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Ali Maher Lateef
[1]Department of Family and Community Medicine, College of Medicine, University of Baghdad, Iraq
[2]Ministry of Health, Salahaldeen Health Directorate, Iraq

Faris Al-Lami
Department of Family and Community Medicine, College of Medicine, University of Baghdad, Iraq

Corresponding Author:
Ali Maher Lateef
[1]Department of Family and Community Medicine, College of Medicine, University of Baghdad, Iraq
[2]Ministry of Health, Salahaldeen Health Directorate, Iraq

Assessment of infection prevention and control practices among healthcare workers of primary health care centers in Baghdad, Iraq - 2024

Ali Maher Lateef and Faris Al-Lami

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Abstract
Background: Infection prevention and control is essential in minimizing the transmission of infectious agents, especially within healthcare environments. Effective infection prevention and control is crucial for safeguarding both patients and healthcare workers, particularly in high-risk settings.
Aim: This study aimed to determine the level of infection control practices among healthcare workers in primary healthcare centers in Baghdad, Iraq.
Subjects and Methods: A cross-sectional study was conducted from May to October 2024, involving 404 healthcare workers in 26 governmental primary healthcare centers in Baghdad city.
Results: Overall, 49.3% of participants demonstrated good infection control practices. Profession was the most significant factor influencing adherence to proper protocols, with higher-risk professions, such as dentists and laboratory staff, showing better compliance. Seventy-four percent, 28.9%, 96.5%, and 82.4% of healthcare workers demonstrated good practices in hand hygiene, personal protective equipment use, healthcare waste disposal, and needle stick injuries prevention, respectively.
Conclusion: The study findings indicates a moderate level of adherence to proper infection prevention and control protocols. Profession, particularly higher-risk roles like dentists and laboratory staff, influenced practice. While healthcare workers generally followed good practices, adherence to protective equipment usage was less consistent. The findings highlight the need for targeted interventions and ongoing education to improve compliance, particularly with protective equipment.

Keywords: Iinfection prevention and control, primary healthcare, healthcare workers, Baghdad

1. Introduction

1.1 Background

The COVID-19 pandemic, which began in December 2019, has been a major global health crisis. The disease spreads primarily via respiratory droplets and aerosols from infected individuals to susceptible hosts [1]. In healthcare settings, this mode of transmission has led to significant challenges, especially during the early pandemic waves in 2020. Studies report that up to 41% of hospitalized COVID-19 patients were infected within healthcare facilities [2], while infection rates among healthcare workers (HCWs) ranged from 0.3% to 43.3% [3].

The pandemic severely impacted primary care services, reducing patient access, delaying treatment for non-COVID conditions, and necessitating robust Infection Prevention and Control (IPC) measures [4]. It emphasized key IPC strategies such as hand hygiene, use of personal protective equipment (PPE), surface disinfection, adequate ventilation, and general precautions to break transmission chains [5]. According to the World Health Organization (WHO), IPC is a clinical and public health specialty using evidence-based approaches to prevent avoidable infections, including those caused by antimicrobial-resistant pathogens, in healthcare settings [6].

IPC is fundamental to safe and quality healthcare, aiming to minimize healthcare-associated infections (HAIs) and protect both patients and HCWs [7]. HAIs, which occur during the delivery of healthcare, can sometimes be treated easily but often pose significant risks. These include infection with resistant microorganisms, flora imbalance, longer hospital stays, higher costs, increased morbidity, long-term disability, and avoidable mortality [8, 9]. The burden of HAIs is particularly high in developing countries and represents a major patient safety concern.

Primary healthcare centers (PHCs) are especially vulnerable due to the broad and often underserved populations they serve, combined with resource limitations [10]. As the first

point of patient contact, PHCs are critical to community health, frequently managing infectious diseases and therefore requiring strong IPC practices to prevent outbreaks [11]. However, PHCs often face challenges such as limited budgets, poor infrastructure, and insufficient IPC training among staff. These are further compounded by staffing shortages and high patient loads, which can lead to inconsistent IPC adherence [12].

Inadequate IPC in PHCs can lead to widespread community transmission, prolonged illness, and increased healthcare costs [13]. Therefore, HCWs play a crucial role in maintaining IPC standards to protect themselves, patients, and visitors. The WHO recommends that all HCWs adhere to IPC protocols consistently, in all settings and for all patients.

Despite this, global studies reveal significant variation in IPC adherence among HCWs, influenced by differences in training, resources, and institutional support. While some HCWs follow IPC protocols diligently, others may neglect them due to time constraints, poor awareness, or lack of supervision [14-16]. In Iraq, research on IPC among HCWs is limited. Most existing studies focus on specific practices like hand hygiene or PPE use [17-19], and are largely conducted in hospital or tertiary care settings. Primary healthcare centers remain under-researched in this regard, despite being key components of the healthcare system.

