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Factors of the Nursing Practice Environment Shaping Nurses' Perceived Benefits of Adverse Event Reporting: A Cross-Sectional Study Among Primary Healthcare Nurses

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Abstract

Background: Adverse event reporting is a critical component of patient safety systems; however, nurses' engagement in reporting is influenced not only by reporting procedures but also by broader organizational characteristics of the nursing practice environment. Understanding how these factors shape nurses' perceptions of reporting systems remains limited, particularly in post-Soviet healthcare contexts. **Objective:** This study aimed to examine how characteristics of the nursing professional practice environment are associated with nurses' perceptions of the benefits of adverse event reporting in primary healthcare settings in Kazakhstan. **Methods:** A cross-sectional survey was conducted among 468 nurses working in primary healthcare settings across six major cities in Kazakhstan. The professional practice environment was assessed using the Revised Professional Practice Environment (RPPE) scale, while attitudes toward adverse event reporting were measured using the Reporting of Clinical Adverse Events Scale (RoCAES), focusing on the "perceived benefits of reporting" dimension. Exploratory factor analysis, Spearman correlation analysis, and binary logistic regression were performed. **Results:** Exploratory factor analysis identified three key dimensions of the professional practice environment: professional motivation and teamwork, interprofessional conflict and communication, and staffing adequacy. Correlation analysis indicated that several dimensions of the practice environment were negatively associated with perceived benefits of reporting. However, multivariable regression analysis showed that cultural sensitivity, internal work motivation, and control over practice were positive predictors of perceived reporting benefits. This contrast between negative bivariate associations and positive multivariable predictors highlights the complex organizational dynamics underlying nurses' reporting attitudes. **Conclusions:** The findings suggest that nurses' perceptions of adverse event reporting are embedded within a broader organizational context of nursing practice. Strengthening supportive professional environments—particularly those that promote motivation, autonomy, and culturally responsive care—may enhance nurses' engagement in patient safety activities and improve the effectiveness of reporting systems.

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1. Introduction

Patient safety continues to be a major priority for healthcare systems worldwide, as adverse events remain a significant source of preventable harm, increased healthcare costs, prolonged hospital stays, and reduced public trust in health services [1,2]. The capacity of healthcare organizations to identify, report, and learn from such events is widely regarded as a fundamental component of patient safety culture and quality improvement initiatives [3,4]. Nurses play a central role in this process, as they provide continuous patient care and are often the first to recognize clinical deterioration, near misses, and unsafe practices [5,6].

Despite the recognized importance of adverse event reporting, underreporting remains a persistent challenge across healthcare systems [7,8]. A range of organizational and psychological barriers may discourage reporting, including fear of blame, uncertainty regarding reporting criteria, lack of feedback, and unclear reporting procedures [9–11]. As a result, reporting behavior is shaped not only by individual attitudes but also by the broader organizational and professional context in which nurses operate [12].

The nursing professional practice environment encompasses organizational characteristics that support or constrain nursing practice, including leadership, autonomy, communication, teamwork, interprofessional relationships, staffing adequacy, and institutional support [13,14]. A supportive practice environment has been consistently linked to improved job satisfaction, reduced burnout, better staff retention, and enhanced patient outcomes [15–17]. Moreover, it may shape patient safety behaviors by influencing communication processes, perceived responsibility, and the perceived value of reporting systems [18].

However, the relationship between the practice environment and adverse event reporting is complex and not necessarily linear. In some contexts, supportive environments may encourage engagement with formal reporting systems. In others, safety concerns may be managed through informal mechanisms such as direct communication, teamwork, and local problem-solving, potentially reducing reliance on formal reporting procedures [19,20].

Existing studies have primarily examined adverse event reporting in relation to patient safety culture, reporting barriers, and organizational climate. In parallel, research on the nursing practice environment has predominantly focused on outcomes such as job satisfaction, burnout, and quality of care [21–25]. However, limited attention has been given to the intersection of these domains—specifically, how organizational characteristics of the nursing practice environment influence nurses' perceptions of the benefits of adverse event reporting.

This gap is particularly relevant in Central Asian and post-Soviet healthcare systems, where organizational structures, hierarchical dynamics, and the evolution of nursing roles differ from those described in Western contexts [26,27]. Consequently, empirical evidence from these settings remains scarce, and current literature provides limited insight into how organizational factors shape reporting perceptions in these environments.

Addressing this gap is important for both theoretical and practical reasons. From a theoretical perspective, examining these relationships contributes to a more integrated understanding of patient safety behaviors within organizational contexts. From a practical perspective, identifying organizational factors associated with more positive perceptions of reporting may support the development of targeted strategies to strengthen patient safety culture and improve reporting systems. In particular, nurses are more likely to engage in reporting when they perceive reporting systems as meaningful, useful, and supportive of clinical improvement [28].

