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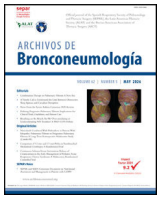

SEPAR's voice

SEPAR Position Paper on Infrastructure, Technology, Staffing, Quality Standards, and Management of Intermediate Respiratory Care Units in Spain

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ABSTRACT

Intermediate Respiratory Care Units (IRCUs) play an increasingly important role in the management of patients with acute or acute-on-chronic respiratory failure who require more advanced monitoring and respiratory support than can be provided on conventional hospital wards but do not require admission to an Intensive Care Unit (ICU). Their development has been driven by the widespread adoption of non-invasive ventilation, high-flow nasal cannula (HFNC) therapy, and continuous respiratory monitoring, and their strategic value was clearly demonstrated during the COVID-19 pandemic. This position paper from the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR) provides evidence-informed recommendations regarding the infrastructure, technology, staffing, organization, and quality standards necessary for the optimal functioning of IRCUs in Spain. A multidisciplinary panel of experts developed consensus-based guidance drawing on available scientific evidence and clinical experience, addressing architectural design, technological resources, professional roles, training pathways, clinical care models, and quality indicators. IRCUs have emerged as a key component in the management of acute and chronic respiratory failure, contributing to improved clinical outcomes and more efficient use of critical care resources. This document highlights the importance of standardized admission criteria, structured care processes, multidisciplinary coordination, and continuous performance evaluation using validated indicators to support the consolidation of IRCUs as high-value, sustainable components of modern respiratory care systems.

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Introduction and historical background of Intermediate Respiratory Care Units

Intermediate Respiratory Care Units (IRCUs) have emerged in response to the growing need for specialized management of patients with acute or acute-on-chronic respiratory failure who do not require admission to an Intensive Care Unit (ICU) but exceed the monitoring and treatment capabilities of conventional hospital wards. Their establishment dates back to the late 20th century, paralleling the progressive adoption of noninvasive respiratory therapies and the development of advanced monitoring technologies that enabled the safe and effective management of semicritical patients in intermediate-care settings. In Spain, the first documented experiences appeared during the 1990s and early 2000s, led by innovative multidisciplinary Pulmonology departments [1].

The evolution of IRCUs has been strongly influenced by advances in noninvasive ventilation (NIV), HFNC therapy, and continuous respiratory monitoring, all of which have profoundly transformed respiratory care. Nevertheless, their expansion was initially uneven, with considerable heterogeneity in structure, staffing, and professional competencies. The COVID-19 pandemic marked a turning point, acting as a powerful catalyst that accelerated their implementation and consolidation across healthcare systems. During this period, IRCUs demonstrated their strategic value by relieving the burden on ICUs, optimizing healthcare resources, and improving survival among patients with acute respiratory failure [2].

At present, IRCUs ensure safe, efficient, and patient-centered management, particularly within Pulmonology services. However, important challenges persist, including variability in structural and functional organization, disparities in staff training, and the absence of standardized quality benchmarks. In this context, the Spanish Society of Pulmonology and Thoracic Surgery (SEPAR) has assumed a leading role in defining evidence-based criteria for quality, management, and excellence, aiming to guide the future development of IRCUs in Spain and establish a reference model for other healthcare systems.

Methodology

This document was developed at the initiative of the Coordination of the Integrated Research Program on NIV-IRCU of SEPAR and approved by SEPAR's Document Management Committee. An expert panel of 12 members with recognized expertise in IRCUs, healthcare management, and quality of care was convened to produce a strategic document aimed at harmonizing organizational standards and clinical practice in these units.

The different sections of the manuscript were initially drafted by panel members according to their specific areas of expertise. The full document was subsequently reviewed through several iterative rounds, during which all authors contributed to refining the content, structure, and interpretation. The final version was approved by all members of the panel, without a predefined agreement threshold, reflecting a fully shared expert perspective.

A comprehensive and structured literature search was performed to inform the development of the document. Searches were conducted in Embase, Scopus, the Cochrane Library, CINAHL, Web of Science Core Collection, and LILACS/IBECS (BVS), structured around five predefined domains: IRCU setting; technologies and monitoring; organization and staffing; quality and outcomes; and population/clinical conditions. Full search strategies are detailed in the Supplementary Material. Given the nature of this work as a strategic positioning document, the literature review was conducted from a scoping and evidence-mapping perspective, aimed at identifying key domains, organizational models, and quality indicators relevant to IRCUs. Accordingly, no restrictive eligibility criteria based on specific study designs or PICO frameworks were predefined.

The available literature in this field is characterized by a predominance of observational studies, descriptive reports, and expert-based experiences, with substantial heterogeneity in study design and outcomes. Importantly, there is a lack of randomized controlled trials comparing IRCU care with conventional ward care or ICU admission strategies, which limits the applicability of formal evidence hierarchies. For this reason, no formal critical appraisal of individual studies (e.g., using GRADE methodology) or meta-analysis was performed, as these approaches are primarily designed for evaluating the certainty of evidence related to specific clinical interventions supported by comparative studies. Instead, the selection and interpretation of the literature were guided by: (1) relevance to IRCU organization and management; (2) applicability to real-world clinical practice; and (3) consistency with existing intermediate-care models.

The final recommendations and statements presented in this document should therefore be interpreted as an evidence-informed expert synthesis rather than as formally graded recommendations derived from a structured consensus process.

Architectural and functional structure of an IRCU

After understanding the historical background and conceptual foundations of IRCUs, it becomes essential to define their architectural and functional characteristics. The design and organization of an IRCU are crucial determinants of its clinical efficiency, safety, and capacity to provide high-quality care for semicritical respiratory patients.

Definition of spaces

An effective IRCU requires clearly defined areas and appropriately equipped spaces to support care, monitoring, and respiratory support for semicritical patients. Architectural guidelines mainly derive from ICUs and describe two main models: open-plan layouts and individual patient rooms, with some mixed approaches.

Open-plan layouts enhance staff efficiency and situational awareness, facilitating early recognition of clinical deterioration and rehabilitation in certain patient populations [3,4]. However, they may increase the risk of multidrug-resistant cross-infections, requiring strong infection-control measures [5]. Room-based layouts provide environmental control, support noisy NIV, and allow family presence, but require compensatory monitoring systems. Patients and relatives generally report higher satisfaction in room-based units, whereas staff may experience higher levels of stress and isolation [6,7]. Room-based layouts also facilitate humanization strategies beyond family presence, such as access to clocks, television, and personal hygiene or bathing facilities, which support patient orientation, preserve circadian rhythms, and help reduce depersonalization and delirium [8].

Unit size should also be considered. Recommendations from other countries suggest a maximum of 10 beds [9], although in practice capacity can vary widely and often responds to epidemiological pressures, as observed in Spain, where the mean number of IRCU beds increased from 4 to 14 during the COVID-19 pandemic [10]. Potential needs for isolation rooms equipped with negative pressure should also be considered during unit design.

Increasing technological complexity, including noninvasive support devices and continuous monitoring, reinforces the need for well-planned spaces that ensure safety, visibility, and efficient workflow, because inadequate design can compromise infection control, emergency response, and ultimately clinical outcomes.

Table 1
Procedures and monitoring in IRCU (basic to advanced/excellence).

