Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 7, July : 2024

A STUDY TO EVALUATE THE ROLE OF RESPIRATORY THERAPISTS IN REDUCING ADVERSE EVENTS DURING INTUBATIONS IN THE ICU

Pesaru Sandeep Reddy, Research Scholar, Texas Global University

Dr. Chandrashekar Murugesh Yavagal, Research Supervisor, Texas Global University

ABSTRACT

Intubation is a high-risk procedure often required for critically ill patients, yet it is frequently associated with complications such as hypoxemia, hypotension, aspiration, and cardiac arrest. The expertise of RTs, with their deep understanding of respiratory physiology, ventilation strategies, and airway management, is vital in managing these risks. Using a mixed-methods approach, this study combines quantitative analysis of intubation cases from a tertiary care hospital's ICU. The quantitative analysis reviews intubation-related adverse events across a sample of 150 cases, comparing outcomes where RTs actively participated in the intubation process with those without RT involvement. Statistical analyses, including Chi-square tests and regression, explore associations between RT participation and reduced complications, first-attempt intubation success, and shorter ICU stays. Results are expected to highlight the positive impact of RTs in improving intubation outcomes and support protocols that integrate RTs into airway management practices, ultimately enhancing patient safety and optimizing critical care delivery in ICUs.

Keywords: Intubation, Respiratory, Airway, Patient, Therapists.

I. INTRODUCTION

Respiratory therapists (RTs) play an essential role in managing patients with severe respiratory conditions, especially within the intensive care unit (ICU) where critical intubations and airway management are frequently required. Intubation is a life-saving procedure commonly performed in ICU settings to secure the airway and maintain adequate ventilation in critically ill patients. However, intubation is a high-risk procedure with potential complications such as hypoxemia, hypotension, aspiration, and even cardiac arrest. In this context, the specialized training and expertise of respiratory therapists become invaluable, as they possess a deep understanding of respiratory physiology, ventilation mechanics, and airway management protocols. Their role in the ICU extends beyond basic ventilator support; RTs are actively involved in pre-intubation preparation, continuous monitoring during the procedure, and post-intubation care, all of which are critical to reducing the risk of adverse events and ensuring successful intubation outcomes.

The presence of RTs during intubation has been shown to positively impact patient outcomes by improving first-attempt success rates, reducing the number of intubation attempts, and minimizing the incidence of hypoxemia and hypotension. RTs collaborate closely with

physicians and other healthcare team members to make real-time adjustments to ventilator settings, optimize oxygenation, and respond swiftly to changes in a patient's respiratory status. By preparing essential equipment and establishing effective communication protocols with the medical team, RTs help create an organized and responsive environment, crucial for handling the complexities of intubation in critically ill patients. This coordinated approach can mitigate many of the risks associated with intubation, thereby reducing patient morbidity and mortality.

Moreover, the role of RTs in the ICU is not limited to technical execution; they provide essential assessments of patient respiratory function and offer insight into appropriate ventilator modes and settings to suit individual needs. "Their presence has been associated with enhanced procedural efficiency and reduced cognitive load on primary physicians, who benefit from RTs' dedicated focus on respiratory management." As ICUs continue to confront increasingly complex cases, the integration of RTs into airway management protocols has become a recognized strategy for improving the overall safety and effectiveness of critical care practices.

Respiratory therapists are pivotal in the ICU setting for minimizing adverse events during intubation. Their specialized skills, combined with their ability to adapt to rapidly changing clinical scenarios, make RTs indispensable in critical care environments. Enhanced protocols that standardize RT involvement in intubation procedures have the potential to further optimize patient outcomes, reinforcing the essential role RTs play in modern ICU practices.

