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RESEARCH ARTICLE

Health Professional's Experience in Patient-Centered Care in Gedeo *Zone*, South Ethiopia, A Grounded Theory Study

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Abstract

Background: Patient-centered care (PCC) places the individual patient at the center of healthcare delivery, ensuring that care is provided in a respectful manner. In Ethiopia, the practice of PCC remains limited, and the reasons for its poor implementation have not been explored in a study setting. This study aimed to explore health professionals' experiences regarding PCC in the Gedeo Zone, Southern Ethiopia.

Method: A health institution-based study was conducted using Glasser's (1992) grounded theory approach. Twenty-one participants were recruited via purposive sampling. Semi-structured interviews were conducted with health professionals at Dilla University General Hospital and Yirga Cheffe Primary Hospital. The interviews were audio recorded and transcribed for thematic analysis using Atlas.ti (v.7) qualitative data analysis software. Inductive thematic analysis was employed to identify themes and sub-themes.

Result: Twenty-one health professionals participated in the study, comprising 43% nurses, 33% general medical practitioners, and 24% senior physicians. Fifty-two percent of the participants were from Dilla University General Hospital, while 48% were from Yirga Cheffe Primary Hospital. Participants identified similar experiences that either facilitated or hindered the implementation of PCC, yet most health professionals had not been exposed to the concept. The thematic analysis revealed four major themes: (a) failure to respect patients' preferences; (b) lack of involvement of patients' families; (c) poor patient-provider interaction; and (d) challenges to implementing PCC. Participants discussed barriers and provided recommendations to improve the understanding and implementation of PCC in healthcare.

Conclusion: This study demonstrated that patient care is primarily delivered from a traditional provider-centered approach focused on episodic curative services, with PCC largely absent in the study setting. However, the support of the hospital senior management team is essential to create an environment that fosters the implementation of PCC and enhances its value among health professionals.

Keywords: Grounded theory, Health professionals, Patient-centered care, South Ethiopia

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1 Introduction

1.1 Background

Patient-centered care (PCC) is increasingly recognized as a crucial aspect of healthcare quality. The Institute of Medicine has highlighted PCC as one of the six most important dimensions of healthcare quality [1], defining it as care that is respectful and responsive to individual patient preferences and needs, ensuring that patient values guide all clinical decisions [2]. This principle has become a guiding tenet in healthcare delivery. According to the World Health Organization (WHO), the implementation of PCC at all levels of health facilities should encompass harmonization, reduced patient waiting times, efficiency and effectiveness of health services, and the maintenance of patient safety, ethics, and professionalism [3].

In Ethiopia, PCC is a component of the compassionate, respectful, and caring (CRC) agenda outlined in the Health Sector Transformation Plan since 2015. Although the inclusion of PCC as a quality dimension in healthcare delivery dates back to 2010, a common understanding of PCC remains lacking in practice [4]. While health systems aim to deliver patient-centered care, health professionals often focus excessively on providing episodic curative services based on a disease-focused approach. In contrast, PCC suggests concrete activities for implementation, including providing information to patients, engaging them in their healthcare, involving patients' families, and empowering patients [5].

The implementation of these activities has been associated with more positive health outcomes [6,7]. Understanding the domains of PCC often depends on the definitions provided by health professionals and the social context. Nevertheless, there is a consensus among various professional groups regarding the core elements of PCC, such as addressing the psychological needs of patients and promoting patient empowerment. However, the focus and emphasis placed on these elements may vary among different health professionals [8].

According to the WHO, health systems prioritize the treatment of individual diseases, leading to an investment in and efficient utilization of health resources based on a medical model of service delivery rather than on patient-centered care. Thus, primary healthcare is designed to mediate between PCC and the provision of medical model health services [9]. This model fulfills the coordination role necessary for patient-centered service delivery, tracking and ensuring the right balance between primary and secondary levels of health service delivery as a whole [9].

Previous studies have found that PCC has the potential to improve health outcomes [10,11] and benefits healthcare systems and providers. Practices that contradict the principles of PCC, such as failing to consider patient preferences in care decisions, have been linked to accusations of malpractice [12,13]. The risks of miscommunication increases when healthcare providers neglect a patient's preferences, needs, and values. Additionally, healthcare systems benefit from PCC by reducing patient waiting times, minimizing unnecessary laboratory investigations and procedures, decreasing out-of-pocket healthcare expenditures, and ultimately improving the efficiency of care [14,15].

The lack of implementation of patient-centered care (PCC) may be attributed to health professionals' insufficient knowledge about how to involve patients in their care and the variability in patient preferences. However, patients are more likely to trust their ability to make decisions regarding treatment and care when they are thoroughly informed [16,17].

Researchers in their field have observed that the Compassionate, Respectful, and Caring (CRC) health workforce—a multi-pronged approach—requires mechanisms to continually remind health professionals of the values and aspirations that led them into the healthcare industry [18]. Unfortunately, this commitment is becoming compromised, as there is a lack of effective service provider-patient interaction and insufficient direct involvement of patients' families in treatment care plans. Moreover, studies on decentralization in Ethiopia often overlook the potential effects of decentralized reforms on patient-centered service delivery models [19].

To date, there are no documented studies exploring health professionals' experiences with patient-centered care in a study setting. These gaps have prompted the researchers to investigate health professionals' experiences with PCC, aiming to provide recommendations for better implementation of PCC in this context.

1.2 Research questions

What experiences do health professionals have about patient-centered care?

2 Methods and Materials

2.1 Study Setting and Period

The study was conducted in the Gedeo Zone, specifically at Dilla University General Hospital and Yirga Cheffe Primary Hospital. This study setting is located approximately 425 km south of the capital, Addis Ababa. The total number of health professionals in the study area is estimated to be around 850. The research was carried out from August to September 30, 2021.

2.2 Study Approach

Health institution-based Glasser's (1992) grounded theory approach was employed.

2.3 Study Population

To elucidate the lived experiences of health professionals directly involved in the health service delivery process, participants were invited to take part in the study. A six-month period was chosen to ensure that eligible participants had sufficient experience without being too short-term in their healthcare roles. Recruitment was based on the participants' expertise related to the concept under inquiry. Paramedical professionals, environmental health professionals, and non-health professionals were excluded from the study.

2.4 Sample Size Determination and Sampling Procedure

The sample size was determined based on data saturation regarding experiences of patient-centered care, and a purposive sampling technique was employed to identify study participants.

2.5 Data Collection Tool and Procedures

A semi-structured questionnaire was designed in English based on a modified two-step theoretical framework model. It included demographic characteristics of the study participants, open-ended questions, and follow-up questions. The questionnaire was then translated back into Amharic.

To collect data from multiple sources, individual face-to-face in-depth interviews were conducted, with audio recordings and field notes taken to capture participants' opinions and viewpoints. A pre-test was conducted with five health professionals at Kabado Primary Hospital, near the study site. During the pre-test, the questionnaire was evaluated for clarity, readability, comprehensiveness, accuracy, and the optimal time required for completing the in-depth interviews. Modifications and amendments to the questionnaire were made based on insights gained from the pre-test.

2.6 Definition of Terms

Health Service Delivery: is the provision of healthcare services to meet health needs of patients in order to improve client satisfaction through strengthening relationships between clients and health service providers [20].

Medical Model Service Delivery: is service delivery model focused on illness and episodic curative services with limited autonomy of patient preference and needs [20].

Health Service Facility: is the point of healthcare service provision in a hospital setting [21].

Patient-Centered Service Delivery Model: is respecting patients' preferences, needs and values to enable multidisciplinary healthcare team to give due attention to patient's concern [22].

Grounded Theory: is a qualitative research approach in which the researchers derive a general abstract theory of a process, action or interaction grounded from the participants viewpoints [23].

2.7 Trustworthiness of the Study

The term "**trustworthiness**" refers to the validity and reliability of qualitative studies [24,25]. It encompasses the rigor of the data and the extent to which the researcher can convey to readers that the study is worthy of their attention [26,27]. In this study, the four criteria for maintaining trustworthiness proposed by Guba, as outlined by Shenton, are employed: conformability, credibility, dependability, and transferability [28].

Confirmability refers to the extent to which the data collected from participants are analyzed objectively. If another researcher were to examine the same data, they would arrive at similar results [26,27]. The data analysis presented in this study reflects a neutral interpretation of the information obtained from participants rather than the researchers' viewpoints. Confirmability was ensured through audio recording and verbatim transcription of the interview sections, thereby establishing the confirmability of this study.

Credibility refers to the accuracy with which the information provided by participants is interpreted [27,29]. This study achieved credibility through individual in-depth interviews, which were not only used to gather information but also to authenticate the data collected. Each interview lasted between 30 to 60 minutes and was audio-taped and recorded.

Dependability pertains to the stability and consistency of the information obtained, as well as the extent to which it remains reliable over time and under varying conditions. To ensure dependability, a comprehensive description of the study setting, data collection techniques, and data analysis methods was provided.

Transferability is the ability of the findings to be applied to similar situations and yield comparable results [24,30]. In this study, transferability was ensured by providing detailed descriptions of the data, study setting, and the socio-demographic characteristics of the participants. This information allows readers to evaluate the applicability of the findings to other contexts.

2.8 Data Processing and Analysis

Filled questionnaires were checked for completeness and consistency, and demographic data were entered into SPSS version 25 for analysis. Qualitative data were categorized and organized into themes and sub-themes that emerged through initial coding, process coding, focused coding, axial coding, and theoretical coding. The transcripts were imported into Atlas.ti (v.7) for further analysis. Regular debriefing sessions were held among the investigators to ensure the accuracy of data coding, analysis, and interpretation.

3 Result

3.1 Demographic Characteristics of the Study Participants

Data were collected from 21 health professionals, achieving a 100% response rate. The average age of the participants was 27.85 years, with the youngest being 25 and the oldest 43. Nearly 52% of the respondents were recruited from Dilla University General Hospital. The majority of respondents (13, or 62%) were female health professionals, and 16 (76%) held a bachelor's degree. The average work experience among the participants in various health service organizations was 6.3 years, ranging from a minimum of 1 year to a maximum of 18 years; however, only 62% (n=13) of the health professionals had less than 5 years of work experience (Table 1).

Table 1 Demographic Characteristics of Participants, Dilla University General Hospital and Yirgacheffe Primary Hospital, South Ethiopia, 2021 (n= 21)

Variables		Frequency	Percentage
Average age		27.85	
Health Facility	Dilla University General Hospital	11	52%
	Yirgcheffe Primary Hospital	10	48%
Gender	Male	8	38%
	Female	13	62%
Level of education	BSc degree	16	76%
	Master's degree	3	14%
	Specialty certificate	2	10%
Professional qualification	Senior physician	5	24%
	General practitioner	7	33%
	Professional nurse	9	43%
Work experience in a year	<5 years	13	62%
	6-10 years	3	14%
	>11 years	5	24%
		n=21	

The following four major themes and twelve sub-themes emerged during data transcription, with direct quotes from study participants providing a rich description of the findings. To maintain confidentiality, participants' ages in years and professional qualifications were used to describe their viewpoints.

Table 2 Major Themes and Sub-Themes

S.N.	Major Themes	Sub-Themes
1.	Failure to respect patient's preference	Information asymmetry
		Physician induced demand
2.	Lack of involvement of patients' family	Patient privacy
		Patient's age
		Patient's medical conditions
3.	Poor service provider-patent interaction	Belief on treatment
		Treatment adherence
		Patient empowerment
4.	Challenges to implement PCC	Work load
		Shortage of medical supplies
		Lack of support from SMT
		Lack of awareness of service providers about PCC

3.2 Patient-centered care

During the data analysis, "patient-centered care" represented how health service providers in the study setting aimed to place patients at the center of their care and deliver quality health services.

3.3 Failure to respect patient's preference

The theme "Aiming to Respect Patients' Preferences" reflects how health professionals in the study setting recognize the low literacy levels of patients, which is linked to the tendency of health professionals to overlook patients' preferences for services, thereby creating additional demand. Within this theme, two subthemes emerged: "Information Asymmetry" and "Physician-Induced Demand".

Information asymmetry

Participants clearly indicated that patient perceptions of health services exist in a healthcare market similar to other consumer goods. The agency relationship is influenced by information asymmetry between physicians and patients, with physicians typically possessing more knowledge about diagnostic and treatment options. Consequently, patients may seek their physician's personal opinions to help them make healthcare decisions. This can lead to the ordering of diagnostic tests or treatments that may not be necessary and might offer minimal benefits to the patients.

One participant noted: "*Low health literacy among patients and a strong doctor-patient relationship can occur in private health facilities, where doctors recommend or encourage patients to use specific health services required for their medical problems*" (A 40-year-old physician).

Physicians induced demand

The doctor-patient relationship is essential to healthcare practice and is central to delivering quality and efficient health services. In the healthcare industry, physicians act as principal agents on behalf of their patients, guiding them to make the best possible treatment decisions. However, physicians' behaviors may be influenced by their desired income levels, and the health system in the private sector often encourages the overutilization of health services to boost revenue in the private healthcare market. Physicians may leverage their knowledge to influence patients, leading to increased utilization of diagnostic tests, imaging services, or screening procedures.

One physician stated: "*As a physician, I have to convince patients and determine the most efficient treatment for their needs, rather than prioritizing patients' voices and needs. In a private setting, physicians may offer more services than optimal for the patient in order to increase the revenue of the private health service organization*" (A 29-year-old physician).

3.4 Lack of involvement of patients' family

Patient-centered care is essential for promoting family engagement in hospital settings when making decisions about treatment plans. However, nurses have varying perceptions of the extent to which family members should be involved in healthcare. Service providers should foster a positive attitude toward patients' families to create a culture of inclusion that supports quality healthcare delivery, family cohesion, and patient safety. Within this theme, three sub-themes emerged: "Patient Privacy", "Patient Age", and "Patient Medical Condition".

Patient privacy

Maintaining patient privacy is of utmost importance during healthcare provision. A well-documented imbalance of decision-making power between service providers and patients' families poses a barrier to engaging family and friends in the treatment process. Furthermore, the apparent transfer of power to the family can impact patient privacy.

One physician noted, "*As a healthcare provider in the obstetrics and gynecology department, I am not comfortable allowing family members and friends to be involved in patients' care processes in the obstetrics unit because I believe it compromises patients' privacy*" (A 43-year-old physician).

Patient's age

In a hospital inpatient unit, involving family members as partners in the care of older patients is critical for improving health outcomes, both

in the hospital and at home following discharge. Although the decision-making power for children under 18 years and unconscious patients is typically held by their parents or legal guardians, study participants noted that these guardians play a crucial role in advocating for clinical decisions and arranging for informed verbal and signed consent.

One nurse stated, "*When the health condition of an older patient is relatively improving, it is better for them to be discharged from the hospital, with care and support provided at home*" (A 28-year-old nurse).

Another argument in favor of involving family members is their important role in patient care, contributing to clinical decision-making and assisting health professionals in providing care. This involvement is facilitated through a genuine commitment to value-based, patient-centered care.

One nurse remarked, "*Patient decision-making is important, but I think the involvement of the patient's family is not essential unless the patient is unable to help themselves, is mentally incapable, or is legally not an adult to make decisions regarding their treatment plan*" (A 32-year-old nurse).

Patient's medical conditions

This sub-theme reflects participants' perceptions of the patient-family relationship and the development of communication patterns prior to the diagnosis of medical conditions. Participants described how family engagement could enhance patients' clinical conditions and motivation to continue with their care, particularly in cases of co-morbidity.

One nurse noted, "*Among the healthcare services provided to patients admitted to the ward, nurses were most likely to seek help from family members or patient attendants for simple daily tasks, such as feeding the patient, maintaining hand hygiene, and providing nail care. However, nurses were less likely to request support from relatives for activities specifically related to skilled nursing roles*" (A 26-year-old nurse).

Study participants expressed concerns about the feelings and worries of elderly patients when their attendants and family members were not allowed to enter specific treatment rooms or stay for extended periods.

3.5 Poor service provider-patent interaction

The skill of service provider-patient interaction is empirically linked to patients' beliefs in modern medicine and their adherence to treatment. Effective communication skills among service providers are a crucial aspect of clinical competence. Three sub-themes were identified concerning poor service provider-patient interaction skills, which hinder and negatively impact patients' health outcomes: "Beliefs on Treatment", "Treatment Adherence", and "Patient Empowerment".

Beliefs on Treatment

Study participants noted that patients who trust their healthcare providers tend to report stronger bonds, greater openness, and shared decision-making power, which fosters respect for the treatments offered. This sub-theme highlights that poor interpersonal relationships between patients and service providers may stem from nurses' attitudes towards patients, influenced by various factors, leading to disappointment when patients do not trust their healthcare providers.

One nurse remarked, "*Sometimes patients perceive a gap in communication skills among service providers, often coupled with language barriers, resulting in misunderstandings. This can lead to a transient poor relationship*" (A 25-year-old nurse).

Conversely, patients also criticized health service providers' attitudes, expressing feelings of disrespect. Some health professionals were reported to insult or embarrass patients during treatment and care. Such incidents tend to spread quickly, deterring patients from seeking treatment at public health facilities. Additionally, patients complained that service providers often disregarded their wishes for relatives to accompany them during hospital visits.

Treatment adherence

Effective service provider-patient interaction positively influences health outcomes by increasing patient satisfaction, leading to a better understanding of health problems and available treatment options, which, in turn, contributes to improved adherence to prescribed treatments. When patients fail to take their prescribed medication as intended, it is often due to poor communication between patients and service providers. A strong patient-doctor relationship and active involvement of patients in the decision-making process are closely linked to medication adherence.

Patient empowerment

Patient empowerment is crucial for shared decision-making with service providers. Feeling involved in their treatment care plans and having a sense of responsibility for their health provides patients with a greater sense of security and control over their future. Patients can learn to address their health problems by utilizing the information and support provided by health professionals. Empowerment begins with the recognition by service providers that patients are capable of managing their own healthcare, which aims to enhance their capacity to think critically, become autonomous, and make well-informed decisions about their health.

Study participants noted that systems for providing information and education in healthcare facilities are in place, but the extent, regularity, and utilization of this information by individual patients are not common practices. They believe that the provision of health information is often non-specific, with most patients typically receiving health information only in the form of counseling during treatment for specific medical conditions.

One physician stated, "*Most of the study participants agreed that providing health information and education to patients is considered a central activity in healthcare facilities to empower them regarding their own health and treatment options*" (A 31-year-old physician).

Another participant pointed out, "*Some patients are not interested in participating actively in their own care due to a lack of understanding. Therefore, most nursing care in a hospital setting should shift from a paternalistic approach to one where patients are considered partners requiring health education*" (A 25-year-old nurse).

3.6 Challenges to implement PCC

This major theme reflects interview participants' experiences regarding the challenges in implementing patient-centered care (PCC) in the study setting, which they identified as a bottleneck to providing quality health services. The majority of participants highlighted four subthemes related to factors that deter the implementation of PCC: "Workload", "Shortage of Medical Supplies", "Lack of Support from Senior Management", and "Lack of Awareness among Health Professionals about PCC".

Workload

This sub-theme pertains to participants' experiences with staffing adequacy and the implementation of patient-centered care. Interviewees identified case-load as a significant barrier to implementing PCC.

Participants described how the availability of staff, the ratio of nurses to patients, and overall workload influenced the implementation of PCC in the hospital. Factors related to staffing, such as having adequate personnel and an optimal nurse-patient ratio, were noted as prerequisites for successfully implementing patient-centered care. Additionally, these factors affect the flexibility of hospital routines, particularly in light of high nurse turnover during off-duty periods.