1.2 Objectives

The objectives of this study were to:

1) Determine the level of infection prevention and control practice among HCWs in primary healthcare centers in Baghdad City for four main components.

2) Study the association between the infection prevention practice level and the socio-demographics of HCWs working in those primary healthcare centers.

2. Subjects and Methods

Study Area, Period, Design, and Population

This facility-based cross-sectional study was conducted from May 5th to October 31st, 2024, in 26 governmental primary healthcare centers (PHCs) in Baghdad, Iraq's capital. Baghdad has a total of 274 PHCs serving approximately 9,235,180 residents.

The source population included all healthcare workers (HCWs) employed in governmental PHCs across Baghdad. The study population comprised HCWs randomly selected from the 26 chosen PHCs.

Inclusion criteria

HCWs with direct patient contact, such as physicians, nurses, laboratory staff, dentists, and others (immunization staff, public health workers, and technicians.)

Exclusion criteria

pharmacists, administrative staff, and HCWs absent during data collection (e.g., on sick or maternity leave).

The sample size was calculated using the Raosoft sample size calculator®, with a minimum recommended size of 384. A total of 404 participants were ultimately enrolled in the study.

Sampling techniques

A multistage random sampling technique was employed for this study. The source population consisted of primary healthcare workers (HCWs) affiliated with Baghdad's Health Directorate/Al-Rusafa and Al-Karkh. Initially, all governmental health districts within these directorates were identified-11 in Al-Rusafa and 12 in Al-Karkh-making a total of 23 districts. Using Microsoft Excel, a simple random sampling method was applied to select 8 districts (4 from each directorate).

Subsequently, all primary healthcare centers (PHCs) within the selected districts were listed. Another random selection using Excel was conducted to choose 26 PHCs from the total of 99. Finally, a list of eligible HCWs was obtained from the human resources department of each selected PHC. From this list, 20-30% of eligible HCWs were randomly selected for participation using a lottery method.

Data collection method

Data for this study were collected in person by the researcher using a self-administered questionnaire. The tool was developed based on the WHO's Practical Guidelines for Infection Control in Healthcare Facilities [20] and the CDC's Core Infection Prevention and Control Practices for Safe Healthcare Delivery [21]. To ensure linguistic and conceptual accuracy, the questionnaire was prepared in English, translated into Arabic, and then back-translated into English. It was reviewed and validated by academic experts in family and community medicine to ensure clarity and consistency across participants. Complex terms were avoided to make the questions accessible, and the Arabic version was used during data collection.

The questionnaire had three main sections:

1. **Sociodemographic Data:** Included items on age, sex, marital status, profession, and work experience.
2. **Work-Related Information:** Covered IPC training, use of IPC guidelines, history of occupational exposure to blood or body fluids, needlestick injuries, and post-exposure prophylaxis.
3. **IPC Practice Assessment:** Comprised 41 items divided into four domains-hand hygiene (16 questions), PPE use (15 questions), healthcare waste disposal (3 questions), and sharps/needlestick injury prevention (7 questions).

Data collection took place twice a week during working hours, with each session lasting 3 to 4 hours. Participants completed the questionnaire in approximately 10 to 15 minutes.

Variables of the Study and Measurements

The study's independent variables included healthcare workers' (HCWs) sociodemographic factors:

1. Age (in years)
2. Sex (male, female)
3. Marital status (single, married, divorced, widowed)
4. Profession type (physician, dentist, nurse, laboratory staff, others)
5. Work experience (<5 years, 5-10 years, >10 years).

The dependent outcome variable was the HCWs' level of Infection Prevention and Control (IPC) practice, assessed across four IPC components. Responses were recorded as 'Yes' (correct) or 'No' (incorrect), with correct answers scored as 1 and incorrect as 0.

IPC practice levels were classified using Bloom's cut-off points (60% and 80%) commonly applied in knowledge, attitude, and practice (KAP) studies (80-84). HCWs were categorized as having Good practice if they correctly answered ≥80% of questions, Fair practice if 60-79%, and Poor if <60% within each IPC component.

Data processing and analysis

Following data collection, each questionnaire was reviewed for completeness and accuracy. Twenty-one questionnaires were excluded due to missing or unclear information. The cleaned data were entered and coded in Microsoft Excel, then exported to SPSS version 25 (IBM Corporation) for analysis.

Descriptive statistics were used to summarize the data, including frequencies, means, and standard deviations. Bivariate analyses, such as the chi-square test of independence and binary logistic regression, were conducted to examine associations between independent variables and the outcome variable. A p-value of less than 0.05 was considered statistically significant, indicating an independent association with the dependent variable.

