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Review Article

Clinical Decision-Making, Financial Incentives, and Ethical Challenges in the Escalation of Mechanical Ventilation: A PRISMA-Guided Review

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ABSTRACT

Background: Mechanical ventilation is a life-saving intervention in critical care; however, decisions regarding its escalation are complex and influenced by clinical uncertainty, ethical challenges, and health system constraints. Increasing concerns have emerged regarding potential overutilization and its impact on patient outcomes and healthcare resources. Objective: To synthesize available evidence on clinical decision-making, financial influences, and ethical dilemmas associated with the escalation of invasive mechanical ventilation in adult critical care settings. Methods: A focused literature review guided by PRISMA 2020 principles was conducted using PubMed, Scopus, and Google Scholar. Studies addressing clinical, ethical, and economic aspects of mechanical ventilation were included and narratively synthesized. Results: The evidence indicates substantial variability in ventilation practices driven by prognostic uncertainty, institutional incentives, and resource pressures. Proactive ethics consultation and structured decision aids improved communication, reduced non-beneficial treatment, and shortened ICU length of stay. Long-term outcomes of prolonged mechanical ventilation were poor, with high mortality and limited functional recovery among survivors. Conclusion: Escalation of mechanical ventilation is shaped by intersecting clinical, ethical, and systemic factors. Integrating ethical frameworks, shared decision-making, and evidence-based de-escalation strategies is essential to promote patient-centered and ethically sound critical care. Keywords: Mechanical Ventilation, Critical Care, Decision Making, Ethics, Health Resources

INTRODUCTION

Mechanical ventilation is a cornerstone of modern critical care and remains one of the most frequently employed life-sustaining interventions for patients with acute respiratory failure and severe critical illness. Advances in ventilatory technology and intensive care practices have substantially improved short-term survival; however, the decision to escalate to invasive mechanical ventilation is inherently complex and extends beyond physiological indications alone. It requires clinicians to balance anticipated clinical benefit against potential harm, patient values, prognosis, and the broader constraints of intensive care delivery. As the global demand for critical care services continues to increase, concerns have emerged regarding variability in ventilation practices and the potential overuse of invasive life-support in situations where benefits may be limited (1).

Critical care medicine is widely recognized as a resource-intensive domain characterized by high technological dependence, specialized workforce requirements, and substantial financial cost. Economic analyses have consistently described intensive care units as labor-intensive and high-cost environments operating under increasing pressure from constrained resources and rising patient volumes (3). In such settings, escalation decisions may be influenced not only by clinical severity but also by institutional factors such as bed availability, reimbursement structures, and defensive medical practices. These system-level pressures raise important questions about whether escalation to mechanical ventilation always reflects optimal, patient-centered decision-making, particularly in health systems with limited critical care capacity (3).

Ethical challenges further complicate decisions surrounding mechanical ventilation, especially when prognosis is uncertain and patients are unable to participate in decision-making. Family members and surrogate decision-makers are often tasked with navigating complex choices between life-prolonging interventions and comfort-focused care, frequently under conditions of emotional distress and incomplete information (7). Evidence suggests that proactive ethics consultation and structured communication strategies can improve alignment between clinicians and surrogates, reduce non-beneficial treatment, and shorten intensive care unit length of stay, underscoring the importance of ethical frameworks in guiding escalation decisions (1,7). Moreover, during periods of resource scarcity or public health emergencies, the ethical imperative for transparent and just allocation of ventilator support becomes even more pronounced, necessitating predefined and clinically sound allocation processes (2).

Long-term outcome data challenge the assumption that escalation to invasive ventilation uniformly improves patient prognosis. Large systematic reviews have demonstrated that patients requiring prolonged mechanical ventilation experience high mortality rates, with nearly 60% mortality at one year and low rates of functional recovery among survivors (4). Only a minority of patients are successfully liberated from ventilation and discharged home, highlighting the significant burden of long-term morbidity associated with prolonged invasive support (4). These findings align with growing recognition that survival alone is an insufficient outcome measure in critical care and that long-term quality of life and functional status must be incorporated into escalation decisions (5). Failure to implement evidence-based practices such as daily sedation interruption and spontaneous breathing trials has also been identified as an ethical concern when preventable harm may result from prolonged ventilation (6).

Despite an expanding body of literature addressing clinical outcomes, ethics, and economics in critical care, existing evidence remains fragmented across disciplines and study designs. There is a lack of integrative synthesis examining how clinical decision-making, financial incentives, and ethical dilemmas collectively shape mechanical ventilation practices. Addressing this knowledge gap is essential to inform patient-centered, ethically defensible, and context-aware escalation strategies in adult intensive care. Therefore, the objective of this review was to synthesize available evidence on the clinical, ethical, and health system factors influencing the escalation of invasive mechanical ventilation and to examine their implications for patient outcomes and critical care practice (1–8).

