

Characterizing Gaps in Delirium Prevention: A Multicentre Cross-Sectional Analysis of Nurse-Reported Screening, Barriers, and ICU--Ward Practice Differences

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Abstract

Background

Delirium prevention depends on timely risk assessment, routine monitoring, and consistent implementation of non-pharmacological preventive practices. Guidelines emphasize recognition of at-risk patients and multicomponent prevention, but implementation at the bedside may vary across clinical settings.

Aim

This study characterized nurse-reported delirium-risk assessment, routine monitoring, reported barriers, and non-pharmacological prevention practices, with particular attention to differences between intensive care units and general wards.

Methods

This multicentre cross-sectional analysis included 234 nurses from five training and research hospitals in Istanbul, Türkiye. Nurses had at least one year of nursing experience and worked in prespecified intensive care units or general wards. Descriptive analyses summarized screening, monitoring, barriers, and preventive-practice frequencies. Eighteen preventive practices shared across settings were evaluated. Pooled outcome distributions were screened before modelling; 14 outcomes were retained for primary proportional-odds ordinal logistic-regression models. Models compared ICU with ward nurses and adjusted for hospital fixed effects, current-unit experience per five-year increase, and education. Benjamini–Hochberg false-discovery-rate correction was applied across the 14 primary ICU–ward comparisons. Sensitivity analyses excluded 14 facility-metadata-flagged records, replaced current-unit experience with a derived total-experience proxy, and omitted hospital fixed effects.

Results

No nurse reported routine delirium-risk assessment for every newly admitted patient. Routine monitoring of patients considered at high risk of delirium was reported by 44 nurses (18.80%); monitoring relied on observation of command-following or agitation-related behaviour rather than a formal delirium instrument. Eight of 14 adjusted ICU–ward practice comparisons remained significant after false-discovery-rate correction. ICU nurses reported more frequent pain relief and avoidance of unnecessary room or unit changes. ICU nurses reported less frequent sleep support, noise reduction, facilitation of family or friend visits, adequate lighting, avoidance of unnecessary catheterization, and avoidance of physical restraints. All 14 primary ordinal models were stable, no binary primary fallback was required, and the directional consistency check supported the ICU–ward effect interpretation. Sensitivity analyses

excluding facility-flagged records and replacing the experience covariate left all conclusions unchanged. Omitting hospital fixed effects produced larger magnitude shifts for five estimates but no direction reversals among the false-discovery-rate-significant primary findings and no change in the number of significant findings.

Conclusion

The findings identify major gaps in routine delirium-risk assessment and high-risk monitoring and show clinically meaningful ICU–ward differences in reported non-pharmacological prevention practices. The pattern suggests setting-specific strengths and implementation gaps: ICU nurses reported stronger implementation of pain relief and avoidance of unnecessary transfers, whereas ward nurses reported more frequent implementation of several environmental, family-contact, sleep-support, catheter-related, and restraint-related practices.

1 Introduction

Delirium is an acute disturbance of attention, awareness, and cognition that is common among hospitalized adults and is associated with adverse clinical outcomes. Prevention and early recognition are therefore central components of hospital care. Current guidance emphasizes identifying patients at risk, addressing modifiable risk factors, and using multicomponent non-pharmacological approaches where appropriate (Inouye et al., 2014, 1999; Hshieh et al., 2015; Oh et al., 2017; NICE, 2023; Devlin et al., 2018; Burton et al., 2021). In intensive care settings, delirium care is commonly discussed alongside pain, agitation, sedation, immobility, and sleep disruption, reflecting the close relationship between delirium prevention and routine bedside care (Devlin et al., 2018; Lewis et al., 2025; Pun et al., 2019).

Nurses are central to delirium prevention because many relevant practices are embedded in everyday care. These include orientation, sleep support, noise reduction, lighting, family engagement, mobilization, hydration, oxygenation, attention to vision and hearing aids, avoidance of unnecessary catheters, medication vigilance, and minimizing physical restraints. Validated instruments such as the Confusion Assessment Method for the Intensive Care Unit (CAM-ICU), the Intensive Care Delirium Screening Checklist (ICDSC), and brief ward-suitable tools such as the 4AT can support structured delirium assessment in clinical environments (Ely et al., 2001; Bergeron et al., 2001; Gusmão-Flores et al., 2012; Wong et al., 2010; Anand et al., 2022; Penfold et al., 2024). However, the availability of assessment instruments does not ensure routine implementation. Delirium prevention requires repeated assessment, monitoring, documentation, interprofessional coordination, and adaptation to local workflow; recent implementation-focused work continues to highlight variability in routine tool completion, electronic alerting approaches, and nurse-driven screening workflows (Penfold et al., 2024; Benn et al., 2025; Korte et al., 2024).