Area	Essential (basic)	Advanced/excellence
Respiratory support therapy	CPAP, pressure support-bilevel ventilation, volumetric ventilation, high-flow therapy	Advanced/intelligent ventilation modes, invasive ventilation via tracheostomy, difficult weaning
Monitoring	SpO_2 (pulse oximetry), heart rate, respiratory rate, noninvasive BP, ECG (if HR >120 bpm), temperature, blood gas analysis, capnography ($PtcCO_2$), basic ventilator curves (pressure, flow, volume/time), FiO_2, tidal volume, peak inspiratory pressure, PEEP, mean airway pressure, peak inspiratory flow, flow waveform, diaphragm and cardiopulmonary ultrasound	P0.1, dynamic compliance, dynamic resistance, plateau pressure, intrinsic PEEP, esophageal pressure, electromyography, advanced hemodynamics (right heart catheterization), minimally invasive hemodynamic monitoring, invasive pulmonary hemodynamic monitoring (in accredited centers), advanced imaging integration
Airway management	Suctioning, mechanical cough assistance, flexible bronchoscopy for secretion management, decannulation, and cannula exchange	Phonation, endoscopic airway procedures (dilation, laser therapy, stent placement)
Other/supportive procedures	Basic respiratory physiotherapy, basic sleep studies (polygraphy)	Pleural drainage, complex nutritional support, respiratory electrophysiology studies, central venous catheter insertion and arterial monitoring (e.g., Bacteremia Zero protocols), pulmonary mechanics studies (Pes, Electrical Impedance Tomography)

Technological requirements

Monitoring and noninvasive support therapies form the structural and functional backbone of any IRCU. Monitoring involves the continuous or intermittent measurement of physiological parameters, performed remotely and with sufficient resolution to detect alarm thresholds and enough variability to support clinical decision-making. In addition, IRCUs must be equipped to perform essential respiratory procedures and safely deliver noninvasive ventilatory support.

For this reason, every IRCU should provide at least basic patient monitoring, essential respiratory therapies, and procedural capabilities, whereas more advanced interventions may be available according to unit expertise. Table 1 summarizes the essential (basic) and advanced/excellence monitoring variables, procedures, and support therapies that should be available in an IRCU.

Architecturally, regardless of whether patients are in direct view or not, the unit must include a centralized monitoring center to minimize delays in detecting clinical deterioration and optimize rapid response to procedural or ventilatory needs.

The respiratory support therapies employed in an IRCU – both invasive and noninvasive – include NIV, invasive ventilation, HFNC, continuous positive airway pressure (CPAP), and mechanical insufflation–exsufflation (MI-E). These therapies must be approved for use in critically ill patients, capable of delivering inspired oxygen fractions close to 100%, and able to maintain operational autonomy during patient transfers or power outages. As in ICUs, it is also essential for these units to have an independent power generator and a dedicated oxygen supply to ensure uninterrupted therapy. All devices should be user-friendly and compatible with various consumables. Ventilators, in particular, must support continuous monitoring of key respiratory parameters, such as real-time flow, pressure, and volume curves [11]. Their use also requires specific infrastructural support, including oxygen and medical air outlets, high-capacity humidification systems, and adequate space for device placement and handling. A robust vacuum outlet is essential for secretion suctioning. Given the high risk of aerosol generation, SEPAR highlights the importance of appropriate ventilation systems, preferably with negative pressure or high air-exchange rates.

Once monitoring is integrated with respiratory therapy devices, frequent evaluation of device performance and patient–ventilator interaction is crucial in the IRCU. Continuous patient surveillance and assessment of treatment tolerance, proper equipment setup, detection of leaks, upper airway events, and patient–ventilator asynchronies are all essential for adjusting parameters and preventing potential harm to respiratory mechanics. Additionally, multiparametric scales with high predictive value for therapeutic failure – such as the Acute Physiology and Chronic Health Evaluation II (APACHE II), the Heart rate, Acidosis, Consciousness, Oxygenation, and Respiratory rate (HACOR) score, the Respiratory Rate-Oxygenation (ROX) index, and the Noninvasive Ventilation Outcomes (NIVO) score – can be used to guide clinical decision-making.

Staffing requirements

The staffing of an IRCU should consist of a multidisciplinary team including, at minimum, physicians, nurses, nursing assistants, and respiratory physiotherapists. When appropriate, consultation with professionals from other services or units should be available to address specific patient needs, such as nutritionists, pharmacists, speech therapists, and psychologists. This collaborative structure ensures comprehensive care tailored to the diverse clinical requirements of semicritical respiratory patients [9].

All professionals working in the unit must be trained in critical respiratory care and airway management, as well as in the monitoring and use of equipment commonly employed in the IRCU, including vital signs monitors, NIV devices, HFNC systems, secretion suction devices, and the management and replacement of tracheostomy cannulas [9,12].

Following recommendations from several national and international scientific societies, IRCUs should be staffed with 1 physician for every 6 patients. However, this ratio should be adjusted according to patient complexity, with increased availability for tracheostomized or highly complex patients. This physician is typically the attending pulmonologist acting as unit coordinator, and continuous coverage, 24 h a day, 7 days a week, should be ensured [12–14].

Nursing care should be provided at a ratio of 1 nurse for every 4 patients (1:4), also available 24 h a day, 7 days a week, with the possibility of improving this ratio when patient severity or complexity so requires (e.g., patients with neuromuscular disease or those undergoing initiation or weaning of NIV or HFNC) [12,13,15–17]. Complementing nursing care, 1 nursing assistant for every 4 patients should be present around the clock, with additional support allocated according to patient needs.

Respiratory physiotherapy should be ensured by 1 physiotherapist for every 6 patients, delivering 1 session daily throughout the week and offering additional afternoon sessions for patients with higher requirements, such as difficulty optimizing gas exchange, managing bronchial secretions, or reduced mobility. The physiotherapist's role encompasses both respiratory therapy and patient mobilization to enhance autonomy and functional recovery [12,17].

Fig. 1. Graphical summary of the architectural, technological and staffing characteristics that a respiratory intermediate care unit (IRCU) should meet.

Finally, to support continuity of care and ensure a familiar environment, family members or the primary caregiver are encouraged to remain in the patient's room.

Fig. 1 graphically summarizes the architectural, technological, and staffing characteristics that an IRCU should meet.

Staff training and continuous professional development

Currently, there are no nationally recognized documents, structured training pathways, or official certification programs for healthcare professionals working in intermediate- or semicritical-

Table 2
Training requirements for healthcare professionals working in respiratory intermediate (semi-critical) care units in countries with an established training tradition.

Country/region	Training framework	Key requirements and competencies	Refs
United States	ABIM pathway: ACGME-accredited Critical Care Medicine fellowship for Internal Medicine-trained physicians	One-year clinical fellowship: minimum 9 months of ICU experience (≥6 months in medical/cardiac ICU and ≥3 months in nonmedical critical care, including trauma, surgical, neurological, or transplant ICUs)	[18,19]
	ABEM pathway: 5 routes to CCM subspecialty certification jointly sponsored by ABIM, ABS, and ABA for Emergency Medicine physicians	Two-year fellowship in Critical Care Medicine followed by a written certification examination	[20]
Europe (ERS)	Respiratory Critical Care HERMES project (2009): educational standards and structured training framework developed through modified Delphi surveys, group discussions, and plenary sessions	Syllabus comprising 229 competencies across 9 sections and 51 modules (215 mandatory and 14 optional), classified into three levels of knowledge	[52,53]
France	Intensive Care Medicine recognized as an independent specialty since 2017: *Diplôme d'Études Spécialisées* (DES) in *Médecine Intensive-Réanimation*, based on the CoBaTrICE competency framework	Ten semesters total: minimum 4 semesters in university-affiliated centers and minimum 2 semesters in nonuniversity training institutions	[54]
Italy	Training embedded in *Malattie dell'Apparato Respiratorio* specialization (4 years). UTIR classified by AIPO into three levels: respiratory monitoring units (RMU), RIICU, and full respiratory ICU	Competency thresholds: ≥50 cases of severe chronic respiratory failure with intensive/semi-intensive practice; ≥80 interventional pulmonology videoendoscopy procedures (≥30 personally performed); ≥200 interpreted respiratory function tests. Nurse-to-patient ratios range from 1:5–6 (RMU) to >1:3 (intensive level)	[14,25]
United Kingdom	Intensive Care Medicine training regulated by the Faculty of Intensive Care Medicine (FICM). Entry after core training in anesthesia, internal medicine, or emergency medicine. Completion through CCT or CESR	Outcome-based ICM CCT curriculum including 14 High-Level Learning Outcomes (HiLLOs) with key capabilities defining expected KSE. Assessment through the FFICM examination or equivalent nationally/internationally recognized ICM examination	[26,27]
Spain (SEPAR)	No formal specialty/subspecialty regulation. SEPAR Working Group position papers aligned with ERS HERMES. Voluntary SEPAR accreditation system (~30 hospitals): basic, specialized, and highly specialized units	IRCU medical teams coordinated by a Respiratory Medicine specialist with critical care experience. Required competencies include advanced airway management, mechanical ventilation, bronchoscopy, and pleural drainage. Proposed staffing: 1 physician per 4–6 patients with 24-h on-site coverage	[15,28]

