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Service Delivery

Out-of-Hours Service Models for Acutely Deteriorating Respiratory Patients: A Scoping Review

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Abstract

Background

Acute respiratory deterioration in hospitalised patients requires timely intervention to prevent further clinical decline. Out-of-hours respiratory care is typically provided through on-call physiotherapy rotas, extended hour cover, or 24/7 on-site services. However, models of care vary widely internationally, and little is known about how these services are structured, delivered, and evaluated for acutely deteriorating respiratory patients.

Objectives

To map and describe international models of care for out-of-hours services for acutely deteriorating respiratory patients, including key model characteristics, workforce configurations, referral processes, reported barriers and facilitators, and associated outcomes.

Methods

A scoping review was undertaken following the Joanna Briggs Institute and PRISMA-ScR guidance. This included a comprehensive search of electronic databases and grey literature. Papers were included if they reported models of out-of-hours care relevant to respiratory physiotherapy or multidisciplinary care for patients with acute respiratory deterioration. Data were extracted independently by four reviewers and synthesised descriptively using a narrative approach.

Results

Thirteen international papers published between 2002 and 2023 were included. The majority (77%) described out-of-hours physiotherapy models; others reported extended hours or multidisciplinary rapid response teams. Operating hours, referral processes, and protocols varied widely, with many services relying on non-specialist physiotherapists for out-of-hours provision. Barriers to service provision included staffing limitations, variability in competence, and organisational challenges. Facilitators included presence of senior support, structured training, protocols, and institution support for extended hours models. Evidence on clinical outcomes was limited and heterogeneous.

Conclusions

Out-of-hours care for acutely deteriorating respiratory patients is delivered through a range of models internationally, with considerable variation in structure and workforce configuration. Further research is needed to evaluate model effectiveness, impact on staff well-being, and relevance to evolving workforce demands.

INTRODUCTION

Out-of-hours respiratory care involves the delivery of time-sensitive interventions outside routine clinical hours and is typically provided through respiratory physiotherapy-led out-of-hours rota.[1] This model often covers evenings, overnight periods, and occasionally weekends, depending on local service design. Respiratory physiotherapy plays a critical role in supporting patients whose respiratory needs require timely intervention that cannot be safely deferred until standard business working hours.[2] Interventions include chest clearance, positioning, adjuncts to increase lung volumes, non-invasive support, and suctioning.[3,4] Interventions are tailored to individual patients to optimise respiratory function and mitigate clinical deterioration.

Internationally, out-of-hours respiratory care is delivered through a range of models, including traditional out-of-hours services where physiotherapists are contacted as needed,[1] extended hours service with physiotherapists on-site beyond standard hours,[5] and in some settings multidisciplinary rapid response teams provide respiratory care out-of-hours.[6] Many out-of-hours services rely on specialist and non-specialist physiotherapists,[2] resulting in variation in the quality and confidence of care delivery due to infrequency of out-of-hours shifts and the challenges of working outside of their usual practice areas. While training initiatives including simulation[7] have been developed to address these issues, concerns remain around staff confidence, stress, and model sustainability.

Despite the time-sensitive nature of these interventions and the vulnerability of the patient group, there is limited formal guidance outlining how out-of-hours respiratory care should be organised, staffed, or delivered. While the Chartered Society of Physiotherapy (CSP) published a toolkit[8] in 2025 to support the redesign of on-call services, this resource offers principles rather than prescriptive national standards. As a result, services have developed in isolation, leading to wide variation in model structure, workforce configuration, and clinical governance. The lack of national or international consensus on what constitutes safe and effective out-of-hours respiratory physiotherapy further complicates efforts to evaluate impact on clinical outcomes, staff wellbeing, and service sustainability.

This scoping review aimed to explore and describe the models of care for out-of-hours services that are currently being implemented internationally for acutely deteriorating respiratory patients. The term "out-of-hours" is used as an umbrella term to describe services delivered outside standard working hours, recognising that definitions and terminology vary. The review sought to identify key model characteristics, including operating hours, referral processes, workforce arrangements, and the use of protocols or guidelines, and to explore how these models may support staff confidence, patient outcomes, and workforce sustainability.