Ethical consideration and scientific approval

Eligible healthcare workers were informed about the study's purpose, benefits, and the estimated time to complete the questionnaire. Participation was entirely voluntary, with no incentives or coercion, and participants were assured of their right to decline or withdraw at any time. Verbal consent was obtained, and anonymity was maintained throughout the study. Completed questionnaires were securely stored under the researcher's supervision.

The study received ethical approval from the Scientific Committee of the Department of Family and Community Medicine, University of Baghdad College of Medicine, and the Council of Family and Community Medicine, Iraqi Board for Medical Specializations. Additionally, formal cooperation and approval letters were obtained from the Baghdad Health Directorate/Al-Rusafa, Baghdad Health Directorate/Al-Karkh, the relevant health districts, and affiliated primary healthcare centers.

3. Results

Socio-demographic characteristics: Throughout the study, 434 HCWs were interviewed, and nine refused to participate, giving a response rate of 97%. Twenty-one participants gave incomplete or unclear responses to the questionnaire questions and were removed; hence, the final sample size was 404. The mean age of the participants was 37.6±10.16 years (Mean±1Sd). Most participants were females, 304 (75.2%), and married 286 (70.8%). Nearly one-third of the participants were dentists 126 (31.2%), while 119 (29.5%) were lab staff, and 62 (15.3%) were physicians. More than half of the participants, 214 (53%), reported a work field experience of more than 10 years. Table (1).

Table 1: HCWs' Sociodemographic Characteristics

Variables	Categories	Frequency (n)	Percentage (%)
Age groups in years	≤ 29y	112	27.7
	30 - 35y	98	24.3
	36 - 46y	100	24.8
	≥47y	94	23.3
Sex	Male	100	24.8
	Female	304	75.2
Marital status	Married	286	70.8
	Single	101	25.0
	Divorced/Widowed	17	4.2
Profession	Physician	62	15.3
	Dentist	126	31.2
	Nurse	51	12.6
	Lab staff	119	29.5
	Others	46	11.4
Experience	<5 years	108	26.7
	5-10 years	82	20.3
	>10 years	214	53.0

3.1 Hand Hygiene

Most participants (74.5%) were considered to have good hand hygiene IPC practice scores ranging from 13 to 16 out of 16 and 80% or more correct responses to the questionnaire questions. Only (6.4%) of the participants were considered to have bad hand hygiene IPC practice, with scores ranging from 0 to 9 out of 16 and less than 60% correct responses to the questionnaire questions. Fig. (1).