One respondent from Yirga Cheffe Primary Hospital stated, "*Despite the high patient flow and fast-paced work routines, there is not enough time to implement PCC, making it an uncommon practice. This issue is exacerbated by the limited availability of professional nurses who face high workloads during their shifts*" (A 31-year-old nurse).

Another nurse remarked, "*To treat patients holis-*

tically, patient-centered care consumes time for me" (A 27-year-old nurse).

Shortage of medical supplies

Study participants primarily linked the implementation of patient-centered care (PCC) to the availability of various resources. Shortages of drugs and medical supplies, often attributed to a lack of financial resources, were frequently reported by participants from Yirga Cheffe Primary Hospital.

One participant noted that the shortage of essential medical supplies further compromises the already limited availability of resources, creating an opportunity for patients to seek care in private health facilities. This was identified as one of the most significant resource-related factors hindering the implementation of PCC in hospital settings.

"*The system for delivering medical supplies in the hospital is very slow, from the time of request to procurement and delivery*" (A 27-year-old physician).

Lack of Support from Senior Management

Senior hospital management and leaders who are not directly involved in patient care must feel committed to creating an enabling work environment for health professionals to implement PCC.

"*Hospital clinical directors should offer opportunities for continuous in-service training to enhance the PCC skills of health professionals, thereby stimulating and sustaining improved healthcare services*" (A 35-year-old senior physician).

Additionally, the senior management team should promote and remunerate health professionals based on merit as a means of supporting improved PCC and enhancing health service delivery.

Other participants indicated, "*Patient-centered care has yet to be fully implemented in the hospital setting; however, support from the senior management team is poorly recognized*" (A 35-year-old senior physician).

Lack of awareness of service providers about PCC

Health professionals in the study setting had little awareness of the transformational concept of patient-centered care. Respondents perceived patient-centered care in various ways. Physicians and nurses commonly viewed it as providing quality care to satisfy patients.

One participant expressed this perspective: "*In this hospital, health professionals have the responsibility to provide quality service to satisfy the patient; this is what patient-centered care means to me*" (A 39-year-old physician).

4 Discussion

main finding of the present study is the lack of understanding regarding the core elements of patient-centered care (PCC), as reflected in the data. However, its implementation in the study setting is still lacking, as the majority of health professionals appear to provide care according to a traditional provider-centered and disease-focused approach. Respondents noted a discrepancy between how health professionals interact with individual patients, indicating that only a few health professionals intended to work within the PCC framework, and even then, to varying degrees.

The implementation of the PCC model in the study setting is notably minimal. Challenges to implementing PCC within healthcare facilities and at the individual patient level are influenced by factors at the systemic level. The analysis suggested that a large proportion of health professionals recognized the importance of this new concept for improving patient health outcomes. However, conflicting data indicated that some health professionals did not support the PCC model at all.

Individual characteristics that affect the implementation of PCC—such as empathy and health professionals' attitudes toward the uniqueness of patients and their preferences—can only be partially influenced by the health facility. In

this context, a lack of adequate nursing staff was highlighted as a significant challenge by study participants from Yirga Cheffe Primary Hospital. Another important challenge for implementing PCC at the individual patient level was the professional expertise of staff. Preliminary analysis of the core elements of PCC from the outer setting indicated that health professionals were primarily focused on episodic, curative aspects, which need to be integrated into current PCC concepts.

According to various studies, this approach to care has resulted in improved healthcare quality in Ethiopia and increased patient/client satisfaction. In this study, key issues raised by participants included failure to respect patients' preferences, lack of involvement of patients' families, poor service provider-patient interactions, and challenges to implementing PCC.

Participants noted that a shortage of time restricts the involvement of patients' families in treatment care plans and clinical decision-making processes, suggesting that poor implementation of PCC may compromise patient health outcomes. This finding is comparable to a study conducted in the United States, which highlighted that clinician attitudes and beliefs contribute to lower rates of family engagement, as the task is perceived as time-consuming and difficult [31]. The similarity may be attributed to consistent clinician attitudes and perceptions toward these concepts.

On the other hand, this finding aligns with a study conducted in London by the International Alliance of Patients' Organizations (IAPO), which emphasizes the importance of involving patients' families in clinical care over time. This approach fosters a partnership between service providers and patients' families, ensuring respect for patients' needs, values, and preferences, reflecting similar concerns among study participants regarding these aspects.

Some study participants noted that when patients are aware of their disease conditions, it significantly influences their sense of being taken seriously and receiving appropriate care. This awareness fosters a sense of personal responsibility for their health and appears to establish a foundation for a continuing relationship with their healthcare providers. This finding is consistent with a study reported by the Health Foundation in 2016 from the UK [32], which revealed that patients who are well-informed and confident in managing their conditions, in partnership with service providers, are more likely to engage in positive health-seeking behaviors, potentially leading to better health outcomes. This suggests that practice should prioritize what is most convenient for the patient.

The majority of health professionals viewed patient-centered care as involving an awareness of the importance of patients' cultures, incorporating values and respect, maintaining optimal communication in all aspects of patient care, and ensuring accountability to patients. This finding resonates with a study conducted in central Ethiopia [33], which found that patients who are familiar with their healthcare providers experience better empathic care. This implies that the perceived intimacy between patients and service providers directly influences PCC encounters [34].

Furthermore, all health professionals agreed that a better understanding of patients' preferences and needs could lead to more effective healthcare, ultimately saving both patient waiting time and resources. Interview participants reported that patients' preferences and needs are better understood and respected in hospital settings. A study conducted in a public hospital in the Benishangul Gumuz regional state highlighted that healthcare provider-related factors, such as poor patient-provider interactions, can negatively affect the implementation of PCC [4]. This finding suggests that PCC is facilitated through mutual understanding and positive interactions between service providers and patients. Disparities in PCC implementation may be linked to variations in communication skills among service providers.

5 Conclusion and Recommendation

Patient-centered care is one of the key dimensions of health service quality in the 21^{st} century and has been a focal point for quality improvement in Ethiopia. This study found that patient care is predominantly being delivered through a traditional provider-centered and disease-focused approach. A critical factor for the successful implementation of patient-centered care appears to be the active involvement of the hospital senior management team and decision-makers, who are positioned to support the implementation process effectively.

To validate our findings and identify systematic differences in the applicability of this practice between public and private health facilities, future researchers should consider conducting quantitative studies.

Limitation

The study findings should be interpreted in light of several limitations. First, interviews were conducted solely with health professionals, meaning that the practice of patient-centered care (PCC) was not assessed from the patients' perspective, and the viewpoints of decision-makers in leadership positions were not explored. As a result, any differences in perspective cannot be identified through this study. Additionally, individuals in leadership roles may not provide insights into management-related and resource-related opinions.

Second, our sample may be subject to selection bias. We assume that participants had a higher intrinsic motivation and interest in the research topic, which may make them more likely to engage in patient care.

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Ethics Approval and Consent to Participate
Ethical clearance was obtained from the Institutional Review Board (IRB) of the Colleges of Health Sciences and Medicine at Dilla University (protocol unique number: 001/17-11). Official letters were submitted to both Dilla University General Hospital and Yirgacheffe Primary Hospital, and permission was granted by the clinical director and CEO of the study settings. Written informed consent was obtained from all study participants.

Participation in the study was voluntary, and those who were unwilling to participate or wished to withdraw at any stage were informed that they could do so without any restrictions. Confidentiality and anonymity were maintained at all levels of the study, and collected data were stored on a password-protected computer accessible only to the research team. Instead of capturing participants' names on the questionnaires, code numbers were assigned to ensure anonymity.

All research methods were conducted in accordance with the ethical standards outlined in the 1964 Declaration of Helsinki and its later amendments.

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Availability of Data and Materials
All data included in this manuscript can be accessed from the corresponding author upon request.

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Authors' Contributions
(GNY) conceptualized and designed the study, collected, analyzed, and interpreted the data, and drafted the manuscript. (NES) and (JTH) also contributed to the study design, analyzed and interpreted the data, drafted the manuscript, and provided guidance throughout the research process. All authors read and approved the final manuscript.

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RESEARCH ARTICLE

Assessment of knowledge and attitude towards human papilloma virus vaccination and associated factors among high school female students in Gedeo Zone, Southern Ethiopia: Institution based cross-sectional study

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Abstract

Introduction: Cervical cancer ranks as the fourth most common cancer among women globally and is primarily caused by the human papillomavirus (HPV). HPV is the most prevalent virus affecting the reproductive system. The peak period for infection occurs shortly after the onset of sexual activity for both men and women. Although penetrative intercourse is not necessary for HPV transmission, it is classified as a sexually transmitted infection. Genital contact between skin cells is a well-known mechanism for transmission.

Methodology: A quantitative cross-sectional study was conducted at an institution. Data were collected through a self-administered questionnaire. After verifying the consistency and completeness of the responses, the data were imported into Epi Data version 4.6.0.2 and then exported to SPSS Windows version 25. Descriptive statistics were used to calculate the frequency of dependent and independent variables. The original logistic model included all explanatory variables with a p-value of less than 0.25 in bivariate logistic regression analysis. In multivariate logistic regression, a p-value of less than 0.05 with a 95% confidence interval was considered significant. The statistical association between knowledge and attitudes regarding the HPV vaccine, along with both crude and adjusted odds ratios, were determined.

Results: A total of 350 respondents participated in the study, yielding a response rate of 92%. The findings indicated that 204 (58.3%) of the female high school students had good knowledge about HPV vaccination. In multivariate analyses, students whose fathers could read and write were approximately 3.45 times more likely to have good knowledge about HPV vaccination compared to those whose fathers could not read and write (AOR = 3.45, 95% CI: (1.26-9.47)). Regarding attitudes, 184 (52.6%) exhibited a favorable attitude toward HPV vaccination. Students who received health education on HPV vaccination were about 2.08 times more likely to have a positive attitude compared to those who did not receive such education (AOR = 2.08, 95% CI: (1.06-3.45)).

Conclusion: The study reveals a relatively high level of knowledge and an average level of attitude toward HPV vaccination among respondents. There remain opportunities for further education, advocacy, and support to enhance both knowledge and attitudes.

Keywords: Attitude, Gedeo Zone, Knowledge, Human papilloma virus, Vaccine

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1 Introduction

Globally, cervical cancer ranks as the fourth most common cancer among women and is caused by the human papillomavirus (HPV) [1]. In 2020, there were approximately 604,127 new cases and 341,831 deaths worldwide due to cervical cancer [2]. HPV strains 16 and 18 are associated with more than 99% of cervical cancer cases linked to genital infections [3]. HPV is the most prevalent virus affecting the reproductive system. The peak time for infection occurs shortly after the onset of sexual activity for both men and women. While penetrative sexual contact is not necessary for HPV transmission, it is classified as a sexually transmitted infection. Genital contact between skin cells is a well-known mechanism of transmission [4].

In low-income countries, cervical cancer is the primary cause of cancer-related illness and mortality. Women with HIV/AIDS are particularly vulnerable to cervical cancer due to an inadequate immune system. HPV is the main cause of nearly all cervical malignancies, with approximately one in twenty cervical cancers worldwide linked to HIV [5].

Providing the HPV vaccine to eligible individuals is crucial for prevention and reducing the burden of cervical cancer. HPV vaccines targeting high-risk HPV types (16 and 18) have shown the potential to prevent approximately 90% of invasive cervical cancers in women [6].

In Kenya and many sub-Saharan African nations, HPV infection is a leading cause of cervical cancer. High coverage of HPV vaccination is a priority for the World Health Organization to eliminate cervical cancer globally. However, the availability of vaccines and logistical challenges hinder the widespread implementation of the current two- or three-dose HPV vaccination schedule [7]. Study conducted in Hadiya , Southern Ethiopia shows that having parents of daughters of the male sex, having only one daughter, having daughter(s) who attended a government school, having poor knowledge, and having a negative attitude were shows significant relation with acceptance of the human papillomavirus vaccine [8].

Negative thoughts, attitudes, and a lack of understanding about HPV vaccination can reduce vaccine coverage. Therefore, this study aimed to address this gap by providing information on the level of awareness and attitudes toward HPV vaccination, as well as the associated factors among female high school students in the study area.

2 Materials and methods

2.1 Study setting and design

A school-based cross-sectional study was conducted among female students in selected high schools in the Gedeo zone from April 2023 to June 2023. This zone is named after the Gedeo people, whose homelands are located within it. Dilla serves as the administrative center, situated 362 km south of Addis Ababa (the capital city of Ethiopia), with the main road from Addis Ababa to Nairobi, Kenya, passing through the town. Dilla is also 100 km from Hawassa, the capital city of the Sidama region [9]. The Gedeo zone is part of the southern regional state and encompasses 10 districts (four towns and eight woredas) and 148 kebeles. According to the 2007 Census conducted by the Ethiopian Central Statistical Agency, the total population of the zone is 847,434, consisting of 424,742 men and 422,692 women, including 239,053 women of reproductive age (15–49).

2.2 Source populations

All selected female students in selected high schools for academic year of 2022/23 during the study period were the participants of the study.

2.3 Study populations

Female students who were available at the day of data collection at selected high schools were included in the study.

2.4 Inclusion criteria

Female students who were present on the day of data collection at the selected high schools were included in the study.

2.5 Exclusion criteria

Female students who were seriously ill and unable to give consent were not included.

2.6 Sample size determination

Using data from a study conducted in Jimma, Ethiopia, the sample size was calculated with the statistical program Open Epi version 3, based on the following assumptions: an α level of significance of 0.05 and a prevalence of knowledge of 52.7% [10]. After accounting for a 10% nonresponse rate, the total sample size was determined to be 363.

2.7 Sampling technique

Study participants were selected using a systematic random sampling technique. First, six schools were randomly chosen from a total of 26 high schools, including one private school. The total sample size was then distributed to the selected schools proportional to their population sizes. Next, the systematic random sampling technique was applied to select individual participants in each high school using intervals (K). The interval (K) was calculated for each school by dividing the total number of eligible students. The first participant was chosen using the lottery method, selecting a number between 1 and K. Finally, the value of K was added sequentially until the proposed sample size was reached.

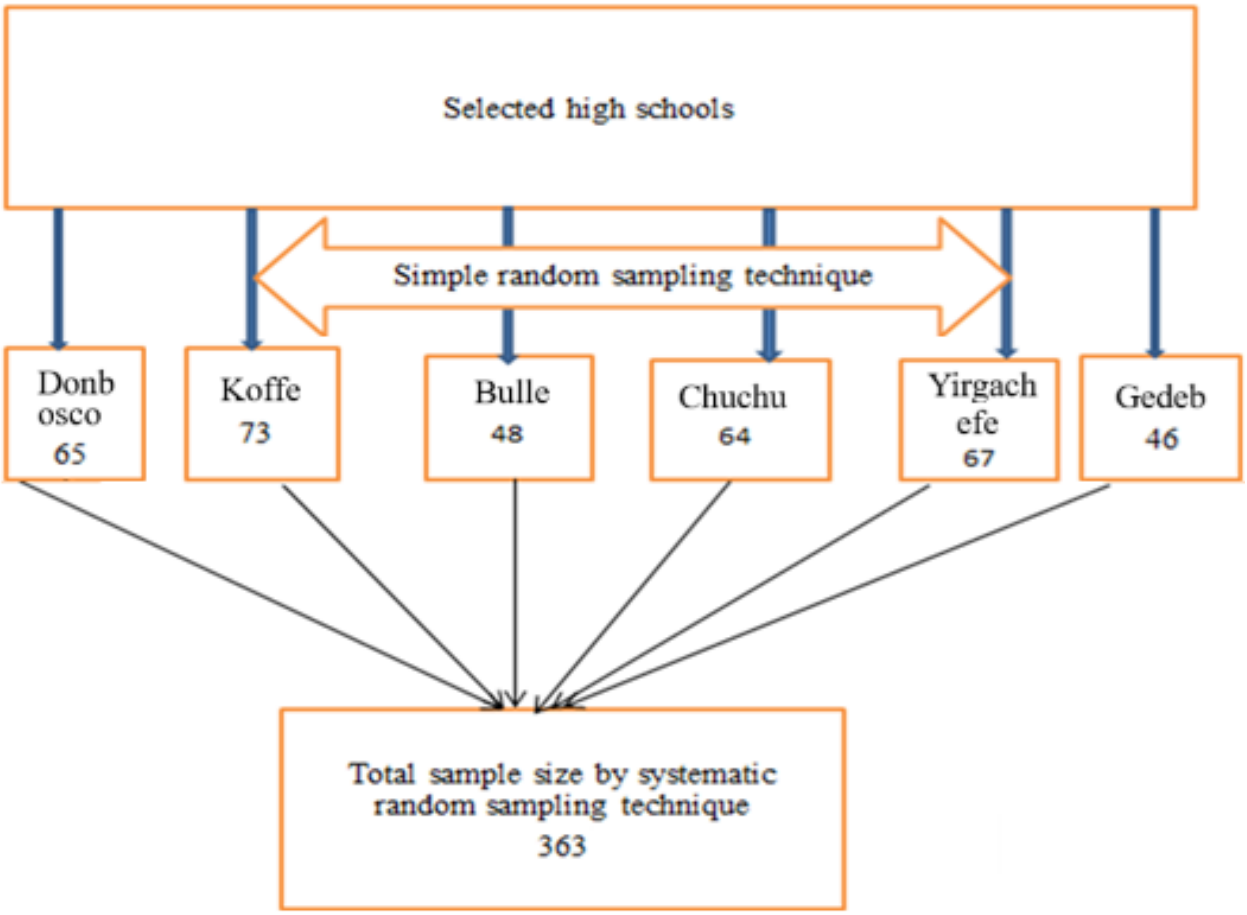

Figure 1 Schematic presentation of sampling procedure towards knowledge and attitude towards human papilloma virus vaccination and associated factors among high school students in Gedeo zone, southern Ethiopia, 2023

2.8 Data collection tools and procedures

A structured questionnaire was used to collect data, which included socio-demographic variables and information-related factors. The questionnaire was adapted through a review of various literature and similar previous studies [9, 11-13]. It was initially prepared in English and then translated into Amharic and Gedeofa by an expert fluent in both languages. To ensure consistency and accuracy, it was back-translated into English by another expert.

Data collection took place at Donbosco, Koffe, Bule, Yirgachefe, Gedeb, and Chuchu high schools. An interviewer-administered questionnaire was utilized for data collection. The data were collected by 12 graduated BSc midwives, with six supervisors appointed to continuously monitor the data collection alongside the principal investigator. Training was provided to both data collectors and supervisors on the research objectives, data collection tools and techniques, and the interview methods employed during the data collection process.

2.9 Variables

2.10 Dependent variable

Knowledge and attitude towards human papilloma virus vaccination

2.11 Independent variables

- **Sociodemographic variables:** age, religion, residence, family income, grade level, type of school, *etc.*;
- **Information related factors:** Presence of TV or Radio, having mobile phone, participation in minimedia club, knowing about HPV vaccine, source of information;
- **Social interaction:** relation with friends, substance addiction, family marital status.

2.12 Operational definition

Knowledge: A woman was considered to have good knowledge about the human papillomavirus vaccination if she answered 'yes' to knowledge questions above the mean score. Otherwise, she was classified as having poor knowledge [13].

Attitude: A woman was deemed to have a favorable attitude toward the human papillomavirus vaccination if she responded 'yes' to attitude questions above the mean score. Otherwise, she was classified as having an unfavorable attitude [13].

Substance Use: Substance use refers to the continued use of any of the following substances (alcohol, tobacco, heroin, marijuana, *etc.*) despite negative health consequences [9].

