Antimicrobial Resistance & Infection Control

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Reasons for insufficient compliance with infection prevention and control measures in the intensive care unit: a qualitative study conducted in Türkiye in 2024

Bahar Madran[1,2*], Zeynep Ilgin Demir[3], Busra Yalcin[3], Oguz Taha Ayaz[3], Kaan Iyikosker[3], Aleyna Keskin[3], Azra Gorel[3], Yunus Aksoy[3], Nilayda Sagaltici[3], Koray Hacioglu[3], Ilker Kayi[1,2], Önder Ergönül[2,4], Sibel Sakarya[1,2] and Şiran Keske[2,4]

Abstract

Background In EU countries, 33,000 people die of antibiotic-resistant infections annually, and Türkiye is one of the countries with the highest rate of antimicrobial resistance. More than 70% of these infections are directly related to healthcare-associated infections (HAIs). Implementing IPC measures is critical to preventing HAIs in ICUs, with the highest risk of HAIs. However, compliance with IPC measures by HCWs is suboptimal. In this study, we aimed to identify the barriers to compliance with infection prevention and control (IPC) measures in intensive care units (ICUs) and to find solutions by interviewing healthcare workers (HCWs).

Methods The study used a qualitative approach with in-depth face-to-face interviews. Between March 1 and May 31, 2024, 20 HCWs were interviewed in five tertiary hospitals in Istanbul. Purposive sampling included at least three HCWs from each hospital: an IPC nurse or physician, an ICU physician, and an ICU nurse. The conceptual framework of the semi-structured interview guide was based on the Health Belief Model (HBM).

Results The majority of HCWs were aware of the importance and benefits of IPC measures; however, none reported full compliance. A significant proportion of HCWs ($n=16$) reported that in-service training programs conducted by infection control committees were not effective enough to positively influence staff behaviuor. Increased workload ($n=13$) and unexpected medical emergencies interrupting IPC activities ($n=13$) were also cited as barriers to compliance. More than half of respondents indicated that increased sanctions ($n=11$), stricter control mechanisms ($n=11$), and more effective IPC training programs ($n=11$) would help improve compliance rates.

Conclusions Addressing barriers and implementing tailored solutions can significantly enhance compliance. By integrating innovative training programs, improving working conditions, and strengthening enforcement

*Correspondence:
Bahar Madran
bmadran@ku.edu.tr

Full list of author information is available at the end of the article

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mechanisms, hospital administrators and IPC committees can foster a safer environment for patients, HCWs, and the broader community.

Keywords Antimicrobial resistance, Healthcare-associated infections, Behaviour change, Compliance, Policy

Introduction

Antimicrobial resistance (AMR) poses a major threat to human health globally. Recent reports from the Organization for Economic Co-operation and Development (OECD) reveal that approximately 4.3 million deaths each year are attributable to AMR [1]. Low- and middle-income countries bear a disproportionate burden of these infections, leading to dire public health implications [2]. If effective measures are not taken by 2050, an estimated 10 million people will die annually from AMR worldwide [3]. The report highlights that, in contrast to other countries, around 70% of resistant infections are estimated to occur in healthcare settings, the highest rate among the OECD member countries of the European Union/ The European Economic Area (EU/EEA) [1]. This sobering data underscores the urgent need for targeted action within healthcare settings.

In the EU/EEA, over 4 million people are affected annually, with 93.000 patients (1 in every 14 patients) having at least one healthcare-associated infection (HAI) on any given day; one in three bacteria causing these infections is resistant to antibiotics [4]. HAIs prolong hospital and intensive care unit (ICU) stays, increase antibiotic consumption, and raise the cost of care [5]. When these side effects overlap with AMR issues, therapeutic options may become untenable [4].

The effectiveness of antibiotics is now in jeopardy, and the development of effective new drugs is limited [6]. Therefore, preventing the transmission of resistant bacteria is critical. The attitudes of healthcare workers (HCWs) are essential in preventing resistant bacterial infections among patients. ICUs are particularly important due to the high prevalence of invasive or non-invasive devices, comorbidity, increased age, and the use of immunosuppressive therapy [5]. Prevalence surveys in the United States suggest that 30% of HAIs occur in ICUs [7]. Conversely, it is estimated that up to 70% of HAIs are preventable with sustained and multifaced infection prevention and control (IPC) programs [8, 9].