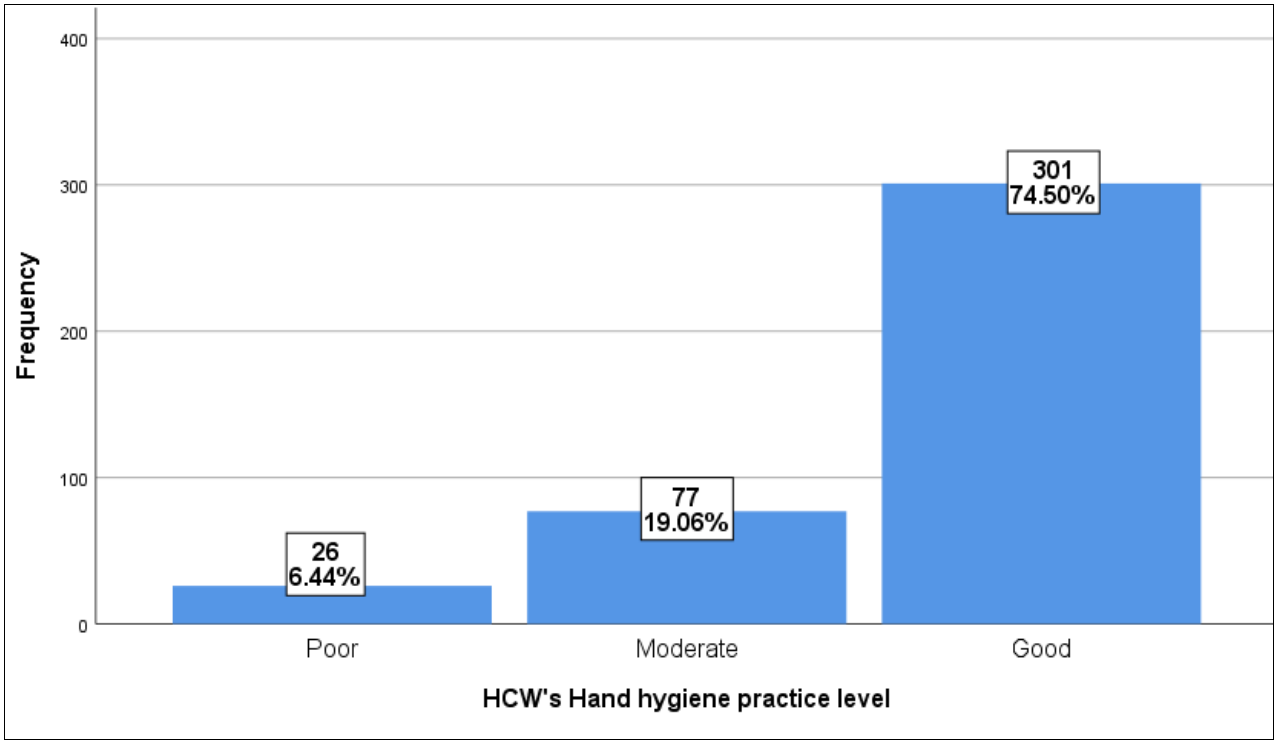

Fig 1: HCW's Hand Hygiene Practice Level

Table 2: HCWs' Hand Hygiene Practice Responses

Hand Hygiene Questions	Response	Number (Total 404)	Percentage (%)
1) Hand hygiene before touching a patient	Yes	362	89.6
2) Hand hygiene before performing a clean/aseptic procedure	Yes	374	92.6
3) Hand hygiene after an exposure risk to body fluids	Yes	401	99.3
4) Hand hygiene after touching a patient	Yes	393	97.3
5) Hand hygiene after touching any object in the patient's immediate surroundings	Yes	339	83.9
6) Hand hygiene before and after using gloves	Yes	346	85.6
7) Hand hygiene between contacts with different patients	Yes	360	89.1
8) Hand hygiene when performing multiple procedures on the same patient	Yes	259	64.1
9) Hand hygiene using alcohol-based hand sanitizers when hands are not visibly soiled	Yes	376	93.1
10) Hand wash when hands are visibly dirty or soiled with blood or body fluids	Yes	401	99.3
11) Hand hygiene using either soap, liquid soap, or alcohol-based hand sanitizers	Yes	402	99.5
12) Hand hygiene for not less than 40-60 seconds	Yes	322	79.7
13) Using paper towels to turn off the water faucet	Yes	150	37.1
14) Cleaning under the fingernails area	Yes	396	98.0
15) Remove jewelry (rings, bracelets) and watches before washing hands	Yes	295	73.0
16) Use circular motions to wash all areas, including palms, back of the hands, fingers, between fingers and wrists	Yes	322	79.7

3.2 Personal Protective Equipment

Nearly 40% of participants (39.4%) were considered to have a bad infection prevention practice regarding using PPE, with scores ranging from 0 to 8 out of 15 and less than 60% correct responses to the questionnaire questions. Only (28.9%) of the participants were considered to have a good infection prevention practice regarding using PPE, with their scores ranging from 12 to 15 out of 15 and 80% or more correct responses to the questionnaire questions, as shown in Fig. (2).

