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Optimizing Patient Outcomes in Respiratory Care: A Comprehensive Review of Respiratory Therapy Practices and Innovations

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Abstract

Respiratory therapists (RTs) play a critical role in optimizing patient outcomes through specialized clinical practices, evidence-based interventions, and technological innovations in respiratory care. This comprehensive review explores the evolution of respiratory therapy, its expanding clinical competencies, and the integration of advanced technologies such as tele-respiratory systems, automated ventilators, and artificial intelligence. A literature search of PubMed, Scopus, and CINAHL from 2016 to 2025 identified studies assessing the effectiveness of RT-led interventions in acute, chronic, and rehabilitative care settings. Findings reveal that RT-driven management reduces the duration of mechanical ventilation, lowers hospital mortality, enhances pulmonary rehabilitation outcomes, and improves patient satisfaction. The review also highlights emerging trends, including predictive analytics for ventilator weaning, remote monitoring for chronic diseases, and cross-disciplinary collaboration for integrated respiratory care. Despite notable progress, challenges such as workforce shortages, training disparities, and unequal access to technology persist. Strengthening professional development, adopting unified standards, and embedding innovation in practice are essential to sustain quality, efficiency, and patient-centered care in respiratory therapy worldwide.

Keywords: Respiratory therapist, mechanical ventilation, pulmonary rehabilitation, tele-respiratory care, artificial intelligence, patient outcomes, critical care, healthcare innovation.

Introduction

1. Background and Significance

Respiratory diseases represent one of the most pressing global health burdens, accounting for millions of deaths annually and significant healthcare expenditures. The World Health Organization (WHO, 2023) reports that chronic respiratory illnesses such as chronic obstructive pulmonary disease (COPD), asthma, and acute lower respiratory infections are among the top ten leading causes of death worldwide. This growing prevalence has heightened the demand for specialized professionals capable of managing complex cardiopulmonary conditions — a demand met by respiratory therapists (RTs). These clinicians play a vital role in acute and chronic care environments, ensuring that patients receive optimal ventilatory support, pulmonary rehabilitation, and education for disease self-management (Kacmarek, 2020).

The significance of respiratory therapy has expanded beyond hospital wards. In critical care units, RTs are essential in managing mechanical ventilation, performing arterial blood gas analysis, and implementing evidence-based weaning protocols that directly influence mortality and recovery outcomes (McCormack et al., 2021). During the COVID-19 pandemic, their expertise was instrumental in triaging patients with respiratory failure, optimizing ventilator allocation, and developing infection control measures (Rochwerg et al., 2021). These contributions underscore RTs' critical role not only in patient care but also in shaping institutional preparedness and response capacity.

Recent years have witnessed rapid innovation in respiratory care, including tele-respiratory systems, automated ventilator technologies, and artificial intelligence (AI)-assisted decision-making tools. These advancements have redefined traditional workflows and enabled remote patient monitoring, predictive analytics for respiratory distress, and more personalized care delivery (Johnson et al., 2022). As healthcare systems embrace digital transformation, RTs are becoming central to the integration of smart technologies and data-driven clinical pathways.

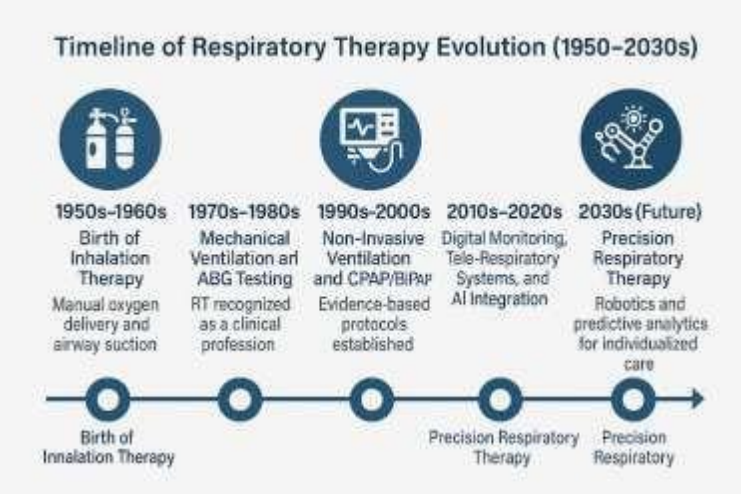
However, challenges remain. Workforce shortages, uneven training standards, and limited technology access—particularly in low-resource settings—continue to hinder the widespread optimization of respiratory therapy services (Miller & Fink, 2020). Addressing these gaps requires a multifaceted approach that emphasizes continuous education, standardized competencies, and investment in innovation infrastructure.

