Power System Technology
ISSN:1000-3673

Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

Advances in Respiratory Diagnostic Tools: Impact on Respiratory Technicians' Workflows

Ahlam Ali Majrashi[1], Waad Ali Alghamdi[2], Raghad Yousef Alghamdi[3], Wadha Dhafer Alqahtani[4] Amal Atallah Alanazi[5], Sarah Saeed Alrashidi[6] and Reem Hamoud Alenzy[7]

[1] Corresponding Author, ahlamc19@gmail.com, Ministry of National Guard-Health Affairs

[2,3,4,5,6,7]Respiratory therapist, Ministry of National Guard-Health Affairs

Abstract

Respiratory care relies on a range of diagnostic tools to evaluate and modify therapeutic interventions. The widespread adoption of these instruments necessitates broader responsibilities for respiratory technicians, as clinical orders become increasingly complex. This expansion of duties challenges professionals focused on operational efficiency while maintaining the productivity essential to meet the growing demand for such services (A. Gao et al., 2019). Technological advances in ventilator monitoring offer potential solutions, but effectively integrating them remains uncertain. Continued development of diagnostic equipment aims to reduce technical interventions and allow respiratory technicians to focus more on patient care, especially in areas like ventilator management (Pápai-Székely et al., 2024).

Keywords: diagnostics; respiratory technicians; workflow; technology; Artificial Intelligence; telemedicine; training; patient outcomes

1. Introduction

Respiratory diagnostics focuses on examining respiratory secretions. The role of a respiratory technician has changed considerably over the last several years. The technician has gone from being a driver to becoming an integral part of the patient care team involving diagnosis and treatment. Respiratory therapists are trained to handle respiratory and chest diseases, cardiac management, intensive care, and anesthetics, as well as providing help during the implementation of diagnostic procedures. Respiratory technicians are key members of any shift because of their advanced training and knowledge of respiratory diagnostic technology.

Respiratory diagnostic tools are designed to determine a patient's condition in cases of respiratory disease or lung function abnormalities (A. Gao et al., 2019). They provide vital details about the function of a patient's respiratory tract and can be used in conjunction with a patient's referral data to monitor their condition and formulate an effective treatment plan (R. Murdoch et al., 2010). A range of devices is offered that can assist with the diagnosis of infections, embolisms, constriction of airways, and much more. After respiratory technicians

Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

have assessed a patient's situation, these tools are used to extract samples for in-depth analysis.

2. Overview of Respiratory Diagnostic Tools

A respiratory diagnostic tool is an instrument that measures and records one or more physiological variables associated with the mechanics of breathing or the gas exchange process. Examples include spirometers, plethysmographs, single-breath diffusing-capacity instruments, and pulse oximeters. Using these tools, respiratory technicians carry out assessments and measurements, which they relay to physicians or respiratory therapists to assist in diagnosis and treatment (Pápai-Székely et al., 2024).

Technological advances over the last decade have yielded a number of enhanced and novel tools. Examples include point-of-care testing (POCT) kits, telemedicine applications, and artificial intelligence (AI) tools. These improve workflow efficiency by accelerating processes, reducing errors, accelerating decision-making, and streamlining record-keeping. Consequently, experienced technicians can spend more time with patients, enhancing comfort and enable them to better address concerns (R. Murdoch et al., 2010). Ongoing training and skill development also enable technicians to remain current in their field and contribute in new situations.

3. Historical Context of Respiratory Diagnostics

Early methods of respiratory diagnosis focused on the use of prototypes designed to make auscultation—the act of listening to the internal sounds of the body into oscillations that cause a noticeable needle deflection—originally termed the stethophone (Kouri et al., 2021). Positioned behind the human ear, the stethophone enabled auscultation over a distance. Early 19th-century physicians also explored methods by which the vibrations emitted or interrupted by parts of the airways could be used to understand respiratory physiology and diagnose illness. A common arrangement entailed using two acoustic devices in tandem: an interface device for coupling chest vibrations to, for example, a large conical paper horn or metal plate; and a receiving device, often a stethoscope or device embodying woods metal, designed to pick up vibrations from the interface and transmit them to the ear. Throughout the nineteenth century, inventors sought more efficient and sensitive ways of coupling chest vibrations to a receiving device. In 1880, Victor Negus noted that his pharyngoscope enabled him to detect "the respiratory vibrations with singular distinctness". During World War I, physiologists endeavoured to devise non-invasive ways of assessing lung function in injured servicemen. Many thought that respiratory auscultation held promise investigated the pressure changes in the respiratory passages caused by the glottis, and found that the highest amplitude oscillations occurred at mid respiratory frequency. Near the second decade of the twentieth century, the larger frequency response of the human medical examination methods and a

Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

detailed understanding of the time and frequency content of these signals led large commissions of physicians and scientists to deem the idea of respiratory diagnosis by auscultation invalid or at least not trustworthy enough. Computed tomography (CT) and magnetic resonance imaging (MRI) have opened up new possibilities. It is now possible to measure regional structure and function with 3D detail and experimental imaging is increasing the resolution and specificity of measurement. Lung function clinics are beginning to adopt rapid, low dose CT scanning for cancer screening and routine health monitoring. Respiratory diagnostic technologies have progressed considerably.

4. Emerging Technologies in Respiratory Diagnostics

In the face of growing healthcare challenges, including a surge in respiratory disease prevalence, technological advances have become crucial across all facets of healthcare delivery. A vital group at the forefront of these changes comprises respiratory technicians, whose work has evolved through three consecutive decades (Rytter et al., 2020). The current landscape features diagnostic tools ranging from bedside pulse oximetry and capnography to blood-gas machines and spirometry. Yet, the future promises a new array of developments. Emerging technologies such as point-of-care testing, e-health platforms, telemedicine, and artificial intelligence applications offer potential for accelerated diagnoses and enhanced patient engagement. Leveraging these possibilities requires respiratory technicians to remain well-informed about forthcoming solutions, scale up their professional training, and support a shift towards automated processes (R. Murdoch et al., 2010).

4.1. Point-of-Care Testing

Point-of-care testing devices are employed by respiratory technicians to conduct simple blood tests such as partial blood gas and blood glucose analysis, with results obtained within minutes.

Isolating the patient and performing blood tests are quite time-consuming. To reduce this task, point-of-care testing devices have been recently introduced. Current diagnostic measurements, including blood glucose and blood gas analysis, require that the patient be isolated in a separate room due to the risk of cross-contamination and nosocomial infection. These devices minimize the chance of nosocomial infection while increasing the efficiency of workflow.

