to assess health professionals' knowledge and prescribing practices related to periconceptional folic acid use and to identify associated. Addressing these gaps is essential for designing targeted interventions to improve professional practice and reduce folate-preventable birth defects.

Methods

Study Setting and Design

The study was conducted in Addis Ababa, the capital city of Ethiopia with an estimated population of approximately four million. Administratively, Addis Ababa is divided into eleven autonomous sub-cities. This study was carried out in Bole Sub-City, located in the southeastern part of Addis Ababa and bordered by Yeka, Kirkos, Nifas Silk-Lafto, Akaky Kaliti, and Lemi Kura sub-cities. According to the Ethiopian Statistics Service (2022), the total population of Bole Sub-City is estimated at 435,421, of which 53.4% are females⁵. An institution-based cross-sectional study design was employed from May to July 2024 in all five public health centers in Bole Sub-City, namely Bole Bulbula, Bole 17, Bole 17/20, Gerji, and Dele Farea Health Centers. The study population included all health professionals working in these facilities for at least six months during the study period. Health professionals who were critically ill or unavailable at the time of data collection were excluded.

Sample Size Determination and Sampling Procedure

The sample size was determined using a single population proportion formula, assuming a 95%

confidence level and a margin of error of 5%. Based on a previous study conducted in Ethiopia, 47.7% of health professionals had sufficient knowledge of periconceptional folic acid use, while 9.7% reported prescribing folic acid during the preconception period³. Using these assumptions, the calculated sample size was 383, and after adding a 10% allowance for non-response, the final sample size was 421. Bole Sub-City was selected using simple random sampling from the eleven sub-cities of Addis Ababa. All public health centers in the selected sub-city were included. The sample size was proportionally allocated to each health center based on the total number of health professionals, and all eligible health professionals available during the data collection period were included in the study.

Operational and Definition of terms

Preconceptional folic acid use: it was defined as the use of folic acid supplements that had started before the last menstrual period. Folic acid is recommended for pregnant women¹².

Periconceptional Folic Acid use: According to the recommendation of the World Health Organization, this period is defined as the period between the first attempt to conceive (four–12 weeks before pregnancy) to 12 weeks of pregnancy¹³.

Prescribing Practice: It defined as the healthcare professional's activity that requires skills and experience developed by formal education and supporting training to deliver it effectively under law and safety¹⁴.

Knowledge of periconceptional folic acid

Health professionals' knowledge of periconceptional folic acid was assessed using eight structured items with dichotomous (Yes/No) responses. Each correct response was scored as one point, yielding a total possible score ranging from 0 to 8. Health professionals who correctly answered five or more items ($\geq 62.5\%$) were categorized as having "good knowledge," while those who scored fewer than five were categorized as having "poor knowledge." This cut-off point was adopted from previous studies and reflects an acceptable level of factual understanding

required to support appropriate counseling and prescribing practices¹⁵. Using this threshold is consistent with similar knowledge-assessment approaches applied in health-services research.

Prescribing practice of periconceptional folic acid

Good prescribing practice was defined as the provision of both counseling and supplementation or treatment-dose folic acid to women during the periconceptional (protective) period, which includes at least one month before conception and three months after conception. Health professionals who did not provide counseling and/or failed to prescribe folic acid during this period were classified as having poor prescribing practice. This definition is based on established clinical recommendations regarding the timing of folic acid supplementation for prevention of neural tube defects¹⁶.

Data Collection Procedures and Quality Assurance

Data were collected using a structured, closed-ended questionnaire developed following an extensive review of relevant literature. The questionnaire comprised sections on socio-demographic characteristics, knowledge of periconceptional folic acid use, and prescribing practices. The instrument was initially prepared in English, translated into Amharic by certified translators, and back-translated into English to ensure linguistic consistency and preserve the original meaning.

Data collection was conducted through face-to-face interviews by five trained midwives with previous data collection experience, while two health officers supervised the process. To reduce the potential for information bias, all data collectors and supervisors were recruited from outside the study facilities. Prior to data collection, a one-day training was provided on the study objectives, data collection procedures, ethical considerations, informed consent, confidentiality, and standardized interviewing techniques. Continuous supervision and daily review of completed questionnaires were undertaken throughout the data collection period to ensure completeness, consistency, and overall data quality.