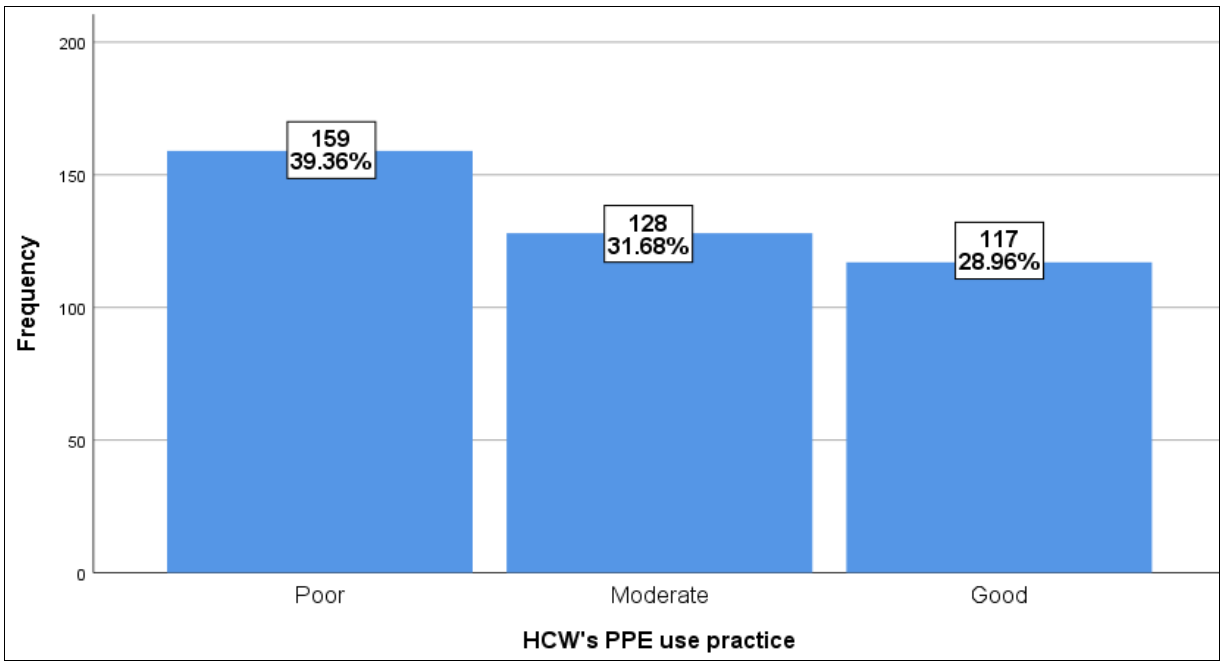

Fig 2: HCW's PPE-use Practice Level

Table 3: HCWs' PPE-use Practice Responses

PPE-use Questions	Response	Number (Total 404)	Percentage (%)
1) Wearing comfortable, well-fitted disposable gloves during work	Yes	296	73.3
2) Changing gloves between different patients	Yes	261	64.6
3) Changing gloves when performing multiple medical tests on the same patient	Yes	142	35.1
4) Changing gloves immediately if they're dirty, soiled, or damaged	Yes	292	72.3
5) Disposing of used gloves in appropriate waste bags	Yes	287	71.0
6) Wearing sterile gloves when examining mucous membranes, body fluids, or blood	Yes	386	95.5
7) Wearing a well-fitted face mask according to risk assessment	Yes	337	83.4
8) Avoid touching the front of the mask	Yes	293	72.5
9) Changing the mask if it becomes damp, dirty, or damaged	Yes	274	67.8
10) Disposing of used masks in appropriate waste bags	Yes	322	79.7
11) Wearing a well-fitted eye goggles/face shield according to risk assessment	Yes	143	35.4
12) Cleaning reusable goggles and face shields between uses and after removal	Yes	136	33.7
13) Wearing protective clothing (apron/gown) according to risk assessment	Yes	161	39.9
14) Changing protective clothing immediately if they're dirty or soiled	Yes	158	39.1
15) Disposing of used protective clothing (apron/gown) in an appropriate waste bag	Yes	159	39.4

3.3 Healthcare Waste Disposal

Almost all the participants (96.5%) were considered to have good infection prevention practices regarding waste disposal, scoring 3 out of 3 and having 80% or more correct responses to the questionnaire questions Fig. (3).

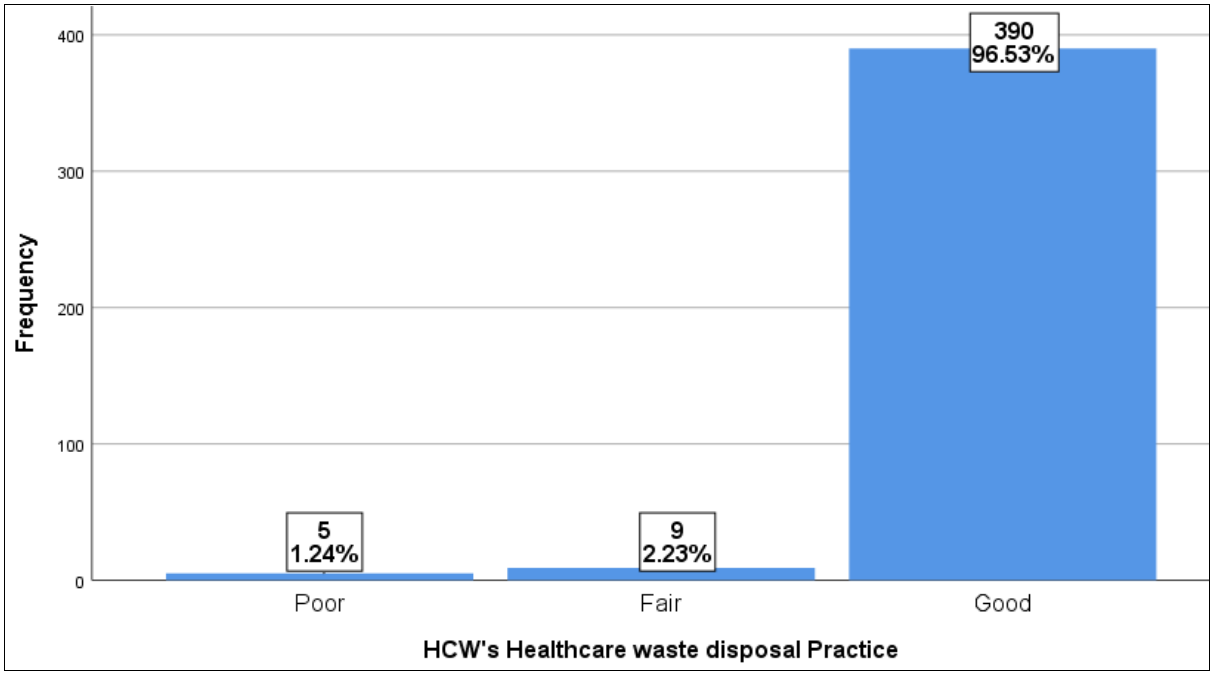

Fig 3: HCW's Healthcare Waste Disposal Practice Level

Table 4: HCWs' Waste Disposal Practice Responses

Healthcare Waste Disposal Questions	Responses	Number (Total 404)	Percentage (%)
1) Dispose of medical waste in yellow-colored disposal bins labeled as "Medical Waste"	Yes	396	98.0
2) Dispose of sharps waste in a yellow-colored, closable, puncture-resistant, leak-proof "Safety Box"	Yes	399	98.8
3) Dispose of non-medical waste in black-colored disposal bins labeled as "General Waste"	Yes	397	98.3

