RESEARCH PAPER

Postoperative Assessment of Accuracy, Urgency Judgement and Prevention Practices among Surgical Ward Nurses: A Cross-Sectional Study

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Received: 24th April, 2026; Revised: 20th May 2026; Accepted: 30th June, 2026; Available Online: 10th July, 2026

ABSTRACT

Aim: To examine associations among postoperative assessment accuracy, vignette-based urgency judgement, recognition and escalation attitudes, and complication-prevention practices, and to identify modifiable workforce factors associated with practice.

Design: Cross-sectional correlational study.

Methods: This study included a sample of 564 staff nurses employed in adult surgery wards in a public teaching hospital in Egypt. The data was collected between 15 February and 30 April 2026. The attitudes related to the recognition and escalation beliefs were tested using two well-known scales; the self-report measures of prevention practices were performed through a 30-item scale developed by the investigator, and the complications recognition, urgency rating, and nurse interventions were determined by six clinical vignettes.

Results: Prevention practice had an average standardized score of 68.23 over 100. The average standardized accuracy of the assessment was 8.45 over 12 while the average standardized urgency judgment was 3.66 over 6. The variables that showed a significant correlation with prevention practice included assessment accuracy ($r = .504$), urgency judgment ($r = .434$), recognition attitude ($r = .475$), and escalation attitude ($r = .587$; all $p < .001$). After adjusting for all variables, each one-unit increase in the number of patients assigned to nurses was associated with a decrease of 1.39 in the score of practice (95% CI −1.82 to −0.97). On the other hand, early warning system training and adequate staff were positively associated with practice. Both accuracy and urgency maintained an independent association with practice. The adjusted R^2 of the final model was .570.

Conclusion: Assessment accuracy and urgency judgement were complementary correlates of postoperative complication-prevention practice. The cross-sectional design, self-reported practice measure and written vignettes preclude causal or real-time performance conclusions.

Implications for the Profession and/or Patient Care: Surgical nursing leaders should combine scenario-based deterioration training with psychologically safe escalation pathways, acuity-responsive patient assignments and adequate staffing.

Impact: The study identifies linked competency, behavioural and workforce targets for strengthening postoperative surveillance and rescue readiness.

Reporting Method: The STROBE statement guided reporting.

Patient or Public Contribution: No patient or public contribution.

Keywords: clinical deterioration; complication prevention; nursing assessment; postoperative care; staff nurses; surgical nursing; urgency judgement

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How to cite this article: Elkady AZ, Khalil MIM, Abdalfadeel ER, Kheder MEA, Esmail WWL, Ahmed AM, Postoperative Assessment of Accuracy, Urgency Judgement and Prevention Practices among Surgical Ward Nurses: A Cross-Sectional Study Int J Drug Deliv Technol. 2026;16(6): 695-709. DOI: 10.25258/ijddt.16.6.108
Source of support: Nil.
Conflict of interest: None

1 | INTRODUCTION

Postoperative care on general surgical wards marks a high-risk transition from continuous procedural monitoring to intermittent ward surveillance. Hemorrhage, opioid-related respiratory depression, pulmonary embolism, sepsis, ileus and urinary retention can progress rapidly after apparently uncomplicated surgery. Although not every complication is preventable, outcomes depend strongly on whether clinicians recognize deterioration, relay concern and initiate an appropriate response before organ dysfunction becomes irreversible. Failure to rescue therefore focuses attention on the care system's capacity to prevent death after a complication rather than on the occurrence of the complication alone he postoperative period in general surgical wards poses a significant risk as patients shift from continuous monitoring during surgery to periodic monitoring in the ward setting. There are instances where postoperative bleeding, opioid-related respiratory depression, pulmonary embolism, sepsis, ileus, and urinary retention may develop rapidly after operations that appeared to be straightforward at first glance. Although not all problems are avoidable, the outcome of patients is highly dependent on their ability to recognize signs of deterioration and respond appropriately before organ failure becomes irreversible. For this reason, "failure to rescue" is defined by its focus on the health care system's ability to prevent mortality after a complication has developed. (Burke et al., 2022; Rosero et al., 2021).

Accurate recognition depends on disciplined nursing surveillance. Surgical ward nurses repeatedly integrate vital signs, respiratory effort, mental status, pain and sedation, fluid balance, urine output, wound and drain findings, laboratory trends, mobility and patients' reports. Nurses use objective measurements together with symptoms, behavioural change, clinical concern and intuition when identifying deterioration (Chung & Jung, 2024). However, substantial variation in assessment, interpretation and escalation behaviour indicates that proximity to the patient does not guarantee reliable recognition (Donnelly et al., 2024). Assessment accuracy should therefore be measured as a clinical decision-making capability rather than inferred from role or experience.

Identification alone will not protect patients if nurses fail to recognise urgency or delay escalation. In order to respond effectively nurses need to triage the threat, to act within their scope of practice, to communicate a succinct assessment and secure definitive review through local escalation pathways. Recognition and escalation attitudes inform these behaviours. ATREND differentiates beliefs about observation, broader evaluation and confidence in perceiving deterioration (Chua et al., 2023) whereas CARED measures confidence, fear of criticism and beliefs about rapid-response systems (Chua et al., 2021). Knowledge alone does not explain whether abnormal findings are translated into timely action by nurses.

Recognition and response are embedded in the behavioural context of complication-prevention practices. Structured monitoring, respiratory exercises, mobilisation, thromboprophylaxis, aseptic wound and drain care, surveillance of elimination and nutrition, pain and sedation reassessment, patient education and structured handover all reduce risk while providing repeated opportunities to detect emerging harm. Organisational conditions influence nurses' ability to work in this way consistently. Lower registered-nurse staffing levels have been associated with increased inpatient mortality, while improved staffing has been associated with decreased mortality, readmissions, and length of stay (McHugh et al., 2021; Musy et al., 2021). Resource limitations, workload, insufficient training, lack of guidelines, and communication barriers can all impede monitoring and escalation (Mbuthia et al., 2024).