4.2. Telemedicine and Remote Monitoring

The digital revolution has transformed the tools and skills used in respiratory diagnostics. E-health is widely employed for both self-management and for professionals to carry out continuous assessments of patients. Instrumental diagnosis has expanded beyond the hospital, and artificial intelligence has emerged to assist during the process. A challenge for respiratory technicians is to keep working efficiently and continue to provide appropriate training to

Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

health professionals. Pneumology departments are also devising new environments through technology to enhance welfare and quality of life.

4.3. Artificial Intelligence in Diagnostics

Artificial intelligence (AI) offers significant opportunities to improve speed and efficiency of interpreting pulmonary function tests (PFTs) and imaging studies, thereby facilitating earlier diagnosis and intervention. Empiric treatment algorithms that recommend therapies based on test results can help guide care in settings where specialized clinical expertise or patient access to multidisciplinary teams is limited. AI algorithms that incorporate additional clinical information such as patient history, symptoms, or laboratory tests may be particularly beneficial in distinguishing conditions with overlapping PFT patterns such as asthma, COPD, and interstitial lung disease.

Because interpretation of PFTs often constitutes a substantial portion of a respiratory technician's daily responsibilities, examination of PFTs represents an area in which AI and machine-learning technologies could have an appreciable impact. An AI-based software model analyzed all PFT parameters individually, providing a quantitative interpretation of each parameter. Diagnostic inferences were made using probabilistic graphic models that combined the information extracted from the data. Validations employing a large database of subjects revealed that the software outperformed practicing pulmonologists in diagnostic accuracy (Topalovic et al., 2019). Although the model did not utilize the full clinical record, this finding underscores the potential of computer-assisted interpretation of PFTs to reduce diagnostic errors and dependence on specialist input. Incorporation of additional clinical variables into diagnostic algorithms may further enhance accuracy (Sindhu et al., 2024). Ongoing research continues to explore the capabilities of AI in this domain and evaluate systems for broader clinical integration.

5. Impact on Workflow Efficiency

Respiratory technicians play a central part in ensuring that test procedures are carried out according to established diagnostic protocols. Advances in diagnostic tools are having a significant impact on the work of these technicians, changing their workflow and task composition. The combination of high-throughput tests, point-of-care rapid testing and digital access to test results creates new demands for respiratory technicians. Yet, respiratory technicians remain the registries and guardians for proper diagnostic work.

The adoption of a new diagnostic technology for tuberculosis in two Brazilian cities from the perspective of patients and healthcare workers: a qualitative study (R. de Camargo et al., 2015) reports that the implementation of the new technology has had a positive impact on working conditions in the laboratory. Technicians no longer have to deal with constant fire hazards or foul odors, and ergonomic conditions have improved since they no longer need to

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

spend the day working over microscopes. Tran documents that technicians now spend about 15 minutes preparing samples, with processing occurring simultaneously on multiple instruments. During processing intervals, they can perform control smears or take breaks. concludes that this new workflow allows efficient sample processing, reduces exposure to unpleasant conditions and improves overall working conditions.

Routine molecular point-of-care testing for respiratory viruses in adults presenting to hospital with acute respiratory illness improves patient outcomes. Rapid influenza PCR testing impacts hospitalization and antiviral use, reducing patient isolation days (L. van Rijn et al., 2017). The development of multiplex qPCR systems and their clinical evaluation enable faster detection of atypical pneumonia and other pathogens, facilitating timely diagnosis and treatment.

5.1. Time Management Improvements

Time is one of the most valuable resources of respiratory technicians (RTs) in hospitals, which play an important role in health care systems and require Effective time-management skills to perform their duties successfully. Continual research aims to increase job efficiency and prevent errors linked to poor time-management and multitasking. Improvements in time allocation are closely linked to the duration and accuracy of all diagnostic processes, which are critical in routine work (Kim et al., 2021).

5.2. Reduction in Manual Errors

There are long-held concerns about the potential for ventilator design to induce human-machine interface related errors. The development of respiratory diagnostics, gas analyzers, lung function test devices, pulse oximeters, cardiopulmonary exercise test systems, bronchial provocation test systems, carbon monoxide diffusion test devices, and other technologies over the past few decades has profoundly impacted the working practices of respiratory technicians (Jiang et al., 2018). Emergent technologies such as point-of-care testing, telemedicine, and artificial intelligence have further altered their procedures, generating significant and diverse effects. Existing devices that rapidly and accurately measure lung function for a diagnosis; prescribe, calibrate, and deliver aerosolized medications; and ensure the safety and efficacy of noninvasive ventilation markedly improve the time-management practices of respiratory technicians by enhancing convenience and efficiency, while reducing the likelihood of human error (Badnjevic et al., 2018).

6. Training and Skill Development

Respiratory diagnoses rely on ongoing advancements in medical technology, spanning digital devices, imaging, and AI-driven applications. Respiratory technicians must acquire the knowledge and skills to harness new diagnostic tools. When implementing additional instruments—such as microchip scanners to enhance the existing functions of pulse

Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

oximeters—both comprehensive training and a thorough understanding of device capabilities are necessary. The integration of emerging technologies necessitates formal training programs to ensure diagnostic accuracy and patient safety. Examining the utility of advanced tools complements investigations into efficiency improvements and their influence on patient outcomes (Johnston et al., 2017).

6.1. Adapting to New Technologies

Medical technology and clinical practice improvements have enhanced healthcare professionals' capabilities to diagnose respiratory diseases. Respiratory diagnostic tools ensure effective decision-making about patients' status, thereby lessening complications and fatal outcomes. Respiratory technicians administer diagnostic tests and interpret results to guide the treatment course. Despite the increasing concern around respiratory diseases, especially their impact on mortality, infrastructural deficits hinder the deployment of diagnostic tools across healthcare sectors. Advances in respiratory diagnostics have structurally changed healthcare operations, but their impact on respiratory technicians remains unaddressed—prompting this investigation into how new tools reshape their workflow.

Advances in the medical field have improved diagnostic aids for respiratory diseases. The services of respiratory technicians have become vital to guarantee efficient treatment procedures and positive outcomes. Effective diagnosis curtails the rate of disease development and the overall number of fatalities. Technological improvements facilitate the detection and treatment of respiratory disorders. Diagnostic tools assist healthcare providers in charting suitable courses of care and managing symptoms effectively. Respiratory technicians administer diagnostic operations and interpret test results to inform treatment decisions (W Costello et al., 2017).

6.2. Continuous Education for Technicians

Respiratory diagnostic technologies are sold widely as methods of accelerating and simplifying diagnoses (Johnston et al., 2017). Point-of-care testing, telemedicine, and artificial intelligence offer on-demand access to respiratory health information and automated interpretation, reducing the need for complex judgments. However, even a cursory overview of emerging technology highlights a persistent tension between diagnostic tools that enhance care and those that mask uncertainty and have yet to improve it. Understanding the role of the respiratory technician provides insight: combining clinical competencies with hands-on expertise, the technician functions as the interface between clinical diagnosis and efficient service delivery. Respiratory diagnostic advances reshape technicians' existing workflows, wherein the adoption of new technology requires not only the opportunity to try and adopt

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

tools that enhance care but also ongoing check-ins that ensure those that do not are rendered unusable.