ACGME, Accreditation Council for Graduate Medical Education; ABIM, American Board of Internal Medicine; ABEM, American Board of Emergency Medicine; ABS, American Board of Surgery; ABA, American Board of Anesthesiology; CCM, Critical Care Medicine; ICU, Intensive Care Unit; ERS, European Respiratory Society; HERMES, Harmonised Education in Respiratory Medicine for European Specialists; CoBaTrICE, Competency-Based Training in Intensive Care Medicine; AIPO, *Associazione Italiana Pneumologi Ospedalieri*; UTIR, *Unità di Terapia Intensiva Respiratoria*; RMU, Respiratory Monitoring Unit; RIICU, Respiratory Intermediate/Semi-Intensive Care Unit; FICM, Faculty of Intensive Care Medicine; CCT, Certificate of Completion of Training; CESR, Certificate of Eligibility for Specialist Registration; HiLLOs, High-Level Learning Outcomes; KSE, Knowledge, Skills, and Experience; FFICM, Fellowship of the Faculty of Intensive Care Medicine.

care units in Spain. In the absence of a regulated framework, it is necessary to analyze training models from countries where comparable levels of care are formally defined and regulated to identify reference standards and best practices that could inform future national strategies. Table 2 provides an overview of the main requirements identified in countries with an established tradition in respiratory intermediate care [1,15–26].

In addition, SEPAR has established a voluntary accreditation system for IRCUs, with approximately 30 Spanish hospitals currently accredited. Units are classified into three levels: basic units, specialized units, and highly specialized units. The geographical distribution of accredited units is heterogeneous, with a higher concentration in major metropolitan areas such as Madrid, Barcelona, and Valencia [18].

The proposed training framework for Spain is structured into three progressive levels applicable to all IRCU healthcare professionals. Rather than establishing rigid time-based requirements, this framework adopts a competency-based model with flexible itineraries, combining modular clinical rotations in accredited units, high-fidelity simulation training, and direct skill assessment and accreditation. This approach is better suited to the diversity of professional profiles and career trajectories within the Spanish healthcare system and is aligned with international frameworks such as the ERS Respiratory Critical Care HERMES project, which defines 229 verifiable competencies across knowledge levels without mandating fixed training durations.

Level 1: core competencies in intermediate respiratory care

This level covers the essential competency domains for all professionals working in an IRCU, with specific content adapted to each professional category.

For physicians, competencies include advanced airway management, noninvasive ventilation, patient–ventilator interaction, respiratory monitoring, oxygen therapy, and basic interventional procedures.

For nurses, competencies include advanced respiratory monitoring, NIV and HFNC circuit management, recognition of patient–ventilator asynchrony, severity scoring systems, and emergency response protocols.

For physiotherapists, competencies include airway clearance techniques, early mobilization, ventilatory muscle training, and weaning support.

Training should take place in accredited respiratory units with adequate case volume and clinical complexity. Simulation-based education is strongly recommended for all professional categories to consolidate technical skills and improve crisis management.

Level 2: advanced competencies in IRCU

This level targets professionals seeking to consolidate advanced competencies beyond the core level, with a minimum indicative duration to be determined through accredited competency assessment rather than calendar time.

For physicians, competencies include invasive ventilation strategies, protocolized weaning, management of complex respiratory conditions, and advanced procedural skills.

For nurses, competencies include independent management of NIV failure, tracheostomy care, interpretation of complex monitoring, and coordination of multidisciplinary care.

For physiotherapists, competencies include management of patients undergoing prolonged weaning, complex secretion clearance, chest physiotherapy in mechanically ventilated patients, and outcome-based functional assessment.

Training must be embedded within accredited IRCUs with sufficient case complexity and structured mentorship programs. Participation in research activities, teaching, and advanced simulation exercises is required for accreditation at this level.

Level 3: excellence and leadership in IRCU (continuous professional development)

This level is open to all professional categories and emphasizes leadership, organizational skills, innovation, and quality improvement. Professionals at this level contribute to the development of training programs, high-fidelity simulation initiatives, research projects, and implementation of advanced monitoring technologies and digital health solutions within accredited IRCUs.

For nurses and physiotherapists specifically, this level encompasses the design of care protocols, coordination of multidisciplinary teams, mentorship of junior professionals, and active participation in quality-indicator monitoring and improvement cycles.

The competency-based framework described above is structured to apply equally to all professional categories working in the IRCU. Formal and standardized training pathways for nursing and physiotherapy in intermediate respiratory care remain insufficiently developed in Spain, and their implementation represents a priority.

Competency domains for nursing professionals should include advanced cardiorespiratory monitoring, NIV and HFNC initiation and management, recognition of patient–ventilator asynchrony, application of severity and functional scales (APACHE, Barthel, CPIS, etc.), tracheostomy care, and participation in clinical safety and quality-improvement programs.

Competency domains for physiotherapy professionals should include airway secretion management techniques (mechanical insufflation–exsufflation, assisted cough, and percussion), early progressive mobilization, ventilatory muscle training and assessment, weaning support protocols, and functional outcome evaluation.

Future national initiatives should prioritize the development of accredited, competency-based curricula for these professionals, with defined assessment tools and standardized pathways leading to recognition across SEPAR-accredited units.

Models and clinical functioning of an IRCU

One of the major advantages of an intermediate care unit is its ability to function as a step-down or step-up unit for patients whose severity levels fall between those requiring intensive care and those typically managed on a general hospital ward [18–20].

In this context, two admission pathways can be considered for patients entering an IRCU:

Step-up or care escalation model

According to the British Thoracic Society, patients most likely to benefit from a respiratory care unit include the following [12]:

- Patients receiving acute NIV for acute hypercapnic respiratory failure with acidosis.
- Patients receiving acute noninvasive CPAP for hypoxemic respiratory failure.
- Patients receiving HFNC for hypoxemic respiratory failure.
- Patients receiving long-term ventilation admitted acutely.
- Patients with severe respiratory disease associated with intellectual disability.
- Medical patients requiring intercostal drainage.
- Patients with acute asthma requiring close monitoring.
- Patients with severe acute pneumonia with risk factors for poor outcomes.
- Patients with intermediate-high-risk or high-risk pulmonary embolism.

The model contemplates direct admission from the emergency department or conventional hospital wards in the following situations:

- Acute respiratory failure requiring NIV or HFNC.
- Acute exacerbation of chronic respiratory failure requiring NIV or HFNC.
- Avoidance of ICU admission when ICU criteria are not met.
- Need for advanced monitoring or surveillance in patients without comorbidities or hemodynamic instability that would otherwise require ICU admission.
- Alternative to endotracheal intubation in hypoxemic respiratory failure.