Egyptian evidence supports structured deterioration systems but does not resolve the nursing competency gap addressed here. Implementation of the National Early Warning Score in an Egyptian emergency hospital increased clinical review after instability and was associated with fewer serious adverse outcomes (Badr et al., 2021). That study did not establish how accurately surgical nurses identify specific postoperative complications, how they judge urgency, or whether these capabilities relate to routine prevention practice. The literature remains fragmented across early-warning compliance, attitudes, staffing, isolated preventive behaviours and patient outcomes. Few studies integrate standardised vignette performance, comprehensive prevention practice and modifiable work-environment conditions in adult surgical wards.

This study integrates failure-to-rescue and nursing-surveillance perspectives. It positions assessment accuracy within the recognise function; vignette-based urgency judgement within the relay and react functions; and complication-prevention practice as the sustained surveillance and risk-reduction work that precedes and supports rescue. Recognition and escalation attitudes represent proximal behavioural determinants, whereas training, patient assignment and staffing adequacy represent modifiable organisational conditions.

1.1 | Aim

To examine associations among postoperative assessment accuracy, vignette-based urgency judgement and complication-prevention practices among staff nurses in adult surgical wards, and to determine whether recognition

attitudes, escalation attitudes and modifiable workforce conditions independently explain variation in reported prevention practice.

1.2 | Hypotheses

H1. Higher postoperative assessment accuracy will be positively associated with stronger complication-prevention practice.

H2. More accurate urgency judgement will be positively associated with stronger complication-prevention practice.

H3. More favourable recognition and escalation attitudes will be positively associated with stronger complication-prevention practice.

H4. Assessment accuracy and urgency judgement will remain independently associated with prevention practice after adjustment for professional and organisational characteristics.

H5. Recent relevant training and adequate staffing will be positively associated with prevention practice, whereas higher patient assignments will be negatively associated with practice.

2 | METHODS

2.1 | Design and reporting framework

A cross-sectional correlational design was used. All variables were measured at one point in time and therefore the analysis estimates between nurse associations, but cannot infer temporal ordering or causation. The conceptual model was the failure-to-rescue sequence of recognising deterioration, communicating concern and responding through nursing action and escalation. Reporting was guided by the STROBE checklist for cross-sectional studies (von Elm et al., 2007).

2.2 | Setting and study period

The research was conducted in adult surgical inpatient wards of a public teaching hospital in northern Egypt. The data were collected between 15 February and 30 April 2026. Participating departments included general, orthopedic, neurological, cardiothoracic, urological, gynecological, ear–nose–throat and mixed surgical wards. The questionnaire asked about nurses' knowledge of local early-warning and rapid-response arrangements as access and familiarity may differ between wards. Site name is blinded in the peer review manuscript.

2.3 | Population, eligibility and recruitment

The population included licensed or registered staff nurses who provided direct care to adults in participating surgical wards. Eligibility required written informed consent and at least 6 months of work in the current ward. Excluded were students, interns, agency staff without a designated ward assignment, nurses working purely administrative roles, nurses on extended leave, and cognitive interviewers and pilot testers.

The researchers employed consecutive recruitment and attempted to approach all accessible eligible nurses during the study period. The research assistant who distributed the study information had no supervisory authority. Access was facilitated by ward managers who did not identify respondents, collect completed questionnaires or receive individual data. The team screened 711 records, and 564 complete eligible records were included in the analysis (79.3%). The recruitment log did not retain reason-specific counts for the 147 non-included records and thus 79.3% is an inclusion proportion, not a response rate.

2.4 | Sample-size determination

We specified an a priori G*Power 3.1.9.7 calculation (Faul et al., 2009) for a fixed-model multiple-regression test of the incremental contribution of two vignette variables after adjustment for 23 existing parameters. With $f^2 = .025$, two-sided $\alpha = .05$ and 90% power, the minimum analysable sample was 510. Allowing 15% for non-participation or unusable questionnaires produced a target of 600. The final sample of 564 exceeded the minimum and provided 22.6 observations per parameter in the 25-parameter model.

2.5 | Variables and measures

The primary outcome was the continuous standardised score from the 30-item Postoperative Complication Prevention Practices Scale (PCPPS-30). Primary exposures were the assessment-accuracy and response-timeliness subscores from the six Postoperative Assessment Accuracy and Response-Timeliness Vignettes (PAART-V6). The response-timeliness subscore operationalised urgency classification under written conditions; it did not measure elapsed clinical response time. Secondary explanatory variables included ATREND and CARED scores, recent postoperative-care training, early-warning-system training, patients assigned per shift and perceived staffing adequacy.

2.5.1 | Sociodemographic and professional characteristics

An 18-item investigator-developed form recorded age, gender, qualification, professional role, nursing and surgical experience, current surgical specialty, shift pattern, typical patient assignment, relevant training during the preceding 2 years, local early-warning and rapid-response systems, recent exposure to deteriorating postoperative patients, rapid-response activations and perceived staffing adequacy. Continuous variables remained continuous when their functional form was acceptable. Categorical variables entered regression as indicator terms with clinically interpretable reference categories.

2.5.2 | Attitudes Towards Recognising Early and Noticeable Deterioration

The 11-item ATREND scale measures beliefs about patient observation, broader assessment beyond vital signs and confidence in recognising deterioration (Chua et al., 2023). Items use a 1 (strongly disagree) to 5 (strongly agree) response scale. Items 7, 8 and 11 were reverse scored according to the item-level scoring key. Total scores range from 11 to 55; higher scores indicate more favourable recognition attitudes. The original validation

reported a content-validity index of .95, Cronbach's α = .745 and test–retest intraclass correlation coefficient = .825.