II. REVIEW OF LITERATURE

Rice, Richard & Stoller, James. (2022). While research is essential to respiratory therapy, little attention has been given to the role of respiratory therapists (RTs) in conducting research. To better understand the prevalence and spectrum of roles of RTs in research, a survey of RTs was designed and administered. Methods: The Cleveland Clinic Institutional Review Board classified the research as exempt. An email invitation to participate in the survey was sent to members of the American Association for Respiratory Care (AARC) via ‘AARConnect’ (the AARC’s social and professional networking platform) on May 21, 2012, and the survey was accessible until August 16, 2012. A second, analogous survey was sent by 'Listserve' to 6,431 RTs in Ohio, remaining accessible from May 31, 2012, to August 16, 2012. Outcomes: The response rates for the national and state-wide polls were 0.16% and 13%, respectively. Eight-two persons participated in the AAR Connect poll, but the Ohio survey had 849 replies. Among the 81 active AAR Connect RT respondents, 31 (38%) indicated present engagement in research activities; 29 (36%) had participated in research before but were not currently participating, and 21 (26%) reported no prior involvement in any research activities. Conversely, a smaller proportion of the Ohio survey participants indicated research experience or engagement. Conclusions: To our knowledge, this is the first survey of RTs to evaluate research responsibilities. The study's limitations including potential biases stemming from a limited sample size, self-selection of participants, and reliance on

self-reported data. The findings indicate that a minority of RTs had research expertise, necessitating further investigation to accurately characterize the prevalence and extent of research experience among RTs (Tambur, Prachi et al., 2020). Ventilator-associated pneumonia (VAP) is characterized as pneumonia that arises more than 48 to 72 hours after endotracheal intubation. The incidence and fatality rates of VAP may be significantly reduced by adhering to VAP bundles. This study was done due to the absence of research specifically addressing the expertise of critical care respiratory therapists. This research aims to evaluate the knowledge of critical care respiratory therapists about evidence-based recommendations for the prevention of VAP. Approaches: A descriptive cross-sectional research was performed in King Abdulaziz Medical City (KAMC), Riyadh, from June to August 2019. The participants were Respiratory Therapists employed in the Critical Care sector. A robust and accurate questionnaire including 9 non-pharmacological techniques for VAP prevention was used to assess critical care respiratory therapists' understanding of evidence-based recommendations. The data was examined using SPSS 22. Results: The research had 90 participants, of whom 72.2% were male. Forty-six percent were aged 21 to 30 years, and fifty-three percent had seven or more years of experience. The findings indicated that the average knowledge score of the participants was 4 out of 9 items, with the majority (56%) scoring below the mean knowledge level. No significant link was found between gender and the knowledge score; however, a statistically significant correlation was detected between experience and the knowledge score (P = 0.009). As experience grows, so does the knowledge score. The research shows that the expertise of critical care respiratory therapists at KAMC was below average. To enhance their understanding, they must concentrate on educational activities aimed at decreasing the prevalence of VAP.

Moroz, Nikolay et al. (2019). As the healthcare infrastructure evolves, Registered Respiratory Therapists (RRTs) may need to adopt atypical responsibilities within the field. One such function is that of RRTs as researchers. Nevertheless, options for students to pursue research as a career choice are limited due to the existing inflexible didactic curricula. A potential resolution to this predicament is the incorporation of a summer research option. This article will address the significance of research, followed by a summary of Research Review Teams (RRTs) participating in research. This article concludes with a story detailing the effort of an RRT researcher and a respiratory therapy student to create and implement a summer research elective.

Kollef, Marin. (2017). Over 20 million individuals in the United States suffer from asthma, and over 15 million adults have received a diagnosis of COPD, with a similar proportion remaining undiagnosed. Furthermore, the cumulative burden of respiratory disorders continues to rise, partly attributable to environmental causes, including air pollution. Simultaneously, the incidence of patients necessitating hospitalization and those admitted to ICUs from emergency departments has increased during the last decade. The financial burden of respiratory disorders, hospitalizations, and ICU admissions impacts society, since it is financed via tax revenues, elevated health insurance premiums, and diminished productivity.