3.4 Needle Stick Injury Prevention

Most participants (82.4%) were considered to have a good NSI & BBV prevention practice, with scores ranging from 6 to 7 out of 7 and having 80% or more correct responses to the questionnaire questions. Only (4.7%) of the participants were considered to have a bad NSI prevention practice, with their scores ranging from 0 to 4 out of 7 and less than 60% correct responses to the questionnaire questions Fig. (4).

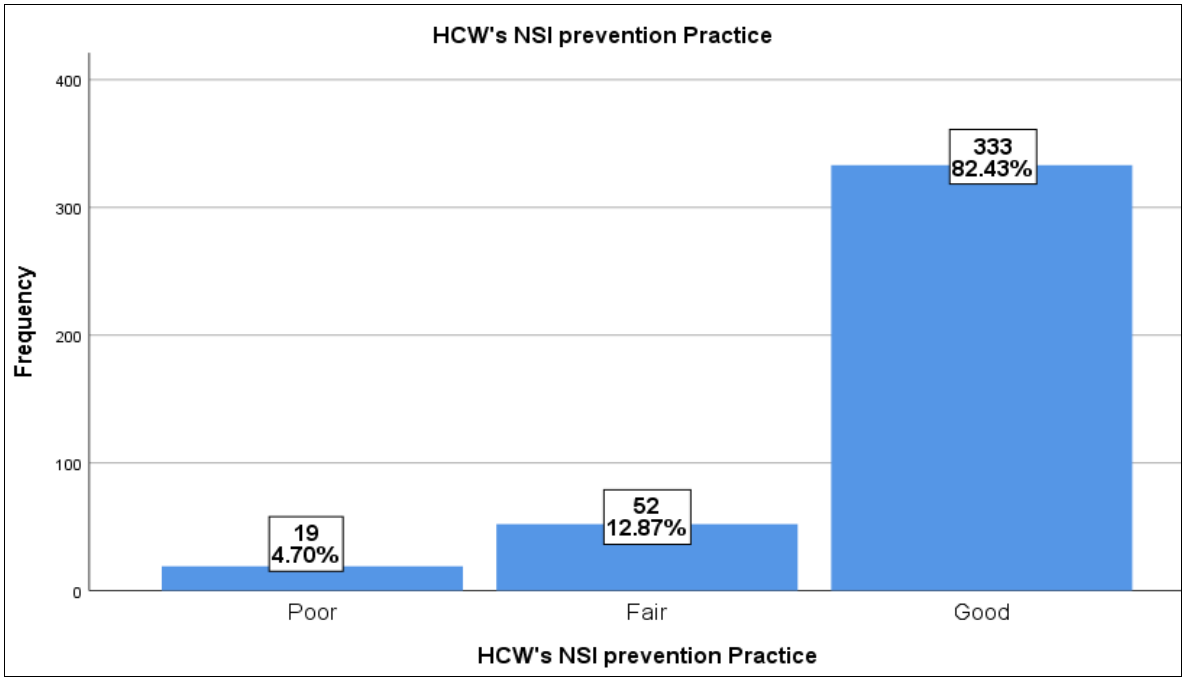

Fig 4: NSI Prevention Practice Level

Table 5: HCWs' NSI Prevention Practice Responses

NSI Prevention Practice Questions	Responses	Number (Total 404)	Percentage (%)
1) Following needle-stick injury prevention guidelines at work	Yes	391	96.8
2) Avoiding the use of needles if safe and effective alternatives are available	Yes	333	82.4
3) Using appropriate protection when there's a risk of exposure to blood/body fluids splashes	Yes	335	82.9
4) Cleaning any spillage of patient's blood by using towels soaked in a disinfectant agent	Yes	387	95.8
5) Vaccinated against Hep. B by receiving 3 doses according to schedule	Yes	386	95.5
6) Avoiding needle recapping and bending	Yes	321	79.5
7) Placing sharps and needles in a nearby 'safety box' immediately after use	Yes	399	98.8

3.5 Infection Prevention and Control Practice (IPC)

IPC total score was calculated by summing the scores in the four parts mentioned above and then classifying them accordingly. Nearly half the participants (49.3%) were considered to have a good IPC practice, with scores ranging from 33 to 41 out of 41 and having 80% or more correct responses to the questionnaire questions. Only (12.6%) of the participants were considered to have a bad IPC practice, with their scores ranging from 0 to 24 out of 41 and less than 60% correct responses to the questionnaire questions, as shown in Fig. (5).