2.5.3 | Clinicians' Attitudes towards Responding and Escalating care of Deteriorating patients

The CARED scale is a 22-item tool that measures confidence in responding and escalating, fear of criticism and beliefs about rapid response systems (Chua et al., 2021). Items are scored on a 5-point scale of agreement; Items 8-13 and 22 are reverse scored. The total scores range from 22 to 110, where higher scores mean more favorable attitudes. The original study reported a content-validity index of.95, Cronbach's α =.86, split-half reliability =.87, and test–retest intraclass correlation coefficient =.92.

2.5.4 | Postoperative Complication Prevention Practices Scale

The investigator-created PCPPS-30 assesses the frequency with which nurses reported executing recommended postoperative safety procedures during the past three months. The response scale ranges from 1 (never) to 5 (always), with no items necessitating reverse scoring. The six prespecified domains are structured monitoring and recognition (Items 1–6), respiratory prevention (Items 7–11), venous-thromboembolism prevention and mobility (Items 12–16), infection and wound or drain care (Items 17–21), gastrointestinal, urinary and nutritional surveillance (Items 22–25), and pain, medication safety, education and communication (Items 26–30). The raw totals vary from 30 to 150. We converted totals to a 0–100 scale using the formula [(raw total − 30)/120] × 100; elevated scores signify a greater frequency of reported practice.

2.5.5 | Postoperative Assessment Accuracy and Response-Timeliness Vignettes

The investigator-developed PAART-V6 has six textual scenarios: opioid-induced respiratory depression, postoperative hemorrhage, pulmonary embolism, sepsis related to surgical-site infection, acute urine retention, and postoperative ileus or bowel obstruction. Participants identified the primary problem, urgency classification, and optimal initial nurse intervention for each case. An expert-validated answer key allocated one point for each accurate response. The assessment-accuracy score comprised problem identification and initial action (12 decisions; range 0–12). The response-timeliness score includes six urgency decisions (range 0–6). The total score ranged from 0 to 18. No partial credit was provided.

2.6 | Translation, cultural adaptation and measurement evaluation

We translated ATREND and CARED using two independent forward translations, consensus reconciliation, two blinded back-translations, comparison with the source instruments and developer review when feasible (Beaton et al., 2000). Each participant completed one language version. The bilingual package retained the original item order and scoring direction and was piloted with 50 nurses who were excluded from the analytic sample.

We estimated Cronbach's α for ATREND, CARED and PCPPS-30 and Kuder–Richardson 20 for the 18 dichotomously scored PAART-V6 decisions. We report domain coefficients only when item number and conceptual coherence supported interpretation.

2.7 | Data-collection procedures

After institutional approvals, researchers approached eligible nurses . They explained the study, answered procedural questions and signed an informed consent before questionnaire access. Participants completed the questionnaire confidentially without managers or colleagues present. The fixed sequence was professional characteristics, ATREND, CARED, PCPPS-30 and PAART-V6; completion required approximately 25–35 minutes. Participants returned paper questionnaires in sealed envelopes to locked collection boxes.

The team assigned anonymous codes and collected no names, employee numbers, patient identification or clinical-record numbers. Researchers reviewed returned forms for eligibility and obvious duplicate submissions but did not urge participants to fill omitted items. The main investigator stored the PAART-V6 answer key separately until recruitment closed.2.8 | Data quality, missing data and bias reduction

We applied a prespecified codebook, range and logic checks, duplicate-record screening and verification of reverse-scored items. The analytic dataset included records with complete data for the primary outcome, primary exposures and regression covariates. All 564 included records were complete for these variables; we therefore used complete case analysis without imputation.

Anonymous self-administration, separation from supervisors and neutral instructions reduced authority and social-desirability pressures. Standardised vignettes added performance-based information beyond attitudes and self-reported practice. We selected regression covariates from the conceptual framework rather than univariable p values. Nevertheless, complete-case inclusion, self-report and cross-sectional measurement cannot eliminate selection bias, common-method bias, residual confounding or reverse-direction associations.

2.9 | Statistical analysis

We analysed data in IBM SPSS Statistics for Windows version (26.0.). Tests were two-sided with α = .05. We report exact p values to three decimals and $p < .001$ for smaller values, while prioritising effect estimates and 95% confidence intervals.

Frequencies and percentages summarised categorical variables. Means and standard deviations described continuous variables; medians and interquartile ranges supplemented bounded scores. Histograms, Q–Q plots, skewness, kurtosis and outlier diagnostics informed distributional assessment. Pearson coefficients quantified

principal linear associations; Spearman coefficients served as sensitivity checks. Independent-samples t tests compared two groups, and one-way analysis of variance compared three or more groups. Cohen's d and η^2 quantified unadjusted effect sizes.

Hierarchical multiple linear regression examined independent associations with the standardised PCPPS-30 score. Block 1 contained sociodemographic and professional characteristics; Block 2 added workforce and organisational conditions; Block 3 added ATREND and CARED; and Block 4 added PAART-V6 assessment accuracy and urgency judgement. Categorical variables were dummy coded, with reference categories identified in the coefficient table. We report B, standard error, standardised β, 95% confidence interval, p value, R^2, adjusted R^2, ΔR^2 and incremental f^2.

Diagnostics evaluated linearity, residual independence and normality, heteroscedasticity, multicollinearity and influential observations using residual plots, Q–Q plots, the Durbin–Watson statistic, White test, variance-inflation factors, studentised residuals, leverage and Cook's distance. The White test indicated heteroscedasticity ($p = .021$), so coefficient inference used HC3 heteroscedasticity-consistent standard errors. A sensitivity analysis excluded observations with Cook's distance > 4/n or absolute externally studentised residual > 3. The direction and significance of the focal associations were unchanged. The five prespecified hypotheses were evaluated without multiplicity adjustment; secondary subgroup comparisons were exploratory.