2.13 Data Processing and Analysis

The pre-coded responses were entered into Epi Info version 3.1 software and then exported to SPSS for Windows version 25 for statistical analysis. Descriptive data were presented using frequencies, tables, figures, means, and standard deviations. A binary logistic regression was employed to identify the associations between independent and dependent variables. Variables with a p-value of less than 0.25 were included in the final model to control confounders. In the final model, variables with a p-value of less than 0.05 and a 95% confidence interval were considered statistically significant based on multivariate logistic regression.

3 Results

3.1 Socio-demographic characteristics

A total of 350 respondents participated in this study, resulting in a response rate of 92%. The mean age of the respondents was 17.19 years, with a standard deviation of 1.93. Among the participants, 179 (51.1%) identified as Protestant, followed by 99 (28.3%) who were Orthodox. Regarding the participants' place of residence, 181 (51.7%) lived in urban areas (Table 1).

Table 1 Socio Demographic characteristics of participants for assessment of knowledge and attitude towards human papilloma virus vaccination among female high school students in Gedeo Zone, 2023

Variables		Frequency (n)	Percentage (%)
Age	14-15	22	6.3
	16-18	260	74.3
	>18	68	19.4
Religion	Orthodox	99	28.3
	Muslim	54	15.4
	Protestant	179	51.1
	Catholic	18	5.2
Mother's educational level	Unable to read and write	81	23.2
	Able to read and write	106	30.3
	Primary(1-8)	61	17.4
	Secondary(9-12)	53	15.1
	Higher education	49	14.0
Father's educational level	Unable to read and write	74	21.1
	Able to read and write	61	17.4
	Primary (1-8)	51	14.6
	Secondary (9-12)	36	10.3
	College and above	128	36.6
Mother's occupation	Government employee	56	16
	Nongovernment employee	28	8
	Farmer	101	28.9
	Merchant	102	29.1
	Daily laborer	26	7.4
	House wife	37	10.6
Father's occupation	Government employee	134	38.3
	Nongovernment employee	10	2.9
	Farmer	112	32
	Merchant	75	21.4
	Daily laborer	12	3.4
	Have no work	7	2
Marital status of student	Single	325	92.9
	Married	25	7.1
Residence	Rural	104	29.71
	Urban	246	70.29

3.2 Information-related factors

Out of the 350 participants in our study, 196 (or 56%) were getting health education regarding the human papilloma virus vaccination (Table 2).

Table 2 Information related factors of participants for assessment of knowledge and attitude towards human papilloma virus vaccination among female high school students in Gedeo Zone, 2023

Variable		Frequency (n)	Percentage (%)
Have you Tv or radio	Yes	182	52
	No	168	48
Have you mobile phone	Yes	303	86.6
	No	47	13.4
Do you use social media	Yes	194	55.4
	No	156	44.6
Do you have information on HPV vaccine?	Yes	233	66.6
	No	117	33.4
Do you get health education on HPV vaccine?	Yes	196	56
	No	154	44
Do you participate in your school minemedia club?	Yes	180	51.4
	No	170	48.6

3.3 Social life

In this study Out of the 350 participants 81.4 % of students had good relationship with their friends (Table 3).

Table 3 Social life characteristics towards human papilloma virus vaccination among female high school students in Gedeo Zone, 2023

Variable		Frequency(n)	Percentage(%)
Do you have good relation with your friends	Yes	285	81.4
	No	65	18.6
Do you have used substance	Yes	27	7.7
	No	323	92.3
Family's substance use status	Yes	34	9.7
	No	316	90.3

3.4 Knowledge characteristics

Approximately 68.9% (241) of the participants had heard about the human papillomavirus vaccination. Among the sampled population, 204 (58.3%) demonstrated good knowledge of the human papillomavirus vaccination based on nine knowledge-assessing questions (Table 4).

Table 4 Knowledge characteristics towards human papilloma virus vaccination among female high school students in Gedeo Zone, 2023

	Variables	Category	Frequency	Percentage
1.	Did you hear about HPV vaccine?	Yes	241	68.9
		No	109	31.1
2.	Why HPV vaccine given?	Prevent cervical cancer	286	78.8
		Other	77	21.2
3.	Did you know about use of HPV vaccine?	Yes	193	55.1
		No	157	44.9
4.	Who should get HPV vaccine?	Female	305	87.1
		Male	45	12.9
5.	Did you know at what age should HPV vaccine started?	Yes	165	47.1
		No	185	52.9
6.	Did you know how many times HPV vaccine given?	Yes	170	48.6
		No	180	51.4
7.	Did you know HPV vaccine given in Ethiopia?	Yes	193	55.1
		No	157	44.9
8.	Did you know HPV vaccine given freely for female students	Yes	205	58.6
		No	145	41.4
9.	Did you know HPV vaccine given better for not started sex?	Yes	221	63.1
		No	129	36.9
	The composite score of knowledge on HPV vaccine	Good knowledge	204	58.3
		Poor knowledge	146	41.7

3.5 Attitude characteristics

Among the sampled population, considering seven attitude-assessing questions, 184 (52.6%) had a favorable attitude toward the human papillomavirus vaccination among female high school students. Many students, 232 (66.3%), believed that the HPV vaccine reduces the risk of cervical cancer (Table 5).

Table 5 Attitude characteristics towards human papilloma virus vaccination among female high school students in Gedeo Zone, 2023

	Variables	Category	Frequency	Percentage
1.	Do you think the vaccination is given to minimize cervical cancer?	No	118	33.7
		Yes	232	66.3
2.	Do you think vaccination helps to prevent HPV infection?	No	174	49.7
		Yes	176	50.3
3.	Do you think HPV vaccine saves life and improve health?	No	160	45.7
		Yes	190	54.3
4.	Do think you recommend the vaccine to others or not?	No	185	52.9
		Yes	165	47.1
5.	Do you think having the HPV Vaccine may become sexually Promiscuous?	No	263	75.1
		Yes	87	24.9
6.	Do you think your family should decide whether you take the vaccine or not	No	192	54.9
		Yes	158	45.1
7.	Do think you take HPV vaccine if it will be started given in your school	No	123	35.1
		Yes	227	64.9
	The composite score of attitude on HPV vaccine	Unfavorable	166	47.4
		Favorable	184	52.6

3.6 Factors associated with knowledge

Both bivariate and multivariate logistic regression analyses were conducted to examine the effects of selected characteristics on knowledge levels regarding the human papillomavirus vaccination among female high school students. Factors such as the students' age, mothers' educational level, fathers' educational level, and social media usage were found to be associated with knowledge levels in the bivariate analyses, with p-values less than 0.25.

In the multivariate analyses, factors including students' residence, fathers' education, having information about the HPV vaccine, receiving health education on the HPV vaccine, and students' substance addiction status were significantly associated with knowledge of the HPV vaccination. Students whose fathers could read and write were approximately 3.45 times more likely to have good knowledge about the human papillomavirus vaccination compared to those whose fathers were unable to read and write (AOR = 3.45, 95% CI: (1.26-9.47)) (Table 6).

Table 6 Bivariate and multivariate analysis of knowledge towards human papilloma virus vaccination among female high school students in Gedeo Zone, 2023

Variable		Frequency		COR(95%CI)	AOR(95%CI)
		Good kge	Poor kge		
Age(in years)	14-15	13	9	1^{st}	1^{st}
	16-18	168	92	0.79(0.33-1.92)	0.61(0.18-2.03)
	>18	23	45	2.83(1.05-7.59)	0.39(0.1-1.57)
Place residence	Urban	170	76	1^{st}	1^{st}
	Rural	34	70	4.61(2.82-7.52) *	3.59(1.67-7.74) **
Grade level	9^{th}	98	51	1^{st}	1^{st}
	10^{th}	106	95	1.72(1.11-2.67)	1.56(0.81-3.01)
Mother's educational level	Unable to read and write	38	43	1^{st}	1^{st}
	Able to read and write	50	56	1(0.55-1.77)	1.14(0.51-2.58)
	Primary school (1-8)	34	27	0.7(0.36-1.37)	1.85(0.71-4.85)
	Secondary school (9-12)	42	11	0.23(0.11-0.51)	0.52(0.18,-.47)
	College and above	40	9	0.2(0.09-0.46)	0.49(0.16-1.51)
Father's educational level	Unable to read and write	35	39	1^{st}	1^{st}
	Able to read and write	29	32	0.99(0.5-1.95) *	3.45(1.26-9.47) **
	Primary school (1-8)	21	30	1.28(0.62-2.64)	1.6(0.61-4.25)
	Secondary school (9-12)	20	16	0.72(0.32-1.6)	2.5(0.79-7.93)
	College and above	99	29	0.26(0.14-0.49)	0.92(0.35-2.44)
Students boyfriend status	Yes	122	71	1^{st}	1^{st}
	No	82	75	1.57(1.02-2.4)	1(0.54-1.87)
Do you have TV or radio?	Yes	117	65	1^{st}	1^{st}
	No	87	81	1.68(1.09-2.57)	0.97(0.54-1.75)
Do you have mobile phone?	Yes	184	119	1^{st}	1^{st}
	No	20	27	2.09(1.12-3.89)	0.96(0.39-2.36)
Have you used social media?	Yes	124	70	1^{st}	1^{st}
	No	80	76	1.68(1.1-2.59)	1.38(0.74-2.58)
Have you participate in school minemedia club?	Yes	112	68	1^{st}	1^{st}
	No	92	78	1.4(0.9-2.14)	1.11(0.61-2.02)
	Yes	165	68	1^{st}	1^{st}
Have you information on HPV vaccine?	No	39	78	4.85(3.02-7.54)***	3.78(2.08-6.85) ***
Do you have good relation with friends?	Yes	179	106	1^{st}	1^{st}
	No	25	40	2.7(1.55-4.7)	1.75(0.84-3.65)
Did you receive health education on HPV vaccine?	Yes	144	50	1^{st}	1^{st}
	No	58	96	4.77(3.02-7.54)*	4.43(2.4-8.2) ***
Substance use status of student	Yes	10	17	1^{st}	1^{st}
	No	194	129	0.39(0.17-0.88)*	1.32(1.45-12.5) **

1^{st} = Reference category, *= PV<0.25, **=PV<0.05, ***= PV<0.0001,
COR= Cruds Odds Ratio, AOR=Adjusted Odds Ratio, CI=confidence interval

3.7 Factors associated with attitude

Both bivariate and multivariate logistic regression analyses were conducted to examine the relationship between selected characteristics and attitude levels toward the human papillomavirus vaccination among female high school students. Factors such as age, students' grade level, place of residence, mothers' occupation, and receiving health education on the HPV vaccine were found to be associated with attitudes in the bivariate analyses, with p-values less than 0.25.

Table 7 Bivariate and multivariate analysis of attitude towards human papilloma virus vaccination among female high school students in Gedeo Zone, 2023

Variable		Frequency		COR(95%CI)	AOR(95%CI)
		Unfavorable attitude	Favorable attitude		
Age (in years)	14-15	9	13	1^{st}	1^{st}
	16-18	114	146	0.89(0.37-2.15)	0.81(0.27-2.41)
	>18	43	25	0.4(0.15-1.08)	0.94(0.26-3.41)
Students grade level	9^{th}	64	85	1^{st}	1^{st}
	10^{th}	102	99	0.73(0.48-1.12)	1(0.56-1.76)
School type	Private	24	41	1^{st}	1^{st}
	Government	142	143	0.59(0.34-1.03)	0.89(0.42-1.88)
Place of residence	Urban	110	136	1^{st}	1^{st}
	Rural	56	48	0.69(0.44-1.1)	1.16(0.58-2.33)
Mother's educational level	Unable to read and write	42	39	1^{st}	1^{st}
	Able to read and write	60	46	0.83(0.46-1.48)	0.78(0.37-1.65)
	Primary school (1-8)	27	34	1.36(0.7-2.64)	0.83(0.34-2.04)
	Secondary school (9-12)	13	40	3.31(1.55-7.1)	1.91(0.71-5.1)
	College and above	24	25	1.12(0.55-2.78)	0.35(0.1-1.24)
Mother's occupation	Government employee	20	36	1^{st}	1^{st}
	Nongovernment employee	16	12	0.42(0.17-1.05) *	1.18(1.54-25) **
	Farmer	61	40	0.36(0.19-0.72) *	1.3(1.12-14.29) **
	Merchant	46	56	0.68(0.35-1.32)	0.46(0.13-1.59)
	Daily laborer	8	18	1.25(0.46-3.39)	0.47(0.11-2.0)
	Housewife	15	22	0.82(0.35-1.91)	0.38(0.1-1.48)
Father's educational level	Unable to read and write	40	34	1^{st}	1^{st}
	Able to read and write	39	22	0.66(0.33-1.33)	0.7(0.28-1.74)
	Primary school (1-8)	28	23	0.97(0.47-1.98)	1.11(0.45-2.71)
	Secondary school (9-12)	10	26	3.06(1.29-7.23)	2.49(0.78-7.94)
	College and above	49	79	1.9(1.06-3.39)	1.41(0.61-3.27)
From whom you live now?	Single	34	23	1^{st}	1^{st}
	Family	126	152	1.78(1.0-3.18)	0.95(0.46-1.95)
	Friends	6	9	2.22(0.70-7.08)	2.25(0.57-8.86)
Did you receive health education about hpv?	Yes	80	85	1^{st}	1^{st}
	No	114	69	0.57(0.37-0.87) *	2.08(1.06-3.45) **
Students boyfriend status	Yes	103	90	1^{st}	1^{st}
	No	63	94	1.71(1.12-2.62) *	2.55(1.43-4.56) **
Do you have mobile phone	Yes	137	166	1^{st}	1^{st}
	No	29	18	0.51(0.27-0.96)	0.7(0.31-1.6)
Do you use social media	Yes	78	116	1^{st}	1^{st}
	No	88	68	0.52(0.34-0.80)	0.67(0.38-1.17)
Do you participate in school minimedia club	Yes	79	101	1^{st}	1^{st}
	No	87	83	0.75(0.49-1.14)	0.88(0.51-1.51)
Do you have good relation with friends	Yes	123	162	1^{st}	1^{st}
	No	43	22	0.39(0.22-0.68) *	1.79(1.12-4.55) **
Substance use of student	Yes	17	10	1^{st}	1^{st}
	No	149	174	1.99(0.88-4.47)	1.67(0.61-4.54)

1^{st} = Reference category, *= PV<0.25, **=PV<0.05, ***= PV<0.0001,

COR= Cruds Odds Ratio, AOR=Adjusted Odds Ratio, CI=confidence interval

In the multivariate analyses, mothers' occupation, students' boyfriend status, receiving health education on the HPV vaccine, and students' relationships with friends were significantly associated with attitudes toward the HPV vaccination. The study revealed that students who received health education on the human papillomavirus vaccination were approximately 2.08 times more likely to have a positive attitude compared to those who did not receive health education (AOR = 2.08, 95% CI: (1.06-3.45)) (Table 7).

4 Discussions

A cross-sectional study was conducted in institutions to assess the knowledge and attitudes of female high school students in the Gedeo zone regarding human papillomavirus vaccination and related issues. The study found significant associations between several factors and knowledge levels about the human papillomavirus vaccination among female high school students, including students' place of residence, fathers' education, having information about the HPV vaccine, receiving health education on the HPV vaccine, and students' substance use status. Additionally, mothers' occupation, students' boyfriend status, receiving health education on the HPV vaccine, and students' relationships with friends were significantly associated with attitudes toward the human papillomavirus vaccination among female high school students.

This study found that 58.3% of participants had good knowledge of the human papillomavirus vaccination among female high school students (95% CI: (36-48)). This result is consistent with a study conducted in southwest Ethiopia, which reported a knowledge level of 43.8% [14]. However, it is higher than findings from studies in Ambo, Ethiopia (24.6%) [15], and Nigeria (21.1%) [16]. These differences may be attributed to variations in study areas or geographical accessibility to information about the HPV vaccine.

Conversely, the finding is lower than studies conducted in Bahirdar (58.1%) (9), Jimma (52.7%) (10), and Arbaminch (71.7%) [17], as well as in Thailand (60%) [18], Romania (85.8%) [19], and Italy (69.9%) (20). The variation in results may stem from differences in study settings, populations, time frames, and the availability and distribution of the HPV vaccine in various countries.

From the current study, 52.6% of female participants had a positive attitude regarding the human papillomavirus vaccination (95% CI: (47-59)). This result is consistent with studies conducted in Ambo town (55.6%) [15] and Minjar Shenkora, Ethiopia (50.8%) [21]. It is higher than findings from studies in Bahirdar (16%) [9] southwest Ethiopia (44.4%) [14], Jimma (31.4%) [10], and Iran (43%) [22]. However, it is lower than results from studies in Nigeria (61.8%) [23] and Italy (20%) [24]. These variations may be attributed to differences in socio-demographic factors, educational levels, and limited coverage of targeted educational initiatives, as well as low access to information in low-income countries.

The current study indicated that students living in urban areas were 3.59 times more likely to have good knowledge about the human papillomavirus vaccination compared to those living in rural areas (AOR: 3.59, 95% CI: (1.67-7.74)). This is likely due to urban students having relatively easier access to information through social and mass media. Participants whose fathers could read and write were 3.45 times more likely to have good knowledge about the human papillomavirus vaccination than those whose fathers were unable to read and write (AOR: 3.45, 95% CI: (1.29-9.47)). This finding is supported by a study conducted in Malaysia (25), suggesting that parents who are literate are more likely to learn about the HPV vaccine through various media.

Having information about the human papillomavirus vaccination increased the likelihood of possessing good knowledge about the vaccine by 3.78 times compared to those without such information (AOR: 3.78, 95% CI: (2.08-6.85)). This result aligns with a study conducted in Debretabor, Ethiopia [26]. This may be explained by students having better access to information from health extension personnel. Students who

received health education about the human papillomavirus vaccination were 4.43 times more likely to have good knowledge about it than those who did not (AOR: 4.43, 95% CI: (2.4-8.2)). Additionally, participants who were not substance addicted were 1.32 times more likely to have good knowledge about the human papillomavirus vaccination compared to those who were addicted (AOR: 1.32, 95% CI: (1.45-12.5)).

The current study shows that students whose mothers are government employees are 1.18 times more likely to have a favorable attitude toward the human papillomavirus vaccination compared to those whose mothers are non-government employees (AOR: 1.18, 95% CI: (1.54-25)), and 1.3 times more likely compared to those whose mothers are farmers (AOR: 1.3, 95% CI: (1.12-14.29)).

Participants who received health education about the human papillomavirus vaccination were two times more likely to have a favorable attitude than those who did not receive health education (AOR: 2.08, 95% CI: (1.06-3.45)). This result aligns with a study conducted in Ambo, Ethiopia [13].

Participants who had a boyfriend were 2.55 times more likely to have a favorable attitude toward the human papillomavirus vaccination compared to those who did not (AOR: 2.55, 95% CI: (1.43-4.56)). This may be due to discussions about the risks of HPV and the importance of vaccination.

Participants who had good relationships with their friends were 1.79 times more likely to have a favorable attitude toward the human papillomavirus vaccination compared to those who did not (AOR: 1.79, 95% CI: (1.12-4.55)). This suggests that discussions about reproductive health issues may occur among friends.

Limitation of the study

The main limitation of this study is that male students were not included as participants. Another drawback is that some students may have been biased, as they were older than the target population regarding receiving the human papillomavirus vaccination.

