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SAĞLIK HİZMETİ İLİŞKİLİ ENFEKSİYONLARA YÖNELİK İNANÇ VE TUTUM ÖLÇEĞİNİN GELİŞTİRİLMESİ

Ferhat POLAT[1]*

Ayşegül TURAN[2]

Ethem MERDAN[3]

ÖZ

Amaç: Bu çalışma, Sağlık Hizmetleriyle İlişkili Enfeksiyon İnançları ve Tutumları Ölçeği'ni geliştirmeyi ve psikometrik özelliklerini değerlendirmeyi amaçlamıştır. Yöntem: Bu metodolojik çalışma, Türkiye'nin Kırşehir ilinde 462 sağlık çalışanını içermiştir. Ölçek geliştirme, literatür taraması, madde havuzu oluşturma, içerik geçerliliği değerlendirmesi, pilot test ve psikometrik değerlendirmeyi içermiştir. Yapı geçerliliği, Açıklayıcı Faktör Analizi ve Doğrulayıcı Faktör Analizi kullanılarak incelenmiştir. Yakınsak ve ayırt edici geçerlilik, Bileşik Güvenilirlik, Ortalama Varyans Çıkarımı, Maksimum Paylaşılan Varyans ve Ortalama Paylaşılan Varyans kullanılarak değerlendirilmiştir. İç tutarlılık, Cronbach alfa kullanılarak değerlendirilmiş ve ölçütle ilgili geçerlilik, yerleşik ölçüm araçlarıyla Pearson korelasyonları kullanılarak incelenmiştir. Bulgular: EFA, toplam varyansın %74,2'sini açıklayan beş faktörlü, 35 maddelik bir yapı ortaya koymuştur. Faktörler arasında İnvaziv İşlemler, İzolasyon, El Hijyeni, Ventilatör İlişkili Olaylar ve Cerrahi Alan Enfeksiyonu yer almaktadır. CFA, kabul edilebilir model uyumu göstermiştir (CMIN/DF = 2,12, RMSEA = 0,07, CFI = 0,93, IFI = 0,93, TLI = 0,92), faktör yükleri 0,70 ile 0,95 arasında değişmektedir. Genel Cronbach alfa değeri 0,890 iken, CR ve AVE değerleri yakınsak geçerliliği, MSV ve ASV değerleri ise ayırt edici geçerliliği desteklemiştir. Sonuç: Beş faktörlü, 35 maddelik ölçek, tatmin edici geçerlilik ve güvenilirlik göstermiş olup, sağlık çalışanlarının temel enfeksiyon kontrol alanlarındaki inanç ve tutumlarının değerlendirilmesini kolaylaştırabilir ve hedefli enfeksiyon önleme eğitimi ve risk yönetimine destek sağlayabilir.

Anahtar kelimeler: Sağlık hizmetleriyle ilişkili enfeksiyon, inançlar, tutumlar, ölçek geliştirme, geçerlilik, güvenilirlik

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[1] *Kırşehir Training and Research Hospital, ferhat4025@gmail.com, https://orcid.org/0009-0004-7903-8139*

2 Kirsehir Ahi Evran University, Faculty of Health Sciences, Nursing Department, aysegul.turan@ahievran.edu.tr, https://orcid.org/0000-0002-0451-8611

3 Kirsehir Ahi Evran University, Vocational School of Health Services, ethem.merdan@ahievran.edu.tr, https://orcid.org/0000-0003-2528-2326

**Bu çalışma Ayşegül Turan'ın danışmanlığında, Ethem MERDAN'ın eş danışmanlığında yürütülen "Sağlık Çalışanlarının Ekip Çalışma sına Yatkınlıklarının Ve Risk Yönetimi Algılarının Nozokomiyal Enfeksiyon İnanç Ve Tutumlarına Etkileri" İsimli tez çalışmasından türetilmiştir.*

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DEVELOPMENT OF A SCALE FOR BELIEFS AND ATTITUDES TOWARD HEALTHCARE-ASSOCIATED INFECTIONS

ABSTRACT

Purpose: This study aimed to develop the Healthcare-Associated Infection Beliefs and Attitudes Scale and evaluate its psychometric properties. Methods: This methodological study included 462 healthcare workers in Kırşehir Province, Türkiye. Scale development involved literature review, item pool generation, content validity assessment, pilot testing, and psychometric evaluation. Construct validity was examined using Exploratory Factor Analysis EFA and Confirmatory Factor Analysis CFA. Convergent and discriminant validity were assessed using Composite Reliability CR, Average Variance Extracted AVE, Maximum Shared Variance MSV, and Average Shared Variance ASV. Internal consistency was evaluated using Cronbach's alpha, and criterion-related validity was examined using Pearson correlations with established measurement instruments. Results: EFA yielded a five-factor, 35-item structure explaining 74.2% of the total variance. The factors were Invasive Procedures, Isolation, Hand Hygiene, Ventilator-Associated Events, and Surgical Site Infection. CFA demonstrated acceptable model fit (CMIN/DF = 2.12, RMSEA = 0.07, CFI = 0.93, IFI = 0.93, TLI = 0.92), with factor loadings ranging from 0.70 to 0.95. Overall Cronbach's alpha was 0.890, while CR and AVE values supported convergent validity and MSV and ASV values supported discriminant validity. Conclusion: The five-factor, 35-item scale demonstrated satisfactory validity and reliability and may facilitate the assessment of healthcare workers' beliefs and attitudes across key infection control domains and support targeted infection prevention training and risk management.

Keywords: Healthcare-associated infection, beliefs, attitudes, scale development, validity, reliability.

