Research Square

Preprints are preliminary reports that have not undergone peer review.
They should not be considered conclusive, used to inform clinical practice,
or referenced by the media as validated information.

Nurses' Perception of a Healthy Work Environment — Psychometric Validation Study

Anna Antoszewska
University of Warmia and Mazury in Olsztyn
Beata Penar-Zadarko
University of Rzeszów
Beata Dobrowolska
Medical University of Lublin
Adrianna Rożniecka
University of Warmia and Mazury in Olsztyn
Dorota Agnieszka Ozga
University of Rzeszów
Anna Szypulska
University of Warmia and Mazury in Olsztyn
Iwona Wołosewicz
University of Warmia and Mazury in Olsztyn
Aleksandra Gutysz-Wojnicka
a.gut.wojnicka@uwm.edu.pl

University of Warmia and Mazury in Olsztyn

Research Article

Keywords: healthy work environment, nursing work environment, psychometric validation, cross-cultural adaptation, hospital nursing, staffing, communication, leadership, teamwork climate

Posted Date: April 22nd, 2026

DOI: https://doi.org/10.21203/rs.3.rs-9003556/v1

License: This work is licensed under a Creative Commons Attribution 4.0 International License. Read Full License

Additional Declarations: No competing interests reported.

Abstract

Aim

To adapt culturally and validate the Polish version of the Healthy Work Environment Assessment Tool for use among hospital nurses working in inpatient wards, and to assess nurses' perception of the work environment in medical and surgical wards.

Design

Two-phase cross-cultural adaptation and psychometric validation study.

Methods

A cross-sectional, multicenter validation study was conducted in eight hospitals in 2024–2025. A convenience sample of nurses providing adult inpatient care completed the Healthy Work Environment Assessment Tool and the measure assessing teamwork and safety climate. Cultural adaptation was conducted in accordance with established translation and expert review procedures. A psychometric evaluation included analyses of internal structure, internal consistency, temporal stability, and convergent validity.

Results

The tool demonstrated good measurement performance, including high internal consistency, satisfactory temporal stability, and convergent validity, as indicated by positive relationships with related constructs. Nurses reported a low-to-moderate level of a healthy work environment, with staffing rated as the weakest area, whereas decision-making and communication were rated higher.

Conclusion

The Polish version of Healthy Work Environment Assessment Tool is suitable for assessing key components of a healthy work environment among hospital nurses in medical and surgical wards and may support monitoring and improvement initiatives.

Implications

Routine assessment can help leaders identify priority gaps, particularly staffing, and guide organizational actions that support nursing retention, quality of care, and patient safety.

Impact

The validated Polish version of the tool enables systematic assessment of nurses' perceptions of a healthy work environment in hospital wards. It can help hospitals identify gaps and guide improvement efforts, particularly in staffing, to support safe, high-quality nursing care.

Reporting Method

The study adhered to the Strengthening the Reporting of Observational Studies in Epidemiology reporting checklist for cross-sectional studies.

Introduction

The healthcare system is facing increasing challenges that directly impact the daily work of medical personnel. The most important include the growing demand for healthcare services, the shortage of nursing staff [1] the aging patient

population, and the dynamic development of technology, which, combined with heavy workloads, contribute to the increasing phenomenon of burnout [2] and highlight the importance of the quality of the work environment for staff well-being [3] and patient safety [4].

Background

The work environment is a complex phenomenon that has been defined and conceptualized in the extensive literature on the subject. From an organizational perspective, it refers to the culture and climate of an institution, from a psychological perspective, it refers to perceived support, satisfaction, and interpersonal relationships and from a practical perspective, it refers to material conditions, workload, and available resources [5]. Researchers suggest that it can be defined in three ways: (a) by emphasizing structural and organizational factors; (b) by emphasizing the psychosocial and relational aspects of work; and (c) by combining both dimensions into a coherent multidimensional framework [6]. The work environment includes organizational elements [7] as well as interpersonal [8] and individual [9] factors that may facilitate or hinder the maintenance of high-quality care. Many researchers emphasize that the work environment of medical staff is crucial for the quality of care, patient safety and employee well-being [10].

The hospital care environment should provide healthcare workers with a safe, supportive work environment that promotes their professional well-being, enables effective task performance, and fosters high-quality patient care. Meta-analytic evidence suggests that negative work environments are associated with poorer patient outcomes [11]. Several studies have documented that hospitals with a better work environment have lower mortality rates [12] and fewer hospital readmissions [13]. Research indicates that investing in improving healthcare workers' working conditions can significantly reduce patient mortality [14], improve patient outcomes, and enhance the quality of care [15]. A poor assessment of the work environment also contributes to the increased frequency of omissions in required nursing care. Research results show a negative correlation between the rationing of nursing care and the assessment of the work environment [16]. This means that the lower the standards are met, the more often nursing care is omitted, which is directly related to poorer quality of care, more frequent complications [11] and mortality [17].

A healthy work environment is also undoubtedly linked to nursing outcomes. The work environment is a key factor influencing nurses' decisions to remain in the profession, and its quality directly determines the level of retention in this professional group [18], burnout [19], and job satisfaction [20]. Research results clearly indicate that investing in improving the work environment for nurses is fundamental to the stability and quality of the healthcare system, as creating such an environment not only attracts and retains competent healthcare workers [21], but also strengthens the loyalty and satisfaction of nursing staff [22]. Elements such as communication, collaboration, and appropriate staffing significantly determine the quality of care provided to patients and their families [23].

Clinical leaders emphasize that ensuring high-quality care requires a focus on team effectiveness [24] which, in turn, requires the use of reliable and valid tools for a comprehensive assessment of organizational climate. Due to the multidimensional nature of this concept, numerous tools have been developed to assess it. A systematic literature review [25] identified 37 instruments assessing the hospital work environment developed since the 1980s. These included both nursing-specific and multiprofessional instruments addressing organizational culture, psychological climate, teamwork, and socio-organizational conditions. Content analysis revealed a wide variety of approaches, encompassing 48 distinct components that contribute to the construct of a healthy work environment. A positive work environment in healthcare is understood as one that fosters excellence and sound practice, protects the health, safety, and well-being of staff, supports high-quality patient care, and enhances the motivation, productivity, and effectiveness of teams and organizations.

Standards for a healthy work environment in intensive care units (Healthy Work Environments (HWE) as defined by the American Association of Critical-Care Nurses (AACN) [26] include six key elements: skilled communication, true collaboration, effective decision-making, appropriate staffing, meaningful recognition, and authentic leadership. To assess

the degree of their implementation, AACN developed the online Work Environment Assessment Tool in 2009. The Healthy Work Environment Assessment Tool (HWEAT) was designed to both establish baseline status and monitor progress of hospital units in implementing and maintaining healthy work environment standards. This tool has been validated in the United States [26]. The Healthy Work Environment Assessment Tool was used to assess the work environment in intensive care units in five European countries, including Poland, as part of the Erasmus+ project (Strategic Partnerships, Key Action 2, sector KA202) entitled “Improving Working Environments for Nurses in the Critical-Care Unit (HWE4CCN)”, implemented between 2019 and 2022 [27]. However, the evaluation of the psychometric properties of the Polish version of HWEAT during the Erasmus project was partial and based on data obtained from nurses working in intensive care units. This justifies further evaluation of the psychometric properties of the Polish version of the HWEAT in other nurse groups.