METHODS

STUDY DESIGN

Scoping review methodology was adopted to systematically explore international models for out-of-hours care of acutely deteriorating respiratory patients. This approach was chosen to examine the breadth and nature of evidence available on this topic and to identify key concepts, gaps, and areas for future research. The review followed the methodological framework proposed by Arksey and O'Malley,[9] further refined by Levac *et al*,[10] and adhered to the updated guidance from the Joanna Briggs Institute (JBI) for conducting scoping reviews.[11]

A protocol was developed *a priori* to guide the review process and ensure methodological transparency. The protocol was prospectively registered on the Open Science Framework and is publicly available at https://osf.io/mbq7j.

ELIGIBILITY CRITERIA

Papers were included if they reported on models of care, service delivery approaches, or multidisciplinary interventions aimed at managing acutely deteriorating respiratory patients out-of-hours in any healthcare setting. International papers were included regardless of healthcare system structure as there may be adaptations that would be applicable to UK healthcare systems. All study designs, including qualitative, quantitative, and mixed-methods research were included. Only English-language publications were included due to resource constraints.

INFORMATION SOURCES AND SEARCH STRATEGY

A three-step search strategy was utilised in this review. First, an initial limited search of MEDLINE (via PubMed) and CINAHL (via EBSCO) was undertaken to identify relevant articles and refine the search terms. Keywords and index terms from the titles and abstracts of retrieved papers were analysed to inform the development of a full search strategy. The full strategy was then adapted and applied across all included databases and information sources. Databases and search terms are in Appendix 1.

STUDY SELECTION

All search results were imported into Rayyan,[12] a platform for systematic review management. Duplicates were removed, and titles and abstracts screened independently by two reviewers against the inclusion criteria. Full-text articles were retrieved and assessed for eligibility. Discrepancies were resolved through discussion or consultation with a third reviewer.

DATA EXTRACTION

The data extraction form was developed and piloted prior to full data extraction by all four independent reviewers. Extracted information included author(s), year of publication, country, study design, setting, population, description of

the care model, components of multidisciplinary involvement, reported outcomes, key findings, and barriers and facilitators to model implementation.

DATA SYNTHESIS

Extracted data were synthesised descriptively using a narrative summary approach. Findings were grouped thematically by model type, operating hours, professions involved, referral processes, use of protocols or guidelines, and reported service or clinical outcomes. The review aimed to highlight both the diversity and commonalities in international approaches to out-of-hours care for acutely deteriorating respiratory patients, and to identify elements of care models that may be transferable to the UK context.

RESULTS

STUDY SELECTION

The results of the search and screening process are presented in the PRISMA flow diagram[13] (Figure 1). Thirteen papers published between 2002 and 2023 were included in this review. Studies were conducted across seven countries and comprised various designs, including trials, observational studies, audits, surveys, reviews, and guidance documents. Most focused on intensive care (ICU) settings, with two examining paediatric populations.[2,14] Full study characteristics are presented in Table 1.

MODELS OF CARE

Out-of-hours respiratory physiotherapy models were the most common, described in 10 of the 13 papers (77%), where physiotherapists were contacted as needed to provide emergency respiratory care.[1,2,14-21] Extended hours physiotherapy services were reported in one study (8%)[5] where physiotherapists were present on-site beyond standard hours to reduce reliance on out-of-hours provision. In addition, a rapid response team (RRT) model was described in one study (8%)[6] where multidisciplinary teams, including medical and nursing staff, responded to acute respiratory deterioration on a 24/7 basis. Guidance documents, such as the Association of Chartered Physiotherapists in Respiratory Care (ACPRC)[1] position statement, recommended out-of-hours respiratory physiotherapy as a minimum standard, with progression towards 24/7 cover where feasible.