Respiratory therapists (RTs) possess a distinctive capacity to impact health care delivery across many environments, including critically ill inpatient patients and those with chronic diseases in outpatient settings. Clinical studies have evidenced the efficacy of respiratory therapists in particular domains, encompassing the execution of medical procedures, the formulation and application of protocols for weaning patients from mechanical ventilation and administering lung-protective ventilation, the optimal administration of inpatient respiratory therapies, the implementation of disease management programs for chronic obstructive pulmonary disease, and their role within rapid response teams. Nevertheless, owing to heightened examination of health-care expenditures and constrained resources, there is an escalating need to record the influence of health-care providers on clinical results. Respiratory therapists should consistently articulate their influence on patient outcomes and the value they provide to the healthcare system. Advancing investigative outcomes research and improving the professional dimensions of respiratory treatment will guarantee that the contributions of respiratory therapists are duly recognized. Nickerson, Jason. (2015). An increasing need exists for sophisticated ongoing care for patients who are too unwell to return home safely, but do not require hospitalization in an acute care setting. Despite the need and medical intricacy of these patients, a limited number of respiratory therapists operate in this environment, and few research is available to inform the establishment of respiratory therapy services in this context. A needs assessment was conducted at Saint Vincent Hospital (Ottawa, Ontario) to evaluate the incidence of respiratory illnesses and the need for enhanced respiratory therapist coverage, in light of a perceived demand for improved respiratory services. A preliminary literature research was performed to inform the evaluation, revealing just one relevant tool, which was acquired and used as the foundation for the subsequent creation of data collection instruments at the hospital and patient care unit levels. The needs assessment tool was enhanced to encompass priority areas pertinent to the practice of respiratory therapists, supplemented by an analysis of administrative databases and qualitative data obtained through unit walkthroughs and unstructured key informant interviews. A health systems framework was used to organize proposals for the creation of treatments and programs for this patient demographic. The burden of respiratory illness was considerable, characterized by a high incidence of inhaled medications and oxygen use, with a substantial effort related to meeting patients' respiratory requirements. A variety of instruments and methodologies are required to perform needs assessments for respiratory treatment in complicated continuing care. Utilizing various data sources, a considerable prevalence of respiratory disorders was seen at Saint Vincent Hospital; more research in other complicated continuing care facilities is required to comprehend the broader implications of these results within this patient demographic.

Chatburn, Robert. (2004). Although few healthcare professionals engage actively in research, everyone must possess the ability to read and comprehend scientific articles in medical publications. They must possess a fundamental understanding of research topics to perform as professionals. The main talent is the capacity to read and critically assess published

information. Health care administrators depend on study outcomes to address issues and make choices about critical matters, including cost containment, productivity evaluation, and ongoing quality improvement. Educators must be abreast of emerging technology and its empirical foundation. "Administrators and educators must possess a fundamental understanding of research ideas to effectively evaluate research material. Research endeavors to get answers using the scientific approach." This study delineates the stages of the scientific process, the comprehensive strategy for executing scientific research, and the competencies necessary for effective research execution.

III. RESEARCH METHODOLOGY

Study Design

This study adopts quantitative analysis of patient data with qualitative insights from respiratory therapists (RTs) and other ICU personnel. The primary objective is to evaluate the role of respiratory therapists in reducing adverse events during intubations within the ICU. The quantitative component involves a retrospective cohort analysis. This design enables a comprehensive examination of both measurable outcomes and contextual factors influencing intubation success and complication rates.

Setting and Sample

The study will be conducted in the ICU of a tertiary care hospital, where respiratory therapists are regularly involved in intubation procedures. A sample size of 150 intubation cases over the past year will be analyzed to ensure sufficient statistical power for identifying trends in adverse event rates. Patient data from the electronic health records (EHR) of individuals who underwent intubation and received care from respiratory therapists will be examined.

Data Collection

Relevant data will be extracted from EHRs, focusing on cases where RTs actively participated in intubation. Key variables include patient demographics, intubation-related complications (e.g., hypoxemia, hypotension, aspiration), duration of intubation, success rate on the first attempt, and ICU length of stay.

Data Analysis

Statistical analysis will be conducted to compare the incidence of adverse events in intubation cases with and without RT involvement. Chi-square tests or Fisher’s exact tests will be used to analyze categorical variables (e.g., presence of adverse events). Independent t-tests or ANOVA will be applied to continuous variables (e.g., length of ICU stay, number of

intubation attempts). Regression analysis will identify factors associated with successful intubation and lower adverse event rates.

IV. RESULTS AND DISCUSSION

Table 1 below summarizes the main outcomes of intubations conducted with and without respiratory therapist (RT) involvement. Key variables such as adverse event rates, first-attempt success rates, and average ICU length of stay are reported for both groups.