5 Conclusion

To assess the knowledge and attitudes of female high school students in the Gedeo zone regarding human papillomavirus vaccination and related issues, a cross-sectional survey was conducted. The results showed that 58.3% of female high school students had good knowledge, while 52.6% demonstrated positive attitudes toward the vaccination. These findings indicate a relatively high level of knowledge and an average level of attitude among the respondents. However, there are still opportunities for further education, advocacy, and support to enhance both knowledge and attitudes.

Recommendation

- Implement comprehensive education and awareness programmes targeting students.
- Health facilities need to improve their approach to delivering messages and raise student's level of knowledge.
- Applying behavioral change communication tactics and HPV vaccination activities can help students develop a positive attitude.

Declaration

Abbreviations

CC	Cervical cancer
CI	Confidence interval
ETB	Ethiopian birr
HEPI	Health Professionals Education Partnership Initiative
HPVV	Human papilloma virus vaccine
NGO	Nongovernmental organizations
WHO	World health organization

Ethics approval and consent to participate

Ethical clearance was obtained from the Institutional Review Board (IRB) of Dilla University College of Medicine and Health Sciences. A formal letter of permission and support was provided to the Gedeo Zone Educational Office. Participants were informed about the aims, objectives, benefits, and risks of the study. Informed, voluntary, written, and signed consent was obtained from each respondent. Participants were assured of their confidentiality and their right to refuse to answer any questions, as well as their ability to stop or withdraw from the study

at any time during data collection. Confidentiality was maintained at all levels of the study through anonymous data collection.

Data sharing statement

The corresponding author can provide the data sets created during this work upon reasonable email request.

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Author contribution

Mebirat Ademassu and Melkam Andargie were involved in designed the research, data collection, analysis, and interpretation of the result and drafted the paper, and participated in preparing all versions of the manuscript. Wagaye Alemu have assisted in the design, and the proposal development, monitored data collection, assisted during analysis, and revised subsequent drafts of the paper. All authors read and approved the final manuscript.

Disclosure

Regarding this paper, the authors disclose no conflicts of interest

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RESEARCH ARTICLE

Under nutrition and associated factors among school adolescents in Ethiopia

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Abstract

Background: Adolescence, defined as the age range of 10-19 years, is a critical period marked by significant physical and psychological growth. During this time, individuals gain approximately one-third of their adult weight and more than one-fifth of their adult height. This makes adolescents particularly vulnerable to malnutrition. This study aimed to assess the prevalence of undernutrition among school adolescents in the Wonago district, Gedeo Zone, South Ethiopia.

Methods: The study involved 443 randomly selected school adolescents from the Wonago district. Nutritional status was evaluated using body mass index for age z-score (BAZ) and height for age z-score. The prevalence of thinness, along with other anthropometric measurements and socio-economic and socio-demographic variables, was described descriptively. A multivariable logistic regression analysis was conducted to identify factors associated with undernutrition (thinness) among adolescents.

Results: The findings indicated that 11.6% of adolescents were undernourished (thin). Female adolescents had a 70% lower likelihood of being undernourished. Those whose primary source of drinking water was spring were four times more likely to experience malnutrition. Adolescents from households with medium wealth status had an 85% reduced likelihood of being undernourished. Additionally, adolescents whose families obtained food through purchase and whose fathers were merchants showed a higher risk of undernutrition. Conversely, those with mothers working as farmers had an 85% lower probability of being undernourished.

Conclusions: Our findings highlight that 11.6% of adolescents in the study were undernourished. Factors such as sex, parental occupation, household wealth, source of drinking water, and the means of obtaining food were significantly associated with the nutritional status of adolescents.

Keywords: Adolescent, Nutritional status, Thin, Wonago District

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1 Introduction

Adolescence spans the age range of 10-19 years, characterized by significant physical and psychological growth. It represents a transition from childhood to adulthood and is marked by an intense anabolic state, during which nearly one-third of adult weight and more than one-fifth of adult height are gained. This period is often described as a critical window of opportunity for growth within the human life cycle, making adequate nutrition essential for optimal development.

Nutritional recommendations for adolescents differ significantly from those for adults and children, and the consequences of nutritional deficiencies can be profound. Nutrition and physical activity are key determinants of adolescents' energy levels, influencing growth and body composition. Inadequate nutrition can delay sexual maturation, hinder linear growth, and compromise peak bone mass. Additionally, undernutrition can negatively impact cognitive development, affecting learning, concentration, and school performance.

In developing countries, adolescents are particularly vulnerable to socio-cultural maltreatment, poverty, political instability, and limited access to education and healthcare, which heightens their susceptibility to nutritional health problems. Factors such as early marriage, although declining, and low secondary school enrollment further exacerbate the risk of poor nutrition among adolescents.

A significant number of adolescents in low- and middle-income countries experience acute or chronic malnutrition, with underweight being a particular concern. In some African and Asian countries, over 10% of adolescent girls are classified as very thin for their age and height, and nearly half of all adolescents are stunted. For example, a 2014 national survey in Bangladesh indicated that more than half of adolescent girls and women consumed inadequately diverse diets, with stunting prevalence among girls aged 10–18 ranging from 23% to 32%.

Gender norms disproportionately affect girls, leaving them more vulnerable to food insecurity and malnutrition. However, a substantial number of adolescent boys are also malnourished. Adolescent girls face a higher risk of dropping out of school, marrying early, and becoming pregnant, all of which can adversely affect their nutrition and health as well as that of their children. Furthermore, adolescence is the last critical opportunity to reverse stunting, highlighting the importance of this demographic for nutritional interventions. Nutritional disorders during adolescence, including unhealthy weight status and deficiencies in energy, macronutrients, and micronutrients, contribute significantly to global morbidity and mortality and warrant focused attention.

Compared to other segments of the population, particularly children under five, the scope and severity of undernutrition among adolescents remain less well-defined. There is a lack of nutritional data on adolescents, despite their significant burden of malnutrition, especially in terms of thinness.

Adolescence represents a critical point for intervention regarding both current and future health, as well as intergenerational nutritional well-being. Healthcare providers should comprehensively screen adolescents for nutritional risks, make timely referrals, and initiate developmentally appropriate interventions. Body mass index (BMI) is recommended as a useful tool for screening nutritional health issues in adolescents and adults, particularly concerning thinness, overweight, and obesity.

Adolescents, being in a transitional phase, often miss out on the attention and care typically afforded to younger children, while also lacking the protection associated with adulthood. In Ethiopia, although there is considerable focus on adolescents' reproductive health issues, research on their nutritional status is notably limited. There is a scarcity of nutrition-related information regarding adolescent health, largely due to the misconception that this group is at low risk for poor health and nutrition.

Consequently, this study was designed to assess

the nutritional status of adolescents and identify associated factors, aiming to contribute to filling the existing evidence gap.

2 Methods

2.1 Study area and period

This study was conducted in Wonago Wereda, Gedeo Zone, South Ethiopia, from November 17 to December 3, 2018. The study area is known for its high population density, particularly among young individuals. In the district, there are 23 schools, of which 15 were randomly selected for this study.

2.2 Study Design

A facility-based cross-sectional study was conducted.

2.3 Sample size determination and sampling technique

The sample size for this study was calculated using single population proportion formula for calculating sample size $(Z_{(\alpha/2)})^2 * p(1-p)/d^2)$ assuming estimated 50% prevalence (p) of undernutrition (to maximize the possible sample size), a 95% confidence interval and a relative precision (d) of 5%. Based on the above assumptions and assuming a 15% non-response rate the total sample size used in this study was 443 adolescents.

To select the schools for this study, a simple random sampling technique was employed. The total sample was proportionally allocated to each school based on the number of eligible adolescents. Each participant was then selected through simple random sampling using the student registry from the schools.

2.4 Data collection Tools and Procedures

Data was collected using a structured questionnaire designed to capture comprehensive information relevant to our study objectives. The questionnaires, adapted from WHO nutritional survey tools, were pretested for clarity and effectiveness. Trained health extension workers served as data collectors, and the entire process was closely supervised by the investigators.

For participants who were minors, assent was obtained from their families, and the overall objectives and procedures of the study were clearly explained to all participants.

2.5 Measurement

Anthropometric Assessment: Height and weight were measured according to WHO guidelines. A battery-powered digital scale was used for weight measurement, accurate to the nearest 0.1 kg. Height was measured to the nearest 0.1 cm using a wooden height-measuring board with a sliding head bar, following standard anthropometric techniques. Body mass index for age z-score (BAZ) and height for age z-score (HAZ) were used as anthropometric indicators. Adolescents with a BAZ score less than -2 were classified as thin, while those with a HAZ score below -2 were classified as stunted.

Stool Examination: Stool examinations were conducted to assess geohelminth infections, including Strongyloidiasis, hookworm, Ascaris lumbricoides, and trichinosis. The Kato-Katz method was employed to examine the stool within one hour of staining.

2.6 Data analysis

All collected data were carefully reviewed and cleaned to ensure accuracy and completeness. The data were then processed and analyzed using appropriate statistical methods. Descriptive analyses were conducted to present sociodemographic and socio-economic information, nutritional status, and feeding practices

Bivariate associations were assessed using binary logistic regression analysis, while the independent associations of the explanatory variables with the outcome variable were evaluated using multivariable logistic regression. Adjusted odds ratios (AOR) with corresponding 95% confidence intervals were calculated for this analysis.

2.7 Ethics approval and consent to participate

Ethical clearance was obtained from the Institutional Review Board of Dilla University College of Health Sciences and Medicine. Written informed consent was secured from the parents of each student, and the purpose of the study was thoroughly explained to the participants. Confidentiality of the information collected was assured, and the privacy of the respondents was maintained throughout the study.

3 Results

3.1 Socio-Demographic Characteristics of Adolescents

This study included a total of 424 adolescents, with a higher proportion of males (247, 58.3%) compared to females (177, 41.7%). Most participants (42.4%) were in middle adolescence (14-16 years), while 40.8% were in early adolescence (10-13 years), and the remaining 16.7% were in late adolescence (17-19 years). The mean age of the participants was 13.9 ± 2.3 years.

Table 1 Socio-Demographic Characteristics of Adolescents among adolescents in Wonago district, Gedeo Zone, Southern Ethiopia, 2020

Characteristic	Category	Frequency (n)	Percentage (%)
Sex	Male	247	58.3
	Female	177	41.7
Age Group	10-13 years	173	40.8
	14-16 years	180	42.4
	17-19 years	71	16.7
Household Size	≤6 members	176	41.5
	>6 members	248	58.5
Parental Education	Literate Fathers	337	79.4
	Mothers with No Formal Education	212	50

In terms of household characteristics, 58.5% of participants came from families with more than six members, while 41.5% had six or fewer family members. The study also revealed disparities in parental education levels: nearly 50% of mothers had no formal education, whereas most fathers (79.4%) were literate.

3.2 Feeding Practices and Nutritional Status

Dietary habits and feeding programs were analyzed to assess their relationship with nutritional status. Among the participants, 27.4% reported eating two or fewer meals per day, which may contribute to inadequate nutrition.

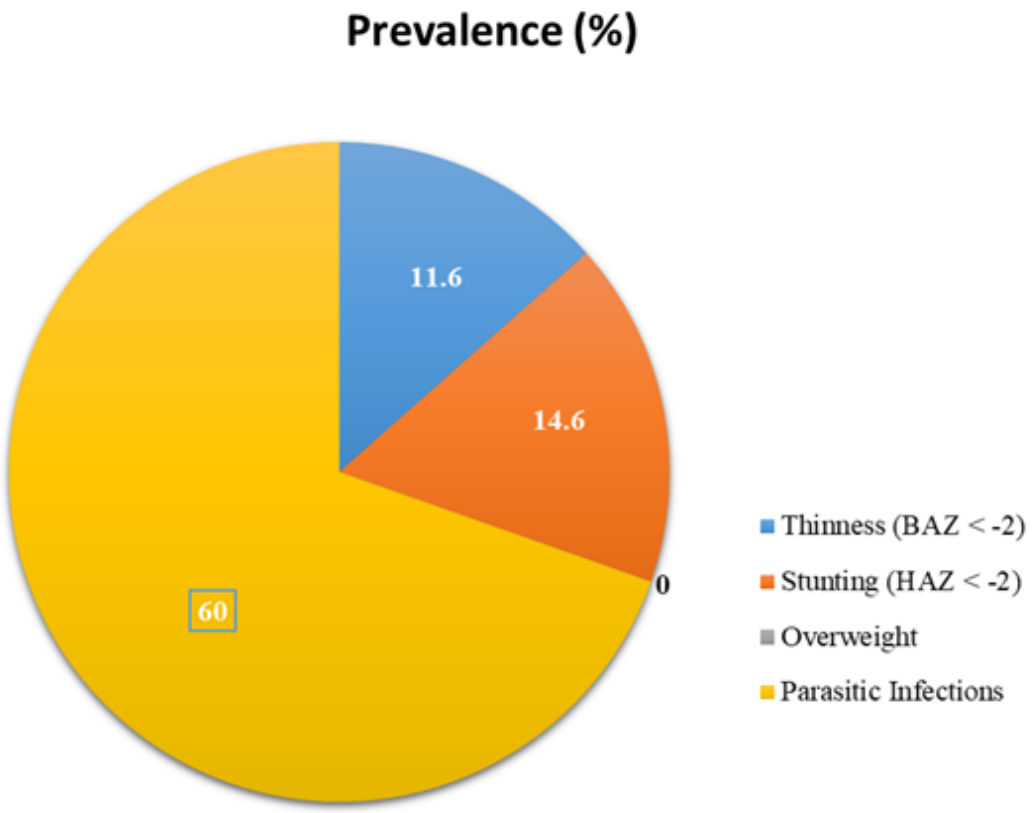
Table 2 Feeding Practices and Nutritional Status of Adolescents among adolescents in Wonago district, Gedeo Zone, Southern Ethiopia, 2020

Feeding Practice	Category	Frequency (n)	Percentage (%)
Meal Frequency	≤2 meals/day	116	27.4
Household Food Source	Own food production	214	50.5
	Purchase food or aid	210	49.5
School Feeding Program	Present in school	245	57.8

Nearly half (50.5%) of the adolescents came from households that produced their own food, while 49.5% relied on purchasing food or receiving aid. Additionally, about 57.8% of the adolescents attended schools with a school feeding program that had been in place for the past six months.

3.3 Prevalence of Under-nutrition

In this study, 11.6% (CI: 8.55% to 14.65%) of participants were classified as underweight/thin (BAZ < -2), and 14.6% (CI: 11.24% to 17.96%) were identified as stunted (HAZ < -2). No adolescents were found to be overweight. Stool examination results indicated that approximately 60% of the adolescents had stool parasites.



BAZ: Body mass index-for age z-score HAZ: Height-for-age z-score

Figure 1 Prevalence of Under-nutrition among adolescents in Wonago district, Gedeo Zone, Southern Ethiopia, 2020

3.4 Factors associated with under nutrition among school adolescents

After controlling confounders using multivariable logistic regression, several factors were found to be significantly associated with undernutrition among adolescents. Specifically, the sex of the adolescents, source of drinking water, mother's occupation, father's occupation, household wealth, and source of food needs were all notable.

The likelihood of being undernourished decreased by 70% for female adolescents compared to their male counterparts [AOR: 0.30, CI: 0.12, 0.77]. Adolescents whose source of drinking water was from springs were over four times more likely to be malnourished [AOR: 4.63, CI: 1.48, 14.43].

Additionally, adolescents from households classified as medium wealth had an 85% lower likelihood of undernutrition [AOR: 0.16, CI: 0.41, 0.65] compared to those from the highest wealth households. Furthermore, adolescents who relied on purchasing food [OR: 3.33, CI: 1.55, 7.18] and those whose fathers were merchants [OR: 5.95, CI: 1.30, 27.22] showed a higher risk of being undernourished. Conversely, adolescents whose mothers were farmers had an 85% reduced probability of undernutrition [OR: 0.14, CI: 0.41, 0.65] compared to those whose mothers were housewives (Table 3).

Table 3 Determinants of undernutrition among school adolescents in Wonago district, Gedeo Zone, Southern Ethiopia, 2020

Variables		Frequency	Under nutrition (BAZ< -2)		
			Prevalence	AOR	95% CI
Age category	Early adolescence	173 (40.8)	17.3	1	Reference
	Middle adolescence	180 (42.4)	6.7	0.45	0.14, 1.40
	Late adolescence	71 (16.7)	9.8	1.63	0.45, 5.91
Sex	Male	247 (58.3)	15.4	1	Reference
	Female	177(41.7)	6.2	0.30	0.12, 0.77
Grade level	Four grade and below	101(23.8)	23.8	1	Reference
	Five to eight grade	286(67.5)	8.0	1.13	0.37, 3.50
	Nine grade and above	37(8.7)	5.4	0.60	0.08, 4.37
Live with parents	Yes	381(90.7)	10.2	1	Reference
	No	39(9.3)	25.6	4.08	1.02, 16.23
Family size	≤ 6	176 (41.5)	14.2	1	Reference
	>6	248 (58.5)	9.7	0.71	0.29,1.74
Meal frequency	Two times or below	116 (27.4)	6.0	1	Reference
	Three times or above	308 (72.6)	13.6	1.54	0.56, 4.25
Drinking water source	Tap water	291(69.8)	9.6	1	Reference
	Wells	64(15.3)	15.6	2.70	0.76, 9.62
	Spring	62(14.9)	17.7	4.63	1.48, 14.43
Stool parasite	Yes	249 (58.5)	10.7	1	Reference
	No	175 (41.5)	14.3	2.0	6 0.89, 4.77
Wealth status	Low	133 (32.8)	6.8	1.65	0.62,4.37
	Medium	138 (34.0)	14.5	0.16	0.41, 0.65
	High	135 (33.2)	10.4	1	Reference
Family food need	Grow their own	214 (50.5)	7.0	1	Reference
	Purchase/aid	210 (49.5)	16.2	3.33	1.55, 7.18
Mother occupation	Housewife	210(49.8)	17.1	1	Reference
	Farmer	73(17.3)	4.1	0.14	0.03, 0.70
	Merchant	102(24.2)	7.8	1.46	0.47, 4.57
	Other	37(8.7)	5.4	0.99	0.16, 6.30
Father occupation	Government employee	90(21.4)	7.8	1	Reference
	Farmer	213(50.7)	8.5	1.6	1 0.37,7.03
	Merchant	91(21.7)	22.0	5.95	1.30,27.22
	Other	26(6.2)	15.4	6.12	0.60, 69.96

4 Discussion

Eradicating underweight and thinness resulting from insufficient energy intake is expected to be a significant challenge for current and future global nutrition policy. Adolescents are a nutritionally critical group due to their high growth requirements, distinct eating patterns, and susceptibility to environmental influences. However, there is a lack of comprehensive data on adolescents' nutritional status.

In this study, a considerable number of adolescents were found to be stunted, with nearly twelve percent classified as underweight. These findings align with previous reports from the national nutrition baseline survey for the National Nutrition Program (NNP) of Ethiopia, which reported a 14% prevalence. Similar results were observed in a study conducted among female adolescents in northern Ethiopia, where 13.6% were found to be stunted. Comparable findings were reported in eastern Sudan, where 13.7%

of adolescent girls were stunted, and in Aligarh, Uttar Pradesh, India, where 14.6% of adolescent boys were also found to be stunted.

The prevalence of underweight among adolescents in this study is lower than findings from various regions in India. For instance, a study conducted in Wardha, India, reported that 53.8% of adolescents were classified as thin, and 50.7% were stunted. Similarly, studies from West Bengal identified a prevalence of 48.3%. These differences may be attributed to variations in study populations and geographic areas. However, the findings in this study are higher than the 6.4% prevalence reported in a study on the nutritional status of in-school adolescents in Ibadan, Nigeria. Likewise, a study from Brazil indicated a lower prevalence (7%) of underweight among adolescents in that region.