In Türkiye, the Ministry of Health implemented the National Hospital Antimicrobial Restriction Program (NHARP) in 2003. However, effective IPC programs are also critical in addition to restricting antibiotic use. Infection control committees (ICCs) and infection control teams (ICTs) routinely conduct education and awareness activities to prevent transmission of resistant pathogens in healthcare settings. However, there is a lack of more comprehensive, and larger studies of the factors that influence the attitudes of HCWs.

HCWs play a vital role in the prevention and control of HAIs. However, despite their awareness of the importance of IPC measures in preventing HAIs [10] their compliance rates can be as low as 22% in all healthcare settings [11], and %53 in ICUs [12]. Lack of knowledge, age, seniority, or work experience are commonly cited for poor compliance with IPC measures [13]. To improve compliance, research is needed that examines the main causes of the problem in more detail, particularly from the perspective of the HCWs experiencing difficulties [10]. Therefore, we aimed to conduct a qualitative study to explore and define the barriers to IPC measures in ICUs, the reasons these measures may be overlooked, and the challenges HCWs face in achieving compliance with IPC protocols despite their training and education and access to proper medical equipment.

Method

Study setting

This study used a qualitative research approach in ICUs of five tertiary-level hospitals in Istanbul, Türkiye. The study sites were two training and research hospitals both of which were public, two university hospitals one of which was private and the other was state, and one private foundation hospital. The training and research hospitals have 1301 ward beds and 280 ICU beds, the university hospitals have 1226 ward beds and 160 ICU beds, while the private foundation hospital has 300 beds and 62 ICU beds.

Definition

IPC practices include hand hygiene, isolation, use of PPE, screening, cohorting, aseptic procedures, cleaning, disinfection, and sterilization [14].

Study design

A qualitative in-depth interview approach was used. The HCWs who had worked in adult ICUs for two years or more were chosen due to their experience of infection control practices during daily care, and treatment. Participants were selected based on a purposive sampling method [15], considering gender, age, type of health worker, and work experience in the ICU. It was planned to interview a total of 24 people (6 participants for each variable), with the condition that there would be at least one intensive care physician, one intensive care nurse, and at least one member of the ICT.

Data collection

The data were gathered between 1 March 2024 and 31 May 2024. We got in touch with the eligible participants through key persons informed them about the study's objectives and data collection processes and sought their approval for participation. The research team was formed by the corresponding author (BM) experienced and certified in qualitative research and infection control studies in healthcare settings. Two authors (SS, ŞK)), also experienced in these fields, supported the design, and conduct of the research. BM trained other research assistants regarding in-depth interviews, data transcription, coding, and analysis. After the interview form was formulated, feedback was received from three HCWs about interview questions. Their feedback led to revisions of the interview form.

The Health Belief Model (HBM) served as the conceptual framework for developing the semi-structured interview guide (appendix 1). The HBM is a fundamental framework used since the 1950s to understand and conceptualize protective health behaviours. Scientists use the HBM to predict why and how people will take action to prevent, screen for, or control disease states [16]. The model is made up of six components: perceived severity, perceived susceptibility, perceived benefits, perceived barriers, cues to action, and self-efficacy [16].

We conducted all interviews at the hospitals, in locations selected by the participants, typically in quiet side rooms. The participants were informed about the research aims and the consent document just before the interviews. Subsequently, written consent was obtained, and all sessions were recorded exactly and transcribed. The interviews were conducted by the corresponding author (BM), with two university students (ZID,; TA) present to observe and take notes as needed. The researchers completed the transcriptions within a month, after that the transcripts were shared with the participants for their comments and corrections. Interviews lasted between 30 and 45 min. The data collection process was terminated when the interviewers determined that saturation had been achieved [17].

Table 1 Demographic characteristics of healthcare workers who participated in the in-depth interviews

Demographic Characteristics		*n* (%)
Gender	Male	**8 (40.0)**
	Female	**12 (60.0)**
Age	20–29	**2 (10.0)**
	30–39	**9 (45.0)**
	40–49	**8 (40.0)**
	50–59	**1 (5.0)**
Hospital	Private	**4 (20.0)**
	Training & Research	**10 (50.0)**
	Private University	**3 (15.0)**
	State University	**3 (15.0)**
Position	Physician	**8 (40.0)**
	Nurse	**12 (60.0)**
Department	ICU staff	**13 (65.0)**
	ICT staff	**7 (35.0)**
Experience in their position (years)	*2–10*	**5 (25.0)**
	11–14	**5 (25.0)**
	15–19	**5 (25.0)**
	≥ 20	**5 (25.0)**
Total		**20 (100.0)**

Data management and analysis

The transcripts and interview notes were kept completely confidential in protected files. We used a combination of deductive and inductive coding and applied thematic analysis. Deductively, we used the HBM framework as an analytic structure; inductively, we allowed the emergence of new codes and categories such as the perceived effectiveness of in-service training modules. Additionally, information about the participant's age, gender, job position, and department (e.g., intensive care unit nurse; ICUN, intensive care unit physician; ICUP, infection control nurse; ICN, and infection control physician; ICP) were appended to the end of each statement. For instance, (45/M/ICUP).