Data Quality Assurance

To ensure data quality, the questionnaire was pretested on 5% of health professionals in Lemi Kura Sub-City, which was not part of the main study area. Based on the pretest, necessary modifications were made to improve clarity and reliability. Supervisors closely monitored the data collection process and reviewed completed questionnaires daily for completeness and consistency. Continuous supervision, standardized data collection procedures, and daily checks were implemented to ensure the accuracy and reliability of the data.

Data Analysis Procedure

The data were checked for completeness, entered into Epi-info version 7, and exported to SPSS version 26 for further data cleaning and analysis. Frequency distributions were obtained to check for data entry errors (missing/unrecognized values and codes). Descriptive statistics, tables, graphs, means, and frequency distributions were used to present the information. Then, bivariate analysis was performed using logistic regression to determine the crude association between the independent variables and the outcome variable. Finally, multivariate analysis using multiple logistic regression was performed to evaluate the independent effect of each variable on outcome variables. The strength of association between dependent variables and independent variables was expressed as odds ratio (OR) and 95% confidence interval, and variables with a p-value less than 0.05, were considered to be significantly associated with the outcome variable.

Results

Socio-demographic Characteristics

More than half of the participants (58.4%) were aged < 30 years, while 41.6% were aged ≥ 30 years. Regarding marital status, 62.3% of participants were single, 34.2% were married, and 3.4% were divorced. Females constituted slightly more than half of the respondents (53.9%), while 46.1% were male.

In terms of professional category, nurses comprised the largest proportion (36.2%), followed by midwives (23.6%), general practitioners (19.0%), and public health professionals/others (21.2%). The majority of participants (65.8%) had less than five years of work experience, while 26.1% had five to nine years, and 8.1% had more than nine years of experience. Regarding previous work experience, 43.1% of the participants had worked in the public sector, 34.0% in the private sector, and 22.9% in non-governmental organizations (NGOs) or other settings. (Table 1).

Table 1, sociodemographic characteristics of health professionals in Bole Sub City, Addis Ababa, Ethiopia 2024

Variables		Frequency	Percentage
Age	<30yrs	237	58.4
	>30	169	41.6
Marital status	Single	253	62.3
	Married	139	34.2
	Divorced	14	3.4
Gender	Female	219	53.9
	Male	187	46.1
Profession	Nurse	147	36.2
	Midwife	96	23.6
	General practitioner	77	19
	Public health and other	86	21.2
Work experience	<5yr	267	65.8
	5-9	106	26.1
	>9yr	33	8.1
Previous work area	Public	175	43.1
	Private	138	34.0
	NGO & other	93	22.9

Regarding professional experience, 37.7% of the participants had worked in an antenatal care (ANC) clinic, whereas 62.3% had no ANC clinic experience. Similarly, 43.6% of the respondents had worked in a labor and delivery ward, while 56.4% had not. In addition, 36.9% of participants

reported receiving training on prenatal and antenatal supplementation, while 63.1% had did not. The majority of participants reported that they had never attended the birth of a neonate with neural tube defects (NTDs). see Table (2)

Table 2 the antenatal care (ANC) clinic, Labor ward and training exposure of health professionals in Bole Sub City, Addis Ababa, Ethiopia 2024

Variables		Frequency	Percentage
Have worked in ANC clinic	Yes	153	37.7
	No	253	62.3
Have worked in labor and delivery ward	Yes	177	43.6
	No	229	56.4
Have you ever taken training on prenatal & antenatal supplementation	Yes	150	36.9
	No	256	63.1
Attended birth of a neonate with NTDs	Yes	70	17.2
	No	336	82.8

Knowledge of Health Professionals on Folic acid use

Only 31.3% of participants reported knowledge of folic acid-enriched food items, while 68.7% did not. A large proportion (89.7%) knew that folic acid deficiency can cause neural tube defects (NTDs), whereas 10.3% were unaware. Similarly, 95.3% of participants were aware that folic acid supplementation can prevent NTDs, and 93.1% correctly identified NTDs as congenital abnormalities.