The study

3.1 Purpose

The aim of this study was to validate the Polish version of the Healthy Work Environment Assessment Tool (HWEAT) questionnaire among nurses working in hospital in medical and surgical wards. The study had the following main objectives: (a) to assess the reliability and validity of the Polish version of HWEAT, (b) to assess the work environment of nurses in surgical and non-surgical wards.

Methods

4.1 Study design

A cross-sectional, multi-center validation study was conducted in 2024–2025.

4.2 Participants

Convenience sampling was used in the study. Inclusion criteria included active employment as a nurse in a hospital, providing direct patient care in a surgical or non-surgical ward for adults, consenting to participate in the study, and not holding a management position. Exclusion from participation included employment in an intensive care unit and emergency department or a lack of consent to participate in the study. Of the 359 nurses invited, 73.6% agreed to participate. A total of 264 nurses participated in both phases – the test and retest.

4.3 Research tools

The following tools were used in the study:

Healthy Work Environment Assessment Tool questionnaire

The HWEAT developed by the American Association of Critical-Care Nurses, is used to assess key elements of a healthy environment. The questionnaire contains 16 items assigned to six key elements (standards) of a healthy work environment: (1) skilled communication, (2) true collaboration, (3) effective decision-making, (4) appropriate staffing, (5) meaningful recognition, and (6) authentic leadership. Responses are provided on a four-point Likert scale, ranging from “strongly agree” (4 points) to “strongly disagree” (1 point). The results of the healthy work environment assessment were analyzed collectively and at the level of individual standards. As the overall score and the score for each specific standard increase, the work environment is perceived as being healthier. The HWEAT questionnaire has been used in numerous studies conducted in hospital settings, covering various units and nursing populations [27]. This tool has been formally validated in the United States, where high internal consistency was demonstrated (Cronbach’s $\alpha = 0.77$; range 0.77–0.81), and its psychometric validity was confirmed [26]. The AACN granted permission to use the Polish version of the HWEAT questionnaire for research purposes.

Safety Attitudes and Behaviors Questionnaire (BePoZa)

The Teamwork and Safety Climate (KPZiB) version of the Safety Attitudes and Behaviors Questionnaire (BePoZa) [28] consists of 27 items. Questions 1–14 assess the teamwork climate, while questions 15–27 assess the safety climate. For statements with a positive construct, a five-point Likert scale was used: 1 – strongly disagree, 2 – somewhat disagree, 3 – neither agree nor disagree, 4 – somewhat agree, 5 – strongly agree. For negatively formulated statements (questions 2, 6, 18, 23, 24), the scoring was reversed: 1 and 2 were changed to 5 and 4, respectively. A higher final score indicates a higher assessment of the teamwork and safety climate.

Hospital Ethical Climate Survey (HECS-Pol) questionnaire

The Polish version of the Hospital Ethical Climate Survey (HECS-Pol) comprises 21 items across five subscales: relationships with colleagues, patients, management, hospital, and doctors. Responses are provided on a five-point Likert scale (1–5), with higher scores indicating a more positive assessment of the ethical climate. The instrument is characterized by high reliability (Cronbach's α = 0.93) and satisfactory test-retest stability [29].

Sociodemographic information was collected, including age, gender,

number of workplaces, number of working hours per month, and work system (single shift/equivalent).

4.4 Cultural adaptation procedure

The cultural adaptation procedure of the HWEAT questionnaire was carried out in accordance with the guidelines of the International Testing Commission. Two English translators independently prepared the Polish version of the questionnaire items. The resulting translations were analyzed by a team of experts, including specialists in nursing and research methodology, and then a working Polish version of the tool was developed. In the next stage, a back-translation into English was performed by an independent translator. The analysis of the back-translation's compliance with the original revealed no significant discrepancies, and none of the items required modification. The final Polish version of the questionnaire was administered to a pilot sample of 30 nurses. In order to assess the content validity of the scale (content validity), an Item-Level Content Validity Index (I-CVI) was determined, with values ranging from 0 to 1 (higher values indicate better content validity) [30]. The assessment was conducted in a group of 10 nurses, and the obtained I-CVI index value was 0.92. This value exceeds the generally accepted threshold of 0.78, confirming the tool's high content validity and indicating a high degree of agreement among the experts.

4.5 Data collection procedures

The study was conducted in eight general hospitals, after obtaining consent from the facility directors. Nurses meeting the inclusion criteria were given paper questionnaires in sealed envelopes. After completion, these were returned to their immediate supervisors. Before data collection began, participants were briefed on the study's objectives and procedures and informed of the voluntary and anonymous nature of their participation. A statement at the beginning of the questionnaire indicated that completing the survey constituted informed consent to participate in the study. Participants were informed that they could withdraw at any stage without providing a reason and that their data would be kept confidential. Throughout the procedure, participants were given the opportunity to ask questions and obtain clarifications, and data collection was conducted without pressure in an environment conducive to free and reliable responses. Of the 359 nurses invited, 73.6% accepted the invitation to participate. A total of 264 nurses participated in both stages – the test and the retest.

4.6 Data analysis

Statistical analyses were performed using the Statistica TIBCO 13.3 package and IBM SPSS Statistics 25 and IBM SPSS AMOS 25 software. Descriptive statistics were used to characterize the nurses' work environment, including frequencies (N), percentages (%), means (x), standard deviations (SD), confidence intervals (CI 95%), and measures of skewness and

kurtosis. Content validity was assessed by determining the Item-Level Content Validity Index (I-CVI). The acceptable I-CVI value was 0.78 or higher [30]. A two-stage approach was used to assess the internal structure of the HWEAT-PL. First, exploratory factor analysis (EFA) was conducted separately for the "hospital-level" and "ward-level" sections to verify whether the empirical data supported the assumed six-factor structure of the instrument. The adequacy of the data for factor analysis was assessed using the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test of sphericity. Next, confirmatory factor analysis (CFA) was performed for the six-factor model in both sections. Model fit was assessed using the χ^2 statistic and the χ^2/df index, as well as the fit indices: RMSEA (with 90% confidence intervals and PCLOSE), CFI, and SRMR. Additionally, the GFI and AGFI indices were reported as auxiliary measures of model fit. Cronbach's alpha coefficient and the item-total correlation matrix were analyzed to assess the consistency of the scale items with the overall score. The test-retest stability of the HWEAT-PL tool was assessed at a three-week interval. Convergent validity was verified by analyzing the correlations of HWEAT-PL scores with the scores on the Safety Attitudes and Behaviors Questionnaire (BePoZa) and discriminant validity was verified by analyzing correlations of HWEAT-PL and the Hospital Ethical Climate Scale (HECS-Pol). A $p < 0.05$ was considered statistically significant. Relationships between quantitative variables were assessed using the Pearson correlation coefficient (r). The strength of the relationship was interpreted based on the absolute value of the coefficient, according to Evans's criteria: $|r|<0.20$ – very weak, 0.20–0.39 – weak, 0.40–0.59 – moderate, 0.60–0.79 – strong, ≥ 0.80 – very strong. Additionally, the relationship between sociodemographic variables and HWEAT dimensions was analyzed.