HOURS OF OPERATION

Five out of thirteen papers (38.5%) provided detailed information on service operating hours. Where reported these hours varied widely depending on the model. Berney *et al*[16] defined out-of-hours physiotherapy as care provided between 21:00 and 06:00. Devroey *et al*[17] described 24/7 on-site cover, with shifts running from 16:00 to 08:00 on weekdays and 12:00- 08:00 on weekends and holidays. Lim *et al*[19] reported out-of-hours shifts starting from 17:00-21:00 daily, and 21:00 to 08:00 overnight, 12:00- 17:00 on Saturdays and 08:00- 17:00 on Sundays. Thomas *et al*[20] reported an average out-of-hours shift from 16:30-08:00, seven days a week. Gustafson and Grant[5] described an extended hours model with physiotherapists on-site from 08:00-20:00 on weekdays.

REFERRAL PROCESS

Referral processes were described in seven of the thirteen papers (54%), with notable variation in approach. In most physiotherapy-led models, referrals were typically initiated by nursing or medical staff using phone or bleep systems.[15,17,18] Lim *et al*[19] described both pre-planned referrals handed over by daytime physiotherapists, and unplanned/emergency referrals initiated by medical staff. Fernando *et al*[6] reported that RRTs could be activated by any healthcare provider or family member in response to concerns about acute deterioration. Triggers for referral commonly included clinical indicators including sputum retention, dyspnoea, ineffective cough, or the need for post-extubation support.[2,6,15]

PROFESSIONALS INVOLVED IN OUT-OF-HOURS SERVICES

Out-of-hours models mostly relied on non-respiratory or general physiotherapists, often supported by senior colleagues by telephone or in-person as well as specialist physiotherapists (*n*=5,38.5%). [2,14,17,19,29] Specialist respiratory or ICU physiotherapists delivered extended hours and 24/7 physiotherapy services.[5,17] Where no physiotherapist was available, basic respiratory care tasks such as suctioning and patient positioning were undertaken by nursing staff.[16,21] In the RRT model, care was delivered by multidisciplinary teams consisting of medical staff, nurses, and respiratory therapists.[6]

PROTOCOLS AND GUIDELINES

Three of the thirteen papers reported the use of protocols (23.1%). Protocols primarily addressed service logistics, including referral method and response time, rather than clinical treatment decision-making. In a UK audit of 20 large NHS trusts in the Trent region, Dixon and Reeve reported that 16 departments had emergency duty protocols in place, 89% of which were documented in written form.[18] These protocols, often based on ACPRC Guidelines,[1] covered aspects such as referral method, expected response time, contact systems, security arrangements, and reimbursement processes. Babu *et al*[15] reported out-of-hours referrals in an ICU setting in India followed The CSP and ACPRC guidance, although no clinical protocols were described. The ACPRC guidance[1] set out recommendations for service structure and competence requirements but did not provide data on implementation outcomes. Most other papers reported reliance on individual clinical judgement, with no formal physiotherapy protocols described to guide intervention selection or delivery.[2,5,6,14,16,17,19-22]

