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Original Research Article

The Association between Staff Training on Utilization and Reporting Patterns of the Occurrence Variance Reporting (OVR) System at Al-Noor Specialist Hospital in Makkah

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Abstract

Background: Occurrence variance reporting (OVR) systems are essential tools for identifying, mitigating, and preventing risks in healthcare, yet they are widely under-used because of inadequate training, fear of blame, and unclear definitions of what constitutes a reportable event. In Saudi Arabia, Vision 2030 reforms place incident reporting at the centre of quality and patient-safety improvement. ***Objective:*** To examine whether a hospital-wide staff training program on the OVR system was associated with changes in the number of incident reports, the distribution of risk levels, and the distribution of incident categories at Al-Noor Specialist Hospital, Makkah. ***Methods:*** A quantitative, retrospective, single-group pre–post quasi-experimental design without a control group was applied to secondary data extracted from the hospital's electronic OVR system. The intervention was a 40-minute face-to-face session (presentation, case study, and system-demonstration video) delivered from mid-May 2024 to 430 documented attendees (≈18.7% of 2,300 employees). A total census of 4,981 reports was analysed across a pre-intervention period (1 July 2023–30 June 2024; n = 2,018) and a post-intervention period (1 July 2024–30 June 2025; n = 2,963). Monthly volumes were compared with the Mann–Whitney U test after Shapiro–Wilk testing; risk-level and category distributions were compared with chi-square tests of independence. ***Results:*** Total reports increased by 46.8%, and monthly volume rose significantly (median 154 vs. 241; U = 11.00, z = −3.52, $p < .001$, rank-biserial r = 0.847). The reporting rate rose from 15.90 to 24.99 per 1,000 patient-days (+57.2%) despite a 6.6% fall in patient-days. Risk-level distribution changed significantly ($\chi^2(3, N = 4,981) = 262.44$, $p < .001$, Cramér's V = 0.230), shifting toward low- and moderate-risk reports (82.0% to 95.9%). Incident-category distribution also changed significantly ($\chi^2(5, N = 4,981) = 243.42$, $p < .001$, Cramér's V = 0.221), with notable increases in the Incident (0.8% to 10.5%) and Adverse Event (29.7% to 34.8%) categories. ***Conclusion:*** Staff training on the OVR system was associated with a sustained increase in incident reporting and with changes in the risk-level and category profile of reports. Because the design lacked a control group and classifications were not independently verified, the changes cannot be attributed to training alone or interpreted as improved classification accuracy. Training appears to be a promising, low-cost strategy against under-reporting when combined with leadership support, feedback to reporters, and evaluation in controlled studies.

Keywords: Incident reporting; Occurrence Variance Reporting; Staff training; Patient safety; Risk level; Saudi Arabia.

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1. INTRODUCTION

Patient safety is a critical determinant of healthcare quality and outcomes. The World Health Organization (WHO) describes it as a framework of organised activities that creates cultures, processes, behaviours, technologies, and environments that consistently lower risk, reduce avoidable harm, make error less likely, and reduce its impact when it does occur [1]. Systematic attention to patient safety accelerated after two landmark reports, *To Err is Human* in the United States and *An Organisation with a Memory* in the United Kingdom, revealed the scale of preventable harm in healthcare [2,3]. Unsafe care continues to cause disability and death for a substantial number of patients worldwide [4].

Incident reporting systems, such as the Occurrence Variance Reporting (OVR) system, are among the principal tools used to identify and analyse unwanted events, including hazards, near misses, and adverse events, so that organisations can implement corrective actions and prevent recurrence [5]. Such systems influence practice by increasing staff knowledge and awareness and improving attitudes towards safety [6]. An effective reporting system should be easy to use, confidential, and supported by leadership, with proper staff training to improve satisfaction and increase the reporting rate [7].

In Saudi Arabia, Vision 2030 is transforming healthcare by aligning local reforms with international best practice and by promoting awareness of patient-safety culture among healthcare practitioners [8]. Sentinel events in the Kingdom have been linked to poor communication, a blame culture, staffing problems, and language barriers, and the Ministry of Health has reported that the large majority of such events are preventable, whereas effective teamwork and management support improve safety [9]. Leadership that builds trust and psychological safety encourages reporting [10], and top-level commitment is positively associated with a strong safety culture and better safety outcomes [11,12].