Thematic analysis was carried out by creating a code tree to identify common themes emerging from the data coded by six researchers (BM, SS, ŞK, IK, BY, Kİ). The transcripts were coded using MAXQDA 2023 software (VERBI Software, Germany). University's Clinical Research Ethics Committee approved the study on 4 January 2023, with the decision number 2023.442.IRB3.195. Furthermore, we have used the COREQ (Consolidated Criteria for Reporting Qualitative Research) checklist to ensure our results are accurately reported.

Results

A total of 24 HCWs working in ICUs of five different hospitals agreed to participate in this study. Twenty HCWs (12 female, 8 male) participated in face-to-face, in-depth interviews, while four declined to participate due to their workload.

Characteristics of study participants

The majority of HCWs who participated in the interview were female (60%) and aged between 30 and 49 years (85%). Half of the participants worked in training and research hospitals, while the other half were employed in private or state universities or private foundation hospitals. Most of the participants were nurses (60%) and the majority worked in ICUs (65%). Half of the participants had 15 or more years of work experience in their current roles (Table 1).

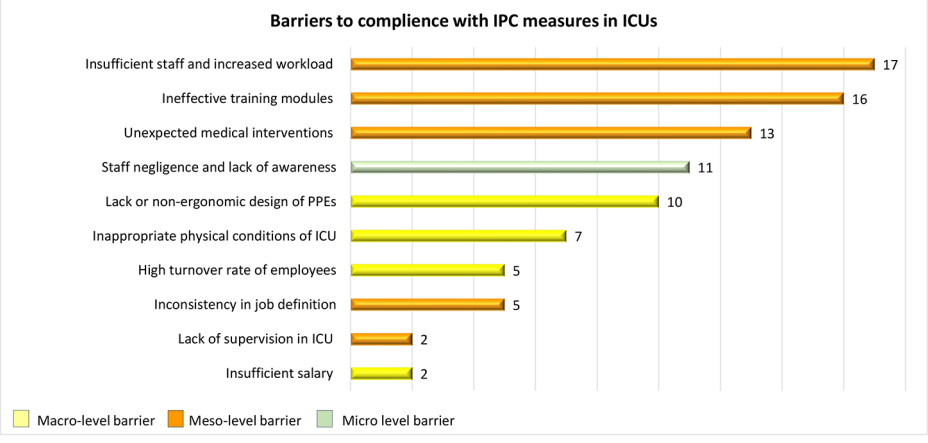
Perceived severity, and susceptibility

Most HCWs were aware of the importance and benefits of IPC measures and recognized the serious consequences of poor compliance. Concerning their-compliance, almost all participants indicated that they adhered to IPC measures, though they admitted occasional lapses (16/17). When asked to rate their compliance, 70% (14/20) of HCWs rated themselves as fully compliant (100%). Regarding the compliance of their colleagues, none of the participants reported full adherence based on observed staff practices. Nine participants had an estimate of their colleagues' compliance rate between 60% and 79%, while eight participants had an estimate of their colleagues' compliance rate between 80% and 100%. Two participants reported that the rate of compliance with IPC measures was below 40%. Some participants reported their observations related to inappropriate initiatives in ICUs, saying, "*During an endotracheal suction procedure that was supposed to be sterile, I saw with my eyes that the suction catheter was left unsheathed at the patient's bedside and the same catheter was reused a second time during the procedure. It was a tragedy.*" (29/M/ICUN) Some reported that the risk perception of colleagues regarding the medical and /or legal consequences of poor compliance with IPC measures was low: "*I saw that no mask or bonnet was worn while the central venous catheter was inserted, and when I warned those people, I received the following response "Oh come on, what's going to happen*?" (40/F/ICUP). "*I have often witnessed dressings that were supposed to be sterile being applied with bare hands*" (33/F/ICN). One participant even reported that (44/F/ICN) the IPC measures were generally not followed strictly and HCWs do not take this issue seriously, saying, "*Let me tell you what I heard with my ears. For example, how many times has an HCW been arrested for not following the isolation rules? What happens if they spread Klebsiella isolates? Especially in intensive care. Then they say there is colonization, and nothing happens to them*". Moreover, in exploring the impact of the COVID-19 pandemic on IPC measures, 12 participants noted an initial increase in IPC compliance during the pandemic that diminished over time. However, 8 participants believed that the pandemic had a lasting positive effect on IPC adherence.