Implementation may differ between intensive care units and general wards. ICU patients often have higher acuity, greater sedation exposure, more invasive devices, and more continuous monitoring. Ward

patients may have greater mobility and different opportunities for family contact, orientation, and environmental modification. Within the Capability–Opportunity–Motivation Behaviour framework, barriers such as lack of rapid tools, time pressure, continuity problems, and absence of institutional expectation represent implementation conditions rather than purely individual knowledge deficits (Michie et al., 2011; Almoliky et al., 2025). Direct comparisons of nurse-reported delirium-prevention practices between ICU and ward settings within the same multicentre cohort remain useful because they can identify setting-specific implementation gaps rather than only general awareness deficits.

This cohort was previously used to evaluate nurses' prioritization of delirium risk factors with the Analytic Hierarchy Process (Zeki et al., 2025). That earlier publication addressed perceived importance of delirium risk factors. The present manuscript is deliberately restricted to a distinct clinical-practice question: how nurses report delirium-risk assessment, monitoring, barriers, and implementation of non-pharmacological prevention practices, and whether shared practices differ between ICU and ward settings. It does not repeat the published AHP ranking results or include priority–practice linkage analyses.

1.1 Aim

The primary aim was to characterize nurse-reported delirium-risk assessment, routine monitoring, reported barriers, and non-pharmacological prevention practices and to compare shared preventive practices between ICU and general-ward nurses.

2 Methods

2.1 Study design and setting

This multicentre cross-sectional study examined nurse-reported delirium-risk assessment, routine monitoring, barriers to care, and non-pharmacological prevention practices in ICUs and general wards. Data were collected between 5 January 2018 and 4 January 2019 in five training and research hospitals in Istanbul, Türkiye. This study was reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for cross-sectional studies to the extent permitted by the available source documentation (von Elm et al., 2007). The present manuscript reports the clinical-practice component of a broader PhD study.

2.2 Participants and eligibility

Nurses were eligible when they voluntarily agreed to participate, were directly involved in patient care, had at least one year of nursing experience, and worked in one of the prespecified ICUs or wards. Eligible ICU settings included general, anaesthesia and reanimation, coronary, cardiovascular surgery, neurology, and neurosurgery ICUs. Eligible ward settings included internal medicine, general surgery, orthopaedics, and oncology wards. The linked analytic cohort comprised 234 nurses: 101 ward nurses and 133 ICU nurses. The source documentation available for the present manuscript supports the final linked analytic

cohort and setting distribution, but does not provide a fully auditable approached–declined–excluded recruitment flow. Therefore, participant-flow reporting is restricted to the verified linked cohort used in the analysis.

2.3 Relationship to the previous AHP publication

The cohort was previously used to examine nurses' prioritization of delirium risk factors through the Analytic Hierarchy Process (Zeki et al., 2025). That publication reported the AHP questionnaire and the AHP prioritization results. The current analysis is a separate clinical-practice analysis. It does not analyse the AHP questionnaire, repeat the published AHP ranking results, or include priority–practice linkage modelling. It reports nurse-reported screening, monitoring, reported barriers, and preventive practices.

2.4 Data-collection instrument

The broader doctoral study used researcher-developed data-collection materials comprising an Analytic Hierarchy Process (AHP) questionnaire on the prioritization of delirium risk factors and a second survey form containing demographic, professional, and clinical-practice items. The study materials were informed by the published delirium literature and relevant clinical practice guidance. The AHP component was reported previously (Zeki et al., 2025) and is not analysed in the present manuscript.

The present analysis uses the clinical-practice component of the second survey form, which collected information on nurses' views regarding delirium prevention, routine delirium-risk assessment and monitoring practices, reported barriers, and frequencies of non-pharmacological preventive practices. The clinical-practice items examined here were not reported in the previous peer-reviewed publication. This clinical-practice survey form has not previously been published in a peer-reviewed article and was not designed or validated as a psychometric scale. Preventive-practice items used four ordered response options—always, frequently, sometimes, and never—and were analysed individually at item level rather than combined into a composite or total scale score. The clinical-practice survey form was administered in Turkish; an English translation is provided as Supplementary Material 1.

2.5 Outcomes

The primary descriptive outcomes were: delirium-risk assessment for newly admitted patients; routine monitoring of patients considered at high risk of delirium; monitoring approaches used by nurses who reported routine high-risk monitoring; and reported barriers to admission risk assessment and routine high-risk monitoring. These barrier questions represented separate clinical workflows and were analysed using their relevant denominators.

The comparative outcomes were the reported frequencies of 18 preventive practices shared across ICU and ward settings. The questionnaire recorded frequency using four ordered categories: always, frequently, sometimes, and never. ICU-specific items related to sedation choice and ventilation-weaning practices were not included in ICU–ward comparative models because they were not applicable to ward nurses and because the current manuscript was restricted to practices shared across settings.

