Comparative Audit of Sedation Practice Across Specialties using SEDlog: Adherence to National Guidelines and Current Evidence

July, 2025

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1. Executive Summary

This report presents a comprehensive analysis of sedation practices across various clinical specialties, drawing upon SEDlog audit data and benchmarking these practices against established UK national guidelines and current evidence on non-anaesthetist administered sedation. The audit reveals variations in adherence to best practices across departments, highlighting both areas of compliance and deficiencies.

Key findings indicate inconsistent pre-assessment rates, particularly in identifying high-risk patient factors. While monitoring with pulse oximetry and blood pressure is generally high, the utilization of capnography, an essential modality for early detection of respiratory compromise, remains suboptimal across many specialties, despite strong guideline recommendations. Drug administration patterns show variability in dosing and the use of adjuvant agents, which can impact overall sedative requirements and patient safety.

The analysis underscores that sedation is a dynamic continuum, and unintended progression to deeper levels necessitates robust preparedness and monitoring. Deficiencies often reflect systemic challenges rather than isolated departmental issues, emphasizing the need for strong institutional governance. Important considerations include mandating comprehensive pre-assessment, standardizing capnography use with appropriate training, formalizing training for non-anaesthetist sedationists, and establishing robust clinical governance structures to ensure continuous quality improvement and patient safety.

2. Introduction

The provision of procedural sedation is an essential aspect of modern healthcare, facilitating a broad spectrum of diagnostic and therapeutic interventions. While often perceived as less invasive or risky than general anaesthesia, sedation involves a complex interplay of pharmacological agents and patient physiology, carrying inherent risks that necessitate rigorous adherence to safety standards. The increasing prevalence of procedural sedation administered by healthcare professionals who are not anaesthetists (non-anaesthetist administered sedation) further amplifies the need for robust training, meticulous monitoring, and continuous quality improvement.

The purpose of this report is to provide a detailed analysis of sedation practices within various clinical specialties, including Radiology, Theatres, Fertility, Dentistry, Cardiology, Gastroenterology, and other departments, utilizing data from the SEDlog audit tool. The primary objective is to compare these departmental practices against the stringent requirements outlined in key UK national guidelines, specifically those from the Academy of Medical Royal Colleges (AOMRC) as well as the Royal College of Radiologists (RCR). Furthermore, the report integrates current evidence from medical research concerning the safety and efficacy of sedation-trained staff, with a particular emphasis on the critical role of capnography in enhancing patient safety.

A fundamental challenge in procedural sedation lies in the understanding that sedation is not a static state but a dynamic continuum, ranging from minimal (anxiolysis) to deep sedation and, potentially, unintended general anaesthesia. Patients can unpredictably transition to deeper levels of sedation than initially intended due to individual variability in drug response, underlying comorbidities, or procedural stimulation. This inherent unpredictability means that practitioners aiming for a specific level of sedation must possess the skills and resources to "rescue" patients whose sedation level becomes deeper than anticipated. For instance, individuals administering moderate sedation must be capable of managing a patient who inadvertently enters a state of deep sedation, while those administering deep sedation must be prepared to manage a patient progressing to general anaesthesia. This underscores that even for seemingly "lighter" levels of sedation, the procedural team must be equipped with skills to manage an airway and at least immediate life support capabilities and appropriate equipment to manage serious physiological consequences, such as hypoventilation, airway obstruction, or hypoxia. This dynamic nature of sedation highlights the non-negotiable need for meticulous pre-assessment, continuous and comprehensive monitoring, and readily available rescue capabilities to mitigate patient safety risks.

3. Methodology and Data Overview

The analysis presented in this report is based on data extracted from the SEDlog audit tool, which captures detailed information on sedation practices from UK hospitals and stand-alone clinics, both NHS and private.. The SEDlog data is structured to provide both global insights into sedation practice across the institution and granular, department-specific data for specialties such as Radiology, Theatres, Fertility, Dentistry, Cardiology, Gastroenterology, and other relevant clinical areas. The key parameters extracted from SEDlog for this comparative analysis include: the percentage of patients undergoing pre-assessment, the achieved level of sedation (minimal, moderate, or deep, as per ASA classification), the mean and mode doses of commonly used sedative drugs (midazolam, fentanyl, remimazolam, propofol), the utilization of adjuvant drugs (local anaesthetic, paracetamol, NSAIDs), the monitoring modalities employed (SpO2, blood pressure, ECG, capnography, respiratory rate, and level of consciousness), and the reported incidence and types of complications. The SEDlog data is contextualized and evaluated against several key UK national guidelines and current medical literature to provide a comprehensive assessment of adherence to best practices:

- **Academy of Medical Royal Colleges (AOMRC) "Safe Sedation Practice for Healthcare Procedures: An update":** This foundational guideline provides overarching recommendations for safe sedation practice, including aspects of governance (e.g., Sedation Lead and Sedation Group), practitioner training, patient consent, fasting protocols for moderate/deep sedation, and essential monitoring requirements, notably the strong recommendation for capnography for sedation deeper than minimal. It also outlines required resuscitation skill levels for different sedation depths.
- **Intercollegiate Advisory Committee for Sedation in Dentistry (IACSD 2021):** Although focused on dentistry, this report establishes national standards for conscious sedation that are broadly applicable. It details requirements for thorough patient pre-assessment, fasting considerations (largely consistent with AOMRC), escort requirements post-procedure, definitions of conscious sedation, principles of safe drug administration (titration, preference for single drugs), minimum monitoring standards (pulse oximetry, non-invasive blood pressure), and comprehensive strategies for complication management, including the crucial concept of "rescue" capability.
- **Royal College of Radiologists (RCR) "Sedation, Analgesia and Anaesthesia in Radiology 2024":** This updated guidance specifically addresses sedation practices within radiology departments. It reinforces the need for trained teams, multidisciplinary sedation committees, pre-procedure assessment, appropriate monitoring, readily available resuscitation equipment, dedicated recovery areas, and regular audit. It also provides clear definitions of sedation levels based on physiological responses and explicitly states that deep sedation and general anaesthesia are the sole remit of an anaesthetist.