1. INTRODUCTION

Healthcare workers are essential healthcare professionals who interact directly with patients at every stage of healthcare delivery, from diagnosis to treatment, care, and rehabilitation. The primary responsibilities of healthcare workers include treating existing health problems, preventing diseases, promoting health, and safeguarding individuals' physical, mental, and social well-being (Dener and Elçin, 2023; Tamer et al., 2024). The safe and high-quality delivery of health care depends on health care workers' professional knowledge, skills and on their ability to accurately assess risks, collaborate effectively within their teams, and adopt safe care practices (Dener and Elçin, 2023; Dagli and Namıduru, 2018; Organ ve Gürbüz, 2012). In this context, the prevention of Health Care-Associated Infections (HAIs) stands out as one of the key components of patient safety and the quality of health care.

HAIs are a significant patient safety issue that arise during the delivery of healthcare and can increase patient morbidity and mortality. HAIs prolong hospital stays, increase treatment costs, and place a significant economic and administrative burden on healthcare systems. The incidence and characteristics of these infections may vary depending on the healthcare setting, patients' clinical conditions, and the procedures performed. Preventing HAIs requires identifying risks specific to the type of infection and its mechanism of development, and implementing preventive strategies tailored to those risks, rather than focusing on a single intervention.

A significant proportion of HAIs are associated with invasive procedures performed during the course of healthcare, lapses in infection control practices, and inadequate hand hygiene practices among healthcare workers. While the use of catheters and other invasive devices poses significant risks for urinary tract infections and bloodstream infections, mechanical ventilation practices represent a critical risk area for ventilator-associated events (Tenke et al., 2017; Maraş et al., 2022; Yüce and Alp, 2016). Similarly, surgical procedures pose a significant risk for surgical site infections, and failure to adhere to isolation precautions and hand hygiene can facilitate the spread of microorganisms within the healthcare setting. Therefore, it is important to take a comprehensive approach to preventing HAIs by addressing risks related to invasive procedures, isolation practices, hand hygiene, ventilator-associated events (VAE), and Surgical Site Infections (SSI).

In addition to technical and institutional measures, healthcare workers' knowledge, beliefs, attitudes, and awareness regarding HAIs also play a decisive role in preventing them. How healthcare workers perceive infection risks, their beliefs regarding the necessity of preventive practices, and their attitudes toward these practices can influence the implementation of infection control behaviors in clinical practice. Since the prevention of infections cannot be explained solely by individual responsibility, team communication, collaboration, shared decision-making, and organizational risk management practices are also important for the sustainability of patient safety (Slawomirski et al., 2017). For this reason, a systematic assessment of healthcare workers' beliefs and attitudes toward HAIs is important both for determining individual awareness and for developing institutional infection control and risk management strategies.

Although there are numerous studies in the literature on HAIs, infection control, and hand hygiene (Sönmez et al., 2021; Alay, 2019; Demirci, 2025; Erden et al., 2024; Çelik et al., 2020; Maraş et al., 2022), there remains a need for a comprehensive assessment tool that evaluates healthcare workers' beliefs and attitudes regarding HAIs by considering various risk areas such as invasive procedures, isolation, hand hygiene, ventilator-associated events, and surgical site infections collectively. Existing studies primarily focus on knowledge levels, specific types of infections, or individual infection control practices, there is a limited number of measurements approaches capable of assessing healthcare workers' beliefs and attitudes toward HAIs in a multidimensional manner. This situation makes it difficult to comprehensively assess healthcare workers' perceptions and attitudes toward HAIs risks and to incorporate the findings into infection control and organizational risk management practices.

In this regard, it is believed that there is a need to develop a valid and reliable measurement tool capable of assessing healthcare workers' beliefs and attitudes toward HAIs in a multidimensional manner. It is anticipated that such an assessment tool will contribute to identifying healthcare workers' perceptions and attitudes regarding infection risks, determining their training needs, and developing institutional strategies for infection control practices. The purpose of this study is to develop a measurement tool to assess healthcare workers' beliefs and attitudes toward healthcare-associated infections andto examine the validity and reliability of the developed scale.

METHOD

3.1. Research Design

A methodological design was employed to develop the Healthcare-Associated Infection Beliefs and Attitudes Scale and to establish evidence for its psychometric quality. The development procedure progressed through several sequential phases, beginning with examination of previous research and formulation of the initial statements, followed by expert review, preliminary testing, and statistical evaluation of the measurement properties. Evidence for construct validity was obtained through Exploratory Factor Analysis (EFA) and Confirmatory Factor Analysis (CFA). Composite Reliability (CR), Average Variance Extracted (AVE), Maximum Shared Variance (MSV), and Average Shared Variance (ASV) were used to examine the relationships among the latent dimensions and to provide evidence of convergent and discriminant validity. Criterion-related validity was investigated by examining associations between the newly developed instrument and established measures with previously documented psychometric properties.

3.2. Sample

The target population comprised healthcare professionals working in Kırşehir Province, Türkiye. The preliminary version of the instrument contained 35 statements. Based on the recommendation of Ebadi et al. (2017), which suggests recruiting 4–10 participants for each statement in scale development studies, a sample of 462 healthcare workers was recruited to allow for possible exclusions and incomplete or unusable responses. Participants were selected through simple random sampling. Eligibility required active employment in the healthcare sector for a minimum of one year and voluntary agreement to participate. Individuals who were members of the Infection Control Committee or who had less than one year of professional experience were not eligible for participation. For an independent evaluation of the factor structure, the 462 observations were allocated at random into two equal groups. One group was designated for EFA (n = 231), whereas the remaining participants constituted the CFA sample (n = 231). This approach enabled the factor solution identified in the first analysis to be tested independently in the second sample.

3.3. Data Collection Tools

Data were obtained using a structured form comprising participant background and occupational information, the preliminary version of the Healthcare-Associated Infection Beliefs and Attitudes Scale, and two established instruments selected to provide evidence for criterion-related validity. Background variables included age, sex, marital status, professional field, duration of employment, and occupation.

Healthcare-Associated Infection Beliefs and Attitudes Scale

The preliminary instrument developed by the researchers comprised 35 statements scored on a five-point Likert response format. Its conceptual structure included five domains: Invasive Procedures, Isolation, Hand Hygiene, Ventilator-Associated Events, and Surgical Site Infection. Respondents rated each statement according to their own beliefs and attitudes concerning healthcare-associated infections.