Staff training is repeatedly identified as a key determinant of OVR utilisation, because it improves knowledge, skills, and confidence and helps staff recognise reportable events [7]. Nevertheless, persistent barriers, including fear of punitive action, weak safety culture, limited understanding of what should be reported, and limited awareness of how reports are used, continue to undermine reporting systems [13]. Safety culture, the integrated pattern of shared beliefs and behaviours that continuously seeks to minimise patient harm [14], is central here: a positive safety culture encourages open disclosure, whereas a blame culture suppresses it [15,16]. Users who receive training report greater satisfaction with reporting software, yet many are never trained on the systems they are expected to use [17].

Intervention studies support the value of training. At King Saud Hospital in Al-Qassim, a structured educational program increased OVR reports from 15 in the pre-test phase to 74 in the post-test phase and to 306 and 216 in two follow-up phases [5]. In a hospital-based radiation oncology department, combined crew-resource training and a customised reporting system raised mean monthly reports from 1.8 to 9.3 [18]. In contrast, OVR volumes across ten governmental hospitals in Makkah declined from 33,170 in 2021 to 22,201 in 2023, a fall attributed to behavioural barriers rather than to a true reduction in incidents [19]. At Al-Noor Specialist Hospital itself, 59% of surveyed physicians and nurses identified a lack of proper training as a major barrier to incident disclosure [20].

Most published evaluations measure reporting volume alone. Evidence on whether training changes the composition of reports, that is, the risk levels assigned and the incident categories used, remains limited, and a systematic review has emphasised that the value of reporting depends on what is reported and how organisations respond, not on volume [21]. It is unclear whether training produces an influx of low-risk reports or empowers staff to document complex, higher-risk events that are most suppressed in punitive cultures.

This study was informed by three complementary frameworks. Adult Learning Theory (andragogy) holds that training is most effective when it is problem-centred and draws on learners' occupational experience [22]; the Theory of Planned Behaviour (TPB) posits that intentions are shaped by attitudes, subjective norms, and perceived behavioural control [23]; and the Technology Acceptance Model (TAM) predicts that a system is adopted when it is perceived as useful and easy to use [24]. Together they suggest that training acts through knowledge, attitudes, self-efficacy, and perceived usefulness and ease of use to change reporting behaviour (Figure 1). These mediators were not measured in the present study.

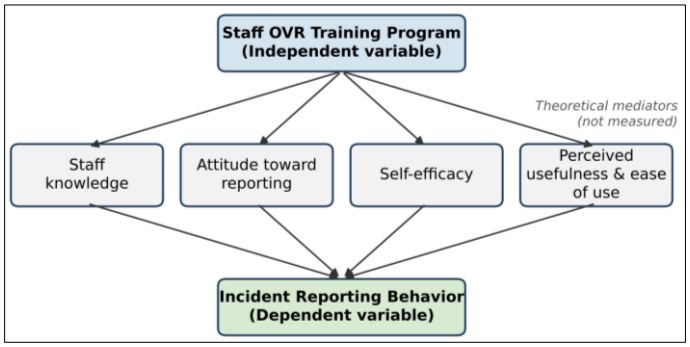


Figure 1: Conceptual framework linking staff training to incident-reporting behaviour. The mediating constructs are derived from andragogy, the Theory of Planned Behaviour, and the Technology Acceptance Model and were not measured in this study

Accordingly, this study examined whether staff training on the OVR system was associated with changes in incident-reporting behaviour at Al-Noor Specialist Hospital by comparing, between the pre- and post-intervention periods, (i) the total number of incident reports, (ii) the distribution of risk levels, and (iii) the distribution of incident categories. Three null hypotheses were tested: that there would be no significant difference between the periods in the number of reports ($H1_0$), in the proportion of risk-level reports ($H2_0$), or in the distribution of incident categories ($H3_0$).

