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Safety of health workers during the COVID-19 pandemic and beyond: piloting WHO framework in Iran



Abstract

Background Health Workers Safety (HWS) is a global health priority and essential at all times, in stable situations, in emergencies, in disease epidemics or pandemics. This study aimed to assess HWS during the COVID-19 Pandemic.

Methods This cross-sectional study was conducted in 2022 in east Azerbaijan province, Iran. HWS was assessed based on 22 indicators suggested by WHO EMRO. We selected 15 PHC facilities and six wards from two hospitals randomly. Data collected (qualitative and quantitative) using national digital health records, staff records, and indicator-specific tools. In addition to measuring the indicator's value, the indicators' feasibility was also assessed. Descriptive and inferential statistics with SPSS-16 were used for data analysis.

Results Totally, 325 Health Workers (HWs) (218 from PHC facilities and 107 from hospitals) participated in the study. Most of the participants in PHC facilities and hospitals were Community Health Workers (CHWs) (Moragheb Salamat) (45.4%) and nurses (37.38%), respectively. Most of HWs had completed the full vaccination schedule for Hepatitis B and COVID-19. Personal Protective Equipment (PPE) safety protocols were adhered by most of HWs within a healthcare facility. None of managers had attended nationally certified training for mental health support for health and care workers. Less than 20% of HWs participated in the work burnout prevention courses and most of HWs complained about work overload, or burnout. The job satisfaction level of hospital HWs (60.20%) was significantly higher than that of HWs from PHC facilities (57.18%) (*P*<0.001).

Conclusion Even though the mental health of HWs was not as expected, the indicators related to physical health and occupational health were at a suitable level. Also, there is not a system in PHC to audit the application of safety measures to mitigate the risk of contracting COVID-19. We recommend creating a specific system (precise and detailed) for HWs' safety and applying safety measures in the PHC routine programs.

Keywords Health worker, Safety, COVID-19 pandemic, Assessment, Iran

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Introduction

The declaration of Alma-Ata in1978 and Astana in 2018 led to the recognition of the importance of the Primary Health Care (PHC) providers and Community Health Workers (CHWs) in bringing health care to where people live and work [1, 2]. CHWs in most Low- and Middle-Income Countries (LMIC) are not trained in the special needs of HWs nor in the simple measures that can be taken to prevent or overcome and control many workers health problems [3].

The Universal Declaration of Human Rights and the 2030 United Nations Agenda for Sustainable Development require governments and other stakeholders to provide safe, secure, and supportive working conditions for all HWs [4, 5]. There are many hazards that HWs might face in the workplace, including sharps injuries, chemical and drug exposure, back injuries, latex allergies, violence, and stress [6, 7]. HWs still experience injuries and illnesses at work even though it is possible to prevent or reduce these hazards [6, 8].

The World Health Organization (WHO) declared Health Workers Safety (HWS) as a global health priority [9]. The HWS is essential at all times in stable situations, emergencies, disease epidemics, or pandemics [9, 10]. WHO has declared COVID-19 as a global pandemic on March 11, 2020 [11]. Ever since, a relatively rising number of COVID-19 patients have caused a huge burden on healthcare systems while they struggle to maintain the delivery of essential health services to their respective populations. At the same time, HWs (particularly in PHC) must work hard in several areas/fields including routine services provision for all target age groups, to follow-up all people with close contact in a daily basis and continues fighting against new corona virus to protect the community [12].

More than any other groups, COVID-19 has made HWs, their surrounding communities, their families, and friends more susceptible to catching and spreading the virus. Even though HWs in various countries only represent 2 to 3% of their respective populations, they account for about 35% of COVID-19 cases that were recorded [9]. HWs as frontline defenders during the COVID-19 pandemic are at high risk of infection, putting themselves, their families, patients, and surrounding communities at risk [13].

 Table 1
 Distribution of the indicators within the identified categories

Categories	Structure	Process	Outcome	Total
Physical health / IPC	4	1	4	9
Mental health / Psychosocial	2	2	2	6
General Occupational Health	3	2	2	7
Total	9	5	8	22

A safe and healthy workplace and workforce are vital for sustainable service provision especially during COVID-19 pandemics. The classic approach to ensuring health and safety in the workplace has depended mainly on the performing of legislation and inspection of workplace to ensure compliance with quality and safety standards. On the second World Patient Safety Day (2020), WHO announced HWS as a priority for patients safety and proposed five key strategies to ensure safety of HWs and patients [13].