The objectives of the step-up model include the following [14]:

- Prevention of intubation: avoidance of invasive mechanical ventilation in 65–70% of cases and reduction of associated complications (nosocomial infections, ventilator-associated pneumonia, delirium, critical illness neuropathy, agitation, among others).
- Reduction or avoidance of ICU days: shortening of average ICU length of stay.
- Scalability: ability to expand during healthcare crises or seasonal epidemic peaks.
- Continuity of care for complex chronic respiratory patients (e.g., COPD with frequent exacerbations or frailty criteria, bronchiectasis, chronic bronchial colonization, obesity-hypoventilation syndrome).
- Optimization of available resources according to patients' actual needs in a humanized care environment.

Step-down model (reduction in level of care)

Step-down refers to the planned transfer of patients from higher-acuity units with advanced monitoring and intensive care requirements [20].

In this scenario, IRCUs have proven highly effective in several processes:

- Management of difficult or prolonged weaning from mechanical ventilation.
- Postextubation care for high-risk patients.
- Postoperative care for patients with high respiratory risk or those at high risk of complications from prolonged intubation or contraindications to intubation (e.g., patients with neuromuscular disease undergoing abdominal or thoracic surgery).
- Monitoring of high-risk patients transferred from intensive care or requiring surveillance that cannot be provided on a conventional ward, functioning as a bridging unit (e.g., following thrombectomy or fibrinolysis for pulmonary embolism).
- Patients with a therapeutic ceiling who remain under active treatment but require a level of care or therapy unavailable on conventional wards (e.g., oncology patients with infectious,

vascular, or immune-mediated respiratory complications, or patients with severe COPD requiring noninvasive respiratory support).
- Decannulation processes: IRCUs are considered optimal settings for decannulation, reducing ICU length of stay and associated costs. Standardized and protocolized decannulation performed by a multidisciplinary team in a monitored area with adequate nurse-to-patient ratios decreases morbidity and mortality [21]. In contrast, direct transfer of these patients from the ICU to conventional wards is associated with higher mortality and multiple complications related to tracheostomy management and inadequate nurse staffing ratios, which do not meet the specific needs of these patients [15]. During the COVID-19 pandemic, more than 60% of IRCU activity in Spain was related to step-down care involving ventilator weaning and decannulation [22].

Criteria for transfer from ICU to IRCU [17]

These criteria are designed for patients who no longer require multiorgan life support but whose respiratory failure or care complexity prevents transfer to a conventional ward. For transfer from the ICU to an IRCU, stability must be demonstrated in three domains while maintaining the need for respiratory support.

Respiratory domain (primary inclusion criterion)

The patient requires support that cannot be provided on a conventional ward:

- Extubation failure: patients requiring prophylactic or therapeutic NIV because of high risk of reintubation.
- Difficult or prolonged weaning from mechanical ventilation: patients with tracheostomy requiring slow weaning protocols who still need partial mechanical ventilation (each center should define partial ventilation according to its own experience, within safety and efficiency parameters).
- Continuous or intermittent NIV requirement: patients with significant hypercapnia ($PaCO_2$ >45 mmHg) or hypoxemia requiring high FiO_2 (>40%) or HFNC after resolution of the critical phase. As a general guideline, patients with a PaO_2/FiO_2 ratio between 100 and 200 are most likely to benefit, although criteria should be individualized.
- Secretion management: inability to independently manage secretions, requiring frequent suctioning (>2 episodes/h) or MI-E with high nursing or physiotherapy demand.

Hemodynamic domain (mandatory stability)
- Absence of shock: systolic blood pressure >90 mmHg or mean arterial pressure >65 mmHg.
- No vasoactive drugs: patients should not require norepinephrine, dobutamine, or other vasoactive agents. Minimal doses may be acceptable in highly specialized units, although the general rule is complete withdrawal.
- Controlled arrhythmias: absence of malignant arrhythmias or hemodynamically significant arrhythmias during the previous 24 h.
- Cardiac monitoring: basic ECG monitoring is generally required. Advanced invasive hemodynamic monitoring, such as pulmonary artery (Swan–Ganz) catheterization, is usually not indicated in IRCUs, although arterial line monitoring may be available in selected, more experienced units. Emerging noninvasive hemodynamic monitoring techniques may further expand monitoring capabilities in the future.

Neurological and metabolic domain
- Adequate level of consciousness sufficient to protect the airway. In tracheostomized patients, lower consciousness scores may be acceptable if the airway is secured, following individualized safety assessment.
- Absence of intracranial hypertension or need for advanced neurologic monitoring.
- No uncontrolled psychomotor agitation requiring deep intravenous sedation.
- Absence of extrarespiratory organ failure.
- Stable renal function: no requirement for continuous renal replacement therapy. Intermittent hemodialysis may be acceptable following multidisciplinary assessment, particularly when respiratory involvement predominates.
- No active severe bleeding or severe paralytic ileus.
- No need for imminent major surgery or exclusive end-of-life palliative care.

Table 3 summarizes the main clinical care processes in the IRCU for common respiratory conditions, including criteria for IRCU admission, escalation to ICU, and step-down to conventional wards or home-based care.

Integrated patient flow model

The IRCU serves as a dynamic pivot within the continuum of care, bridging the community, the emergency department, intensive care, conventional wards, and post-acute settings such as day hospitals or home hospitalization. Coordination with the ICU is bidirectional and guided by established protocols based on the criteria stated in Table 3.

The IRCU operates under a formalized multidisciplinary governance structure, coordinating with Cardiology, Infectious Diseases, Anesthesiology, Hematology-Oncology, Palliative Care, and central support services such as Radiology and Respiratory Therapy. Allied specialists – including Rehabilitation, Physiotherapy, Nutrition, Mental Health, Social Work, and Speech Therapy – are integrated through structured care pathways and regular multidisciplinary meetings. Clear roles, responsibilities, and coordination protocols ensure that all specialties contribute effectively to patient care during the IRCU stay and support continuity of care after discharge.

The organization and functioning of the IRCU rely on structured ward rounds with defined short- and medium-term objectives, as well as regular clinical sessions. Safety rounds should be conducted at least twice yearly. A multidisciplinary committee reviews complex cases, ensures adherence to therapeutic plans, defines therapeutic ceilings, addresses do-not-intubate orders, and includes representation from all relevant specialties, thereby ensuring comprehensive and coordinated patient care.

Finally, continuity of care after IRCU discharge is carefully structured to ensure patient safety and optimal recovery. In most cases, patients are first transferred to conventional wards, where their clinical status continues to be monitored. Coordination with outpatient respiratory clinics, home hospitalization programs, and primary care remains essential to support ongoing management.

The integrated flow model, illustrated in Fig. 2, highlights the unit's pivotal role in early admission, accelerated weaning, seamless step-down care, and coordinated escalation to ICU when necessary. Multidisciplinary governance, standardized procedures, and structured care pathways ensure high-quality care, continuous monitoring, and safe discharge planning, thereby supporting optimal patient outcomes throughout the respiratory care trajectory.

IRCU as functional management units

Conceptual framework of the Intermediate Respiratory Care Unit

IRCUs represent a specific level of care dedicated to the management of semicritical respiratory patients [1,23]. Their configuration

Table 3
Clinical care processes in the IRCU.