Factors associated with underweight and thinness in this study included the sex of the adolescents, source of drinking water, mother's occupation, father's occupation, household wealth, and source of food needs. Notably, female adolescents were less likely to be underweight compared to their male counterparts. This finding is consistent with results from Ibadan, Nigeria, where male adolescents were found to be at a higher risk of underweight. Similarly, the Indian National Nutrition Monitoring Bureau identified males as being at greater risk of undernutrition compared to females. This may be due to better access to food for female adolescents in developing countries, as they often engage in domestic work and may not miss meals. Additionally, adolescent males may be involved in heavier labor, which could contribute to their increased risk of undernutrition.

Among family socio-demographic characteristics, maternal working status was significantly associated with being underweight. Specifically, adolescents whose mothers were farmers were less likely to be underweight compared to those whose mothers were housewives. Mothers engaged in income-generating activities can positively impact their adolescents' nutritional status, as farming can enhance family productivity and food sources.

Conversely, adolescents whose fathers were merchants were about six times more likely to be underweight. This may be linked to differences in educational status; fathers with government jobs tend to have higher education levels, which can lead to greater awareness of nutritious foods essential for children's health. For instance, a study in Brazil found that maternal schooling was negatively associated with the likelihood of being thin.

Adolescents who sourced their drinking water from springs were four times more likely to be underweight compared to those using tap water. This increased risk may stem from a higher likelihood of repeated infections due to contaminated spring water, as many households do not treat their drinking water. Additionally, adolescents from families that purchase their food were more likely to be underweight than those who produce their own. This may be linked to better access to a variety and quantity of nutritious food in families that grow their own.

Interestingly, adolescents from households with medium economic status were less likely to be underweight compared to those from higher economic status. This finding contrasts with typical results from studies on nutritional status. The lower likelihood of underweight among adolescents in medium economic status may be due to differing nutritional characteristics between populations in medium and high economic brackets. In this study area, families in higher economic status were primarily merchants and generally less educated than those in the medium bracket, who were more often government employees and better informed about nutrition. Additionally, many families in the medium economic category were farmers, providing their own food.

This study aimed to assess the nutritional status of adolescents and identify associated factors, addressing a significant gap in literature. While we identified important risk factors for adolescent malnutrition in the study area, there are notable limitations, including a small sample size and the exclusion of out-of-school adolescents, which may have yielded different insights.

5 Conclusion and Recommendations

Our study revealed that 11.6% of adolescents were undernourished. Specifically, female adolescents, those who drank spring water, adolescents whose mothers were unemployed, and those whose families relied on purchasing food were at a higher risk of being underweight. These findings underscore the need for targeted interventions aimed at these vulnerable groups.

Stakeholders involved in nutrition programs should prioritize adolescent nutrition, particularly in developing countries, to address these disparities. Furthermore, additional studies with more robust designs are needed to accurately assess the nutritional status and its determinants among adolescents.

List of abbreviations

AOR	Adjusted Odds Ratio
BAZ	Z –Score for BMI for age
BMI	Body Mass Index
CI	Confidence Interval
COR	Crude Odds Ratio
CSA	Central Statistical Agency
HAZ	Z score for height for age
NNP	National Nutrition Program
WHO	World Health Organization

Declarations

Ethics approval and consent to participate

Ethical clearance was obtained from the Institutional Review Board of Dilla University College of Health Sciences and Medicine. Written informed consent was secured from the parents of each student, and the purpose of the study was thoroughly explained to the participants. Confidentiality of the information collected was assured, and the privacy of the respondents was maintained throughout the study.

Consent for publication

Not applicable

Availability of data and material

The data underlying this study are readily available from Dryad public repository with the following link https://datadryad.org/stash/share/yJ-DH8TMKiGdRNXlfTqXfL_IdOdqori9LjakPa2dUTE and the preprint of this manuscript is also available on (https://www.researchsquare.com/article/rs-117812/v1)

Competing interests

There is no competing of interest among authors or anyone else.

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Authors' contributions

MF conceived the idea, analyzed, interpreted, and prepared the manuscript. RH, FW, and AA participated in the analysis/result writing, interpretation, and preparation of the manuscript. All the authors have read and approved the manuscript.

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RESEARCH ARTICLE

Effects of infection prevention training on healthcare waste handlers' compliance in hospitals of Gedeo zone, Southern Ethiopia: a quasi-experiment study

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Abstract

Background: Healthcare waste handlers (HCWHs) are at risk of health issues due to exposure to infectious healthcare waste. Infection prevention and control (IPC) training is essential to enhance their knowledge, attitudes, practices, and compliance (KAPC) with standard precautions (SP), thereby reducing the spread of infections. However, the effectiveness of IPC training for HCWHs in low-resource settings like Ethiopia remains under-researched. This study aims to evaluate the impact of IPC training on HCWHs' KAPC regarding standard precautions in public hospitals within the Gedeo zone of Southern Ethiopia.

Methods: A quasi-experimental study design was conducted with 124 HCWHs across four public hospitals from July to December 2022. Each hospital delivered a four-day IPC training program, utilizing a structured and interactive approach that included presentations, hands-on demonstrations, and group discussions to promote participation and understanding. HCWHs' KAPC regarding standard precautions were assessed using structured questionnaires and observational checklists. Data analysis employed descriptive statistics and the Wilcoxon Signed Rank Test, with regression analysis identifying demographic factors associated with KAPC changes post-training. A significance level of $p < 0.05$ was established.

Results: The median score differences between pretest and posttest were statistically significant for knowledge ($z = -8.554$, $p = 0.00$, $r = 0.54$), attitude ($z = -8.356$, $p = 0.00$, $r = 0.53$), practice ($z = -8.696$, $p = 0.00$, $r = 0.55$), and compliance ($z = -8.523$, $p = 0.00$, $r = 0.54$). IPC training resulted in significant improvements: knowledge increased by 46%, attitude by 8.1%, practice by 19.4%, and compliance by 23.7%. IPC-related awareness among HCWHs (AOR: 2.55; 95% CI: 1.16-5.61) and the presence of Environmental Health Officers (EHOs) in hospitals (AOR: 2.53; 95% CI: 1.17-5.43) were significantly associated with positive attitudes toward SP. Additionally, attitudes were significantly linked to HCWHs' practices regarding infection prevention measures (AOR: 2.48; 95% CI: 1.10-5.59), and practices were statistically associated with compliance levels (AOR: 27.02; 95% CI: 9.50-76.87).

Conclusion: IPC training effectively enhanced HCWHs' knowledge, attitudes, practices, and compliance with standard precautions.

Keywords: Compliance, Ethiopia, Healthcare waste handlers, IPC training, Knowledge

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1 Introduction

Globally, the healthcare sector faces significant challenges in healthcare waste management [1]. Ethiopia, like many developing nations, confronts numerous obstacles, including inadequate infrastructure, limited resources, and a shortage of trained personnel [2, 3]. These issues increase the risk of infections among healthcare waste handlers and the general population [4]. Evidence shows that healthcare cleaners and waste handlers are often contracted externally, with little to no consideration given to their training, particularly in infection prevention and control (IPC) [5]. A substantial proportion (55%) of healthcare waste handlers (HCWHs) lack essential knowledge and understanding of safe practices, further heightening the risk of hospital-acquired infections (HAIs) [1, 6].

HAIs significantly impact the quality of patient care and outcomes [7]. They affect approximately 10% of hospitalized patients in developed countries and 25% in developing countries, resulting in adverse healthcare outcomes such as prolonged hospital stays, increased costs, and considerable morbidity and mortality [8, 9]. In developing nations, the prevalence of HAIs is largely due to insufficient knowledge and awareness of healthcare waste management among workers [10]. Certain occupational groups, including hospital cleaners and laundry service workers, are particularly vulnerable to injuries and infections due to their job roles and exposure risks [11].

Existing evidence indicates that training in healthcare waste management can enhance compliance with standard precautions, thereby reducing occupational exposures [12, 13]. This suggests that effective training and education are crucial for managing healthcare waste, lowering the incidence of HAIs, improving patient outcomes, and ensuring safer working conditions for healthcare workers [12, 13]. Moreover, quality healthcare delivery is impossible without effective IPC [14, 15]. The World Health Organization (WHO) asserts that effective IPC methods can reduce HAIs by at least 30% [15-17]. There is an increasing recognition of the need for effective infection prevention practices at all levels in Ethiopia to enhance HAI prevention [18].

Healthcare waste handlers are often underpaid, undereducated, inadequately protected, and work in hazardous environments with little to no in-service training [12, 19, 20]. They are among the most vulnerable to hospital-acquired infections (HAIs). Infections such as hepatitis B, hepatitis C, and HIV are primarily transmitted by healthcare workers who do not adhere to infection prevention measures [21, 22]. The incidence of these infections may be significantly higher among healthcare waste handlers, who often demonstrate low compliance with standard precautions in their daily tasks.

The importance of IPC training programs in enhancing the knowledge and practices of healthcare workers is well established [23]. However, evidence on the effectiveness of such training specifically for healthcare waste handlers is lacking. This study aims to address this gap by evaluating the efficacy of an IPC training program tailored for healthcare waste handlers in hospitals within the Gedeo zone of Southern Ethiopia.

The results of this study will assess the effectiveness of IPC training for healthcare waste handlers. Findings will provide valuable insights for policymakers, healthcare administrators, and training providers regarding the necessity of specialized training for this group of healthcare workers. The study aims to improve the knowledge, attitudes, practices, and compliance of healthcare waste handlers with standard precautions for infection prevention, particularly in public hospitals in the Gedeo zone and similar settings in developing countries. Ultimately, this research seeks to reduce the incidence of HAIs and enhance patient safety.

2 Materials and Methods

2.1 Study area

This study was conducted in the Gedeo zone of Southern Ethiopia, focusing on healthcare waste handlers in four governmental hospitals. Geographically, the zone is located north of the equator, spanning from 5^o53'N to 6^o27'N lati-

tude and from 38^{o}8' to 38^{o}30'E longitude. The altitude ranges from 1,500 to 3,000 meters, and the climate is characterized as sub-humid tropical. The zone includes one general hospital (a teaching hospital), three primary hospitals, thirty-five health centers, one hundred forty-six health posts, and seventeen private health facilities. According to current border delineations, the total land area of the region is approximately 1,347.04 square kilometers.

2.2 Study setting

The study was conducted in four public hospitals (three primaries and one general hospital) in Gedeo zone of Southern Ethiopia.

2.3 Study period

This study was conducted at hospitals in Gedeo zone for up to six months from July, 2022 to December, 2022.

2.4 Study design

A pre-post intervention quasi-experimental study was conducted to assess changes in the knowledge, attitudes, practices, and compliance of healthcare waste handlers following IPC training.

2.5 Source population

All healthcare waste handlers employed in healthcare facilities within the Gedeo zone were included as the study population.

2.6 Study population

Healthcare waste handlers employed in public hospitals of the Gedeo zone served as the study population. A comprehensive list of these handlers was obtained from hospital administrative records, ensuring the selection and inclusion of eligible representative participants from the hospitals.

2.7 Eligibility criteria

Inclusion: All workers in public hospitals within the Gedeo zone responsible for healthcare waste collection and transportation, as well as service staff involved in waste treatment and disposal, were included in this study.

Exclusion: Healthcare waste handlers in public hospitals of the Gedeo zone who did not complete all training modules were excluded from the study.

2.8 Intervention

An infection prevention and control (IPC) training program was specifically designed for healthcare waste handlers. The training covers four

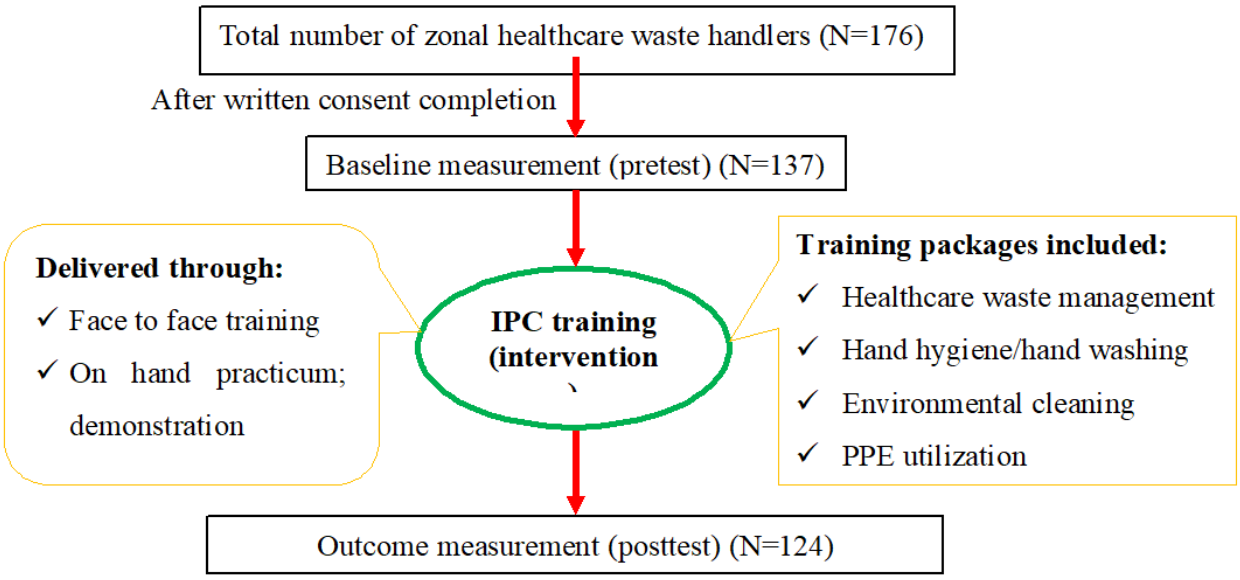

Figure 1 Flow chart for quasi-experiment (pre-post) study

components of standard precautions directly related to their roles: the healthcare waste management system (including waste segregation and disposal procedures), personal protective equipment usage, environmental cleaning, and hand hygiene. The training was delivered using a hands-on, participatory approach, incorporating lectures, demonstrations, group discussions, and practical exercises to enhance understanding and application of the concepts. Post-intervention evaluation included pre- and post-training assessments through structured questionnaires, observation checklists, and periodic follow-ups to measure knowledge retention and improvements in compliance with IPC practices.

2.9 Sample size and sampling procedure

A single population proportion formula was used to determine the sample size, assuming a 48% proportion of healthcare waste handlers with good knowledge based on previously conducted studies in Northern and Eastern Ethiopia [24, 25]. With a 95% confidence level and a 5% margin of error, the calculated sample size, including the non-response rate, was 422. However, due to the small source population size of 176 public hospital staff involved in the healthcare waste management system at the study locations, this interventional study adopted a rule of thumb, utilizing 70% of the population. As a result, the actual maximum sample size of 137 was determined, accounting for a 10% non-response rate. The number of healthcare waste handlers to be included from each hospital was calculated in proportion to the total number of HCWHs in each facility. A list of each healthcare waste handler was obtained from hospital administrative records. Based on this, a baseline survey was conducted, and the intervention was implemented at each hospital.

2.10 Data collection

The study utilized structured questionnaires that included 16 yes/no questions for assessing knowledge, along with three-point Likert scale questions: 19 for attitude, 14 for practice, and 12 for compliance. These questionnaires were used to evaluate infection prevention measures among healthcare waste handlers and to determine changes following the IPC training.

2.11 Quality assurance

A pre-test of the data collection tools was conducted using 5% of the actual sample size at a healthcare facility in the West Guji zone under similar conditions. The data collection tools were initially prepared in English after a thorough review of relevant literature and guidelines [26-29]. They were later translated into the local language (Amharic) to facilitate easier analysis

and quicker responses from participants. Finally, the tools were translated back into English for data entry and analysis.

The intervention materials included instructions, descriptions, images, posters, and specific examples of recommended practices [16]. Three environmental health professionals, certified as trainers of trainers (TOT), were selected to deliver the IPC training. These health professionals were oriented on how to conduct the training for healthcare waste handlers and were instructed to explain the intervention's implementation to participants. Additionally, all participants received identical training resources, including printed materials and visual aids, to ensure consistency in the content delivered. A monitoring mechanism was established to oversee the training sessions across different hospitals.

2.12 Data analysis

The data was entered into EpiData version 4.2.0 (CDC, Atlanta, GA, USA) and analyzed using SPSS version 26. Descriptive statistics were employed to provide an overview of the characteristics of healthcare waste handlers, including age, gender, years of experience, and baseline scores for knowledge, attitude, practice, and compliance.

To determine significant improvements following the IPC training, the Wilcoxon Signed-Rank Test was used to compare mean or median scores for knowledge, attitude, practice, and compliance before and after the training. The Chi-Square test assessed the association between IPC training and compliance with infection prevention measures among healthcare waste handlers. Regression analysis identified demographic characteristics associated with differences in knowledge, attitude, practice, and compliance following the implementation of IPC training. The significance level was set at $p < 0.05$.

2.13 Operational Definition

Knowledge Level of Healthcare Waste Handlers about Standard Precautions: This refers to the understanding of facts, information, and guidelines related to infection prevention and control (IPC). It encompasses awareness of infection transmission modes, proper procedures, and safety precautions [30]. Knowledge was measured using a tool developed based on WHO universal precautions and previous research [31, 32], consisting of 16 yes/no items. Scores were categorized as a good level of knowledge if they were higher than or equal to the median score (≥ 0.88); otherwise, they were classified as a low level of knowledge.

Attitude of Healthcare Waste Handlers Towards Standard Precautions: This reflects the feelings, beliefs, and perceptions of healthcare waste handlers regarding IPC practices, influencing their behavior and motivation [33, 34]. It was measured using 19 questions on a 3-point Likert scale (1. Not agree, 2. Undecided, 3. Agree), addressing factors that influence healthcare waste handlers' behavior and motivation towards infection prevention. Scores were categorized as "not acceptable attitude" if they were lower than the median score (< 2.74) and "acceptable attitude" if they were greater than or equal to the median score (≥ 2.74).

Practices of Healthcare Waste Handlers Regarding Standard Precautions: This refers to the actual actions taken by healthcare waste handlers to prevent the spread of infections in healthcare settings. Practices were measured using 14 items on a 3-point Likert scale (1. Never, 2. Sometimes, 3. Always), including IPC procedures, PPE usage, environmental cleaning, hand hygiene, and healthcare waste handling [16, 30]. Results were categorized as "poor level of practice" if the score was less than the median score (< 2.50) and "good level of practice" if the score was greater than or equal to the median score (≥ 2.50).

Compliance Level of Healthcare Waste Handlers with Standard Precautions: This measures the extent to which healthcare waste handlers adhere to IPC guidelines consistently and correctly, reflecting the alignment between knowledge, attitude, and actual practices [30, 35]. Compliance was assessed using 12 items adapted from a compliance instrument based on WHO universal precautions and previous re-

search [31, 32], with a 3-point Likert scale (1. Never, 2. Sometimes, 3. Always). Scores were categorized as "good compliance level" if they were higher than or equal to the median score (≥ 2.50); otherwise, they were classified as poor compliance. A good compliance level indicates that safe infection prevention practices have become habitual for healthcare waste handlers [18].