Therefore, the present study aimed to examine how characteristics of the nursing professional practice environment are associated with nurses' perceptions of the benefits of adverse event reporting in primary healthcare settings in Kazakhstan. In addition, the study explored the factor

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structure of the Revised Professional Practice Environment (RPPE) scale to better understand the underlying organizational dimensions of the practice environment in this context.

The study was guided by the following research question:

Which organizational dimensions of the nursing professional practice environment are associated with nurses' perceptions of the benefits of adverse event reporting?

2. Materials and Methods

2.1. Study Design

A descriptive cross-sectional approach was used in this study. The reporting of the study followed the recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.

2.2. Setting and Sample

The study population consisted of registered nurses employed in public primary healthcare (PHC) settings across six major cities in Kazakhstan, including Almaty, Astana, Shymkent, Karaganda, Semey, and Aktobe.

Data collection was carried out using an online questionnaire distributed through six medical universities located in these cities. The survey link was disseminated via professional and academic communication channels to nurses enrolled in accelerated evening training programs who were concurrently employed in PHC settings.

Participants were informed prior to participation that the survey was intended only for nurses currently working in PHC. In addition, the questionnaire included a screening item on workplace setting, and only responses confirming employment in PHC were retained for analysis.

A targeted sampling strategy with elements of convenience sampling was applied, utilizing existing professional networks. Healthcare organizations were not treated as sampling units, as recruitment was conducted through group communication channels rather than via individual institutions. This approach may have led to a higher representation of nurses actively engaged in professional development and continuing education.

A total of 491 responses were collected. Following data cleaning, 23 questionnaires were excluded due to missing or incomplete data, resulting in a final analytical sample of 468 nurses.

A formal sample size calculation was not performed, as the study aimed to include all eligible participants available during the data collection period using a non-probability sampling approach. The final sample size (n = 468) was considered sufficient for the planned statistical analyses, including exploratory factor analysis and regression modelling, and exceeded commonly recommended minimum thresholds.

Participant eligibility was defined based on predefined inclusion and exclusion criteria.

Inclusion criteria were:

(1) registered nurses working in primary healthcare settings,

(2) active involvement in clinical practice,

(3) willingness to participate in the study.

Exclusion criteria were:

(1) incomplete questionnaire responses,

(2) respondents not employed in PHC settings,

(3) nurses on leave during the data collection period.

The study protocol was reviewed and approved by the Local Ethics Committee of S.D. Asfendiyarov Kazakh National Medical University (Approval No. 04-101224, 29 April 2025). Participation was voluntary and anonymous, and informed consent was obtained from all participants before completing the survey.

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2.3. Instruments

Two previously validated instruments were utilized in this study.

Before data collection, both instruments were translated into Kazakh and Russian following a forward–backward translation procedure. The initial translation was carried out by faculty members of the Department of Nursing at S.D. Asfendiyarov Kazakh National Medical University with both academic and clinical expertise. This was followed by an independent back-translation into English to verify conceptual and linguistic consistency with the original versions. Any discrepancies identified during this process were reviewed and resolved through consensus among the research team. These steps were undertaken to ensure conceptual, semantic, and cultural equivalence of the instruments.

In the current study, selected psychometric properties of the instruments were evaluated, including internal consistency and underlying factor structure. Full psychometric validation of the instruments within the Kazakhstani context was beyond the scope of the present research.

2.3.1. Nursing Practice Environment

The nursing professional practice environment was evaluated using the Revised Professional Practice Environment (RPPE) scale [29]. This instrument was chosen due to its ability to capture a broad range of organizational and relational aspects of the practice environment. The RPPE includes 42 items grouped into eight subscales: leadership and autonomy in clinical practice, control over practice, communication about patients, teamwork, handling disagreement and conflict, internal work motivation, staff relationships with physicians, and cultural sensitivity.

All items were rated on a 4-point Likert scale ranging from 1 (strongly disagree) to 4 (strongly agree), with higher scores reflecting more favorable perceptions of the professional practice environment. In the present study, the RPPE demonstrated high internal consistency (Cronbach's α = 0.87).

2.3.2. Attitudes Toward Adverse Event Reporting

Nurses' attitudes toward adverse event reporting were evaluated using the Reporting of Clinical Adverse Events Scale (RoCAES) [30]. This instrument was selected as it is specifically designed to assess healthcare professionals' perceptions and attitudes related to adverse event reporting and has been widely applied in patient safety research.