We found that all participants were aware that HCWs play a critical role in the risk of infection transmission. Although all HCWs believed that the COVID-19 pandemic had a positive effect on IPC measures, most of them expressed that this effect diminished during the pandemic (12/20). Most of them (12/20) identified nurses as the profession most at risk of transmitting infections due to their proximity to patients, followed by physicians (8/20) who perform riskier interventions. Four HCWs expressed specific concerns about the role of surgeons in contributing to infection transmission.

Perceived barriers

We identified 10 key barriers to compliance, which we categorized into three levels: macro, meso, and micro. Macro barriers pertain to overarching policies, meso barriers relate to organizational and service execution challenges at clinics, and micro barriers involve issues at the individual level (Graph 1). Most of the barriers cited by HCWs were related to meso-level issues including insufficient staff and increased workload, ineffective in-service training modules, unexpected medical interventions, inconsistency in job definitions among employees, and lack of supervision in the ICU. At the macro level, they pointed to factors such as the lack or non-ergonomic design of PPEs, inappropriate physical conditions of ICUs, high staff turnover, and insufficient salaries. Participants also highlighted micro-level issues resulting from staff negligence and lack of awareness. Some HCWs described physicians, especially surgeons, as pointing out



Graph 1 Barriers to compliance with the IPC measures expressed by the HCWs who work in adult ICUs

in terms of transmission of infections due to the lack of compliance with the IPC measures. One of them (42/F/ICN) expressed his concerns as follows; "*We have a lot of trouble with surgeons. For example, our intensive care units work well, but someone comes in from outside and ignores all protocols -no protective equipment, no hand hygiene. They dive right into the patient's care. He opens the dressing. He tries to dress it by hand. Sometimes he tries to open the patient's stitches there. He is trying to suture the patient again. I cannot believe it" (age, sex, position, and department)".*

Cues to action: suggestions to improve IPC compliance

Participants offered 11 recommendations to improve IPC compliance (Graph 2). We categorized the recommendations, similarly, referring to them as macro, meso, and micro-level solutions. Most of the solutions proposed by HCWs were related to the meso level and included measures such as increasing sanctions, strengthening control mechanisms, reducing workload, revising training programs, using innovative methods and products that leverage technology in infection control, and implementing a rotation system to transfer non-compliant staff to other units.

At the macro level, participants expressed interest in developing financial or moral reward systems, improving the physical conditions of ICUs, increasing salaries, and improving the quality of PPEs (Graph 2).

When asked about the potential impact of financial penalties on poor compliance, 12 participants believed it would be effective, while three thought it would be ineffective. Five participants did not provide a specific answer. Supporters of financial sanctions are mainly ICU nurses (9/12). In addition, some healthcare professionals have suggested that financial penalties for those who do not attend IPC training may increase attendance (2/12).

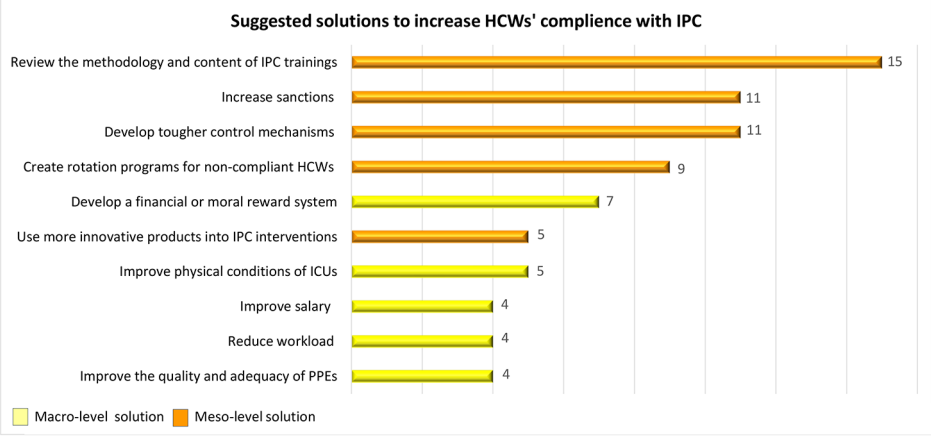
Self-efficacy and the role of in-service training of ICC and ICT