2.6 Data management and consistency safeguards

The final linked clinical-practice analytic file contained all 234 eligible nurses. The structured hospital code recorded in the clinical-practice questionnaire was treated as the authoritative hospital-site variable. Fourteen records contained discordant or ambiguous auxiliary free-text facility metadata in a companion prioritization form from the broader study; these records remained valid participant links and were retained in the primary analysis. A sensitivity analysis excluded these 14 records.

2.7 Statistical analysis

Analyses were performed using MATLAB R2023a (MathWorks, Natick, MA, USA) with the Statistics and Machine Learning Toolbox. Continuous variables were summarized using means and standard deviations. Categorical variables were summarized using frequencies and percentages. The 18 shared preventive-practice outcomes and primary model covariates contained no missing values; therefore, the core comparative analyses used the complete linked cohort of 234 nurses. Variable-specific denominators were used for conditional follow-up questions. The main text reports routine implementation, defined descriptively as responses of always or frequently. The full four-level distributions of all 18 shared preventive-practice items are provided in Supplementary Table S1. Missingness and denominator checks, blind outcome-eligibility and category-collapsing decisions, proportional-odds diagnostics, binary routine-implementation sensitivity models, directional consistency results, and item-level clinical sensitivity analyses are reported in Supplementary Tables S2–S7.

Outcome eligibility for ordinal modelling was determined from pooled response distributions before ICU–ward contrasts were examined. Sparse extreme categories containing fewer than 10 pooled observations were merged with the adjacent category. Sparse interior categories containing fewer than 10 pooled observations were merged with the adjacent category having the smaller pooled count; ties were resolved toward the less-frequent-implementation category. Items were retained as ordinal outcomes when at least three ordered categories remained and each retained category contained at least 10 pooled observations. Otherwise, the item was collapsed into a binary indicator of routine implementation, defined as always or frequently versus sometimes or never, when this was numerically stable. Items too sparse for stable binary modelling were restricted to descriptive reporting.

Fourteen of the 18 shared practices were retained for proportional-odds ordinal logistic-regression models after the blind outcome-eligibility and category-collapsing procedure (Supplementary Table S3). The original questionnaire coding was retained: 1 = always, 2 = frequently, 3 = sometimes, and 4 = never. MATLAB's ordinal logit model estimates cumulative log-odds. Because lower-numbered categories represent more frequent implementation, adjusted odds ratios greater than 1 indicate greater odds of reporting more frequent implementation. A synthetic-data direction check and a directional consistency check were retained as safeguards.

Each primary model included clinical setting as the primary explanatory variable, with ward nurses as the reference group. Models were adjusted for hospital site fixed effects, years of experience in the current

unit expressed per five-year increase, and education, dichotomized as bachelor's degree or higher versus below bachelor's degree. Adjusted odds ratios, 95% confidence intervals, and two-sided p-values were reported. Benjamini–Hochberg false-discovery-rate correction was applied across the 14 primary ICU–ward comparisons.

Binary routine-implementation models were fitted as sensitivity analyses where stable estimation was possible. Proportional-odds diagnostics were evaluated using nonparallel ordinal models. When nonparallel models were unavailable because of numerical instability, this was documented and the stable proportional-odds model was retained. For the item with evidence of a proportional-odds violation, threshold-specific nonparallel estimates and the binary sensitivity estimate were examined.

Clinical sensitivity analyses compared the primary adjusted model against three perturbations. First, models were rerun after excluding the 14 facility-metadata-flagged records. Second, current-unit experience was replaced by a derived total-experience proxy, calculated as current-unit experience plus previous ICU experience plus previous ward experience and expressed per five-year increase. Third, hospital fixed effects were omitted while retaining clinical setting, current-unit experience, and education. This third analysis was used to assess whether hospital adjustment materially drove the ICU–ward estimates; it did not replace the hospital-adjusted primary model. Sensitivity results were compared with the primary estimates using direction, false-discovery-rate significance status, and log-odds-ratio shifts.

2.8 Ethical considerations

The study was reviewed and approved by the Koç University Social Sciences Research Ethics Committee (reference number: 2018.007.IRB3.007). The study adhered to the principles of the Declaration of Helsinki. Institutional permission was obtained from the Istanbul Provincial Health Directorate, and written informed consent was obtained from all participants.

3 Results

3.1 Participant characteristics

The linked analytic cohort included 234 nurses: 101 nurses (43.16%) working in general wards and 133 nurses (56.84%) working in ICUs. Seven nurses (2.99%) had received previous training on delirium risk factors. Participant characteristics are presented in Table 1. To maintain consistency with the previously published BMC Nursing paper, the manuscript-facing experience distribution is reported using the published grouped categories. The adjusted models used years of experience in the current unit as a continuous covariate scaled per five-year increase.

Table 1
Participant characteristics of the linked cohort (*N* = 234).