The RoCAES consists of 25 items organized into five domains: perceived blame associated with reporting, criteria for identifying reportable events, perceptions of colleagues' expectations, perceived benefits of reporting, and clarity of reporting procedures.

All items were rated using a 4-point Likert scale. Higher scores on the "perceived benefits of reporting" subscale reflect more positive perceptions of the usefulness and value of adverse event reporting.

Prior to analysis, negatively worded items were reverse-coded to ensure consistency in score interpretation, with higher values indicating more positive attitudes. In this study, the RoCAES demonstrated satisfactory internal consistency (Cronbach's α = 0.84).

2.3.3. Demographic Characteristics

Information on participants' demographic and professional background was collected, including age, gender, clinical experience, qualification category, and level of nursing education.

2.4. Data Collection

Data collection was conducted between 15 September and 20 November 2025 using an anonymous online questionnaire administered through Google Forms. The survey link was disseminated via professional and academic communication channels to reach nurses who met the inclusion criteria.

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Participants were informed prior to participation that the survey was intended exclusively for nurses working in primary healthcare settings. Before accessing the questionnaire, respondents were provided with an electronic informed consent statement describing the study objectives, the voluntary nature of participation, data confidentiality, and the right to withdraw at any stage. Proceeding to the questionnaire was considered as provision of informed consent.

No personally identifiable information, such as names, contact details, or IP addresses, was collected. All data were stored in a secure, password-protected database accessible only to members of the research team.

Participation was voluntary, and no incentives were offered. While these measures were implemented to reduce potential response bias, the possibility of social desirability bias inherent in self-reported data cannot be entirely excluded.

2.5. Data Preparation

Prior to analysis, negatively worded items were reverse-coded so that higher scores consistently represented more positive perceptions.

The dataset was examined for missing values and inconsistencies. Questionnaires with substantial missing data were excluded according to predefined data-cleaning criteria. No imputation procedures were applied, and all analyses were performed using complete-case data.

Mean scores were calculated for each scale and subscale. For descriptive purposes and for binary logistic regression analysis, responses were categorized using a cut-off value of 2.5, corresponding to the midpoint of the 4-point Likert scale. Values below 2.5 were interpreted as less favorable perceptions, whereas values of 2.5 or higher indicated more favorable perceptions [32].

Because dichotomization can lead to a reduction in variability and potential loss of information, additional analyses were conducted using the continuous form of the outcome variable.

Likert-scale variables were treated as continuous in descriptive and correlation analyses to preserve variability and better capture the strength and direction of associations. Dichotomization was applied only in logistic regression models to facilitate interpretation, while continuous measures were retained in linear regression analyses to provide complementary and more robust estimates.

2.6. Statistical Analysis

All statistical analyses were carried out using IBM SPSS Statistics software (version 29.0).

Descriptive statistics were applied to summarize participants' characteristics and study variables. Continuous variables are presented as means with standard deviations, whereas categorical variables are described using frequencies and percentages.

The internal consistency of the measurement instruments was evaluated using Cronbach's alpha coefficients.

To explore the underlying structure of the instruments within the study sample, exploratory factor analysis (EFA) was performed using principal axis factoring with Varimax rotation. This procedure was intended to assess the structural consistency of the instruments rather than to conduct a full psychometric validation. The suitability of the data for factor analysis was examined using the Kaiser–Meyer–Olkin (KMO) measure and Bartlett's test of sphericity. Factor loadings of 0.40 or higher were considered significant for interpretation.

Associations between variables were assessed using Spearman's rank correlation coefficient due to the ordinal nature of the data.

To identify independent predictors of perceived benefits of adverse event reporting, multivariable binary logistic regression analysis was conducted. Prior to model estimation, key assumptions were evaluated, including multicollinearity, which was assessed using variance inflation factors (VIF). All VIF values were within acceptable limits.

In addition, multiple linear regression analysis was performed using the continuous form of the outcome variable to further examine the stability of the observed associations. While the logistic regression model relied on a dichotomized outcome variable to facilitate interpretation, the linear

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regression model retained continuous scale scores to preserve variability and reduce potential information loss.

A p-value of less than 0.05 was considered statistically significant.

3. Results

3.1. Participant Characteristics

Table 1 summarizes the demographic profile of the study participants. The final sample included 468 nurses employed in public primary healthcare settings across six major cities in Kazakhstan (Almaty, Astana, Shymkent, Aktobe, Semey, and Karaganda).

Participants' ages ranged from 20 to 58 years, with a mean age of 38.5 years (SD = 10.68). The duration of professional experience varied from 1 year to over 25 years, with an average of 12.5 years (SD = 8.2).

