

## Review Article

# Optimizing critical care for the elderly in resource-limited setting: intensive care unit versus high dependency unit

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## ABSTRACT

This article delves into the comparative advantages of Intensive Care Units (ICUs) over High-Dependency Units (HDUs) for geriatric patients, particularly in settings with limited resources. It investigates how ICUs outperform HDUs in terms of clinical outcomes and economic efficiency. Recent studies highlight that ICUs offer superior monitoring and specialized care, resulting in significantly better health outcomes for elderly patients, especially those with severe comorbidities and complex medical conditions. Lower mortality rates and improved functional recovery post-discharge underscore the benefits of ICU care compared to HDUs. Moreover, the economic analysis emphasizes the importance of cost-effectiveness in resource-constrained environments, ensuring that investments in ICU facilities yield substantial improvements in patient outcomes. This article consolidates evidence to underscore the advantages of ICU care for geriatric patients, advocating for informed healthcare policies that prioritize ICU resources to maximize overall health benefits.

**Keywords:** High dependency unit, Intensive care unit, Elderly population, Geriatric patients, ICU vs HDU

## INTRODUCTION

A critical care unit in a healthcare facility encompasses Intensive Care Units (ICUs) and High Dependency Units (HDUs) to manage patients with severe conditions. ICUs provide intensive care for life-threatening illnesses requiring invasive support, advanced medical resources, and a high staff-to-patient ratio to maintain organ function. In contrast, HDUs offer intermediate care for patients needing close monitoring but not invasive ventilation or extensive vasopressor therapy. Acting as a bridge between ICUs and general wards, HDUs facilitate smooth patient transitions through structured "step-up" and "step-down" criteria based on clinical needs. Together, ICUs and HDUs ensure tailored, resource-efficient care, particularly critical

in optimizing outcomes for elderly patients in critical conditions.<sup>1</sup>

By 2050, the global population over 80 years is projected to double with older adults often experiencing geriatric syndromes (e.g., pressure ulcers, incontinence, delirium) that increase vulnerability to poor outcomes.<sup>2,3</sup> Up to 90% of older ICU survivors report suffering from one or more of these conditions, leading to ongoing higher nursing care needs, decreased independence, and reduced Quality of Life (QoL).<sup>4</sup> Aging is also linked to multimorbidity (e.g., hypertension, diabetes) and frailty, which heighten the risk of adverse outcomes including mortality. These factors necessitate extensive care in medical as well as surgical geriatric patients to mitigate complications.<sup>5</sup> As elder

adults survive critical illness, the healthcare system must allocate resources and ensure trained ICU staff to manage geriatric-specific needs. Therefore, assessing QoL is crucial to comprehensively gauge the impact of ICU care and inform future healthcare strategies.

Advancements in intensive care have shifted the focus from merely reducing mortality to enhancing survivors' QoL which is crucial for evaluating ICU care requiring significant financial investment, making cost-effectiveness and cost-utility analyses essential for optimizing resource allocation.<sup>6,7</sup> While developed nations have extensively studied ICU survivors' QoL, research in resource-limited settings like India remains limited.<sup>8-10</sup> Although, HDUs, positioned between ICUs and general wards, offer a cost-effective alternative by improving patient flow, resource utilization, and operational efficiency, their overall contribution to improved outcomes is debatable.<sup>11,12</sup>

This study aims to evaluate the necessity and comparative effectiveness of ICU versus HDU setups in hospital settings for elderly patients, factoring in cost-effectiveness and cost-utility factors. Thus, providing valuable insights into preferring ICU over HDU. Such insights are critical for informed healthcare policy decisions and optimizing ICU care practices to enhance overall patient outcomes.

## METHODS

Studies comparing patient outcomes in HDUs and ICUs were reviewed to assess the impact of converting HDUs to ICUs, particularly for elderly patients. However, the data available is limited. The primary metrics evaluated for comparison between ICU and HDU were: prognosis in elderly (mortality rates, recovery times, complication rates, and overall patient outcomes) along with post-operative care, infection control policy and economic evaluation.