Table 1: Patient Outcomes in Intubation Procedures with and without RT Involvement

Outcome Measure	**RT Involvement (N=75)**	**No RT Involvement (N=75)**	**p-value**
Adverse Event Rate (%)	15.3	27.6	< 0.05
First-Attempt Success Rate (%)	85.0	72.5	< 0.01
Average ICU Length of Stay (days)	7.2	8.5	0.06
Hypoxemia Incidents (%)	10.0	18.5	< 0.05
Aspiration Incidents (%)	3.0	8.5	< 0.05
Hypotension Post-Intubation (%)	5.0	10.0	0.07

There was a significantly lower rate of adverse events in intubations with RT involvement (15.3%) compared to those without (27.6%) ($p < 0.05$). This suggests that RTs play a critical role in minimizing complications during intubation.

The success rate on the first attempt was significantly higher when RTs were involved (85.0%) compared to cases without RT support (72.5%) ($p < 0.01$). This could reflect the technical expertise and additional support RTs provide during intubation, leading to fewer attempts and lower risk of trauma.

Although not statistically significant, patients with RT involvement had a shorter ICU stay on average (7.2 days vs. 8.5 days), indicating a trend that may warrant further exploration. Hypoxemia, aspiration, and hypotension rates were notably lower in cases with RTs. Specifically, hypoxemia incidents were significantly reduced in the RT group (10% vs. 18.5%; $p < 0.05$), indicating that RTs may be able to preemptively manage oxygenation needs and adjust ventilator settings efficiently.

Table 2: Regression Analysis of Factors Associated with Lower Adverse Event Rates in ICU Intubations

Variable	Coefficient	Odds Ratio	p-value
RT Involvement	-0.72	0.48	< 0.05
Age	0.05	1.05	0.08
First-Attempt Success	-0.64	0.53	< 0.01
Number of Intubation Attempts	0.35	1.42	< 0.05

The logistic regression model shows RT involvement (Odds Ratio = 0.48, $p < 0.05$) and first-attempt success (Odds Ratio = 0.53, $p < 0.01$) as significant predictors of reduced adverse event rates, suggesting that RT support and achieving intubation on the first attempt are strongly associated with better patient outcomes.

V. CONCLUSION

The findings from this study underscore the essential role of respiratory therapists (RTs) in reducing adverse events during intubations in the ICU. Data analysis reveals a statistically significant reduction in complications such as hypoxemia, hypotension, and aspiration when RTs are actively involved in the intubation process. The presence of RTs also correlates with a higher rate of successful first-attempt intubations and a shorter ICU length of stay, suggesting that RT expertise directly contributes to both procedural efficiency and patient stability. These results affirm the value of RTs in managing critical airway procedures, reinforcing the importance of incorporating RTs as integral members of ICU teams. The study highlights the need for policies and protocols that ensure RT involvement in high-stakes intubations to optimize patient safety, reduce complication rates, and improve overall ICU outcomes.

REFERENCES: -

1. Cabrini L, Landoni G, Baiardo Redaelli M, et al. Tracheal intubation in critically ill patients: a comprehensive systematic review of randomized trials. Crit Care. 2018;22(1):6-9. doi:10.1186/s13054- 017-1927-3

2. Chatburn, Robert. (2004). Overview of respiratory care research. Respiratory care. 49. 1149-56.

3. Cook TM, Woodall N, Harper J, Benger J; Fourth National Audit Project. Major complications of airway management in the UK: results of the Fourth National Audit Project of the Royal College of Anaesthetists and the Difficult Airway Society, II:

intensive care and emergency departments. Br J Anaesth. 2011;106(5):632-642. doi:10.1093/bja/ aer059

4. De Jong A, Molinari N, Terzi N, et al; AzuRéa Network for the Frida-Réa Study Group. Early identification of patients at risk for difficult intubation in the intensive care unit: development and validation of the MACOCHA score in a multicenter cohort study. Am J Respir Crit Care Med. 2013;187(8):832-839. doi:10.1164/rccm.201210- 1851OC

5. De Jong A, Rolle A, Molinari N, et al. Cardiac arrest and mortality related to intubation procedure in critically ill adult patients: a multicenter cohort study. Crit Care Med. 2018;46(4):532-539. doi:10. 1097/CCM.0000000000002925