The sample was overwhelmingly female (97.2%, n = 455), while male participants accounted for 2.8%. This distribution is consistent with the gender composition typically observed in the nursing workforce.

In terms of clinical roles, most respondents were staff nurses (85.0%), followed by senior nurses (12.8%) and head nurses (2.1%).

Overall, the study population predominantly comprised mid-career female nurses working in clinical roles within urban primary healthcare settings.

Table 1. Demographic characteristics of nurses across the cities of Kazakhstan.

Characteristics	City						
	Almaty N (%)	Astana N (%)	Shymkent N (%)	Aktobe N (%)	Semey N (%)	Karaganda N (%)	Total N (%)
Age (in years)							
<30	56 (52.8)	5 (4.7)	19 (17.9)	16 (15.1)	5 (4.7)	5 (4.7)	106 (100.0)
30-39	68 (46.3)	4 (2.7)	17 (11.6)	40 (27.2)	7 (4.8)	11 (7.5)	147 (100.0)
40-49	54 (43.9)	7 (5.7)	22 (17.9)	23 (18.7)	8 (6.5)	9 (7.3)	123 (100.0)
≥50	40 (43.5)	4 (4.3)	12 (13.0)	15 (16.3)	15 (16.3)	6 (6.5)	92 (100.0)
Work tenure							
1-5	55 (52.4)	4 (3.8)	14 (13.3)	17 (16.2)	9 (8.6)	6 (5.7)	105 (100.0)
6-15	101 (42.8)	11 (4.7)	35 (14.8)	53 (22.5)	20 (8.5)	16 (6.8)	236 (100.0)
16-25	37 (51.4)	3 (4.2)	12 (16.7)	14 (19.4)	2 (2.8)	4 (5.6)	72 (100.0)
> 25	24 (46.2)	2 (3.8)	7 (13.5)	10 (19.2)	4 (7.7)	5 (9.6)	52 (100.0)
Gender							
Female	212 (46.6)	20 (4.4)	67 (14.7)	91 (20.0)	35 (7.7)	30 (6.6)	455 (100.0)
Male	6 (46.2)	-	3 (23.1)	3 (23.1)	-	1 (7.7)	13 (100.0)
Clinical position							

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Nurse	182 (45.7)	16 (4.0)	61 (15.3)	83 (20.9)	29 (7.3)	27 (6.8)	398 (100.0)
Senior Nurse	32 (53.3)	4 (6.7)	8 (13.3)	8 (13.3)	5 (8.3)	3 (5.0)	60 (100.0)
Head Nurse	4 (40.0)	-	1 (10.0)	3 (30.0)	1 (10.0)	1 (10.0)	10 (100.0)

3.2. Reliability of the Study Instruments

The internal consistency of the instruments is presented in Table 2.

The Revised Professional Practice Environment (RPPE) scale demonstrated high reliability, with a Cronbach's alpha of 0.87. The Reporting of Clinical Adverse Events Scale (RoCAES) also showed good internal consistency, with a Cronbach's alpha of 0.84.

Both values exceed the commonly accepted threshold of 0.70, indicating satisfactory reliability of the instruments within the study sample.

Table 2. Internal consistency of the study instruments.

Scale	Number of Items	Cronbach's α
Revised Professional Practice Environment (RPPE)	42	0.87
Reporting of Clinical Adverse Events Scale (RoCAES)	25	0.84

Note: Cronbach's alpha values ≥ 0.70 indicate acceptable internal consistency.

Both instruments demonstrated good internal consistency, with Cronbach's alpha coefficients exceeding the acceptable threshold of 0.70.

3.3. Factor Structure of the RPPE Scale

An exploratory factor analysis (EFA) was performed to identify the latent structure of the Revised Professional Practice Environment (RPPE) scale within the study sample.

The adequacy of the dataset for factor analysis was confirmed by a high Kaiser–Meyer–Olkin (KMO) value of 0.949, indicating excellent sampling adequacy. In addition, Bartlett's test of sphericity was statistically significant ($\chi^2 = 12{,}665.842$; df = 861; $p < 0.001$), supporting the presence of sufficient correlations among variables to justify factor extraction.

Factor extraction was carried out using principal axis factoring, followed by orthogonal Varimax rotation with Kaiser normalization. The initial solution yielded six factors with eigenvalues exceeding 1.0, collectively explaining 56.98% of the total variance.

Despite meeting the statistical criteria, the six-factor solution demonstrated limited conceptual clarity due to cross-loadings and overlapping item distributions. Therefore, a more interpretable three-factor structure was selected for subsequent analysis.