Characteristic	<i>n</i>	%
Age, years, mean ± SD (range)	28.06 ± 5.93 (18–45)	
Sex		
Female	194	82.91
Male	40	17.09
Education		
High school	14	5.98
Associate degree	26	11.11
Bachelor's degree	183	78.21
Master's degree	10	4.27
Doctorate	1	0.43
Clinical setting		
General ward	101	43.16
Intensive care unit	133	56.84
Total years of experience (BMC-published categories)		
Less than 2 years	119	50.85
2–4 years	59	25.22
5–10 years	38	16.24
More than 10 years	18	7.69
Previous delirium-risk-factor training		
Yes	7	2.99
No	227	97.01

The descriptive experience distribution is retained in the same form as the previously published BMC Nursing paper. The adjusted models used current-unit experience as a continuous covariate; a derived total-experience proxy was used only in sensitivity analysis.

3.2 Delirium-risk assessment, monitoring, and reported barriers

No nurse reported routine delirium-risk assessment for every newly admitted patient. The most frequently reported barriers to admission risk assessment were the absence of a rapid and easy-to-use assessment tool (76/234, 32.48%), insufficient time due to high workload (69/234, 29.49%), and the absence of an institutional expectation to perform assessment (57/234, 24.36%). Routine monitoring of patients considered at high risk of delirium was reported by 44 nurses (18.80%). Among these 44 nurses, eight (18.18%) reported observing whether the patient followed commands and 36 (81.82%) reported observing agitation-related behaviour without using a formal delirium instrument. Among nurses who did not report routine high-risk monitoring, the most frequently reported barriers were the absence of a rapid and easy-to-use monitoring tool (70/190, 36.84%), insufficient time due to high workload (58/190, 30.53%), and the absence of an institutional expectation to perform monitoring (37/190, 19.47%). Table 2 presents the separate barrier analyses for admission risk assessment and routine high-risk monitoring.

Table 2
Nurse-reported delirium-risk assessment, routine monitoring, and reported barriers.

Item	<i>n</i>	%
Admission delirium-risk assessment for newly admitted patients		
Performed routinely	0	0.00
Not performed routinely	234	100.00
Reported barriers to admission risk assessment (n = 234)		
Did not consider assessment necessary	24	10.26
Insufficient knowledge of delirium risk factors	6	2.56
Insufficient time due to high workload	69	29.49
No rapid and easy-to-use assessment tool	76	32.48
No institutional expectation to perform assessment	57	24.36
No reason given / not classified	2	0.85
Routine monitoring of patients considered at high risk of delirium		
Performed routinely	44	18.80
Not performed routinely	190	81.20
Monitoring approach among nurses reporting routine high-risk monitoring (n = 44)		
Observed whether the patient followed commands	8	18.18
Observed agitation-related behaviour without a formal instrument	36	81.82
Reported barriers to routine high-risk monitoring (n = 190)		
Insufficient knowledge of delirium risk factors	2	1.05
Lack of continuity of care	23	12.11
Insufficient time due to high workload	58	30.53
No rapid and easy-to-use monitoring tool	70	36.84
No institutional expectation to perform monitoring	37	19.47

Variable-specific denominators are shown explicitly. Admission risk assessment and routine high-risk monitoring represent separate clinical workflows and were not merged into a single barrier analysis. The two unclassified admission-barrier records are retained in the denominator to preserve the locked cohort count and source percentages.

3.3 Routine implementation of shared delirium-prevention practices

Table 3 summarizes routine implementation of the 18 shared preventive practices, defined descriptively as responses of “always” or “frequently.” Full four-level response distributions are provided in Supplementary Table S1. Several physiological or task-oriented practices showed high routine implementation in both settings, including hydration, oxygenation, nutrition, orientation, pain relief, and polypharmacy review. In contrast, cognitive stimulation and provision of a visible clock or calendar were reported as routine by fewer than 40% of nurses in both settings. Large unadjusted setting differences were also visible for several practices, including noise reduction, family or friend visits, adequate lighting, avoidance of unnecessary room or ward changes, and avoidance of physical restraints.

Table 3
Routine implementation of the 18 shared delirium-prevention practices by clinical setting.

Practice	Ward, <i>n</i> (%)	ICU, <i>n</i> (%)
Early exercise and mobilization	86 (85.15)	103 (77.44)
Pain relief	96 (95.05)	128 (96.24)
Support daytime wakefulness and high-quality night-time sleep	91 (90.10)	103 (77.44)
Prevent exposure to excessive noise	92 (91.09)	89 (66.92)
Facilitate regular family and friend visits	92 (91.09)	92 (69.17)
Provide adequate room lighting	97 (96.04)	105 (78.95)
Provide cognitive-stimulation activities	25 (24.75)	34 (25.56)
Provide a clearly visible clock and calendar	27 (26.73)	47 (35.34)
Ensure availability of glasses and hearing aids	83 (82.18)	106 (79.70)
Provide orientation to place, time, and person	97 (96.04)	127 (95.49)
Educate family members on supporting orientation	53 (52.48)	77 (57.89)
Avoid unnecessary room or ward changes	57 (56.44)	104 (78.20)
Ensure adequate hydration	101 (100.00)	126 (94.74)
Ensure adequate oxygenation	101 (100.00)	132 (99.25)
Avoid unnecessary catheterization	92 (91.09)	113 (84.96)
Review for polypharmacy	97 (96.04)	128 (96.24)
Ensure adequate nutrition	98 (97.03)	131 (98.50)
Avoid physical restraints	75 (74.26)	68 (51.13)

Routine implementation was defined descriptively as a response of “always” or “frequently.” Full four-level response distributions are provided in Supplementary Table S1.