2.10 | Ethical considerations

The Research Ethics Committee issued approval on 10 February 2026, and the study site granted administrative access before recruitment. All participants received written information about the study purpose, procedures, minimal risks, confidentiality and voluntary participation and provided written informed consent. Participation or refusal did not affect employment or appraisal. The questionnaire collected no direct identifiers, and we report aggregate data only.

2.11 | Patient and public involvement

Patients and members of the public did not contribute to study design, instrument development, recruitment, data collection, interpretation or dissemination because the study examined nurses' professional assessment and practice. Surgical nurses participated in cognitive interviewing and pilot testing as professional stakeholders; this did not constitute patient or public involvement.

2.12 | Protocol transparency and data availability

The protocol, bilingual questionnaire package, scoring key, codebook and statistical syntax are retained in the corresponding author's secure institutional archive. De-identified participant data and analysis code may be available on reasonable request, subject to ethics and institutional approval.

3 | RESULTS

3.1 | Analytic sample and participant characteristics

The team screened 711 records and included 564 in the analytic file; 147 records were not included, yielding an inclusion proportion of 79.3%. Reason-specific exclusion counts were unavailable. The included records had no missing values for primary analyses. Mean age was 31.66 ± 6.96 years (median 31.0, IQR 26.0–37.0), and 78.7% were women. Bachelor's-prepared nurses formed the largest qualification group (48.6%), and 70.2% were staff nurses. Mean total nursing experience was 9.96 ± 6.87 years, mean surgical experience was 6.51 ± 5.40 years and mean patient assignment was 8.86 ± 2.27 patients per shift (Tables 1 and 2).

3.2 | Recognition attitudes, escalation attitudes and prevention practices

Mean ATREND was 40.69 ± 7.40 of 55, and mean CARED was 80.19 ± 14.42 of 110. Observation beliefs had the highest standardised ATREND domain score (71.3%), whereas broader-assessment beliefs had the lowest (61.7%). Rapid-response-system beliefs had the highest CARED domain score (68.5%); the reverse-scored fear-of-escalation domain had the lowest (62.8%).

Mean PCPPS-30 was 111.87 ± 19.04 of 150, equivalent to 68.23 ± 15.87 on the 0–100 metric. Infection and wound-care practice scored highest (73.3%), whereas pain, medication safety, education and structured communication scored lowest (65.9%). Internal consistency was $\alpha = .801$ for ATREND, $\alpha = .892$ for CARED and $\alpha = .930$ for PCPPS-30. (Table 3).

3.3 | Assessment accuracy and urgency judgement

Mean assessment accuracy was 8.45 ± 2.32 of 12 (70.4%), mean urgency judgement was 3.66 ± 1.48 of 6 (61.0%) and mean total PAART-V6 was 12.11 ± 3.20 of 18. In every scenario, correct urgency classification was less frequent than correct problem identification. Acute urinary retention produced the highest problem-identification (83.5%) and initial-action (74.3%) performance. Pulmonary embolism had the lowest correct urgency classification (57.1%), followed by sepsis associated with surgical-site infection (58.9%). (Table 4).

3.4 | Relationships among assessment, attitudes and prevention practices

All prespecified continuous measures correlated positively. PCPPS-30 correlated most strongly with CARED ($r = .587$, $p < .001$) and moderately with assessment accuracy ($r = .504$), ATREND ($r = .475$) and urgency judgement ($r = .434$; all $p < .001$). Assessment accuracy and urgency judgement correlated at $r = .392$ ($p < .001$), indicating related but non-redundant capabilities (Table 5).

3.5 | Unadjusted workforce and organisational associations

Nurses with recent postoperative-care training scored 5.95 points higher on PCPPS-30 than nurses without training ($d = 0.381$), and nurses with early-warning training scored 9.64 points higher ($d = 0.636$). PCPPS-30 differed across

perceived staffing adequacy, local early-warning-system type and rapid-response availability. Patient assignment correlated inversely with PCPPS-30 ($r = -.347$, $p < .001$). These comparisons were exploratory (Table 6).

3.6 | Hierarchical regression of complication-prevention practices

Professional characteristics explained 2.1% of variance and did not improve model fit ($p = .552$). Workforce and organisational conditions added 25.2% (incremental $f^2 = .347$); ATREND and CARED added 26.6% ($f^2 = .578$); and assessment accuracy plus urgency judgement added 5.0% ($f^2 = .121$). The final model explained 58.9% of variance (adjusted $R^2 = .570$; $F[25, 538] = 30.893$, $p < .001$; Table 7).

In the fully adjusted model, CARED had the largest standardised association ($\beta = .356$), followed by ATREND ($\beta = .225$), assessment accuracy ($\beta = .208$) and urgency judgement ($\beta = .112$). Each additional correct assessment decision corresponded to a 1.42-point higher PCPPS-30 score (95% CI 0.96–1.88), and each additional correct urgency decision corresponded to a 1.20-point higher score (95% CI 0.50–1.90). Each additional assigned patient corresponded to a 1.39-point lower score (95% CI −1.82 to −0.97). Early-warning training was associated with a 2.69-point higher score (95% CI 0.25–5.13). Compared with very inadequate staffing, adequate and very adequate staffing were associated with 3.80-point (95% CI 1.10–6.50) and 7.32-point (95% CI 2.27–12.36) higher scores, respectively. General postoperative-care training was not independently associated with practice. Surgical experience had a small inverse coefficient ($B = -0.291$, 95% CI −0.578 to −0.004, $p = .047$); because this was not a focal hypothesis and may reflect covariate adjustment, it warrants cautious interpretation. Durbin–Watson was 2.04, maximum VIF was 3.53 and the influence sensitivity analysis did not change the focal conclusions (Table 8).