7. Patient Outcomes and Satisfaction

An overarching concern with respiratory diagnostic tools involves the ramifications of their output for subsequent decision-making, the treatment of the patient, and the physician's appointment time, which, in turn, impacts the productivity and workflow of the physicians. Much of the literature on the efficiency and use of respiratory diagnostic tools largely concerns the management of test requests and the issuing of results at the healthcare organizational level, with few studies commenting on how such processes impact respiratory technicians or the wider diagnostic pathways in which these individuals operate.

Existing evidence strongly supports the proposition that introducing large-scale diagnostic improvements benefits patient management. Rapid culture and antigen techniques that provide methods of testing samples closer to the patient site, or through point-of-care testing, lead to tangible operational benefits by providing early and reliable indications of the nature of the respiratory infection (T. Timbrook et al., 2023). Improved accuracy coupled with a reduction in the time taken to obtain test results improves patient outcomes and allows for greater patient engagement by respiratory technicians. Equipping individuals providing diagnostic services with a greater understanding of the condition helps better prepare them for, and respond to, various queries, including those related to future lifestyle changes that patients can implement to prevent ailments from reemerging (D. Blakey et al., 2018).

7.1. Enhanced Diagnostic Accuracy

Diagnostic tools are crucial both for defining respiratory pathologies and enhancing outcomes, including timely treatment, infection control, prognosis, and outbreak management. Their application has consequently become widespread, with respiratory technicians embracing a larger role in respiratory assessment than the delivery of medical aid alone (R. Murdoch et al., 2010). For decades, technicians have relied on a simple array of tools, with the associated workflow remaining constant until recent advances in data processing. The introduction of rapid microbiological identification at the point of care, telemedicine, artificial intelligence, and other technologies has relieved pressure on numerous routine and time-consuming tasks through workflow automation, yet the daily time allocation of the respiratory technician remains condensed and sensorious. A comprehensive review of respiratory diagnostic improvements available to technicians illustrates how these tools reconfigure the everyday practices associated with the profession; several applications stand out as particularly influential. Mechanical ventilation in conjunction with bronchoalveolar lavage is the standard treatment technique on ICU. From complete central lines to catheter insertion, a series of respiratory tools can deliver continuous results in a fraction of the

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

traditional sampling or lab processing time, allowing the technician to invest heavily in patient engagement (A. Gao et al., 2019). Several variables are employed to guarantee clinical soundness, with respiratory technicians prioritizing patient assistance on the primary ventilation equipment and (all too often) esthetic central lines and ventilation covers that precede diagnostic data. Multiplexed head-to-head evaluations show that respiratory technicians still are expected to juggle several questionnaires and sampling conditions when using widespread solutions; the possibility for next-generation alternatives to underpin their daily practice and provide the physical—or cognitive—leeway needed to improve existing workstreams comes as a relief (Salez et al., 2015).

7.2. Patient Engagement Strategies

Communicating among themselves, and with other stakeholders such as patients, physicians, and nurse practitioners, constitutes an integral element of the work of respiratory technicians. The dramatic improvements in technology and the burgeoning presence of the Internet of Things within healthcare systems, transform not only the working methods of respiratory technicians, but the very fabric of their work. In parallel, continuing education and the constant acquisition of new skills, remain imperative for professionals in this sector.

8. Challenges Faced by Respiratory Technicians

The integration of new technologies in respiratory diagnostic tools presents several challenges for respiratory technicians. The implementation, integration, and adoption of these technologies remain significant hurdles. Transferring generated data from digital tools to hospital or primary care electronic health records, and sharing it with physicians for further analysis, requires overcoming interoperability issues (Chouvarda et al., 2022). Additionally, the quantity of digital-based diagnostic methods and devices, along with the numerous parameters to be monitored, can complicate physicians' monitoring of results and management of patient cases. These factors also increase the workload of respiratory technicians, who must efficiently balance and modulate the adoption of new technologies with maintaining optimal routine performance (Pápai-Székely et al., 2024).

8.1. Integration of New Tools

The integration of new respiratory diagnostic tools in healthcare practice has transformed respiratory technicians' workflows. New technologies in point-of-care testing, telemedicine and artificial intelligence improve efficiency and expand diagnostic capability. Technicians leverage the new capabilities to enhance supervision, technical support, data compilation and clinical duties. Successful adoption depends on continuous training towards mastery of diverse tools. The advances improve diagnostic accuracy, speed and clinician confidence. Technician involvement is critical for balancing innovative practice with efficient operation and optimal performance.

Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

In modern healthcare, diagnostic technologies help clinicians and respiratory technicians detect, assess and treat diseases and injury—especially involving airway, breathing and other respiratory symptoms. State-of-the-art solutions cover lung function and toxicity, cellular changes, airway hyper-reactivity, allergic diseases, infection, inflammation, perfusion, thromboembolism and oncological screening. Applications extend beyond intensive care and recovery environments to clinical wards and outpatient settings. Sophisticated innovations continue to emerge and transform healthcare processes (R. Murdoch et al., 2010).

Trends in healthcare demand further advancement. The combination of technological innovation, research development and automation introduced new solutions for technicians. Advanced tools support diverse applications, from environmental testing and clinical practice to niche markets in health, sport, hygiene and safety. The resulting impact on respiratory technicians emphasizes the need for ongoing examination and adaptation (R. de Camargo et al., 2015).

8.2. Workload Management

Respiratory technicians routinely face fluctuating workloads that challenge the efficient management of routine tasks such as equipment calibration and inventory control, especially with variable patient scheduling. The availability of advanced diagnostic instruments contributes to streamlining procedures and reducing turnaround times, yet it also introduces operational complexities given patient volume variability and occupancy levels.

Nevertheless, the continual addition of innovative diagnostic technologies—ranging from advanced spirometry devices and gas dilution systems to automated oscillometry, diffusion testing, comprehensive body plethysmographs, forced oscillation technique systems, and respondents for one-arm maneuvers—contributes to heightened demand and burgeoning workloads. Despite the benefits, respiratory technicians express an acute need for practical guidance from manufacturers to leverage these instruments effectively (Chouvarda et al., 2022). The situation is further influenced by external conditions such as pandemic-induced escalations in diagnostics demand, underscoring concerns related to equipment availability and the inherent limitations of interpretative knowledge.

