



CLINICAL PHARMACY ASSOCIATION

Impact and value of critical care pharmacy: A round up of the evidence base

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Workforce expectations for critical care pharmacists are laid down in terms of staffing levels and level of competence as national standards. In England, an NHS service specification for critical care describes expected activities required of critical care pharmacists.

International and UK data shows an improvement in medication safety, patient safety and other outcome measures, including mortality and length of stay where pharmacists are working on critical care units, particularly where pharmacists attend multidisciplinary ward rounds.

Data from the PROTECTED study conducted in the UK shows that pharmacists can make large numbers of contributions, both in intercepting prescribing errors and in optimising therapy. The majority are graded as of 'moderate severity' impact or greater. Half the interventions were made on the MDT ward round. The intervention rate was higher at weekends compared with weekdays in those units that offered a seven day service.

Medication errors are commonly intercepted by critical care pharmacists. The interception rate is significantly higher when critical care pharmacists attend the ward round. It is likely that prescribing error rates are similar on critical care areas without pharmacists or where insufficient time is allocated to the critical care pharmacist to perform this activity, but a significant mechanism to prevent errors from reaching the patient is absent, leading to preventable patient harm.

Additionally, medicines are commonly optimised by critical care pharmacists. The optimisation rate is significantly higher when critical care pharmacists attend the ward round. In areas without an appropriately trained pharmacist the opportunity to optimise medicines in the critically ill is lost.

Pharmacists working in critical care are able to network together to produce resources that can be shared back across networks and thereby amplify their expertise to affect patient care across health care systems as well as at individual patient level.

Economic data on the impact of a critical care pharmacist comes largely from international studies. Considerable cost savings and cost avoidance are attributed to clinical pharmacist activity, with the cost per adverse drug event avoided being in the region of \$6,400.

Utilising a model that accounts for the probability (rather than certainty) of an adverse drug event being prevented by the critical care pharmacists intervention, one US hospital estimates it has avoided additional costs of \$209,000–\$280,000 from 129 interventions over a 4.5 month period in

2007, as well as direct cost savings (6 x \$10–\$100, 3 x \$101–\$1000, and 3 x cost saving of over \$1000). These costs exclude litigation claims. Forty percent of the interventions were made on the ward round and 39 percent were made from the chart review.

Whilst the data is not from the UK, it is likely that the cost avoidance and cost savings attributable to the activity of the critical care pharmacist is substantial. Some UK data is referenced in the costing statement for the NICE guideline on medicines optimisation (NG5) with a more conservative £0–£795 per adverse drug reaction avoided assigned, though the costs are based on non-elective inpatient bed day tariff (£265) rather than the daily cost of an ICU bed (c£1500).

Investment is required to increase the number of pharmacists on critical care units, to close the weekend working gap and to increase the competence of the available workforce to improve patient safety and optimise patient outcomes. National and international data shows this considerably improves economic outcomes.

**[Guidelines for the Provision of Intensive Care Services \(GPICS\), 2nd edition,](#)
Faculty of Intensive Care Medicine & Intensive Care Society, 2019**

Standards

- There must be a designated intensive care pharmacist for every critical care unit.
- The critical care pharmacist must have sufficient job time within which to do the job. There should be 0.1 whole time equivalent (WTE) pharmacist for every Level 3 bed and for every two Level 2 beds for a 5/7 a week service.
- Clinical pharmacy services should be available seven days per week. However, as a minimum, the service must be provided five days per week (Monday-Friday) with plans to extend the ward service to seven days a week before 2020.
- The most senior pharmacist within a healthcare organisation who works on a daily basis with critically ill patients must be competent to at least Advanced Stage II (excellence level) in adult critical care pharmacy.
- Other clinical pharmacists who provide a service to intensive care areas and have the minimum competencies to allow them to do so (Advanced Stage I) must have access to an Advanced Stage II (excellence-level) intensive care pharmacist for advice and referrals.
- As a minimum, the pharmacist must attend daily multidisciplinary ward rounds on weekdays (excluding public holidays).
- There must be sufficient patient-facing pharmacy technical staff to provide supporting roles.

Recommendations

- To maintain the continuity of the service during annual leave, sick leave and training leave, additional appropriate resources will be required (20% minimum is recommended).
- Intensive care pharmacists should undergo an independent, recognised process to verify competence level.
- Senior specialist intensive care pharmacist support should, preferably, be provided within the organisation but may be provided from a critical care network or on a regional basis.
- A peer-to-peer practitioner visit should occur at least once a year to ensure training issues are identified and to help maintain the competence of small teams and sole workers. This supports General Pharmaceutical Council (GPhC) revalidation.
- Where a team of intensive care pharmacists is in place, there should be a structured range of expertise, from trainee to Fellow level.
- Intensive care pharmacists are encouraged to become active independent prescribers.