Interprofessional Team Collaboration Assessment Scale

The Interprofessional Team Collaboration Assessment Scale, developed by Orchard et al. (2012), was developed to examine the extent of collaborative practice among professionals working in healthcare environments. The instrument uses a five-point Likert response format, with higher scores reflecting more favorable perceptions of interprofessional collaboration. Reported Cronbach's alpha coefficients range from 0.80 to 0.97. The Turkish version, with established validity and reliability evidence, was selected as one of the external measures for examining criterion-related validity.

Risk Management Scale for Health and Fitness Facilities

Eraslan and Çimen (2022) developed the Risk Management Scale for Health and Fitness Facilities to assess risk management practices within health and fitness organizations. The instrument contains 24 statements distributed across three dimensions and uses a five-point Likert response format. Previous research reported Cronbach's alpha coefficients between 0.85 and 0.90 for its dimensions. In the present study, this instrument served as a second external measure in the evaluation of criterion-related validity.

3.4. Data Analysis

Statistical analyses were performed with SPSS version 25.0 and AMOS version 24.0. The analytical strategy included examination of the factor structure, assessment of common-method bias, evaluation of internal consistency, investigation of convergent and discriminant validity, and testing of criterion-related validity.

Construct Validity

EFA was first conducted to identify the underlying dimensional structure of the instrument. CFA was subsequently performed in an independent sample to determine whether the factor solution obtained from the exploratory analysis was adequately supported by the observed data. Before EFA, the suitability of the correlation matrix for factor analysis was examined using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity. Decisions concerning the factor solution were based on factor eigenvalues, the proportion of variance accounted for by the extracted dimensions, and standardized factor loadings. The adequacy of the CFA model was evaluated using CMIN/DF, RMSEA, CFI, IFI, and TLI.

Common-Method Bias

Potential common-method bias was examined using Harman's single-factor procedure. The proportion of variance accounted for by the first unrotated factor was considered, with a value below 50% interpreted as indicating that a substantial single-factor effect was unlikely to account for the observed covariance among the measures (Kline, 2016).

Reliability

Internal consistency was examined by calculating Cronbach's alpha coefficients for both the complete instrument and each of its dimensions. Higher coefficient values were interpreted as indicating greater consistency among the statements comprising each measurement domain.

Convergent and Discriminant Validity

Evidence of convergent validity was examined through standardized factor loadings, CR, and AVE. Discriminant validity was evaluated by comparing AVE with MSV and ASV values and by examining the square root of AVE in relation to correlations between the latent dimensions. The pattern of these coefficients was used to determine whether each dimension represented a distinct construct.

Normality

The distributional characteristics of the observed variables were examined before CFA. Skewness and kurtosis statistics were inspected, and values between −1.50 and +1.50 were regarded as consistent with an acceptable approximation to normality.

Criterion-Related Validity

Criterion-related validity was examined through the associations of the newly developed instrument with the Interprofessional Team Collaboration Assessment Scale and the Risk Management Scale for Health and Fitness Facilities. Pearson's correlation coefficient was calculated to determine the direction and strength of the relationships. Statistical significance was evaluated together with the magnitude and direction of each correlation coefficient.

4. RESULTS

4.1. Participants and Descriptive Characteristics

73.4% of the participants were nurses, 72.5% were women, 74.9% were in the 20–29 age group, 70.8% had 1–5 years of professional experience, 76.6% were single, and 56.5% worked in a clinic (Table 1).

Table 1. Participant background and occupational information

	Physician n, %	Nurse n, %	Midwife n, %	Laboratory technician n, %	medical imaging technician n, %	Anesthesia technician n, %	Other n, %	Total n, %
Male	3 (0.6)	85 (18.4)	0	1 (0.2)	3 (0.6)	2 (0.4)	33 (7.1)	127 (27.5)
Female	7 (1.5)	254 (55)	1 (0.2)	0	0	1 (0.2)	72 (15.6)	335 (72.5)
20-29	4 (0.9)	257 (55.6	1 (0.2)	1 (0.2)	0	1 (0.2)	82 (17.7)	346 (74.9)
30-39	3 (0.6)	47 (10.2)	0	0	0	0	15 (3.2)	65 (14.1)
40-49	3 (0.6)	29 (6.3)	0	0	0	1 (0.2)	6 (1.3)	39 (8.4)
50+	0	6 (1.3)	0	0	3 (0.6)	1 (0.2)	2 (0.4)	12 (2.6)
1-5	7 (1.5)	236 (51.1)	1 (0.2)	1 (0.2)	0	1 (0.2)	81 (17.5)	327 (70.8)
6-10	0	18 (3.9)	0	0	0	0	11 (10,5)	29 (6.3)
11-15	0	11 (2.4)	0	0	0	0	1 (0.2)	12 (2.6)
16-20	3 (0.6)	25 (5.4)	0	0	0	1 (0.2)	4 (0.9)	33 (7.1)
21-25	0	35 (7.6)	0	0	0	0	1 (0.2)	36 (7.8)
26+	0	14 (3)	0	0	3 (0.6)	1 (0.2)	7 (1.5)	25 (5.4)

Married	6 (1.3)	73 (15.8)	0	0	3 (0.6)	2 (0.4)	24 (5.2)	108 (23.4)
Single	4 (0.9)	266 (57.6)	1 (0.2)	1 (0.2)	0	1 (0.2)	81 (17.5)	354 (76.6)
Policlinic	3 (0.6)	62 (13.4)	0	0	0	0	37 (8)	102 (22.1)
Clinic	4 (0.9)	216 (46.8)	1 (0.2)	1 (0.2)	0	0	39 (8.4)	261 (56.5)
Operating room	3 (0.6)	55 (11.9)	0	0	0	3 (0.6)	6 (1.3)	67 (14.5)
Radiology unit	0	2 (0.4)	0	0	3 (0.6)	0	4 (0.9)	9 (1.9)
Administrative unit	0	4 (0.9)	0	0	0	0	19 (4.1)	23 (5)
Total	10 (2,2)	339 (73,4)	1 (0.2)	1 (0.2)	3 (0.6)	3 (0.6)	105 (22.7)	462 (100)