2. MATERIALS AND METHODS

2.1 Study design

A quantitative, retrospective, single-group pre–post quasi-experimental design without a control group was used, based on secondary data from the hospital's OVR system. Reporting patterns were compared across two consecutive 12-month periods: a pre-intervention period (1 July 2023–30 June 2024) and a post-intervention period (1 July 2024–30 June 2025). Randomised and non-equivalent control-group designs were not feasible because the Quality and Patient Safety Department delivered the training as a hospital-wide initiative and comparable report-level data from another hospital were unavailable. Using full annual cycles allowed for recurring seasonal variation in hospital activity.

2.2 Study setting

The study was conducted at Al-Noor Specialist Hospital, a Ministry of Health tertiary hospital in Makkah, Saudi Arabia, with approximately 2,300 employees. Patient-safety events are documented electronically through the OVR module of the hospital's APEX information system, which is accessible to all departments and administered by the Quality and Patient Safety Department, which receives, investigates, and closes every report. Hospital policy requires reporting within 24 hours of discovery, allows any employee to report by name or anonymously, and commits to a non-punitive response. An OVR is defined nationally as any undesired event affecting patients, employees, family members, visitors, the facility, equipment, or property that is inconsistent with standard operations of care [25].

2.3 Training intervention

The intervention was a face-to-face session of about 40 minutes designed and delivered by the Quality and Patient Safety Department from mid-May 2024 onwards; after roll-out, the same session was incorporated into orientation for all newly hired staff. Each session comprised (i) a 22-slide presentation entitled *Occurrence Variance Report in Health Care: The Importance of Reporting Safety Events in Health Care*; (ii) a case study in which participants applied the definitions and risk matrix to a worked scenario; and (iii) a short video demonstrating step by step how to submit a report in the OVR system. Participants also received QR codes linking to the training materials.

The content mapped directly onto the study outcomes. To address under-reporting, the session presented the hospital's own figures (about eight patients exposed to harm or potential harm each day), described when an OVR must be submitted, and stressed that anyone may report, by name or anonymously, within 24 hours under a non-punitive policy. To address classification, each reportable category was defined and illustrated, with emphasis on the many near misses that precede each sentinel event. To address risk assignment, the session presented the five-level severity scale (negligible to catastrophic), the likelihood × severity matrix, and the resulting risk bands (1–3 low, 4–6 moderate, 8–12 high, 15–25 extreme), with required actions and turnaround times of 5, 10, 10, and 15 working days, respectively.

A total of 430 attendance records were documented, representing approximately 18.7% of the hospital's workforce; 363 attendees (84.4%) were from clinical departments (medical and allied health) and 67 (15.6%) from administrative departments. Departmental headcounts were unavailable, so coverage could not be expressed per department.

2.4 Population, eligibility, and data collection

The unit of analysis was the OVR report. All reports submitted from any department between 1 July 2023 and 30 June 2025 were eligible; reports outside this window, duplicate entries, and records missing any key variable were excluded. No sampling was performed: all eligible reports were analysed as a total census, so no a priori sample-size calculation was required. After approval by the Ministry of Health Institutional Review Board, the IT department exported all OVR records from the APEX system to Microsoft Excel, including entry date, risk level, and incident category. Reports were assigned to a period by entry date. Identifiers such as names, ID numbers, and incident narratives were removed at export. The same system, extraction procedure, and eligibility criteria were applied to both periods, and the OVR fields follow a standardised national taxonomy, supporting consistency of the data.

2.5 Study variables

The independent variable was the training program, operationalised as study period (pre- vs. post-intervention), because analysis was conducted at the system level rather than the individual-reporter level. An incident was defined as any event or outcome that could have reduced, or did reduce, the safety margin for the patient, whether or not preventable or involving error [26]. The dependent variables were: (i) the number of eligible incident reports, analysed as monthly counts; (ii) risk level assigned at submission (low, moderate, high, extreme); and (iii) incident category assigned at submission (adverse event, incident, near miss, no-harm event, sentinel event, unsafe condition). Risk level and category were assigned by reporters and were not independently verified.