3 Results

3.1 Demographic Characteristics

The study included 124 healthcare waste handlers who had completed training, with a dropout rate of 9.5%. As shown in Table 1, the majority of participants were from Dilla General Hospital (48.4%), followed by Gedeb Primary Hospital (20.2%), Bule Primary Hospital (16.9%), and Yirga-Chefe Primary Hospital (14.5%). A higher proportion of respondents worked in the inpatient department (IPD) (16.1%), followed by the outpatient department (OPD) (13.7%) and the operating room (OR) (8.06%).

Most participants were female (79.8%), with the majority aged 18-30 years (88.9%) and having two to five years of experience in healthcare waste handling (68.7%). The mean age of the respondents was 26.56 ± 5.56 years. Marital status was classified as single (21%), married (75.8%), divorced (1.6%), and widowed (1.6%). Most respondents (71%) had worked at a hospital for two to five years. Regarding educational status, 55.7% held diplomas, while 36.3% and 8% had completed secondary and primary school, respectively. The respondents reported an average monthly income of 1800.87 ± 330 Ethiopian Birr (Table 1).

Table 1 Socio-demographic characteristics of the respondents (n = 124)

Variables		Frequency	Percentage
Gender of the respondents	Female	99	79.8
	Male	25	20.2
Age of the respondents	18-20	13	10.5
	21-30	91	73.4
	31-40	15	12.1
	41 and above	5	4.0
	Mean age	26.56 ± 5.56 years	
Marital status of the respondents	Single	26	21
	Married	94	75.8
	Divorced	2	1.6
	Widowed	2	1.6
Work experience	One year	11	8.9
	Two to five years	88	71
	Six and above years	25	20.1
Educational status	Primary school	10	8.1
	Secondary school	45	36.3
	TVET	61	49.2
	Diploma and above	8	6.4
Monthly income	1296 to 1500 Birr	8	6.4
	1501 to 1600 Birr	20	16.1
	1601 to 1900 Birr	39	31.5
	1901 to 2000 Birr	55	44.4
	2001 and above	2	1.6
	Average monthly income	1800.87 ± 330 Birr	
Exposure to HAIs	No	96	77.4
	Yes	28	22.6
Previous training status on SPs	No	70	56.5
	Yes	54	43.5
Previous training on PPE usage	No	77	62.1
	Yes	47	37.9
Period of last training on PPE	No training at all	77	62.1
	Less than a year	21	16.9
	Two years	16	12.9
	More than two years	10	8
Previous awareness status about the job	No	70	56.5
	Yes	54	43.5
Awareness about the existence of IPC committee	No	71	57.3
	Yes	53	42.7

Many respondents (56.5%) reported that they had not received training on recommended infection prevention measures since their hiring (Table 1). Additionally, there were no environmental health professionals present in the primary hospitals of the Gedeo zone during the study period (Table 2).

Table 2 Participant characteristics across study settings (n = 124)

Variables		Frequency	Percentage
Respondents' corresponding hospital (proportional)	Bule Primary Hospital	21	16.9
	Dilla General Hospital	60	48.4
	Gedeb Primary Hospital	25	20.2
	Yirga-chefe Primary Hospital	18	14.5
Departments of study participants	In patient	20	16.19
	Out patient	17	13.70
	Operation room	13	10.48
	Emergency ward	10	8.06
	Delivery room	9	7.26
	Laundry	7	5.64
	Neonatal Intensive Care Unit	6	4.84
	Obstetrics ward	6	4.84
	Medical Admin	5	4.03
	Medical ward	5	4.03
	Medical laboratory	5	4.03
	Orthopedics	4	3.22
	Surgical ward	4	3.22
	Gynaecology ward	3	2.41
	Pediatric	3	2.41
	Antenatal Care ward	3	2.42
	Intensive Care Unit	2	1.61
	Pharmacy	2	1.61
Is (are) there EHO(s) in the hospital?	No (in primary hospitals)	64	51.62
	Yes (in General hospital)	60	48.38

3.2 Comparison of pre- and post-KAPC scores across study hospitals

During the pre-training assessment, significant gaps were observed among study participants in knowledge, attitude, practice, and compliance with standard precautions across the hospitals in the study area. Relatively, healthcare waste handlers (HCWHs) at Dilla General Hospital had better scores compared to those at primary hospitals (Figure 2). However, after the training, there was a significant improvement across all hospitals.

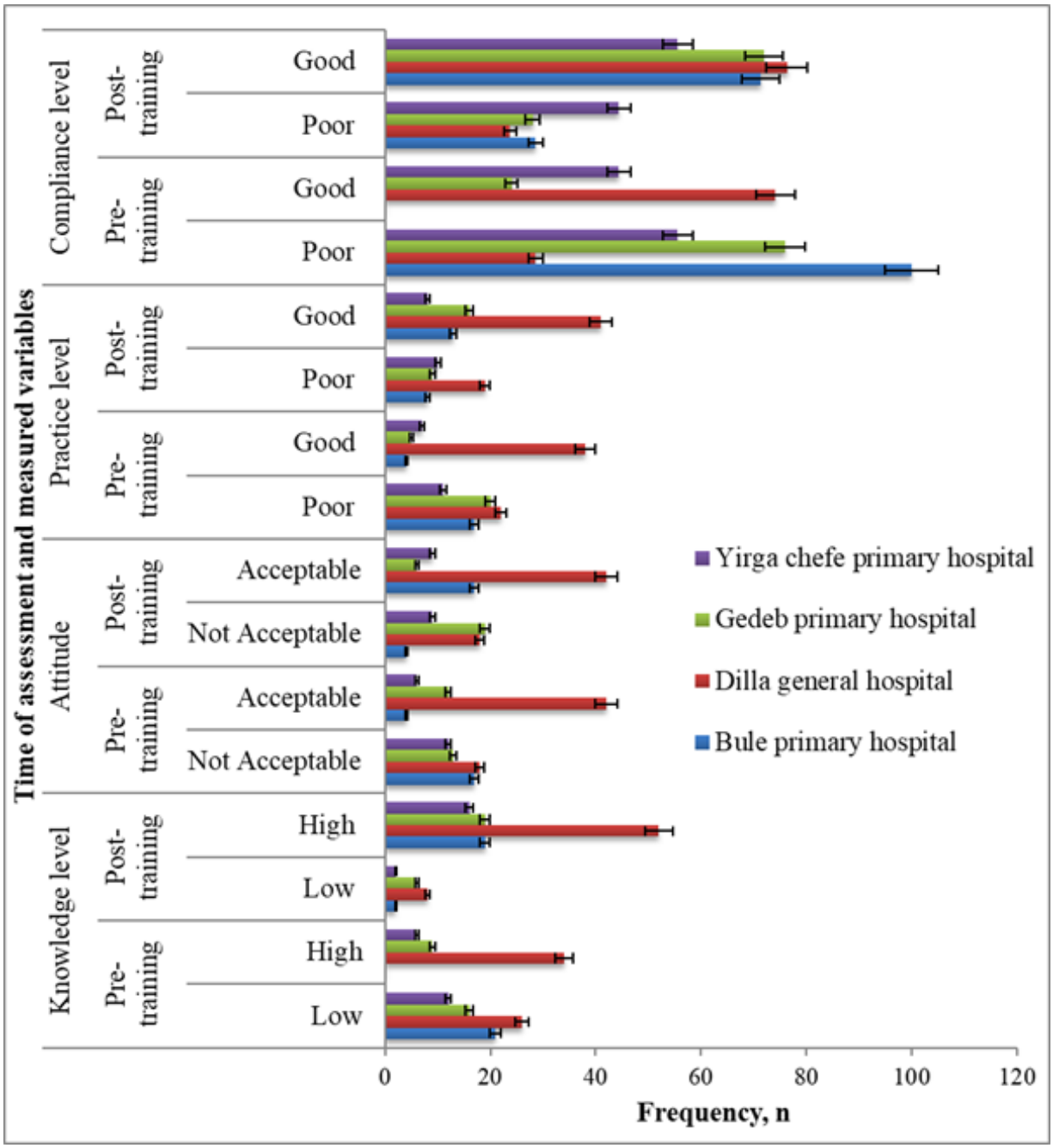

Figure 2 Comparison of HCWHs' KAPC across study sites at pre-and post-training

3.3 Effects of infection prevention training on HCWH's KAPC

There was a statistically significant difference when comparing pre-test and post-test scores at $p < 0.05$. Healthcare waste handlers' (HCWHs) knowledge, attitude, practice, and compliance scores for standard precautions improved positively in Gedeo zone hospitals after IPC training (Figure 3). The proportion of participants with a good level of knowledge increased significantly by 46% (from 39.5% to 85.5%), while acceptable attitude, good practice, and good compliance increased by 8.1% (from 51.6% to 59.7%), 19.4% (from 43.5% to 62.9%), and 23.7% (from 44% to 67.7%), respectively, following IPC training (Figure 3).

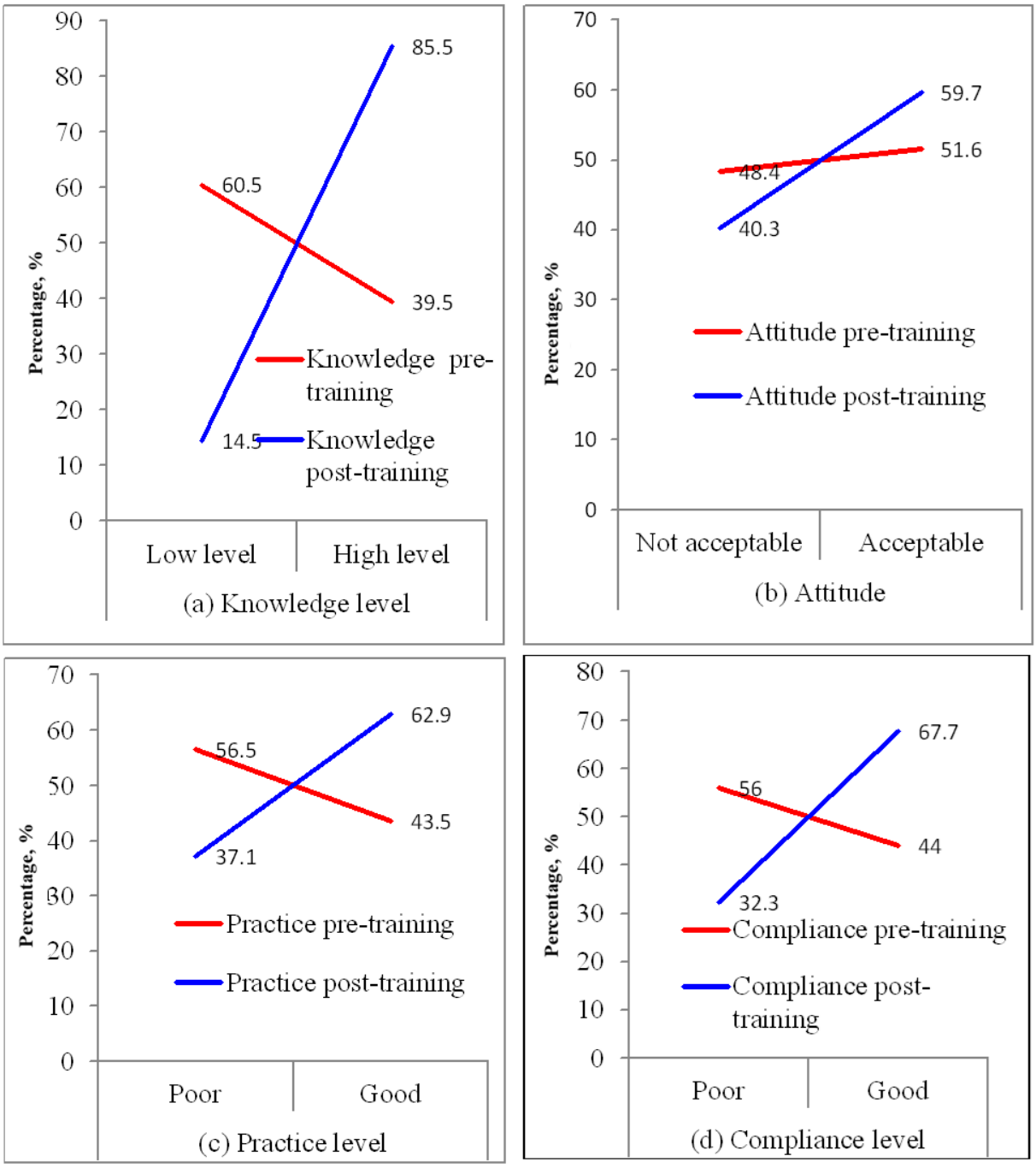

Figure 3 Percentage distribution of subjects according to: (a) knowledge, (b) attitude, (c) practice and (d) compliance level before and after IPC-training

Comparing the optimum knowledge, attitude, practice and compliance mean scores pre- intervention, the post-intervention scores showed a positive significant change at $p < 0.05$ (Table 3).

Table 3 Description of mean and median for KAPC scores at pre- and post-training

Variables	N	Mean	SD	Minimum	Maximum	Percentiles			p-value
						25^{th}	50^{th} (Median)	75^{th}	
Knowledge at pretest	124	.6972	.20118	.00	1.00	.5625	.6875	.8750	0.001
knowledge posttest	124	.8821	.10214	.50	1.00	.8125	.8750	.9850	
Attitude at pretest	124	2.6935	.27196	1.37	3.00	2.5395	2.7368	2.8947	0.001
Attitude at posttest	124	2.9121	.11185	2.47	3.00	2.8421	2.9474	3.0000	
Practices at pretest	124	2.4994	.33447	1.86	3.00	2.2321	2.5000	2.7857	0.001
Practice at posttest	124	2.8376	.12699	2.29	3.00	2.7857	2.8571	2.9286	
Compliance at pretest	124	2.5000	.32752	1.83	3.00	2.3333	2.5000	2.7500	0.001
Compliance at posttest	124	2.8293	.13644	2.42	3.00	2.7500	2.8333	2.9167	

A Wilcoxon signed-rank test revealed that median knowledge scores were significantly higher after the intervention (Md = 0.88, n = 124) compared to before (Md = 0.69, n = 124), z = -8.554, p = 0.00, with an effect size of r = 0.54. The results also indicated that attitude scores significantly improved post-intervention (Md = 2.95, n = 124) compared to pre-intervention scores (Md = 2.74, n = 124), z = -8.356, p = 0.00, with an effect size of r = 0.53. Similarly, practice scores were significantly higher after the intervention (Md = 2.86, n = 124) compared to the pre-test (Md = 2.50, n = 124), z = -8.696, p = 0.00, with a large effect size of r = 0.55. Additionally, compliance scores towards standard precautions statistically increased after the intervention (Md = 2.83, n = 124) compared to the pre-test (Md = 2.50, n = 124), z = -8.523, p = 0.00, with an effect size of r = 0.54 (Tables 3 and 4).

Table 4 Wilcoxon Signed Ranks Test results for KAP and compliance comparing posttest-pretest

Ranks						
Variables (posttest-pretest)		N	Mean Rank	Sum of Ranks	Z	p-value
Knowledge posttest- Knowledge pretest	Negative Ranks	6^a	32.58	195.50	-8.554	.000
	Positive Ranks	104^b	56.82	5909.50		
	Ties	14^c				
	Total	124				
Attitude posttest- Attitude pretest	Negative Ranks	7^a	26.93	188.50	-8.356	.000
	Positive Ranks	99^b	55.38	5482.50		
	Ties	18^c				
	Total	124				
Practice posttest – Practices pretest	Negative Ranks	11^a	14.27	157.00	-8.696	.000
	Positive Ranks	100^b	60.59	6059.00		
	Ties	13^c				
	Total	124				
Compliance posttest- Compliance pretest	Negative Ranks	12^a	15.25	183.00	-8.523	.000
	Positive Ranks	97^b	59.92	5812.00		
	Ties	15^c				
	Total	124				

a. posttest (after intervention) < pretest (before intervention)
b. posttest (after intervention) > pretest (before intervention)
c. posttest (after intervention) = pretest (before intervention)

3.4 Factors associated with baseline KAPC of HCWHs towards standard precautions

As indicated in Table 5, regression analysis showed a significant association between baseline knowledge and IPC-related awareness provided to healthcare waste handlers (HCWHs) at the time of employment (AOR: 2.65; 95% CI: 1.04-6.76; p = 0.041). Additionally, the presence of Environmental Health Officers (EHOs) in hospitals was significantly associated with knowledge (AOR: 3.14; 95% CI: 1.10-8.95; p = 0.033), as was the baseline attitude of HCWHs towards standard precautions (AOR: 6.59; 95% CI: 2.35-18.47; p = 0.000). Consequently, HCWHs who received IPC-related awareness during their employment were 2.65 times more likely to be knowledgeable about standard precautions than their counterparts. Similarly, participants working in hospitals with EHOs were 3.14 times more likely to have a high level of knowledge about standard precautions compared to those in hospitals without EHOs.

Moreover, the availability of EHOs was significantly associated with the baseline attitude of study participants towards standard precautions. Participants in hospitals with EHOs were 5.14 times more likely to have a positive attitude towards standard precautions than those without (AOR: 5.14; 95% CI: 1.63-16.23; p = 0.005). Additionally, participants with a secondary school education were 10.51 times more likely to exhibit a positive attitude towards infection control standard precautions compared to those with a primary school education (AOR: 10.51; 95% CI: 1.94-56.89; p = 0.006).

Similarly, the presence of EHOs was linked to the baseline practices of participants regarding standard precautions (p = 0.005). Those working in hospitals with EHOs were 3.78 times more likely to demonstrate good practices related to standard precautions compared to those in hospitals without EHOs (AOR: 3.78; 95% CI: 1.49-9.58).

Additionally, participants' marital status and baseline practices were significantly associated with compliance levels to standard precautions. Married participants were 4.21 times more likely to adhere to standard precautions than unmarried participants (AOR: 4.21; 95% CI: 1.39-12.76; p = 0.011). Furthermore, participants with a good level of baseline practices were 5.21 times more likely to have a good level of compliance with standard precautions compared to those with poor baseline practices (AOR: 5.21; 95% CI: 2.18-12.48; p = 0.000).

3.5 Factors associated with post KAPC of HCWHs towards standard precautions

Factors associated with post knowledge of HCWHs about standard precautions

Marital status, work experience, monthly income, previous training attended on standard precautions, and prior awareness of healthcare waste handlers regarding standard precautions were candidate variables associated with the knowledge of HCWHs about infection prevention measures ($p < 0.25$). However, multivariable logistic regression analysis indicated that none of these candidate variables were significantly associated with the knowledge of healthcare waste handlers about standard precautions in this study.

Factors associated with post-attitude of HCWHs towards standard precautions

Work experience, previous training on standard precautions, and the availability of Environmental Health Officers (EHOs) in healthcare facilities were candidate variables associated with the knowledge of healthcare waste handlers (HCWHs) regarding infection prevention measures ($p < 0.25$).

However, as indicated in Table 5, multivariable logistic regression analysis revealed that IPC-related awareness provided to HCWHs at the time of employment and the presence of EHOs in hospitals were significantly associated with the attitudes of HCWHs towards standard precautions for infection prevention ($p < 0.05$). Specifically, healthcare waste handlers who received prior awareness about infection prevention measures during their employment were 2.55 times more likely to have an acceptable attitude to-

wards standard precautions (AOR: 2.55; 95% CI: 1.16-5.61). Additionally, the presence of EHOs in healthcare facilities was linked to the attitudes of HCWHs towards standard precautions. In hospitals with assigned EHOs, HCWHs were 2.53 times more likely to possess an acceptable attitude towards standard precautions (AOR: 2.53; 95% CI: 1.17-5.43).