Table 1. Study Characteristics

Author	Year	Country	Study Design	Setting	Model Type	Hours of Operation	Professions Involved	Referral Process	Protocols/ Guidelines
ACPRC[1]	2017	United Kingdom	Guidance documentation	Acute hospitals	On-call	Not applicable	Physiotherapists	Not applicable	ACRPC and CSP Standards
Babu *et al*[15]	2010	India	Single centre randomised controlled trial	ICU	On-call	Not specified	Physiotherapists	From Nurse/Doctor with specified clinical triggers	CSP/ACPRC on-call standards for referral triggers
Berney *et al*[16]	2002	Australia	Single centre case-control	ICU	On-call	21:00- 06:00	Physiotherapists/ Nurses	Not specified	Not specified
Brusco *et al*[22]	2006	Australia	Systematic review	Mixed hospital settings	On-call, weekend, and extended hours	Not specified	Physiotherapists	Not specified	Not specified
Devroey *et al*[17]	2016	Belgium	Single centre service evaluation	Acute hospital	On-call	Weekday: 16:00- 08:00 Weekend: 12:00- 08:00	ICU Physiotherapists	From Nurse/Doctor with specified clinical triggers	Not specified
Dixon and Reeve[18]	2003	United Kingdom	National audit	Acute hospitals	On-call	Not specified	Physiotherapists	Bleep/Phone	ACPRC on-call standards
Fernando *et al*[6]	2018	Canada	Single centre cohort study	Acute hospitals	Rapid Response Team	24/7	Medical, nursing, respiratory therapists	Referral from staff/ family	Not specified
Gustafson and Grant[5]	2017	United Kingdom	Single centre service evaluation	ICU	Extended Hours	08:00- 20:00 Weekdays	ICU Physiotherapists	Pre-arranged by Physiotherapist	No formal protocol
Lim *et al*[19]	2008	Singapore	Single centre retrospective study	Hospital wards	On-call	Weekdays: 17:00-21:00 Sat: 12:00-17:00 Sun: 08:00-17:00 Overnight: 21:00- 08:00	Physiotherapists	Physiotherapist and Medical Staff	Not specified
Shannon *et al*[2]	2015a	United Kingdom	Single centre randomised crossover trial	Paediatric ICU	On-call	Not specified	Respiratory specialist and non-respiratory specialist physiotherapists	Not specified	Not specified
Shannon *et al*[14]	2015	United Kingdom	Single centre randomised crossover trial	Paediatric ICU	On-call	Not specified	Respiratory specialist and non-respiratory-specialist physiotherapists	Not specified	Not specified
Thomas *et al*[20]	2023	Australia and New Zealand	Multicentre cross-sectional survey	ICU	On-call	16:30- 08:00, Seven days a week.	Physiotherapists	Not specified	Not specified
Van Der Lee *et al*[21]	2018	Australia	Multicentre cross-sectional survey	ICU	On-call	Not specified	Physiotherapists	Initiated by daytime treating physiotherapist	Not specified

Abbreviations- ACPRC: Association Chartered Physiotherapists in Respiratory Care; CSP: Chartered Society of Physiotherapy; ICU: Intensive Care Unit.

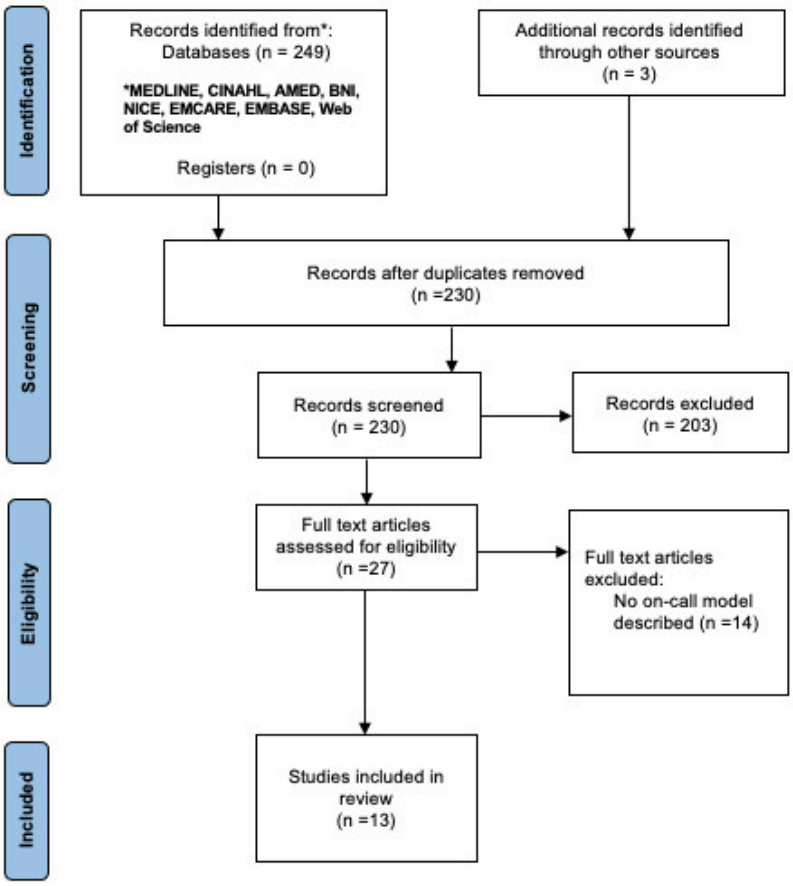

Figure 1. PRISMA flow diagram for scoping review process.[13]