## DISCUSSION

### *ICU vs. HDU prognosis in elderly patients*

Studies from developed nations consistently demonstrate superior outcomes for elderly patients treated in ICUs compared to those in HDUs. McQuillan et al highlighted that inadequate pre-ICU care correlates with worse outcomes in critically ill patients, advocating for early, intensive interventions to prevent adverse events.<sup>6</sup> Parkhe et al further underscored the impact of delayed ICU admissions from emergency departments, showing a 30% increase in mortality rates due to delayed transfers.<sup>13</sup> Kaarlola et al examined long-term survival and quality of life among elderly ICU patients, reporting a 1-year survival rate of 45%, significantly higher than the 25% observed in less intensive care settings, along with better quality-adjusted life years (QALYs).<sup>14</sup> Ridley (1998) noted that while HDUs provide important care, they lack the comprehensive monitoring found in ICUs. Elderly

patients with complex health issues benefit more from ICU care, which can reduce mortality by about 20% for high-risk surgical patients.<sup>15</sup>

The debate surrounding the conversion of HDUs to ICUs underscores the benefits of ICU care, particularly for critically ill elderly patients. A study involving 1,116 elderly patients found significantly lower in-hospital mortality rates in ICUs compared to HDUs, with a 30-day mortality rate of 24% versus 34%, respectively.<sup>16</sup> Another study focusing on functional status among 150 elderly ICU patients, demonstrated better preservation of physical, cognitive, and social functioning at discharge compared to HDU counterparts.<sup>17</sup>

Further, supporting the advantages of ICU care, a study involving 500 elderly patients highlighted better management of comorbidities such as cancer and organ dysfunction, leading to improved outcomes and lower mortality rates in ICU settings.<sup>18</sup> Additionally, another research conducted on elderly patients requiring mechanical ventilation showed superior outcomes, including reduced mortality rates and shorter hospital stays in ICUs compared to HDUs, particularly for severe respiratory failure cases.<sup>19</sup> Another study focusing on patients with septic shock found that ICU admission was associated with lower 30-day mortality compared to HDU admission despite high in-hospital mortality rates of approximately 30%, indicative of severe patient conditions.<sup>20</sup>

These findings collectively emphasize that ICU care significantly enhances prognosis for elderly patients through intensive monitoring and timely interventions not available in HDUs. Further, highlighting the benefits of converting HDUs to ICUs to improve health outcomes and quality of life for elderly patients.

### *ICU vs. HDU for postoperative care after emergency surgery*

Determining the appropriate level of post-operative care for elderly patients undergoing emergency surgery is critical, with contrasting outcomes observed between ICUs and HDUs. A study reviewed data from Japan's national in-patient registry spanning 2010 to 2018, encompassing 158,149 patients undergoing emergency surgeries. Results showed that ICU admission was associated with lower in-hospital mortality compared to HDU admission for medium-mortality risk procedures (ICU: 12.0% vs. HDU: 10.2%; Odds Ratio (OR) =0.90, 95% Confidence Interval (CI): 0.85-0.96, p=0.001) and high-mortality risk procedures (ICU: 21.1% vs. HDU: 21.6%; OR=0.86, 95% CI: 0.78-0.96, p=0.005). However, no significant differences were noted for low-mortality risk procedures.<sup>21</sup> Similarly, ICU admission demonstrated lower in-hospital mortality for medium and high-mortality risk procedures, highlighting the benefits of intensive monitoring and advanced care in ICUs.<sup>22</sup>

These findings underscore that ICU treatment may yield superior outcomes for surgeries with medium and high mortality risks, compared to HDU care.

#### *Division of ICU unit into medical ICU versus surgical ICU*

A study explored the division of ICUs into medical and surgical units, comparing outcomes to evaluate which model might offer superior patient care and resource utilization. Traditionally, ICUs have been either combined for both medical and surgical patients or segregated with designated medical services, as seen more commonly in the United States. A study comparing combined and segregated medical/surgical ICU models found no significant differences in mortality or length of stay (LOS), despite older medical patients in 2012.<sup>23</sup> Another study presented a compelling statistics on outcomes for extremely elderly patients admitted to medical-surgical ICUs across Canada. Medical patients had higher ICU (26.5% vs. 18.7%) and hospital (41.5% vs. 31.6%) mortality rates than surgical patients. The median ICU length of stay was 4.1 days for medical and 3.8 days for surgical emergency patients. The study highlighted that similar proportions of medical (56.8%) and surgical (54.3%) patients required vasopressor support. Medical patients required more non-invasive ventilation (19.3% vs. 9.8%) and dialysis (7.6% vs. 4.1%), while surgical patients more often needed invasive ventilation (85.2%).<sup>24</sup> A retrospective study at an urban tertiary care centre compared outcomes between critically ill surgical and medical patients. Surgical patients had a higher rate of harm (39.1% vs. 22.6%) but lower mortality (6.2% vs. 8.8%) than medical patients. Procedural harm was more frequent in surgical cases, highlighting the need for better harm mitigation.<sup>21</sup>

Further research is needed to refine outcome measures and reassess ICU resource allocation between medical and surgical units. Customized care strategies are crucial to address the complexities of managing critically ill elderly patients and optimizing outcomes.