4.2. Item Generation and Content Validity

In the development of scale items, the following studies from the literature were consulted (Aylaz et al., 2018; Bulut et al., 2022; Arimbi, 2025; Allegranzi et al., 2016; Anderson, 2014; Sönmez et al., 2021; Alay, 2019; Demirci, 2025; Erden et al., 2024; Çelik et al., 2020; Maraş et al., 2022) and expert opinions were utilized. The opinions of academic experts and clinicians specializing in healthcare-associated infections were evaluated using the Lawshe technique. From the initial draft scale consisting of 56 items, items with a CVR <0.62 according to Lawshe's critical values were excluded following an evaluation by ten experts (Romero-Jeldres et al., 2023). Lawshe's critical value for content validity depends on the number of experts. For 10 experts, the minimum content validity criterion is 0.62 (Alqahtani et al., 2023). Since the content validity index value for this scale (0.67) is greater than the content validity criterion (0.62), content validity has been confirmed (Lawshe, 1975). The expert opinion evaluation form is provided in the appendix (Supplementary File 1). Following the expert evaluation, 35 items were selected for psychometric testing.

4.3. Pilot Testing

A preliminary evaluation was conducted with 30 healthcare workers to determine whether the statements could be understood as intended and whether any wording required modification. The assessment was conducted through direct interaction with the participants. Feedback indicated that the statements were understandable and appropriate for the intended population, and no concerns regarding ambiguous or repetitive wording were reported. As this phase was intended solely to refine the preliminary instrument, responses obtained from these participants were excluded from the subsequent statistical analyses.

4.4. Exploratory Factor Analysis

Following data collection, the 462 observations were allocated into two equal groups through a simple randomization procedure generated with Random.org. The first group (n = 231) served as the exploratory sample, whereas the second group (n = 231) was reserved for subsequent CFA. EFA was conducted with the exploratory sample to identify the underlying dimensional structure of the instrument. The KMO statistic was .821, and Bartlett's test of sphericity was statistically significant (χ^2 = 21,234.371, p < .001), demonstrating that the correlation matrix was suitable for factor extraction. Five dimensions with eigenvalues exceeding 1.00 were retained: Invasive Procedures, Isolation, Hand Hygiene, Ventilator-Associated Events, and Surgical Site Infection.

Potential common-method bias was further examined through Harman's single-factor procedure. The first unrotated factor accounted for 27.73% of the variance, which was substantially below the 50% criterion suggested by Kline (2016). This finding indicates that the observed covariance pattern was not predominantly attributable to a single underlying factor. The five retained dimensions collectively accounted for 74.20% of the total variance (Table 2).

Table 2. Exploratory Factor Analysis

Factors and their components	Eigen value	Explained variance (%)	Factor loading
INVASIVE PROCEDURE	9,709	27,739	
IP1 I should wait for the antiseptic applied to the skin to dry before performing an invasive procedure.			,928
IP2 I believe that using a bundle protocol during Central Venous Catheterization (CVC) procedures is effective in preventing infections.			,919
IP3 I believe that chlorhexidine baths in intensive care units are effective in preventing central venous catheter (CVC)-related infections.			,908
IP4 I believe it is necessary to routinely change peripheral venous catheters (cannulas, branuls, IV catheters) every 72 to 96 hours.			,905
IP5 The closed dressing covers on the catheter should be changed every two days.			,883
IP6 I believe that sterile gloves should be used during urinary catheterization procedures.			,875
IP7 I believe that tap water is sufficient for inflating the balloon after a urinary catheter has been inserted.			,854
IP8 Urinary bags should be kept below the level of the bladder.			,853
IP9 Urine bags should not come into contact with the floor.			,835
IP10 I believe that, as part of preoperative preparation, the surgical site must be prepared by trained healthcare personnel.			,765
IP11 I believe that taking the patient's overall hygiene into account before invasive procedures reduces the risk of infection.			,721
ISOLATION	5,232	14,949	
I1 I think the order in which you put on and take off gloves, masks, caps, and aprons is important.			,921
I2 Special attention should be given to providing information on isolation protocols during patient transfers between clinics.			,902
I3 I believe that a patient under isolation should not be taken out of their room unless absolutely necessary.			,840
I4 I believe that the technical equipment used on a patient under isolation measures should be cleaned without being removed from the room.			,836

I5 I believe that frequent reports of cases where isolation protocols are not followed are effective in raising awareness among healthcare workers.			,820
I6 I believe that adherence to waste management procedures in isolation areas is critical for preventing infections.			,773
I7 I believe that when isolation protocols are not followed, both patients and healthcare workers are at risk.			,771
HAND HYGIENE	4,085	11,672	
HH1 I make it a priority to practice hand hygiene (hand washing or hand rubbing with an alcohol-based antiseptic) before coming into contact with a patient.			,935
HH2 Hand hygiene must be practiced even before putting on gloves			,915
HH3 Hand hygiene must be maintained even after removing gloves			,892
HH4 Hand hygiene must also be maintained during non-invasive procedures (monitoring of vital signs)..			,746
HH5 I believe it is important to keep hand hygiene products in sufficient quantities and in easily accessible locations.			,746
HH6 I think it is necessary to organize ongoing campaigns to raise awareness about hand hygiene.			,725
SURGICAL SITE INFECTION	3,665	10,470	
SSI1 I believe that inadequate sterilization and disinfection increase the risk of Surgical Site Infection (SSI).			,935
SSI2 I believe that healthcare workers should be familiar with the sterilization methods for surgical instruments, such as dry heat, steam, ethylene oxide, etc.			,891
SSI3 I believe that healthcare workers need to be familiar with the sterilization control criteria for surgical instruments.			,878
SSI4 I believe that operating room staff should undergo routine vaccinations and health screenings.			,757
SSI5 I believe that careful monitoring of the incision site for signs of infection is important in preventing surgical site infections..			,701
SSI6 I believe that having a dressing team composed of healthcare professionals who have received certified training is important for preventing surgical site infections.			,628
Ventilator-Associated Event (VAE)	3,280	9,372	
VAE1 I believe that unnecessarily frequent replacement of materials increases the risk of VAE.			,931
VAE2 I believe that lying on your back increases the risk of VAE.			,915
VAE3 I believe that inadequate care (oral care, wound care, etc.) increases the risk of VAE.			,848
VAE4 I believe that ventilators must be regularly maintained and calibrated to prevent VAE.			,806
VAE5 I believe that aspiration techniques are important in preventing VAE.			,742