OUTCOMES

Patient and service outcomes were reported in twelve of the thirteen papers (92.3%). These outcomes were variable and often secondary to descriptions of service models. Some papers reported positive clinical impacts associated with models of care, including reductions in ICU length of stay and ventilation duration, often associated with intensive or out-of-hours physiotherapy provision.[16,23] Babu *et al*[15] reported improvements in respiratory measures, including peak expiratory flow rate and six-minute walk distance, linked to out-of-hours physiotherapy. Shannon *et al*[14] found that specialist respiratory physiotherapists more frequently applied effective techniques such as combined chest wall vibration and suction, alongside greater improvements in compliance and tidal volumes, and fewer adverse events (4.8% vs 12.7%) compared to non-respiratory physiotherapists .[2]

Service level outcomes included quantifying treatments delivered out-of-hours,[17] reduced out-of-hours burden and cost savings associated with extended hours models.[5] The RRT model highlighted challenges in overnight acute care delivery, reporting higher mortality associated with nighttime activations.[6] Overall, while some papers demonstrated positive impacts, formal evaluations of effectiveness, patient centred outcomes, and long-term recovery were limited.

BARRIERS AND FACILITATORS

All included papers reported barriers and facilitators to implementing and delivering out-of-hours care for acutely deteriorating respiratory patients (Table 2). Two papers noted the difficulty of maintaining staff competence and confidence, particularly where non-respiratory physiotherapists were involved.[1,14] Staffing limitations were reported as a barrier in both research design[15] and service delivery,[5,21] contributing to concerns about consistency of service delivery and patient safety. Financial and organisational challenges were also identified, highlighting issues related to cost effectiveness and staffing sustainability.[5,17] Brusco *et al*[23] highlighted barriers, including heterogeneity of study designs and low to medium study quality, which limited conclusions about best practice models.

Facilitators of out-of-hours models of care included formal training, access to senior staff, clear protocols, adequate staffing, and organisational commitment to service quality. (Table 2). The ACPRC[1] and the UK audit by Dixon

Table 2. Barriers and Facilitators

Author	Year	Barriers	Facilitators
ACPRC[1]	2017	Challenges to maintain competency in non-specialist physiotherapists; managing fatigue, securing funding, and ensuring service robustness.	Advocates for minimum standards; structured training; clear policies; appropriate staffing and promoting service value.
Babu *et al*[15]	2010	Staffing limitations.	Use of CSP/ACPRC guidelines for referrals.
Berney *et al*[16]	2002	Lack of standardisation of clinical decision making.	Dedicated ICU physiotherapy staffing model.
Brusco *et al*[22]	2006	Study heterogeneity, low-moderate quality.	Demonstrated feasibility in some critical care subgroups (Acute spinal cord injury and high-risk elderly surgical ICU patients).
Devroey *et al*[17]	2016	Unable to assess cost effectiveness due to lack of baseline data and ethical constraints.	Dedicated ICU physiotherapy team; institutional support and positive staff perception of value.
Dixon and Reeve[18]	2003	Inconsistent adherence to protocols.	Clear protocols, training, and support from senior respiratory physiotherapists.
Fernando *et al*[6]	2018	Night-time service challenges; delays in activation, reduced staff experience, shift patterns at risk of impacting cognitive performance.	24/7 multidisciplinary team and defined activation criteria.
Gustafson and Grant[5]	2017	Staffing challenges, burnout risk.	Extended hours reduced on-call burden, organisational support
Lim *et al*[19]	2008	No evaluation of long-term outcomes or cost effectiveness.	Structured after-hours service.
Shannon *et al*[2]	2015a	Skill level having potential impact on patient outcomes.	Use of force-sensing technology for training feedback; potential for targeted education.
Shannon *et al*[14]	2015	Confidence gaps between specialist and non-specialist.	Highlighted need for targeted training.
Thomas *et al*[20]	2023	Lower staffing linked to dissatisfaction, variability in access to senior staff.	Access to senior staff. Integrated orientation and educated processes.
Van Der Lee *et al*[21]	2018	Staffing limitations, reliance on other health professionals to provide respiratory care.	Larger ICUs, more availability for on-call staff.