3.4 Outcome eligibility for adjusted ICU–ward models

Pooled blind outcome-eligibility screening retained 14 shared practices for primary ordinal modelling. Four practices were restricted to descriptive reporting because their non-routine response counts were too sparse after pooling: adequate hydration, adequate oxygenation, polypharmacy review, and adequate nutrition. No outcome required a binary model as its primary analysis.

3.5 Adjusted ICU–ward comparisons

All 14 primary proportional-odds ordinal models were stable, and no binary primary fallback was required. Eight ICU–ward setting effects remained significant after false-discovery-rate correction (Table 4). ICU nurses reported significantly more frequent pain relief and avoidance of unnecessary room or ward changes. ICU nurses reported significantly less frequent sleep support, noise reduction, facilitation of family or friend visits, adequate room lighting, avoidance of unnecessary catheterization, and avoidance of physical restraints. Six practices showed no statistically detectable ICU–ward difference after adjustment and false-discovery-rate correction: early mobilization, cognitive stimulation, provision of a visible clock or calendar, availability of glasses or hearing aids, orientation, and family orientation or education.

Table 4
Adjusted ICU–ward comparisons for the 14 primary ordinal outcomes.

Practice	Adjusted OR	95% CI	<i>p</i>	BH <i>q</i>
Early exercise and mobilization	0.70	0.42–1.18	0.180	0.252
Pain relief	2.18	1.26–3.77	0.005	0.009*
Support daytime wakefulness and high-quality night-time sleep	0.34	0.20–0.59	< 0.001	< 0.001*
Prevent exposure to excessive noise	0.21	0.12–0.36	< 0.001	< 0.001*
Facilitate regular family and friend visits	0.19	0.11–0.33	< 0.001	< 0.001*
Provide adequate room lighting	0.25	0.14–0.44	< 0.001	< 0.001*
Provide cognitive-stimulation activities	0.87	0.53–1.43	0.588	0.651
Provide a clearly visible clock and calendar	1.16	0.70–1.93	0.554	0.651
Ensure availability of glasses and hearing aids	0.68	0.40–1.14	0.145	0.226
Provide orientation to place, time, and person	1.15	0.68–1.95	0.606	0.651
Educate family members on supporting orientation	1.12	0.68–1.84	0.651	0.651
Avoid unnecessary room or ward changes	2.29	1.35–3.87	0.002	0.004*
Avoid unnecessary catheterization	0.43	0.25–0.72	0.002	0.004*
Avoid physical restraints	0.28	0.17–0.47	< 0.001	< 0.001*

OR: odds ratio; CI: confidence interval; BH: Benjamini–Hochberg false-discovery-rate correction. Ward nurses are the reference group. Because the original response coding was retained (1 = always, 4 = never), adjusted ORs greater than 1 indicate more frequent reported implementation in ICUs, whereas ORs below 1 indicate less frequent reported implementation in ICUs. Models were adjusted for hospital fixed effects, current-unit experience per five-year increase, and education. *BH *q* < 0.05.

Figure 1 summarizes the adjusted ICU–ward odds ratios for the 14 modelled shared practices. The figure illustrates the main pattern of results: ICU nurses reported more frequent implementation of pain relief and avoidance of unnecessary room or unit changes, whereas ward nurses reported more frequent implementation of several sleep, environmental, family-contact, catheter-related, and restraint-related preventive practices.

3.6 Model diagnostics and binary sensitivity analyses

The directional consistency check supported the ICU–ward effect interpretation (Supplementary Table S6). Twelve of the 14 binary routine-implementation sensitivity models were stable (Supplementary Table S5). The two unavailable binary sensitivity models were pain relief and orientation; both were affected by quasi-separation after dichotomization because several hospital-by-setting strata contained no non-routine responses. These unavailable binary sensitivity models did not affect the primary analysis because both corresponding ordinal primary models were stable.

Nonparallel proportional-odds diagnostics were available for seven outcomes (Supplementary Table S4). One available diagnostic indicated a proportional-odds violation: adequate room lighting. The threshold-specific nonparallel ICU effects for adequate lighting were both below 1 and statistically significant (OR 0.30, 95% CI 0.16–0.56; OR 0.15, 95% CI 0.05–0.45), consistent with the primary conclusion that ICU nurses reported less frequent implementation of adequate lighting. Seven nonparallel diagnostic models were unavailable because the more flexible category-specific models were numerically unstable; the corresponding stable proportional-odds estimates were retained and interpreted with the available binary sensitivity results.