4.5. Descriptive Statistics and Internal Consistency

The Draft Scale of Beliefs and Attitudes Toward Healthcare-Associated Infections was examined to determine whether it met the assumption of normal distribution prior to conducting confirmatory factor analysis. Table 3 presents the means, internal consistency, skewness, and kurtosis values for the scale dimensions. The scale's overall internal consistency coefficient α is 0.890. The skewness and kurtosis values range from -0.60 to 1.22, indicating no significant deviation from a univariate normal distribution (Tabachnick and Fidell, 2013). Factor reliabilities range from α = 0.79 to α = 0.93.

Table 3. Descriptive Results

Scale dimensions	Mean	Standard deviation	Skewness	Kurtosis	Reliability Cronbach Alpha
Invasive procedure	3.31	.79	-.14	.21	.91
İsolation	3.64	.79	.25	-.30	.88
Hand hygiene	3.54	.84	.13	.26	.88
Ventilator-Associated Event	3.59	.69	-.60	1.22	.79
Surgical Site Infection	2.97	.98	.52	-.54	.93

4.6. Confirmatory Factor Analysis

To validate the five-factor structure obtained from the EFA, CFA was conducted using AMOS 24 (Table 4; Figure 2). The scale model consists of five factors: Invasive Procedures (F1), Isolation (F2), Hand Hygiene (F3), Ventilator-Associated Events (F4), and Surgical Site Infection (F5).

The results of the CFA indicated that the standardized factor loadings for all items ranged from 0.70 to 0.95 and that all factor loadings were statistically significant ($p < 0.001$). The fact that the factor loadings were above the acceptable threshold indicates that the items adequately represent the latent structures to which they belong. The R^2 values, which indicate the proportion of variance explained by the items, ranged from 0.484 to 0.905. Various goodness-of-fit indices were examined to assess the fit of the five-factor measurement model to the data. The model's CMIN/DF value was found to be 2.12, the RMSEA value 0.07, the CFI value 0.93, the IFI value 0.93, and the TFI value 0.92.

Table 4. Healthcare-Associated Infection Belief and Attitude Draft Scale CFA

Factor name	Factor symbol	Factor Loading	R^2	Standard Error	Critical Ratio	P value	Composite Reliability	AVE	MSV	ASV	√‾AVE	Interfactorial correlation coefficient				
												F1	F2	F3	F4	F5
F1: Invaziv Procedure							0,97	0,76	0,18	0,12	0.87	1	0,22	0,17	0,25	0,05
	IP1	0,91	0.828	0,03	9,37	< 0,001										
	IP2	0,89	0.790	0,03	9,66	< 0,001										
	IP3	0,91	0.830	0,03	9,35	< 0,001										
	IP4	0,93	0.858	0,02	9,02	< 0,001										
	IP5	0,88	0.780	0,03	9,73	< 0,001										
	IP6	0,87	0.756	0,04	9,85	< 0,001										
	IP7	0,84	0.698	0,04	10,07	< 0,001										
	IP8	0,84	0.707	0,04	10,04	< 0,001										
	IP9	0,84	0.704	0,04	10,05	< 0,001										
	IP10	0,84	0.706	0,04	10,05	< 0,001										
	IP11	0,85	0.716	0,04	10,02	< 0,001										
F2: Isolation							0,95	0,74	0,24	0,10	0.86	0,22	1	0,61	0,40	0,51
	I1	0,95	0.905	0,02	6,83	< 0,001										
	I2	0,90	0.802	0,03	9,07	< 0,001										
	I3	0,87	0.759	0,03	9,44	< 0,001										
	I4	0,87	0.754	0,03	9,48	< 0,001										
	I5	0,77	0.595	0,04	10,13	< 0,001										
	I6	0,88	0.767	0,03	9,38	< 0,001										
	I7	0,78	0.610	0,05	10,10	< 0,001										
F3: Hand Hgyiene							0,97	0,76	0,18	0,12	0.87	0,17	0,61	1	0,42	0,52
	HH1	0,91	0.833	0,02	8,90	< 0,001										
	HH2	0,93	0.870	0,02	8,27	< 0,001										
	HH3	0,87	0.757	0,03	9,60	< 0,001										
	HH4	0,95	0.893	0,02	7,65	< 0,001										
	HH5	0,87	0.761	0,03	9,57	< 0,001										
	HH6	0,86	0.745	0,03	9,66	< 0,001										
F4: Ventilator Associated Events							0,88	0,61	0,46	0,25	0.78	0,25	0,40	0,42	1	0,56
	VAE1	0,88	0.778	0,04	6,69	< 0,001										
	VAE2	0,84	0.701	0,04	7,98	< 0,001										
	VAE3	0,74	0.553	0,06	9,31	< 0,001										
	VAE4	0,70	0.484	0,07	9,66	< 0,001										
	VAE5	0,72	0.520	0,06	9,49	< 0,001										
F5: Surgial Site Infection							0,95	0,74	0,24	0,10	0.86	0,05	0,51	0,52	0,56	1
	SSI1	0,84	0.701	0,04	9,19	< 0,001										
	SSI2	0,87	0.759	0,03	8,65	< 0,001										
	SSI3	0,85	0.797	0,04	9,07	< 0,001										
	SSI4	0,83	0.717	0,04	9,26	< 0,001										
	SSI5	0,89	0.691	0,03	8,15	< 0,001										
	SSI6	0,79	0.624	0,05	9,64	< 0,001										
Values Harmony Goodness		CMIN/DF	RMSEA		CFI	IFI	TLI									
Model values		2.12	0.07		0.93	0.93	0.92									

