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RESEARCH ARTICLE

# An Islamic ethical framework for artificial intelligence and sedation in critical care: A Maqasid al-Shariah–based approach

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**Abstract** - The rapid integration of artificial intelligence (AI) in critical care sedation introduces complex ethical dilemmas that intersect with Islamic bioethics. The integration of AI into intensive care sedation management has redefined how clinicians monitor, modulate, and maintain states of unconsciousness. As AI becomes increasingly integrated into intensive care units (ICUs), particularly in the modulation of sedation, profound ethical and theological questions arise, especially for Muslim patients and physicians. This paper critically examines the implications of AI-driven sedation management in critical care through the lens of Islamic bioethics. The Islamic ethical framework showed AI-driven sedation protocols address autonomy, beneficence, non-maleficence, and justice through the lens of Sharia (Islamic law) and Maqasid al-Sharia (the higher objectives of Islamic law). It looks at how Islamic values like niyyah (intention), amanah (trust), and hurmat al-insan (the importance of human life) can help ensure that AI technologies used for sedation respect patients' awareness, dignity, and readiness for the end of life. Drawing from Maqasid al-Sharia, this manuscript presents a theologically grounded critique of sedation algorithms that risk depersonalising care. It proposes a beautiful framework for integrating Islamic spiritual values with emerging sedation technologies, ensuring that human dignity and divine accountability remain central in AI-assisted ICUs care.

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## Introduction

Advances in artificial intelligence (AI) have transformed multiple domains of clinical medicine, including the innovation within intensive care units (ICUs) (Farhud DD & Zokaei S, 2021; Basubrin O, 2025). While these advancements promise enhanced safety and efficiency, they also introduce ethical complexities. Among the most significant developments is the integration of AI into sedation management in ICU. Sedation is a cornerstone of critical care, facilitating mechanical ventilation, alleviating distress, and improving patient outcomes (Page V. & McKenzie C., 2021). The procedure requires a complex process that balances analgesia, anxiolysis, and hypnosis to maximise patient comfort and physiological stability. Traditionally, sedation depth and drug choice have been governed by clinical judgement, informed by physiological monitoring and patient-specific needs (Carini FC et al., 2024). AI-driven sedation systems, such as closed-loop infusion controllers and predictive analytics algorithms, promise unprecedented precision in drug titration, real-time monitoring, and the mitigation of oversedation or undersedation events. Clinicians should begin by getting aware of and comprehending the fundamentals of artificial intelligence (Singh M. & Nath G., 2022). With the advent of AI, sedation management now leverages machine learning algorithms to optimise drug dosing, anticipate complications, and minimise adverse effects (Alowais SA et al., 2023). AI systems may make decisions that influence consciousness, awareness, and readiness for death, where medical decision-making intersects with Islamic bioethical principles (Habeebullah AA, 2024). From an Islamic perspective, medical ethics is not derived solely from secular principles such as autonomy, beneficence, non-maleficence, and justice (Chamsi-Pasha H. & Albar MA., 2013). Rather, it is rooted in a divinely orientated moral framework sourced from the Qur'an, the Sunnah, consensus (*ijma'*), analogy (*qiyas*), and reasoned juristic deliberation (*ijtihad*). Within this framework, the doctrine of *Maqasid al-Sharia* as the higher objectives of Islamic law plays a central role in guiding the ethical permissibility of medical interventions. The five primaries of *Maqasid al-Sharia* include preservation of religion (*hifz al-din*), life (*hifz al-nafs*), intellect (*hifz al-'aql*), progeny (*hifz al-nasl*), and wealth (*hifz al-mal*). Therefore, this *Maqasid al-Sharia* offers a holistic, value-laden structure through which emerging medical technologies can be evaluated.

Despite the rapid uptake of AI in critical care, there remains no dedicated Islamic ethical framework for AI-driven sedation. The absence of such a framework risks the uncritical importation of ethically neutral or secularly derived protocols into Muslim-majority contexts, potentially undermining religious values, spiritual dignity, and culturally embedded modes of end-of-life care. This paper addresses this gap by developing an Islamic ethical framework for AI-assisted sedation in critical care, grounded in *Maqasid al-Sharia*. It argues that such a framework is necessary to safeguard life, intellect, and dignity, while ensuring that *niyyah* (intention) and *amanah* (trust) underpin algorithmic decision-making processes. This study aims to explore the ethical integration of artificial intelligence (AI) in sedation management within critical care settings from an Islamic perspective, employing the *Maqasid al-Sharia* framework to assess its implications on autonomy, human dignity, and end-of-life care in Muslim patients. This is the first study to apply *Maqasid al-Sharia* to AI-driven sedation in critical care, offering a novel ethical framework that integrates Islamic principles with emerging AI technologies in ICU settings.