Adult Critical Care service specification (170118S) D05

NHS England, 2019

- Each provider must have a designated Clinical Director/lead Consultant, matron and advanced level pharmacist for Critical Care, all of whom should be actively engaged in their local Adult Critical Care Operational Delivery Network (ODN).
- Clinical pharmacists are essential practitioners within the critical care multi-professional team and are vital to the routine delivery in critical care practice of medicines optimisation.
- Patients in Critical Care should receive twice daily ward reviews by a Consultant in Intensive Care Medicine (in line with 7-day standards) (Domains 1 and 3).
- In addition, there should be multidisciplinary 7-day input available from the extended team (e.g. microbiology, pharmacy, physiotherapy and where applicable, dietetics and speech and language).
- Clinical pharmacists supporting delivery of medicines optimisation in critical care areas must provide patient-centred care, including:
 - medicines reconciliation (on admission and discharge)
 - independent patient medication review with attendance of multi-professional ward rounds
 - professional support activities, including
 - clinical guidelines
 - medication-related clinical incident reviews
 - clinical audit and evaluation
- The provider should comply with:
 - Intensive Care Society: Levels of Care, 2009
 - Guidelines for the transport of the critically ill adult (3rd Edition)
 - Guidelines for Provision of Intensive Care Services (FICM/ICS)
- There is designated medical, nursing and pharmacy leadership (Quality Indicator; self-declared).

Adult Critical Care: Specialist Pharmacy Practice

Department of Health (England) 2005, Gateway 5122

- Junior pharmacists who regularly provide a service to critical care areas must have access to a specialist critical care pharmacist. This may be within the Trust or externally (for example, within a critical care network or equivalent).
- It is a specific recommendation of this expert group that pharmacists caring for critically ill patients should have foundation level competencies (as described in the document) as a minimum standard.
- It is also recognised that larger critical care units dealing with a wide range of complex patients will require the highest level of critical care pharmacy support.
- Annex 1: Proposed Career Pathways in Critical Care Pharmacy
- Annex 2: Specialist Competencies for Clinical Pharmacy Practice in Critical Care
- Annex 3: Core Clinical Knowledge for Advanced Critical Care Pharmacists
- Annex 4: Issues To Be Considered by Commissioners

[Quality Critical Care: Beyond Comprehensive Critical Care: A report by the Critical Care Stakeholder Forum](#)

Department of Health 2005, Gateway 5144

- Critical care capacity is not just the number of physical beds in designated critical care areas. It also includes the resources devoted to supporting actual or potentially critically ill patients away from traditional critical care units. This includes essential services such as pharmacy.
- The provision of therapeutic and diagnostic support is fundamental to the care pathway of critically ill patients. However, the roles of health professionals who work in this field are often overlooked, underestimated and under resourced. Key professions in the critical care setting include clinical pharmacy.
- Delays in treatment of critical illness are frequent, and can be crucial so there either needs to be medical staff immediately available to prescribe and ensure administration of treatments, or appropriately trained nurses and allied health professionals should be enabled to give life-saving therapies. Independent nurse prescribers and, in future, appropriately qualified pharmacists, can take responsibility for the prescribing of medications in emergency care situations and in the support of outreach services.

RELEVANT NATIONAL PUBLICATIONS

[The role of the pharmacist in the intensive care unit](#)

Journal of the Intensive Care Society, 2019; 20(2): 161-164

- An overview of the role of pharmacists in critical care intended for a non-pharmacist readership.

[Reducing medication errors in critical care patients: pharmacist key resources and relationship with medicines optimisation](#)

International Journal of Pharmacy Practice, 2018, December; 26(6): 534-540

- Consensus on the Top 5 combined medication error reduction resources was established: advanced-level clinical pharmacist embedded in critical care being ranked most important. When looking at the PROTECTED-UK cohort data, pharmacists working on units with high resources made significantly more clinically significant medicines optimisations compared to those on low-resourced units (OR 3.09; P = 0.035)

[Critical care pharmacy workforce: UK deployment and characteristics in 2015](#)

International Journal of Pharmacy Practice, 2018, August; 26(4): 325-333

- This UK survey identified widespread input by pharmacists into critical care, but that the level of input was variable and particularly infrequent at weekends. Units with pharmacists possessing more advanced levels of competence had greater input into the multi-professional ward round and other activities (such as governance/incident investigation, guideline production, education, audit, research, etc).

[PROTECTED-UK: Clinical pharmacist interventions in the UK critical care unit: exploration of relationship between intervention, service characteristics and experience level](#)

International Journal of Pharmacy Practice, 2017, August; 25(4): 311-319

- Further exploration of the PROTECTED study that concludes clinical pharmacists are essential for safe and optimised medical therapy, and to reduce prescribing errors. Adequate staffing is required. Few centres provided weekend services, although the intervention rate was significantly higher on weekends than weekdays in those centres that did provide weekend services. The presence of electronic prescribing did not make a difference to contribution rates.