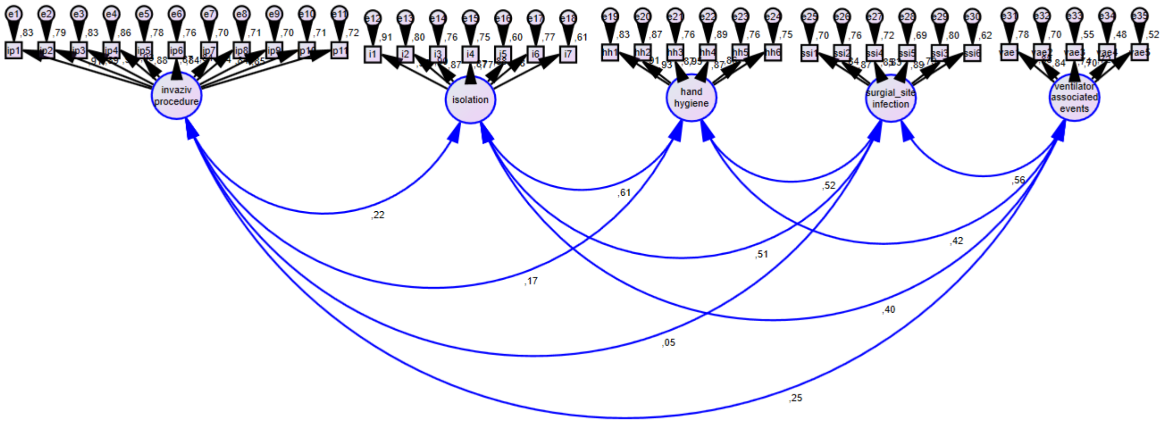

Figure 1. CFA diagram

4.7. Convergent and Discriminant Validity

Evidence supporting convergent validity was obtained from the standardized factor loadings, CR, and AVE coefficients. Standardized loadings were statistically significant for all 35 statements ($p < .001$) and varied between 0.70 and 0.95. These coefficients indicate strong associations between the observed statements and their respective latent dimensions. CR coefficients varied from 0.88 to 0.97, whereas AVE coefficients ranged from 0.61 to 0.76. Since all CR values exceeded 0.70 and all AVE values were greater than 0.50, the predefined criteria for convergent validity were satisfied.

Discriminant validity was evaluated using √AVE, MSV, ASV, and the correlations among the latent dimensions. MSV values were 0.18 for F1, 0.24 for F2, 0.18 for F3, 0.46 for F4, and 0.24 for F5. The corresponding ASV values were 0.12, 0.10, 0.12, 0.25, and 0.10, respectively. For every dimension, both MSV and ASV remained below the corresponding AVE value, indicating that each dimension shared greater variance with its own indicators than with the other dimensions. In addition, the correlations between the latent factors remained below the relevant √AVE coefficients. Collectively, these findings provide evidence that the five dimensions represent empirically distinguishable constructs.

4.8. Criterion-Related Validity

Criterion-related validity was investigated by comparing the newly developed Healthcare-Associated Infection Beliefs and Attitudes Scale with two previously validated instruments: the Risk Management Scale for Health and Fitness Facilities and the Interprofessional Team Collaboration Assessment Scale. Associations among the scale scores were examined using Pearson's correlation coefficients (Table 5).

The total score of the Healthcare-Associated Infection Beliefs and Attitudes Scale showed a strong positive association with the Risk Management Scale for Health and Fitness Facilities (r = .75, p < .001) and a moderate positive association with the Interprofessional Team Collaboration Assessment Scale (r = .46, p < .001). The positive direction and magnitude of these relationships were consistent with the expected associations among conceptually related constructs. These results provide supporting evidence for the criterion-related validity of the newly developed instrument.

Table 5. Healthcare-Associated Infection Belief and Attitude Draft Scale correlation analysis

	Risk management Scale Pearson's R	Teamwork Scale Pearson's R
Healthcare-Associated Infection Belief and Attitude Draft Scale (general)	.75**	.46**
Invaziv Procedure	.61**	.15**
Isolation	.38**	.84**
Hand Hgyiene	.25**	.67**
Surgial Site Infection	.15**	.55**
Ventilator Associated Events	.22**	.28**

Note: **: p≤.001

DISCUSSION

This study was conducted to develop and evaluate the psychometric properties of the Healthcare-Associated Infection Beliefs and Attitudes Scale, with a particular focus on infection control areas that represent distinct clinical and organizational risks. The analyses yielded a five-factor, 35-item structure comprising Invasive Procedures, Isolation, Hand Hygiene, VAE, and SSI. The factor structure identified through EFA was subsequently supported by CFA, while the reliability, convergent validity, discriminant validity, and criterion-related validity findings provided complementary evidence for the measurement quality of the instrument. Collectively, these findings suggest that the scale may provide a multidimensional approach to examining healthcare workers' beliefs and attitudes toward HAIs.

The five-factor structure demonstrated acceptable model-data fit in the CFA. The CMIN/DF value of 2.12, RMSEA of 0.07, CFI of 0.93, IFI of 0.93, and TLI of 0.92 indicate that the proposed model provides an acceptable representation of the observed data. These findings are particularly important because the factor structure was not evaluated solely on the basis of exploratory results, rather, the structure identified in one subsample was subsequently tested in an independent subsample. This approach strengthens the evidence that the identified dimensional structure is not merely a product of sample-specific characteristics.