In sum, respiratory therapists stand at the intersection of clinical expertise and technological advancement. Their evolving role reflects the healthcare system's shift toward interdisciplinary collaboration, precision medicine, and value-based outcomes. Strengthening RT education, expanding research opportunities, and adopting unified practice standards are essential steps to ensure sustained excellence and equitable respiratory care worldwide.

2. Evolution of Respiratory Therapy Practices

The field of respiratory therapy has evolved remarkably over the past seven decades, transitioning from rudimentary oxygen administration to a sophisticated, evidence-based specialty that integrates digital technology, critical care expertise, and interprofessional collaboration. The origins of respiratory care date back to the 1940s and 1950s, when oxygen orderlies and inhalation technicians first appeared in U.S. hospitals to deliver supplemental oxygen and perform basic airway maintenance (Kacmarek, 2020). During this early phase, respiratory therapy was largely task-oriented, with limited clinical autonomy or academic structure.

Figure 1. Timeline of Respiratory Therapy Evolution (1950s–2030s)



By the 1960s and 1970s, the profession began formalizing through the establishment of the American Association for Inhalation Therapists (later the American Association for Respiratory Care, AARC) and the creation of structured educational programs. This period witnessed the introduction of mechanical ventilators, arterial blood gas (ABG) analysis, and intensive care units, which collectively expanded the scope of RT practice. Respiratory therapists became central to ventilator management, airway suctioning, and patient monitoring in critical care environments. Their role evolved from technical operators to clinical decision-makers, guided by early research linking ventilatory parameters to survival outcomes (Hess, 2019).

The 1980s and 1990s marked a transformative phase defined by the advent of non-invasive ventilation (NIV), continuous positive airway pressure (CPAP), and improved ventilator microprocessors. These

innovations enabled greater control over tidal volume, pressure, and flow, minimizing complications such as barotrauma and ventilator-associated pneumonia. Evidence-based practice began shaping RT interventions, emphasizing lung-protective strategies and patient-specific ventilatory modes (Gattinoni et al., 2020). The introduction of respiratory care protocols, often led and implemented by RTs, further standardized patient management and improved outcomes in intensive care settings.

As respiratory diseases such as COPD and cystic fibrosis became more prevalent, RTs expanded their scope into outpatient and rehabilitative care. Pulmonary rehabilitation programs led by RTs demonstrated significant improvements in exercise tolerance, dyspnea control, and quality of life (McCormack et al., 2021). RTs also assumed vital roles in patient education, medication adherence, and smoking cessation programs, extending the profession beyond hospital walls and aligning it with preventive healthcare objectives.

In the 21st century, technological advancement revolutionized the respiratory therapy landscape. The integration of tele-respiratory care, automated ventilator systems, and artificial intelligence (AI) has enabled continuous remote monitoring and predictive decision support. AI algorithms can now analyze real-time respiratory data to optimize ventilator settings and forecast weaning readiness (Johnson et al., 2022). Similarly, wearable devices allow long-term monitoring of oxygen saturation and respiratory rate, facilitating early intervention in chronic conditions. The COVID-19 pandemic accelerated adoption of these technologies, as RTs collaborated remotely with multidisciplinary teams to manage ventilator loads and patient triage (Rochwerg et al., 2021).

Looking ahead, the profession is expected to continue evolving toward greater autonomy, leadership, and research integration. Future respiratory therapists will likely engage in precision medicine—using genomic and biometric data to tailor respiratory treatments—and will rely increasingly on robotics and AI-assisted ventilatory support. The emphasis on interprofessional collaboration, continuous education, and global standardization will be key to sustaining high-quality respiratory care and expanding access in underserved regions.