[Pharmacist independent prescribing in critical care: results of a national questionnaire to establish the 2014 UK position](#)

International Journal of Pharmacy Practice. 2016, April; 24(2): 104-113

- This UK survey found over a third of pharmacists in critical care were prescribers, with over 70 percent of critical care pharmacists intending to be prescribers within three years of completing the survey.

[Impact of the introduction of a specialist critical care pharmacist on the level of pharmaceutical care provided to the critical care unit](#)

International Journal of Pharmacy Practice. 2016, April; 24(2): 104-113

- This study evaluated the impact of a dedicated specialist critical care pharmacist service on patient care in a UK critical care unit. Results showed that the quantity of individual patient contributions doubled after increasing staffing, preventing medication errors and optimising use of medicines, with no change in the control group critical care units.

[Pharmacist's Review and Outcomes: Treatment Enhancing Contributions Tallied, Evaluated and Documented \(PROTECTED-UK\)](#)

Journal of Critical Care. 2015 Aug;30(4):808-13

- This UK multicentre observational study demonstrated that both medication error resolution and pharmacist-led optimisation rates were substantial. Almost one in six prescription items required an intervention from the clinical pharmacist. The error rate (6.8 percent) was slightly lower than an earlier UK prescribing error study (EQUIP), with optimisations occurring on a further 8.3 percent of prescription items and referral to the pharmacist for advice on 1 percent of all items. Two thirds of all interventions were of moderate to high impact.

[Proactive clinical pharmacist interventions in critical care: effect of unit speciality and other factors](#)

International Journal of Pharmacy Practice. 2014 Apr;22(2) :146-54

- Clinical pharmacists with critical care training make important medication recommendations across general and specialist critical-care units. The patient case mix and admitting speciality have some bearing on the types of medication interventions made. Moreover, severity of patient illness, scope of regular/routine specialist pharmacist service and support systems provided also probably affect the reason for these interventions.

[Pharmacist proactive medication recommendations using electronic documentation in a UK general critical care unit](#)

International Journal of Clinical Pharmacy. 2012 Apr;34(2):351-7

- There was a high acceptance rate for proactive medication-related recommendations made by critical care pharmacists via the electronic review form. The majority of pharmacist recommendations were related to adding or refining currently prescribed medication. Ten percent of recommendations related to medication reconciliation of patients' pre-admission medication.

[The development of a training pack for band 7 intensive care pharmacists.](#)

Journal of the Intensive Care Society. 2014;15(2):109-12

- This paper describes the development of a training pack for band 7 intensive care pharmacists by a collaborative group, and its subsequent dissemination nationally.

[Clinical pharmacist interventions on a UK neurosurgical critical care unit: A 2-week service evaluation](#)

International Journal of Clinical Pharmacy. 2011; 33:755-758

- The results of the clinical pharmacist intervention evaluation demonstrated an important role for critical care pharmacists in the safe and effective use of medicines in a UK Neurocritical care unit.

[Management of long-term hypothyroidism: a potential marker of quality of medicines reconciliation in the intensive care unit.](#)

International Journal of Pharmacy Practice. 2012 Oct;20(5):303-6

- Medicines reconciliation was poor and long term therapy such as thyroxine therapy often not restarted. This led to harm on a number of occasions. The medicines reconciliation process became the responsibility of critical care pharmacists and was much improved.

INTERNATIONAL SUPPORTING EVIDENCE

[Benefit of incorporating clinical pharmacists in an adult intensive care unit: A cost-saving study](#)

JCPT, June 2020

- The participation of a clinical pharmacist in a multidisciplinary ICU team reduces healthcare expenditures through treatment optimisation translated into cost avoidance. This study has corroborated prior evidence that clinical pharmacist involvement in ICUs provides economic value and quality assurance in healthcare settings.

[Cost avoidance associated with clinical pharmacist presence in a medical intensive care unit](#)

JACCP 2019 December; 2(6): 610-615

- Clinical pharmacist-generated cost avoidance over a 12-month period in a medical ICU was calculated and the benefit-cost ratio was found to be 24.5:1. Day of the week but no call status affected average cost avoidance. Employing a clinical pharmacist to be part of the multidisciplinary MICU team can reduce health care expenditures through cost avoidance.

[Impact on patient outcomes of pharmacist participation in multidisciplinary critical care teams: A systematic review and meta-analysis](#)

Critical Care Medicine. 2019 Sep; 47 (9): 1243-1250

- Including critical care pharmacists in the multidisciplinary ICU team improved patient outcomes including mortality, ICU length of stay in mixed ICUs, and preventable and nonpreventable adverse drug events.