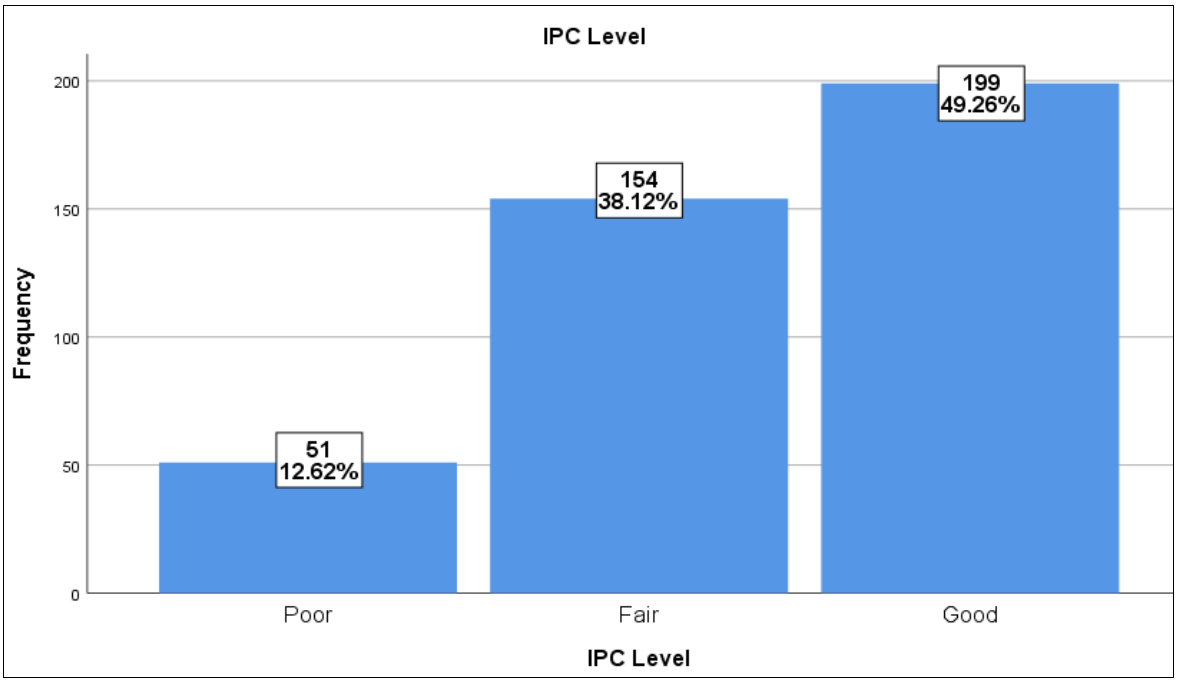

Fig 5: IPC Practice Classification Level

4. Discussion

4.1 Hand Hygiene Practice

This study's overall level of good hand hygiene practice (74.5%) aligns with findings from several other studies, particularly those conducted in PHCs or general hospital settings. For example, a study conducted in PHCs in Saudi Arabia [22] reported a slightly higher level of adherence (78%), while other studies reported that good adherence to proper hang hygiene practices was found among 55.2%, and 55.8% of HCWs in a tertiary hospital in Nigeria and a pediatric oncology ward in Saudi Arabia respectively [23, 24]. Some observational studies conducted in ICUs in Saudi Arabia reported lower compliance rates of 59% and 42%, respectively [25, 26].

4.2 Personal Protective Equipment

In this study, 28.9% of healthcare workers (HCWs) demonstrated good adherence to PPE practices-lower than rates reported during the COVID-19 pandemic, such as 51.7% in Bangladesh and 46.8% in Egypt [27, 28]. The reduced emphasis on pandemic-related precautions in 2024 may explain this decline. Adherence varied in India as well, dropping to 18% in lower-risk areas despite high compliance in ICUs and operating theatres [29]. This study's rate is comparable to Ethiopia's 31.9% [30] but notably lower than Bahrain's 82.1% during the pandemic [31]. These differences reflect the impact of time, resources, and healthcare infrastructure, highlighting the ongoing need for training, consistent PPE availability, and adherence monitoring in primary care settings.