4.7 Ethical procedures

The research protocol was approved by the Warmia and Mazury University's Research Ethics Committee in Olsztyn (approval number: 19/2023). The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was received from the nurses after they were given information about the purpose of the study. Participation in the study was entirely voluntary. Participants had the right to withdraw at any stage by refusing to complete or return the questionnaire. During data collection, participants were given the opportunity to ask questions and seek clarification regarding the research procedure. To ensure confidentiality and data protection, all responses were anonymized using coded questionnaires, and the data were securely stored in a manner accessible only to the research team.

Results

Participants

Two hundred and sixty-four nurses participated in both phases of the study (test and retest). The mean age at testing was 40.52 ± 12.96 years (Me = 41). Most of the nurses worked 100–180 hours per month (71.97%) in 12-hour day, night shifts system (77.65%); the majority had higher education with a specialization (47.35%) and were employed in surgical wards (62.88%). Details are presented in Table 1.

Table 1
Characteristics of Participants

Variables	Test n = 264	
	n	%
Gender		
Female	253	95.83%
Male	11	4.17%
Age	40.52 ± 12.96, Me = 41	
Number of workplaces	1.29 ± 0.54, Me = 1	
Number of working hours per month		
Below 100 hours	2	0.76%
100–180 hours	190	71.97%
181–230 hours	60	22.73%
231–300 hours	11	4.17%
Over 300	1	0.38%
Number of working hours at the workplace		
Below 100 hours	4	1.52%
100–180 hours	247	93.56%
181–230 hours	12	4.55%
231–300 hours	1	0.38%
Work system		0.00%
Single-shift/ 8-hour day shift	51	19.32%
12-hour day, night shifts	205	77.65%
12-hour day shifts	8	3.03%
Education		
Medium	24	9.09%
Higher	110	41.67%
Secondary school with specialization	5	1.89%
Higher education with specialization	125	47.35%
Seniority		
Below 6 months	1	0.38%
6–11 months	42	15.91%
Me – median		
Analysis of the internal structure of HWEAT		
Exploratory factor analysis (EFA)		

Variables	Test n = 264	
	n	%
1–2 years	34	12.88%
3–7 years	46	17.42%
8–12 years	31	11.74%
13–20 years	41	15.53%
Over 20 years	69	26.14%
Ward		
Medical ward	98	37.12%
Surgical ward	166	62.88%
Me – median		
Analysis of the internal structure of HWEAT		
Exploratory factor analysis (EFA)		

Exploratory factor analysis was performed on the collected data. The adequacy of the data for factor analysis was confirmed based on the Kaiser–Meyer–Olkin measure (KMO = 0.89) and Bartlett's test of sphericity (χ^2=2968.68; $p < 0.001$) for the "hospital-level" part, and KMO = 0.91 and Bartlett's test (χ^2=3215.36; $p < 0.001$), respectively for the "ward-level" part.

Preliminary analysis of the correlation matrix revealed numerous statistically significant correlations ($p < 0.05$) between items, indicating the existence of common dimensions measured by the tool. For the ""hospital-level" section, correlations ranged from r = 0.17 to 0.74, while for the "ward-level" section, they ranged from r = 0.15 to 0.77. In accordance with the study's objective, EFA was used to verify whether the six-factor structure of the tool described in the original study is comparable in the Polish nursing population. The factors were defined as: (1) skilled communication, (2) true collaboration, (3) effective decision-making, (4) appropriate staffing, (5) meaningful recognition, and (6) authentic leadership, with the designations MP ("hospital-level") and O ("ward-level"). The analysis yielded factor loadings of at least 0.40 for the items within the assigned factors.

Correlations between HWEAT factors in the in the "hospital-level" section were statistically significant and positive ($p < 0.05$) and mostly moderate (r = 0.33–0.64). Similarly, in the in the "ward-level" section, interfactor correlations were statistically significant and positive ($p < 0.05$) and mostly moderate (r = 0.33–0.70). Details are presented in Table 2.

Confirmatory factor analysis (CFA)

A CFA was conducted to assess the fit of the six-factor theoretical model. For the "hospital-level" section, the chi-square test was statistically significant (χ^2=345.02; $p < 0.001$), and the relative index $\chi^2/df = 3.80$ indicated an acceptable fit. For the "ward-level" section, the chi-square test was also significant (χ^2=359.00; $p < 0.001$), and $\chi^2/df = 4.03$ also indicated an acceptable fit. It should be emphasized that the chi-square test is sensitive to sample size and model complexity.

In the "hospital-level" section, RMSEA = 0.078 (90% CI: 0.070–0.087) and SRMR = 0.075 were obtained, which indicates an acceptable fit. The CFI = 0.912 suggests an acceptable fit. At the same time, the PCLOSE index value of 0.001 does not support the "close fit hypothesis" (RMSEA ≤ 0.05). The GFI = 0.650 and AGFI = 0.555 were low and indicate poorer fit in these measures. In the "ward-level" section, RMSEA = 0.081 (90% CI: 0.072–0.088) and SRMR = 0.062 were obtained, indicating acceptable fit. The CFI = 0.914 also suggests an acceptable fit. As above, PCLOSE = 0.001 does not support the "close fit hypothesis". The GFI and AGFI indices were low (0.633 and 0.534, respectively). In summary, the six-factor model

was partially confirmed, and the fit to the data was acceptable to moderate based on RMSEA, CFI, and SRMR, with low GFI/AGFI values and without confirmation of the “close fit hypothesis” in the PCLOSE test.

Table 2
Correlation analysis between HWEAT factors

Variable	x	SD	MP1	MP2	MP3	MP4	MP5	MP6	O1	O2	O3	O4	O5	O6
MP1	2.86	0.57	1	0.56	0.55	0.33	0.45	0.46						
MP2	2.58	0.59	0.56	1	0.54	0.41	0.45	0.47						
MP3	2.88	0.48	0.55	0.54	1	0.44	0.54	0.55						
MP4	2.37	0.62	0.33	0.41	0.44	1	0.53	0.52						
MP5	2.67	0.55	0.45	0.45	0.54	0.53	1	0.64						
MP6	2.8	0.53	0.46	0.47	0.55	0.52	0.64	1						
O1	2.95	0.6							1					
O2	2.63	0.62							0.57	1				
O3	2.96	0.49							0.57	0.54	1			
O4	2.43	0.64							0.33	0.39	0.43	1		
O5	2.77	0.59							0.48	0.46	0.55	0.54	1	
O6	2.84	0.57							0.52	0.5	0.57	0.49	0.7	1
MP - “hospital-level” O – “ward-level”														
Validity and reliability of the HWEAT test														

Factors were labeled according to the original version of the HWEAT instrument. Furthermore, internal consistency and a test-retest approach were used to assess the HWEAT reliability. Specifically, the retest approach aimed to assess the instrument’s stability and to determine the extent to which the results of the work environment tests were independent of participant-level random factors, such as negative personal experiences or data-collection procedures. Analysis of the internal structure of the item-total correlation matrix revealed moderate correlations between the items and the total.

Internal reliability analysis

Cronbach’s alpha was 0.895 for the “hospital-level” section and 0.900 for the “ward-level” section. In the retest, alpha values were even higher (0.915 and 0.913, respectively), confirming the instrument’s internal stability over time. Item-total correlations for individual statements ranged from 0.34 to 0.71, and the alpha values after item deletion were lower than the total alpha, indicating that none of the questions compromised the instrument’s reliability. All items contribute significantly to the measurement of the construct under study. Detailed results are presented in Tables 3 and 4.