[Impact of a pharmacist intervention at an intensive care rehabilitation clinic.](#)

BMJ Open Qual. 2019 Sep;8(3):e000580.

- Clinical pharmacists undertaking medication review in an ICU follow up clinic identified that medication problems are common following critical care. Better communication of medication changes both to patients and their ongoing care providers may be beneficial following a critical care admission. In the absence of highly effective communication, a pharmacy intervention may contribute substantially to an intensive care rehabilitation or recovery program.

[The effect of a medication reconciliation program in two intensive care units in the Netherlands: a prospective intervention study with a before and after design.](#)

Ann Intensive Care [Internet]. 2018 Dec 7;8(1):19.

- Medication reconciliation by pharmacists at ICU transfers is an effective safety intervention, leading to a significant decrease in the number of medication errors on patient transfer and is cost-effective in reducing potential patient harm.

[Impact of quality bundle enforcement by a critical care pharmacist on patient outcome and costs.](#)

Crit Care Med 2018; 46:199–207

- Critical care pharmacist-led interventions were associated with decreases in ICU and hospital length of stays and ICU drug costs. The cost savings made were greater than the salary costs of the pharmacists.

[Impact of pharmacist management of pain, agitation, and delirium in the intensive care unit through participation in multidisciplinary bundle rounds.](#)

Am J Health System Pharm . 2017 Feb 15;74(4):253–62.

- The provision of proactive critical care pharmacist services directed at PAD management is an innovative approach to fostering interprofessional collaboration and optimizing clinical outcomes.

[Medication review by a clinical pharmacist at the transfer point from ICU to ward: A randomized controlled trial.](#)

J Clin Pharm Ther. 2015;40:578–83.

- The integration of a clinical pharmacist at the transfer point from ICU to ward led to a significant reduction in drug-related problems.

[Do we need a pharmacist in the ICU?](#)

Intensive Care Medicine, July 2015; Volume 41, Issue 7 Pages 1314 – 1320

[Pharmacist contributions as members of the multidisciplinary ICU team](#)

Chest. 2013 Nov;144(5):1687-95

[A systematic review of evidence-informed practices for patient care rounds in the ICU](#)

Critical Care Medicine 2013 41(8), 2015–29

[Clinical and financial impact of pharmacy services in the intensive care unit: pharmacist and prescriber perceptions](#)

Pharmacotherapy. 2013 Apr;33(4):401-10

[Interventions to reduce medication errors in adult intensive care: a systematic review](#)

Br J Clin Pharmacol. 2012 Sep;74(3):411-23

[Evaluation of the role of the critical care pharmacist in identifying and avoiding or minimizing significant drug-drug interactions in medical intensive care patients](#)

Journal of Critical Care. February 2011; Volume 26, Issue 1, Pages 104.e1–104.e6

[On-ward participation of a hospital pharmacist in a Dutch intensive care unit reduces prescribing errors and related patient harm: an intervention study](#)

Critical Care 2010, 14(5), R174

[Effects of pharmacist participation in intensive care units on clinical and economic outcomes of critically ill patients with thromboembolic or infarction-related events](#)

Pharmacotherapy. 2009 Jul;29(7):761-8

[Clinical and economic outcomes of involving pharmacists in the direct care of critically ill patients with infections](#)

Critical Care Medicine. December 2008; Volume 36 - Issue 12 - pp 3184-3189

[International critical care hospital pharmacist activities](#)

Intensive Care Medicine 2008, 34(3), 538–542

[Impact of a clinical pharmacist-enforced intensive care unit sedation protocol on duration of mechanical ventilation and hospital stay](#)

Critical Care Medicine. February 2008; Volume 36,2, pp 427-433

[Clinical pharmacy services, pharmacy staffing, and hospital mortality rates](#)

Pharmacotherapy. 2007 Apr;27(4):481-93.

[Cost implications of and potential adverse events prevented by interventions of a critical care pharmacist](#)

American Journal of Health-System Pharmacy. December 1, 2007 vol. 64 no. 23 2483-2487

[The impact of critical care pharmacists on enhancing patient outcomes](#)

Intensive Care Medicine. May 2003, Volume 29, Issue 5, pp 691-698

[The critical care pharmacist: an essential intensive care practitioner](#)

Pharmacotherapy. 2002 Nov;22(11):1484-8.

[Pharmacist participation on physician rounds and adverse drug events in the intensive care unit](#)

JAMA July 1999;282(3):267-270

[Impact of a clinical pharmacist on cost saving and cost avoidance in drug therapy in an intensive care unit](#)

Hosp Pharm. 1994 Mar;29(3):215-8, 22

[Impact of a clinical pharmacist in a multidisciplinary intensive care unit](#)

Critical Care Medicine 1994; 22:1044-1048