#### *ICU-induced psychosis in elderly*

The terms "ICU syndrome" and "ICU psychosis" have been used interchangeably, but ICU syndrome is essentially delirium, caused by organic stressors affecting the central nervous system. Delirium, affecting 40% of ICU patients, involves cognitive disturbances and is linked to metabolic imbalances, infections, and other medical issues. Sleep deprivation, the unfamiliar ICU environment, advanced age, underlying cognitive impairment, anxiety, sensory overload or deprivation, immobilization, and pain increase the risk of delirium.<sup>25,26</sup> Ortiz et al compared delirium severity between medical ICU and surgical ICU patients, adjusting for medication use. Delirium, affecting up to 80% of older ICU patients, showed no significant severity difference between the two units after accounting for benzodiazepines and opioids. Initially, SICU patients had higher delirium severity, but this was not sustained

after adjusting for medication. Age, Black race, daily doses of benzodiazepines and opioids were key factors linked to delirium severity. SICU patients had longer ICU and hospital stays and more days on mechanical ventilation, emphasizing the impact of sedation practices on delirium severity.<sup>27</sup>

Currently, there appears to be a lack of specific studies directly comparing delirium incidence between ICU and HDU settings. The available literature predominantly addresses delirium within ICUs, with reported incidences varying widely based on patient populations and assessment methods. Given this gap in the literature, further research is warranted to explore and compare the incidence and characteristics of delirium in ICU versus HDU settings. Such studies would provide valuable insights for healthcare providers aiming to improve patient outcomes across different levels of critical care.

#### *Comparing ICU and HDU for post-surgery geriatric patients: focusing on infection control policies*

To examine the benefits of ICU admission compared to HDU admission for geriatric patients in the post-surgical setting, while focusing on infection control policies, a study highlighted the alarming prevalence of multidrug-resistant gram-negative bacteria in Indian hospitals criticizing inadequate infection control measures due to resource constraints, ignorance, or negligence, creating ideal conditions for the superbugs to thrive.<sup>28</sup> Another study focusing on infection control policies comparing ICUs and HDUs highlighted that ICUs typically enforce stricter infection control measures, including regular environmental monitoring, utilization of HEPA filters, and rigorous equipment and bed disinfection protocols. The study posited that these enhanced infection control practices in ICUs may effectively mitigate healthcare-associated infections among geriatric patients.<sup>29</sup>

Literature is suggestive that ICU care may offer superior outcomes for geriatric patients following surgery, particularly concerning reduced mortality rates and enhanced infection control measures.<sup>20</sup>

#### *Economic evaluation of ICU versus HDU care: insights from the recent studies*

A comparative analysis of ICU and HDU for liver disorders found that annual healthcare system costs were higher for ICU care (\$386,199) than HDU care (\$336,651). However, the cost per patient was lower in HDUs (\$1,966) compared to ICUs (\$2,728). Interestingly, ICU costs per bed-day were lower (\$212 vs. \$185).<sup>29</sup> Mishra et al conducted a cost-effectiveness analysis on ICU care in a tertiary hospital in India. They found ICU care, although more expensive upfront, offers better quality of life and is highly cost-effective based on cost per QALY in ICU settings (\$1,396).<sup>8</sup> Another study focusing on mechanically ventilated COVID-19 patients highlighted significant differences in hospitalization costs

between ICU and HDU care. ICU care was found to be more cost-effective, with an incremental cost-effectiveness ratio well below Japan's threshold, indicating a lower cost per QALY.<sup>1</sup> In a related study, researchers discovered that even though the ICU treatment for pneumonia patients incurred higher expenses per patient, the reduced mortality rate ultimately resulted in better cost-effectiveness when compared to HDU care.<sup>8</sup> These findings indicate that ICUs could potentially offer greater value by improving outcomes and reducing mortality rates, thus justifying the higher initial investment.

## CONCLUSION

The comparison of ICUs and HDUs for geriatric patients highlights the benefits and limitations of each care setting. ICUs offer superior outcomes, including reduced mortality, faster recovery, and better management of complex conditions, making them essential for critically ill elderly patients. HDUs, while more resource-efficient, are suited for patients with less severe needs but may lead to higher complications and mortality in frail elderly individuals. Economic evaluations show that while ICUs are more expensive upfront, they can be more cost-effective in the long term by improving survival rates and quality of life. However, HDUs remain a viable alternative for patients not requiring intensive care, particularly in resource-limited settings. In conclusion, healthcare systems should tailor care based on patient needs, with ICUs for high-risk patients and HDUs for those with less critical conditions. Further, research is needed to refine these distinctions and optimize patient outcomes.

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