4 | DISCUSSION

4.1 | Principal findings

This study integrated postoperative assessment performance, urgency judgement, recognition and escalation attitudes, and modifiable work-environment conditions within one failure-to-rescue model. Stronger reported prevention practice was associated with more accurate complication assessment, more appropriate urgency classification and more favourable recognition and escalation attitudes. The clinical-vignette scores added 5.0% of explained variance after professional characteristics, organisational conditions and attitudes. The pattern supports a systems interpretation: clinical judgement matters, but reliable prevention also depends on communication climate and nursing capacity.

The overall prevention-practice score indicated moderately frequent rather than consistently optimal performance. Infection and wound care scored highest, whereas pain and medication safety, patient education and structured communication scored lowest. These lower-scoring activities are central to rescue readiness because opioid sedation reassessment, warning-sign education, trend interpretation and structured escalation can determine whether subtle deterioration receives timely review.

4.2 | Assessment accuracy and urgency judgement

Assessment accuracy exceeded urgency-judgement performance. Nurses more often recognised the likely complication and selected an appropriate initial action than correctly classified how rapidly escalation was required. Pulmonary embolism and sepsis associated with surgical-site infection produced the weakest urgency classifications. These conditions often require integration of respiratory, circulatory, cognitive and contextual cues rather than reliance on a single threshold. The finding is consistent with evidence that nurses combine vital signs, symptoms, behavioural change, patient concern and intuition when detecting deterioration (Chung & Jung, 2024), but it shows that cue recognition does not guarantee an appropriately urgent response.

Ward audits have similarly indicated that rapid-response triggers are widespread whereas policy-concordant escalation occurs less regularly, even when nurses initiate other measures within their scope (Considine et al., 2023). Respiratory rate and level of consciousness also remain among the least consistently documented or used deterioration criteria (Considine et al., 2024). These deficiencies are directly important to pulmonary embolism, opioid-related respiratory depression and sepsis. Structured postoperative surveillance should therefore incorporate airway and breathing, circulation and bleeding, neurological status and sedation, fluid balance and elimination, wound and drain findings, pain, mobility and patient-reported change.

Education should assess urgency appraisal separately from diagnostic recognition. A postoperative trial reported that combining Modified Early Warning Score use with a nursing guide reduced complications and intervention time (Mert et al., 2024). Scenario-based training should likewise require nurses to identify what to do first, whom to contact and how rapidly the response must occur.

4.3 | Recognition attitudes and escalation culture

Escalation attitudes showed the largest standardised association with prevention practice, followed by recognition attitudes. Technical competence alone therefore did not account for reported safety practice. Nurses must also view escalation as legitimate, expect a constructive response and feel able to speak when the clinical picture conflicts with a reassuring score or another clinician's plan.

The comparatively low reverse-scored fear-of-escalation domain offers a plausible behavioural mechanism. CARED distinguishes confidence, fear of criticism and rapid-response-system beliefs (Chua et al., 2021), and qualitative evidence indicates that negative responder attitudes and stigma can delay activation even when nurses recognise deterioration (Ruiz et al., 2024). The CARED

association may therefore reflect local hierarchy and safety climate as well as individual confidence.

Formal 24-hour rapid-response availability did not remain independently associated after adjustment. A team can exist without clear activation authority, psychological safety or dependable follow-through. Hospitals should evaluate the complete escalation pathway: understood criteria, nurse-initiated activation, structured communication, respectful response, feedback and transfer when clinically indicated.

4.4 | Workforce and organisational determinants

Patient assignment and perceived staffing adequacy remained independently associated with prevention practice after adjustment for attitudes and vignette performance. These associations are clinically coherent because postoperative prevention requires repeated assessment, trend review, mobilisation, respiratory exercises, medication surveillance, education, documentation and reassessment. When workload compresses nursing time, teams may preserve visible immediate tasks while delaying surveillance and anticipatory care.

The direction is consistent with outcome-based evidence. Increased patient assignment loads and missed surveillance care have been linked to higher inpatient mortality, whereas better staffing of registered nurses is associated with lower mortality, fewer readmissions and shorter stays (Al-Ghraiybah et al., 2024; McHugh et al., 2021; Musy et al., 2021). The present study did not measure patient outcomes and cannot establish causality, but it identifies prevention practice as a plausible nursing-process pathway linking staffing to failure to rescue.

Early-warning training remained associated with practice, whereas general postoperative-care training did not. Deterioration training may be more specific to cue integration, urgency thresholds, communication and escalation. Broad training may also operate through attitudes or vignette performance already entered in later blocks; the study did not test mediation. Training records should therefore capture content, recency, simulation exposure and demonstrated competence rather than attendance alone.

4.5 | Contribution to nursing knowledge

The findings extend failure-to-rescue theory by positioning complication prevention before and across the recognise–relay–react sequence. Respiratory assessment, opioid monitoring, drain review, mobilisation, wound surveillance, education and handover generate the observations from which deterioration is recognised while reducing preventable risk. Prevention and rescue readiness are therefore interdependent nursing functions.

Professional characteristics explained little variance compared with organisational conditions and attitudes, while vignette performance added a smaller but unique contribution. Seniority, qualification and role did not substitute for demonstrated surveillance and escalation capability. Workforce planning should combine verified clinical judgement, a supportive escalation culture, acuity-responsive staffing and reliable response systems.

4.6 | Strengths and limitations

Strengths include integration of clinically coherent individual and organisational determinants, use of established attitude measures alongside standardised vignettes, a broad practice outcome, a prespecified hierarchical model and transparent reporting of robust standard errors, confidence intervals, variance change, multicollinearity and influence sensitivity.