Optimizing workflow in respiratory diagnostics emerges as a critical focus, necessitating strategies that uphold high standards of diagnostic accessibility and delivery. Enhancements in time management for routine duties not only curtail unnecessary delays but also support technicians in mitigating the pressures imposed by extensive daily operation targets. The strategic adoption of tools that accelerate case processing and facilitate rapid dissemination through immediate access to reports and images address fundamental workload challenges. These measures align with potential shifts in the structural organization of diagnostic

Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

departments, delineating a trajectory for future operational paradigms (M. Baltruschat et al., 2020).

9. Future Trends in Respiratory Diagnostics

Respiratory diseases continue to constitute a significant burden on healthcare systems and are an important cause of disability and death worldwide. Improving the diagnosis of suspected respiratory tract infections has strong potential for direct clinical benefit. The causes of respiratory tract infections differ according to the affected anatomical site. Progress has been made in several areas of respiratory diagnostics over the last decade, potentially prompting a revolution in respiratory diagnostics. An increasing number of pathogens for which conventional microbiological testing fails to provide timely or definitive diagnoses can now be identified using molecular diagnostics. However, timing is a concern issuing from the nexus of the biological progression of respiratory disease, and the implementation of diagnostics into clinical practice.

Future trends in respiratory diagnostics may include: diagnostic tests based on host responses; predictive analytics capturing the highly evolving nature of the system; integrated Diagnostics (combining clinical, imaging, and laboratory data), including integrated point of care diagnostics at the bedside supplemented by high-end multiplex diagnostic platforms; and new monitoring techniques emerging from wearable technologies (R. Murdoch, 2016) (R. Murdoch et al., 2010) (A. Gao et al., 2019).

9.1. Predictive Analytics

Predictive analytic methods are expected to have a significant impact on respiratory diagnostics and, by extension, respiratory technicians' work practices (Nir-Paz et al., 2019). Such tools have already been developed for predicting the inherent risks of a number of conditions, including asthma (Badnjevic et al., 2018). Current methods work by taking time series data for a patient and attempting to predict the probability that an acute condition will occur. Extensions to the use of ambient and wearable sensors will enable these warnings to be issued in real time. Techniques of this kind are widely used in other areas of science and industry to anticipate impending problems, allowing operators to intervene early enough to prevent continued performance degradation. Although the ability to predict the need for an acute respiratory intervention is not yet within the reach of available models, the nature of the warning does not place a strict requirement on accurate forecasting. It is an indication to begin monitoring the patient more closely and to undertake further evidential reasoning. The use of such tools increases the amount of time respiratory technicians have to dedicate to patients identified as potentially at risk, while simultaneously reducing the time invested with those who are unlikely to require further assistance.

Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

9.2. Wearable Technology

Wearable technology is poised to transform respiratory health monitoring through continuous assessment of physiological or biochemical parameters under natural conditions (Aliverti, 2017). Equipped with integrated applications and cloud-based data repositories, wearable biomedical sensors will form an integral part of the healthcare Internet of Things. Many wearable devices have been designed for unobtrusive use—such as sweaters, hats, glasses, patches, watches and belts—that do not restrict daily activities or mobility. Advances in sensors, miniaturized processors, body area networks and wireless data transmission now enable pervasive measurement of physical, physiological and biochemical parameters in clinical, occupational, exercise or daily-life environments. Wearable technology offers unique opportunities for personalized respiratory medicine by assessing variables such as pulse oximetry, pulmonary ventilation, activity and air quality.

Health monitoring plays a central role in disease prevention and management, particularly during global health crises. Continuous respiratory monitoring through devices such as spirometers and motion-capture systems can inform the selection and dosage of therapy, which is advantageous for individuals with respiratory or chronic conditions. Although optical techniques like opto-electronic plethysmography (OEP) provide detailed analyses, they remain costly and require specialized personnel. Portable and cost-efficient wearable systems capable of measuring chest wall motion, respiratory sounds and airflow represent an attractive alternative. Such devices have demonstrated versatility for use in telemedicine and personalized care, enabling continuous patient monitoring outside clinical environments and thereby reducing healthcare costs and stress levels. At least four respiratory wearable sensors based on fiber Bragg grating, inductive, capacitive and conductive technologies have recently proven effective for evaluating healthy individuals across various everyday-life scenarios. The applicability of these devices to the post-stroke patient population—who commonly exhibit altered chest wall kinematics due to hemiplegia—has yet to be validated. A six-subject pilot study comparing respiratory parameters recorded by a multi-sensor wearable platform against an OEP reference standard suggests that accuracy is sensitive to sensor positioning, particularly at elevated respiratory rates (Di Tocco et al., 2022).

10. Ethical Considerations in Respiratory Diagnostics

The integration of advanced diagnostic tools into respiratory care processes imparts an information-rich environment fraught with ethical and governance concerns. A broad range of respiratory diagnostics encompasses physical assessments, fluid and tissue sampling, blood and determined gas analysis, in-office tests, and imaging examinations. The emergence of new modalities and technological innovation has amplified the pace of tool development. Simultaneously, as the utility of the resulting information streams increases, so does the need to apply automated reasoning and approach the data management task ethically.

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

Respiratory diagnostics addresses the care and management of patients with breathing difficulty using information derived from physical examination and a diverse assortment of diagnostic tools (Chouvarda et al., 2022). Distinct modalities provide complementary and often overlapping views concerning the function and pathology of the respiratory apparatus. Protocols for data collection and interpretation rely on an increasingly diverse and sophisticated array of available hardware and techniques, combined with operational expertise to determine the appropriate utilization of each. The proliferation of techniques presented conjunctively with advances in data acquisition and analytical procedures changes the nature of the work carried out by the respiratory technician and influences the broader discipline of respiratory diagnostics.

10.1. Data Privacy Issues

Respiratory diagnostics allow tools and techniques to be employed to measure the respiratory function of patients. Such diagnostic methods enable healthcare professionals to detect abnormalities or impairments in respiratory function. Throughout the past century, numerous attempts have been made to develop and improve respiratory diagnostic techniques. However, the increasing number and diversity of diagnostic tools pose challenges to respiratory technicians, as their responsibilities in performing respiratory diagnoses grow more complex (Gürsoy et al., 2020). The information provided in this report facilitates clearer explanations of the associated challenges. The development of respiratory diagnostic methods and the application of new technologies bring changes to the working patterns of respiratory technicians. Automated data recording and processing reduce the time and effort required, thus improving work efficiency. The clinical outcome information obtained is useful for refining diagnostic techniques and guiding therapeutic interventions (Verri Lucca et al., 2020). Additionally, the incorporation of technologies such as telemedicine, artificial intelligence, and virtual reality into respiratory diagnostics further enhances efficiency, problem-solving capabilities, and engagement with patients and colleagues.