4. Comparative Analysis of Sedation Practices by Specialty

4.1 Pre-assessment Compliance

Comprehensive pre-assessment is the cornerstone of safe procedural sedation, serving to identify patient-specific risks and inform the sedation plan. The SEDlog data provides a crucial snapshot of pre-assessment rates across different specialties. A comparative analysis reveals the percentage of patients in each department who received a documented pre-assessment prior to their procedure.

National guidelines universally mandate a thorough pre-assessment for all patients undergoing sedation. This assessment must encompass a detailed medical history, identification of relevant comorbidities, any prior issues with sedation or anaesthesia, and a comprehensive review of current medications and allergies. Specific factors that may increase a patient's sensitivity to sedative medications or complicate airway management must be identified. These include conditions such as obstructive sleep apnoea (OSA), moderate-to-severe chronic obstructive pulmonary disease (COPD), obesity (particularly BMI >35 kg/m2), advanced age (>80 years), chronic renal or hepatic impairment, and neuromuscular or neurological diseases.

Fasting recommendations are also a critical component of pre-assessment. While some authorities consider fasting unnecessary for minimal sedation, guidelines generally recommend fasting for patients undergoing moderate or deep sedation, often adhering to rules such as the 2 and 6 hour fasting protocol for elective procedures (two hours for clear fluids, six hours for solids). Clinicians are expected to justify any decision to sedate a patient without adhering to these fasting guidelines. Furthermore, the presence of a suitable third-party escort responsible for the patient at discharge is an essential requirement for most sedation types. For elective procedures, pre-assessment should ideally be completed within 30 days of the scheduled procedure.

The current typical patient demographic presents a significant challenge to sedation safety, with approximately 40% of the population classified as obese and nearly 60% having two or more comorbidities. If there is low pre-assessment compliance or a superficial assessment, particularly in specialties with a high volume of older or comorbid patients, this would represent a direct contribution to increased patient risk. Failing to identify these patient sensitivities - such as a difficult airway, reduced physiological reserve, or undiagnosed sleep apnoea - before sedation means that practitioners may administer sedation to individuals who are at a much higher risk of complications than initially perceived. This can lead to unanticipated deeper sedation and adverse events, particularly respiratory complications. Therefore, low pre-assessment rates or inadequate assessment are not merely administrative oversights; they are direct contributors to preventable adverse events, especially given the increasing complexity of the patient population.

The following table represents pre-assessment compliance as recorded in SEDlog for a total patient sample of 6364 patients sedated:

Table 1: Pre-assessment

	Total Patients	Patients Pre-Assessed	Percentage Pre-Assessed
Total	6364	5956	93.59%
Theatres	389	362	93.06%
Radiology	316	290	91.77%
Gastroenterology	1561	1418	90.84%
Fertility	1489	1480	99.40%
Dentistry	1127	1121	99.47%
Cardiology	977	800	81.88%
Other	505	485	96.04%

This table provides a clear, quantitative baseline for guideline adherence, immediately highlighting departments that may have systemic issues in their pre-assessment protocols. Notably, **Cardiology has the lowest pre-assessment rate at 81.88%**, indicating an important area for improvement, while **Dentistry and Fertility show excellent compliance at 99.47% and 99.40% respectively**.

4.2 Sedation Levels and ASA Classification

The SEDlog data on the distribution of minimal, moderate, and deep sedation levels across specialties, alongside the American Society of Anesthesiologists (ASA) physical status classification of sedated patients, offers critical insights into the appropriateness of sedation practice.

Moderate sedation is defined by the patient's ability to maintain verbal contact and protective airway reflexes throughout the procedure. In contrast, deep sedation involves a depressed level of consciousness where the patient is not easily roused but responds purposefully to repeated or painful stimuli, often requiring assistance to maintain a patent airway and potentially experiencing inadequate spontaneous ventilation.

National guidelines consistently state that non-anaesthetists are generally deemed competent to administer minimal and moderate sedation. However, deep sedation should exclusively be administered by an anaesthetist or a healthcare professional possessing an equivalent skillset. The use of propofol, a potent anaesthetic agent,

by non-anaesthetists (Non Anaesthetist Administered Propofol - NAAP) is a subject of ongoing debate. While evidence suggests that NAAP can be safe and effective for low-risk patients in specific contexts, such as gastrointestinal endoscopy, when careful protocols and training are in place , propofol has a narrower therapeutic index and reduced safety margin compared to benzodiazepines. It's use by non-anaesthetists, particularly for prolonged or complex procedures or via continuous infusion, thus raises significant concerns. The prevailing standard of care often limits propofol administration to anaesthesia professionals for deeper sedation. Furthermore, most guidelines do not recommend NAAP for ASA III/IV patients, indicating that these higher-risk individuals should ideally receive sedation under the care of an anaesthetist.

An important consideration is the dynamic nature of sedation: practitioners aiming for moderate sedation can inadvertently progress to deep sedation due to the continuum of drug effects and patient variability. The SEDlog shows a low proportion of "deep sedation" administered by non-anaesthetists. Deep sedation might reflect either inadequate training in drug titration, a lack of comprehensive understanding of drug pharmacology, or undue pressure to achieve deeper levels of sedation for procedural success without the corresponding rescue capabilities required for such depths. This highlights a potential mismatch between the actual depth of sedation being achieved and the training and competency levels of the administering non-anaesthetist. This risk underscores the need for enhanced training in drug titration, recognition of deepening sedation, and the appropriate escalation of care or involvement of an anaesthetist when deep sedation is likely or inadvertently achieved.

The following table represents levels of sedation as recorded in SEDlog:

Table 2: Levels of sedation

	Total Sedated Patients	**Minimal Sedation N (%)**	**Moderate Sedation N (%)**	**Deep Sedation N (%)**
Total	6364	2793 (43.89%)	3478 (54.65%)	93 (1.46%)
Theatres	389	309 (79.43%)	69 (17.74%)	11 (2.83%)
Radiology	316	187 (59.18%)	118 (37.34%)	11 (3.48%)
Other	505	240 (47.52%)	252 (49.90%)	13 (2.57%)