In an attempt to reinforce the prevention and management of HWS, WHO Regional Office for the Eastern Mediterranean (EMRO) has developed a comprehensive set of 22 key performance indicators to address HWs safety. This will offer a better understanding of the current situation and a further orientation about existing gaps. It should be the base for the reinforcement of improvement measures that would promote the HWS, and accordingly, patient safety [14]. It is aligned with the WHO Thirteenth General Program of Work (GPW13) and the strategic vision of EMRO [15].

The purpose of this study is to conduct a field test for a set of HWs indicators in PHC facilities and hospitals in the Islamic Republic of Iran. The study results might be of great interest for the refinement of the tool as well as identifying key factors for its successful implementation at the ground level.

Methods

A cross-sectional study conducted in 15 randomly selected PHC facilities and 6 wards from 2 hospitals in Tabriz city of East Azerbaijan province to assess HWS Indicators during the COVID-19 pandemic and beyond in the Islamic Republic of Iran.

A set of 22 indicators provided by the EMRO was used to assess HWS (Appendix 1). These indicators assess the HWS in three categories. These categories include Infection Prevention and Control (IPC)/physical health (9 indicators), mental health/psychosocial (6 indicators) and general occupational health (7 indicators). HWS assessment indicators are classified into three levels of structure, process, and outcome (Table 1).

PHC facilities selection

In this project, 15 PHC facilities were elected randomly from Tabriz district health network. Three rural health centers, 2 urban/rural health centers, and 10 urban health centers (5 private and 5 public health centers) were selected out of 65 urban and rural comprehensive health centers (Table 2). All staff members of the selected facilities were invited to the study. The participation rate was 92.4% (218/236).

Table 2 Characteristics of selected PHC facilities

Health center type	Covered Population	Staff Number
Urban – Rural (Public)	13,888	20
Urban – Rural (Public)	8308	14
Rural (Public)	8672	10
Rural (Public)	6223	7
Rural (Public)	10,881	17
Urban (Private)	22,928	20
Urban (Private)	27,871	31
Urban (Private)	15,324	16
Urban (Private)	12,639	11
Urban (Private)	20,283	19
Urban (Public)	16,524	15
Urban (Public)	16,913	10
Urban (Public)	17,068	13
Urban (Public)	21,605	13
Urban (Public)	16,549	20

Table 3 Characteristics of selected hospital	wards for field test
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Hospital Type	Ward	Staff Number
Private - General	1	15
	2	19
	3	12
Public - Teaching	1	8
	2	12
	3	11

Hospital selection

Two hospitals were randomly selected from the public teaching (N=11) and private hospitals (N=7) in Tabriz using a random number generator. Hospital A belongs to the private sector and Hospital B is a specialty and subspecialty public teaching hospital (Table 3). Six wards were selected randomly from 2 hospitals (3 wards from each hospital). All staff members from the selected wards were invited to the study. In addition to the staff of the three selected wards, 40 individuals, including students, clinical faculty members, quality improvement staff, and security personnel, also participated in this study. The response rate was 91.4%, with 107 out of 117 invited participants.

Investigators

Three investigators and two supervisors were nominated to run the project. The investigators were selected among people who had the experience of working in the primary health care system and quality improvement projects. They participated in 5 clarification sessions to familiarize themselves with the study aims and tools. Then, they spent an additional day participating in pilot fieldwork (at a public comprehensive health center) to solve any potential problems they may face during data collection phase. The investigators were split into two data collection teams. The first team was composed of 2 investigators

Developing project tools

supervisor to assess selected hospitals.

Two specific tools (questionnaire and checklist) were used to assess HWS in both hospitals and PHC facilities.

second team was composed of an investigator and a

Health workers safety assessment questionnaire The information about HWs was incomplete in the digital system, therefore, in addition to data collected from the electronic health file, a researcher-made questionnaire was used to collect data from facility staff unanimously (Indicators number 1, 2, 6, 8, 9, 10,11, 12, 13, 14, 15, 16, 17,18, 19, 21, 22). At each PHC facility, all HWs were interviewed by an investigator.

The questionnaire consisted of 3 main sections including demographic questions, 15 questions related to HWS, and a set of job satisfaction questions (Appendix 2). The short version of the Job Satisfaction Questionnaire was developed by researchers in the Persian language (Indicator 15). The questionnaire was validated and its reliability was confirmed in previous studies. This questionnaire was distributed among all staff in 15 health care facilities and 6 wards from 2 hospitals. Self-administered questionnaires were collected and analyzed.