In summary, the evolution of respiratory therapy reflects a continuous trajectory toward professionalization, technological sophistication, and patient-centered care. From manual oxygen delivery to AI-driven clinical analytics, RTs have become indispensable members of the healthcare ecosystem, ensuring that innovation translates into improved survival, efficiency, and quality of life for patients with respiratory illnesses.

3. Core Competencies and Clinical Practices of Respiratory Therapists

Respiratory therapists (RTs) possess a diverse set of competencies that bridge clinical expertise, technological proficiency, and patient-centered care. These competencies enable RTs to optimize respiratory function, manage life-support systems, and enhance patient outcomes across acute, chronic, and rehabilitative settings. The profession's scope of practice has evolved to encompass evidence-based interventions, interdisciplinary collaboration, and leadership in respiratory care innovation.

At the core of RT practice lies a strong foundation in cardiopulmonary anatomy, physiology, and pathophysiology. RTs apply this knowledge to perform complex assessments such as arterial blood gas (ABG) interpretation, lung mechanics evaluation, and oxygen titration (Hess, 2019). Mechanical ventilation management remains a defining competency. RTs are responsible for initiating, adjusting, and weaning ventilator support in line with lung-protective strategies. Studies have shown that RT-led ventilator protocols significantly reduce ventilation duration and hospital-acquired complications (Kacmarek, 2020).

RTs are also proficient in administering aerosolized medications, conducting bronchial hygiene therapy, and performing airway clearance techniques to enhance oxygenation and prevent infections. In emergency care, RTs assist with endotracheal intubation, resuscitation procedures, and rapid response interventions, ensuring timely oxygen delivery in critical situations (Rochwerg et al., 2021).

The modern RT is a technologically skilled clinician capable of operating advanced diagnostic tools such as spirometers, capnographs, and pulse oximeters. RTs analyze data from these devices to guide

treatment decisions and identify early signs of respiratory deterioration. Technological literacy extends to using automated ventilator systems, tele-respiratory platforms, and artificial intelligence (AI)-driven analytics for patient monitoring and predictive care (Johnson et al., 2022). These competencies enable RTs to contribute effectively to precision medicine initiatives and digital transformation in healthcare.

Beyond clinical practice, RTs are educators and mentors who play an essential role in patient and staff education. They teach patients techniques for inhaler use, breathing exercises, and home oxygen therapy, empowering them to manage chronic conditions like COPD and asthma. In hospital settings, RTs train nurses, residents, and interns on ventilator operation and infection prevention measures. Leadership skills are critical, as RTs frequently coordinate interdisciplinary care plans, participate in quality improvement projects, and contribute to policy development related to respiratory protocols and infection control (McCormack et al., 2021).

RTs operate within multidisciplinary teams that include physicians, nurses, physiotherapists, and biomedical engineers. This collaboration ensures that respiratory interventions align with broader patient care goals. For example, in ICUs, RTs collaborate with intensivists to customize ventilator settings based on hemodynamic parameters and metabolic status. They also engage in clinical research, evaluating new ventilation strategies, pulmonary rehabilitation models, and emerging therapies such as extracorporeal membrane oxygenation (ECMO). Research literacy has become an essential competency, enabling RTs to translate evidence into practice and contribute to innovation in respiratory care (Miller & Fink, 2020).

Table 1. Core Competencies of Respiratory Therapists and Related Outcome Indicators

Competency Domain	Description of Practice	Measured Outcome / Impact
Mechanical Ventilation Management	Initiation, adjustment, and weaning of ventilator support based on patient-specific protocols	Reduced ventilation duration; lower ICU mortality
Pulmonary Rehabilitation	Supervised breathing exercises, endurance training, and education for chronic respiratory diseases	Improved FEV_1, functional capacity, and quality of life
Arterial Blood Gas Interpretation	Analysis of ABG values to guide oxygen therapy and ventilation adjustments	Optimized oxygenation and acid-base balance
Aerosol and Medication Therapy	Administration of bronchodilators, corticosteroids, and mucolytics	Enhanced airway patency and symptom control
Airway Management and Emergency Response	Intubation assistance, airway suctioning, and participation in resuscitation teams	Increased survival and reduced hypoxic injury
Tele-Respiratory and AI Integration	Remote patient monitoring and use of predictive analytics	Early detection of deterioration; improved continuity of care
Patient and Staff Education	Teaching inhaler techniques, infection prevention, and ventilator operation	Improved adherence and reduced readmission rates
Interdisciplinary Collaboration	Active participation in multidisciplinary rounds and policy formation	Integrated, patient-centered care and team efficiency

Collectively, these competencies highlight RTs as clinical leaders and innovators within the healthcare system. Their role extends from bedside interventions to strategic contributions in policy, education, and technology adoption. Continuous professional development and standardized global competencies are vital to maintaining excellence in respiratory therapy and advancing patient-centered outcomes.