Clinical condition	IRCU admission criteria	Escalation to ICU criteria	Discharge criteria (ward/home)
Respiratory sepsis	Acute respiratory failure requiring HFNC or NIV, with relative hemodynamic stability and no established multiorgan failure; no immediate indication for intubation [18,19]	Development of shock (persistent hypotension, increasing vasopressor requirements), deterioration in consciousness, or failure of HFNC/NIV with progressive hypoxemia or acidosis [18]	Hemodynamic stability without vasopressors, withdrawal or clear step-down from HFNC/NIV, clinical and inflammatory improvement, and ability to complete antibiotic therapy on the ward or at home [18,19]
Respiratory distress (ARDS without intubation)	Moderate-to-severe hypoxemia requiring HFNC or NIV, patient conscious and cooperative, without shock or immediate need for intubation [18]	Increased work of breathing, inability to maintain oxygenation targets with noninvasive support, exhaustion, altered consciousness, or hemodynamic instability requiring intubation [18]	Significant reduction in FiO_2 and flow requirements, transition to conventional oxygen therapy with near-normal respiratory rate and no accessory muscle use, allowing transfer to a Pulmonology/Internal Medicine ward [18,19]
Pulmonary embolism (PE)	Intermediate-high or intermediate-low risk PE with high thrombotic burden [18]	Hypotension, signs of shock, recurrent syncope, or acute worsening of right ventricular function indicating need for fibrinolysis or advanced support [18]	Sustained hemodynamic stability, adequate oxygen saturation with low-flow or no supplemental oxygen, controlled pain, and stabilized anticoagulation, allowing continuation of care on the ward or at home with follow-up [18,19]
COPD exacerbation	Exacerbation with respiratory acidosis or significant hypercapnia requiring NIV, cooperative patient, without imminent respiratory arrest or shock [12,18,20]	NIV failure (persistent or worsening acidosis, rising $PaCO_2$, somnolence, extreme agitation, or poor tolerance), severe arrhythmias, or shock requiring intubation [18,20]	Normalization or clear improvement in pH and $PaCO_2$, safe progressive withdrawal from NIV, stability on conventional oxygen therapy, optimized inhaled treatment, and discharge education [12,20]
Asthma exacerbation	Severe acute asthma with persistent dyspnea after initial treatment, requiring close monitoring and possible HFNC/NIV, without major alteration in consciousness [18]	Rapid deterioration despite maximal treatment, inability to speak, extreme fatigue, progressive hypercapnia, or decreased consciousness indicating need for intubation [18]	Controlled exacerbation with near-normal respiratory rate, adequate oxygen saturation on low-flow oxygen or room air, and a clear maintenance/self-management plan before transfer to the ward or discharge [12]
Immunocompromised patient (pneumonia/infiltrates)	Hypoxemia requiring HFNC or NIV in a hemodynamically stable or minimally supported immunocompromised patient at high risk of deterioration, without immediate indication for intubation [18]	Acute respiratory deterioration requiring intubation (worsening blood gases, exhaustion, altered consciousness) or development of septic shock/multiorgan failure [18]	Clinical and radiologic improvement, progressive withdrawal of noninvasive respiratory support, manageable oxygen therapy on the ward or at home, and stabilized antimicrobial treatment [18,19]
Pulmonary fibrosis/interstitial lung disease (exacerbation)	Acute exacerbation with significant hypoxemia requiring HFNC or NIV, no immediate need for intubation, and clearly defined therapeutic goals and escalation limits [18,19]	If aggressive management is indicated: failure of noninvasive support with severe hypoxemia or clinical deterioration requiring intubation; if intubation is not planned, escalation should focus on intensifying palliative care [18]	Stabilization of dyspnea and oxygenation with requirements compatible with ward- or home-based care, and a follow-up plan involving the interstitial lung disease unit and palliative/primary care according to prognosis [18,19]

as a functional management unit responds to the need to establish a specific care model with organizational autonomy and clinical leadership within hospital care pathways [10,19,24]. The functional definition of the IRCU provides clarity in patient flow, facilitates standardization of admission and discharge criteria, and allows efficient planning of human and technological resources according to patient complexity [20,25].

Additionally, this model responds to a contemporary paradigm of hospital care based on the following principles:

- Risk stratification.
- Stepped levels of care.
- Proactive clinical management.
- Efficiency and safety.

Therefore, the configuration of the IRCU as a functional management unit is not an optional organizational model but rather a structural necessity for any hospital caring for respiratory patients with clinical complexity.

Reference models in intermediate care

Intermediate care units are not exclusive to the respiratory field. Multiple specialties have developed intermediate care structures that bridge the gap between conventional hospitalization and critical care for semicritical patients.

Coronary care units and stroke units are well-established examples managing patients with acute syndromes without invasive mechanical ventilation. These units operate with continuous monitoring, specific protocols, and clearly defined admission criteria. Their success is reflected in reduced in-hospital mortality, standardized clinical management, and optimized use of ICU beds. They function with specific nurse-to-patient ratios, ensuring patient safety without the need for sedation or advanced life support.

Recent studies have confirmed their effectiveness in both clinical outcomes and operational efficiency, consolidating their role within modern cardiologic and neurologic care [25,27–29]. Functional organization includes stable multidisciplinary teams, time-sensitive protocol-based care, and direct coordination with different hospital services, all of which have been essential to their consolidation as a quality standard in European and North American healthcare systems.

Anglo-Saxon and Scandinavian healthcare systems have developed Intermediate Care Units (IMCUs) or High Dependency Units (HDUs) for semicritical patients requiring intensive monitoring without invasive ventilation or deep sedation. These units operate with functional independence and nurse-to-patient ratios ranging from 1:2 to 1:4 and have demonstrated reductions in ICU overcrowding while improving stepped-care delivery [30,31].

These models share common structural principles with IRCUs: precise definition of the target population, functional autonomy, staffing proportional to intermediate complexity, and an approach

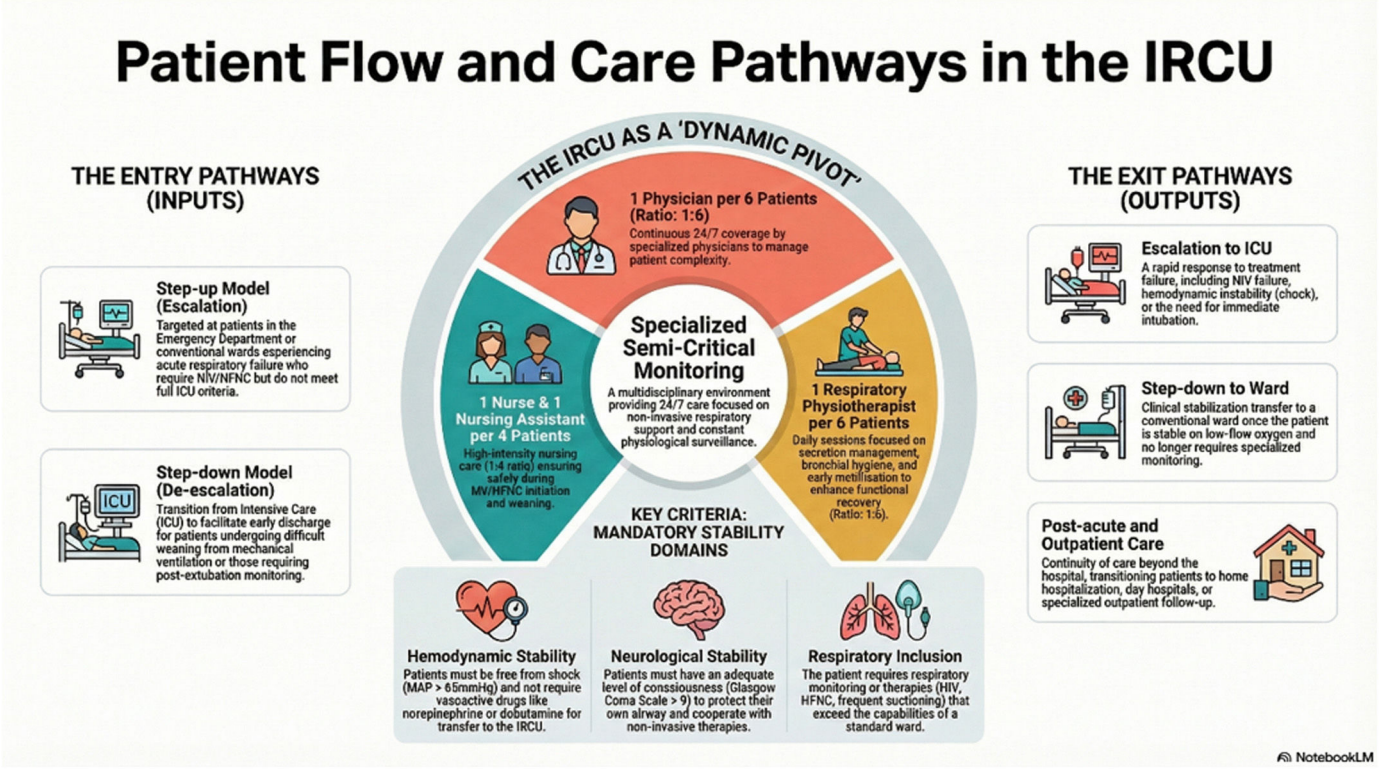

Fig. 2. Integrated patient flow within the IRCU. The diagram illustrates the IRCU as a central pivot connecting the community, emergency department, ICU, conventional wards, and post-acute care settings.

oriented toward clinical anticipation. Their consolidation has been supported by both clinical evidence and operational efficiency.