Table 3
Validity and reliability of HWEAT factors for the test

Test									
Hospital-level	x	SD	Item-total correlation	Post-item alpha	Ward-level	x	SD	Item-total correlation	Post-item
p.1	2.86	0.69	0.477	0.890	p.1	2.96	0.71	0.500	0.895
p.2	2.88	0.71	0.594	0.886	p.2	2.94	0.75	0.618	0.891
p.3	2.78	0.67	0.609	0.886	p.3	2.92	0.70	0.631	0.890
p.4	2.44	0.78	0.512	0.890	p.4	2.47	0.80	0.523	0.894
p.5	2.44	0.74	0.540	0.888	p.5	2.46	0.76	0.535	0.894
p.6	2.88	0.70	0.603	0.886	p.6	2.96	0.70	0.658	0.889
p.7	2.86	0.61	0.615	0.886	p.7	2.89	0.63	0.591	0.892
p.8	2.77	0.69	0.556	0.888	p.8	2.85	0.68	0.528	0.894
p.9	2.94	0.64	0.503	0.889	p.9	3.08	0.65	0.519	0.894
p.10	2.21	0.75	0.375	0.895	p.10	2.28	0.79	0.344	0.901
p.11	2.41	0.69	0.521	0.889	p.11	2.42	0.68	0.519	0.894
p.12	2.42	0.76	0.604	0.886	p.12	2.55	0.83	0.641	0.890
p.13	2.86	0.59	0.530	0.889	p.13	2.97	0.58	0.568	0.893
p.14	2.76	0.68	0.655	0.884	p.14	2.82	0.72	0.684	0.888
p.15	2.73	0.66	0.647	0.884	p.15	2.80	0.73	0.655	0.889
p.16	2.84	0.65	0.569	0.887	p.16	2.86	0.69	0.575	0.892
Cronbach's alpha 0.895					Cronbach's alpha 0.900				

x — mean; SD — standard deviation; −95% / +95% lower/upper limit of the 95% confidence interval for the mean.

Table 4
Test-retest validity and reliability of HWEAT factors

Retest									
Hospital-level	x	SD	Item-total correlation	Post-item alpha	Ward-level	x	SD	Item-total correlation	Post-item alpha
p.1	2.88	0.65	0.553	0.910	p.1	3.04	0.67	0.593	0.909
p.2	2.89	0.70	0.643	0.907	p.2	2.93	0.72	0.665	0.907
p.3	2.86	0.62	0.641	0.908	p.3	3.01	0.68	0.644	0.907
p.4	2.52	0.75	0.578	0.910	p.4	2.57	0.76	0.600	0.909
p.5	2.51	0.74	0.568	0.910	p.5	2.54	0.76	0.591	0.909
p.6	2.89	0.62	0.603	0.909	p.6	2.96	0.64	0.652	0.907
p.7	2.86	0.63	0.629	0.908	p.7	2.89	0.66	0.612	0.908
p.8	2.78	0.67	0.701	0.906	p.8	2.83	0.69	0.677	0.906
p.9	2.94	0.64	0.625	0.908	p.9	3.03	0.65	0.622	0.908
p.10	2.32	0.78	0.486	0.913	p.10	2.37	0.85	0.437	0.915
p.11	2.49	0.66	0.561	0.910	p.11	2.51	0.68	0.567	0.910
p.12	2.52	0.71	0.612	0.909	p.12	2.64	0.75	0.599	0.909
p.13	2.91	0.56	0.536	0.911	p.13	3.00	0.59	0.505	0.911
p.14	2.80	0.62	0.657	0.907	p.14	2.87	0.66	0.620	0.908
p.15	2.73	0.65	0.708	0.906	p.15	2.83	0.69	0.693	0.906
p.16	2.85	0.64	0.599	0.909	p16	2.92	0.69	0.620	0.908
Cronbach's alpha 0.915					Cronbach's alpha 0.913				

x — mean; SD — standard deviation; −95% / +95% lower/upper limit of the 95% confidence interval for the mean.

HWEAT test stability analysis

After 3 weeks (retest), the instrument was re-administered to assess temporal stability. Pearson correlation coefficients and Cronbach's alpha coefficients values for the "hospital-level" (MP) and "ward level" (O) question obtained at test and retest are presented in Table 5. Pearson correlation coefficients for the "hospital-level" (MP) questions and for each factor were statistically significant, ranging from r = 0.657 (MP. Effective decision-making) to r = 0.481 (MP. Authentic leadership). Pearson correlation coefficients for the "ward-level" (O) for each factor were statistically significant, ranging from r = 0.648 (O. Effective decision-making) to r = 0.491 (O. Appropriate staffing). Detailed results are presented in Table 6.

Table 5
HWEAT Stability analysis

Stability analysis	Test		Retest	
	r	*α*	*r*	*α*
MP. Skilled communication	0.404	0.575	0.529	0.692
MP. True collaboration	0.515	0.740	0.540	0.761
MP. Effective decision-making	0.458	0.771	0.539	0.822
MP Appropriate staffing	0.417	0.588	0.526	0.689
MP. Meaningful recognition	0.479	0.647	0.563	0.720
MP. Authentic leadership	0.603	0.807	0.576	0.792
O. Skilled communication	0.481	0.649	0.551	0.711
O. True collaboration	0.529	0.754	0.530	0.754
O. Effective decision-making	0.465	0.776	0.544	0.826
O. Appropriate staffing	0.423	0.594	0.485	0.653
O. Meaningful recognition	0.491	0.658	0.473	0.642
O. Authentic leadership	0.589	0.799	0.596	0.802
MP - "hospital-level" O – "ward-level"; α – Cronbach's alpha; r - Pearson correlation				

Table 6
Test-retest results of the stability analysis of the HWEAT questionnaire subscales

Test-retest	1 Skilled communication	2 True collaboration	3 Effective decision-making	4 Appropriate staffing	5 Meaningful recognition	6 Authentic leadership
MP. Skilled communication	0.551					
MP. True collaboration		0.606				
MP. Effective decision-making			0.657			
MP Appropriate staffing				0.485		
MP. Meaningful recognition					0.519	
MP. Authentic leadership						0.481
O. Skilled communication	0.545					
O. True collaboration		0.637				
O. Effective decision-making			0.648			
O. Appropriate staffing				0.491		
O. Meaningful recognition					0.562	
O. Authentic leadership						0.524
MP - "hospital-level" O – "ward-level"						

The construct validity of the Polish version of the HWEAT was assessed using Pearson correlations (r) between HWEAT factor scores and scores on two instruments: Safety Attitudes and Behaviors Questionnaire (BePoZa) and the Hospital Ethical Climate Scale (HECS-Pol). In the case of BePoZa, all correlations were positive and statistically significant ($p < 0.001$), and their strength was mostly moderate ($r = 0.297–0.584$), indicating consistency between the HWEAT and a measure addressing related aspects of the work environment. Detailed results are presented in Table 7. In the case of HECS-Pol, all correlations were positive and significant ($p < 0.001$), but their strength was mostly moderate ($r = 0.221–0.481$). Detailed results are presented in Table 8.