Abbreviations: ACPRC: Association of Chartered Physiotherapists in Respiratory Care; CSP: Chartered Society of Physiotherapy; ICU: Intensive Care Unit

and Reeve[18] highlighted the role of structured training programmes and clear policy frameworks in supporting staff competence and service delivery. Thomas *et al*[21] similarly identified access to senior ICU physiotherapists support as key enablers of safe and effective service delivery. Van der Lee *et al*[21] reported that larger ICUs with higher physiotherapy staffing levels facilitated after-hours service provision. Dedicated ICU physiotherapy teams with institutional support were identified as facilitators[5,17] alongside the use of national or professional guidelines to further support service quality.[1,15,18]

DISCUSSION

This scoping review highlights considerable variation in how out-of-hours respiratory care is structured and delivered across international healthcare systems. Models ranged from traditional out-of-hours services such as from 16:00-8:00 seven days a week, to extended working hours and 24/7 multidisciplinary teams, with operational hours, staffing configurations, and referral processes differing significantly between settings. Importantly, these models were implemented across a diverse range of hospital types, from specialist ICUs to general wards each with distinct clinical demands and workforce capabilities.

Variability is important to note and highlights the challenge of prescribing a single "ideal" model for out-of-hours respiratory care. Rather than advocating for a one-size-fits-all approach, our findings support the need for scalable and contextually adaptable service models that can evolve in response to local population needs, organisational resources, and existing workforce capacity. Future guidance may be more effectively framed around a set of core principles or standards, such as those outlined in the CSP Toolkit[8] which define the function and responsiveness of out-of-hours care, allowing for localised implementation within a flexible framework.

Barriers identified suggest a potential need for deliberate and system-level planning in designing sustainable out-of-hours respiratory services. Workforce limitations and inconsistent staff competence, particularly among non-specialist physiotherapists, raise important questions about how services can safely scale or operate in resource-constrained environments. These challenges are unlikely to be addressed through training alone and demand integrated approaches that include role clarity, protected time for skill maintenance, and flexible models of care. Applying imple-

mentation science frameworks such as the Consolidated Framework for Implementation Research (CFIR)[23] and Expert Recommendations for Implementing Change (ERIC)[24] may help organisations systematically identify and address context-specific barriers and facilitators to service implementation.

Financial and organisational barriers may also suggest that commissioning out-of-hours services should go beyond workforce inputs and consider broader questions of service value, outcome measurement, and long-term sustainability through appropriate data collection and analysis. Health economic evaluation was largely absent in the current literature and could play a critical role in informing decisions around resource allocation and service design.

A notable observation across papers was the diversity of professionals delivering out-of-hours respiratory interventions. While physiotherapists were the primary providers, responsibility for managing acute deterioration was sometimes shared with, or transferred to other health professionals, including nurses and medical staff, particularly in RRT models of multidisciplinary nature. These arrangements raise important questions about professional boundaries, role clarity, and the competencies required to deliver safe and effective respiratory care out-of-hours. Rather than focussing on the role of respiratory physiotherapy, it may be more productive to consider who is best equipped to respond to acute respiratory deterioration and under what conditions. Re-framing the issue shifts the lens from profession-specific tasks to the broader issue of system responsiveness, interdisciplinary capability and sustainability, and patient safety.

Finally, facilitators such as structured training, senior mentorship, clear protocols, and institutional support offer valuable direction for service development. However, ensuring consistent access to these enablers across diverse settings remains a challenge, particularly where staffing and financial constraints exist. Alignment of governance structures, education pathways, and quality monitoring may help promote consistent, high-quality care delivery.

CONCLUSION

This scoping review identified wide variation in out-of-hours respiratory care models internationally, reflecting differences in context, resource availability, and workforce. A single standardised model is unlikely to address the diverse needs and contextual challenges identified across settings. Future research should focus on identifying core components of safe and effective care - including staff competence, timely access, and referral clarity - and on adapting these through flexible, context-sensitive implementation. Collaboration between professional bodies, policymakers, and service leaders- including those in strategic physiotherapy roles, will be critical to enable the development of models that are evidence-informed, equitable, and sustainable in real-world practice.

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SUPPLEMENTARY MATERIALS

Appendix

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