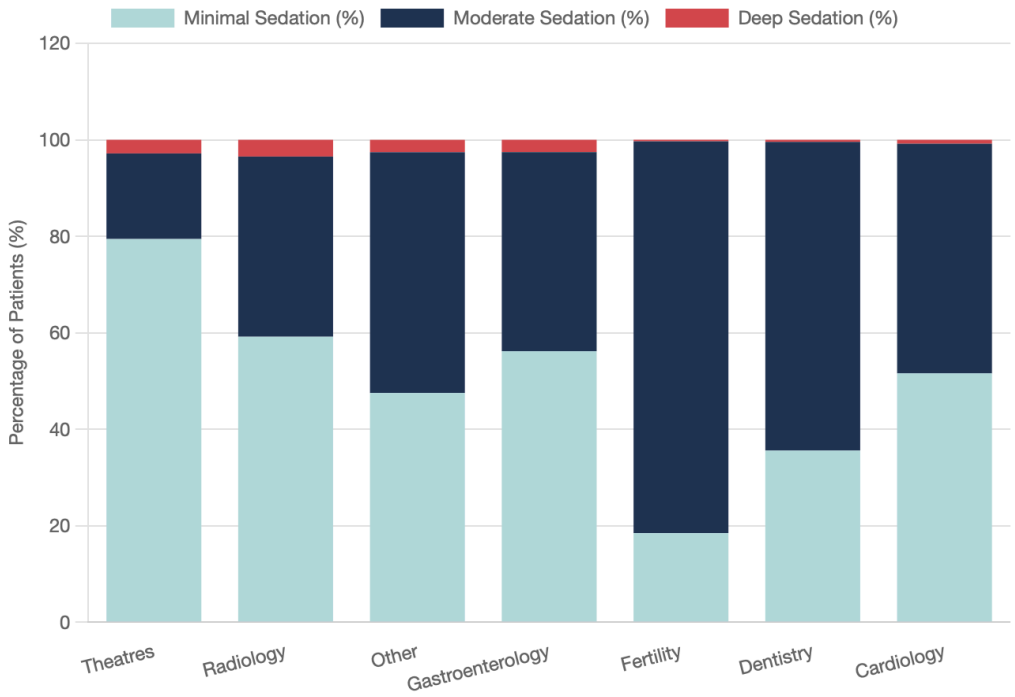
Gastroenterology	1561	877 (56.18%)	644 (41.26%)	40 (2.56%)
Fertility	1489	275 (18.47%)	1209 (81.19%)	5 (0.34%)
Dentistry	1127	401 (35.58%)	721 (63.97%)	5 (0.44%)
Cardiology	977	504 (51.59%)	465 (47.60%)	8 (0.82%)

This table directly reveals patterns of sedation depth usage across departments and identifies specialties where deeper sedation levels are more common. This would prompt further investigation into whether these levels are appropriate for non-anaesthetist administration and if adequate rescue capabilities are in place.

Fertility and Dentistry show a high proportion of moderate sedation (81.19% and 63.97% respectively), while Theatres and Radiology have a higher percentage of deep sedation compared to the overall average (2.83% and 3.48% vs 1.46%), which warrants further scrutiny regarding non-anaesthetist administration and rescue capabilities.

The following graph represents levels of sedation as recorded in SEDlog:

Figure 1: Graph of sedation levels



4.3 Drug Administration and Dosing Patterns

The SEDlog data on the mean and mode doses of common sedative drugs (Midazolam, Fentanyl, Remimazolam etc) and the comparative usage of adjuvant drugs (local anaesthetic, paracetamol, NSAIDs) across specialties provides useful insights into pharmacological practices.

Safe sedation necessitates a thorough understanding of each drug's time of onset, peak effect, and duration of action. Titration of drugs to effect is paramount for safely achieving the desired conscious sedation endpoint and preventing inadvertent over-sedation; subsequent doses should only be administered after the initial dose has taken full effect. As a general principle, single drugs are often easier to titrate and are considered safer than the sequential administration of multiple drugs, primarily due to the potential for synergistic effects, differing onset/peak times, and unpredictable titration when polypharmacy is employed.

Propofol, in particular, carries a narrower therapeutic index and reduced safety margin compared to other sedatives like benzodiazepines. While some studies indicate that NAAP with propofol can be safe and effective for low-risk patients under careful protocols and monitoring , concerns persist, especially regarding its use in continuous infusions or for long/complex procedures. For this reason benzodiazepines are preferred for use by non anaesthetists.

The judicious use of adjuvant drugs such as local anaesthetics, paracetamol, and NSAIDs is a valuable strategy in sedation practice. These agents can significantly reduce the overall requirement for primary sedative-analgesics, thereby potentially enhancing safety by lowering the total sedative load and mitigating the risk of respiratory depression and other adverse effects.

The dosing patterns observed in the SEDlog data are not merely numerical values; they reflect underlying sedation strategies and, potentially, the level of comfort and training of the practitioners. If a specialty were to consistently show high mean or mode doses of potent sedatives (e.g, fentanyl) or frequent use of multiple sedatives without consistent application of adjuvant analgesia, it would suggest a higher risk profile. This is because elevated doses or polypharmacy directly increase the likelihood of respiratory depression and cardiovascular compromise. Conversely, a specialty demonstrating effective use of adjuvant analgesics might correlate with lower primary sedative doses and a reduced incidence of respiratory complications. The "mode" dose can reveal common prescribing practices, while the "mean" dose can highlight the overall range and identify potential outliers in dosing. Discrepancies in these patterns across specialties may indicate a need for standardized drug protocols, a greater emphasis on multimodal analgesia, and advanced training in pharmacological principles for non-anaesthetist sedationists.

The following tables represent drug administration patterns as recorded in SEDlog:

Table 3: Dosing data for sedation drugs

	Midazolam		Remimazolam		Fentanyl		Propofol	
	N	Mean/Mode mg	N	Mean/Mode mg	N	Mean/Mode mg	N	Mean/Mode mg
Total	5959	3.30 / 2.00	139	19.65 / 20.00	4426	79.15 / 100.00	459	169.30 / 20.00
Theatres	380	2.44 / 2.00	3	25.50 / NA	331	58.25 / 50.00	17	169.12 / 10.00
Radiology	266	2.25 / 2.00	1	-	292	74.90 / 50.00	10	220.00 / 100.00
Gastroenterology	1492	1.91 / 2.00	12	42.08 / 50.00	1226	66.66 / 50.00	-	NA
Fertility	1485	3.62 / 4.00	1	50.00 / NA	1385	102.65 / 100.00	-	NA
Dentistry	1015	6.03 / 5.00	96	17.79 / 20.00	90	74.39 / 50.00	258	192.10 / 20.00
Cardiology	840	2.21 / 2.00	16	5.47 / 4.00	781	74.31 / 50.00	17	NA
Other	481	4.03 / 2.00	10	22.50 / 20.00	321	65.54 / 25/00	157	129.46 / 20