Regarding supplementation practices, 56.4% of participants knew that both pregnant and

non-pregnant women should take folic acid to reduce the risk of NTDs, while 43.6% lacked this knowledge. Although 84.5% were aware that folic acid should be administered during the periconception period, knowledge of the recommended dosage was limited. Only 40.1% correctly identified the standard dose of 0.4 mg for women with no previous NTD-affected pregnancy, and 34.7% knew the recommended 4 mg dose for women with a prior NTD-affected pregnancy; the remaining 59.9% and 65.3%, respectively, did not know the correct doses (Table 3).

Table 3: Knowledge of health professionals on folic acid use in Bole Sub City, Addis Ababa, Ethiopia 2024

Variables		Frequency	Percentage
Knowledge about Folic acid enriches food stuffs	Yes	127	31.3
Folic acid deficiency can cause NTDs	Yes	364	89.7
	No	42	10.3
Knowledge about the prevention of NTDs using Folic acid	Yes	387	95.3
	No	19	4.7
NTDs are congenital abnormality	Yes	378	93.1
	No	28	6.9
	No	279	68.7
Pregnant and non-pregnant women are subjected to folic acid supplement to decrease risk of NTDs	Yes	229	56.4
	No	177	43.6
To prevent NTDs, folic acid supplement should be taken during Preconception period	Yes	343	84.5
	No	63	15.5
Correct dose of folic acid for a women had no previous pregnancy with NTD is 0.4mg	Yes	163	40.1
	No	243	59.9
Correct dose of folic acid for a women with a prior NTD affected pregnancy is 4mg	Yes	141	34.7
	No	265	65.3

Over all Knowledge about periconceptional folic acid use

The Figure below presents information on the knowledge and practice of health professionals regarding the use of folic acid. This study determined that nearly equal numbers of participants had good (50.7%) and poor (49.3%) knowledge about periconceptional folic acid use.

Prescribing practice of periconceptional folic acid

This study determined that the majority of healthcare professionals (60.6%) had poor prescribing practices for periconceptional folic acid, whereas only 39.4% had good practices in the study area.

Factors associate with Knowledge periconceptional folic acid use.

Nursing professionals had 2.84 times higher odds of having good knowledge of folic acid use compared with midwives (AOR = 2.84; 95% CI: 1.44–5.60). Similarly,

public health professionals and others were significantly more likely to have good knowledge compared with midwives (AOR = 4.26; 95% CI: 1.98–9.40).

Health professionals with previous work experience in non-governmental organizations (NGOs) had higher odds of good knowledge compared with those working in public health institutions (AOR = 2.52; 95% CI: 1.34–4.74). Participants who had experience in working at antenatal care (ANC) clinics were 2.20 times more likely to have good knowledge of folic acid use than those without such experience (AOR = 2.20; 95% CI: 1.07–4.53).

In addition, health professionals who received training on prenatal and antenatal supplementation were significantly more likely to have good knowledge (AOR = 2.85; 95% CI: 1.40–5.78). Participants who had ever attended cases of neural tube defects (NTDs) were markedly more likely to have good knowledge compared with those who had not encountered such cases (AOR = 12.60; 95% CI: 5.80–27.35) (Table 4).

Table 4: Factors associate with Knowledge periconceptional folic acid use among health professionals in Bole Sub City, Addis Ababa, Ethiopia 2024

Identified factors		Frequency Good knowledge	Poor knowledge	COR (95 CI)	AOR (95 CI)
Age	<30yrs	124	113	Reference	
	>30	82	87	1.16(0.78-1.73)	
Profession	Midwife	68	28	Reference	Reference
	GP	52	25	1.17(0.6-2.23)	1.01(0.46-2.2)
	Nurse	61	86	3.4(1.97-5.9)*	2.84(1.44-5.6)*
	Public health	25	61	5.9(3.12-11.2)*	4.26(1.98-9.4)*
Previous work	Public	111	64	Reference	Reference
	Private	64	74	2(.27-3.16)	1.53(0.87-2.7)
	NGO & other	31	62	3.5(2.04-5.9)*	2.52(1.34-4.74)*
Have been worked in ANC clinic	Yes	115	38	5.38(3.44-8.43)*	2.85(1.4-5.78)*
	No	91	162	Reference	Reference
Have you ever taken training on folic acid	Yes	112	38	5.08(3.24-7.94)*	2.2(1.07-4.53)*
	No	94	162	Reference	Reference
Have you ever attended NTDs?	Yes	18	52	3.67(2.05-6.53)*	12.6(5.8-27.35)*
	No	188	148	Reference	Reference