10.2. Informed Consent

In clinical practice, informed consent remains fundamental (Chouvarda et al., 2022). Several respiratory diagnostic tools require blood sampling, invasive airway access, or the use of radioactive substances (Zagami et al., 2015). These circumstances necessitate an informed explanation of the objectives and possible complications. Procedures undertaken without prior explanation—and often without securing signature approval—can lead to problems in the communication of results, potentially prompting patients to seek other opinions, which devalues the examiner’s role.

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

11. Case Studies

The adoption of new respiratory diagnostic devices is reshaping the role of respiratory technicians across healthcare settings, influencing skills, workflow, and patient interactions. Respiratory technicians originated as skilled assistants to physicians—also called respiratory therapists or clinical physiologists—who operate investigative devices and interpret resulting data. Today's tools include spirometry, gas dilution techniques, body plethysmography, flow-volume measurements, respiratory gas analysis, pulse oximetry, polysomnography, cardiopulmonary exercise testing, and more. Technicians acquire, analyze, and interpret respiratory parameters articulated through varying protocols and specifications, often uncommon to routine clinical practice. Technicians must grasp the physiological utility of the parameters to distinguish between relevant clinical information and artifact. Some devices feature automated environments optimized for specific diseases or conditions (Pápai-Székely et al., 2024). Advanced instruments now offer integration with anaesthesia and intensive-care systems, equipped with embedded algorithms for automated, real-time data analysis—devices like the Oxycon Mobile, Wooden Frog, or Jeager Viasys, now available in 32- and 64-bit computer versions—further emphasizing the centrality of the technician's role within computing and data management frameworks.

Advances in molecular analysis, mass spectrometry, quantitative bacterial genomic information, and related paradigms provide unprecedented precision in diagnosing and managing conditions like pneumonia and respiratory infections. Exploiting routes such as the nasophaynx, inhalation, exhalation, and peripheral blood enables rapid, accurate identification of pathogens (A. Gao et al., 2019). These capabilities allow technicians to derive information from nasotracheal exhaled volatile compounds, pinpoint particular agents with high confidence, and map genetic profiles to tailored antibiotic regimens. Broad application demands instruments suitable for point-of-care testing at initial referral stages, which existing laboratory-based systems cannot support.

11.1. Successful Implementations

Conditional to the point of usage, point-of-care testing and telemedicine support rapid pathogen identification, complemented with artificial intelligent assistance for healthcare personnel (L. van Rijn et al., 2017). Respiratory technicians constantly strive to reduce diagnostic time, increase accuracy, integrate new tools into situated workflows, and maintain patient engagement. Emerging technology stimulates efficiency and requires ongoing training.

In an external quality panel, the ePlex® respiratory pathogen panel successfully detected 17/20 specimens, whereas the laboratory-developed real-time PCR assay detected only 12. A comparative evaluation of multiplex molecular panels demonstrated high sensitivity and

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

broad coverage (Salez et al., 2015). The Cepheid Xpert Xpress Flu/RSV assay obtained comparable results with a turnaround time of 30–45 min. Multiplex point-of-care testing accelerates clinical decision-making, reduces turn-around-times, and limits unnecessary antibiotic prescriptions. Upon introducing the Alere i Influenza A & B assay, patient isolation days declined from 144 to 31 per 100 admissions, with antibiotic use remaining largely unaffected and oseltamivir administration increasing. Representing cutting-edge innovation, such technology enhances respiratory diagnostics in efficient wards as well as for patients with rapid clinical deterioration.

Small and portable devices perform molecular diagnostics in about 15 min, enabling either dedicated point-of-care testing in hospital wards or near-patient testing in monthly primary care visits. Laboratory technicians may prepare each sample in roughly 15 min before commencing analysis (R. de Camargo et al., 2015). Simultaneous handling of four samples per instrument is feasible; in Manaus, two instruments operate continuously. While automated processing proceeds, technicians attend to other tasks such as smear control and HIV testing. Integration with complementary triage algorithms saves approximately 30 min before molecular testing. By streamlining workload allocation, laboratory teams attain consistent throughput despite variable demand.

11.2. Lessons Learned from Failures

Failures of diagnostic tools and hazards in operating machinery present instructive lessons on improving work procedures and technologies. Such fidelity illuminates the vulnerabilities and systemic deficiencies, guiding enhancements in both robustness and ergonomics. In addition to highlighting material and design robustness, it invites rigorous examination of experimental protocol and operator training, whose inadequacies can exacerbate systemic failures. The need for enhanced training resounds through the field (Torres Martí et al., 2019). Failure modes further exemplify constraint degradation, regulatory non-compliance, and complex cascade effects. Technical shortfalls such as cracked insulators or contaminated electrodes propagate under variable environmental conditions, future exposure, and routine use, necessitating ongoing evaluation. These challenges intensify the paradox of integrating automation and information technology to increase throughput without overtaxing the instruments or the technicians.

12. Comparative Analysis of Traditional vs. Modern Tools

Respiratory technicians have a central role in the performance and rate of respiratory diagnostic tests. Diagnostic tools have experienced substantial progress that shapes functionality and workflow among respiratory technicians.

Traditional respiratory diagnostic tools include microscopy, breath, blood, spirometry, pulse oximetry, histological, and clinical laboratory tests. These long-standing tools require at least

Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

one respiratory technician to conduct the tests with a second support technician managing samples and instrument sanitization. The combined approach results in substantial devote time to each test. Before completing the test, there is typically an incubation phase where the technician concentrates efforts on related activities.

Emerging and futuristic technologies include single-port, haptic, multiplex technologies, telemedicine, artificial intelligence (AI), point-of-care, and other devices supplemented by expert systems. The introduction of advanced technologies extends the role of technicians beyond traditional tasks such as sterilization and sample transfer to include supporting expert systems and providing hands-on support for AI-driven tasks. Evolution of advanced diagnostic tools instigates a redistribution of workload among respiratory technicians when compared to the demands of traditional instruments.

Multiplex techniques generally compare favourably with traditional methods of diagnosis for respiratory infections, being more sensitive, reproducible and automatable (Salez et al., 2015). Facilities that adopt advanced tools in their daily procedures experience a significant reduction in workload. Efficient practices allow qualifying technicians to accelerate the production flow. The increased efficiency generates greater availability and more time to manage additional tasks.

Deployment of advanced respiratory diagnostic tools confronts technicians with new requirements beyond the estimation of instrument efficiency (Antón Pagarolas & Pumarola Suñé, 2014). A technician who adopts and supports sophisticated devices without adequate experience is less effective than one concentrating on well-understood traditional methods. Access to pertinent information is fundamental for adequate assessment of a newly introduced advanced instrument and its incorporation into daily workflow.