Impact of the IRCU as a functional unit

From a healthcare management perspective, the functional model enables the development of a specific set of activity, efficiency, and outcome indicators that ensure process traceability and facilitate impact evaluation in terms of care value and system efficiency [32].

In this regard, available studies have shown that implementation of functional IRCUs is associated with a significant reduction in ICU admissions among patients with moderate respiratory failure, without compromising clinical outcomes or patient safety [10,33]. To standardize measurement of these outcomes, this document includes a dedicated chapter defining the indicators considered most representative and with the greatest measurement capacity.

From an economic standpoint, the IRCU model offers a highly favorable cost-effectiveness profile. Several studies have documented that patient care in IRCUs reduces utilization of high-complexity resources without compromising clinical safety. In a retrospective observational study conducted at a Spanish tertiary hospital (*Fundación Jiménez Díaz*), IRCU care significantly reduced cost per patient, amounting to €1574 per episode compared with €5869 for patients with similar clinical characteristics managed in the ICU. Moreover, no differences in in-hospital mortality were observed between the two groups, reinforcing the hypothesis that appropriate patient selection optimizes both the clinical and economic performance of IRCUs [34].

These findings are consistent with more recent experiences during the SARS-CoV-2 pandemic, in which the estimated cost per bed-day was €164 in the IRCU compared with €696 in the ICU, resulting in cumulative savings exceeding €200,000 over only 2 months of operation [35]. This cost differential is explained not only by lower staffing requirements and greater specialization but also by shorter lengths of stay, reduced pharmacologic resource consumption, and lower logistical complexity, all of which contribute to sustainability.

Economic analysis should not be limited to direct costs alone but should also incorporate a comparative perspective of different funding models and return on investment, as summarized in Table 4. Furthermore, the efficiency of IRCUs cannot be assessed exclusively in monetary terms. There are nonmonetized organizational and care-related benefits – such as improved continuity of

Table 4
Comparison of financing models.

DRG-based model	Public hospitals (fixed budget)
Savings translate into direct financial benefit	Savings translate into released capacity
Incentives aligned with efficiency	System value outweighs direct economic value
Calculated ROI is applicable	ROI should be interpreted as social value and improved patient flow

ROI, return on investment; DRG, diagnosis-related groups.

Table 5
Nonmonetized factors.

Factor	Organizational and care impact
Improved patient satisfaction	Enhanced perceived quality of care and continuity
Reduced ICU staff burnout	Improved staff well-being and workforce sustainability
Increased ICU availability for emergencies	Greater capacity to respond to time-critical cases
Reduced surgical waiting lists	Improved operating room scheduling and throughput
Improved control of nosocomial infections	Reduced cross-contamination and hospital-acquired infections

Table 6
Steps for implementing an IRCU as a functional unit.

Phase	Key objectives	Main actions	Expected outcomes
1. Needs assessment	Identify local respiratory care demand	Analysis of admissions for COPD, pneumonia, asthma, and postsurgical patients; estimation of candidates for NIV/HFNC	Initial sizing of the IRCU
2. Definition of the care and structural model	Determine capacity, location, and equipment	Define number of beds (4–12), proximity to ICU or postanesthesia care areas, and minimum technological equipment (monitors, NIV, HFNC)	Structurally viable and adequately equipped unit
3. Functional organization	Establish clinical governance and multidisciplinary coordination	Pulmonology leadership, specific nursing training, coordination with physiotherapy, pharmacy, and social work, and 24-h medical coverage	Specialized and cohesive team
4. Admission and referral protocols	Ensure appropriate use and smooth patient flow	Define clinical and functional criteria, step-up (ED/ward) and step-down (ICU) pathways, and integration into triage systems	Efficient utilization of critical care resources
5. Information systems and indicators	Ensure traceability and quality	Integration of templates into the EHR, recording of indicators (mortality, readmissions, length of stay, costs), and periodic audits	Continuous monitoring and improvement of care
6. Sustainability and scalability	Ensure medium- and long-term viability	Inclusion in regional strategic plans, adaptation for smaller hospitals, national accreditation, and budget recognition	Consolidated, replicable, and sustainable model

care, reduced ICU burden, and higher satisfaction among patients and healthcare professionals – which are detailed in Table 5.

Clearly defining the structure and functions of the IRCU allows inclusion of staffing, technology, and maintenance needs in the hospital's annual budget. This facilitates justification of the necessary resources to hospital management and enables integration of the unit into hospital financing models, ensuring greater long-term stability and sustainability.

In high-demand scenarios (seasonal pressure, complex chronic respiratory diseases, or epidemic crises), the functional IRCU has proven to be an effective and cost-efficient resource [18].

Functional design enhances patient safety and quality of care by standardizing processes and ensuring continuity of complex respiratory care. Additionally, it allows formation of stable, specialized teams in noninvasive ventilation, oxygen therapy, and respiratory monitoring, thereby increasing the unit's problem-solving capacity and fostering a culture of clinical excellence, operational efficiency, and commitment to outcomes [19,23,36,37].

Implementation of the IRCU as a functional unit across healthcare systems

Implementation of an IRCU as a functional management unit must be adapted to the organizational, clinical, and economic characteristics of each healthcare system.

Experience from different healthcare systems allows the proposal of a structured 6-phase implementation strategy adaptable to all hospital levels, summarized in Table 6.

Needs assessment and clinical workload analysis

The first step is to define the potential demand for patients who would benefit from admission to the IRCU [1,37]. It is also essential to estimate the volume of patients likely to require NIV, HFNC, or advanced monitoring. Recent studies estimate that approximately 10–15% of hospitalized respiratory patients could benefit from IRCU admission, a figure that may reach 25% in referral hospitals with high respiratory complexity [32].

Definition of the care and structural model

Once the target population has been identified, the unit's structural and operational model should be designed according to the hospital's size and complexity. The literature suggests that 4–12 beds provide an optimal balance between efficiency, quality control, and operational sustainability, although the appropriate unit size should ultimately be adapted to institutional context, case mix, and patient complexity [23]. Units that are too small risk underutilization or higher per-patient costs, whereas overly large units may dilute functional specificity and complicate clinical governance. Strategic placement near the ICU or postanesthesia care areas, together with integration within the Pulmonology service, is recommended to facilitate coordination, streamline patient flow, and ensure rapid access to critical support when needed.

Functional organization and strategic leadership

The success of the model largely depends on specialized clinical leadership under the direct responsibility of the Pulmonology department, with formal competencies in critical care and advanced respiratory support. Medical coverage should be guaranteed 24 h a day, 7 days a week, either through onsite staffing in large hospitals or through mixed models with telemedicine support in smaller or rural hospitals in coordination with the ICU or Anesthesiology departments [37,38]. Multidisciplinary coordination with other services – including Endocrinology, Otolaryngology, Hospital Pharmacy, Social Work, Clinical Psychology, Anesthesiology, ICU, and Emergency Medicine – is essential to ensure patient-centered care and proactively address complex needs.