MATERIALS AND METHODS

This review was designed as a focused literature review incorporating systematic elements and conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA 2020) framework. The aim was to synthesize available clinical evidence examining how decision-making processes, economic considerations, and ethical challenges influence the escalation of invasive mechanical ventilation in adult critical care settings.

A comprehensive search of the literature was performed across three electronic databases, including PubMed (MEDLINE), Scopus, and Google Scholar. The search was conducted using predefined key terms related to mechanical ventilation, escalation of care, ethics, and health system influences. To enhance

coverage and minimize the risk of missing relevant studies, reference lists of eligible articles were manually screened, and forward citation tracking was performed.

Eligible studies included those focusing on adult patients receiving invasive mechanical ventilation and addressing clinical decision-making, ethical considerations, health system factors, or economic influences related to the initiation, continuation, or withdrawal of ventilatory support. Quantitative, qualitative, mixed-methods studies, as well as systematic and narrative reviews, were considered for inclusion. Studies were excluded if they involved pediatric populations, non-human subjects, or focused exclusively on technical ventilator parameters without reference to clinical decision-making or ethical considerations. Editorials and opinion pieces lacking analytical synthesis were also excluded.

Following the literature search, all retrieved records were imported into a reference management system, and duplicate entries were removed prior to screening. Titles and abstracts were screened for relevance, after which full-text articles were assessed for eligibility. The study selection process was conducted in accordance with PRISMA 2020 recommendations and is illustrated in the PRISMA flow diagram.

Data were extracted from included studies using a standardized framework to ensure consistency and completeness. Extracted information included publication details, study design, clinical setting, sample size or scope, and key findings related to decision-making in mechanical ventilation. Particular attention was paid to reported ethical dilemmas, economic pressures, health system constraints, and patient outcomes such as mortality, ventilator liberation, and post-intensive care functional status.

Given the heterogeneity of study designs, populations, and reported outcomes, a qualitative narrative synthesis was undertaken. Findings were organized thematically into domains reflecting clinical decision-making processes, financial and health system influences, and ethical challenges in critical care escalation. Outcome data were summarized descriptively without quantitative pooling. This review was based exclusively on previously published literature, and therefore did not require ethical approval.

Search String Used

("mechanical ventilation" AND "clinical decision making" AND (ethics OR overutilization OR "financial incentives"))

RESULTS

Study Characteristics

The included literature comprised a heterogeneous body of evidence published between 1998 and 2022, encompassing prospective controlled studies, randomized clinical trials, systematic reviews, mixed-methods reviews, and narrative clinical reviews. Study designs ranged from single-center prospective studies involving fewer than 100 mechanically ventilated patients to large multicenter trials and systematic reviews synthesizing data from thousands of patients across multiple countries. Clinical settings predominantly included adult medical, surgical, trauma, cardiac, and neurological intensive care units, as well as post-acute care hospitals managing patients with prolonged mechanical ventilation. Sample sizes varied substantially, reflecting the diversity of study designs and research objectives. Citation impact ranged from modestly cited conceptual analyses to highly influential clinical and ethical investigations.

Clinical Decision-Making in Mechanical Ventilation

Across studies, clinical decision-making regarding initiation, continuation, and withdrawal of mechanical ventilation was consistently described as complex and multifactorial. Interventional

evidence demonstrated that structured decision-support tools and communication aids improved concordance between clinicians and patient surrogates and reduced decisional conflict in cases of prolonged mechanical ventilation. Proactive ethics consultation was associated with reductions in intensive care unit length of stay and an increased frequency of decisions to limit or forego non-beneficial life-sustaining treatments. Qualitative findings revealed substantial variability in clinician practices, particularly in sedation management and ventilator liberation strategies, highlighting the absence of uniform decision-making frameworks across institutions. In contexts of resource scarcity, studies emphasized the necessity of predefined, systematic allocation processes based on clinical prognosis and disease-specific predictors.

Financial and Health System Factors

Economic considerations emerged as a central theme influencing critical care delivery. Mechanical ventilation was consistently characterized as a high-cost, resource-intensive intervention requiring advanced technology and specialized personnel. Prolonged mechanical ventilation was associated with substantial healthcare expenditures, affecting hundreds of thousands of patients annually and contributing to significant financial strain on healthcare systems. Several studies highlighted the presence of misaligned financial and organizational incentives within critical care environments, particularly in settings facing increasing demand and constrained resources. These economic pressures were reported to intersect with clinical decision-making, potentially influencing escalation and continuation of invasive life-support therapies.