Before rotation, the first factor accounted for 36.15% of the variance, while the second factor explained 10.56%. The remaining factors contributed smaller proportions of explained variance (3.62%, 2.75%, 2.45%, and 1.45%, respectively). Following rotation, variance was redistributed across factors, resulting in a more balanced structure (21.40%, 10.90%, 7.42%, 7.12%, 6.47%, and 3.69%).

Items with factor loadings of 0.40 or higher were considered to contribute meaningfully to factor interpretation. Most items demonstrated communalities above 0.40, indicating that the extracted factors adequately represented the underlying variance of the RPPE scale.

The resulting factor structure differs from previously reported RPPE configurations, reflecting context-specific organizational patterns within the study setting.

The rotated factor loading matrix is presented in Table 3.

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Table 3. Rotated factor loading matrix of the RPPE items.

RPPE Items	Factor 1	Factor 2	Factor 3
I feel a high degree of personal responsibility for the work I do	0.777		
I feel a great sense of personal satisfaction when I do my work well	0.818		
I have challenging work that motivates me to do the best job I can	0.756		
Working in this unit/department gives me the opportunity to gain new knowledge and skills	0.771		
I am motivated to do well because I am empowered by my work environment	0.724		
Working in this environment increases my sense of professional growth	0.748		
There is a lot of teamwork between unit/department staff and doctors	0.733		
Physicians and staff have good working relationships	0.703		
Staff have access to the necessary resources to provide culturally competent care	0.714		
Staff are sensitive to the diverse patient population for whom they care	0.716		
Staff respect the diversity of their health care team	0.701		
Other hospital units/departments seem to have a low opinion of my unit/department		0.756	
Inadequate working relationships with other hospital groups limit the effectiveness of work on this unit		0.709	
When staff disagree, they ignore the issue, pretending it will “go away”		0.761	
Most conflicts occur with members of my own discipline		0.788	
Most conflicts occur with members from other disciplines		0.764	
There are enough staff to provide quality patient care			0.730
We have enough staff to get the work done			0.720

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Note: Only factor loadings ≥ 0.40 are reported. Factor 1 – Professional Motivation and Teamwork; Factor 2 – Interprofessional Conflict and Communication; Factor 3 – Staffing Adequacy. Extraction was performed using principal axis factoring, followed by Varimax rotation with Kaiser normalization.

The labeling of factors was based on the conceptual similarity of items with the highest factor loadings within each factor. Based on the pattern of item loadings, the extracted factors were interpreted as representing professional motivation and teamwork, interprofessional conflict and communication, and staffing adequacy.

Inspection of the rotated factor matrix indicated that the majority of meaningful item loadings were concentrated within three interpretable factors. The remaining factors contained only a small number of items with weak or cross-loadings and were therefore not retained for further interpretation. Thus, the three-factor structure was retained for further analysis.

The identified three-factor structure reflects key organizational dimensions of the professional practice environment and is consistent with previously reported conceptual patterns, while also capturing context-specific characteristics of the study setting.

3.4. Associations Between Nursing Practice Environment Factors and Perceived Benefits of Adverse Event Reporting

Spearman rank-order correlation analysis was applied to examine the relationships between dimensions of the nursing practice environment and nurses' perceived benefits of adverse event reporting (Table 4).

Table 4. Spearman correlation coefficients between nursing practice environment factors and perceived benefits of adverse event reporting.

Variables	Perceived benefits of reporting
Leadership & Autonomy in Clinical Practice	-0.317**
Control Over Practice	-0.508**
Communication about Patients	-0.300**
Teamwork	0.091*
Handling Disagreement & Conflict	-0.153**
Internal Work Motivation	-0.463**
Staff Relationships with Physicians Subscale	-0.433**
Cultural Sensitivity	-0.509**

Note: Spearman correlation coefficients (r) are presented. *p < 0.05; **p < 0.01.

The analysis revealed that several organizational dimensions were significantly associated with perceived benefits of reporting, with correlation coefficients indicating varying strengths of association. Notably, the majority of associations were negative in direction.

The strongest inverse associations were observed for cultural sensitivity (r = -0.509) and control over practice (r = -0.508). Similarly, internal work motivation (r = -0.463) and staff relationships with physicians (r = -0.433) showed moderate negative correlations with perceived benefits of reporting.

Moderate negative associations were also identified for leadership and autonomy in clinical practice (r = -0.317) and communication about patients (r = -0.300). Handling disagreement and conflict demonstrated a weaker, yet statistically significant, inverse relationship (r = -0.153).

In contrast, teamwork was the only dimension that showed a positive association with the outcome variable of reporting, although the strength of this relationship was weak (r = 0.091).