2.6 Statistical analysis

Analyses were performed in SPSS. Frequencies and percentages described risk-level and category distributions, and means, standard deviations, and medians summarised monthly volumes. Normality of monthly counts (12 months per period) was assessed with the Shapiro–Wilk test; because post-intervention counts were not normally distributed, monthly volumes were compared with the Mann–Whitney U test, with the rank-biserial correlation as the effect size. Associations between period and risk level and between period and incident category were tested with chi-square tests of independence, with Cramér's V as the effect size; adjusted standardised residuals (|value| > 1.96) were used to identify the cells driving significant associations. All expected cell counts exceeded 5. To assess secular trends in the absence of a control group, hospital activity indicators (patient-days, admissions, emergency department visits, outpatient visits) from the hospital Statistics Department were compared between periods, and the OVR rate was expressed per 1,000 patient-days. Statistical significance was set at $p < 0.05$ (two-tailed).

2.7 Ethical considerations

The study was approved by the Institutional Review Board of the Ministry of Health, Saudi Arabia (approval reference H-02-K-076-1025-143). The study used de-identified secondary data and involved no direct contact with human participants; therefore, informed consent was not required. The dataset was stored on a password-protected computer accessible only to the investigators and will be securely deleted on completion of the research.

3. RESULTS

3.1 Reporting volume

After screening, 4,981 reports were analysed: 2,018 in the pre-intervention period and 2,963 in the post-intervention period, an increase of 46.8%. Mean monthly reports rose from 168.2 (SD 45.41) to 246.9 (SD 26.58) (Table 1). Pre-intervention monthly counts were normally distributed (W = 0.90, $p = .143$), whereas post-intervention counts were not (W = 0.80, $p = .009$). The Mann–Whitney U test showed a significant increase in monthly reports (mean rank 7.42 vs. 17.58; U = 11.00, z = −3.523, $p < .001$), with a large effect size (r = 0.847). Reporting remained above the pre-intervention mean in every post-intervention month (Figure 2). $H1_0$ was therefore rejected.

Table 1: Monthly incident reports in the pre- and post-intervention periods

Period	Months (n)	Total reports	Mean (SD)	Median	Min–Max	Shapiro–Wilk W (*p*)	Mean rank
Pre-intervention	12	2,018	168.2 (45.41)	154	103–281	0.90 (.143)	7.42
Post-intervention	12	2,963	246.9 (26.58)	241	223–318	0.80 (.009)	17.58

Note: Mann–Whitney U = 11.00; Wilcoxon W = 89.00; z = −3.523; $p < .001$; rank-biserial r = 0.847. Pre-intervention: 1 July 2023–30 June 2024; post-intervention: 1 July 2024–30 June 2025.

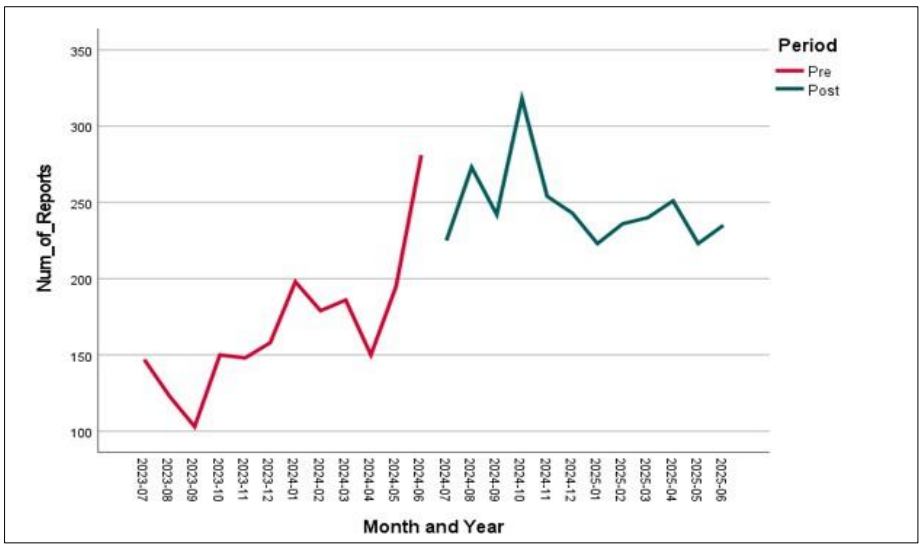


Figure 2: Monthly number of OVR reports from July 2023 to June 2025 in the pre-intervention (red) and post-intervention (green) periods. Training sessions began in mid-May 2024

Hospital activity did not account for the increase (Table 2). Total patient-days decreased by 6.6% and emergency department visits by 8.9%, while admissions (+1.9%) and outpatient visits (+4.8%) changed modestly. The OVR rate rose from 15.90 to 24.99 reports per 1,000 patient-days, an increase of 57.2%.