Although mandatory training is required for all ICU staff, participation rates remain very low. When asked about the effectiveness of the training programs provided by the ICC or ICT, only 4 participants rated them as adequate. Among those who deemed the ICC training ineffective, most were ICU nurses with less than 15 years of experience. Participants suggested that training content should be short-concise, and need-based and that training methodologies should be motivative, creative, participatory, and delivered by instructors with strong communication skills. Further suggestions to increase training participation included making attendance mandatory, scheduling training during working hours, and organizing it in advance to align with HCW working schedules. Additional recommendations for training modules included using creative methods like drama or theatre, group sessions, face-to-face individualized training, or bedside interactive training. Supervision during training and short-term assignment of non-compliant HCWs to ICC roles were also proposed (Table 2).

Discussion

This study was conducted with in-depth face-to-face interviews with HCWs in the ICUs across five hospitals in Türkiye to identify barriers and facilitators to IPC compliance. The findings reveal a low level of compliance with ICP measures among HCWs, primarily attributed to dissatisfaction with training effectiveness, excessive workloads, and insufficient control mechanisms and sanctions, among other factors.

IPC measures are essential to protect patients, HCWs, and the broader community from HAIs and antibiotic resistance. These measures include rules that must be strictly adhered to in healthcare settings. However, our findings reveal a discrepancy between self-reported



Graph 2 Suggested solutions to increase HCWs' compliance with the IPC measures by HCWs who work in ICUs

Table 2 The essentials of an effective IPC training program

Features	
Content	Short and concise
	Need-based
Methods	Motivating
	Creative methods
	Group training
	Individualized training
	Interactive/bedside
	Supervision during training
Increasing participation	Mandatory participation
	Training should be organized regularly and scheduled in advance on workdays
	Training hours should be accepted as working hours
	Arrange the working plan according to the training schedule

compliance and actual observed adherence. While most participants rated their compliance highly (14 out of 20 self-assessed at 100%), 16 out of 17 admitted to occasional lapses. Interestingly, HCWs were more critical when evaluating peers, with assessments often lower than their self-assessments. This leniency in self-judgment may stem from biases outlined in the Health Belief Model, such as underestimating personal risk, minimizing the severity of lapses, or overestimating self-efficacy [16].

When we explored the reasons behind the poor compliance, we found that most were linked to organizational and service execution challenges in clinics, as well as individual-level issues such as negligence and lack of awareness. Although poor compliance with infection control has similar causes in different countries, the reasons may vary depending on each country's specific conditions and the characteristics of its healthcare system. For example, Houghton et al. identified inadequate PPE, ineffective training, and heavy workloads as critical barriers, alongside poor communication, and unclear guidelines in their rapid qualitative reviews [18]. Similarly, Houben et al. in a cross-sectional study from the Netherlands, highlighted high work pressure and inadequate local IPC guidelines [19]. In contrast, Falana et al. highlighted factors such as inadequate IPC materials, poor waste management policies, and weak infrastructure as barriers in Nigeria [20]. In Türkiye, significant changes emerged after the 2003 Health Transformation Program (HTP), including the widespread privatization of the healthcare system, the concentration of intensive care beds and staff in private healthcare institutions, and the shift to a performance-based payment system for HCWs [21]. Right now, Türkiye faces unique systemic challenges, such as high staff turnover, understaffing, and low salary levels [22]. Some of the findings in this study may be related to these factors. For example, the inability to increase the number of HCWs despite the increased workload, the Ministry of Health's granting of greater autonomy to hospitals, the reduction in the frequency of inspections and controls, and the failure to sanction health workers for non-compliance weakened the power of hospital management and ICCs to impose sanctions to increase compliance with the IPC measure [21, 22].