13. Regulatory and Compliance Issues

Respiratory technologies are subject to national and international standards and regulations, ensuring high-quality, safe, and effective product manufacture. Devices must comply with standards and, when appropriate, obtain the CE mark before marketing in Europe. Certification confirms conformity with defined safety, quality, and performance requirements. This enforces quality and safety controls throughout the supply chain—over raw materials, components, manufacturing, distribution, and delivery—to protect end users. Standards may address specific requirements or broader aspects applicable across respiratory equipment segments. Several standardization committees develop and maintain regulations applicable to the respiratory field (Chouvarda et al., 2022) (E. Gosch et al., 2013).

13.1. Standards for Diagnostic Tools

Diagnostic tools are used to analyze respiratory specimens and data for the identification and treatment of respiratory disease. The need to deliver accurate, accessible, and reliable

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

diagnosis of respiratory diseases has resulted in a significant expansion in the array of diagnostic technologies available to respiratory physicians and technicians.

The expansion of diagnostic tools and technological advances has transformed and enriched the workflow, responsibilities, and role of the respiratory technician. The importance of the respiratory technician in the diagnosis of respiratory disease is evidenced by the degree to which emerging technologies increase work efficiency, demand additional training and skill acquisition, enhance patient outcomes and satisfaction, introduce new challenges, and highlight future trends and ethical considerations.

Advances such as point-of-care testing (POCT) and telemedicine extend diagnostic testing and support outside of the hospital, facilitating quicker diagnosis and treatment and yielding timely patient diagnoses. The growth and availability of portable and handheld diagnostic devices enable rapid testing in remote situations, permitting earlier and more frequent measurements. Artificial intelligence (AI), machine learning, "big data" analytics, and the Internet of Things (IoT) generate diagnostic tools that reduce errors, speed assessment, and increase prediction accuracy (R. Murdoch et al., 2010).

13.2. Accreditation Processes

The International Federation of Respiratory Care (IFRC) offers a respiratory therapist accreditation program aligned with several national bodies. In the USA, the National Board for Respiratory Care (NBRC) administers examinations for Certified Respiratory Therapist (CRT) and Registered Respiratory Therapist (RRT), governing credentialing. Most US states require state licensure, usually entailing NBRC certification. Several European countries regulate the profession. Canada requires passing the Canadian Board for Respiratory Care (CBRC) exam, while Australia recognizes registration through the Australian and New Zealand Board of Respiratory Care (ANZBRC) (R. Murdoch et al., 2010).

14. Interdisciplinary Collaboration

Many diagnostic tools require respiratory technicians to collaborate with healthcare professionals from other disciplines. For example, a technician may perform spirometry tests and then discuss the results with a pulmonologist to assist in forming a diagnosis or treatment plan. Specialists agree that technological advances facilitate interdisciplinary teamwork, allowing technicians to discuss findings via electronic messaging or virtual meetings with physicians and IT professionals (C. McCormack et al., 2021). Such collaborations ensure accurate and timely diagnoses and integrate diagnostic data into broader healthcare IT systems.

Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

14.1. Working with Physicians

Respiratory technicians play a pivotal role in determining the study protocol and scheduling diagnostic procedures (Pápai-Székely et al., 2024). Physicians welcome their expertise and rely on technicians to ensure that examination schedules are organized accurately. Balance is required, however, partly because the appearance of new diagnostic methods has increased the number of available investigations. Nonetheless, technicians generally prefer to be occupied rather than idle.

14.2. Engagement with IT Professionals

—Innovations in digital technologies have profound effects on the work of respiratory technicians; collaborative engagement with information technology (IT) professionals is a crucial component of successful relocation and adaption.

Instruments for respiratory diagnostics have evolved considerably over past decades to become more sensitive and efficient. Device synthesis, portability, and automated processing have experienced analogous developments. The initial goals of many of these improvements have been to increase diagnostic accuracy and enable earlier, more reliable disease detection (Honkoop et al., 2022). Meanwhile, due to recent global crises, the ability to bring medical care to patients' homes has become increasingly important, fostering new and better systems for remote diagnostics. The range of technology relevant to these objectives therefore continues to develop rapidly. With the ongoing enhancement of diagnostic instruments, new services, and communication protocols, respiratory technicians face the difficult task of implementing and controlling multiple technologies simultaneously as part of their quest to optimize workflow (W Costello et al., 2017).

The presence of cutting-edge equipment alone rarely guarantees improvements in diagnostic or operational performance. Respiratory technicians consequently must collaborate with IT experts to ensure seamless integration and, ultimately, to convert the recorded data into functional diagnostics.

15. Financial Implications of Advanced Tools

The financial ramifications of implementing advanced respiratory diagnostic tools warrant careful consideration. Upfront expenses encompass not only instrument procurement but also installation, integration with existing hospital systems, and staff training. Reimbursement rates have not always kept pace with the acquisition costs of new systems, yet organizations can often offset these expenditures through enhanced productivity, notably by accommodating a higher volume of procedures within the same time frame, thus increasing total revenue. Prominent expenditure categories include the diagnostic apparatus itself, dedicated reagents or supplies, and the cost of disseminating test results. Decisions on instrument selection must balance anticipated patient throughput, the instrument's operational

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

life span, reliability, and the organization's capacity to manage workflows. Urgent care settings seek instruments with rapid turnaround times and simple specimen preparation; smaller clinics prioritize ease of use and minimal waste; larger hospitals require higher throughput and automated specimen handling; whereas reference laboratories favor methods with high sensitivity and specificity. Patient screening programs frequently adhere to manufacturer guidelines to maintain regulatory compliance but must tailor testing strategies in alignment with local epidemiology and clinical contexts.

15.1. Cost-Benefit Analysis

Cost-benefit analysis examines the incremental costs and effects of two or more alternative interventions (A. Pinsky & T. Hayden, 2019). Cost-effectiveness analyses support investigations of cost and outcomes when the outcomes are quantified in natural units such as life-years gained or number of patients screened (J. Millman et al., 2013). Decision analysis often employs cost-benefit techniques to incorporate the trade-off between test performance, timing of results, and implementation cost.

Across a number of different scenarios, the use of rapid molecular diagnostic testing for tuberculosis (TB) could reduce respiratory isolation costs by an average of $2,278 per inpatient admission. This represents a substantial saving for medium-sized U.S. public hospitals, amounting to approximately $533,520 annually. The principal advantage of Xpert over prior nucleic acid amplification tests (NAATs) lies in its simplicity and automation, which facilitate real-time rather than batched testing and enable the rapid availability of results. Xpert remains cost-saving despite costs similar to previous NAATs due to a reduction in the number of respiratory isolation days. Eliminating four days of isolation corresponds to a 14% decrease in overall hospitalization costs compared with the standard smear strategy. Even if respiratory isolation were free, the Xpert approach would still be preferred unless the cost of a hospital bed day decreased by more than 50%. Cost savings depend on a minimum volume of testing at the hospital since capital and maintenance expenses are distributed across the total number of tests performed.