Table 7
Pearson r correlation of HWEAT with BePoZa

MP. Skilled communication	**Teamwork climate**	**Safety climate**	**BePoZa**
	0.339	**0.348**	**0.368**
MP. True collaboration	0.298	0.330	0.339
MP. Effective decision-making	0.442	0.505	0.511
MP Appropriate staffing	0.297	0.500	0.431
MP. Meaningful recognition	0.396	0.456	0.461
MP. Authentic leadership	0.514	0.560	0.584
O. Skilled communication	0.434	0.390	0.445
O. True collaboration	0.362	0.364	0.393
O. Effective decision-making	0.509	0.555	0.576
O. Appropriate staffing	0.307	0.499	0.435
O. Meaningful recognition	0.472	0.522	0.539
O. Authentic leadership	0.534	0.553	0.593
MP - "hospital-level"; O – "ward-level"; p < 0.0001			

Table 8
Pearson r correlation of HWEAT with HECS-Pol

MP. Skilled communication	Relationships with colleagues	Relationships with patients	Relations with management	Relations with the hospital	Relationships with doctors	HECS-Pol
	0.227	**0.256**	**0.285**	**0.313**	**0.206**	**0.295**
MP. True collaboration	0.250	0.231	0.264	0.350	0.246	0.311
MP. Effective decision-making	0.345	0.321	0.345	0.393	0.309	0.394
MP Appropriate staffing	0.234	0.221	0.319	0.301	0.224	0.305
MP. Meaningful recognition	0.311	0.301	0.276	0.356	0.305	0.356
MP. Authentic leadership	0.388	0.337	0.408	0.438	0.323	0.437
O. Skilled communication	0.280	0.272	0.338	0.387	0.229	0.345
O. True collaboration	0.321	0.287	0.308	0.410	0.270	0.365
O. Effective decision-making	0.390	0.348	0.402	0.458	0.318	0.439
O. Appropriate staffing	0.238	0.226	0.322	0.316	0.254	0.320
O. Meaningful recognition	0.389	0.369	0.353	0.417	0.331	0.423
O. Authentic leadership	0.412	0.368	0.431	0.481	0.326	0.462
MP - “hospital-level”; O – “ward-level”; $p < 0.0001$						

Descriptive statistics and factors influencing HWEAT levels

The aim of the analysis was to present descriptive statistics for individual HWEAT dimensions and to identify factors differentiating the results. Across the entire sample (n = 264), mean scores ranged from 2.31 to 2.95 (scale 1–4), and medians ranged from 2.50–3.00, indicating a low-to-moderate level of a healthy work environment. The lowest scores were recorded for the “appropriate staffing” dimensions (MP: M = 2.31; O: M = 2.35), while the relatively highest scores were recorded for “effective decision-making” (MP: M = 2.87; O: M = 2.95) and “skilled communication” (MP: M = 2.87; O: M = 2.95). The remaining dimensions were in the middle of the distribution (e.g., “meaningful recognition”: MP: 2.64; O: 2.76; “authentic leadership”: MP: 2.78; O: 2.83; “true collaboration”: MP: 2.55; O: 2.62). The variability of the scores was moderate (SD approximately 0.51–0.63), and the 95% confidence intervals for the means were narrow (approximately ± 0.05–0.06), indicating satisfactory precision of the estimates. The distributions were close to normal, with weak skewness (from approximately − 0.22 to 0.40) and kurtosis close to zero (from approximately − 0.05 to 1.35). In some dimensions, such as “effective decision-making”, slightly higher kurtosis was observed, suggesting a more “peaky” distribution around the central values. A comparison of perspectives indicates slightly higher ratings for “ward-level” than “hospital-level”, although these differences remain small.

Analyses of differentiating factors revealed no influence of gender, age, total monthly work hours, or shift pattern on the levels of individual HWEAT dimensions. However, significant associations were found for characteristics related to career

progression and workload. Employment duration (in months) was associated with the “appropriate staffing” dimension in both the “hospital-level” and “ward-level” perspectives. The number of hours spent in the workplace differentiated scores on “true collaboration” from the “hospital-level” perspective. Education was associated with the level of “skilled communication” in both perspectives. Seniority differentiated “effective decision-making” in the “hospital-level” perspective. Detailed results are presented in Table 9.

Table 9
Descriptive statistics of the HWEAT questionnaire

HWEAT dimensions/ standards	N	x	ME	Min	Max	Q1	Q3	SD	-95%	+ 95%	Skewness	Kurtosis
MP. Skilled communication	264	2.87	3.00	1.00	4.00	2.50	3.00	0.59	0.54	0.64	0.04	0.43
MP. True collaboration	264	2.55	2.33	1.00	4.00	2.00	3.00	0.60	0.55	0.65	0.40	0.73
MP. Effective decision-making	264	2.87	3.00	1.00	4.00	2.75	3.00	0.51	0.47	0.56	-0.17	1.34
MP Appropriate staffing	264	2.31	2.50	1.00	4.00	2.00	2.50	0.60	0.56	0.66	-0.17	-0.02
MP. Meaningful recognition	264	2.64	2.50	1.00	4.00	2.00	3.00	0.58	0.54	0.64	0.10	0.13
MP. Authentic leadership	264	2.78	3.00	1.00	4.00	2.33	3.00	0.56	0.52	0.61	-0.07	0.57
O. Skilled communication	264	2.95	3.00	1.00	4.00	2.50	3.50	0.63	0.58	0.69	-0.08	0.15
O. True collaboration	264	2.62	2.67	1.00	4.00	2.33	3.00	0.62	0.57	0.68	0.24	0.34
O. Effective decision-making	264	2.95	3.00	1.00	4.00	2.75	3.25	0.52	0.47	0.56	-0.22	1.35
O. the appropriate staffing	264	2.35	2.50	1.00	4.00	2.00	3.00	0.62	0.57	0.68	-0.15	-0.05
O. Meaningful recognition	264	2.76	3.00	1.00	4.00	2.50	3.00	0.61	0.56	0.67	0.07	0.18
O. Authentic leadership	264	2.83	3.00	1.00	4.00	2.33	3.00	0.60	0.56	0.66	-0.01	0.24

N — number; x — mean; ME — median; Min/Max — minimum/maximum values; Q1/Q3 — first/third quartile; SD — standard deviation; −95% / +95% lower/upper limit of the 95% confidence interval for the mean; MP — Hospital-level; O — Ward-level. Scale 1–4 (higher = more favorable).

Discussion

The aim of this study was to assess the psychometric properties of the Polish version of the HWEAT and to measure the level of key elements of a healthy work environment among nurses. Although tools assessing related dimensions of organizational climate are available in Poland, including BePoZa (teamwork and safety climate components) [28] and the

Polish version of Practice Environment Scale of the Nursing Work Index (PES-NWI) [31], they do not directly relate to the full set of HWE standards defined by the AACN. Therefore, adaptation and validation of the HWEAT and verification of its reliability and validity in a sample of Polish nurses are important for further research and international comparisons.