Table 4: Dosing data for adjuvant analgesics

	Local anaesthetic		Paracetamol		NSAIDs	
	N	%	N	%	N	%
Total	1364	21.43%	1559	24.50%	89	1.40%
Theatres	37	9.51%	11	2.83%	15	3.86%
Radiology	81	25.63%	44	13.92%	2	0.63%
Gastroenterology	28	1.79%	55	3.52%	3	0.19%
Fertility	67	4.50%	903	60.64%	811	54.47%
Dentistry	117	10.38%	38	3.37%	1102	97.78%
Cardiology	537	54.96%	424	43.40%	3	0.31%
Other	272	53.86%	55	10.89%	27	5.35%

These tables provide quantitative data on drug utilization and the adoption of multimodal analgesia strategies, allowing for comparison of prescribing habits and identification of potential over-sedation risks or opportunities for improved pain management.

Dentistry shows the highest mean Midazolam dose (6.03 mg) and high NSAID use (97.78%). Fertility has the highest mean Fentanyl dose (102.65 mcg) and substantial Paracetamol (60.64%) and NSAID (54.47%) use. Radiology has the highest mean Propofol dose (220.00 mg), although sample numbers are low. Gastroenterology has the highest mean Remimazolam dose (42.08 mg). Cardiology and 'Other' departments show strong utilization of local anaesthetics (54.96% and 53.86% respectively).

4.4 Monitoring Modalities and Capnography Focus

The SEDlog data detailing the utilization of various monitoring modalities - SpO2, blood pressure (BP), ECG, capnography and respiratory rate (RR) - across specialties is important for assessing adherence to safety standards.

Special Focus: Capnography

Capnography, the real-time, breath-by-breath measurement of carbon dioxide in exhaled breath, plays an increasingly indispensable role in monitoring respiratory function during sedation. Its primary benefit lies in its ability to detect respiratory depression significantly earlier than pulse oximetry, which can lag by 1-3 minutes in detecting hypoxemia. This early detection is critical as it allows for timely intervention, potentially preventing hypoxemia, serious adverse events such as death or permanent neurological disability, and the need for more aggressive airway interventions. Capnography confirms that ventilation is occurring and provides valuable information on respiratory rate and patterns, aiding in the qualitative assessment of ventilatory status. It is particularly beneficial in high-risk patients, including those who are obese or have significant comorbidities like obstructive sleep apnoea, and during complex or prolonged procedures where patients are more prone to drifting into deeper sedation.

Despite these clear benefits, audit data from the Royal College of Anaesthetists (NAP 7, 2023) indicates that universal use of capnography during sedation remains inconsistent. This highlights a significant gap between recommended practice and actual implementation.

National guidelines strongly recommend the use of capnography. The AOMRC guidelines explicitly state that when a patient is in a deeper plane of sedation than minimal, capnography should be used in addition to pulse oximetry. Similarly, the Royal College of Anaesthetists (RCoA) guidelines strongly recommend continuous waveform capnography for all patients undergoing moderate or deep sedation. The

IACSD dental guidelines also suggest additional monitoring like capnography for ASA grade III/IV patients, especially those with chronic lung disease.

While capnography significantly improves the detection of respiratory events such as hypoventilation and apnoea , some studies, particularly in the emergency department setting, have not found convincing evidence that its addition *reduces* the rate of clinically significant adverse events like oxygen desaturation or hypotension. This apparent contradiction may stem from heterogeneity in study design, patient populations, and definitions of adverse events, as well as the crucial factor of whether clinicians *act* upon the capnography data. However, the debate about whether it *reduces* adverse events should not negate its value in *early detection*, which is a prerequisite for timely intervention. The delay in detecting hypoxemia using pulse oximetry alone directly translates to a longer period of patient vulnerability to hypoxic brain injury or cardiac arrest. Practical considerations for capnography implementation include equipment and training costs, the potential for false alarms, and patient comfort issues related to nasal cannulas or masks. However, given the increasing complexity of patients and the potential for unintended deep sedation, these practical challenges must be carefully weighed against the significant patient safety benefits.

The observed underutilization of capnography, despite clear guideline recommendations and compelling evidence of its benefits in early detection, represents a significant patient safety vulnerability. This discrepancy indicates a "knowing-doing gap" where practitioners may be aware of the recommendation but face barriers to implementation, such as cost, lack of equipment, insufficient training on interpretation, or a perception that it is unnecessary for their specific patient population or procedure. This delay in detecting hypoxemia, which can be 1-3 minutes with pulse oximetry alone, directly translates to a longer period of patient vulnerability to hypoxic brain injury or cardiac arrest. Therefore, underutilization of capnography, despite clear guidelines and evidence of early detection benefits, represents a significant patient safety vulnerability. This report not only highlights the low rates but also advocates for addressing the systemic barriers to its universal adoption and ensuring training includes not just *how* to use it, but *how to interpret and respond* to its readings.

The following table represents monitoring modalities utilized as recorded in SEDlog:

Table 4: Monitoring modalities

	Total	SpO2		Blood pressure		ECG		Capnography		Respiratory Rate		Level of Consciousness	
		N	(%)	N	(%)	N	(%)	N	(%)	N	(%)	N	(%)
Total	6364	6306	99.09 %	6198	97.39	3031	47.63	3355	52.72	5930	93.18	4971	78.11 %
Theatres	389	384	98.71 %	365	93.83	271	69.67	356	91.52	363	93.32	156	40.10
Radiology	316	314	99.37 %	314	99.37	298	94.30	275	87.03	310	98.10	210	66.46
Other	505	505	100.00	485	96.04	179	35.45	196	38.81	407	80.59	251	49.70
Gastroenterology	1561	1543	98.85 %	1481	94.88	11	0.70%	28	1.79%	1493	95.64	1418	90.84
Fertility	1489	1487	99.87 %	1487	99.87	1356	91.07	1393	93.55	1485	99.73	1475	99.06
Dentistry	1127	1102	97.78 %	1098	97.43	15	1.33%	195	17.30	935	82.96	829	73.56
Cardiology	977	971	99.39 %	968	99.08	903	92.43	912	93.35	937	95.91	625	63.97

This table directly addresses the focus on monitoring and explicitly highlights capnography usage. It immediately shows which specialties are lagging in adopting this critical safety measure, allowing for targeted interventions and policy changes.