4.3 Healthcare Waste Disposal

This study found that 96.5% of healthcare workers (HCWs) adhered to proper healthcare waste disposal practices, with 98% correctly using color-coded bins-yellow for medical waste, puncture-resistant containers for sharps, and black for general waste. These adherence rates are higher than those reported in Iraq (87.8%), India (60%), and Saudi Arabia (49.5%) [32-34]. For example, a study in Basra noted only 70.4% consistently segregated waste, and 86.9% disposed of

sharps properly [32]. In India, while 98% segregated waste, only 86% used yellow bins for infectious waste and 76% used puncture-proof containers for sharps [33]. These findings suggest strong knowledge but variable consistency, highlighting the need for ongoing training and monitoring to reinforce complete compliance with waste management protocols.

4.4 Needle Stick Injury Prevention

In this study, it was found that (82.4%) of HCWs demonstrated good NSI prevention practices, indicating strong adherence to safety protocols. This is similar to findings from a study conducted in Malaysia, where 86% of nurses exhibited good NSI prevention practices [35], suggesting a high level of safety awareness across different healthcare settings. However, a local study in Baghdad general and tertiary hospitals reported that only 61.5% of healthcare providers reported good practices [36], indicating that hospital settings may face more challenges in implementing effective prevention measures compared to PHCs. Factors such as higher patient volumes and less emphasis on NSI prevention in hospitals could contribute to this discrepancy. In contrast, PHCs may benefit from more focused training and consistent protocol enforcement, leading to better compliance.

4.5 Infection Prevention and Control Practice

In this study, 49.3% of healthcare workers (HCWs) in Baghdad's primary healthcare centers demonstrated good adherence to infection prevention and control (IPC) practices, while 38.1% showed fair adherence, and 12.6% poor adherence. These findings align with other studies in Iraq, which reported adherence ranging from 40% in Kerbela [19] to 69.2% in Erbil [37], and 48.5% in Babil [38]. Regional comparisons show wide variation: from 10.2% in Najran, Saudi Arabia [39], to 79.8% in Al-Baha [40]; 49.7% among physicians in Lebanon [41]; and 18.5% among dentists in Palestine [42]. In Egypt, 41.4% of nurses demonstrated competent IPC practice [43], while higher rates were reported in Jordan (77.9%) and the UAE (88.6%) [44, 45]. These results reflect disparities in IPC adherence across settings and highlight the need for improved training, resource allocation, and standardized IPC protocols in lower-resource healthcare systems.

Limitations

This study has several limitations, including reliance on self-reported data, which may introduce response bias, and its cross-sectional design, which precludes causal inferences. Conducted in primary healthcare centers in Baghdad, the findings may not be generalizable to other regions. Unmeasured factors such as workload and access to PPE were not assessed. Future studies should use longitudinal designs, objective compliance measures, and broader geographic coverage.

5. Conclusion and Recommendations

Conclusion

- **Infection Prevention and Control Practice:** Nearly half of the healthcare workers demonstrated good infection prevention and control practices.
- **Hand Hygiene:** The majority of the participants demonstrated good hand hygiene practices.
- **Personal Protective Equipment:** An alarming low portion of the participants exhibited good infection prevention practices regarding the use of personal protective equipment. Adherence was notably better for certain types of PPE, such as gloves and masks, than goggles/face shields and protective clothing like gowns or aprons.
- **Healthcare Waste Disposal:** Almost all participants practiced good infection prevention regarding waste disposal.
- **Needle Stick Injury Prevention:** Most participants demonstrated good practice preventing needle-stick injuries.

Profession type significantly influenced practice levels in all four examined domains of IPC.

Healthcare professionals in higher-risk roles, such as dentists and laboratory workers, demonstrated better compliance with protocols like hand hygiene, PPE use, waste disposal, and NSI precautions. In contrast, physicians exhibit lower compliance.

Other sociodemographic factors such as age, sex, marital status, and experience didn't show a significant influence on HCWs' practice levels.

Recommendations

- **Enhance Training:** Implement targeted, continuous training on in IPC for healthcare workers, focusing on areas with low compliance, such as PPE and hand hygiene.
- **Improve PPE Adherence:** Address gaps in PPE use (e.g., goggles and gowns) through hands-on training and visual reminders in high-risk areas. Ensure easy access to PPE and reinforce correct usage.
- **Profession-Specific Training:** Provide consistent IPC training for physicians and healthcare professionals in lower-risk roles to highlight the importance of IPC protocols.
- **Strengthen Hand Hygiene:** Emphasize hand hygiene improvements during high-risk procedures and in areas with lower compliance despite generally strong adherence.
- **Monitor and Provide Feedback:** Continuously monitor IPC practices, especially in PPE use and needle-stick prevention, and provide real-time feedback to reinforce good practices.
- **Cultivate Organizational Support:** Foster a culture that values IPC, emphasizing its role in patient and worker safety to improve compliance among all staff.
- **Boost Engagement:** Recognize and reward good IPC practices in healthcare workers, particularly in high-risk roles, to motivate better adherence among peers.

Conflict of Interest

Not available

Financial Support

Not available

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