The limitations of the study include convenient sampling, cross sectional design, and single setting. These limitations limit the generalizability of the current findings.

4.7 | Implications for nursing practice, education, management and policy

Surgical nursing services should use a competency bundle rather than a knowledge-only course. The bundle should cover whole-patient assessment, trend interpretation, early-warning-score calculation, high-risk patterns, urgency classification, immediate nursing actions, SBAR or ISBAR communication and escalation drills. Simulation should prioritise pulmonary embolism, haemorrhage, opioid-related respiratory depression and sepsis and should assess observable performance rather than attendance.

Nurse managers should audit both detection and response. Relevant indicators include completeness and timing of respiratory rate, oxygen saturation, mental-status and sedation assessment; action on abnormal trends; time from trigger to senior review; nurse-initiated rapid-response activation; actions before team arrival; transfer decisions; and feedback after escalation. Audit should support coaching and system redesign rather than blame.

Workforce policy should align assignments with acuity, turnover and surveillance intensity. Education cannot compensate fully for inadequate nursing capacity. Leaders should protect time for reassessment, mobilisation, patient education and communication and should establish explicit authority for nurses to obtain urgent review without hierarchical delay.

4.8 | Implications for future research

Prospective multisite studies should link nurse-level measures with timestamped clinical actions and patient outcomes, including unplanned intensive-care admission, cardiac arrest, postoperative complications, length of stay and failure to rescue. Multilevel models should separate nurse, shift, ward and hospital effects and measure staffing as an acuity-adjusted exposure. Mediation and interaction analyses could test whether training operates through attitudes or judgement and whether staffing modifies the benefit of competence.

Measurement research should precede broad use of PCPPS-30 and PAART-V6. Independent samples should evaluate content and structural validity, measurement

invariance across Arabic and English versions, test–retest reliability, responsiveness and criterion validity against observation or chart audit. Scenario studies should also examine decision latency, confidence calibration and incomplete or conflicting cues.

5 | CONCLUSION

Within this cross-sectional model, postoperative complication-prevention practice was associated with clinical judgement, escalation readiness and organisational capacity. Assessment accuracy and urgency judgement were complementary capabilities, and urgency appraisal showed the larger vignette deficit. More favourable recognition and escalation attitudes, lower patient assignments, adequate staffing and early-warning training were associated with stronger reported practice. These findings support an integrated safety strategy combining scenario-based competency assessment, psychologically safe escalation, acuity-responsive staffing and audit of surveillance and response. The design does not support causal conclusions,

6 | RELEVANCE TO CLINICAL PRACTICE

Clinical leaders should integrate assessment accuracy, urgency judgement, early-warning systems, escalation culture and staffing within one postoperative surveillance pathway. Nurses require repeated practice in recognising complication patterns, assigning urgency, initiating immediate actions and escalating without fear of criticism. Managers must pair competency development with safe assignments, protected reassessment time, nurse-initiated escalation authority and feedback after rapid-response events.

7 | DECLARATIONS

Acknowledgements: None.

Funding: This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

Conflict of interest: The author declares no conflict of interest.

Ethics approval: The blinded Research Ethics Committee issued approval on 10 February 2026. Protocol-title equivalence requires written confirmation before submission.

Informed consent: All participants received written study information and provided written informed consent before participation.

Data availability: De-identified participant data and analysis code may be available from the corresponding author on reasonable request, subject to ethics and institutional approval.

Patient or public contribution: No patient or public contribution.

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Table 1: Participant demographic and professional characteristics (n = 564)

Characteristic	n	%
Age (years)		
Mean ± SD	31.66 ± 6.96	—
20–29	239	42.4
30–39	238	42.2
40–49	83	14.7
≥50	4	0.7
Gender		
Female	444	78.7
Male	120	21.3
Highest nursing qualification		
Diploma	173	30.7
Associate/institute	73	12.9
Bachelor's degree	274	48.6

Characteristic	n	%
Postgraduate diploma	27	4.8
Master's degree	12	2.1
Doctorate	5	0.9
Current professional role		
Staff nurse	396	70.2
Senior staff nurse	95	16.8
Charge nurse	73	12.9
Total nursing experience (years)		
Mean ± SD	9.96 ± 6.87	—
<5	145	25.7
5–9	137	24.3
10–14	142	25.2
≥15	140	24.8
Surgical nursing experience (years)		
Mean ± SD	6.51 ± 5.40	—
<5	241	42.7
5–9	179	31.7
10–14	95	16.8
≥15	49	8.7
Current surgical unit		
General surgery	150	26.6
Orthopaedic surgery	109	19.3
Neurosurgery	42	7.4
Cardiothoracic surgery	25	4.4
Urology	76	13.5
Gynaecology	59	10.5
Ear, nose and throat	30	5.3
Mixed surgical	73	12.9
Usual shift pattern		
Day	119	21.1
Evening	85	15.1
Night	81	14.4
Rotating	279	49.5
Patients assigned per shift		
Mean ± SD	8.86 ± 2.27	—

SD, standard deviation. Percentages may not total 100.0 because of rounding.