Table 2: Hospital activity indicators and OVR reporting rate in the two study periods

Indicator	Pre-intervention	Post-intervention	Change (%)
Total patient-days	126,934	118,563	−6.6
Admissions	19,287	19,659	+1.9
Emergency department visits	181,146	164,971	−8.9
Outpatient visits	454,531	476,250	+4.8
OVR reports	2,018	2,963	+46.8
OVR reports per 1,000 patient-days	**15.90**	**24.99**	**+57.2**

Note: Change (%) = (post − pre) / pre × 100. Reporting rate = OVR reports / total patient-days × 1,000.

3.2 Risk-level distribution

Low- and moderate-risk reports predominated in both periods (Table 3). The proportion of high-risk reports fell from 16.2% to 3.7% and that of extreme-risk reports from 1.8% to 0.4%, while moderate-risk reports rose from 41.8% to 49.0% and low-risk reports from 40.2% to 46.9% (Figure 3). Combined, high- and extreme-risk reports declined from 18.0% to 4.1%, and low- and moderate-risk reports increased from 82.0% to 95.9%. The association between period and risk level was significant, $\chi^2(3, N = 4{,}981) = 262.44$, $p < .001$, Cramér's V = 0.230 (medium effect; minimum expected count 19.9). Adjusted residuals identified the decline in high-risk reports as the largest contributor. $H2_0$ was rejected.

Table 3: Distribution of OVR reports by risk level before and after the intervention

Risk level	Pre-intervention n (%)	Post-intervention n (%)	Total n (%)	Adjusted residual (post)
Extreme	37 (1.8)	12 (0.4)	49 (1.0)	−5.0
High	327 (16.2)	111 (3.7)	438 (8.8)	−15.2
Moderate	843 (41.8)	1,451 (49.0)	2,294 (46.0)	+5.0
Low	811 (40.2)	1,389 (46.9)	2,200 (44.2)	+4.7
Total	**2,018 (100.0)**	**2,963 (100.0)**	**4,981 (100.0)**	

Note: Percentages are within period. Pearson $\chi^2(3, N = 4{,}981) = 262.44$, $p < .001$; Cramér's V = 0.230. No cells had an expected count < 5 (minimum 19.9). |Adjusted residual| > 1.96 indicates a cell differing significantly from expectation at α = .05.

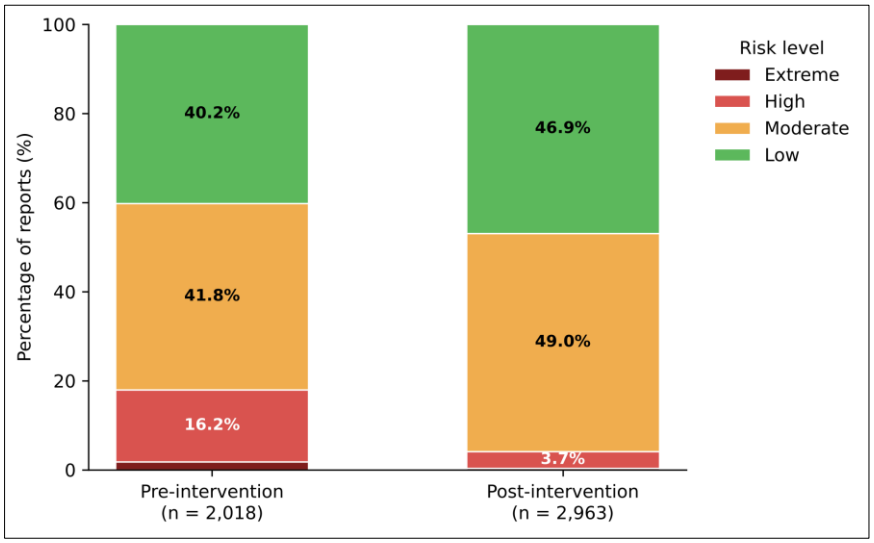


Figure 3: Proportional distribution of OVR reports by risk level in the pre- and post-intervention periods. Extreme-risk segments (1.8% and 0.4%) are too small to label