All eight false-discovery-rate-significant ICU–ward differences were analytically corroborated by at least one prespecified diagnostic or sensitivity analysis. Five were supported by available proportional-odds diagnostics, two were supported by concordant binary sensitivity models when the nonparallel diagnostic was unavailable, and the adequate-lighting association remained directionally consistent in both threshold-specific nonparallel ordinal estimates and the binary sensitivity model.

3.7 Clinical sensitivity analyses

Clinical sensitivity analyses are summarized in Table 5, with item-level comparisons provided in Supplementary Table S7. Excluding the 14 facility-metadata-flagged records and replacing current-unit experience with the derived total-experience proxy produced 14 stable models each, retained eight false-discovery-rate-significant setting effects, and showed no material changes relative to the primary model. Omitting hospital fixed effects also produced 14 stable models and retained eight significant setting effects. This hospital-omitted model produced five material magnitude changes but no direction reversals among the false-discovery-rate-significant primary findings and no change in the number of significant findings. One non-significant estimate changed direction in the hospital-omitted sensitivity analysis but remained non-significant; therefore, the clinical interpretation of the primary findings was unchanged.

Table 5
Clinical sensitivity analyses compared with the primary adjusted model.

Sensitivity arm	Stable models	Significant after BH	Material changes	Interpretation
Exclude 14 facility-metadata-flagged records	14/14	8	0	No material change in direction, magnitude, or FDR status.
Replace current-unit experience with total-experience proxy	14/14	8	0	No material change in direction, magnitude, or FDR status.
Omit hospital fixed effects	14/14	8	5	Five estimates showed material magnitude changes; no direction reversal among significant findings and no significance-status change.

BH: Benjamini–Hochberg false-discovery-rate correction. The hospital-omitted model was an additional sensitivity analysis and does not replace the hospital-adjusted primary model. Material magnitude changes indicate changes in odds-ratio magnitude, not loss of statistical significance. One non-significant estimate changed direction in the hospital-omitted sensitivity analysis but remained non-significant.

4 Discussion

4.1 Principal findings

In this multicentre cohort of 234 nurses, routine delirium-risk assessment and routine monitoring of high-risk patients were uncommon. No nurse reported routine risk assessment for every newly admitted patient, and fewer than one in five nurses reported routinely monitoring patients considered at high risk of delirium. Among nurses who reported routine monitoring, the reported approaches relied on observation of command-following or agitation-related behaviour rather than a formal delirium instrument. These findings indicate that delirium-related nursing work in this cohort was not organized around systematic risk assessment and formal monitoring.

The adjusted ICU–ward models identified clear setting-specific differences in reported non-pharmacological prevention practices. ICU nurses reported more frequent pain relief and avoidance of unnecessary room or ward changes. In contrast, ICU nurses reported less frequent sleep support, noise reduction, facilitation of family or friend visits, adequate lighting, avoidance of unnecessary catheterization, and avoidance of physical restraints. These results suggest that ICU and ward environments have different implementation strengths and gaps rather than a uniform pattern of better practice in one setting.

4.2 Screening and monitoring gaps

The absence of routine admission risk assessment is clinically important because structured risk recognition is a prerequisite for targeted prevention. For both admission risk assessment and routine high-risk monitoring, the most frequent barrier was the absence of a rapid and easy-to-use tool. Time pressure and lack of institutional expectation were also common barriers in both workflows. This pattern points primarily to workflow and organizational opportunity barriers rather than to individual motivation alone, consistent with implementation frameworks and recent reviews of nurse-led delirium-management barriers (Michie et al., 2011; Almoliky et al., 2025). Similarly, the low rate of routine high-risk monitoring and reliance on non-instrument-based observation suggest that delirium monitoring was not embedded as a standardized nursing process in these settings. This interpretation is consistent with recent evidence that delirium-screening tools can show variable completion rates when introduced into routine hospital practice (Penfold et al., 2024; Benn et al., 2025).

4.3 ICU–ward practice differences

The ICU advantages were concentrated in pain relief and avoidance of unnecessary room or ward changes. These findings are plausible because pain assessment and continuity of location may be integrated into ICU routines, monitoring systems, and safety priorities. However, the cross-sectional self-report design cannot establish the mechanisms causing these differences.