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**Research Methodology**

This study adopts a conceptual analysis approach, integrating Islamic jurisprudential analysis with bioethical and clinical protocol evaluation. The methodology integrates two parallel yet complementary streams: (i) an ICU sedation clinical pathway analysis, augmented by AI-driven decision-support scenarios, and (ii) an Islamic legal framework grounded in *Maqasid al-Sharia*. The overarching aim is to produce a theological-ethical framework that aligns critical care sedation protocols with Islamic moral imperatives while maintaining clinical efficacy.

**Research Finding**

1. ICU sedation clinical pathway analysis, augmented by AI-driven decision-support scenarios

Sedation management in the ICU remains a complex and dynamic clinical challenge. Optimal sedation enables tolerance of mechanical ventilation, minimises distress, and prevents adverse outcomes. However, the clinical practice is plagued by wide variability and inconsistent adherence to guideline-based pathways (Pearson SD & Patel BK, 2020). A systematic review done by Jackson DL et al. (2009) showed that both under-sedation and over-sedation have been independently associated with increased morbidity, prolonged ICU stay, and impaired long-term cognitive outcomes. Accordingly, the concept of optimal sedation and the scale or method used to quantify sedation varied significantly. Significant rates of less-than-ideal sedation were documented in all included investigations, with a higher propensity for over-sedation. Improvements to the uniform definition and assessment of sedation may improve the standard of care of patients in the ICU (Jackson DL et al., 2009).

Despite the establishment of evidence-based guidelines such as the 2018 PADIS (Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption) recommendations, clinical translation often falters (Devlin JW et al., 2018). Contributing factors include staff shortages, inter-provider variability, high patient complexity, and the limitations of one-size-fits-all approaches. AI, with its capacity for real-time data synthesis, predictive analytics, and personalised modelling, offers new avenues for optimising ICU sedation. AI-driven decision-support systems (DSS) can continuously analyse physiological parameters, pharmacokinetic profiles, and contextual clinical variables, thereby guiding titration and reducing cognitive burden on clinicians (Elhaddad M. & Hamam S., 2024; Hehsan MR. & Muhd Shukeri WFW., 2021).

***AI-Driven Decision-Support Scenarios***

From the evidence synthesis, three AI-augmented scenarios emerged (Elhaddad M. & Hamam S., 2024; Ouanes K. & Farhah N., 2024; Bajgain B. et al., 2023).

a) Predictive Titration Model
   i) Machine learning algorithms predict optimal sedative dosing based on real-time physiological data (heart rate variability, EEG-derived indices, ventilator synchrony).
   ii) Adaptive feedback adjusts infusion rates before clinical deterioration occurs.
b) Delirium Risk Stratification
   i) AI integrates sedation depth scores with biomarkers, patient age, comorbidities, and drug exposure to calculate delirium probability.
   ii) Provides proactive alerts recommending lighter sedation or non-pharmacological strategies.
c) Weaning Readiness Optimisation
   i) AI forecasts patient readiness for sedation weaning by analysing cumulative sedation exposure, ventilator synchrony, and spontaneous breathing trial predictors.
   ii) Supports timely liberation from sedation, reducing ventilation duration.

2. Islamic legal framework grounded in *Maqasid al-Sharia*

The application of AI in sedation practices within critical care settings necessitates not only clinical justification but also a robust ethical and legal grounding. Within the Islamic tradition, this foundation is best articulated through the framework of *Maqasid al-Sharia* (the higher objectives of Islamic law), which transcends a literalist legal reading by situating medical practice within a purposive and holistic paradigm. The *Maqasid,* classically articulated as the preservation of religion (*hifz al-din*), life (*hifz al-nafs*), intellect (*hifz al-'aql*), progeny (*hifz al-nasl*), and wealth (*hifz al-mal*), provide both ethical direction and normative legitimacy for medical interventions, including the integration of AI technologies in critical care (Hehsan MR. et al., 2023; Hehsan MR., 2014).