Taken together, these findings indicate that nurses' perceptions of the benefits of adverse event reporting are differentially associated with multiple dimensions of the professional practice

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environment, highlighting the complex and, in some cases, counterintuitive nature of these relationships.

3.5. Predictors of Perceived Benefits of Adverse Event Reporting: Logistic Regression Analysis

Binary logistic regression analysis was performed to identify predictors of perceived benefits of adverse event reporting among nurses.

The overall model was statistically significant ($\chi^2 = 87.515$, df = 8, $p < 0.001$), indicating good model fit. The model explained between 17.1% (Cox–Snell R^2) and 27.5% (Nagelkerke R^2) of the variance. The Hosmer–Lemeshow test also indicated an adequate fit.

Control over practice, teamwork, internal work motivation, and cultural sensitivity were significantly associated with perceived benefits of reporting.

Higher levels of cultural sensitivity, internal work motivation, and control over practice were associated with increased odds of perceiving reporting as beneficial. In contrast, teamwork was negatively associated with perceived benefits of reporting, indicating lower odds of favorable perceptions.

Other variables, including leadership and autonomy in clinical practice, communication about patients, handling disagreement and conflict, and staff relationships with physicians, were not statistically significant predictors in the multivariable model.

The results of the logistic regression analysis are presented in Table 5.

Table 5. Logistic regression analysis of predictors of perceived benefits of adverse event reporting.

Variable	B	SE	p	OR (Exp(B))	95% CI
Leadership & Autonomy in Clinical Practice	0.314	0.376	0.403	1.37	0.66–2.86
Control Over Practice	0.765	0.348	0.028	2.15	1.09–4.25
Communication about Patients	0.115	0.342	0.737	1.12	0.57–2.19
Teamwork	−0.702	0.311	0.024	0.50	0.27–0.91
Handling Disagreement & Conflict	−0.183	0.373	0.624	0.83	0.40–1.73
Internal Work Motivation	0.926	0.451	0.040	2.52	1.04–6.11
Staff Relationships with Physicians Subscale	0.146	0.484	0.763	1.16	0.45–2.99
Cultural Sensitivity	1.174	0.437	0.007	3.24	1.37–7.61

3.6. Multiple Linear Regression Analysis

To further assess the independent contributions of organizational factors, a multiple linear regression analysis was conducted using perceived benefits of adverse event reporting as a continuous outcome variable (Table 6).

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Table 6. Multiple linear regression analysis of predictors of nurses' perceived benefits of adverse event reporting.

Variable	B	SE	β	t	p
(Constant)	3.646	0.179		20.355	<0.001
Leadership autonomy in clinical practice	-0.092	0.052	-0.079	-1.772	0.077
Control over practice	-0.209	0.049	-0.235	-4.291	<0.001
Teamwork	0.136	0.044	0.134	3.123	0.002
Handling disagreement and conflict	0.133	0.075	0.087	1.764	0.078
Internal work motivation	-0.313	0.072	-0.289	-4.346	<0.001
Cultural sensitivity	-0.141	0.060	-0.162	-2.367	0.018

Note: B – unstandardized coefficients; β – standardized coefficients; SE – standard error.

The regression analysis confirmed that several organizational factors remained independently associated with the outcome when considered simultaneously. Control over practice ($\beta = -0.235$, $p < 0.001$), internal work motivation ($\beta = -0.289$, $p < 0.001$), and cultural sensitivity ($\beta = -0.162$, $p = 0.018$) were significant predictors of perceived benefits of adverse event reporting.

Teamwork was positively associated with the outcome ($\beta = 0.134$, $p = 0.002$), suggesting that collaborative environments may enhance the perceived value of reporting systems.

Leadership and autonomy in clinical practice ($p = 0.077$) and handling disagreement and conflict ($p = 0.078$) did not reach statistical significance in the adjusted model, although both variables showed directional trends.

The model explained 40.7% of the variance in the dependent variable ($R^2 = 0.407$), indicating a meaningful level of explanatory power for the studied outcome.

4. Discussion

This study investigated how characteristics of the nursing professional practice environment are associated with nurses' perceptions of the benefits of adverse event reporting in primary healthcare settings across six major cities in Kazakhstan.

Existing evidence suggests that the nursing professional practice environment plays an important role in influencing patient safety outcomes and safety-related behaviors among healthcare professionals [18,33,34].

In addition to examining these associations, the present study also explored the underlying structure of the professional practice environment using exploratory factor analysis.

These findings should be interpreted within the organizational context of the healthcare system in Kazakhstan, which continues to evolve from traditionally hierarchical management structures toward more collaborative and patient-centered models of care.