Results of the validation process

The Polish version of the HWEAT demonstrated very good psychometric properties. Internal consistency of the entire scale was high: at baseline, α = 0.895 (hospital-level perspective) and α = 0.900 (ward-level perspective), and at retests, α = 0.915 and α = 0.913, respectively. Item-total correlations for all items ranged from moderate to high, and the "post-item alpha" values remained lower than the total α, indicating that no item reduced the scale's reliability. Test-to-retest stability after three weeks was satisfactory for all dimensions and both assessment perspectives. When assessing sample size adequacy, commonly cited item-to-respondent ratios were also considered. Although there is no clear consensus in the literature regarding the minimum required sample size in validation studies, a ratio of at least 1:10 is often recommended [32]. In the current study, 16 questionnaire items were completed by 264 participants, a proportion that significantly exceeded the threshold, thereby confirming that the sample was sufficiently large for reliable psychometric analyses [32]. In the "hospital-level" category, Pearson r coefficients ranged from r = 0.481 (authentic leadership) to r = 0.657 (effective decision-making), and in the "ward-level" category, from r = 0.491 (appropriate staffing) to r = 0.648 (effective decision-making). All correlations were statistically significant. Convergent validity was confirmed by positive, mostly moderate correlations of HWEAT scores with the BePoZa questionnaire ($p < 0.001$), ranging from 0.297 to 0.584, with the strongest associations observed for dimensions related to leadership and decision-making. Furthermore, descriptive statistics suggest low-to-moderate levels of healthy work environment ratings in the study sample, with relatively low scores for "appropriate staffing" and higher scores for "effective decision-making" and "skilled communication," which is consistent with the correlation profile and further supports the scale's theoretical validity. Cronbach's alpha was 0.895 for the entire scale in the "hospital-level" perspective and 0.900 in the "ward-level" perspective. For the subscales (test), the highest α was recorded for "authentic leadership" (0.799) and the lowest for "appropriate staffing" (0.594). For the interpretation of reliability, Cronbach's alpha values ≥ 0.70 were assumed to be acceptable (preferably 0.70–0.90), and values < 0.6 were unacceptable [32]. The results for the entire scale and most subscales met these criteria, confirming the tool's good internal consistency. In the original validation of the HWEAT by Connor et al. (2018), internal consistency was α = 0.77 for the total scale (standard range 0.77–0.81, and 3-week test–retest stability was in the range of 0.50–0.68. In the Japanese adaptation, α = 0.607–0.811 for the domains and ICC = 0.618–0.903 were reported after approximately two weeks, with an acceptable CFA model fit (CFI = 0.918; RMSEA = 0.082) [33]. The GFI and AGFI indices served as supplementary indicators, and their low values suggest a poorer fit in these measures. However, the overall assessment using RMSEA, CFI, and SRMR indicates an acceptable or moderate fit.

To assess the construct validity of the Polish version of HWEAT, two external tools available in Polish that measure related dimensions of the work environment was used, i.e., the Safety Attitudes and Behaviors Questionnaire (BePoZa) and the Hospital Ethical Climate Scale (HECS-Pol). Positive, statistically significant correlations were obtained between all HWEAT dimensions and subscales. BePoZa, mostly of moderate strength, confirming the convergent validity of the instrument. The strongest relationships were found for the standards "authentic leadership" and "effective decision-making", which were clearly associated with both teamwork and safety climate. In the case of HECS-Pol, all correlations were positive, but their strength was mostly weak to moderate, suggesting that the Hospital Ethical Climate Scale measure construct related to the healthy work environment, but not the same. Taken together, these results suggest that healthy work environment standards, as measured by the HWEAT, are consistently related to the concept of the healthy work environment, which supports the good construct validity of the Polish version of the questionnaire.

Healthy Work Environment Assessment

In the current study, the level of a healthy work environment, assessed using the Polish version of the HWEAT, was low to moderate from both the "hospital-level" and "ward-level" perspectives. The mean values of individual standards ranged

from 2.31 to 2.95 points on a scale of 1 to 4, indicating that healthy work environment standards are only partially implemented in the units studied. The lowest-rated area was “appropriate staffing” (M = 2.31 from the “hospital-level” perspective and M = 2.35 from the “ward-level” perspective), while the relatively highest values were obtained in “effective decision-making” (MP: M = 2.87; O: M = 2.95) and “skilled communication” (MP: M = 2.87; O: M = 2.95). This profile of results indicates that nurses should more closely assess the functioning of communication processes and the possibility of participating in decision-making, while also clearly indicating insufficient organizational conditions of work, primarily related to staff shortages and workload.

The results obtained in the study are consistent with the AACN framework, which identifies “appropriate staffing” as one of six key standards for a healthy work environment, and is also directly dependent on systemic and organizational decisions. International studies consistently link staffing shortages and poorer work environments to negative consequences for staff (including burnout and intention to leave) and care outcomes [35]. Relatively higher scores in the areas of “skilled communication” and “effective decision-making” can be interpreted as indicators of stronger team functioning. At the same time, persistently low scores for “appropriate staffing” indicate that staffing shortages may limit the transfer of these resources into daily practice and contribute to the workload [36]. Consequently, actions aimed at organizing and planning resources (including appropriate staffing and adapting the workload to the severity of the patient’s condition) are justified [37], while simultaneously strengthening solutions supporting communication and involving staff in decision-making processes [38].

It is noteworthy that the scores obtained in the “ward-level” perspective were slightly higher than those in the “hospital-level” perspective, which may reflect a stronger sense of team belonging and better interpersonal relationships within the immediate work environment. This phenomenon has also been observed in other studies, where the local nursing teamwork climate was assessed more favorably than the broader hospital organizational context. This may indicate that nurses compensate for systemic deficiencies through informal team support and intra-ward collaboration [39].

The results indicate that general demographic and organizational characteristics (gender, age, number of working hours per month, work system) did not differentiate the evaluations of the work environment, and similar observations are found in other studies [40]. However, variables reflecting the career path and actual workload were significant [41]. These relationships suggest that the perception of a healthy work environment is shaped to a greater extent by work experience, level of competence (education) [42] and work intensity in the workplace, which is particularly evident in staffing, collaboration, communication, and decision-making.

In summary, the results confirm that a healthy work environment for nurses in Polish hospital wards remains a priority that requires systemic intervention. Strengthening structural standards, such as appropriate staffing and meaningful recognition of nurses’ work, seems particularly important. These standards, as demonstrated in international studies, are key determinants of staff well-being, quality of care, and patient safety. Using HWEAT not only enables a reliable diagnosis of these areas but also provides a foundation for monitoring the effects of future corrective actions.

Limitations

This study has several limitations that should be considered when interpreting the results. First, convenience sampling was used, which may limit the sample’s representativeness and the generalizability of the results to the entire population of nurses in Poland. The demographic and professional structure of the study group—though typical of the nursing community—may have further influenced the responses obtained. Second, the geographic scope of the study was limited, which may reflect specific regional organizational and staffing conditions and limit the possibility of extrapolating the results to centers in other regions and facilities with different profiles. Third, the cross-sectional nature of the study does not allow for inferences about cause-and-effect relationships or the assessment of changes over time. The results reflect respondents’ perceptions at a specific point in time and may have been influenced by ongoing organizational or individual factors that were not accounted for.

Conclusions

In Poland, the Healthy Work Environment Assessment Tool (HWEAT) was tested among medical and surgical nursing wards and demonstrated good psychometric properties, including high internal consistency, satisfactory measurement stability, and evidence of convergent validity. The validated Polish version of the HWEAT may be a useful tool for monitoring the quality of nurses' work environments across various types of units and facilities, and for designing studies on the relationships between working conditions and care rationing, burnout, job satisfaction, and patient health outcomes. Moreover, the use of HWEAT in national and international studies enables comparison of the effects of organizational interventions and the formulation of practical recommendations and health policies based on empirical data.