Screening programs aiming to identify COPD patients among high-risk populations in China have also been examined from a cost-effectiveness perspective. The portable spirometer emerges as a more promising tool for large-scale COPD screening due to its higher sensitivity and specificity compared with screening questionnaires. Key drivers of uncertainty include the height of male patients, lung volume decline rates in moderate COPD cases, and the discount rate applied (Qu et al., 2021). Early detection and treatment can mitigate lung function decline. The analysis incorporates local data such as predicted forced expiratory volume in one second (FEV1) ranges from a nationwide study and-region-specific cost information. Base-case parameters align with practical clinical settings, and scenario testing evaluates the necessity of confirmatory diagnostic tests following positive screening results.

Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

Portable spirometers remain cost-effective even when diagnostic procedures are omitted for high-risk patients.

Methodological controversy persists in economic evaluations of COPD screening, with some studies favoring questionnaire-based approaches and others advocating longer-term modeling techniques. Longer treatment durations decrease the incremental cost-effectiveness ratio, potentially rendering screening interventions cost-saving. Limitations of the current analysis include reliance on utility scores derived from other countries and the exclusion of certain adverse events or pneumonia risks associated with specific treatments due to data scarcity. The model focuses on classified COPD patients but can be adapted to other high-risk populations such as smokers or individuals with emphysema if relevant data become available. These findings and the accompanying model provide valuable input for the formulation of COPD screening policies in high-risk groups.

15.2. Funding Opportunities

Modern respiratory-diagnostic tools offer enhanced accuracy through embedded digital pattern-recognition techniques. Several developments relevant to a technician’s work are surveyed, including quality indicators that signal equipment failure. Models of equipment failure can improve practice efficiency if managed properly, but integrating real-time failure detection presents additional responsibilities when workflow efficiency and regulatory compliance are priorities. Similarly, automatic recognition of test artifacts based on operator errors creates conflicting demands on the technician’s role, and on the workflow as a whole.

16. Conclusion

Respiratory diagnostic advances include novel sampling techniques, analytical platforms, increasing automation, and the computing revolution. While diagnostic results have improved, the resulting clinical information is often underutilized due to limitations imposed by the overall clinical process and pathway. More rapid diagnostics can reduce morbidity, mortality, and improve resource utilization if integrated correctly within clinical pathways. Despite this, increasing hospital and emergency department demand continue to negatively impact patient flow and outcomes across health systems. Key to improving outcomes and enhancing patient experience is early and correct diagnosis, often requiring tests that can be performed at the point of care. The role of the respiratory technician remains pivotal in this process, utilizing diagnostic systems on behalf of the patient and supporting the clinical team. Transformative technologies include point-of-care testing, wearable sensors, advanced analytics, robotic systems, telemedicine, smartphone applications, ultralow-power integrated chips, and AI/machine learning. Deployment of these technologies will have considerable implications for the respiratory technician’s role and for healthcare provision. (A. Gao et al., 2019) Respirology encompasses respiratory-function tests, arterial puncture, and collection of

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

biological materials; new and improved diagnostic tools and technologies have facilitated the work of the respiratory technician. Strategic application of emerging technology positively influences contemporary work practices and contributes to improved patient outcomes. Advances such as point-of-care devices, telemedicine, and AI offer the prospect of safer, timelier, and more accurate diagnoses, reducing errors and supporting the development of specialist expertise. A wide range of commercial systems survey a growing spectrum of pathologies; although respiratory technicians already command specialized skills, appropriate ongoing training needs to keep pace with innovation. These capabilities foster integration of measurement techniques, environments, and location to optimize data workflow, processing, and feedback. Consolidation of the traditional role, novel tools, and enhanced workflows suggests that the development and expansion of new technology represents an important step in the continuing evolution of the discipline. (L. van Rijn et al., 2017)

References:

A. Gao, C., C. Huston, J., Valda Toro, P., Gautam, S., & S. Dela Cruz, C. (2019). Molecular Diagnostics in Pulmonary Infections. ncbi.nlm.nih.gov
1. Pápai-Székely, Z., Grmela, G., & Sárosi, V. (2024). Novel diagnostic processes and challenges in bronchoscopy. ncbi.nlm.nih.gov
2. R. Murdoch, D., C. Jennings, L., Bhat, N., & P. Anderson, T. (2010). Emerging Advances in Rapid Diagnostics of Respiratory Infections. ncbi.nlm.nih.gov
3. Kouri, A., J. Dandurand, R., S. Usmani, O., & Chow, C. W. (2021). Exploring the 175-year history of spirometry and the vital lessons it can teach us today. ncbi.nlm.nih.gov
4. Rytter, H., Jamet, A., Coureuil, M., Charbit, A., & Ramond, E. (2020). Which Current and Novel Diagnostic Avenues for Bacterial Respiratory Diseases?. ncbi.nlm.nih.gov
5. Topalovic, M., Das, N., Burgel, P. R., Daenen, M., Derom, E., Haenebalcke, C., Janssen, R., A. M. Kerstjens, H., Liistro, G., Louis, R., Ninane, V., Pison, C., Schlesser, M., Vercauter, P., F. Vogelmeier, C., Wouters, E., Wynants, J., & Janssens, W. (2019). Artificial intelligence outperforms pulmonologists in the interpretation of pulmonary function tests.. [PDF]
6. Sindhu, A., Jadhav, U., Ghewade, B., Bhanushali, J., & Yadav, P. (2024). Revolutionizing Pulmonary Diagnostics: A Narrative Review of Artificial Intelligence Applications in Lung Imaging. ncbi.nlm.nih.gov
7. R. de Camargo, K., R. Guedes, C., Caetano, R., Menezes, A., & Trajman, A. (2015). The adoption of a new diagnostic technology for tuberculosis in two Brazilian cities from the perspective of patients and healthcare workers: a qualitative study. ncbi.nlm.nih.gov
8. L. van Rijn, A., H. T. Nijhuis, R., Bekker, V., H. Groeneveld, G., Wessels, E., C. W. Feltkamp, M., & C. J. Claas, E. (2017). Clinical implications of rapid ePlex®