The standardized factor loadings ranged from 0.70 to 0.95, indicating substantial associations between the observed items and their corresponding latent factors. The relatively high loadings across all dimensions also suggest that the items capture meaningful aspects of the constructs they were designed to represent. The five factors collectively explained 77.2% of the total variance, providing further support for the explanatory capacity of the proposed multidimensional structure.

The factor composition is also theoretically consistent with major domains of HAI prevention. Hand hygiene, isolation precautions, safe invasive procedures, prevention of infections associated with mechanical ventilation, and surgical site infection prevention represent interconnected but distinguishable components of infection prevention and patient safety (Anderson et al., 2014; Allegranzi et al., 2016; Alay, 2019; Erden et al., 2024). Accordingly, the emergence of these domains as separate dimensions suggests that beliefs and attitudes toward HAIs may not constitute a single, homogeneous construct. Instead, healthcare workers may hold different perceptions depending on the clinical process and infection risk involved. The distinction between Hand Hygiene and Isolation is particularly meaningful. Although both practices aim to interrupt the transmission of microorganisms, they involve different behavioral and organizational requirements. Hand hygiene primarily concerns adherence to appropriate hand decontamination practices, whereas isolation involves the implementation of transmission-based precautions and the management of patient-care environments. Treating these areas as separate dimensions may therefore allow healthcare organizations to identify more specific attitudinal gaps and tailor educational interventions accordingly.

The identification of Invasive Procedures, VAE, and SSI as distinct factors reflects the diversity of clinical processes through which infection risks emerge. Invasive procedures can compromise natural protective barriers and create opportunities for microbial transmission, whereas VAE prevention is closely associated with the care of mechanically ventilated patients. SSI prevention, in turn, requires coordinated perioperative practices extending from preoperative preparation to postoperative care. Evidence-based recommendations have emphasized the importance of systematic approaches to SSI prevention, including appropriate perioperative and postoperative practices (Anderson et al., 2014; Allegranzi et al., 2016). In intensive care settings, nursing practices and adherence to infection prevention procedures are likewise important components of reducing risks associated with mechanical ventilation (Erden et al., 2024).

The overall Cronbach's alpha coefficient of 0.890 indicates a high level of internal consistency for the scale. In addition, the factor-specific CR values ranged from 0.88 to 0.97, suggesting that the items within each dimension demonstrate substantial consistency in measuring their respective latent construct. These findings are consistent with the strong standardized factor loadings observed in the

CFA. Evidence for convergent validity was also favorable. Standardized factor loadings were at or above 0.70, while CR values exceeded the commonly accepted threshold of 0.70 and AVE values ranged from 0.61 to 0.76. These results indicate that the latent dimensions account for a substantial proportion of the variance in their associated items. The findings therefore provide convergent evidence that the items within each dimension reflect a common underlying construct.

It is noteworthy that the reliability coefficients were relatively high across the dimensions. Although high internal consistency is desirable, excessively high coefficients may sometimes indicate item redundancy. In the present study, however, the combination of strong factor loadings, satisfactory AVE values, and the multidimensional factor structure suggests that the high reliability estimates are more likely to reflect coherent measurement than simple duplication of item content. Nevertheless, future studies should further investigate the scale at the item level and examine whether shorter forms could retain adequate psychometric performance without compromising conceptual coverage.

The findings also provided evidence that the five dimensions are empirically distinguishable. The MSV and ASV values for all dimensions were lower than their respective AVE values, indicating that each factor shares more variance with its own indicators than with the other dimensions. In addition, the correlations among the latent factors remained below the square root of the AVE values, providing further support for discriminant validity.

The inter-factor correlations are particularly informative in interpreting the multidimensional structure. The strongest association was observed between Isolation and Hand Hygiene ($r = 0.61$). This relationship is theoretically plausible because both dimensions contribute to interrupting the transmission of infectious agents. Nevertheless, the magnitude of the association was not sufficiently high to suggest that the two dimensions represent the same construct. This finding supports retaining them as separate dimensions while acknowledging their conceptual relationship. A similar pattern was observed between VAE and SSI ($r = 0.56$). Although both dimensions concern specific categories of healthcare-associated infection risk, they are associated with different clinical processes and preventive practices. Their moderate correlation therefore supports the interpretation that the scale captures related but distinguishable areas of infection control.

Criterion-related validity was examined through associations between the newly developed scale and established measures addressing risk management and interprofessional team collaboration. The total score of the Healthcare-Associated Infection Beliefs and Attitudes Scale demonstrated a strong positive correlation with the Risk Management Scale for Health and Fitness Facilities ($r = 0.75$, $p < 0.001$) and a moderate positive correlation with the Interprofessional Team Collaboration Assessment Scale ($r = 0.46$, $p < 0.001$).

The relatively strong association with risk management is theoretically consistent with the nature of HAI prevention. HAIs are not solely the consequence of individual clinical practices; their prevention requires systematic identification of risks, implementation of preventive measures, monitoring, and organizational learning. Surveillance has consequently been emphasized as an important component of HAI prevention and control (Sönmez et al., 2021). The strong relationship observed in the present study suggests that more favorable beliefs and attitudes toward HAI prevention may coexist with stronger perceptions or practices related to organizational risk management.

The moderate association with interprofessional team collaboration provides complementary evidence. Infection prevention involves multiple professional groups and requires effective communication, coordination, and shared responsibility. Therefore, the relationship between the developed scale and team collaboration is conceptually plausible. At the same time, the correlation was not so high as to indicate that the two instruments assess the same construct. This pattern is desirable for criterion-related validity because the measures are theoretically related while remaining conceptually distinct.