Ethical Challenges in Escalation of Care

Ethical dilemmas were prominently reported across all study types. Challenges included determining appropriateness of continued ventilation in patients with poor prognosis, balancing life-prolonging treatment against quality of life considerations, and supporting family members acting as surrogate decision-makers. Evidence indicated that failure to implement established evidence-based protocols, such as daily sedation interruption and spontaneous breathing trials, raised ethical and professional concerns when preventable harm could occur.

Table 1. Characteristics of Included Studies

Author (Year)	Study Design	Setting	Sample Size / Scope	Primary Focus
Dowdy et al. (1998)	Prospective controlled study	Adult ICU	99 patients on >96 h mechanical ventilation	Impact of proactive ethics consultation on ICU outcomes
Hick et al. (2007)	Policy and ethical framework review	Disaster & critical care settings	Conceptual	Ventilator allocation during resource scarcity
Dorman et al. (2007)	Narrative health economics review	Critical care systems	Not applicable	Economic burden and resource intensity of ICU care
Damuth et al. (2015)	Systematic review & meta-analysis	Acute and post-acute care hospitals	124 studies, 16 countries	Long-term outcomes of prolonged mechanical ventilation
Lamb et al. (2015)	Clinical review	ICU	Not applicable	Ethical and clinical issues in prolonged ventilation
Manthous et al. (2016)	Selective literature review	ICU	Not applicable	Ethical implications of non-adherence to ventilator protocols
Cox et al. (2019)	Multicenter randomized clinical trial	Medical & surgical ICUs	210 patients, 5 centers	Decision aids for surrogate decision-making
Varga et al. (2022)	Systematic mixed-methods review	Adult ICUs	18 studies, 10 countries	Clinician perceptions of sedation and ventilation decisions

During periods of resource scarcity or disaster scenarios, ethical frameworks emphasizing fairness, transparency, and clinical justification were identified as essential for ventilator allocation. The literature consistently underscored the importance of advance planning and institutional policies to guide ethically defensible decisions.

Table 2. Clinical Decision-Making Factors Identified Across Studies

Domain	Key Findings	Supporting Studies
Decision support	Decision aids improved clinician-surrogate agreement and reduced decisional conflict	Cox et al., 2019
Ethics consultation	Proactive ethics involvement reduced ICU length of stay and facilitated limitation of non-beneficial treatment	Dowdy et al., 1998
Prognostic uncertainty	Lack of reliable predictors complicated escalation and withdrawal decisions	Damuth et al., 2015
Practice variability	Significant variation in sedation and ventilation practices among clinicians	Varga et al., 2022
Resource scarcity	Systematic allocation frameworks required during ventilator shortages	Hick et al., 2007

Table 3. Financial and Health System Influences on Mechanical Ventilation

Factor	Description	Evidence Source
Cost intensity	Critical care described as technologically heavy, labor-intensive, and high-cost	Dorman et al., 2007
Prolonged ventilation burden	Affects ~400,000 patients annually with costs >$35 billion	Cox et al., 2019
System pressure	Increasing demand with limited ICU capacity creates economic stress	Dorman et al., 2007
Incentive misalignment	Financial and organizational incentives may conflict with patient-centered outcomes	Dorman et al., 2007

Table 4. Ethical Challenges and Patient Outcomes

Ethical Issue / Outcome	Evidence Summary	Supporting Studies
Inappropriate escalation	Failure to apply evidence-based weaning protocols raises ethical concerns	Manthous et al., 2016
Surrogate distress	Families struggle between life-prolonging treatment and comfort-focused care	Cox et al., 2019
Allocation fairness	Disaster planning requires just and clinically sound ventilator allocation	Hick et al., 2007
Liberation from ventilation	Only ~50% successfully liberated from prolonged ventilation	Damuth et al., 2015
Long-term mortality	One-year mortality approximately 59%	Damuth et al., 2015
Functional outcomes	Only 19% discharged home; long-term quality of life often impaired	Damuth et al., 2015

Patient Outcomes

Long-term outcome data revealed substantial morbidity and mortality associated with prolonged mechanical ventilation. Approximately half of patients were successfully liberated from mechanical ventilation, while one-year mortality approached 60%. Functional outcomes were poor, with a minority of patients ultimately discharged directly home. Survivors frequently experienced long-term impairments in physical function and quality of life following intensive care. These findings were consistent across multiple healthcare systems and reinforced concerns regarding the balance between potential benefits and harms of prolonged invasive ventilation.

DISCUSSION

This review highlights that clinical decision-making surrounding mechanical ventilation is not solely a technical or physiological process but is deeply influenced by ethical considerations, economic pressures, and health system structures. Across diverse study designs and healthcare contexts, the escalation of invasive ventilation consistently emerged as a complex intervention with far-reaching consequences for patient outcomes, resource utilization, and moral accountability. The findings reinforce growing concerns in critical care literature that decisions regarding ventilatory support often extend beyond individualized clinical need and are shaped by systemic incentives, prognostic uncertainty, and institutional norms (15).