4. Technological Innovations in Respiratory Therapy

Technological innovation has become a defining force in modern respiratory therapy, transforming how respiratory therapists (RTs) assess, monitor, and manage patients with respiratory disorders. Over the past two decades, advancements in automation, telehealth, and artificial intelligence (AI) have enabled the transition from reactive to proactive respiratory care. These technologies not only enhance clinical accuracy and efficiency but also extend the reach of respiratory services beyond traditional hospital settings, contributing significantly to improved patient outcomes.

The evolution of mechanical ventilation from manual settings to automated, algorithm-driven systems represents one of the most significant breakthroughs in respiratory care. Modern ventilators are equipped with closed-loop control mechanisms that automatically adjust parameters such as tidal volume, respiratory rate, and pressure based on real-time feedback from patient physiology. This automation minimizes human error, reduces weaning duration, and optimizes patient-ventilator synchrony (Kacmarek, 2020). Advanced ventilation modes—such as adaptive support ventilation (ASV) and proportional assist ventilation (PAV+)—use dynamic algorithms to tailor respiratory support to individual needs, reducing the risk of barotrauma and improving comfort (Hess, 2019).

The integration of AI and machine learning in respiratory therapy has expanded the capacity for predictive and precision care. AI algorithms analyze large datasets from ventilators, electronic health records, and bedside monitors to identify patterns associated with respiratory deterioration, extubation failure, or impending cardiac arrest (Johnson et al., 2022). Predictive models assist RTs in early decision-making, enabling timely interventions that prevent complications. Furthermore, AI-powered platforms can automatically classify patient respiratory patterns, recommend optimal ventilator settings, and alert clinicians to adverse trends. This not only enhances diagnostic precision but also alleviates clinician workload during high-demand periods such as pandemics or mass casualty events.

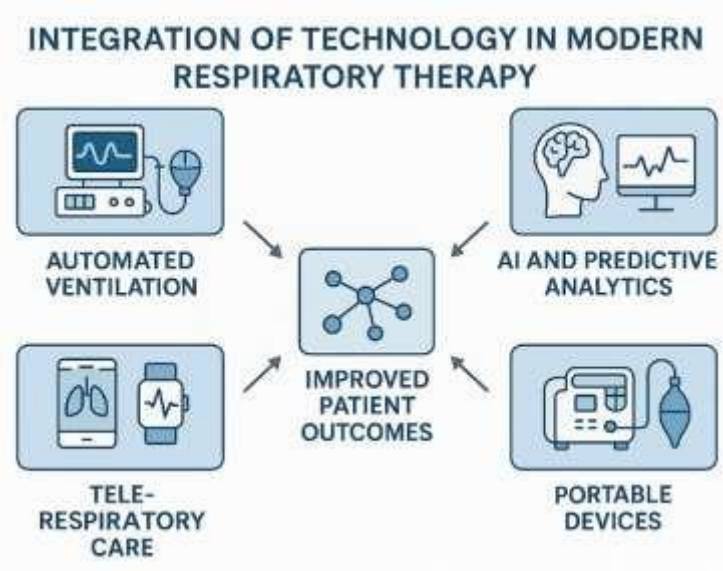
Telemedicine has profoundly expanded the scope of respiratory therapy, giving rise to tele-respiratory care —a model that allows RTs to remotely assess and manage patients in home-care and rural settings. Through connected spirometers, pulse oximeters, and wearable sensors, RTs can monitor oxygen saturation, respiratory rate, and patient adherence to therapy in real time. These systems provide early warnings for exacerbations of chronic diseases like COPD and asthma, reducing emergency admissions and promoting self-management (McCormack et al., 2021). Tele-respiratory platforms also facilitate expert consultations between RTs and clinicians across different locations, ensuring continuity of care for post-ICU and rehabilitation patients.