NB: COR crude odds ratio, AOR adjusted odds ratio, * p <0.05, ** p <0.001

Practice about Folic acid use and Associated Factors

Older health professionals had 1.27 times higher odds of practicing folic acid use compared with younger professionals; however, this association was not statistically significant. Nurses (AOR = 2.74; 95% CI: 1.44–5.21) and public health professionals/others (AOR = 2.20; 95% CI: 1.06–4.58) were significantly more likely to have poor prescribing practice compared with midwives. Health professionals with previous work experience in non-governmental organizations (NGOs) also showed higher odds of poor practice compared with those working in public health institutions (AOR = 1.25); however, this association was not statistically significant.

In contrast, health professionals who had experience working in antenatal care (ANC) clinics were 2.37 times more likely to demonstrate good prescribing practice compared with those without ANC experience. Participants who had received training on prenatal and antenatal supplementation were less likely to have good prescribing practice (AOR = 2.11; 95% CI: 1.06–4.19). Health professionals who had ever attended cases of neural tube defects (NTDs) were significantly more likely to demonstrate good prescribing practice (AOR = 14.40; 95% CI: 6.07–34.20) compared with those who had not encountered such cases (Table 5).

Table 5. Factors associate with prescribing practice of periconceptional folic acid among health professionals in Bole Sub City, Addis Ababa, Ethiopia 2024

Identified factors		Frequency		COR (95 CI)	AOR (95 CI)
		Good practice	Poor practice		
Age	<30yrs	99	138	Reference	
	>30	61	108	1.2(0.84-1.9)	
Profession	Midwife	52	44	Reference	Reference
	GP	44	33	0.88(0.48-1.62)	0.71(0.34-1.48)
	Nurse	39	108	3.27(1.9-5.6)*	2.74(1.44-5.21)*
	Public health	25	61	2.9(1.56-5.3)*	2.2(1.06-4.58)*
Previous work	Public	76	99	Reference	Reference
	Private	59	79	1.02(0.65-1.61)	0.69(0.39-1.22)
	NGO & other	25	68	2.08 (1.2-3.6)*	1.35(0.73-2.59)
Have been worked in ANC clinic	Yes	89	64	3.56(2.33-5.43)*	2.37(1.2-4.64)*
	No	71	182	Reference	Reference
Have you ever taken training on folic acid	Yes	88	62	3.6(2.37-5.54)*	2.11(1.06-4.19)*
	No	72	184	Reference	Reference
Have you ever attended NTDs?	Yes	8	62	6.4(2.97-13.7)*	14.5(6.13-34.6)*
	No	152	184	Reference	Reference

NB: COR crude odds ratio, AOR adjusted odds ratio, * p <0.05, ** p <0.001

DISCUSSION

A key finding of this study was the substantial gap in healthcare providers' knowledge and prescribing practices regarding folic acid. Participants were almost equally divided between good and poor knowledge, while the majority reported suboptimal prescribing practices. These findings may be partly explained by the limited clinical exposure of many participants, particularly their lack of experience in antenatal care (ANC) clinics and labor and delivery wards, where folic acid supplementation is routinely provided.. This finding aligns with research conducted in developing countries³. The lack of adequate knowledge may be attributed to a lack of ongoing training and guidelines on the subject, leading to a decreased likelihood of updating knowledge on congenital abnormalities and their prevention methods.

In our study, being midwives and general practitioners was associated with good knowledge and practice on folic acid use. This might be explained by the level of clinical encounter in the different health professionals had to women seeking peri-conception care, it is more for midwives and GP. Owing to their work in ANC clinics and delivery wards, physicians and midwives may have had more opportunities to explore and learn about preventive methods, including folic acid supplementation, for tube defects and other congenital anomalies. This focused exploration and learning can contribute to their superior knowledge and practices compared with other healthcare professionals.