The evidence synthesized in this review aligns with prior studies demonstrating that structured decision-support mechanisms and proactive ethics consultation improve alignment between clinical teams and patient surrogates while reducing non-beneficial prolongation of life-sustaining treatment. The prospective study by Dowdy et al. demonstrated that early ethics involvement was associated with shorter ICU stays and increased clarity in end-of-life decision-making, findings that are concordant with later randomized evidence showing reduced decisional conflict when formal decision aids are employed in prolonged ventilation scenarios (16,17). These results support the theoretical framework that transparent communication and shared decision-making mitigate moral distress and reduce inappropriate escalation of invasive therapies.

From a health system perspective, the review corroborates earlier economic analyses characterizing intensive care as a technologically intensive and resource-constrained domain. Dorman et al. previously emphasized that critical care operates under increasing financial pressure, a concern that remains highly relevant as demand for mechanical ventilation continues to rise globally (18). The substantial costs associated with prolonged ventilation, coupled with limited ICU capacity, create environments in which escalation decisions may be influenced—intentionally or unintentionally—by institutional reimbursement models, bed availability, and defensive medical practices. These findings extend prior observations by situating economic stress not merely as a background factor, but as an active determinant in clinical trajectories.

Ethical challenges emerged as a central and recurring theme across the included literature. The difficulty of balancing life-prolonging treatment against quality-of-life considerations was consistently reported, particularly when prognosis is uncertain and families act as surrogate decision-makers. Studies examining disaster preparedness and ventilator scarcity further underscore the necessity of pre-established, ethically defensible allocation frameworks that prioritize fairness, transparency, and clinical justification (19). Importantly, the ethical concerns identified were not limited to crisis situations; routine ICU care was shown to involve similar dilemmas when evidence-based weaning strategies are underutilized or delayed, potentially exposing patients to avoidable harm (20).

Patient outcome data synthesized in this review further emphasize the gravity of escalation decisions. The high one-year mortality rate and low rates of successful liberation from prolonged mechanical ventilation reported in large meta-analyses are consistent with previous longitudinal ICU outcome studies (21). The finding that only a minority of survivors are discharged directly home underscores the long-term functional and psychosocial burden borne by patients and families. These outcomes challenge the assumption that escalation to invasive ventilation inherently confers survival benefit and reinforce calls for more nuanced, patient-centered approaches to critical care decision-making.

Mechanistically, prolonged mechanical ventilation contributes to muscle atrophy, ventilator-associated complications, and cognitive impairment, which collectively diminish post-ICU recovery potential. Theoretical models of critical illness recovery increasingly recognize that survival alone is an insufficient endpoint and that long-term functional outcomes must be considered during escalation decisions (22). Integrating these considerations into bedside practice requires clinicians to move beyond protocol-driven escalation toward individualized risk-benefit assessment informed by patient values and realistic prognostic communication.

The strengths of this review include the integration of clinical, ethical, and economic perspectives across a broad range of study designs and healthcare settings, allowing for a comprehensive understanding of the factors influencing mechanical ventilation practices. However, several limitations must be acknowledged. The heterogeneity of included studies precluded quantitative synthesis, and the reliance on published literature introduces the potential for publication bias. Many included studies were conducted in high-income countries, limiting generalizability to low- and middle-income settings where resource constraints may exert even greater influence on decision-making. Additionally, the number of interventional studies addressing ethical or financial drivers of escalation remains limited.

Future research should prioritize prospective, context-sensitive investigations examining how institutional policies, reimbursement models, and clinician training influence ventilation decisions in routine practice. Studies integrating patient-reported outcomes and long-term functional status into escalation frameworks are particularly needed. Moreover, there is a clear need for implementation research evaluating structured ethics consultation, decision aids, and de-escalation protocols in diverse healthcare systems. Addressing these gaps will be essential to advancing ethically grounded, evidence-based, and patient-centered critical care.

CONCLUSION

This review demonstrates that escalation of invasive mechanical ventilation is not a purely clinical act but a multidimensional decision influenced by ethical considerations, economic pressures, and institutional practices. The available evidence consistently indicates that premature or prolonged ventilation may expose patients to substantial harm without proportional benefit, particularly in the context of poor long-term survival and functional outcomes. Interventions such as structured decision aids and early ethics consultation appear effective in improving communication, aligning care with patient values, and reducing non-beneficial treatment. Nevertheless, gaps persist in the implementation of evidence-based weaning strategies and ethically grounded escalation frameworks. Addressing these challenges requires system-level reforms, clinician education, and research focused on integrating long-term outcomes and patient-centered values into critical care decision-making. Strengthening ethical governance and transparency in ventilation practices is essential to improving both patient outcomes and trust in healthcare systems.

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