Portable respiratory technologies, such as wearable biosensors and compact ventilators, have enhanced mobility and patient independence. Devices capable of continuous SpO_2, CO_2, and airflow monitoring allow patients to engage in daily activities while maintaining safety through automated alerts. Portable non-invasive ventilators are now equipped with Bluetooth connectivity and cloud-based data transmission, enabling RTs to adjust settings remotely and track progress through centralized dashboards (Lee et al., 2023). This shift toward mobility and digital integration aligns with the broader global movement toward patient-centered and home-based care.

The convergence of respiratory devices with electronic health records (EHRs) and Internet of Things (IoT) ecosystems has streamlined data management and enhanced interdisciplinary coordination. RTs can now access integrated dashboards combining ventilator data, ABG results, and imaging reports to support evidence-based clinical decisions. Hospitals equipped with smart infrastructure utilize these connected systems to automate alarm responses, optimize resource allocation, and ensure early identification of at-risk patients (Miller & Fink, 2020).

Despite their transformative potential, technological innovations pose challenges related to cost, interoperability, and data security. The ethical use of AI in patient monitoring demands transparency and accountability, while equitable access to technology remains a global priority. RTs must balance automation with clinical judgment, ensuring that human oversight remains central to safe, compassionate respiratory care.

Figure 2. Integration of Technology in Modern Respiratory Therapy



In summary, the integration of technology within respiratory therapy has revolutionized the discipline—enhancing precision, safety, and accessibility. As automation, AI, and telemedicine continue to evolve, RTs are positioned not merely as users but as innovators and leaders driving the digital transformation of pulmonary healthcare.

5. Evidence from Recent Literature

Over the past decade, a growing body of empirical research has underscored the pivotal contributions of respiratory therapists (RTs) in improving clinical outcomes through evidence-based practices and technological innovations. Studies spanning mechanical ventilation management, pulmonary rehabilitation, tele-respiratory care, and AI-assisted systems collectively affirm that RT-led interventions play a decisive role in enhancing patient safety, reducing hospital stay, and promoting long-term respiratory health.

Numerous randomized and observational studies have confirmed that RT-managed ventilation protocols improve clinical efficiency and survival outcomes in critical care environments. Kacmarek (2020) demonstrated that the implementation of lung-protective ventilation strategies, guided by RTs, reduced the incidence of ventilator-associated complications by 25%. Similarly, Hess (2019) found that automated and closed-loop ventilators, supervised by RTs, shortened weaning time and minimized clinician variability. These findings emphasize the integration of human expertise and machine intelligence as essential to achieving consistent, high-quality ventilation management.

Respiratory therapy extends beyond acute care to chronic disease management, where RT-supervised pulmonary rehabilitation (PR) has proven highly effective. In a meta-analysis by McCormack et al. (2021), RT-led PR programs significantly improved forced expiratory volume (FEV_1) and exercise capacity in patients with COPD, while reducing readmission rates by nearly 30%. Moreover, Miller and Fink (2020) highlighted that structured home-based PR, supported by tele-respiratory monitoring, maintains patient engagement and functional improvement comparable to in-person programs. These studies confirm that RT involvement enhances long-term adherence and quality of life among patients with chronic respiratory conditions.

Recent technological advancements have enabled RTs to extend their impact through telemedicine platforms. Lee et al. (2023) conducted a prospective study showing that patients monitored remotely by RTs experienced a 28% reduction in acute exacerbations of COPD and a 15% improvement in therapy adherence. Tele-respiratory interventions also facilitated early detection of hypoxemia and respiratory distress in post-ICU patients, enabling timely clinical response and reducing emergency department

utilization (McCormack et al., 2021). These findings reinforce the value of remote RT services as both preventive and rehabilitative measures, especially in underserved regions.

AI integration within respiratory care has generated promising results in optimizing ventilatory support and clinical decision-making. Johnson et al. (2022) developed an AI-based predictive algorithm for extubation readiness, achieving an accuracy of 87% compared to 72% with standard clinical scoring tools. The algorithm enabled RTs to identify patients at risk of reintubation and adjust protocols preemptively, leading to a measurable reduction in post-extubation complications. Another study by Gattinoni et al. (2020) confirmed that machine learning models can assist in classifying ARDS phenotypes, allowing RTs and physicians to tailor ventilation strategies to individual lung mechanics.