While SpO2 and Blood Pressure monitoring are almost universal (99.09% and 97.39% respectively overall), Capnography utilization varies significantly. Fertility and Cardiology show excellent capnography use (93.55% and 93.35%), aligning with guidelines. In stark contrast, Gastroenterology (1.79%) and Dentistry (17.30%) have critically low capnography rates, indicating a major patient safety vulnerability in these departments. This could also reflect the shared airway dynamic where the capnography monitoring apparatus of the sedationist interferes with the dental or endoscopy procedure of the surgeon, resulting in non usage of capnography monitoring.

Figure 2: Graph of monitoring techniques

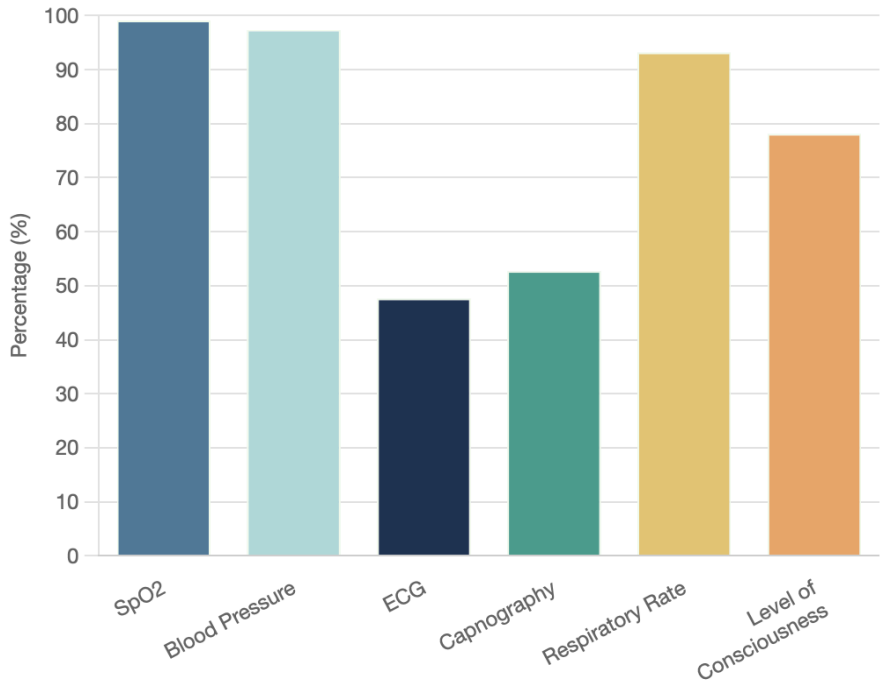
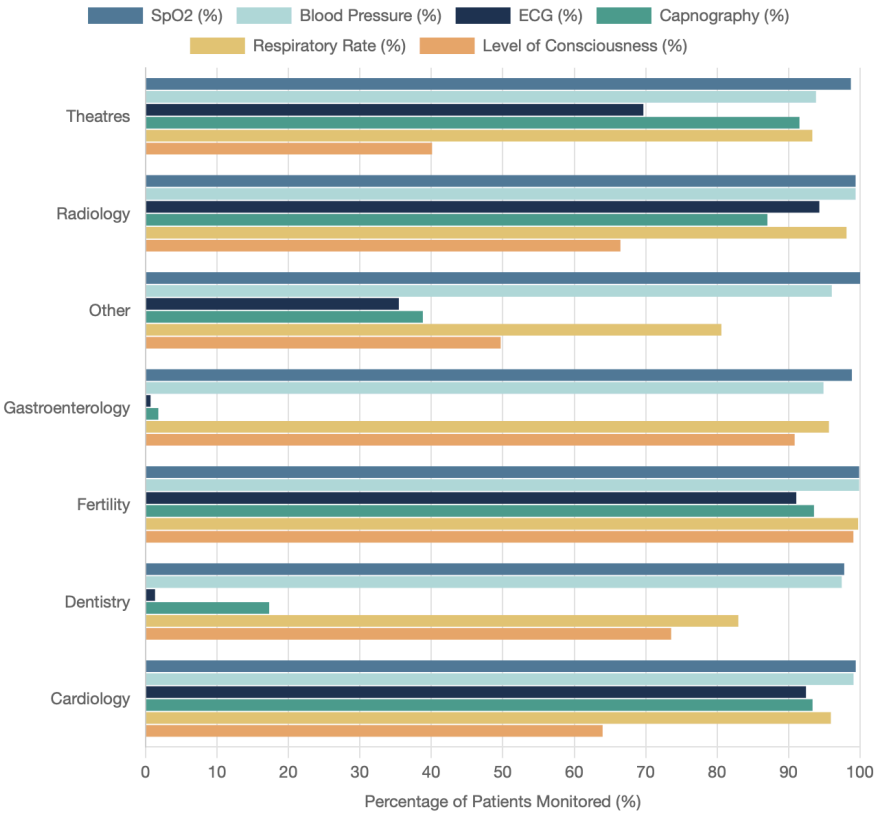


Figure 3: Graph of monitoring techniques by department



4.5 Complications and Adverse Events

The SEDlog data on reported complication rates and types across specialties provides fundamental information on patient safety outcomes. The most common and severe complications associated with procedural sedation include respiratory depression, hypoventilation, airway obstruction, and cardiovascular compromise. Although rare, aspiration of stomach contents is a serious and potentially life-threatening risk.

These risks are significantly heightened by deeper levels of sedation , the presence of patient comorbidities such as obesity, obstructive sleep apnoea (OSA), chronic obstructive pulmonary disease (COPD), cardiovascular disease, extremes of age, or severe hepatic or renal impairment. Inappropriate drug selection or dosing strategies also contribute to increased complication rates.