Abbreviations

AACN
the American Association of Critical-Care Nurses
BePoZa
Safety Attitudes and Behaviors Questionnaire
CFA
Confirmatory factor analysis
EFA
Exploratory factor analysis
HECS
Pol-the Hospital Ethical Climate Survey questionnaire
HWE
Healthy Work Environments as defined by the American Association of Critical-Care Nurses
HWEAT
the Healthy Work Environment Assessment Tool
I
CVI-Item-Level Content Validity Index
KMO
Kaiser-Meyer-Olkin
KPZiB
the Teamwork and Safety Climate version of the Safety Attitudes and Behaviors Questionnaire

Declarations

Ethics approval and consent to participate

The research protocol was approved by the Warmia and Mazury University's Research Ethics Committee in Olsztyn (approval number: 19/2023). The study was conducted in accordance with the principles of the Declaration of Helsinki. Written informed consent was received from the nurses after they were given information about the purpose of the study. Participation in the study was entirely voluntary. Participants had the right to withdraw at any stage by refusing to complete or return the questionnaire. During data collection, participants were given the opportunity to ask questions and seek clarification regarding the research procedure. To ensure confidentiality and data protection, all responses were anonymized using coded questionnaires, and the data were securely stored in a manner accessible only to the research team.

Consent for publication - Not applicable. This study did not include patient or public involvement in its design, conduct, or reporting.

Availability of data and materials - The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests - The authors declare that they have no competing interests

Funding - The authors declare no conflicts of interest. This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Authors' contributions - All authors meet the criteria for authorship and have made substantial contributions to the conception and design of the study, critical revision of the manuscript for important intellectual content, and final approval of the version submitted.

AA: Conceptualization, Data Curation, Formal Analysis, Methodology, Investigation, Project Administration, Visualization, Writing – original draft.

BP-Z: Conceptualization, Formal Analysis, Methodology, Investigation.

BD: Conceptualization, Formal Analysis, Methodology, Investigation, Supervision, Validation.

AR: Conceptualization, Methodology, Investigation.

DAO: Conceptualization, Methodology, Investigation.

ASZ: Conceptualization, Methodology, Investigation.

IW: Conceptualization, Methodology, Investigation.

AG-W: Conceptualization, Formal Analysis, Funding Acquisition, Methodology, Project Administration, Resources, Supervision, Validation, Writing – review & editing.

Acknowledgements - Not applicable

References

1. Tamata AT, Mohammadnezhad M. A systematic review study on the factors affecting shortage of nursing workforce in the hospitals. Nurs Open. 2023;10(3):1247–57. https://doi.org/https://doi.org/10.1002/nop2.1434.
2. Li LZ, Yang P, Singer SJ, Pfeffer J, Mathur MB, Shanafelt T. Nurse Burnout and Patient Safety, Satisfaction, and Quality of Care: A Systematic Review and Meta-Analysis. JAMA Netw Open. 2024;7(11):e2443059–2443059. https://doi.org/10.1001/jamanetworkopen.2024.43059.
3. Kohnen D, De Witte H, Schaufeli WB, Dello S, Bruyneel L, Sermeus W. Engaging leadership and nurse well-being: the role of the work environment and work motivation—a cross-sectional study. Hum Resour Health. 2024;22(1):8. https://doi.org/10.1186/s12960-023-00886-6.
4. Aiken LH, Sermeus W, Van den Heede K, Sloane DM, Busse R, McKee M, Bruyneel L, Rafferty AM, Griffiths P, Moreno-Casbas MT. (2012). Patient safety, satisfaction, and quality of hospital care: cross-sectional surveys of nurses and patients in 12 countries in Europe and the United States. *BMJ*, 20:344: e1717. 10.1136/bmj.e1717
5. Maassen SM, Weggelaar Jansen AMJW, Brekelmans G, Vermeulen H, van Oostveen CJ. Psychometric evaluation of instruments measuring the work environment of healthcare professionals in hospitals: a systematic literature review. Int J Qual Health Care. 2020;32(8):545–57. https://doi.org/10.1093/intqhc/mzaa072.
6. Pearson A, Laschinger H, Porritt K, Jordan Z, Tucker D, Long L. Comprehensive systematic review of evidence on developing and sustaining nursing leadership that fosters a healthy work environment in healthcare. Int J Evid Based

Healthc. 2007;5(2):208–53. https://doi.org/https://doi.org/10.1111/j.1479-6988.2007.00065.x.

7. Serewa K, Szpakow A. (2024). Job satisfaction of nurses and the determinants of organizational climate: insights from hospitals in Lubelskie Voivodeship. *Nursing in the 21st Century*, *23*(3(88), 161–167. https://doi.org/10.2478/pielxxiw-2024-0025
8. Ystaas LMK, Nikitara M, Ghobrial S, Latzourakis E, Polychronis G, Constantinou CS. (2023). The Impact of Transformational Leadership in the Nursing Work Environment and Patients' Outcomes: A Systematic Review. *Nursing Reports*, *13*(3), 1271–1290. https://www.mdpi.com/2039-4403/13/3/108
9. Sinskey JL, Chang JM, Lu AC, Pian-Smith MC. Patient Safety and Clinician Well-Being. Anesthesiol Clin. 2023;41(4):739–53. https://doi.org/10.1016/j.anclin.2023.05.003.
10. Wei H, Sewell KA, Woody G, Rose MA. The state of the science of nurse work environments in the United States: A systematic review. Int J Nurs Sci. 2018;5(3):287–300.
11. Lake ET, Sanders J, Duan R, Riman KA, Schoenauer KM, Chen Y. A meta-analysis of the associations between the nurse work environment in hospitals and 4 sets of outcomes. Med Care. 2019;57(5):353–61.
12. Aiken LH, Clarke SP, Sloane DM, Lake ET, Cheney T. Effects of Hospital Care Environment on Patient Mortality and Nurse Outcomes. JONA: J Nurs Adm. 2008;38(5):223–9. https://doi.org/10.1097/01.NNA.0000312773.42352.d7.
13. Lasater KB, Mchugh MD. Nurse staffing and the work environment linked to readmissions among older adults following elective total hip and knee replacement. Int J Qual Health Care. 2016;28(2):253–8.
14. Al-ghraiybah T, Lago L, Fernandez R, Sim J. Effects of the nursing practice environment, nurse staffing, patient surveillance and escalation of care on patient mortality: A multi-source quantitative study. Int J Nurs Stud. 2024;156:104777. https://doi.org/https://doi.org/10.1016/j.ijnurstu.2024.104777.
15. Cho E, Sloane DM, Kim E-Y, Kim S, Choi M, Yoo IY, Lee HS, Aiken LH. Effects of nurse staffing, work environments, and education on patient mortality: An observational study. Int J Nurs Stud. 2015;52(2):535–42. https://doi.org/https://doi.org/10.1016/j.ijnurstu.2014.08.006.
16. Zhao Y, Ma D, Wan Z, Sun D, Li H, Sun J. Associations between work environment and implicit rationing of nursing care: A systematic review. J Nurs Adm Manag. 2020;28(8):1841–50. https://doi.org/https://doi.org/10.1111/jonm.12895.
17. Aiken LH, Clarke SP, Sloane DM, Sochalski J, Silber JH. Hospital Nurse Staffing and Patient Mortality, Nurse Burnout, and Job Dissatisfaction. JAMA. 2002;288(16):1987–93. https://doi.org/10.1001/jama.288.16.1987.
18. Llaurado-Serra M, Santos EC, Grogues MP, Constantinescu-Dobra A, Coţiu M-A, Dobrowolska B, Friganović A, Gutysz-Wojnicka A, Hadjibalassi M, Ozga D. Critical care nurses' intention to leave and related factors: survey results from 5 European countries. Intensive Crit Care Nurs. 2025;88:103998.
19. Kim LY, Rose DE, Ganz DA, Giannitrapani KF, Yano EM, Rubenstein LV, Stockdale SE. Elements of the healthy work environment associated with lower primary care nurse burnout. Nurs Outlook. 2020;68(1):14–25.
20. Bragadóttir H, Kalisch BJ, Flygenring BG, Tryggvadóttir GB. The Relationship of Nursing Teamwork and Job Satisfaction in Hospitals. SAGE Open Nurs. 2023;9:23779608231175027. https://doi.org/10.1177/23779608231175027.
21. Georgiou E, Hadjibalassi M, Friganović A, Sabou A, Gutysz-Wojnicka A, Constantinescu-Dobra A, Alfonso-Arias C, Curado-Santos E, Slijepčević J, Coţiu Mă-A, Llaurado-Serra M, Borzuchowska M, Režić S, Dobrowolska B. Evaluation of a blended training solution for critical care nurses' work environment: Lessons learned from focus groups in four European countries. Nurse Educ Pract. 2023;73:103811. https://doi.org/https://doi.org/10.1016/j.nepr.2023.103811.
22. Salehi T, Barzegar M, Saeed Yekaninejad M, Ranjbar H. (2020). Relationship between healthy work environment, job satisfaction and anticipated turnover among nurses in intensive care unit (ICUs). Annals Med Health Sci Res, *10*(2).
23. Alanazi FK, Sim J, Lapkin S. Systematic review: Nurses' safety attitudes and their impact on patient outcomes in acute-care hospitals. Nurs Open. 2022;9(1):30–43. https://doi.org/https://doi.org/10.1002/nop2.1063.