When examining the "cues for action" that HCWs identify for the low compliance they observe, it is clear that they point primarily to external factors, such as increased monitoring and sanctions, as well as improving the effectiveness of training programs to support behavior change [16]. Similar recommendations have been made in studies from other countries [18, 19, 23]. Promoting a culture of safety as a priority in healthcare settings will also be one of the most effective external factors. Interventions designed for this purpose can improve HCWs' perceptions of safety culture and prevent the spread of resistant microorganisms by increasing compliance with IPC measures [24]. Another factor "sanctions" is one of the most frequently cited suggestions by HCWs. Regular monitoring of behaviors by ICTs concerning IPC measures, establishing a mechanism to provide regular audits and feedback to employees, and implementing effective sanctions for inappropriate behavior will positively support individual behavior change among HCWs and raise awareness and consciousness. It is extremely important that sanctions should be fair, educational, and applicable to ensure the expected change [25, 26]. To create positive behavior change among employees, their knowledge should also be supported. However, in many healthcare organizations today, education is still provided through desk-based, inactive, and long-term training. This traditional training does not create the added value. Lack of training by experts in the field, lack of use of technological tools such as multimedia or digital simulators during the training, and lack of effective feedback after the training are situations that prevent the development of training [27].

The COVID-19 pandemic temporarily improved IPC compliance due to the HCWs' fear of transmitting infections to loved ones and increased risk perception and awareness [14, 28]. However, compliance decreased over time based on the changing risk perception among HCWs [29]. Participants in our study also reported a gradual decline in compliance as pandemic-related risks decreased. Similar trends have been observed in other studies, which reported the importance of effective training programs and organizational support in strengthening and increasing the sustainability of compliance [28, 30].

Our findings highlight the need for more engaging and practical training methodologies. Participants proposed concise, interactive training sessions integrated into work

hours and facilitated by skilled communicators. These suggestions align with Rowe et al.'s 2021 review, which found that on-the-job training strategies outperformed traditional approaches like peer-to-peer and in-service training [31]. Innovative methods, including drama, bedside teaching, and mandatory sessions during paid work hours, could significantly enhance participation and compliance. However, it appears that more in-depth research is needed to tailor training programs to the specific needs of staff, the clinic, and the overall context.

Strengths and limitations

A key strength of the study is that its findings are based on the perspectives of individuals with firsthand experience. This direct insight from those actively engaged in clinical practice adds authenticity and relevance to the findings, making them highly applicable to real-world settings. By gathering data from HCWs who encounter IPC challenges daily, the study ensures that the results reflect the actual barriers and enablers within the ICU environment. The qualitative design of the study is another strength, as it provides in-depth insights into the underlying causes of the problem. This study has several limitations. Firstly, although we included nurses and physicians who work in ICUs and play a critical role in IPC compliance, the inclusion of other stakeholders could have further broadened the results and scope of the study. Secondly, although the study was conducted in different ICUs in both private and public hospitals, the qualitative approach limits the generalizability of the results.

Conclusion

Promoting a prevention culture should be an essential part of the solution to achieve sustained effective IPC programs. Addressing barriers and implementing tailored solutions can significantly enhance compliance. By integrating innovative training programs, improving working conditions, and strengthening enforcement mechanisms, hospital administrators and IPC committees can foster a safer environment for patients, HCWs, and the broader community. Further qualitative studies should be performed regularly to detect ongoing and novel problems in IPC measures and the unmet requests of HCWs in ICUs.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13756-025-01544-3.

Supplementary Material 1

Author contributions

B.M., İ.K., Ö.E., S.S., and Ş.K. were involved in the conceptualization of the study, B.M. and S.K. prepared the interview questions based on the HBM, B.M., Z.I.D., and O.T.A. conducted the interviews, A.K., A.G., Y.A., N.S., and K.H., were responsible for the transcripts of the interviews, B.Y. and K.İ. were responsible for the data analysis under the supervision of B.M. and S.K. All authors were involved in writing the main manuscript text. All authors reviewed the manuscript.

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Data availability

No datasets were generated or analysed during the current study.

Declarations

Competing interests

The authors declare no competing interests.

Ethical approval

Ethical approval was obtained for this trial (2023.442.IRB3.195). Consent was obtained from all hospital and intensive care unit managers. Verbal and written informed consent were obtained from participants, and all ethical procedures were followed.

Author details

[1]School of Medicine, Public Health Department, Koç University, Topkapi, Istanbul, Türkiye, Turkey
[2]Koç University Isbank Center for Infectious Disease Research Center, Istanbul, Türkiye
[3]School of Medicine, Koç University, Istanbul, Türkiye
[4]School of Medicine, Infectious Disease and Clinical Microbiology, Koç University, Istanbul, Türkiye

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