Admission, referral, and care flow protocols

Definition of structured and homogeneous admission criteria is essential to ensure appropriate utilization of the unit. Protocols should clearly define bidirectional referral flows with the ICU and Anesthesiology departments, as well as with the emergency department and other services that may require IRCU support to avoid unnecessary ICU admissions (step-up model). These pathways should align with triage systems, include dedicated electronic templates, and ensure immediate access to diagnostic tests [18,39].

Information systems, quality indicators, and continuous improvement

An IRCU should be fully integrated into hospital information systems to enable standardized data collection and periodic analysis

Table 7
Key research domains and activities in IRCU.

Area	Contribution of the IRCU as an independent research unit	References
Clinical and translational research	Heterogeneous respiratory patient population (COPD exacerbations, hypoxemic respiratory failure, postoperative thoracic complications, neuromuscular disorders, and complex tracheostomized patients) suitable for real-world observational studies and clinical trials	[28]
Data quality and multicenter research	Standardized monitoring and ventilatory support protocols enabling systematic collection of high-quality clinical and physiological data and the development of robust multicenter databases	[2,10,59]
Technological innovation	Optimal setting for validation of NIV, HFNC, multiparametric monitoring, imaging techniques, and artificial intelligence-based and telemonitoring solutions with direct clinical applicability	[34,41,42,47,55–57]
Health outcomes and healthcare management	Assessment of the impact of IRCU on ICU admission reduction, hospital mortality, resource optimization, and quality of care	[27,47,58,59]
Training and educational research	Key environment for advanced training in ventilation and monitoring, including educational innovation and high-fidelity simulation research	[47,58,59]
Collaborative networks	Integration into national and international research networks promoted by scientific societies (ERS, ALAT, SEPAR), facilitating multicenter studies and protocol standardization	[28]
Future research directions	Development of multicenter registries, respiratory failure biomarkers, big data analytics, personalized medicine, and digital health strategies	–

of key performance and outcome indicators – such as risk-adjusted mortality, avoided ICU admissions, length of stay, readmissions, and costs – within a continuous improvement framework aligned with a Learning Health System and supported by standardized clinical templates and evidence-based respiratory care algorithms [14,40,41].

Sustainability, scalability, and institutional recognition

The model should consider financial feasibility and medium- to long-term sustainability, integrating into the strategic plans of both the hospital and the regional healthcare system. IRCUs may be linked to integrated care strategies for complex chronic patients, hospital bed reorganization, waiting list reduction, or high-resolution admission pathways for respiratory diseases [34,42].

In hospitals with space or staffing limitations, a mixed model may be considered in which the unit shares infrastructure with other intermediate care units while maintaining its functional respiratory specificity and ensuring availability of the resources required by its patient population [9]. It is essential that IRCUs have the necessary resources to qualify for SEPAR accreditation, which requires indicators adapted to the national healthcare system and patient needs. Achievement of this accreditation implies dedicated budget allocation, inclusion in analytical accounting models, and evaluation in terms of organizational, clinical, and economic impact.

IRCU as a platform for clinical innovation and applied research

IRCUs should also be recognized as clinical environments with high potential for knowledge generation and support of applied research in respiratory and intermediate critical care. It should be noted that this research potential is not exclusive to IRCUs, as other well-structured clinical units share comparable capacities. The differential value of IRCUs lies in the availability of specific patient populations – such as patients undergoing prolonged weaning, chronic NIV, or management of hypoxemic respiratory failure – and in the standardization of care processes, which facilitates systematic, high-quality collection of clinical and physiologic data to support observational studies, clinical trials, and multicenter initiatives.

IRCUs provide an optimal environment for evaluation of emerging technologies, including advanced ventilatory support systems, monitoring devices, digital health solutions, and artificial intelligence-based tools with direct clinical applicability. In addition, these units are particularly well suited for research in health outcomes, quality of care, resource utilization, and educational innovation.

Integration of IRCUs within national and international collaborative networks – such as SEPAR, CIBERES, REVA, and the ERS – is essential to promote multicenter research, attract competitive funding, foster innovation, and accelerate translation of knowledge into clinical practice. Research activity within IRCUs should be understood as embedded within the broader hospital ecosystem and collaborative scientific networks rather than as an autonomous function of the unit itself. This framework is more applicable to units of all complexity levels, including basic IRCUs, which can contribute meaningfully to multicenter data collection and technology evaluation without requiring independent research infrastructure.

Key research domains are summarized in Table 7.

Quality indicators in the IRCU for outcome evaluation

Consolidation of IRCUs as strategic healthcare assets requires an evaluation framework grounded in standardized quality indicators, including the general quality indicators established for conventional wards, capable of objectively quantifying clinical effectiveness, operational efficiency, and economic impact. Systematic monitoring of these indicators enables evidence-based decision-making, supports accountability in resource allocation, and strengthens integration of IRCUs within the hospital organizational model and continuum of care, as recently demonstrated in an IRCU implementing a structured quality management system [43].

To operationalize this approach, a structured indicator registry is proposed, incorporating a core data template and reference benchmarks for each metric. Routine assessment of these indicators will facilitate generation of performance reports, thereby guiding managers and clinical leaders in identifying priorities for improvement and aligning IRCU activity with institutional objectives and national quality standards.

Definition of indicators

The selected indicators (Table 8) will be developed according to the proposed model (online-only supplement), incorporating established weighting criteria and following previous experiences in IRCUs using structured quality management frameworks [43]. These indicators are organized into the following categories [44].

Table 8
Structural, process-of-care, clinical outcome, and efficiency indicators.

Indicator	Formula	Standard	Frequency	References
Structural indicators				
Average physician-to-patient ratio	Total number of admitted patients/Total number of physicians	6:1 (eventually 4:1 depending on complexity)	Monthly	[1,13]
Average nurse-to-patient ratio	Total number of admitted patients/Total number of nurses	4:1	Monthly	[1,13,40,41,60,61]
Average nursing assistant-to-patient ratio	Total number of admitted patients/Total number of nursing assistants	4:1	Monthly	[60,61]
Average physiotherapist-to-patient ratio	Total number of admitted patients/Total number of physiotherapists	6:1	Monthly	[41,55]
Percentage of monitored beds	(Number of monitored beds/Total number of IRCU beds) × 100	100%	Annual	[1]
Percentage of beds equipped for NIV	(Number of IRCU beds equipped for NIV/Total number of IRCU beds) × 100	100%	Annual	[1]
Percentage of professionals with specific NIV training	(Number of professionals working in the IRCU with specific NIV training/Total number of professionals working in the IRCU) × 100	75%	Annual	[12,17]
IRCU bed ratio per 100,000 inhabitants	Number of IRCU beds/Assigned population	3 per 100,000 inhabitants	Annual	[13,61]
Process-of-care indicators				
Percentage of patients with nutritional risk assessment	Number of patients with initial nutritional risk assessment/Total number of IRCU discharges × 100	95%	Annual	[56]
Completion of nursing admission and daily follow-up protocol	Number of patients with completed nursing admission and follow-up protocols in the IRCU/Total IRCU admissions × 100	95%	Annual	–
Delivery of the IRCU welcome protocol	Number of patients whose relatives received the IRCU welcome protocol/Total IRCU admissions × 100	95%	Annual	–
Respiratory physiotherapy sessions	Number of IRCU patients receiving at least 5 respiratory physiotherapy sessions per week/Total IRCU admissions × 100	>95%	Annual	–
Percentage of discharges with a specific IRCU report	Number of patients with a specific IRCU discharge report/Total IRCU discharges × 100	95%	Annual	–
Clinical outcome indicators				
IRCU mortality	Number of patients who died/Total IRCU admissions × 100	<8%	Annual	[30,34,41,57]
Early ICU readmission from the IRCU	Number of patients discharged from ICU to IRCU who are readmitted to ICU within <72 h/Total ICU-to-IRCU discharges × 100	<6%	Annual	[30,34,41,57]
Early hospital readmission	Number of patients readmitted within 30 days after IRCU discharge/Total IRCU discharges × 100	<10%	Annual	[58]
NIV failure rate	Number of IRCU patients transferred to ICU/Total IRCU admissions × 100	<10%	Annual	–
Early recannulation rate	Number of patients recannulated within <96 h/Total number of decannulated patients in the IRCU × 100	<5%	Annual	–
Average waiting time for IRCU admission	Number of patients admitted to the IRCU within <4 h from referral/Total IRCU admissions × 100	90%	Annual	–
Facial pressure ulcer rate	Number of IRCU patients developing facial pressure ulcers/Total IRCU admissions × 100	<5%	Annual	[59]
Percentage of ICU-to-IRCU discharges	Number of ventilatory failure patients discharged from ICU to IRCU/Total ICU ventilatory failure discharges × 100	>90%	Annual	–
Efficiency and management indicators				
IRCU admissions grouped by DRG	Number of IRCU admissions grouped by DRG/Total IRCU admissions × 100	>95%	Monthly	–
Average length of stay	Total hospitalization days in the IRCU/Number of monthly discharges	<7 days	Monthly	[47,58,59]
Occupancy index	Patient bed-days in the IRCU (Number of operational beds × 365) × 100	60–80%	Monthly	–