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

Respiratory Pathogen Panel testing compared to laboratory-developed real-time PCR. ncbi.nlm.nih.gov
9. Kim, Y. J., Kim, G., Kim, S., Jung, D., & Park, M. (2021). Designing optimizing procedures for task switching to ensure efficiency in the hospital laboratory. ncbi.nlm.nih.gov
10. Jiang, M., Liu, S., Gao, J., Feng, Q., & Zhang, Q. (2018). Comprehensive Evaluation of User Interface for Ventilators Based on Respiratory Therapists' Performance, Workload, and User Experience. ncbi.nlm.nih.gov
11. Badnjevic, A., Gurbeta, L., & Custovic, E. (2018). An Expert Diagnostic System to Automatically Identify Asthma and Chronic Obstructive Pulmonary Disease in Clinical Settings. ncbi.nlm.nih.gov
12. Johnston, M., Bridges, T., Palen, B., Parsons, E., Wemple, M., & Adamson, R. (2017). Hands-on Pulmonary Curriculum: Interactive Learning Sessions on Oxygen Delivery, Spirometry, Positive Airway Pressure Devices, Tracheostomy, and Thoracostomy Tubes. ncbi.nlm.nih.gov
13. W Costello, R., L Dima, A., Ryan, D., Andrew McIvor, R., Boycott, K., Chisholm, A., Price, D., & D Blakey, J. (2017). Effective deployment of technology-supported management of chronic respiratory conditions: a call for stakeholder engagement. ncbi.nlm.nih.gov
14. T. Timbrook, T., B. Wigmosta, T., B. Hemmert, R., B. Dimas, J., Krause, A., Spinali, S., Thelen, M., Tongio, I., & Tissier, J. L. (2023). Measuring clinical outcomes of highly multiplex molecular diagnostics for respiratory infections: A systematic review and conceptual framework. ncbi.nlm.nih.gov
15. D. Blakey, J., G. Bender, B., L. Dima, A., Weinman, J., Safioti, G., & W. Costello, R. (2018). Digital technologies and adherence in respiratory diseases: the road ahead. ncbi.nlm.nih.gov
16. Salez, N., Vabret, A., Leruez-Ville, M., Andreoletti, L., Carrat, F., Renois, F., & de Lamballerie, X. (2015). Evaluation of Four Commercial Multiplex Molecular Tests for the Diagnosis of Acute Respiratory Infections. ncbi.nlm.nih.gov
17. Chouvarda, I., Perantoni, E., & Steiropoulos, P. (2022). Respiratory decision support systems. ncbi.nlm.nih.gov
18. M. Baltruschat, I., Steinmeister, L., Nickisch, H., Saalbach, A., Grass, M., Adam, G., Knopp, T., & Ittrich, H. (2020). Smart Chest X-ray Worklist Prioritization using Artificial Intelligence: A Clinical Workflow Simulation. [PDF]
19. R. Murdoch, D. (2016). How best to determine causative pathogens of pneumonia. ncbi.nlm.nih.gov

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

20. Nir-Paz, R., Almogy, G., Keren, A., Livne, G., Amit, S., Wolf, D., & E Moses, A. (2019). 2223. Real-time Prediction of Respiratory Pathogen Infection Based on Machine Learning Decision Support Tool. ncbi.nlm.nih.gov
21. Aliverti, A. (2017). Wearable technology: role in respiratory health and disease. [PDF]
22. Di Tocco, J., Lo Presti, D., Zaltieri, M., Bravi, M., Morrone, M., Sterzi, S., Schena, E., & Massaroni, C. (2022). Investigating Stroke Effects on Respiratory Parameters Using a Wearable Device: A Pilot Study on Hemiplegic Patients. ncbi.nlm.nih.gov
23. Gürsoy, G., Doerr, M., Wilbanks, J., K. Wagner, J., Tang, H., & E. Brenner, S. (2020). Navigating ethical quandaries with the privacy dilemma of biomedical datasets. ncbi.nlm.nih.gov
24. Verri Lucca, A., Augusto Silva, L., Luchtenberg, R., Garcez, L., Mao, X., García Ovejero, R., Miguel Pires, I., Luis Victória Barbosa, J., & Reis Quietinho Leithardt, V. (2020). A Case Study on the Development of a Data Privacy Management Solution Based on Patient Information. ncbi.nlm.nih.gov
25. Zagami, D., Hockenhull, J., Bodger, A., & Bajee Sriram, K. (2015). Communication of Pulmonary Function Test Results: A Survey of Patient's Preferences. ncbi.nlm.nih.gov
26. Torres Martí, A., Lee, N., Cillóniz, C., Vila Estapé, J., & Van der Eerden, M. (2019). Laboratory diagnosis of pneumonia in the molecular age. [PDF]
27. Antón Pagarolas, A. & Pumarola Suñé, T. (2014). Diagnóstico microbiológico de las infecciones virales respiratorias en el paciente adulto. ncbi.nlm.nih.gov
28. E. Gosch, M., E. Shaffer, R., E. Eagan, A., J. Roberge, R., J. Davey, V., & J. Radonovich, L. (2013). B95: A new respirator for health care personnel. ncbi.nlm.nih.gov

B. McCormack, M., Bascom, R., Brandt, M., Burgos, F., Butler, S., Caggiano, C., E. F. Dimmock, A., Fineberg, A., Goldstein, J., C. Guzman, F., N. Halldin, C., D. Johnson, J., S. Kerby, G., A. Krishnan, J., Kurth, L., Morgan, G., A. Mularski, R., B. Pasquale, C., Ryu, J., Sinclair, T., F. Stachowicz, N., Taite, A., Tilles, J., R. Truta, J., N. Weissman, D., David Wu, T., & P. Yawn, B. (2021). Electronic Health Records and Pulmonary Function Data: Developing an Interoperability Roadmap. An Official American Thoracic Society Workshop Report. ncbi.nlm.nih.gov

29. Honkoop, P., Usmani, O., & Bonini, M. (2022). The Current and Future Role of Technology in Respiratory Care. ncbi.nlm.nih.gov
    A. Pinsky, B. & T. Hayden, R. (2019). Cost-Effective Respiratory Virus Testing. ncbi.nlm.nih.gov

Power System Technology
ISSN:1000-3673
Received: 16-04-2025 Revised: 05-05-2025 Accepted: 31-07-2025

30. J. Millman, A., W. Dowdy, D., R. Miller, C., Brownell, R., Z. Metcalfe, J., Cattamanchi, A., & Lucian Davis, J. (2013). Rapid Molecular Testing for TB to Guide Respiratory Isolation in the U.S.: A Cost-Benefit Analysis. ncbi.nlm.nih.gov
31. Qu, S., You, X., Liu, T., Wang, L., Yin, Z., Liu, Y., Ye, C., Yang, T., Huang, M., Li, H., Fang, L., & Zheng, J. (2021). Cost-effectiveness analysis of COPD screening programs in primary care for high-risk patients in China. ncbi.nlm.nih.gov