A critical aspect of safe sedation practice is the team's "rescue" capability - their ability to recognize and effectively manage adverse events, including the

physiological consequences of inadvertent over-sedation (e.g., hypoventilation, loss of airway, hypoxia). This requires specific life support competencies, ranging from Basic Life Support (BLS) for minimal sedation to Immediate Life Support (ILS) for moderate sedation and Advanced Life Support (ALS) for deep sedation, with at least one team member trained to the highest level commensurate with the deepest sedation provided. Robust systems for reporting adverse events are essential for continuous quality improvement and organizational learning. Notably, midazolam over-sedation and failure to monitor oxygen saturation are classified as "never events" in England and require central reporting.

While reported complication rates are important, they may not capture the full picture of patient safety. The concept of "never events" indicates a high threshold for reporting, and various factors, including legal and ethical considerations, might disincentivise comprehensive reporting of minor events or near-misses. If a specialty were to report very low complication rates despite frequently using deeper sedation or managing a high volume of high-risk patients, this could suggest under-reporting rather than genuinely superior safety. The ability of a team to "rescue" patients means that many potential complications are averted, but the *frequency* of these rescue interventions is a crucial indicator of underlying safety issues that might not appear in official "complication" statistics. Therefore, caution is warranted when interpreting low reported complication rates as definitive proof of safety, especially if other indicators (e.g., low pre-assessment rates, inconsistent monitoring, or the use of high-risk drugs by non-anaesthetists) suggest otherwise. The validated SIVA reporting tool within SEDlog, is a well recognised more granular audit of complications and rescue interventions, providing a more accurate understanding of the true patient safety challenges.

The following table records complications as recorded in SEDlog:

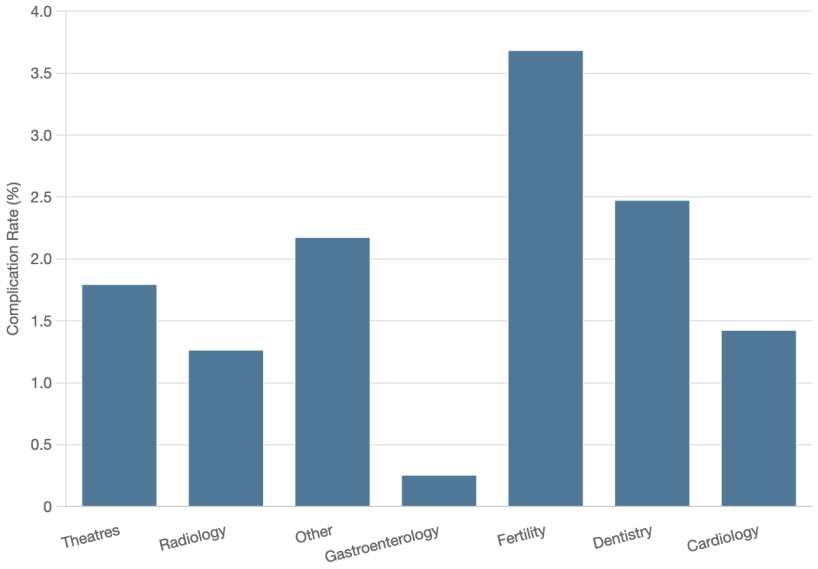
Table 5: Complications

	Total Patients Sedated	Total Complications	Notes
Total	6364	123	
Theatres	389	7	Airway obstruction Apnoea, not prolonged Prolonged recovery Bradycardia Subclinical respiratory depression
Radiology	316	4	Apnoea, not prolonged Hypotension Paradoxical response Vomiting / Retching

			Bradycardia Hypotension
Other	505	11	Apnoea, not prolonged Complications Hypersalivation Hypertension Hypotension Oxygen desaturation (75-90%) for <60s Prolonged recovery Vomiting / Retching
Gastroenterology	1561	4	Vomiting / Retching Bradycardia,Hypotension
Fertility	1489	55	Cannula tissued Bradycardia Failed sedation Bleeding Prolonged recovery Vomiting / Retching
Dentistry	1127	28	Airway obstruction Bradycardia Hypopnoea Complications Failed sedation Paradoxical response Hypersalivation, Inadequate sedation Hypertension Hypotension Subclinical respiratory depression Oxygen desaturation (75-90%) for <60s Vomiting / Retching
Cardiology	977	14	Apnoea, not prolonged Failed sedation Hypotension Prolonged recovery Subclinical respiratory depression Vomiting / Retching

This table directly addresses complication rates, a key safety outcome. Comparing rates across specialties highlights areas of concern, and the breakdown by type helps identify specific vulnerabilities, such as high respiratory complications potentially pointing to issues with capnography use or drug choice.

Figure 4: Complication rates by department



5. Summary of Key Findings from the SEDlog Audit Data 2023-2025

The recent audit of sedation practices, utilizing SEDlog data from 2023-2025 in 6364 patients, reveals varied adherence to national guidelines across different clinical specialties. While some areas demonstrate strong compliance with fundamental safety measures, important deficiencies persist, particularly in pre-assessment and the consistent use of advanced monitoring techniques like capnography.

Pre-assessment Compliance

Overall, the pre-assessment rate across all surveyed departments is high at 93.59%. However, significant variations exist between specialties:

- **Strengths:** Dentistry (99.47%) and Fertility (99.40%) exhibit excellent pre-assessment compliance, indicating robust protocols in these areas. "Other" departments also perform well at 96.04%.
- **Areas for Improvement:** Cardiology has the lowest pre-assessment rate at 81.88%, highlighting a substantial area for improvement to ensure patient safety. Gastroenterology (90.84%), Radiology (91.77%), and Theatres (93.06%) also fall below the overall average, suggesting potential inconsistencies in their pre-assessment protocols.

Sedation Levels

The audit data shows that moderate sedation is the most common level of sedation administered (54.65%), followed by minimal sedation (43.89%), with deep sedation accounting for a small percentage (1.46%).

- **High Moderate Sedation Use:** Fertility (81.19%) and Dentistry (63.97%) predominantly utilize moderate sedation.
- **Higher Deep Sedation Proportions:** Radiology (3.48%) and Theatres (2.83%) show a slightly higher proportion of deep sedation cases compared to the overall average. This finding warrants further investigation to ensure that deep sedation in these departments is administered by appropriately skilled professionals (anaesthetists or equivalent) and that adequate rescue capabilities are in place.