Qualitative study guide 8-question checklist was developed to assess qualitative indicators during the interviews and observations (Indicators number 2, 5, 12, 13, 18). All managers and HWs in the PHC facilities, hospital managers in both hospitals, ward managers/head nurses, and all hospital ward staff were interviewed/observed by the investigators and/or supervisors according to the developed checklist (Appendix 3).

Data collection

Data were collected (qualitative and quantitative) using national digital health records, staff record, self-administered questionnaire, and checklist. Data collection took approximately 4–5 h for each PHC facility and about two days for hospital wards. Data collection started on the 13th of December 2021 and was completed on January 2nd, 2022.

All study documents including indicators list, metadata, and implementation protocol were translated into Farsi Language and distributed among the project team members, investigators, and facility focal persons. After organizing the project team and planning data collection, two separate meetings were organized with the hospital managers and director of the Tabriz district health network to introduce the project aim and objectives and to obtain their support. The other meeting was held with the director of the PHC network and statistics department in East Azerbaijan province to introduce the project investigators for PHC facilities and ask them to introduce focal person from each PHC facility to have a briefing session.

After translating individual facility data collection and aggregated data collection sheets, 2 days training program has been held for investigators (7–8 December) and focal persons (11–12 December) to brief the study objectives, clarify data collection methods, and discuss data collection tools.

Quantitative data analyses

Descriptive statistical analyzes including average, frequency, and percentage were used to describe results. Mann-Whitney test was used to compare HWS indicators between PHC facilities and hospitals. We used SPSS 16 software for data analysis.

Based on the suggestion of the EMRO, in addition to measuring the value of the indicators, the feasibility of the indicators was also estimated. The feasibility score was calculated between 1 and 10.

Qualitative data analysis

The data was analyzed using content analysis, a technique for identifying, analyzing, and summarizing the themes present in text.

Results

In total, 218 HWs from health centers and 107 hospital workers participated in the study (Table 4).

 Table 4
 Demographic Characteristics of Health Workers

 Demographic Characteristics
 Demographic Characteristics

Demographic Characteristics		PHC facilities (N=218)	Hospitals (N = 107)
		Frequency (%)	Frequency (%)
Job classification	Dentist	5 (2.3)	-
	Environmental Health Expert	9 (4.1)	1 (0.93)
	Laboratory Technician	8 (3.7)	-
	Facility Supervisor	5 (2.3)	-
	Nutrition Expert	8 (3.7)	-
	Occupational Health Expert	6 (2.8)	1 (0.93)
	Physician	27 (12.4)	7 (6.54)
	Cleaner	10 (4.6)	7 (6.54)
	Psychology Expert	6 (2.8)	4 (3.74)
	Community Health Worker (Moragheb-e- Salamat)	99 (45.4)	-
	Reception staff	15 (6.9)	2 (1.87)
	Administrative Expert	10 (4.6)	3 (2.8)
	Nurse Assistant	-	10 (9.35)
	Guard	-	2 (1.87)
	Head Nurse	-	5 (4.67)
	Nurse	-	40 (37.38)
	Psychiatrist	-	1 (0.93)
	Quality Improvement Expert	-	3 (2.8)
	Rehabilitation Expert	-	1 (0.93)
	Secretary staff	-	7 (6.54)
	Medical students	-	13 (12.15)
	Others	10 (4.6)	-
Marriage status	Single	41 (19.8)	26 (27.7)
	Married	166 (80.2)	68 (72.3)
Gender	Female	177 (81.6)	68 (63.6)
	Male	40 (18.4)	39 (36.4)
Age	Mean (SD)	38.78 (8.35) Years	37.83 (8.57) Years
Job experience	Mean (SD)	11.46 (8.53) Years	11.84 (7.74) Years
Education level	Diploma	19 (9)	18 (17.5)
	Associate Degree	12 (5.7)	4 (3.9)
	Bachelor	126 (59.7)	57 (55.3)
	Masters	17 (8.1)	14 (13.6)
	Medical Doctor or PhD	37 (17.5)	10 (9.7)
Employment type	Permanent	72 (33.03)	34 (31.77)
	Time-Based Contract	127 (58.26)	63 (58.87)
	Others	19 (8.72)	10 (9.34)

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IPC / physical health indicators

According to the study results, 86.5% of HWs in the PHC facilities and 83.5% in the hospitals had training courses on IPC practices. Based on an interview with managers of the PHC facilities and hospitals, inspection for any damaged of malfunctioning Personal Protective Equipment (PPE) was not performed. Maintenance checks to ensure sufficiency of PPE were conducted regularly (monthly). HWs response to availability of PPE was calculated of 100% in both PHC facilities and hospitals. The percentage of vaccinated HWs with nationally approved COVID-19 and Hepatitis B vaccines are shown in Fig. 1. This indicator was calculated when a short time had passed since the starting of the COVID-19 booster dose.