3.3 Incident-category distribution

Unsafe Condition and Adverse Event were the most frequent categories overall (57.4% and 32.7% of all reports). The association between period and category was significant, $\chi^2(5, N = 4{,}981) = 243.42$, $p < .001$, Cramér's V = 0.221 (medium effect; minimum expected count 6.9) (Table 4, Figure 4). The largest change was in the Incident category, which rose from 0.8% to 10.5%; 94.8% of all Incident reports in the dataset were submitted after the intervention. Adverse Event reports increased from 29.7% to 34.8% and Sentinel Event reports from 0.1% to 0.5% (88.2% of all sentinel reports occurred post-intervention). Unsafe Condition reports increased in absolute number (1,312 to 1,548) but declined as a share of reports (65.0% to 52.2%) because other categories grew faster. Near Miss (3.7% to 1.8%) and No-Harm Event (0.7% to 0.2%) reports declined in both proportion and absolute number. $H3_0$ was rejected.

Table 4: Distribution of OVR reports by incident category before and after the intervention

Incident category	Pre-intervention n (%)	Post-intervention n (%)	Total n (%)	Adjusted residual (post)
Adverse event	599 (29.7)	1,032 (34.8)	1,631 (32.7)	+3.8
Incident	17 (0.8)	310 (10.5)	327 (6.6)	+13.5
Near miss	74 (3.7)	52 (1.8)	126 (2.5)	−4.2
No-harm event	14 (0.7)	6 (0.2)	20 (0.4)	−2.7
Sentinel event	2 (0.1)	15 (0.5)	17 (0.3)	+2.4
Unsafe condition	1,312 (65.0)	1,548 (52.2)	2,860 (57.4)	−8.9
Total	**2,018 (100.0)**	**2,963 (100.0)**	**4,981 (100.0)**	

Note: Percentages are within period. Pearson $\chi^2(5, N = 4{,}981) = 243.42$, $p < .001$; Cramér's V = 0.221. No cells had an expected count < 5 (minimum 6.9). |Adjusted residual| > 1.96 indicates a cell differing significantly from expectation at $\alpha = .05$.

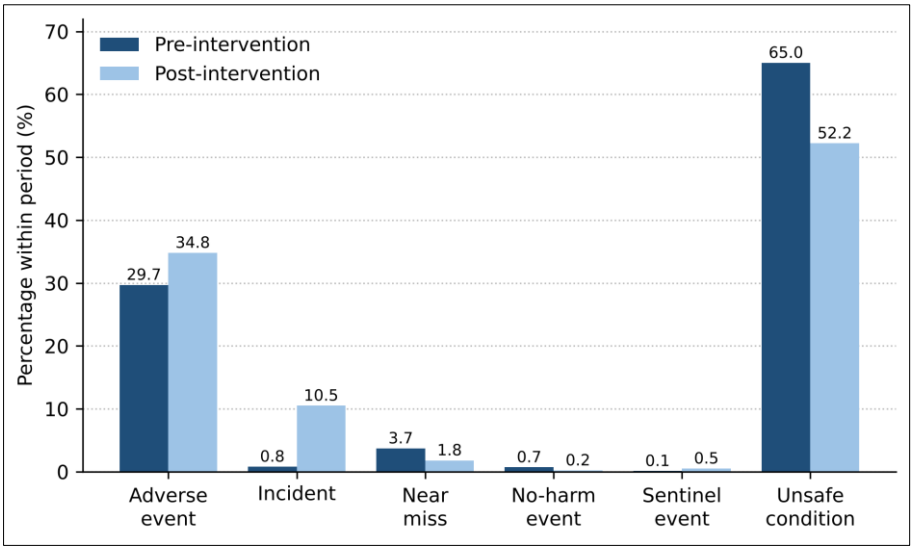


Figure 4: Percentage distribution of OVR reports by incident category within the pre- and post-intervention periods

Table 5 summarises the hypothesis tests; all three null hypotheses were rejected.