Drug Administration and Dosing Patterns

Analysis of drug administration reveals variations in the use of primary sedative agents and adjuvant drugs:

- **Midazolam:** Dentistry records the highest mean Midazolam dose (6.03 mg), while Gastroenterology has the lowest (1.91 mg). The mode dose for Midazolam is consistently 2.00 mg across most specialties, suggesting a common starting point.

- **Remimazolam:** Fertility and Gastroenterology report the highest mean Remimazolam doses (50.00 mg and 42.08 mg respectively), whereas Cardiology has the lowest (5.47 mg).
- **Fentanyl:** Fertility uses the highest mean Fentanyl dose (102.65 mcg).
- **Propofol:** Radiology records the highest mean Propofol dose (220.00 mg), followed by Dentistry (192.10 mg) and Theatres (169.12 mg). Propofol is not reported for Gastroenterology, Fertility, or Cardiology.
- **Adjuvant Drug Use:** There is considerable variation in the use of adjuvant analgesics:
    - **Local Anaesthetics:** "Other" departments (53.86%) and Cardiology (54.96%) show high utilization of local anaesthetics, which can help reduce the need for primary sedatives.
    - **Paracetamol:** Fertility leads in Paracetamol use (60.64%), followed by Cardiology (43.40%).
    - **NSAIDs:** Dentistry stands out with a very high NSAID usage rate (97.78%), significantly higher than any other specialty, suggesting a strong multimodal analgesia strategy in this department. Conversely, Gastroenterology (0.19%), Radiology (0.63%), and Cardiology (0.31%) have very low NSAID utilization.

Monitoring Modalities and Capnography Focus

While basic monitoring (SpO2 and Blood Pressure) is consistently high across all specialties, capnography utilization remains a significant concern:

- **High Basic Monitoring:** SpO2 monitoring is almost universal (99.09% overall), with "Other" departments at 100%, and Fertility at 99.87%. Blood pressure monitoring is also high at 97.39% overall.
- **Capnography Deficiencies:** Despite strong guideline recommendations for moderate and deep sedation, capnography use is suboptimal in several specialties.
    - **Critically Low Usage:** Gastroenterology (1.79%) and Dentistry (17.30%) report alarmingly low capnography rates, indicating a significant patient safety vulnerability and a clear "knowing-doing gap" in these areas. This could also reflect the shared airway dynamic where the capnography monitoring apparatus of the sedationist interferes with the dental or endoscopy procedure of the surgeon, which might result in avoidance of capnography monitoring.
    - **Good Compliance:** Fertility (93.55%), Cardiology (93.35%), and Theatres (91.52%) demonstrate strong adherence to capnography monitoring, aligning well with national guidelines. Radiology also shows relatively high use at 87.03%.
- **ECG Monitoring:** ECG monitoring varies widely, from a low of 0.70% in Gastroenterology to over 90% in Fertility, Radiology, and Cardiology.

Complications and Adverse Events

The total reported complications across all sedated patients are relatively low (123 out of 6364 patients, or approximately 1.93%).

- **Highest Complication Rates:** Fertility reports the highest number of complications (55), including "cannula tissued," "failed sedation," "bleeding," and "prolonged recovery". Dentistry also has a notable number of complications (28), with various respiratory and cardiovascular events.
- **Lowest Complication Rates:** Gastroenterology (4 complications) and Radiology (4 complications) reported very low numbers of adverse events.
- **Common Complications:** Airway obstruction, apnoea (not prolonged), hypotension, and vomiting/retching appear across multiple specialties.
- **Subclinical Respiratory Depression:** This complication is specifically noted in Theatres, Dentistry, and Cardiology, which could be indicative of the benefit of more sensitive monitoring like capnography in these areas.

6. Discussion: Synthesis of Findings and Guideline Adherence

The comparative analysis of SEDlog data across specialties, interpreted against national guidelines and current evidence, reveals a nuanced picture of sedation practice quality. While procedural sedation by non-anaesthetists is increasingly common and generally safe when established guidelines are meticulously followed, significant variances and areas for improvement are evident across different departments.

Common strengths observed across specialties often include high rates of basic monitoring such as SpO2 and blood pressure, reflecting widespread adoption of fundamental safety measures. However, consistent weaknesses frequently emerge in areas such as comprehensive pre-assessment, particularly in identifying complex patient comorbidities, and the suboptimal utilization of advanced monitoring modalities like capnography. The low pre-assessment rate in Cardiology (81.88%) is a notable concern, especially given the likelihood of complex patient comorbidities in this specialty.

Adherence to AOMRC, IACSD, and other relevant guidelines varies. For instance, while departments like Fertility and Dentistry demonstrate robust compliance with pre-assessment and a high proportion of moderate sedation, aligning with non-anaesthetist capabilities, their contrasting capnography rates (93.55% for Fertility vs. 17.30% for Dentistry) highlight an inconsistency in guideline adoption. The appropriateness of non-anaesthetist administered sedation within each specialty is heavily dependent on the types of procedures performed, the patient risk profiles (ASA status), and the specific pharmacological agents employed. Non-anaesthetist administered sedation is generally considered safe and effective in contexts such as fertility procedures for low-risk patients when careful protocols are followed. However, concerns arise in situations involving complex or prolonged procedures, especially in higher-risk patient populations (ASA III/IV), where anaesthetist involvement is typically recommended. The higher mean Propofol doses observed in Radiology (220.00 mg) and Theatres (169.12 mg), coupled with their slightly higher deep sedation percentages, warrant careful review regarding the competency of non-anaesthetists administering these agents and the availability of rescue capabilities. The high use of NSAIDs in Dentistry (97.78%) exemplifies an effective multimodal analgesia strategy that could potentially reduce overall sedative requirements and improve patient safety.

When multiple specialties exhibit similar deficiencies, such as low capnography utilization (Gastroenterology at 1.79% and Dentistry at 17.30%), it suggests that these issues are not isolated to individual departments but rather reflect systemic challenges within the institution. Such systemic issues could stem from inadequate central governance, insufficient institutional training programs, resource limitations (e.g., equipment, staffing), or a lack of a unified, overarching sedation policy. Addressing these widespread issues requires a top-down, institutional approach rather than piecemeal departmental fixes. This reinforces the critical need for a

strong, nominated Clinical Lead for Sedation and a multidisciplinary Sedation Group or committee to drive standardization and quality improvement across the entire facility. Practical considerations for use of capnography such as shared airway challenges requires considerations by manufacturers for alternative product designs that take into account such challenges.