Previous studies have predominantly focused on healthcare workers' knowledge, attitudes, or practices regarding HAIs and infection prevention. Aylaz et al. (2018), for example, examined nurses' knowledge regarding hospital-acquired infections, while Bulut et al. (2022) investigated nurses' knowledge and attitudes concerning nosocomial infections and their prevention. Other studies have addressed specific infection control practices, including prevention of HAIs in neonatal intensive care units and intensive care settings (Alay, 2019; Erden et al., 2024). These studies provide important evidence regarding healthcare workers' knowledge and infection prevention practices; however, they do not provide a multidimensional measurement framework specifically designed to examine beliefs and attitudes across distinct clinical infection-risk domains. The present scale addresses this gap by organizing HAI-related beliefs and attitudes around five clinically meaningful areas: invasive procedures, isolation, hand hygiene, VAE, and SSI. This structure may provide greater diagnostic value than a general measure because it allows researchers and healthcare organizations to identify domain-specific patterns. For example, a healthcare worker may demonstrate favorable attitudes toward hand hygiene while holding less favorable beliefs regarding invasive procedures or isolation precautions. A global score could conceal such differences, whereas a multidimensional instrument can make them visible.

This distinction also has implications for infection control education. Previous research has emphasized the importance of healthcare workers' knowledge and practices in HAI prevention (Aylaz et al., 2018; Bulut et al., 2022). However, educational interventions that address all infection control topics uniformly may not adequately respond to domain-specific needs. The scale developed in this study may therefore be used to identify areas requiring greater educational attention and to support the development of more targeted training programs.

Implications for Healthcare Management and Patient Safety

The findings have implications beyond scale development. HAIs represent an important patient safety and healthcare quality concern, and their prevention requires coordination between individual healthcare workers, clinical teams, infection control committees, and organizational management. The presence of legal and malpractice cases associated with HAIs further demonstrates that infection prevention should be considered within a broader framework of patient safety and organizational risk management (Demirci, 2025; Arimbi, 2025). From a healthcare management perspective, the scale may be particularly useful as a diagnostic instrument. Infection control committees and healthcare administrators can use dimension-specific scores to identify areas in which healthcare workers' beliefs and attitudes require strengthening. Such information could inform targeted educational programs, risk management strategies, quality improvement initiatives, and patient safety interventions.

The scale may also provide a baseline for evaluating educational interventions. Rather than relying solely on knowledge tests or satisfaction measures, researchers may examine whether an intervention is associated with changes in healthcare workers' beliefs and attitudes across specific infection control domains. This potential application is particularly relevant to institutions seeking to integrate infection prevention with continuous quality improvement and organizational risk management. However, the scale should not be interpreted as a direct measure of actual infection prevention behavior or institutional infection rates. Beliefs and attitudes represent important psychological and organizational dimensions of infection prevention, but favorable responses do not necessarily guarantee adherence to recommended practices. Accordingly, the instrument is best considered as one component of a broader assessment framework that may be complemented by observational measures, surveillance indicators, and other objective quality measures.

Limitations

This study has some limitations. The fact that the research was conducted using data collected from healthcare workers in Kırşehir Province may limit the generalizability of the findings to workers in different geographic regions and under different healthcare delivery models. Studies conducted in different types of institutions, among different occupational groups, and within different healthcare systems will contribute to assessing the generalizability of the scale. The fact that scale items are based on self-reports by healthcare workers may lead to potential biases such as social desirability and common-method bias. Although the results of Harman's one-factor test in this study which showed that a single factor explained 27.73% of the variance suggest that common-method bias is below the critical level, self-report-based measures should not be considered entirely objective indicators of behavior.

Although the construct validity of the study was supported by EFA and CFA, the scale needs to be revalidated in different samples and at different healthcare institutions. Validation studies conducted among different occupational groups and in different clinical settings are important for assessing the stability of the five-factor structure. Furthermore, in future research, linking scale scores to objective outcomes such as observed infection control practices, hand hygiene compliance, or institutional infection control indicators could provide stronger evidence regarding the scale's external validity.

This study presents an initial assessment of the scale's psychometric properties. Future research into the scale's sensitivity, test-retest reliability, and measurement invariance across different groups will expand the scope of the tool's application. Examining changes in scale scores before and after educational or infection control interventions will allow for an assessment of the scale's ability to detect changes in healthcare workers' beliefs and attitudes.

CONCLUSION

This study developed and psychometrically evaluated the Healthcare-Associated Infection Beliefs and Attitudes Scale, which addresses a significant gap in the assessment of healthcare workers' beliefs and attitudes toward the prevention and control of HAI. The findings supported a five-factor, 35-item structure encompassing invasive procedures, isolation, hand hygiene, ventilator-associated events, and surgical site infections. The factor structure identified through exploratory factor analysis was confirmed by confirmatory factor analysis, and the model demonstrated acceptable goodness-of-fit indices. Additionally, findings regarding convergent and discriminant validity provided evidence that the scale adequately represents its intended constructs. Rather than assessing attitudes toward healthcare-associated infections as a single, overarching construct, the scale allows for the evaluation of healthcare workers' beliefs and attitudes across different infection-related risk areas. This framework can facilitate the identification of specific areas where healthcare workers may require additional training, behavioral support, or organizational interventions.

This scale can serve as a practical assessment tool for healthcare organizations seeking to identify areas requiring improvement in infection prevention and control practices. Its use can support the development and evaluation of targeted training programs, risk management strategies, and patient safety initiatives. The scale may contribute to future research examining the relationships between healthcare-associated infection beliefs and attitudes, teamwork, risk management, organizational practices, and infection prevention outcomes.

The Healthcare-Associated Infection Beliefs and Attitudes Scale provides a multidimensional and psychometrically validated tool for assessing healthcare workers' beliefs and attitudes regarding key risk areas for healthcare-associated infections. Future studies involving larger and more diverse samples, different healthcare settings, and longitudinal or intervention-based designs are needed to further establish the scale's measurement stability, predictive validity, and applicability across various professional and organizational contexts.

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