Based on observation, the percentage of adherence to the PPE safety protocols in PHC facilities were 95.57% for wearing masks, 99.53% for disinfectants, 100% for hand washes/rubs, and in hospitals were 100% for masks, disinfectants and hand washes/rubs. Both PHC facilities and hospitals managers stated that internal surveys/assessment to check protocol adherence among HWs were not conducted.

According to the self-administered questionnaires results, work-related infectious diseases among HWs in the last 3 months prior to the assessment in the PHC facilities and hospitals were 7.84% and 16.15%, respectively. HWs who tested positive for COVID-19 or experienced COVID-19 symptoms in the last 30 days prior to the data collection were 1.04% in the PHC facilities and 5.45% in the hospitals. Also, 8.98% of HWs in

hospitalsand 3.21% in PHC facilities hospitalized for over 24-hr due to a work-related injury or infection, including COVID-19. No one died due to work-related injuries or infections in any of the PHC facilities and hospitals.

Mental health indicators

According to the results, none of the managers and supervisors in the PHC facilities and hospitals had attended any nationally certified training for mental health support for workers. HWs who attended at least one training on recognition and prevent of work burnout, and promotion of resilience in PHC facilities and hospitals were 15.5% and 16%, respectively. The ratio of the incidents when HWs had personally experienced violence, harassment, or abuse in PHC facilities and hospitals were 0.45 and 0.34 (incidents per HWs), respectively.

Based on self-administered questionnaires results, 0.35 HWs in PHC facilities worked extra hours at home and 0.37 HWs worked extra hours at hospitals. Extra hours work at PHC facilities and hospitals were 0.06 h and 0.31 h, respectively. Also, 69.77% of HWs in PHC facilities and 58.62% of HWs in hospitals complained about work overload or burnout.

Results of the jab satisfaction survey among 324 HWs showed that the job satisfaction level of 107 hospital HWs (60.20%) was significantly higher than that of 217 HWs from PHC facilities (57.18%) (P<0.001) (Fig. 2).



Fig. 1 Health workers who have completed the vaccination of Hepatitis B and COVID - 19



Fig. 2 Level of job satisfaction during COVID - 19 pandemic among health workers



Fig. 3 Applying safety measures in health care facilities during the COVID-19 pandemic

General occupational health indicators

Based on self-administered questionnaires results, 22% and 54.6% of HWs were trained on occupational health safety and risk management in the PHC facilities and hospitals, respectively. All of the HWs in the PHC facilities and hospitals had healthcare insurance that covers injuries and potential work-related illnesses, including physical and/or mental health issues. But liability insurance among hospitals HWs (86.8%) was higher than PHC facilities HWs (37.8%). Results of an interview with

managers of PHC facilities and hospitals showed that 95% of safety measures for mitigating the risk of contracting COVID-19 infection were applied in the PHC facilities and 79.2% in the hospitals. Results of applying safety measures were shown in Fig. 3.

Based on document review results, occupational hazard assessment was not integrated into the PHC system, but in some hospital wards, occupational hazard assessment was performed in the last six months prior to the data collection and two hazards were identified averagely.

Table 5Feasibility score of HWS indicators in health carefacilities

Categories of Health Worker Safety	PHC facilities	Hospitals
IPC / Physical Health	9.34	8.98
Mental Health	7.7	7.83
General Occupational Health	8.2	8.36
Overall	8.53	8.47

About 84% and 66% of HWs had a complete health record and full medical history documentation in the PHC facilities and hospitals, respectively.

Work-related injuries, including physical and/or mental health illnesses, among PHC facilities hospitals HWs were 0.43 and 0.25, respectively. Also, the ratio of the annual workdays lost due to work-related illnesses among PHC facilities and hospitals HWs were 7.26 (day) and 9.37 (day), respectively.