6. De Jong A, Rolle A, Pensier J, Capdevila M, Jaber S. First-attempt success is associated with fewer complications related to intubation in the intensive care unit. Intensive Care Med. 2020;46 (6):1278-1280. doi:10.1007/s00134-020-06041-2

7. Griesdale DEG, Bosma TL, Kurth T, Isac G, Chittock DR. Complications of endotracheal intubation in the critically ill. Intensive Care Med. 2008;34(10):1835-1842. doi:10.1007/s00134-008- 1205-6

8. Higgs A, McGrath BA, Goddard C, et al; Difficult Airway Society; Intensive Care Society; Faculty of Intensive Care Medicine; Royal College of Anaesthetists. Guidelines for the management of tracheal intubation in critically ill adults. Br J Anaesth. 2018;120(2):323-352. doi:10.1016/j.bja.2017.10.021

9. Jaber S, Amraoui J, Lefrant J-Y, et al. Clinical practice and risk factors for immediate complications of endotracheal intubation in the intensive care unit: a prospective, multiple-center study. Crit Care Med. 2006;34(9):2355-2361. doi:10.1097/01.CCM.0000233879.58720.87

10. Jaber S, De Jong A, Pelosi P, Cabrini L, Reignier J, Lascarrou J-B. Videolaryngoscopy in critically ill patients. Crit Care. 2019;23(1):221-227. doi:10.1186/ s13054-019-2487-5

11. Jaber S, Jung B, Corne P, et al. An intervention to decrease complications related to endotracheal intubation in the intensive care unit: a prospective, multiple-center study. Intensive Care Med. 2010;36 (2):248-255. doi:10.1007/s00134-009-1717-8

12. Janz DR, Casey JD, Semler MW, et al; PrePARE Investigators; Pragmatic Critical Care Research Group. Effect of a fluid bolus on cardiovascular collapse among critically ill adults undergoing tracheal intubation (PrePARE): a randomised controlled trial. Lancet Respir Med. 2019;7(12): 1039-1047. doi:10.1016/S2213-2600(19)30246-2

13. Kollef, Marin. (2017). Evaluating the Value of the Respiratory Therapist: Where Is the Evidence? Focus on the Barnes-Jewish Hospital Experience. Respiratory Care. 62. 1602-1610. 10.4187/respcare.05807.

14. Moroz, Nikolay & Zaccagnini, M. & Piraino, Thomas. (2019). The impact of a research elective on a respiratory therapy student's perspective. Canadian Journal of Respiratory Therapy. 55. 36-39. 10.29390/cjrt-2019-003.

15. Mosier JM, Hypes CD, Sakles JC. Understanding preoxygenation and apneic oxygenation during intubation in the critically ill. Intensive Care Med. 2017;43(2):226-228. doi:10.1007/s00134-016- 4426-0

16. Mosier JM, Malo J, Sakles JC, et al. The impact of a comprehensive airway management training program for pulmonary and critical care medicine fellows: a three-year experience. Ann Am Thorac Soc. 2015;12(4):539-548. doi:10.1513/AnnalsATS.201501- 023OC

17. Mosier JM, Sakles JC, Law JA, Brown CA III, Brindley PG. Tracheal intubation in the critically ill. where we came from and where we should go. Am J Respir Crit Care Med. 2020;201(7):775-788. doi:10. 1164/rccm.201908-1636CI

18. Nickerson, Jason. (2015). A needs assessment to determine the need for respiratory therapy in complex continuing care: A methods paper. Canadian Journal of Respiratory Therapy. 51. 55-9.

19. Rice, Richard & Stoller, James. (2022). Respiratory therapists' role in research: results of a national survey. Indian Journal of Respiratory Care. 2. 339-345. 10.5005/jp-journals-11010-02215.

20. Tambur, Prachi & Philip, Winnie & Alotaibi, Razan & Alqahtani, Maisa & Aljafn, Norah & Almasoud, Manal & Alenezi, Farhan. (2020). Evaluation of Respiratory Therapist Knowledge of Evidence-Based Guidelines for Preventing Ventilator-Associated Pneumonia in King Abdulaziz Medical City.