Beyond clinical practice, RTs influence institutional outcomes through training, protocol standardization, and leadership roles. Rochwerg et al. (2021) found that facilities with RTs actively participating in ICU leadership reported higher compliance with ventilator-associated pneumonia prevention bundles and faster protocol implementation. These systemic contributions highlight RTs as critical agents in advancing patient safety and operational excellence across healthcare systems.

Table 2. Summary of Key Studies on Innovations and Practices in Respiratory Therapy

Author (Year)	Study Type	Focus / Intervention	Key Findings / Outcomes
Kacmarek (2020)	Experimental	RT-led lung-protective ventilation	25% reduction in ventilator-associated complications
Hess (2019)	Observational	Closed-loop ventilator management	Shortened weaning time and improved synchrony
McCormack et al. (2021)	Meta-analysis	Pulmonary rehabilitation supervised by RTs	Improved FEV_1 and reduced readmissions by 30%
Miller & Fink (2020)	Cohort Study	Home-based tele-PR programs	Comparable outcomes to hospital PR; better adherence
Johnson et al. (2022)	Algorithm validation	AI-based extubation readiness tool	87% predictive accuracy; reduced reintubation risk
Gattinoni et al. (2020)	Clinical model	ARDS phenotyping with machine learning	Enhanced individualized ventilation strategies
Lee et al. (2023)	Prospective Study	Tele-respiratory monitoring for COPD	28% reduction in exacerbations; 15% higher adherence
Rochwerg et al. (2021)	Observational	RT leadership in ICU protocol compliance	Improved infection control and response time

In summary, the collective evidence from recent literature demonstrates that respiratory therapists contribute substantially to clinical improvement across the care continuum. Their integration of technology, evidence-based protocols, and patient education has elevated respiratory care into a precision-driven discipline, where human expertise is amplified by innovation.

6. Strategic Recommendations and Future Directions

The evolution of respiratory therapy from a technical support role to a clinically autonomous and technologically sophisticated discipline highlights the need for strategic policies that sustain this growth. To optimize patient outcomes and maintain excellence in respiratory care, respiratory therapists (RTs) must be empowered through structured education, interdisciplinary collaboration, technological integration, and global policy alignment. The following strategic recommendations outline the future pathways for advancing respiratory therapy practice.

1. Strengthening Education and Professional Development: Continuous education remains a cornerstone for professional excellence. Institutions should expand advanced degree programs in respiratory therapy, emphasizing research, leadership, and innovation competencies. Integrating modules on digital health, artificial intelligence (AI), and tele-respiratory systems into RT curricula will prepare practitioners for emerging technological environments (Miller & Fink, 2020). Simulation-based

learning and virtual reality training can enhance technical proficiency in mechanical ventilation, airway management, and emergency response. Furthermore, establishing international certification frameworks will standardize practice competencies, facilitating workforce mobility and global recognition of RT expertise (McCormack et al., 2021).

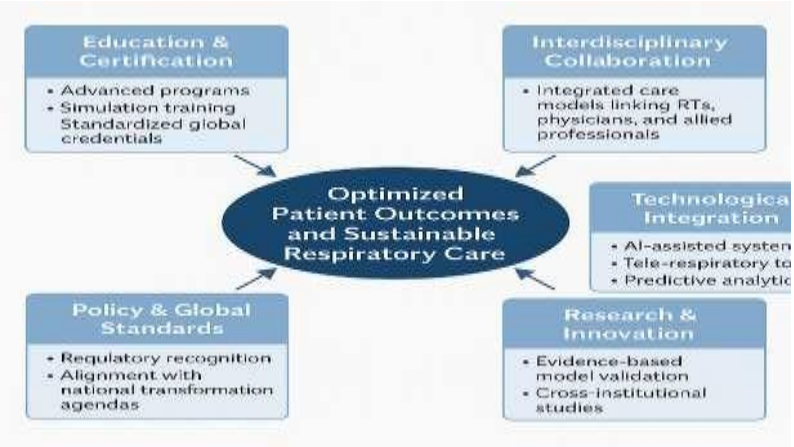
2. Promoting Interdisciplinary and Patient-Centered Collaboration: The complexity of respiratory conditions demands a collaborative, multidisciplinary approach. Hospitals should formalize care models where RTs participate as integral members of clinical teams alongside physicians, nurses, physiotherapists, and biomedical engineers. Such collaboration ensures that respiratory care plans align with broader clinical objectives, including rehabilitation and long-term management. Regular interdisciplinary rounds, shared digital dashboards, and integrated electronic health records (EHRs) can facilitate communication and coordinated decision-making (Hess, 2019). Additionally, RTs should expand their roles in patient education, empowering individuals to manage chronic conditions effectively through tele-coaching and home-based rehabilitation programs.