Factors associated with post-practices of HCWHs with standard precautions

Gender, previous training on standard precautions, attitude, and the availability of EHOs in healthcare facilities were candidate variables associated with the practices of healthcare waste handlers (HCWHs) regarding standard

Table 5 Factors associated with knowledge, attitude, practice and compliance level of HCWHs to standard precautions at baseline and post-training

Variables	Category	AOR (95% CI)	p-value
Factor associated with baseline knowledge about standard precautions			
IPC related awareness provided for HCWHs	No	Reference	
at employing time	Yes	2.65 (1.04-6.76)	0.041*
Availability of Environmental Health	No	Reference	
Officers (EHOs) at hospital	Yes	3.14 (1.10-8.95)	0.033*
Baseline attitude of HCWHs	No	Reference	
	Yes	6.59; (2.35-18.47)	0.000*
Factor associated with baseline attitude towards standard precautions			
Availability of EHOs at hospitals	No	Reference	
	Yes	5.14 (1.63-16.23)	0.005*
Participants' educational level	No	Reference	
	Yes	10.51 (1.94-56.89)	0.006*
Factor associated with baseline practice with standard precautions			
Availability of EHOs at hospital	No	Reference	
	Yes	3.78 (1.49-9.58)	0.005*
Factor associated with baseline compliance to standard precautions			
Marital status of participants	Single	Reference	
	Married	4.21 (1.39-12.76)	0.011*
Baseline practice with standard precautions	Poor	Reference	
	Good	5.21 (2.18-12.48)	0.000*
Factor associated with post-attitude towards standard precautions			
Previous SP training attended by HCWHs	No	Reference	
	Yes	2.55 (1.16-5.61)	0.021*
Availability of EHOs in the hospital	No	Reference	
	Yes	2.53 (1.17-5.43)	0.018*
Factor associated with post-practice with standard precautions			
Attitude towards infection prevention	Not acceptable	Reference	
	Acceptable	2.48 (1.10-5.59)	0.028*
Factors associated with post-compliance level to standard precautions			
Practice of HCWHs towards infection	Poor level	Reference	
prevention	Good level	27.02 (9.50-76.87)	0.000*

precautions ($p < 0.25$). However, multivariable logistic regression analysis revealed that only attitude was significantly associated with the practices of HCWHs towards standard precautions for infection prevention. As shown in Table 5, HCWHs with an acceptable attitude towards infection prevention measures were 2.48 times more likely to perform good practices in accordance with standard precautions (AOR: 2.48; 95% CI: 1.10-5.59).

Factors associated with post-compliance level of HCWHs to standard precautions

Gender, practices of healthcare waste handlers (HCWHs) towards infection prevention, and the availability of Environmental Health Officers (EHOs) in healthcare facilities were candidate variables associated with the compliance of HCWHs to standard precautions ($p < 0.25$). However, multivariable logistic regression analysis revealed that the practices of HCWHs towards infection prevention were significantly linked to their compliance levels with standard precautions. As shown in Table 5, HCWHs with a good level of practices regarding infection prevention measures were 27.02 times more likely to adhere to standard precautions compared to those with a low level of practices (AOR: 27.02; 95% CI: 9.50-76.87)

4 Discussions

This interventional study meticulously examined the knowledge, attitude, practices, and compliance levels of healthcare waste handlers (HCWHs) regarding standard precautions. The findings indicate that infection prevention training significantly improved the knowledge, attitude, practice, and compliance of HCWHs with standard precautions. These results align with previous studies [25, 26, 28, 36, 37], highlighting the crucial role of training in enhancing infection control practices. Our study corroborates findings from a study conducted in Nigeria [38], which reported increases in knowledge and adherence to standard precautions among teaching hospital staff following training sessions. This evidence suggests that structured training programs can positively influence the behavior of HCWHs, leading to improved healthcare waste management practices.

Furthermore, our study revealed that providing IPC-related awareness to participants during their employment significantly correlated with their knowledge of standard precautions ($p = 0.041$). Specifically, participants who received IPC-related awareness demonstrated superior baseline knowledge compared to those who did not. This may be attributed to the fact that HCWHs who reported receiving adequate awareness and education on IPC issues were more knowledgeable, practical, and compliant with standard precautions [39, 40]. This finding emphasizes the necessity of implementing in-service training to enhance the knowledge and practices of HCWHs regarding standard precautions [41]. Additionally, our study indicates that HCWHs' practices towards infection prevention significantly influenced their compliance with standard precautions ($p < 0.05$), underscoring the critical role of infection prevention practices in adherence to these standards.

The presence of Environmental Health Officers (EHOs) in hospitals significantly influenced both baseline and post-intervention attitudes towards standard precautions ($p = 0.000$). Participants employed in hospitals with EHOs exhibited a more positive baseline and post-intervention attitude compared to those in hospitals without assigned EHOs. This may be due to the primary responsibilities of EHOs, which include disseminating up-to-date information to healthcare staff and advocating for universal precautions to mitigate occupational risks. The environmental health profession, one of the oldest public health fields, is often regarded as the cornerstone of public health [42].

EHOs focus on promoting occupational health and safety, which involves safeguarding health in the workplace by raising awareness among healthcare workers about the importance of adhering to infection prevention guidelines and protocols [43]. They are responsible for developing, promoting, and enforcing guidelines, policies, and laws related to environmental health, as well as addressing environmental health risks

[44]. Additionally, our study found that the availability of EHOs in hospitals was associated with the baseline practices of participants regarding standard precautions, underscoring the pivotal role EHOs play in the healthcare setting.

Participants' educational status was another significant factor associated with baseline attitudes towards standard precautions ($p = 0.006$). In this study, participants with a secondary school education exhibited a more acceptable (positive) attitude towards standard precautions than those with only a primary education. This finding aligns with previous research [45, 46], which indicated that higher educational levels are linked to more positive attitudes towards standard precautions due to increased exposure and access to information. However, high formal education does not guarantee correct knowledge of standard precautions, nor does it necessarily lead to positive behavior. For instance, someone with greater knowledge than hospital waste handlers may still practice poorly with standard precautions [45].

Additionally, the current study revealed that the baseline compliance level of participants with standard precautions was significantly linked to their marital status. Married participants were more likely to have and perform good practices regarding standard precautions compared to their unmarried counterparts. This finding is consistent with a previous study conducted in Hawassa, Southern Ethiopia [47], which found that married participants were more compliant with standard precautions than unmarried healthcare workers.

The evidence from this study emphasizes the crucial role of IPC training in improving the knowledge, attitude, practices, and compliance (KAPC) of healthcare waste handlers (HCWHs). It provides valuable insights for developing targeted, context-specific strategies to address identified gaps and enhance HCWHs' practices. By prioritizing comprehensive training programs and fostering stakeholder engagement alongside supportive institutional frameworks, hospitals can strengthen infection prevention measures, ensure proper waste management, reduce infection risks, and create a safe environment for both staff and clients.

The implications of the study highlight the need for ongoing training programs to maintain high levels of compliance among healthcare waste handlers. Limitations of the study include a small sample size and potential biases in self-reported data. Future research could explore the long-term effects of infection prevention training on healthcare waste handlers' practices. This underscores the importance of continuous education and reinforcement of best practices to ensure the safety of healthcare workers and patients.

5 Conclusion

This interventional study highlights the significant impact of infection prevention and control (IPC) training on improving the knowledge, attitude, practices, and compliance (KAPC) of healthcare waste handlers (HCWHs) regarding standard precautions. The findings underscore the crucial role of structured training programs in enhancing adherence to infection control practices and promoting effective waste management.

The study also identifies key determinants of KAPC, such as IPC-related awareness, the presence of Environmental Health Officers (EHOs), educational status, and marital status, all of which significantly influence baseline and post-training outcomes. These findings emphasize the necessity of implementing comprehensive and ongoing IPC training, supported by strong institutional frameworks and stakeholder engagement, to foster a safe working environment, reduce infection risks, and ensure sustainable improvements in healthcare waste management practices.

Moreover, hospital management should prioritize recruiting and retaining qualified EHOs to ensure adherence to these standards. EHOs should consistently provide updates and guidance on IPC practices and protocols to reinforce compliance.

Abbreviations

AOR	Adjusted Odds Ratio
CI	Confidence Interval
EHOs	Environmental Health Officers
HAIs	Hospital Acquired Infections
HCWHs	Healthcare Waste Handlers
IPC	Infection Prevention and Control
KAPC	Knowledge, Attitude, Practice and Compliance
Md	Median
PPE	Personal Protective Equipment
SP	Standard Precautions

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Ethical approval and consent to participate

Ethical approval was obtained from the Dilla University College of Health Sciences and Medicine Institutional Review Board, with protocol number DUIRB/029/22-01. Informed consent was secured from all participants, and their confidentiality and privacy were ensured throughout the study.

Consent for publication: Not applicable

Availability of data and materials

The datasets used the study are available from the corresponding author up on request.

Declaration of conflict of interest

There was no conflict of interest among the authors regarding this article.

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RESEARCH ARTICLE

Sanitary Practices of Food and Drinking Establishments and Associated Factors in Worabe Town, Silte Zone, Ethiopia

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Abstract

Background: Foodborne illnesses pose a significant threat to public health worldwide, affecting both developed and developing nations. In urban settings, food service establishments cater to large volumes of customers, increasing the risk of infections. However, there is limited information about the sanitary practices of these establishments in the current study location. Therefore, this study aimed to assess the sanitary practices and associated factors in food and drinking establishments in Worabe Town, Silte Zone, Ethiopia.

Method: A cross-sectional study design was conducted from August 1 to 10, 2023, with 339 randomly selected participants from food and drink establishments. Data were collected using pretested structured questionnaires and observation checklists. The collected data were entered into EpiData version 4.6 and transferred to SPSS version 26 for analysis. Descriptive statistics, including means, frequencies, and percentages, are presented, along with bivariate and multivariable logistic regression analyses.

Result: In this study, 334 respondents from food and drink establishments participated, resulting in a response rate of 98%. Nearly half of the participating establishments were restaurants (49.7%). Among the facilities, 45.5% provided both food and drink services, while 41.6% offered food exclusively. The study found that 68.9% of respondents followed good food handling practices, but 52.4% of food and drinking establishments were found to have poor sanitary practices. Establishments with trained food hygiene managers (AOR = 2.6, 95% CI: 1.58–4.42), food handlers who underwent medical examinations (AOR = 1.3, 95% CI: 1.01–2.95), and those receiving supportive supervision from regulatory bodies every six months (AOR = 2.3, 95% CI: 1.66–4.06) were significantly associated with better sanitary practices.

Conclusion: This study revealed that only half of the food and drinking establishments operate under satisfactory sanitary conditions. Factors significantly associated with improved sanitary practices included having trained food hygiene managers, food handlers who had undergone medical examinations, and establishments receiving regular supportive supervision from regulatory bodies. It is recommended to strengthen the implementation of hygiene training, medical check-ups, and sustainable supportive supervision for all workers in these establishments.

Keywords: Food and drinking establishment, Sanitary practice, Silte Zone, Worabe, Ethiopia

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1 Introduction

Sanitary practices in food and drinking establishments, including handwashing, surface sanitization, and safe food storage, are essential to prevent contamination and health risks. Mendebo, Berhane, and Haile (2017) found that sanitary conditions in Ethiopian establishments are affected by environmental and managerial factors. In developing countries, foodborne diseases, stemming from poor food handling, inadequate temperature control, and poor personal hygiene among food handlers, hinder socio-economic development [1, 2]. Effective sanitary practices ensure proper maintenance, availability of handwashing facilities, waste management, and monitoring of cleanliness process [3].

Food safety is the most public health concern and is a scientific discipline that describes the handling, preparation, and storage of food in ways that prevent foodborne illnesses [4]. An adequate supply of safe, healthy, and nutritious food is essential for health and well-being. People can become sick when they eat food contaminated with hazards called foodborne disease [5]. The magnitude of over 200 different foodborne diseases caused by various bacteria, viruses, parasites, and harmful toxins or chemicals makes food safety a critical public health issue globally [6,7].

Improper food handling procedures are responsible for over 50% of total food poisoning cases worldwide [8]. Developed countries face a significant challenge with food safety, with an estimated 76 million cases of foodborne illnesses each year, leading to 325,000 hospitalizations and 5,000 deaths, costing $23 billion [9]. Poor food handling practices cause approximately 600 million cases and 420,000 deaths annually, with one in ten people becoming ill from consuming contaminated food. Food-borne illnesses are prevalent globally, making food safety a public health issuer [10]. In the USA and England, outbreaks of food-borne illnesses cause 5,000 and 500 deaths each year, respectively, with similar trends reported in other parts of Europe and North America [11]. The African region and Southeast Asia have the highest rates of morbidity and mortality due to foodborne diseases, as reported by the WHO [12].

Like other developing countries, in Ethiopia there is a high burden of foodborne diseases due to food contamination. The main reasons for the consumption of unsafe food were the lack of clean water, weak regulatory / supervision activities, a dense population, and poor environmental conditions intensifying the situation. The rise in the appearance of diarrheal diseases among children is an indicator of the food hygiene situation and inappropriate food preparation practices in the Region [13]. In many urban centers, eating in food service establishments such as restaurants, hotels, cafeterias, and fast-food restaurants is common. These facilities prepare, handle, and serve large amounts of foods and drinks to large groups of people in a short period of time, which may present a potential risk of infection [3]. Food processed in large quantities is susceptible to contamination and increased foodborne illness when it does not follow food hygiene principles [14].

In previous studies, poor sanitary practices in food and drink establishments in Ethiopia have been documented, with magnitudes varying across locations: Burayu Town (47.9%), Addis Ababa (58.8%), Adwa (53.3%), and Bahrdar (78.7%) [15–18]. In Worabe town, most public restaurants and drinking establishments are in densely populated areas and often do not meet standard sanitation requirements, resulting in poor hygiene practices. The urban's lively economic, recreational, and construction sectors contribute to heavy daily usage of these establishments. Consequently, the health risks posed to customers due to potential foodborne diseases are markedly elevated. Additionally, there is a notable scarcity of research-based information on the extent and associated factors of sanitary practices within public food and drinking establishments in the study area. Therefore, this study aimed to address this study gap by assess sanitary practices and associated factors in food and drinking establishments in Worabe town, Silte Zone, Ethiopia.

2 Methods and Materials

2.1 Study setting and Period

The study was conducted in Worabe town, which is in located central Ethiopia, Silte administrative zone, from August 1 to 10, 2023. It is found 172 kilometers south-west of Addis Ababa, Ethiopia's capital. In total, 79,408 people live in Worabe, 40,498 of whom are men and 38,910 of whom are women. In the town, there are eleven health posts, two health centers, and one specialized hospital with more than 500 medical professionals. Additionally, the town is home to 1,586 licensed food and drink establishments, spread out among cafeterias (361), hotels (10), restaurants (779), bars and restaurants (127), juice houses (123) and bakeries/bakery (40) [19].

A cross-sectional study design was employed to assess the sanitary conditions of these licensed food and drinking establishments and the factors associated with them.

2.2 Source population

All licensed food and drink establishments in Worabe Town served as the source population for this study. The study subjects were randomly selected from these establishments.

2.3 Eligibility criteria

The study focused solely on food and drink establishments that had obtained proper authorization from regulatory bodies, such as the town's Trade and Industry office, to prepare and sell food and beverages for consumption. Establishments that were suspended or restricted by regulatory bodies during the data collection period were not included in the study.

2.4 Sample Size Determination

The sample size was determined using a single population proportion formula, based on an assumption of overall poor sanitary conditions in 53.3% of establishments [17], a 5% margin of error, and a 95% confidence level, resulting in an initial sample size of 382. Since the study area had a finite population of 1,586 establishments (less than 10,000), a sample size reduction formula was applied, decreasing the sample size to 308. After accounting for a 10% non-response rate, the final sample size was adjusted to 339.

2.5 Sampling Procedure

All food and drink establishments were included in the sampling frame for the sampling procedure. The targets were determined based on the size of the sampling frame using proportional allocation. Establishments were stratified by their type of service into the following categories: hotels, bars and restaurants, restaurants, cafeterias, pastry shops, and juice vendors. This stratification ensured representativeness and avoided over- or underrepresentation. Study subjects were then selected through simple random sampling.

2.6 Data Collection Tools and Process

Data were collected using a structured questionnaire and an observational checklist adapted from previous studies [16–18,20]. The reliability of these tools was assessed using Cronbach's alpha. A team of six data collectors and supervisors, consisting of five certified nurses and one Bachelor of Science in Environmental Health, conducted interviews with the managers and/or owners of the establishments and observed food handlers. The collected data included the physical conditions of the food and drink establishments, sanitary facilities, and verification of the legal authorization to serve food and drink [21]. The checklist was modified based on comparable research and guidelines from the Ethiopian Food and Drug Authority (EFDA), which currently tracks and evaluates food and beverage establishments using operational inspection checklists.

2.7 Study Variables

Sanitary practices (good or bad) serve as the dependent variable in this study. The overall sanitary practice score was calculated based on 18 criteria, with each criterion assigned a value of '1' for the presence of a sanitary practice and '0' for its absence. The sum of these criteria was computed, and the mean score of all observations was used as a cut-off point to categorize

establishments. Food and drink establishments that scored equal to or above the mean value were classified as having good sanitary practices, while those scoring below the mean were considered to have poor sanitary practices [16]. For analysis, a value of '1' was assigned for good sanitary practices and '0' for poor practices. The internal consistency of the items used to measure each composite variable (all 18 variables) was assessed using Cronbach's alpha, yielding a value of 0.76.

The independent variables included the presence of sanitary facilities such as chemicals and detergents, sewerage systems, washing basins and sinks, separate kitchens, water storage, clean utensils, and waste disposal methods (both solid and liquid). Other factors considered were personal hygiene, environmental sanitation, the presence or absence of regulatory inspections, and the presence or absence of trained managers in hygiene and sanitation. Additionally, socio-demographic characteristics of the managers, including sex, age, marital status, level of education, and business ownership, were also included as independent variables.

2.8 Data Quality Assurance

Questionnaires and observation checklists were originally written in English, then translated into Amharic, the local language, and subsequently back into English to ensure consistency. Data collectors and supervisors underwent three days of training on data collection methods and techniques. Five percent of the tools were pretested in Butajira Town to assess their clarity. Supervisors closely monitored the data collection process, and at the end of each day, we held discussions with them to address any issues that arose.

2.9 Data Analysis

The collected data were checked for completeness and consistency before being coded and entered EpiData version 4.6, then exported to SPSS version 26 for further analysis. Descriptive statistics were calculated for all variables according to their type. Means, medians, and standard deviations were calculated for continuous variables, while categorical variables were presented as frequencies and percentages. The mean score value was used to assess sanitary practices. Model fit was evaluated using the Hosmer-Lemeshow goodness-of-fit test. All tests with $p < 0.05$ at a 95% confidence interval were considered statistically significant.

3 Results

3.1 Food and drink establishment characteristics

The study included 334 establishments, resulting in a response rate of 98%, with 49.7% identified as restaurants. Among these establishments, 41.6% served exclusively food, 8.1% served exclusively drinks, 45.5% offered both food and drink, and 4.8% provided food, drinks, and lodging. Many of the establishments (63.2%) were rented, and 68.6% had been supervised at least once in the past six months. Additionally, 60.8% of the establishments were in operation for 1 to 2 years, while only 5.4% had been in service for more than 11 years. The analysis revealed that 88% of the establishments had separate kitchens from other areas, and within these kitchens, 76% maintained clean processing equipment. Furthermore, a significant portion of the kitchens (85.6%) had refrigerators equipped with fixed thermometers for storing perishable food items (Table 1).