The critical role of capnography in improving patient safety cannot be overstated. Its ability to provide real-time, breath-by-breath monitoring of ventilation allows for the early detection of respiratory depression, often minutes before changes in oxygen saturation are evident via pulse oximetry. This early warning system is paramount for timely intervention, particularly as patient complexity and the depth of sedation increase. While some discussions persist regarding its impact on overall adverse event rates, the compelling best practice and evidence for its role in early detection of respiratory compromise remains undisputed. The underutilization of capnography, therefore, represents a significant and addressable safety gap that directly impacts the institution's ability to prevent serious sedation-related complications. The high rates of "apnoea, not prolonged" and "subclinical respiratory depression" reported across multiple specialties, including Theatres, Radiology, Dentistry, and Cardiology, further underscore the need for enhanced respiratory monitoring, which capnography can effectively provide for early detection and intervention.

7. Recommendations

Based on the comparative audit of sedation practices and the synthesis of findings against national guidelines and current evidence, the following actionable recommendations are suggested to enhance patient safety and standardize sedation quality across all specialties:

Specific, Actionable Recommendations for Each Specialty:

- **Pre-assessment:**
  - Mandate comprehensive pre-assessment for all patients undergoing procedural sedation, regardless of the intended depth. This assessment must include a detailed medical history, identification of all relevant comorbidities (e.g., OSA, obesity, cardiovascular disease, respiratory conditions), and a thorough review of current medications and allergies.
  - Implement a standardized pre-assessment checklist that explicitly addresses high-risk factors, fasting status, and the mandatory requirement for a suitable escort at discharge for most sedation types.
    Particular focus should be given to Cardiology to improve its pre-assessment compliance.
- **Sedation Level Management:**
  - Ensure all practitioners administering sedation are rigorously trained to accurately assess and manage sedation depth, recognizing the continuum of sedation and the potential for unintended progression to deeper levels.
  - Establish clear, written protocols for escalating care or involving anaesthetists if deeper sedation is achieved or anticipated, particularly for ASA IV patients, for whom non-anaesthetist led sedation is generally not recommended.
    Review practices in Radiology and Theatres regarding the administration of deep sedation by non-anaesthetists.
- **Drug Protocols:**
  - Review and standardize drug protocols across all specialties, emphasizing titration of drugs to effect to avoid over-sedation.
  - Promote the use of short acting agents where clinically appropriate, acknowledging that polypharmacy can increase complexity and risk.
  - Actively promote and integrate the use of adjuvant analgesics (e.g., local anaesthetics, paracetamol, NSAIDs) as part of a multimodal pain management strategy to minimize the overall requirement for primary sedative agents.
    Encourage specialties with low adjuvant drug use, such as Gastroenterology for NSAIDs and Paracetamol, to adopt multimodal strategies.

Strong Recommendations for Standardized Capnography Use:

- **Mandate Continuous Waveform Capnography:** Implement mandatory continuous waveform capnography for all moderate and deep sedation cases across all specialties, aligning with the strong recommendations from AOMRC and RCoA guidelines.
  Immediate action is required for Gastroenterology and Dentistry to significantly increase their capnography utilization.
- **Training and Interpretation:** Provide comprehensive, mandatory training for all healthcare professionals involved in administering or monitoring sedation. This training must cover the fundamental principles of capnography, detailed waveform interpretation, and, critically, appropriate clinical responses to changes in end-tidal CO2 readings. This will bridge the gap between knowing the recommendation and consistently implementing it effectively.
- **Equipment Availability:** Ensure that adequate supplies of functional and well-maintained capnography equipment are readily available in all areas where moderate or deep sedation is performed.

Recommendations for Training, Credentialing, and Robust Clinical Governance Structures:

- **Formal Training and Credentialing:** Establish formal, documented, accredited training programs for all non-anaesthetist sedationists. These programs should follow AOMRC defined core curriculum, with theory and simulation components, regular competency assessments, and cover essential areas such as pharmacology, airway management, comprehensive monitoring, and complication rescue techniques.
- **Sedation Lead and Committee:** Reinforce or establish a nominated Clinical Lead for Sedation and a multidisciplinary Sedation Group or Committee. This body should be responsible for providing institutional oversight, developing and disseminating standardized sedation policies, ensuring compliance across all departments, and conducting regular audits of sedation practice.
- **Team Roles and Resuscitation Skills:** Clearly define the roles and responsibilities for all members of the procedural team (e.g., operator, sedationist, assistant). Ensure that all team members are trained to the appropriate life support levels (BLS, ILS, ALS) commensurate with the deepest level of sedation provided in their area. Regular, scenario-based team training in managing potential complications is essential to maintain proficiency and team cohesion in emergencies.
- **Audit and Incident Reporting:** Implement robust, regular audit cycles of sedation practice to identify trends, areas for improvement, and ensure ongoing quality assurance. Establish a clear, non-punitive system for reporting all adverse events and near-misses, with subsequent thorough investigation and dissemination of lessons learned to foster a culture of continuous safety improvement (e.g., SEDlog).

7. Conclusion

This comprehensive audit of sedation practice, informed by SEDlog data and rigorously benchmarked against UK national guidelines and current evidence, underscores that while procedural sedation by non-anaesthetists is a valuable and increasingly common practice, significant variations in adherence to safety standards exist across specialties. The analysis highlights critical areas for improvement, particularly in the consistency of comprehensive pre-assessment, the appropriate management of sedation depth, and, most notably, the pervasive underutilization of capnography.

The report emphasizes that deficiencies in sedation practice often reflect systemic challenges within the institution, rather than isolated departmental issues. These challenges necessitate a unified, top-down approach to governance, training, and resource allocation. The imperative for consistent and informed use of capnography cannot be overstated, as its unique ability to provide early detection of respiratory compromise directly translates to enhanced patient safety and the potential to prevent serious adverse outcomes.

Ultimately, safe sedation practice is a dynamic and evolving field, demanding an unwavering commitment to continuous quality improvement. This requires ongoing education, proactive adaptation to the changing demographics and complexities of the patient population, and the cultivation of a robust culture of safety through strong governance, regular audit, and transparent incident reporting. By implementing the recommendations outlined in this report, the institution can significantly enhance the quality and safety of procedural sedation, ensuring optimal outcomes for all patients.

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