Feasibility of HWS indicators

The feasibility of 22 HWS indicators were assessed in 15 PHC facilities and six hospital wards. Category of "mental health" had the lowest feasibility score in both PHC facilities (7.7 out of 10) and hospitals (7.83 out of 10) (Table 5). Among HWS indicators, the indicator number 19: "number of the hazards identified in each occupational hazard assessment" in PHC facilities (4.4 out of 10) and hospitals (5.5 out of 10) showed the lowest feasibility score (Appendix 4).

Discussion

This study assessed HWS during the COVID-19 pandemic based on 22 indicators developed by EMRO. Totally, 325 HWs (218 from PHC facilities and 107 from hospitals) participated in the study. According to the developed framework by EMRO, HWS indicators are distributed across three categories as relevant to the WHO key strategies of HWs safety improvement; physical health/IPC, mental health, and general occupational health. Study results showed that indicators related to the physical health category had a suitable level. Accordingly, most of HWs trained on IPC practice, availability of PPE at healthcare facilities were well, most of HWs had completed the full vaccination schedule (3 doses) of Hepatitis B and (2 doses) COVID-19, PPE safety protocols were adhered by most of HWs within a healthcare facility and few HWs had experienced COVID-19 symptoms. Despite these successes, inspection for any damaged or malfunctioning PPE mostly was not performed, and just in a few facilities had a random or regular inspection for malfunctioning PPE. Unlike the physical health category, the indicators of the mental health category did not match the expected situation. Accordingly, none of managers had attended in nationally certified training for mental health support for workers, less than 20% of HWs participated in the work burnout prevention courses and most of the HWs complained about work overload or burnout. However, indicators related to occupational health addressed expected safety standards. The participation of most HWs in occupational health safety and risk management courses, covering most HWs with healthcare insurance and liability insurance, and applying safety measures for mitigating the risk of contracting COVID-19 infection are the most important evidences to confirm these successes. Despite these successes, hazard assessment was not performed in healthcare facilities and 25% of HWs experienced work-related injuries.

HWs are at risk of contracting infectious diseases, including COVID-19 [8, 16]. The study results also showed that, the percentage of work-related infectious diseases among HWs in PHC facilities and hospitals were 7.84% and 16.15%, respectively. About 14% of COVID-19 cases reported to the WHO in 2020 early September were in HWs [8]. Another study demonstrated a 5.62% infection among HWs [17]. The ability of the health system to battle the pandemic and provide vital services is impacted by infected HWs [16]. The susceptibility of HWs to work-related infection can be due to late diagnosis of the infection in patients, extra working hours, burn-out, poor implementation of IPC measures, and inadequate PPE [8, 18, 19].

In line with the increasing number of COVID-19 cases and admitted patients, pressure on HWs raised dramatically as a result of the COVID-19 pandemic [20]. The psychological stress on HWs is considerable, and there is a chance that they will experience poor mental health outcomes [21]. Interviews with care providers in both PHC facilities and hospitals demonstrated that most of them suffering from mental health disorders such as stress, depression, anxiety, and fatigue. Also, self-administered questionnaires results showed that more than half of the HWs in health care facilities have experienced burnout. Accordingly, Ferry et al., (2021), showed that the majority of HWs (79%) complained about burnout and 76% of them recorded increased stress [20]. According to the systematic reviews, HWs in EMRO countries experience high levels of depression, with a pooled prevalence of 33.03% [6]. Burnout is assumed to increase as a result of irregular working time, working with individuals who have a confirmed COVID-19 infection, workers shortage, the provision of complicated care, worry about having access to enough PPE, and a history of depression [22-25]. HWs burnout leads to decreased productivity, higher absenteeism, and compromised patient care due to increased errors. Additionally, workers facing burnout are at risk of severe health issues, including depression and suicide [26].

The ability of workers to carry out essential safety functions may be limited by the environment and infrastructure [27]. One of the major concerns to the HWS has been problems regarding to IPC, especially in low- and middle income countries (L/MICs) [28, 29]. Fortunately, the current study results showed that in Iran, as a MIC, access to safety equipment and PPE was good, and based on observations, it was determined that safety measures such as providing masks and physical distance measures were implemented in the majority of healthcare facilities. Also, the results revealed that all of HWs adhered to the PPE safety protocols (100% for masks, disinfectants, and hand hygiene) within a hospital. These results align with similar studies conducted in EMR country. In Egypt, a study indicated that compliance with PPE usage and hand hygiene was notably high at 81.9% among nurses during the third wave of COVID-19 [30]. Similarly, in Saudi Arabia, the overall hand hygiene compliance rate among HWs was reported at 70%, with nurses showing higher compliance (73%) compared to doctors (67%) [31]. Previous studies identified several factors as both barriers to HWs adhering to IPC guidelines, including the length and ambiguity of local guidelines, constantly changing local guidelines, increasing workloads and fatigue, a lack of training about how to use PPE, a lack of PPE, provision of poor-quality equipment, and uncomfortably of masks use and other equipment [32 - 34].