Table 1 Characteristics of food and drink establishments in Worabe Town, Silte zone, Ethiopia, 2023 (n=334)

Characteristics	Category	Frequency (N)	Percentage (%)
Type of establishments	Hotels	2	0. 6
	Restaurants	166	49.7
	Bar and Restaurants	23	6.9
	Cafeterias	77	23
	Bakery/Pastry	40	11.9
	Juice Vendors	26	7.8
Type service provides	Exclusively Food	139	41.6
	Exclusively drink	27	8.1
	Food and Drink	152	45.5
	Food, Drink and bed	16	4.8
Ownership of the building	Owned	123	36.8
	Rented	211	63.2
Supervised at least once in last six months	Visited	229	68.6
	Not visited	105	31.4
Service Year of establishments	1-2 years	238	71.1
	3-5 years	35	10.5
	6-10 years	78	23.4
	≥11 years	18	5.4
A separate room for kitchen	Yes	294	88
	No	40	12
Equipment cleanness and free from dirt and filth	Yes	254	76
	No	80	24
Running water in the kitchen	Yes	283	84.7
	No	51	15.3
Proper food handling	Yes	230	68.9
	No	104	31.1
Floor clean	Yes	262	78.4
	No	72	21.6
Presence of hood and chimney	Yes	244	73
	No	90	27
Insect Observed	Yes	124	37
	No	210	73
Availability of Refrigerator	Yes	286	85.6
	No	48	14.4
Separate storeroom	Yes	226	67.7
	No	108	32.3

3.2 Characteristics of managers of establishments

In this study, more than half of the establishments (52.7%) were managed by their owners, while 30.8% were managed by relatives and 16.5% by employed managers. The majority of managers were women (51.2%), with a mean age of 33.22 years. The educational backgrounds of the managers varied: 6% had no formal education, 36.2% had primary education, and 31.7% had secondary education. Only 35.9% had received training in food hygiene or related topics. While 79.9% of food handlers wore clean overcoats or gowns, only 52.4% wore appropriate

hair coverings, and just 33.5% had undergone medical checks within the last six months. Furthermore, the majority (66.5%) did not possess a medical check-up card at the time of data collection (Table 2).

Table 2 The socio-demographic characteristics of managers of public food and drinking establishments in Worabe Town, Silte zone, Ethiopia, 2023 (n = 334)

Characteristics	Category	Frequency	Percentage (%)
Manager of the Establishment	Owner	176	52.7
	Relatives	103	30.8
	Employed	55	16.5
Sex ofmanager	Male	163	48.8
	Female	171	51.2
The age range of managers	18-24 years	100	29.9
	25-30 years	132	39.5
	31-35 years	57	17
	≥36 years	45	13.4
Marital status	Single	159	47.6
	Married	127	38
	Divorced	37	11
	Separated	3	0.9
	Widowed	8	2.4
Educationalstatus	No formaleducation	20	6
	Primaryeducation	121	36.2
	Secondaryeducation	106	31.7
	Diploma and above	87	26

3.3 Accessibility of Water Supply and Sanitation Facilities

A significant majority of establishments (91.6%) utilized privately installed water sources supplied by the municipality. Additionally, 64.4% had water storage tanks to manage shortages. Almost all establishments (94.1%) had latrines, with 72% providing comfortable toilets and 40% offering separate latrines for males and females. Furthermore, 90.4% of the establishments had separate handwashing facilities, although only 54.2% supplied soap or liquid detergent for handwashing (Table 3).

Table 3 Availability of water supply and sanitation facilities of food and drinking establishments in Worabe Town, Silte zone, Ethiopia, 2023 (n = 334)

Characteristics	Category	Frequency	Percentage (%)
Source of water for establishment	Privately instilled	306	91.6
	Communal distribution	10	3.0
	Buy from others	18	5.4
Presence of tanker	Yes	215	64.4
	No	119	35.6
Presence of toilet	Yes	314	94.1
	No	20	5.9
Separation of toilet for male and female	Yes	134	40.0
	No	200	60.0
Toilet comfortable	Yes	242	72.0
	No	92	28.0
Presence of hand washing basin in the toilet	Yes	243	73.0
	No	91	27.0
Presence of separate hand washing facility in the toilet	Yes	302	90.4
	No	32	9.6
Presence of soap for hand washing	Yes	181	54.2
	No	153	45.8
Availability of shower service	Yes	234	70.0
	No	100	30.0
Separate room for clothing, resting and placing of cloths	Yes	167	50.0
	No	167	50.0
Basin for washing utensils used for food and drinking	Yes	334	100
	No	-	-
Number of compartments of basins for establishments	3 compartments	202	60.5
	2 compartments	115	34.4
	1 compartment	17	5.1
Utensils and equipment stored in containers	Yes	261	78
	No	73	22
Appropriate refuse receptacles placed in appropriate place	Yes	246	73.7
	No	88	26.3
Refuse transport to final disposal before over filling	Yes	273	81.7
	No	61	18.3
Installation of drainage system for collection of liquid waste	Yes	219	65.6
	No	115	34.4
Type of drainage system for the collection of liquid waste	A closed type	290	86.8
	Open trench	44	13.2

3.4 General sanitary practice in food and drinking establishments

The absence of standardized grading tools complicates the assessment of overall sanitary practices in food and drink establishments. By selecting 18 determinants, a mean score of 11.5 was established to classify the establishments as having either good or poor sanitary practices (Table 4).

Table 4 Sanitary practice of public food and drinking establishments in Worabe Town, Silte zone, Ethiopia, 2023 (n=334)

Criteria for sanitary condition:	Frequency	Percentage (%)
Establishments with functional washing facility	302	90.4
Establishments with functional latrine	314	94
Establishments that managed latrine facility properly	253	76
Establishment containers for solid waste storage	246	73.7
Establishments that disposed liquid wastes properly	290	86.8
Establishments having 3 compartments for dish/glass washing	202	60.5
Establishments with storeroom for non-perishable foods	227	67.7
Establishments with separate kitchen rooms	294	88
Establishments with functional refrigerator	286	85. 6
Establishments with piped water supply	306	91.6
Establishments that dispose of solid waste properly	246	73.7
Establishments that practice proper storage of food utensils	261	78
Establishments that store water drinking materials properly	215	64.4
Establishments with food handlers wearing proper outer garment	267	79.9
Establishments with food handlers wearing proper hair cover	150	46.7
Establishments with food handler's medical checkup in the last 6 months	112	33.5
Establishments with no insect or rodent infestation	124	37
Establishments with separate dressing room for food handlers	167	50

Overall, 47.7% of establishments had good sanitary practices while 52.3% had poor sanitary practices, as shown in Figure 2.

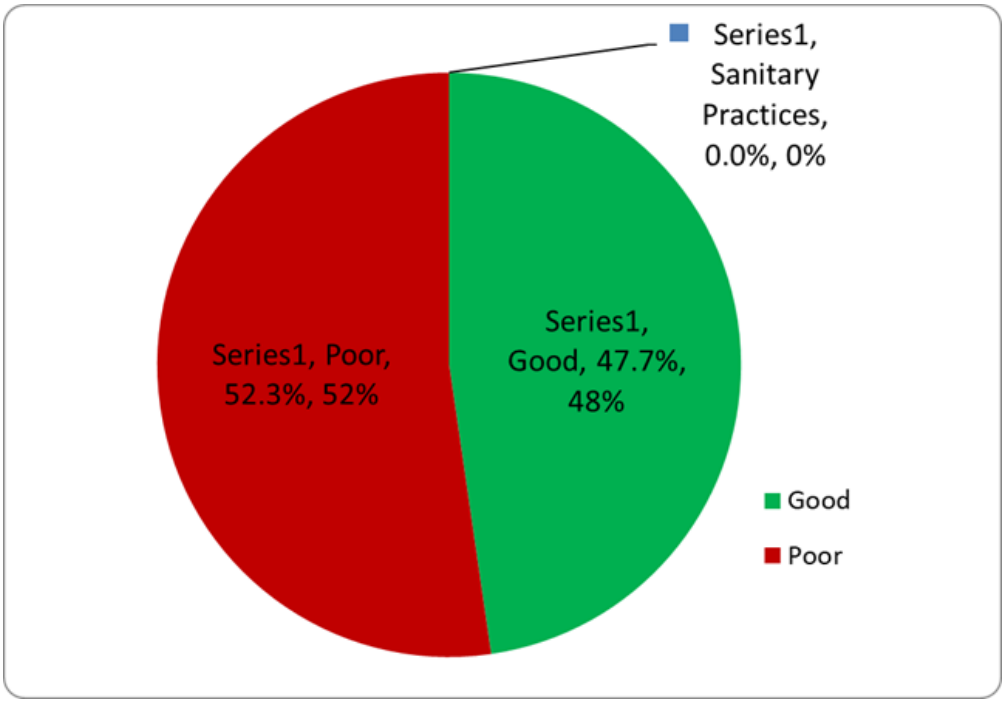

Figure 1 Overall status of sanitary practice in the food and drinking establishment in Worabe Town, Silte zone, Ethiopia, 2023

3.5 Factors associated with sanitary practices

In the bivariate analysis, candidate variables for multivariable analysis included food hygiene training received by the manager, visits in the last six months, equipment cleanliness, availability of a separate handwashing facility, appropriate refuse receptacle placement, proper food handling, floor cleanliness, ventilation, the presence of a separate storage room, workers wearing appropriate clean coats, and possession of a medical check-up card within the last six months.

The multivariable logistic regression analysis showed that managers who received food hygiene training, establishments supervised in the last six months, and food handlers who had medical check-ups were statistically significantly associated with good sanitary practices ($P < 0.05$). However, factors such as equipment cleanliness, the presence of a separate handwashing facility, appropriate garbage receptacle location, proper food handling, clean floors, installed ventilation, separate storage rooms, and workers wearing clean overcoats were not statistically associated ($P > 0.05$) with good sanitary practices.

Establishments that had been supervised by regulatory bodies at least once in the past six months were 2.35 times more likely to have good sanitary practices compared to those not supervised during that period (AOR = 2.35, 95% CI: 1.66–4.06). Managers trained in food hygiene were 2.6 times more likely to operate establishments with good sanitary practices compared to untrained managers (AOR = 2.6, 95% CI: 1.58–4.42). Additionally, food handlers who had undergone medical check-ups were 1.73 times more likely to maintain good food handling practices compared to those who had not (AOR = 1.73, 95% CI: 1.01–1.95) (Table 5).

Table 5 The candidate variables for sanitary practices among public food and drinking establishments in Worabe Town, Silte zone, Ethiopia, 2023 (n=334)

Variable	Category	Sanitary practice		COR (95%CI)	AOR (95%CI)
		Good	Poor		
Floor clean	Yes	138	124	2.7(1.53-4.74)	1.42(0.69-2.92)
	No	21	51	1	1
Workers wear appropriate clean over coat	Yes	129	128	2.55(1.43-4.53)	1.87(0.98-3.58)
	No	20	47	1	1
Supervised in the last six months	Yes	128	101	3.02(1.84-4.957)	2.35(1.66-4.06)*
	No	31	74	1	1
Dose equipment's cleanness	Yes	135	119	2.64(1.546-4.533)	1.4(0.73-2.28)
	No	24	56	1	1
Separate hand washing facility	Yes	152	150	3.611.51-8.62)	1.33(0.49-3.64)
	No	7	25	1	1
Food handling properly	Yes	130	100	3.36(2.03-5.55)	1.42(0.629-2.92)
	No	29	75	1	1
Food hygiene training taken by the manager	Yes	80	41	3.3 (2.02-5.15)	2.64(1.58-4.42) *
	No	79	134	1	1
Installed for ventilation	Yes	134	110	3.16(1.87-5.35)	1.14(0.536-2.43)
	No	25	65	1	1
Separate storeroom	Yes	124	102	3.58(1.65-7.8)	1.286(0.72-2.75)
	No	32	73	1	1
Medical checkup card in the last six months	Yes	88	41	2. 63(1. 649-4.21)	1.73(1.01-2.95) *
	No	71	134	1	1
Appropriate refuse receptacle place	Yes	134	112	3.01(1.78-5.10)	1.34(0.7-2.58)
	No	25	63	1	1

NB: *shows significant association at P <0.05, COR=Crude Odds Ratio, AOR=Adjusted Odds Ratio

4 Discussions

The aim of this study was to assess sanitary practices and associated factors in food and drinking establishments in Worabe town, Silte Zone, Ethiopia. The current study findings revealed that the magnitude of poor sanitary practices of establishments was 52.4%. The findings of this study nearly similar to study conducted in Adwa, which found a similar magnitude of poor sanitary practices (53.3%) [17]. However, study found a lower magnitude of poor sanitary practices than similar studies conducted in other parts of Ethiopia, such as Addis Ababa (58.8%) [16], Fiche (71.8%) [22] and Bahr Dar (78.7%) [18] and Benin, Nigeria (69.2%) [23]. The disparity could be attributed to the fact that food and drinking establishments in major urban are more vulnerable to poor sanitation practices due to factors such as high customer volumes, staff turnover, competition and cost pressures, and the complexity of supply chains. These factors can make it challenging for businesses to keep proper sanitation practices, which can lead to health risks for customers.

Despite the lower magnitude of poor sanitary practices in our study, the high proportion of establishments with poor sanitary practices is still concerning and highlights the urgent need for interventions aimed at improving food hygiene practices in Ethiopia. The risk of foodborne illnesses is particularly high among vulnerable populations such as children, pregnant women, and immune-compromised individuals, emphasizing the importance of addressing this issue [24].

This could be attributed to the relative similarity of socio-economic and socio-cultural status between the two study areas. However, regardless of the reasons for the magnitude of poor sanitary practices, the need for interventions aimed at improving food hygiene practices remains urgent.

The majority of establishments in our study (94%) had toilets, which is in line with the results of previous studies done in other parts of Ethiopia like Fiche (74%), Bahir Dar (93.2%) and Addis Ababa (92.2%) [16,18,22]; but lower than similar studies done Mekelle (97.0%) and Adwa (98.4%) [17,21].This may be the food and drinking establishment included in study from Mekele and Adwa city may include establishment that have high standards for sanitations or may have greater access to resources such as funding, materials and skilled labor compared to the others. On the other hand, in the current study, only 76% of the establishments with toilets were properly managed. Compared to a study carried out in Addis Ababa, which found that 71% of establishments had properly managed latrine facilities, this finding is marginally better [16]. The availability of toilet facilities does not guarantee good sanitary conditions, and toilet facilities must be properly kept and cleaned on a regular basis. If a latrine is not maintained in a hygienic and clean manner, it is of little use or benefit. Regular cleaning, disinfection, and appropriate waste disposal techniques are necessary for this [25].

In our study, 73.7% of food and drinking establishments had appropriate solid waste collection and storage containers. The results of this study were higher than those of related studies conducted in Bahir Dar and Addis Ababa [16,18], where 33.6% and 46.8% of establishments, respectively, had appropriate solid waste collection and storage containers. The socio-economic differences between the establishments included in the study and the study area may account for the higher percentage of establishments in the study area that have suitable containers for collecting and storing solid waste; however, more solid waste collection and storage containers are still needed.

The current study also found factors associated with the sanitation practices of food and beverage establishments in the study area. Among these associated factors were the manager's food hygiene training, any recent six-month supervisions, and any medical checkups for food handlers. For instance, establishments with managers who have received training on food hygiene are more likely to have good sanitary practices than establishments without such training. Our study finding was supported by a study conducted in Addis Ababa city, Addis Ababa Uni-

versity Students' cafeteria, Burayu town, Fiche town and Adwa town [15–17,22,26]. According to studies, training managers and other staff on sanitation and hygiene has a direct impact on the overall sanitation of food and drinking establishments [27,28]. This is because they have a better understanding of the risks associated with foodborne illnesses, are more compliant with regulations, can provide leadership to their team, and can improve the establishment's reputation. Overall, this leads to a reduced risk of foodborne illnesses and increased customer satisfaction [29].

Medical examinations are intended to detect and treat food handlers who have organisms colonized on them in order to reduce the risk of food contamination and, consequently, safeguard consumers [30]. According to a study conducted in food establishments in Mettu and Bedelle towns, Southwest Ethiopia, having regular medical checkups, maintaining good hygiene, attempting to improve their knowledge and practice of food safety, and using separate utensils for raw and cooked foods to reduce cross-contamination are some of the factors that can help food handlers adhere to good sanitary practices [31]. The current study confirmed also that food handlers who underwent medical examinations had almost twice the likelihood of adhering to good sanitary practices compared to those who did not. This is because food handlers who were medically checked changed their behavior as a result of the counseling they received during their checkup [32].

The study also shows that regular supervision of visits from regulatory bodies are associated with good sanitary practice. Compared to their counterparts, establishments that had at least one supervision visit in the previous six months were more likely to have good sanitary practices. This is consistent with a study done in Addis Ababa, Fiche town, and Adwa town [16,17,22].This might be the result of regular supervisory visits to the establishment, which is a useful implement for enhancing and preserving the sanitary conditions of food and drinking establishments.

This study has some limitations. Since it was a cross-sectional study, it only reflected the sanitary practices of the establishments at the time of the assessment. These practices may change over time and under different circumstances. Despite the use of deep training and standardized checklists, there may still be an observational bias. Additionally, the use of self-reported questionnaires may result in over- or under-estimation of the outcome variable. Although efforts were made to control potential confounding variables, there may still be some unmeasured variables that could affect the results.

This study provides valuable insight into food and drinking establishments' sanitary practices in Worabe town, pinpointing areas needing improvement. The findings underscore the importance of trained food hygiene managers and regularly examined food handlers, as well as the role of supportive supervision from regulatory bodies. By identifying these key factors, the study contributes to understanding how to effectively enhance hygiene standards in the food services industry. Policymakers should prioritize prompt regulatory inspections and supportive supervision, mandate comprehensive capacity building for food managers and handlers and also promote routine medical examinations for food handlers. These measures will elevate the sanitation and hygiene standard and safeguard public health, fostering consumer trust in local food and drinking establishments.

5 Conclusion

In conclusion, the study findings indicate that the level of good sanitary practices among food and drinking establishments in the town is low. Significant factors that contributed to improved sanitary practices included establishments with trained food hygiene managers, food handlers who underwent medical examinations, and those receiving supportive supervision from regulatory bodies every six months.

Therefore, it is recommended that regulatory bodies conduct regular inspections to ensure proper hygiene and sanitation practices. Addi-

tionally, further training for food managers in food hygiene and sanitation is essential, along with promoting medical checkups for food handlers to monitor their health status. Furthermore, mixed-method studies and microbiological tests should be conducted to assess other sanitary practice-related issues in food and drinking establishments.

Declaration

Ethical consideration

Written ethical clearance was obtained from the Research and Ethical Committee of Addis Ababa Medical and Business College, with reference number AAMBC/ZC/2465/15. A formal letter was also submitted to the Worabe Town Trade and Industry Office, as well as the Health Office. Additionally, verbal consent was obtained from each respondent during the data collection process after briefly outlining the study's objectives. To maintain confidentiality, identifiers such as names and codes were not included in the questionnaire.

Conflicting interests

The authors have disclosed no potential conflicts of interest related to the study, writing, or publication of this article.

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Availability of data and materials

The manuscript holds all the data. The corresponding author can provide the datasets used in this study upon reasonable request.

Abbreviations

AOR	Adjusted Odds Ratio
COR	Crude Odds Ratio
EFDA	Ethiopian Food and Drug Authority
SPSS	Statistical Package for the Social Sciences
WHO	World Health Origination

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