Table 2: Training, clinical exposure and organisational characteristics (n = 564)

Characteristic	n	%
Postoperative-care training in previous 2 years		
No	325	57.6
Yes	239	42.4
Early-warning/deterioration training in previous 2 years		
No	323	57.3
Yes	241	42.7
Local early-warning system		
NEWS2	112	19.9
MEWS	108	19.1
Other	44	7.8
None	201	35.6
Unsure	99	17.6
Rapid-response/medical-emergency-team availability		
24 hours	180	31.9
Limited hours	159	28.2
No	103	18.3
Unsure	122	21.6
Deteriorating postoperative patients cared for in previous 6 months		
None	12	2.1
1–5	181	32.1
6–10	208	36.9
>10	129	22.9
Unsure	34	6.0
Rapid-response/MET activations initiated in previous 12 months		
None	225	39.9
1–2	196	34.8
3–5	112	19.9
>5	31	5.5
Perceived staffing adequacy		
Very inadequate	92	16.3
Inadequate	266	47.2
Adequate	182	32.3

Characteristic	n	%
Very adequate	24	4.3

EWS, early-warning system; MET, medical emergency team; MEWS, Modified Early Warning Score; NEWS2, National Early Warning Score 2; RRT, rapid-response team.

Table 3: Descriptive statistics and internal consistency of study measures (n = 564)

Measure/domain	Range	Mean ± SD	Median	IQR	Standardised %	α/KR-20
ATREND						
observation	6–30	23.11 ± 4.60	24.00	20.00–27.00	71.3	.771
broader assessment	2–10	6.93 ± 2.08	7.00	5.00–9.00	61.7	.588
confidence	3–15	10.64 ± 2.78	11.00	8.00–13.00	63.7	.664
ATREND total	11–55	40.69 ± 7.40	42.00	36.00–46.00	67.5	.801
CARED						
confidence	7–35	25.71 ± 5.72	26.00	22.00–30.00	66.8	.817
fear of escalation (reversed)	7–35	24.58 ± 5.69	25.00	21.00–29.00	62.8	.776
rapid-response-system beliefs	8–40	29.91 ± 6.37	31.00	25.00–35.00	68.5	.796
CARED total	22–110	80.19 ± 14.42	81.00	70.00–91.00	66.1	.892
PCPPS-30						
monitoring/recognition	6–30	22.11 ± 4.93	22.00	19.00–26.00	67.1	.842
respiratory prevention	5–25	18.62 ± 4.37	19.00	16.00–22.00	68.1	.842
VTE/mobility	5–25	18.56 ± 4.32	19.00	16.00–22.00	67.8	.829
infection/wound care	5–25	19.66 ± 3.93	20.00	17.00–23.00	73.3	.811
GI/urinary/nutrition	4–20	14.73 ± 3.63	15.00	12.00–18.00	67.1	.816
pain/safety/education	5–25	18.18 ± 4.32	18.00	15.00–22.00	65.9	.830
PCPPS total	30–150	111.87 ± 19.04	112.00	99.75–126.00	68.2	.930
PAART-V6						
PAART accuracy	0–12	8.45 ± 2.32	9.00	7.00–10.00	70.4	—
PAART timeliness	0–6	3.66 ± 1.48	4.00	3.00–5.00	61.0	—
PAART total	0–18	12.11 ± 3.20	12.00	10.00–15.00	67.3	.658

α, Cronbach's alpha; IQR, interquartile range; KR-20, Kuder–Richardson 20; PAART-V6, Postoperative Assessment Accuracy and Response-Timeliness Vignettes; PCPPS-30, Postoperative Complication Prevention Practices Scale. Standardised percentage = [(observed mean − scale minimum)/(scale maximum − scale minimum)] × 100. Reliability for the accuracy and urgency subscores was not estimated separately because they comprise heterogeneous clinical decisions; KR-20 is shown for the 18-decision total.

Table 4: Correct postoperative-vignette decisions by scenario (n = 564)

Clinical scenario	Problem identified n (%)	Urgency correct n (%)	Initial action correct n (%)
1. Opioid-induced respiratory depression	409 (72.5)	344 (61.0)	400 (70.9)

Clinical scenario	Problem identified n (%)	Urgency correct n (%)	Initial action correct n (%)
2. Postoperative haemorrhage	420 (74.5)	356 (63.1)	394 (69.9)
3. Pulmonary embolism	380 (67.4)	322 (57.1)	344 (61.0)
4. Sepsis associated with surgical-site infection	373 (66.1)	332 (58.9)	350 (62.1)
5. Acute urinary retention	471 (83.5)	376 (66.7)	419 (74.3)
6. Postoperative ileus/bowel obstruction	407 (72.2)	333 (59.0)	398 (70.6)

Each decision was scored 1 when correct and 0 when incorrect. Problem identification plus initial action formed the 0–12 assessment-accuracy score; urgency decisions formed the 0–6 response-timeliness score.

Table 5: Pearson correlations among principal study variables (n = 564)

Variable	Mean	SD	1	2	3	4	5
1. ATREND total	40.69	7.40	—				
2. CARED total	80.19	14.42	.284***	—			
3. Assessment accuracy	8.45	2.32	.311***	.326***	—		
4. Urgency judgement	3.66	1.48	.247***	.331***	.392***	—	
5. PCPPS standardised	68.23	15.87	.475***	.587***	.504***	.434***	—

Variables: 1 = ATREND total; 2 = CARED total; 3 = assessment accuracy; 4 = urgency judgement; 5 = PCPPS-30 standardised score. ***p < .001, two-sided.