***Preservation of Religion (Hifz al-Din)***

In sedation contexts, *Hifz al-Din* requires that AI-driven decisions respect the patient's ability to maintain religious identity, intention (*niyyah*), and basic spiritual functions. Sedation algorithms must be designed to avoid unnecessary suppression of consciousness that may impede obligatory worship unless medically necessary under *darura*. AI-supported sedation breaks when clinically safe that can allow intermittent alertness during prayer times or for spiritual interaction with family. Furthermore, ensuring life-supporting sedation aligns with *Hifz al-Din*, since protecting life is foundational to fulfilling religious duties. Thus, the ethical imperative under *Hifz al-Din* merges and protects spiritual integrity with life preservation of the patient. Islamic jurisprudence recognises *darura* (necessity) as a legal maxim that permits the temporary suspension of certain ritual duties when life is endangered, thereby harmonising medical intervention with spiritual preservation (Hehsan MR, 2023).

***Preservation of Life (Hifz al-Nafs)***

Sedation in critical care is fundamentally used to stabilise and preserve life, especially in mechanically ventilated patients. AI enhances this objective by providing predictive titration that prevents oversedation or hypoventilation, minimising complications associated with deep or prolonged sedation, and preventing iatrogenic harm by continuous risk assessment for haemodynamic instability. From the perspective of *hifz al-nafs*, sedation, whether administered directly or guided by AI decision-support systems, serves the primary function of preserving human life. This objective legitimises the use of AI-assisted sedation where it demonstrably reduces risk, prevents iatrogenic harm, or enables life-saving interventions such as mechanical ventilation or invasive surgery. Therefore, the maxim *dar' al-mafasid wa jalb al-masalih* (preventing harm and securing benefit) governs algorithmic decision-making. Importantly, *Hifz al-Din* and *Hifz al-Nafs* overlap: safeguarding life is both a religious and ethical obligation.

***Preservation of Intellect (Hifz al-'Aql)***

AI-driven sedation bears direct consequences on cognition and long-term neurological outcomes. Islamic law places significant emphasis on preserving intellect as a core human faculty. Excessive or prolonged sedation risks violating *Hifz al-'Aql* by inducing delirium or cognitive injury. Prolonged or unnecessary sedation can have long-term implications on fertility, familial responsibilities, and financial sustainability. Here, AI offers a double-edged sword: while it has the potential to optimise drug delivery, reduce complications, and shorten intensive care stays, it also raises questions of cost, access, and distributive justice. AI's capacity to detect deep sedation earlier, flag sedation exceeding 72 hours, and adjust titration aligns with the maqasid objective of protecting cognitive integrity. The ethical directive is to avoid unnecessary deep sedation unless clinically justified and clinicians align their practice with the preservation of intellect and human dignity (Hehsan MR, 2023).

***Preservation of Progeny (Hifz al-Nasl)***

The protection of progeny extends to safeguarding the physiological well-being of present, future generations and the integrity of familial lineage. Sedation choices in pregnant ICU patients must avoid teratogenicity. AI algorithms should therefore incorporate pregnancy-specific considerations, selecting agents with minimal fetal harm. In critical care, pregnant patients sedated with teratogenic drugs risk fetal injury. Therefore, AI can guide clinicians toward safer agents and AI can model fetal–maternal dynamics for safer pharmacology. Thus, a Maqasid-aligned AI approach prioritises maternal and fetal safety, ensuring the preservation of lineage.

***Preservation of Property/Wealth (Hifz al-Mal)***

While not always central in sedation discourse, *Hifz al-Mal* becomes relevant for healthcare resource utilisation, cost-burden on families, and equitable access. AI may reduce ICU length of stay, medication expenditure and may reduce costs associated with complications. However, costly proprietary AI systems risk widening inequities. Under Islamic ethics, technology must not privilege wealthier patients or burden families with excessive cost. A maqasid-consistent AI system must be equitable, affordable and accessible. Islamic ethics requires fairness in allocation, ensuring that technological benefits are available without financial injustice.