These organizational characteristics may affect how communication processes are structured, the degree of autonomy in clinical decision-making, and how reporting systems are perceived by healthcare professionals.

Within such environments, hierarchical relationships and ongoing changes in professional roles may influence reporting practices by limiting upward communication, encouraging informal resolution of issues, and shaping perceptions of accountability.

The exploratory factor analysis identified three key dimensions of the professional practice environment: professional motivation and teamwork, interprofessional conflict and communication, and staffing adequacy. Although the original RPPE scale conceptualizes the professional environment through multiple subscales, the present findings suggest that, in this context, several organizational and interpersonal elements cluster into broader conceptual domains. Similar multidimensional structures have been reported in previous studies examining organizational conditions of nursing work and their influence on patient outcomes and staff performance [35,36].

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In particular, motivational, relational, and teamwork-related aspects of practice appear to form a unified dimension of the work environment, whereas conflict and communication challenges represent a distinct organizational domain. These findings indicate that nurses' perceptions of their professional environment are shaped by the interplay between relational dynamics within clinical teams and structural conditions of care delivery.

The correlation analysis indicated that multiple dimensions of the nursing practice environment were associated with perceived benefits of adverse event reporting, with most relationships demonstrating a negative direction. Although this pattern may initially appear counterintuitive, it likely reflects the complex organizational dynamics through which clinical environments shape perceptions of reporting systems. Previous research suggests that organizational culture, communication patterns, and professional autonomy influence how healthcare professionals perceive and engage with reporting systems in practice [37–39].

In more supportive environments characterized by strong autonomy, effective communication, and high internal motivation, patient safety concerns may be addressed directly through teamwork and informal communication. As a result, formal reporting systems may be perceived as one of several mechanisms supporting patient safety, rather than the primary tool for managing clinical incidents.

The logistic regression analysis provided further insight into the organizational determinants of nurses' perceptions of adverse event reporting. However, the interpretation of these findings requires careful consideration of the differences between bivariate and multivariable analytical approaches. The change in the direction of associations observed for some variables (e.g., teamwork) between these analytical levels may reflect suppression effects and the interrelated nature of organizational factors.

When examined independently, individual dimensions of the work environment may capture overlapping aspects of organizational functioning, whereas multivariable models allow for the estimation of independent effects by accounting for these interdependencies. Therefore, these differences should not be interpreted as contradictory findings, but rather as reflecting the multidimensional structure of the nursing practice environment.

The differences in direction between regression models may reflect scaling effects and the treatment of variables as continuous versus dichotomized, rather than true conceptual contradictions.

When these interrelationships were taken into account, only a limited number of variables remained significant predictors of perceived benefits of reporting. Specifically, cultural sensitivity, internal work motivation, and control over practice were positively associated with perceived benefits of adverse event reporting.

These findings are consistent with previous research indicating that supportive work environments, professional autonomy, and higher internal motivation are associated with increased engagement in patient safety activities, including incident reporting. At the same time, variations in the magnitude and direction of associations may reflect contextual differences in organizational structures, reporting practices, and professional roles within the healthcare system [40–44].

In contrast, teamwork demonstrated a negative association with the perceived benefits of reporting in the multivariable model. This finding provides important insight into the dynamics of safety practices in clinical settings. In environments characterized by strong teamwork and effective informal communication, safety concerns may be addressed directly within teams through immediate problem-solving rather than through formal reporting procedures. Similar patterns have been described in studies of safety culture and incident reporting behavior among healthcare professionals [45,46].

However, this finding should not be interpreted as diminishing the importance of formal reporting systems. Rather, it highlights the coexistence of formal and informal safety processes within healthcare organizations. While informal communication enables rapid responses to clinical issues, formal reporting systems remain essential for organizational learning, documentation, and the identification of systemic risks.

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Importantly, similar patterns were observed in both logistic and linear regression analyses, supporting the robustness of the identified relationships across different analytical approaches. This suggests that the observed associations are not merely an artifact of the applied dichotomization but reflect underlying organizational dynamics. At the same time, the explained variance of the regression model was moderate, indicating that additional individual, organizational, and contextual factors not included in the present study may also influence nurses' perceptions of adverse event reporting.

The present study contributes to the limited international literature on nursing practice environments and patient safety culture in Central Asian and post-Soviet healthcare systems. While most existing research on adverse event reporting has been conducted in Western healthcare contexts, empirical evidence from Central Asia remains scarce [47]. The current findings therefore provide valuable insights into how organizational characteristics of nursing practice environments shape safety-related attitudes in healthcare systems undergoing structural and professional transformation.