The ICU disadvantages were concentrated in practices related to environmental modification, family contact, sleep, catheter avoidance, and restraints. Reduced family visitation, noise control, lighting optimization, and sleep support may be more difficult in high-acuity ICU environments, but the observed differences should not be interpreted as inevitable. Instead, they identify concrete implementation targets aligned with multicomponent delirium-prevention principles and ICU guidance addressing pain, sedation, delirium, immobility, and sleep disruption (NICE, 2023; Devlin et al., 2018; Lewis et al., 2025; Pun et al., 2019; Burton et al., 2021). The physical-restraint finding is particularly important because restraint avoidance is both a delirium-prevention and patient-safety concern. The catheterization finding also suggests a potential device-related implementation gap.

4.4 Model diagnostics and robustness

The modelling diagnostics support the credibility of the primary findings. All 14 primary proportional-odds ordinal models were stable, no binary primary fallback was required, and the directional consistency check passed. Eight ICU–ward associations remained significant after false-discovery-rate correction. The binary sensitivity analyses were largely concordant with the primary ordinal models. The only proportional-odds violation was for adequate lighting; the nonparallel threshold-specific estimates and the binary sensitivity model supported the same clinical direction as the primary model. Therefore, the adequate-lighting conclusion does not rest solely on the proportional-odds assumption.

Clinical sensitivity analyses strengthened the robustness interpretation. Excluding the 14 facility-metadata-flagged records did not change the number of significant findings and showed no material changes relative to the primary model. Replacing current-unit experience with a total-experience proxy also showed no material changes relative to the primary model. Omitting hospital fixed effects changed

the magnitude of five estimates but did not produce direction reversals among the false-discovery-rate-significant primary findings or alter the number of significant findings. One non-significant estimate changed direction but remained non-significant. This indicates that hospital adjustment matters quantitatively, but the overall ICU–ward pattern is not an artifact of the hospital fixed-effect specification.

4.5 Implications for practice

The findings support several practical priorities. Hospitals should consider structured delirium-risk assessment at admission, clearer institutional expectations for delirium screening and monitoring, rapid bedside tools, alerting or documentation pathways where appropriate, and feedback systems to support routine completion. Implementation strategies should be setting-specific. In ICUs, environmental control, sleep support, family-contact facilitation, restraint minimization, and catheter review may require particular attention. In wards, pain management and avoidance of unnecessary transfers may deserve additional review. Education alone is unlikely to be sufficient if workload, time pressure, lack of rapid tools, and lack of institutional expectation remain unaddressed (Michie et al., 2011; Almoliky et al., 2025; Pun et al., 2019).

4.6 Strengths and limitations

This study has several strengths. It used a linked multicentre cohort including both ICU and ward nurses, retained item-level preventive-practice information, used ordinal models rather than unnecessary dichotomization for the primary analysis, adjusted for hospital site and key covariates, applied false-discovery-rate correction, and incorporated direction and sensitivity checks.

Several limitations should also be considered. The data were collected between January 2018 and January 2019 and should be interpreted as a historical baseline. Practices were self-reported rather than directly observed or audited, creating the possibility of social-desirability bias and ceiling effects. The cross-sectional design does not support causal inference. Some outcomes had high routine-implementation rates and were restricted to descriptive reporting. Nonparallel ordinal diagnostics were unavailable for seven items because the more flexible category-specific models were numerically unstable. Binary sensitivity models were unavailable for two items because of quasi-separation after dichotomization. These limitations were documented transparently and did not affect the stable primary ordinal models. The study was not designed as an equivalence study; therefore, non-significant ICU–ward comparisons should be interpreted as no statistically detectable difference rather than evidence of equivalent implementation. Detailed approached–declined–excluded recruitment counts were not available in the source documentation used for this manuscript. Finally, the study was conducted in five hospitals in one city, which may limit generalizability.

5 Conclusion

This multicentre analysis identified major gaps in nurse-reported routine delirium-risk assessment and monitoring and demonstrated setting-specific differences in reported delirium-prevention practices. ICU nurses reported more frequent implementation of pain relief and avoidance of unnecessary room or

ward changes, whereas ward nurses reported more frequent implementation of sleep support, noise reduction, family or friend visits, adequate lighting, avoidance of unnecessary catheterization, and avoidance of physical restraints. These findings were robust to facility-flag exclusion and the definition of nursing experience, and the overall pattern was not eliminated when hospital fixed effects were omitted. The results identify concrete, setting-specific targets for improving delirium-prevention implementation.

Declarations

Ethics approval and consent to participate

The study was reviewed and approved by the Koç University Social Sciences Research Ethics Committee (reference number: 2018.007.IRB3.007). The study adhered to the principles of the Declaration of Helsinki. Institutional permission was obtained from the Istanbul Provincial Health Directorate, and written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Author Contribution

MZ led the current manuscript concept, statistical-analysis strategy, statistical analysis and reproducibility workflow, model validation, sensitivity-analysis framework, interpretation of the adjusted ICU--ward comparisons, visualization planning, and drafting and revision of the manuscript. ÖZ led the original PhD study, clinical-practice data collection, questionnaire implementation, source-document verification, clinical nursing interpretation, and drafting and revision of the manuscript. PG contributed to the original research design, doctoral supervision, nursing-practice interpretation, and critical revision of the manuscript. MF contributed to nursing-practice interpretation, delirium-care implementation framing, and critical revision of the manuscript. MAK contributed to psychological and behavioural interpretation of delirium-prevention practices, interpretation of implementation barriers, and critical revision of the

manuscript. MÖ contributed to doctoral supervision, nursing and health-informatics interpretation, data interpretation, and critical revision of the manuscript. All authors read and approved the final manuscript.