Table 6: Unadjusted associations between workforce factors and PCPPS-30 standardised scores (n = 564)

Factor/category	n	Mean ± SD	Test statistic	Effect size
Postoperative-care training			t = 4.504; p < .001	d = 0.381
No	325	65.70 ± 15.87		
Yes	239	71.66 ± 15.25		
Early-warning/deterioration training			t = 7.698; p < .001	d = 0.636
No	323	64.11 ± 16.37		
Yes	241	73.74 ± 13.34		
Local early-warning system			F = 5.379; p < .001	η^2 = .037
NEWS2	112	72.28 ± 14.15		
MEWS	108	70.28 ± 16.21		
Other	44	71.52 ± 16.80		
None	201	66.12 ± 15.10		
Unsure	99	64.21 ± 17.03		
Rapid-response team availability			F = 4.383; p = 0.005	η^2 = .023
24 hours	180	70.71 ± 14.99		
Limited hours	159	67.09 ± 16.52		
No	103	64.12 ± 15.43		
Unsure	122	69.51 ± 15.98		
Staffing adequacy			F = 3.685; p = 0.012	η^2 = .019
Very inadequate	92	65.43 ± 15.12		

Factor/category	n	Mean ± SD	Test statistic	Effect size
Inadequate	266	67.07 ± 16.21		
Adequate	182	70.70 ± 15.59		
Very adequate	24	73.02 ± 14.13		
Patients assigned per shift	564	8.86 ± 2.27	r = -.347; p < .001	—

d, Cohen's d; η^2, eta squared; PCPPS-30, Postoperative Complication Prevention Practices Scale. Independent-samples t tests compared two groups; one-way analysis of variance compared factors with three or more categories; Pearson correlation assessed patient assignment. Effect sizes are reported as absolute values.

Table 7: Hierarchical multiple linear regression model summary for PCPPS-30 standardised score (n = 564)

Model	Predictors entered	R^2	Adjusted R^2	ΔR^2	F (df1, df2)	p	F change	p change
1	Professional characteristics	.021	−0.002	.021	0.901 (13, 550)	.552	0.901	.552
2	Model 1 + workforce conditions	.273	.245	.252	9.705 (21, 542)	< .001	23.530	< .001
3	Model 2 + ATREND/CARED	.540	.520	.266	27.509 (23, 540)	< .001	156.128	< .001
4	Model 3 + accuracy/urgency judgement	.589	.570	.050	30.893 (25, 538)	< .001	32.683	< .001

Note. Model 1 included age, gender, surgical nursing experience, qualification, role and shift pattern. Model 2 added patients per shift, postoperative-care training, early-warning training, staffing adequacy, local early-warning-system availability and 24-hour rapid-response-team availability. Model 3 added ATREND and CARED totals. Model 4 added assessment accuracy and urgency judgement. All p values are two-sided.

Table 8: Fully adjusted regression coefficients for PCPPS-30 standardised score (n = 564)

Predictor	B (95% CI)	HC3 SE	β	t	p
Continuous professional characteristics	—	—	—	—	—
Age (years)	0.200 (-0.023, 0.423)	0.114	0.088	1.760	.079
Surgical nursing experience (years)	-0.291 (-0.578, -0.004)	0.146	-0.099	-1.990	.047
Gender (reference: Female)	—	—	—	—	—
Male	0.216 (-1.816, 2.248)	1.034	0.006	0.209	.835
Highest nursing qualification (reference: Diploma)	—	—	—	—	—
Associate/institute	-1.906 (-4.924, 1.113)	1.537	-0.040	-1.240	.215
Bachelor's degree	0.325 (-1.674, 2.324)	1.018	0.010	0.319	.750
Postgraduate diploma	-0.432 (-6.112, 5.247)	2.891	-0.006	-0.149	.881
Master's degree	0.340 (-3.373, 4.052)	1.890	0.003	0.180	.857
Doctorate	2.732 (-12.451, 17.915)	7.729	0.016	0.353	.724
Professional role (reference: Staff nurse)	—	—	—	—	—
Senior staff nurse	0.852 (-1.892, 3.596)	1.397	0.020	0.610	.542
Charge nurse	-0.385 (-3.218, 2.448)	1.442	-0.008	-0.267	.790

Predictor	B (95% CI)	HC3 SE	β	t	p
Shift pattern (reference: Day)	—	—	—	—	—
Evening	-0.621 (-3.706, 2.463)	1.570	-0.014	-0.396	.692
Night	-0.445 (-3.546, 2.656)	1.579	-0.010	-0.282	.778
Rotating	-0.464 (-2.961, 2.033)	1.271	-0.015	-0.365	.715
Workforce and organisational factors	—	—	—	—	—
Patients assigned per shift	-1.393 (-1.821, -0.966)	0.217	-0.199	-6.408	< .001
Postoperative-care training Yes (reference: No)	1.005 (-0.899, 2.909)	0.969	0.031	1.037	.300
Early-warning training Yes (reference: No)	2.689 (0.247, 5.131)	1.243	0.084	2.163	.031
Staffing adequacy (reference: Very inadequate)	—	—	—	—	—
Inadequate	2.251 (-0.246, 4.748)	1.271	0.071	1.771	.077
Adequate	3.799 (1.098, 6.500)	1.375	0.112	2.763	.006
Very adequate	7.315 (2.266, 12.364)	2.570	0.093	2.846	.005
Systems availability	—	—	—	—	—
Local EWS Available (reference: None/unsure)	-0.041 (-2.365, 2.283)	1.183	-0.001	-0.035	.972
24-hour RRT Available (reference: No/limited/unsure)	0.336 (-1.583, 2.256)	0.977	0.010	0.344	.731
Recognition, escalation and vignette performance	—	—	—	—	—
ATREND total score	0.483 (0.357, 0.609)	0.064	0.225	7.541	< .001
CARED total score	0.392 (0.324, 0.460)	0.035	0.356	11.294	< .001
Assessment accuracy score	1.420 (0.963, 1.876)	0.232	0.208	6.111	< .001
Urgency judgement score	1.200 (0.502, 1.899)	0.356	0.112	3.375	< .001

B, unstandardised coefficient; β, standardised coefficient; CI, confidence interval; HC3 SE, heteroscedasticity-consistent standard error. Reference categories appear in the group headings. The intercept is omitted. Model R^2 = .589; adjusted R^2 = .570; $F(25, 538) = 30.893$, $p < .001$; Durbin–Watson = 2.04; maximum variance-inflation factor = 3.53. Coefficient inference uses HC3 standard errors.