Crucially, this *maqasid*-centric approach positions Islamic ethics not as a reactive framework but as a proactive and anticipatory one. Rather than simply evaluating the permissibility of AI-guided sedation post hoc, it demands an upfront integration of theological, ethical, and legal considerations into the design, validation, and governance of such technologies. This ensures compliance with the objectives of al shariah which is *jalb al-masalih wa dar' al-mafasid* (promoting benefits and preventing harms), thereby embedding Islamic normative principles at the very heart of medical innovation. In summary, grounding AI-assisted sedation in *Maqasid al-Sharia* offers a comprehensive Islamic legal and ethical framework that reconciles medical necessity with spiritual accountability. It operationalises sedation not only as a clinical tool but also as a moral act embedded in the higher objectives of Sharia, ensuring that the preservation of life, intellect, and faith remains central to technological integration in critical care.

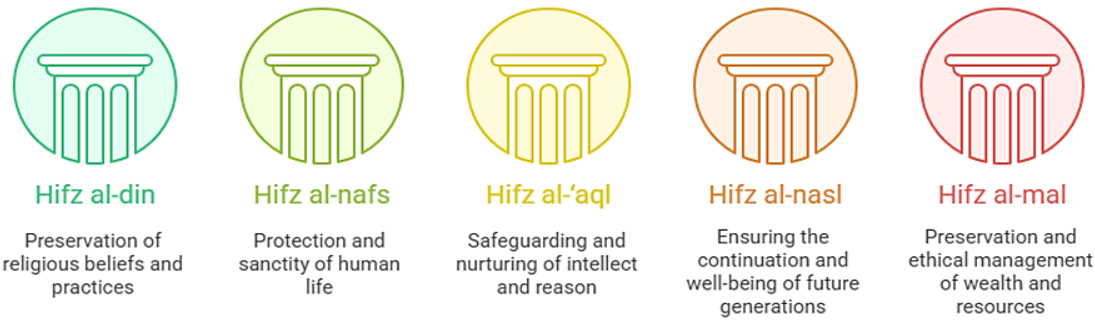


Figure 1. Core objectives of Islamic Law (*Maqasid al-Sharia*)

**Discussion**

The findings of this study highlight the need for a structured framework that harmonises clinical effectiveness, ethical accountability, and spiritual integrity in AI-driven sedation. To address this, we propose the *Maqasid al-Sharia–Sedation–*

*AI Matrix (MSA Matrix)*, a conceptual model that integrates the higher objectives of Islamic law with the technological capabilities of artificial intelligence in critical care.

1. *Maqasid al-Sharia*–Sedation–AI Matrix (MSA Matrix)
   The integration process yielded a five-axis mapping where each *maqasid* directly informed sedation-related decision-making:

| Maqasid al-Sharia Objective | Clinical Sedation Domain | AI Decision Node | Islamic Ethical Directive | Practical ICU Example |
|---|---|---|---|---|
| Preservation of Religion (*Hifz al-Din*) | Sedation in conscious or initiation in unstable Muslim patients | BIS target setting Prayer-friendly sedation scheduling | Facilitate patient's ability to perform obligatory prayers if possible | AI proposes sedation breaks for alertness during prayer times if stable |
| Preservation of Life (*Hifz al-Nafs*) | Sedation initiation in unstable patients | BIS target setting | Prioritise life-saving sedation over procedural delays | AI suggests immediate propofol infusion for severe ARDS agitation; override allowed if hypotension threatens mortality |
| Preservation of Intellect (*Hifz al-ʻAql*) | Depth and duration of sedation | Sedation titration loop | Avoid unnecessary deep sedation to preserve cognitive function | AI flags sedation >72h; system prompts discussion for early light sedation unless clinically contraindicated |
| Preservation of Progeny (*Hifz al-Nasl*) | Sedation in pregnant ICU patients | Drug selection algorithm | Minimise teratogenic sedation agents | AI prioritises dexmedetomidine over benzodiazepines in 2nd trimester ARDS case |
| Hifz al-Mal (Preservation of Wealth) | Sedation cost-effectiveness and resource stewardship | AI-enabled optimisation of sedative drug use, ventilator weaning readiness, and ICU stay duration | Justice, equity, and stewardship of resources; avoidance of extravagance (*israf*) | AI shortens ICU stay by guiding timely sedation weaning, reducing overall hospital stay and costs |