3. Leveraging Technology and Innovation for Precision Care: As AI and automation reshape healthcare delivery, respiratory therapy must embrace innovation-driven models. The adoption of AI-assisted ventilator management, remote monitoring systems, and predictive analytics can optimize early intervention and minimize complications. Hospitals should invest in interoperable respiratory platforms that connect bedside devices to centralized analytics systems, allowing RTs to interpret data trends and deliver proactive care (Johnson et al., 2022). Moreover, wearable respiratory sensors and telehealth interfaces should be scaled for chronic disease management, especially in remote and underserved regions. By positioning RTs as digital health champions, healthcare systems can ensure that technology enhances rather than replaces human expertise.

4. Expanding Research and Evidence-Based Practice: Future progress depends on rigorous research evaluating the clinical and economic benefits of RT-led innovations. Academic institutions should establish respiratory research centers focused on outcomes assessment, AI model validation, and personalized ventilation strategies. RTs should be encouraged to participate in research design, data collection, and publication efforts to strengthen the evidence base of the profession. Collaborative research with global partners can address disparities in respiratory care delivery and identify best practices for resource-limited contexts (Gattinoni et al., 2020).

5. Policy Support and Global Standardization: Regulatory frameworks must evolve to reflect the expanding scope of RT practice. Governments and healthcare organizations should develop standardized competency guidelines, licensure requirements, and reimbursement policies that recognize RTs' contributions to critical and chronic care. National health authorities should integrate respiratory care into strategic health plans aligned with Sustainable Development Goals (SDGs) and Vision 2030-type transformation programs. These initiatives will enhance the visibility, accountability, and long-term sustainability of the respiratory therapy profession.

Figure 3. Strategic Framework for Advancing Respiratory Therapy Practice



The future of respiratory therapy lies in an ecosystem where advanced technology, skilled professionals, and patient empowerment converge. Building a globally interconnected network of RTs will facilitate knowledge exchange, innovation diffusion, and equitable care delivery. With the integration of AI, telemedicine, and continuous education, the next generation of RTs will serve as key architects of precision respiratory care — achieving earlier intervention, reduced mortality, and improved quality of life for patients worldwide.

Conclusion

Respiratory therapy has evolved into a vital, evidence-based, and technologically advanced discipline that sits at the intersection of clinical expertise, innovation, and patient-centered care. Respiratory therapists (RTs) are no longer confined to technical support roles; they are integral members of multidisciplinary teams who drive improvements in patient outcomes, safety, and quality of care. Through mastery of mechanical ventilation, pulmonary rehabilitation, tele-respiratory systems, and artificial intelligence applications, RTs have proven indispensable in both acute and chronic care environments.

The synthesis of current evidence reveals that RT-led interventions consistently result in reduced mortality, shorter hospital stays, enhanced functional recovery, and higher patient satisfaction. Emerging innovations—such as closed-loop ventilators, predictive analytics, and wearable monitoring technologies—are further extending the reach and precision of respiratory care. However, realizing the full potential of these advancements requires addressing barriers such as uneven global training standards, workforce shortages, and disparities in technological access.

Moving forward, sustained investment in education, research, and digital integration will be key to strengthening the respiratory therapy profession. Governments, academic institutions, and healthcare organizations must collaborate to standardize competencies, promote continuous learning, and embed innovation in daily practice. By uniting human expertise with technological progress, respiratory therapists will continue to lead the transformation of respiratory care toward safer, smarter, and more sustainable patient outcomes worldwide.

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