Table 5: Summary of hypothesis testing

Hypothesis	Test	Statistic	df	*p*-value	Effect size	Decision on H_0
H1: Number of reports	Mann–Whitney U	U = 11.00; z = −3.523	—	< .001	r = 0.847 (large)	Rejected
H2: Risk-level proportions	Chi-square	$\chi^2 = 262.44$	3	< .001	V = 0.230 (medium)	Rejected
H3: Incident-category distribution	Chi-square	$\chi^2 = 243.42$	5	< .001	V = 0.221 (medium)	Rejected

Note: r = rank-biserial correlation; V = Cramér's V; df = degrees of freedom.

4. DISCUSSION

This study found that the year following a hospital-wide OVR training program differed significantly from the preceding year in reporting volume, risk-level profile, and category mix. Taken together, these three dimensions offer a fuller view of reporting behaviour than volume alone, although, given the design, the changes represent associations with the training period rather than demonstrated effects of training.

Reporting volume:

The 46.8% increase in reports, sustained across all 12 post-intervention months and persisting after adjustment for a decline in patient-days, is the most apparent change. An increase in reports should not be read as an increase in harm; incident reporting systems characteristically suffer from under-reporting due to limited awareness, uncertainty about what to report, fear of blame, and a perception that reporting achieves nothing [13], and incident reports capture only a fraction of actual events [27]. The rise is therefore more consistent with reduced under-reporting than with deteriorating safety. The direction of change agrees with the Saudi educational intervention of AL-Reshidi [5] and with the fivefold increase reported by Swanson *et al.*,[18], and it contrasts with the declining OVR volumes reported across Makkah governmental hospitals between 2021 and 2023 [19]. Notably, fewer than one in five employees attended training, yet reports rose by almost half, which suggests either diffusion of the training message beyond attendees, for example through peers

and unit leaders, or the influence of concurrent organisational factors.

The content of the session offers plausible mechanisms. Using the hospital's own data and a worked case is consistent with the problem-centred principle of andragogy [22]; the emphasis on anonymous, non-punitive reporting addresses the attitudes, norms, and perceived behavioural control described by the TPB [23]; and the step-by-step video addresses the perceived ease of use central to the TAM [24]. Abu Alrub *et al.,* similarly found that 74.3% of trained staff reported greater confidence in using an electronic reporting system [7]. These mechanisms were not measured here and remain hypotheses.

Risk-level distribution:

The marked fall in the proportion of high- and extreme-risk reports should not be interpreted as a decline in serious events at the hospital. Because the total number of reports increased, the change mainly reflects proportionally greater growth in low- and moderate-risk reports: staff appear more willing to report less serious events that would previously have gone unrecorded. Lower-severity events are the most under-reported, because staff tend to prioritise serious cases and to regard minor events as not worth documenting; uncertainty about reporting thresholds for such events has been identified as a key driver of under-reporting that training can address [7]. Training that presented the risk matrix explicitly may also have reduced over-classification of moderate events as high risk, as AL-Reshidi observed improved knowledge of severity levels after education [5]. However, risk levels were assigned by reporters and were not scored against an independent standard, so the present data cannot show whether classification became more accurate. A reporting profile weighted toward low- and moderate-risk events is nevertheless characteristic of mature systems, because such reports reveal weaknesses before harm occurs.

Incident-category distribution:

The largest category change was in Incident reports, almost all of which (94.8%) were submitted after the intervention, together with increases in Adverse Event and Sentinel Event reports. This pattern may reflect greater awareness of the definitions and boundaries of each category, which staff require explicit training to apply [1,6], and a reduced reluctance to label serious events once the non-punitive purpose of reporting was emphasised. The absolute rise in Unsafe Condition reports is also encouraging, because these reports capture latent conditions, dormant system weaknesses that cause harm only when combined with active failures at the point of care [28]; their proportional decline simply reflects faster growth in other categories.