To the best of our knowledge, the HWS had not been assessed according to a comprehensive set of criteria. This study provides the first valid scientific evidence of the HWS status. However, the current study had some limitations. Required data for some indicators were not recorded in health facilities (digital/paper) and data recorded in the digital system (Sib software) were not completely accurate for some indicators. During the COVID-19 pandemic, most HWs have been doing extra work from home (remote work) such as doing a verbal screening of suspected COVID-19 patients, for which they have not been fully compensated (Indicator 13). A clear and complete record of these extra worked hours is not available in the digital system. To address these limitations, we used a survey to collect the data.

In the Iranian PHC system there is no integrated program to assess and document HWs and Patient safety. To implement safety programs, it is required to have a planned training and capacity building for managers in national and sub-national levels, safety focal persons and all care providers as well as developing a statistic system to collect required data consistently, particularly for the following indicators; adherence to PPE safety protocols (Indicator 5), the experience of violence, harassment, or abuse in the workplace (Indicator 12), number of identified hazards (Indicator 19). Also, to enhance data collection feasibility, it is recommended to implement a user-friendly digital system for easy and consistent data entry, including online forms, automated surveys, and periodic reports. In this study, to improve data availability and resolve limitations, the required data were gathered by an anonymous survey, interview with HWs and managers, focus group discussion, and document review.

Conclusion

This is the first study on the assessment of HWS without any preliminary education and interventions, which was conducted according to the measures provided by the WHO/EMRO. A review of available documents, electronic data, as well as researchers' observations, and interviews with managers and HWs of healthcare facilities showed that, even though the mental health of HWs was not as expected, the indicators related to physical health and occupational health were at an appropriate level.

Addressing the mental health challenges faced by HWs is critical for both their well-being and the quality of patient care. To support this, it is recommended to implement comprehensive mental health training programs, including workshops, online courses, and peer support groups, with a focus on stress management and recognizing burnout to enhance mental health of HWs.

Also, there is no system in PHC to audit the application of safety measures to mitigate the risk of contracting COVID-19. Thus, it could be recommended that creating a specific information system (precise and detailed) with a focus on identifying safety hazards and collecting feedback from healthcare workers and applying safety measures in the PHC routine programs.

The developed framework and technical support by EMRO to assess HWs safety will offer a great opportunity to better explore safety and quality gaps in relation to the health care providers and consequently for patient safety. All Members States will have the opportunity to use this advisory capacity to apply the indicators efficiently according to their own health system resources and capacity. Therefore, the safety initiative needs to be integrated in the health systems and the HWS assessment should be a continuous process, in essence, rather than a one-time occasion, and the improvement level should be monitored across each facility level.

On the other hand, recently EMRO has developed a framework for Patient Safety Friendly Primary Care and applied in some countries as a pilot study. It's worth to think about an integrated framework (both patient and HWS) to use the synergic effect of these to improve safety and quality based on the assessment outcomes in each health care facility in a daily manner.

Supplementary Information

The online version contains supplementary material available at https://doi.or g/10.1186/s41043-025-00749-x.

Supplementary Material 1	
Supplementary Material 2	
Supplementary Material 3	
Supplementary Material 4	

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Author contributions

Jafar Sadegh Tabrizi: Wrote the paper; Analyzed and interpreted the data, materials. Mondher Letaief: Supervised the study methodology and drafted the initial manuscript. Hossein Abdollahi: Wrote the paper; Analyzed and interpreted the data. Ramin Rezapour: Collected and analyzed the data. Ahmed M N A M Alboksmaty: Supervised the study methodology. Mostafa Farahbakhsh: Wrote the paper; Analyzed and interpreted the data.

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Data availability

Data will be made available on request.

Declarations

Ethics approval

This study was part of an approved study in the Research Ethics Committee of Tabriz University of Medical Science (ethical code: IR.TBZMED.REC.1401.141). The methods were performed in accordance with the relevant guidelines and regulations. "Informed consent" was obtained from all study participants.

Competing interests

The author(s) declared no potential conflicts of interest.

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