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Structural indicators

These indicators evaluate the physical, technological, and competency-related resources of the IRCU, including human resources, monitoring capacity, and equipment. Their purpose is to ensure that the unit has the necessary infrastructure to provide advanced respiratory support safely.

- Mean nurse-to-patient ratio.
- Mean physician-to-patient ratio.
- Mean physiotherapist-to-patient ratio.
- Percentage of beds equipped with monitoring systems suitable for NIV.
- Percentage of beds equipped with NIV devices.
- Percentage of professionals with specific training in NIV.
- Number of IRCU beds per 100,000 inhabitants.

Care process indicators

These indicators measure adherence to protocols and the quality of routine clinical practice, including admission procedures, follow-up, physiotherapy, and communication with families. Their

purpose is to reduce variability in care delivery and ensure systematic and reproducible management.

- Percentage of patients undergoing nutritional risk assessment.
- Compliance with nursing admission and daily follow-up protocols.
- Percentage of families receiving the IRCU welcome protocol.
- Percentage of patients receiving the minimum recommended number of weekly respiratory physiotherapy sessions.
- Percentage of discharges including a specific IRCU clinical report.

Clinical outcome indicators

These indicators quantify the impact of the IRCU on patient prognosis, safety, and clinical stability. Their purpose is to objectively measure effectiveness of care and facilitate early detection of risk areas.

- IRCU mortality rate.
- Early ICU readmission rate.
- Early hospital readmission rate after IRCU discharge.
- NIV failure rate (transfer from IRCU to ICU due to NIV failure).
- Early recannulation rate.
- Mean waiting time from referral to IRCU admission.
- Rate of facial pressure ulcers.
- Percentage of ICU patients with ventilatory failure discharged to the IRCU.

Efficiency and management indicators

These indicators analyze the relationship between resource consumption and the clinical value generated, including occupancy, length of stay, patient flow, and case complexity. Their purpose is to optimize operational use of the IRCU within the hospital and support its contribution in terms of cost-effectiveness.

- Percentage of IRCU admissions grouped by DRG.
- Mean length of stay in the IRCU.
- IRCU occupancy rate.

Definition of the measurement system and reporting frequency

Measurement of indicators in the IRCU must be based on a standardized framework that ensures comparability and validity. Each indicator should include a precise definition, calculation formula, data source (electronic health record, hospital discharge database, nursing records, monitoring systems), unit of measurement, and target population. Integration into the electronic health record through structured templates and mandatory fields enables automated data capture, reduces errors, ensures traceability, and facilitates multicenter analysis.

The optimal reporting frequency should balance timeliness and robustness:

- Monthly reporting should include activity indicators (admissions, occupancy, admission/discharge ratio) and process indicators (NIV or HFNC initiation, protocol adherence, safety checklists), together with minor complications.
- Quarterly reporting should include analysis of clinical outcomes (risk-adjusted mortality, early readmissions, NIV failure), efficiency indicators (avoided ICU admissions, adjusted length of stay), and major complications.
- Annual reporting should evaluate strategic outcomes, temporal trends, intercenter benchmarking, and the impact on ICU workload and overall cost-effectiveness.

Data quality should be ensured through cross-validation with external databases, internal audits, and oversight by a designated quality manager responsible for detecting inconsistencies and initiating corrective actions. Periodic reports must be shared with the clinical team and discussed in multidisciplinary meetings so that the information generated becomes a driver of organizational change. This measurement and reporting framework aligns the IRCU with the principles of a Learning Health System, transforming routine monitoring into a tool that improves clinical outcomes, optimizes resource utilization, and strengthens governance [45,46].

Follow-up reports

Preparation of follow-up reports in the IRCU represents the operational mechanism through which data are transformed into a tool for management and continuous improvement. To ensure applicability across different healthcare settings, this model should be structured in a tiered manner according to the complexity level of the unit.

All levels should incorporate a mandatory core framework to ensure quality of care and patient safety, including systematic monitoring of key indicators and implementation of essential clinical-organizational algorithms, such as admission and discharge criteria, escalation protocols (IRCU-to-ICU), definition of respiratory support failure, and recording and analysis of adverse events and device-related complications [47,48].

Building on this common foundation, higher-complexity units may integrate advanced analytical tools, including risk-adjusted indicators, predictive models of respiratory support failure (e.g., HACOR and ROX indices), interhospital benchmarking, and business intelligence systems with real-time dynamic dashboards [49]. Reports should follow a standardized structure including an executive summary, analysis of key indicators, interpretation of trends, and proposed improvement actions. Recommended reporting frequency is monthly for process and activity indicators, quarterly for clinical outcomes and efficiency indicators, and annually for strategic evaluation, including cost-effectiveness analyses and external benchmarking [50].

Within a model aligned with the concept of a Learning Health System, reports should be explicitly linked to improvement plans with assigned responsibilities, defined timelines, and monitoring metrics, thereby ensuring a continuous cycle of evaluation, intervention, and reassessment [51].

Conclusions

IRCUs have become an essential link between conventional hospital wards and intensive care units, providing specialized management for semicritical respiratory patients. Their evolution has been driven by advances in NIV, HFNC therapy, and continuous monitoring, with the COVID-19 pandemic highlighting their strategic value. Beyond their clinical role, the configuration of IRCUs as functional management units is fundamental to ensuring organizational clarity, efficient patient flow, and optimal resource allocation.

This model enables standardization of admission and discharge criteria, supports multidisciplinary teamwork, and facilitates integration of the unit within hospital care pathways. Implementation of robust management strategies and systematic use of quality indicators – including structural, process, clinical outcome, and efficiency metrics – are essential for evaluating performance, guiding continuous improvement, and demonstrating the value of IRCUs within the healthcare system.

Ongoing efforts by scientific societies such as SEPAR to define evidence-based standards and promote accreditation will be crucial for consolidating IRCUs as sustainable, high-impact units. The

future success of IRCUs will depend on multidisciplinary collaboration, continuous professional development, and integration of innovative technologies, thereby ensuring their continued contribution to excellence in respiratory care.

Conflict of interests

The authors state that they have no conflict of interests.

Appendix A. Supplementary data

Supplementary data associated with this article can be found in the online version available at https://doi.org/10.1016/j.arbres.2026.05.007.

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