The decline in Near Miss and No-Harm Event reports, in both proportion and absolute number, runs counter to expectations and contrasts with the tenfold increase in near-miss reports reported after an electronic system and training were introduced at a Riyadh teaching hospital [7]. One explanation is reclassification: with clearer category boundaries, some events previously labelled near misses or no-harm events may have been reported as Incidents or Adverse Events. Alternatively, heightened attention to serious events and hazards may have displaced near-miss reporting. Either way, near-miss reporting is a sensitive indicator of a learning culture, consistent with the high-reliability emphasis on weak signals [29], and it warrants targeted reinforcement.

Implications:

More and broader reporting provides more data for detecting trends and prioritising risks, but increased reporting does not by itself improve safety unless it is matched by analysis, action, and feedback to reporters [21]. As reporting volume grows, quality and patient-safety teams require capacity to review reports and close the loop; lack of feedback is a major cause of reporting fatigue [13]. Hospitals should embed OVR training in orientation with periodic refreshers, use case material that reflects local reporting data and priorities, emphasise near-miss reporting explicitly, and monitor a dashboard covering volume, risk-level and category distribution, near-miss share, timeliness, and the proportion of reports leading to action. At policy level, documented incident-reporting training could be incorporated into national quality standards, supported by standardised training modules, benchmarking of reporting indicators across hospitals, and national guidance that codifies just-culture principles distinguishing human error, at-risk behaviour, and reckless conduct [30].

4.1 Strengths and limitations

Strengths of the study include full 12-month observation windows on each side of the intervention, a total census of nearly 5,000 reports from routinely collected electronic data in a busy tertiary hospital, analysis of report composition as well as volume, and adjustment for hospital activity.

Several limitations apply. First, the single-group pre–post design without a control group precludes causal inference; concurrent factors such as revisions to the OVR cycle and policy introduced alongside the training, broader patient-safety programs, accreditation activity, or leadership changes may have contributed, and their contributions cannot be separated from that of training. Reporting was already rising before the intervention (Figure 2), and the roll-out overlapped the final six weeks of the pre-intervention period, which may have inflated pre-intervention counts and attenuated or otherwise biased the comparison; an interrupted time-series analysis with more data points would better account for pre-existing trends. Second, the data come from one hospital, limiting generalisability. Third, risk levels and categories were assigned by reporters and were not independently verified, so distributional changes cannot

be interpreted as improved classification accuracy. Fourth, patient outcomes were not examined. Finally, staff perceptions, the hypothesised mediators, and safety culture (for example, with the AHRQ Hospital Survey on Patient Safety Culture) were not measured. Future multicentre, controlled, mixed-methods, and longer-term studies linking reporting patterns to clinical outcomes and comparing training modalities are recommended.

5. CONCLUSION

Staff training on the OVR system at Al-Noor Specialist Hospital was associated with a sustained 46.8% increase in incident reports, a 57.2% increase in the reporting rate per 1,000 patient-days, a shift toward low- and moderate-risk reports, and significant changes in incident categorisation, particularly increases in Incident, Adverse Event, and Sentinel Event reports. The concurrent decline in Near Miss and No-Harm Event reports indicates that training alone may not be sufficient to establish consistent proactive reporting. Because the study lacked a control group and did not independently verify classifications, the findings indicate association rather than causation. Practical, context-specific, organisation-wide training appears to be a feasible, low-cost strategy to reduce under-reporting, provided it is supported by leadership commitment, a just culture, meaningful feedback to reporters, and evaluation in controlled studies.

DECLARATIONS

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Ethics approval and consent to participate: Approved by the Institutional Review Board of the Ministry of Health, Saudi Arabia (reference H-02-K-076-1025-143). The requirement for informed consent was not applicable because only de-identified secondary data were used.

Author contributions: SSK conceived the study, collected and analysed the data, and drafted the manuscript. WMK supervised the study and critically revised the manuscript. Both authors approved the final version.

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Conflicts of interest: The authors declare no conflicts of interest.

Data availability: The data are held by Al-Noor Specialist Hospital and are not publicly available because of institutional confidentiality requirements; aggregated data are available from the corresponding author on reasonable request.

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