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Data Availability

The datasets generated and analysed during the current study are not publicly available because of institutional data-sharing restrictions and participant-privacy considerations, but may be available from the corresponding author upon reasonable request and subject to institutional approval.

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Figures

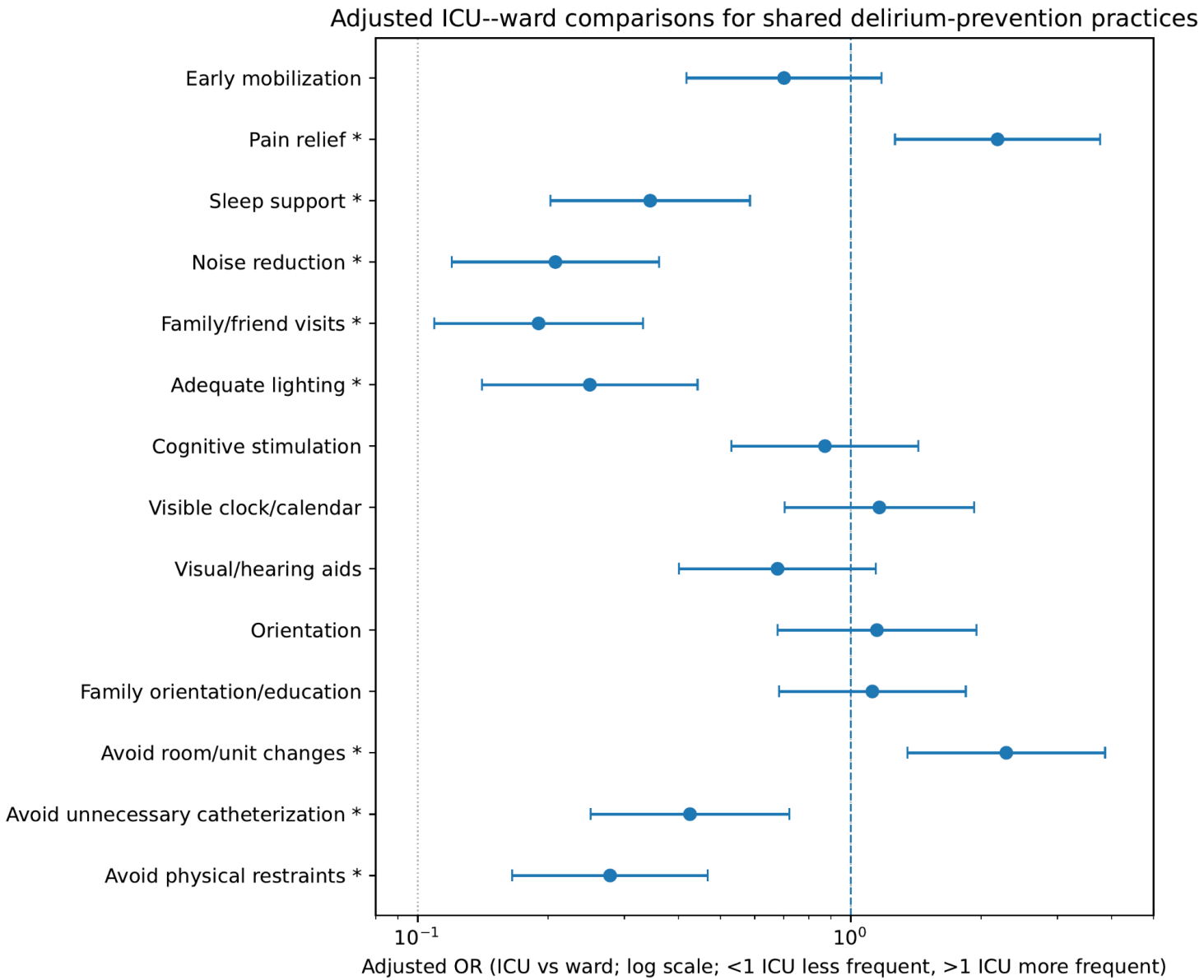


Figure 1

Adjusted ICU–ward odds ratios for the 14 modelled shared delirium-prevention practices. Odds ratios greater than 1 indicate more frequent reported implementation in intensive care units; odds ratios below 1 indicate less frequent reported implementation in intensive care units compared with general wards. Error bars show 95% confidence intervals. The vertical reference line denotes an odds ratio of 1.

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