This study found that those who had never attended any training on prenatal and antenatal supplementation were less likely to have sufficient knowledge and that the odds of having insufficient

knowledge were 5.080 times higher for those who had not attended training. Its consistency with many findings in the UK revealed that a training program for general practitioners and practice nurses led to an increase in their knowledge and recommendations for folic acid¹⁷. Similarly, a study in Canada showed that an educational intervention for healthcare providers resulted in improved knowledge and counseling practices related to folic acid¹⁸. This finding highlights the crucial role of training and education in enhancing health care professionals' knowledge and use of folic acid. The finding that Health professionals who had worked in ANC clinic were more likely to have sufficient knowledge and good practice of prescribing is consistent with that of previous studies¹⁹. This might be due to the fact that , professionals who worked in ANC clinic were more likely to get update training on MCH service including prevention of congenital abnormality. Additionally, those who worked in ANC clinics were more likely to explore information on supplementation because it is a component of ANC care.

This study suggests that direct exposure to and experience in dealing with NTD cases can significantly improve healthcare professionals' knowledge and practices related to folic acid supplementation. Attending NTD cases allows them to witness the real-world consequences of insufficient folic acid intake, and the importance of proper folic acid supplementation during pregnancy. This hands-on experience can be more impactful in enhancing their understanding and appreciation of the role of folic acid in preventing congenital anomalies than theoretical knowledge alone. Direct exposure to the consequences of inadequate folic acid intake can help solidify their

understanding of and commitment to promoting folic acid supplementation¹⁹. However, the findings should be interpreted with caution, as the cross-sectional design precludes the establishment of causal relationships, and the possibility of selection bias could not be entirely avoided.

Conclusion and Recommendations

Although a considerable proportion of health professionals had adequate knowledge of periconceptional folic acid use, appropriate prescribing practices remained suboptimal. Professional exposure, antenatal care experience, and training on folic acid supplementation and neural tube defects were important determinants of both knowledge and prescribing practice. The observed gap between knowledge and practice suggests that awareness alone is insufficient to ensure evidence-based implementation. Strengthening healthcare providers' practical competence through targeted training, continuous professional development, and greater clinical exposure may improve adherence to recommended prescribing practices, enhance the quality of preconception and antenatal care, and ultimately reduce the burden of folate-preventable neural tube defects.

Competing Interests

The authors declare that they have no competing interests.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' Contributions

All authors made substantial contributions to the work reported, including the conception and design of the study, data acquisition, analysis, and interpretation. All authors were involved in drafting the manuscript or revising it critically for important intellectual content, approved the final version to be published, agreed on the journal to which the article has been submitted, and accept accountability for all aspects of the work.

Availability of Data and Materials

The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Abbreviations and Acronyms

ANC	Antenatal Care
EDHS	Ethiopian Demographic Health Survey
ETB	Ethiopian Birr
FA	Folic Acid
FEP	Free Erythrocyte Protoporphyrin
FD	Folate Deficiency
Hgb	Hemoglobin
IDA	Iron Deficiency Anemia
IFA	Iron/Folic Acid
IFAS	Iron Folic Acid Supplementation
INACG	International Nutritional Anemia Consultancy Group
IRB	Institutional Review Board
LBW	Low Birth Weight
MCH	Maternal and Child Health
NNP	National Nutrition Planning
NTD	Neural Tube Defect
RDA	Recommended Dietary Allowance
SNNP	Southern Nation and Nationality
SRS	Simple Random Sampling
WHO	World Health Organization
WRA	Women of Reproductive Age

Declarations

Ethical Considerations

Ethical clearance was obtained from the Research Ethics Review Committee of Sante Medical College, Department of Public Health (Ref. No. V1/031/2024), following approval from the Addis Ababa Health Bureau Public Health Research Directorate. Permission to conduct the study was secured from the Bole Sub-City Administration Health Office, and a letter of cooperation was provided to the selected health facilities. Prior to data collection, informed oral consent was obtained from all participants. Participants were informed about the purpose of the study, the confidentiality of the information they provided, and their right to decline participation, skip any question, or withdraw from the interview at any time without any consequences.

Acknowledgment

The authors thank the Department of Public Health, Santé Medical College for its technical support and the Bole Sub-City Health Office, study participants, data collectors, and supervisors for their valuable cooperation and contribution to this study.

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