2. Ethical Safeguards in AI-Supported Sedation
   The mapping revealed critical inflection points where Islamic ethics enrich AI's decision-making:
   i) AI Bias Mitigation: Ensuring algorithmic fairness by including Islamic end-of-life ethics in AI training datasets.
   ii) Consent Pathway Integration: Embedding family consultation and *shura* in AI's recommendation steps before irreversible sedation decisions.
   iii) Tayseer Principle: Applying the Islamic principle of facilitation (*tayseer*) to reduce patient suffering without violating *haram* boundaries.
3. Practical ICU Applications
   a) Scenario A – Agitated Mechanically Ventilated Muslim Patient:
      i) AI suggests deep sedation due to persistent ventilator asynchrony.
      ii) Ethical override: Limit sedation depth to maintain intermittent alertness for spiritual needs unless physiologically unsafe.
   b) Scenario B – Elderly Patient with Poor Prognosis:
      i) AI recommends prolonged midazolam infusion for comfort.
      ii) Maqasid intervention: Shift towards opioid-based comfort sedation to avoid unnecessary suppression of cognition, facilitating final acts of worship.
   c) Scenario C – Pregnant Trauma Patient:
      i) AI selects standard sedation protocol including benzodiazepines.
      ii) Maqasid-guided modification: Replace with non-teratogenic agents despite slightly higher cost and slower onset.

***Autonomy and Niyyah***

Patient autonomy, while central in modern bioethics, is interpreted in Islam not merely as individual freedom but as moral agency directed by divine accountability. The principle of niyyah foregrounds intentionality in both clinical practice and patient consent. In the context of AI-driven sedation, niyyah requires that medical decisions be made with sincerity, clarity of purpose, and alignment with the patient's welfare. Sedation should thus not obscure patient dignity or silence their voice but rather ensure that decisions reflect both clinical necessity and the ethical duty to honour the patient's conscious intentions where possible.

***Beneficence, Amanah, and AI***

The Islamic principle of beneficence converges with amanah—the trust placed in healthcare professionals and, by extension, in the tools and technologies they employ. AI systems, when used in sedation management, represent a trust-laden delegation of clinical judgement. From an Islamic perspective, clinicians bear a dual amanah: first, the responsibility to safeguard life and alleviate suffering; second, the duty to ensure that AI systems are transparent, validated, and accountable. Beneficence in this sense requires a rigorous scrutiny of AI tools, ensuring that their deployment maximises therapeutic benefit while preventing undue reliance on opaque algorithms.

***Non-Maleficence and Hurmat al-Insan***

The ethical principle of "do no harm" resonates deeply with hurmat al-insan, the sanctity and inviolability of human life. Sedation carries inherent risks, from haemodynamic instability to loss of meaningful interaction at the end of life. Islamic jurisprudence tolerates sedation under the maxim of darura (necessity) when harm prevention outweighs potential risks. In the context of AI, non-maleficence demands careful calibration: algorithms must not depersonalise care or lead to decisions that diminish the spiritual and existential dimensions of dying. Hurmat al-insan ensures that even when sedation is indicated, it must be applied in a manner that preserves dignity, safeguards awareness where possible, and acknowledges the patient's readiness for death in alignment with Islamic teachings on end-of-life care.

**Conclusion**

AI-assisted sedation in critical care holds immense potential but demands ethical vigilance. This study critically examined the ethical and theological dimensions of artificial intelligence (AI)-driven sedation in critical care through the lens of *Maqasid al-Sharia*. The findings reveal that while AI offers transformative potential in optimising sedation management through predictive titration, delirium risk stratification, and weaning readiness optimisation, it also raises profound ethical dilemmas. These include questions of accountability, distributive justice, and preservation of human dignity. By mapping sedation practices onto the higher objectives of Sharia, this study demonstrates that AI can be ethically integrated into intensive care only when it safeguards life (*hifz al-nafs*), intellect (*hifz al-'aql*), religion (*hifz al-din*), progeny (*hifz al-nasl*), and wealth (*hifz al-mal*). Grounding its application in *Maqasid al-Sharia* ensures that life, intellect, faith, progeny, and resources are preserved while aligning technology with spiritual integrity. The proposed Maqasid al-Sharia–Sedation–AI Matrix (MSA Matrix) provides a proactive framework that ensures clinical efficacy is balanced with spiritual integrity and ethical responsibility. Ultimately, this framework demonstrates that innovation and Islamic ethics can harmonise to safeguard human dignity and divine trust, setting a model for globally responsible AI-driven systems in medicine.

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**Conflict of Interest**

The authors declare no conflicts of interest.

**Author Contributions**

Muhamad Rafiqi Hehsan was the corresponding and sole author for this article.

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