In addition, the findings highlight that improving patient safety reporting systems requires a broader organizational approach that extends beyond technical reporting procedures. Strengthening key elements of the professional practice environment—such as nurses' autonomy, internal motivation, culturally responsive care, and involvement in clinical decision-making—may enhance the perceived value of reporting systems and promote greater engagement in patient safety activities.

At the same time, healthcare organizations should not rely exclusively on formal reporting mechanisms. Instead, both formal and informal processes of managing patient safety should be recognized and aligned. In particular, fostering a supportive organizational culture that encourages open communication and reduces hierarchical barriers may enhance both informal problem-solving and formal reporting practices.

These findings are consistent with previous research demonstrating that professional empowerment, supportive work environments, and inclusive organizational cultures contribute to stronger engagement in patient safety practices. Moreover, the results may have broader relevance for other healthcare systems, particularly those in transitional and post-Soviet contexts, where hierarchical organizational structures and evolving professional roles continue to influence patient safety behaviors.

Finally, these findings should be interpreted in light of the cross-sectional design and the use of self-reported data, which may be subject to response bias. Nevertheless, the study provides a comprehensive and contextually grounded analysis of organizational factors associated with nurses' perceptions of adverse event reporting.

Strengths and Limitations

This study has several notable strengths. It included a relatively large sample of nurses from primary healthcare institutions across six major cities in Kazakhstan, which enhanced the diversity of the study population and enabled the analysis of regional variability in nursing practice environments.

Validated and widely used instruments were applied to assess both the professional practice environment and nurses' perceptions of adverse event reporting. Both scales demonstrated good internal consistency, supporting the reliability of the measurements.

A further strength lies in the use of multiple complementary analytical approaches, including exploratory factor analysis, correlation analysis, and multivariable regression. The combination of these methods allowed for a comprehensive examination of both the structural dimensions of the practice environment and their associations with reporting perceptions. The use of both logistic and linear regression models also strengthened the robustness of the findings.

Several limitations should be acknowledged. The cross-sectional design precludes causal inference. In addition, the use of self-reported data may introduce response bias, including potential social desirability effects.

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The sampling strategy included elements of convenience sampling, which may limit representativeness. Participants were recruited through professional and educational networks, potentially resulting in a sample with higher levels of professional engagement. Furthermore, the study focused on nurses working in public primary healthcare settings, predominantly in urban areas, which may limit generalizability to rural regions and private healthcare institutions.

The dichotomization of the outcome variable, applied for logistic regression analysis, may have reduced variability and resulted in some loss of information. However, this limitation was addressed by conducting additional linear regression analysis using the continuous outcome variable, which yielded consistent results.

Finally, although participation was voluntary and anonymous, and no identifiable data were collected, the mode of survey distribution may have introduced selection bias.

Future research should employ longitudinal designs and include a broader range of healthcare settings to better understand how organizational factors influence adverse event reporting and patient safety culture across diverse contexts.

5. Conclusions

This study provides insight into how characteristics of the nursing professional practice environment are associated with nurses' perceptions of the benefits of adverse event reporting in primary healthcare settings in Kazakhstan. The findings demonstrate that the practice environment functions as a multidimensional organizational context shaping how reporting systems are perceived and utilized in patient safety processes.

Three key dimensions of the practice environment were identified—professional motivation and teamwork, interprofessional conflict and communication, and staffing adequacy—reflecting the combined influence of relational and structural factors. In addition, cultural sensitivity, internal work motivation, and control over practice emerged as important organizational characteristics associated with more favorable perceptions of adverse event reporting.

The negative association observed for teamwork suggests that in highly collaborative environments, safety concerns may be managed through direct communication and informal problem-solving rather than formal reporting mechanisms. This highlights the need to consider reporting systems as one component of a broader organizational safety framework.

These findings contribute to the limited empirical evidence on nursing practice environments and patient safety culture in Central Asian and post-Soviet healthcare systems. They indicate that strengthening professional autonomy, supporting internal motivation, and promoting culturally responsive care may enhance engagement in reporting practices.

Given the cross-sectional design, the results should be interpreted as associations rather than causal relationships. Further research using longitudinal designs is needed to better understand how organizational culture, leadership, and system-level factors influence the implementation and effectiveness of reporting systems.

From a practical standpoint, improving patient safety requires an integrated approach that aligns formal reporting mechanisms with informal communication processes. Efforts to strengthen organizational culture, enhance feedback systems, and support nurses' involvement in clinical decision-making may increase the effectiveness and sustainability of reporting practices in primary healthcare.

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Informed Consent Statement: Participants were provided with information about the study objectives, the voluntary nature of participation, and data confidentiality. Submission of the completed questionnaire was considered as provision of informed consent.

Data Availability Statement: The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

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