24. Cummings GG, Tate K, Lee S, Wong CA, Paananen T, Micaroni SPM, Chatterjee GE. Leadership styles and outcome patterns for the nursing workforce and work environment: A systematic review. Int J Nurs Stud. 2018;85:19–60. https://doi.org/https://doi.org/10.1016/j.ijnurstu.2018.04.016.
25. Maassen SM, Weggelaar Jansen AMJW, Brekelmans G, Vermeulen H, van Oostveen CJ. Psychometric evaluation of instruments measuring the work environment of healthcare professionals in hospitals: a systematic literature review. Int J Qual Health Care. 2020;32(8):545–57. https://doi.org/10.1093/intqhc/mzaa072.
26. Connor JA, Ziniel SI, Porter C, Doherty D, Moonan M, Dwyer P, Wood L, Hickey PA. Interprofessional use and validation of the AACN healthy work environment assessment tool. Am J Crit Care. 2018;27(5):363–71.
27. Georgiou E, Mpouzika M, Llaurado-Serra M, Friganović A, Sabou A, Gutysz-Wojnicka A, Constantinescu-Dobra A, Alfonso-Arias C, Curado-Santos E, Slijepcevic J, Coțiu MA, Penar-Zadarko B, Režić S, Dobrowolska B, Kyranou M. Intensive Care Unit Nurses' Perceptions of Work Environments: A Cross-Sectional Study from Five European Countries. J Adv Nurs. 2026;0:1–11. https://doi.org/10.1111/jan.70559.
28. Szpakowski R, Fronczak A, Zając P, Dykowska G. Validation of the research tool and measurement of pediatric patient safety in a hospital using the BePoZa questionnaire. Nurs Public Health. 2019;9. https://doi.org/10.17219/pzp/92355.
29. Dziurka M, Ozdoba P, Olson L, Jedynak A, Ozga D, Jurek K, Dobrowolska B. Hospital ethical climate survey - selected psychometric properties of the scale and results among Polish nurses and midwives. BMC Nurs. 2022;21(1):295. https://doi.org/10.1186/s12912-022-01067-x.
30. Lynn MR. Determination and quantification of content validity. Nurs Res. 1986;35(6):382–5. https://doi.org/10.1097/00006199-198611000-00017.
31. Brzyski P, Kózka M, Squires A, Brzostek T. How factor analysis results may change due to country context. J Nurs Scholarsh. 2016;48(6):598–607.
32. Boateng GO, Neilands TB, Frongillo EA, Melgar-Quiñonez HR, Young SL. Best practices for developing and validating scales for health, social, and behavioral research: a primer. Front Public Health. 2018;6:149.
33. Kitayama M, Unoki T, Matsuda Y, Matsuishi Y, Kawai Y, Iida Y, Teramoto M, Tatsuno J, Hamamoto M. Development and initial validation of the Japanese healthy work environment assessment tool for critical care settings. PLoS ONE. 2022;17(5):e0268124. https://doi.org/10.1371/journal.pone.0268124.
34. Peterson RA, Kim Y. On the relationship between coefficient alpha and composite reliability. J Appl Psychol. 2013;98(1):194–8. 10.1037/a0030767.
35. Lucas P, Jesus É, Almeida S, Araújo B. Relationship of the nursing practice environment with the quality of care and patients' safety in primary health care. BMC Nurs. 2023;22(1):413.
36. Soukup T, Lamb BW, Shah NJ, Morbi A, Bali A, Asher V, Gandamihardja T, Giordano P, Darzi A, Green JS. Relationships between communication, time pressure, workload, task complexity, logistical issues and group composition in transdisciplinary teams: a prospective observational study across 822 cancer cases. Front Communication. 2020;5:583294.
37. Gurková E, Mikšová Z, Labudíková M, Chocholková D. Nurses' work environment, job satisfaction, and intention to leave–a cross-sectional study in Czech hospitals. Cent Eur J Nurs Midwifery. 2021;12(4):495–504.
38. Teutsch D, Frick E, Kubitza J. What motivates critical care nurses to stay in their job? – Structural aspects for empowering intrinsic motivation in permissive professional contexts: A scoping review. Intensive Crit Care Nurs. 2025;88:103929.
39. Radosz-Knawa Z, Kamińska A, Malinowska-Lipień I, Brzostek T, Gniadek A. (2023). Opinion of Nurses of Internal Medicine Wards Regarding Factors Determining Their Work – Observational And Cross-Sectional Studies. Cent Eur J Public Health, *31*(4).
40. Skela-Savič B, Sermeus W, Dello S, Squires A, Bahun M, Lobe B. How nurses' job characteristics affect their self-assessed work environment in hospitals—Slovenian use of the practice environment scale of the nursing work index.

BMC Nurs. 2023;22(1):100.

41. Duffield C, Diers D, O'Brien-Pallas L, Aisbett C, Roche M, King M, Aisbett K. Nursing staffing, nursing workload, the work environment and patient outcomes. Appl Nurs Res. 2011;24(4):244–55.
42. Medina-Córdoba M, Cadavid S, Espinosa-Aranzales A-F, Aguía-Rojas K, Bermúdez-Hernández PA, Quiroga-Torres D-A, Rodríguez-Dueñas WR. The effect of interprofessional education on the work environment of health professionals: a scoping review. Adv Health Sci Educ. 2024;29(4):1463–80.