Telehealth in the ICU: Current insights and future directions

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Introduction

Interest in the use of telehealth in intensive care has been growing steadily as one way to respond to the rising global demand for critical care expertise (Xyrichis et al. 2021, Weiss et al. 2021). The outbreak of COVID-19 catapulted telehealth to the forefront of care delivery as a way to keep both providers and patients safe, while potentially relieving the strain on healthcare systems (Institute for Healthcare Improvement, 2023). Despite expectations, telehealth in the intensive care unit (ICU) has not yet realised its full potential. In this paper, we critically examine current insights concerning the evidence, opportunities, and challenges of telehealth in the ICU.

Defining telehealth

The term telehealth is often used interchangeably with telemedicine, though technically the former encompasses a broader range of remote activities. A universally accepted definition of telehealth applied specifically to the ICU remains elusive, which aggravates challenges concerning its development and evaluation.

Telehealth in the ICU

Typically, telehealth in the ICU includes the use of real-time or store-and-forward technology to enable remote communication among ICU clinicians, remote monitoring of patient's vital signs and data, providers' use of decision support tools, patients' health records, laboratory and diagnostics management, alerts and note sharing (Douglas et al. 2019; Weiss et al. 2021). In addition, the COVID-19 pandemic sparked a rapid uptake of telehealth innovations such as

virtual visiting to overcome the challenge of social distancing while meeting patients and families' need for social support (Rose et al., 2022).

Telehealth initiatives in intensive care are also varied in operation and integration between bedside and remote (tele) ICU teams. For example, in some telehealth initiatives the tele-ICU staff remain part of the multi-professional team participating in many aspects of care while in others their involvement is limited to remote consultation and monitoring (Kahn et al. 2019; Krupp et al. 2021).

Current insights

Evidence of effectiveness

The quantitative evidence for telehealth in ICU is increasing, but it remains plagued with quasi experimental designs that limit confident conclusions on its effectiveness. Mackintosh et al. (2016) concluded that multi-site randomised controlled trials with accompanying process evaluations are needed to confidently determine effectiveness, implementation, and associated costs of telehealth in ICU. While definitive evidence remain lacking, suggestive evidence is nevertheless promising with one non-randomised, stepped-wedge trial across 56 ICUs in the US (Lilly et al. 2014) associating telehealth with a reduction in ICU mortality (OR 0.74, 95% CI 0.68 to 0.79, $p< 0.001$). Moreover, recently Spies et al.'s (2023) randomised, stepped-wedge, cluster trial in 12 ICUs in Germany showed evidence for increased adherence to quality indicators for 'sedation, analgesia and delirium' (OR 5.32, 95% CI 3.39 to 8.35), 'ventilation' (OR 2.24, 95% CI 1.19 to 4.21), 'weaning from ventilation' (OR 9.04, 95% CI 2.70 to 30.24), 'infection management' (OR 4.39, 95% CI 1.48 to 13.03), 'enteral nutrition' (OR 1.57, 95% CI 1.03 to 2.41), 'patient and family communication' (OR 6.78, 95% CI 3.97 to 11.58), and 'early mobilisation' (OR 3.16, 95% CI 2.16 to 4.62).

Challenges of implementation

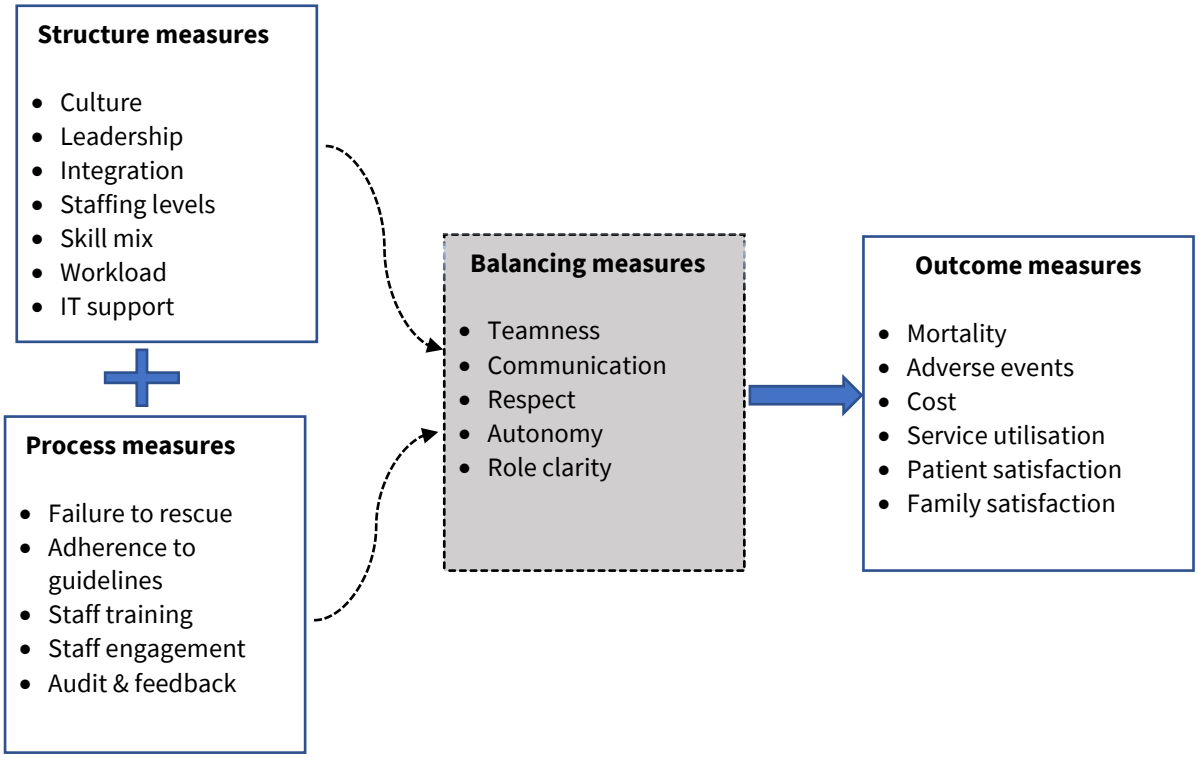
Research on the process and impact of implementing telehealth in ICU, and specifically on clinicians' working practices, has so far been inconclusive. Qualitative studies identified that lack of collaboration between bedside and remote ICU teams, complaints from bedside teams about frequent interruptions, and concerns about being watched were factors likely to compromise implementation of telehealth (Thomas et al. 2017). While the technological capabilities of telehealth evolve rapidly, such challenges are likely to persist.

Indeed, we completed a qualitative evidence synthesis (Xyrichis et al. 2021) examining the implementation of telemedicine in ICU in which we identified a range of contextual and behavioural factors influencing implementation. These included clinicians' perceptions of additional workload requirements, need for more co-ordination work, and concerns around privacy. Additional barriers to implementation related to lack of trust, role clarity, acceptance, familiarity, and effective communication between bedside and remote providers. On the other hand, interprofessional collaboration in the form of support for decision-making and mentoring of junior staff facilitated successful implementation.

Evidence gap

The above insights notwithstanding, evidence accumulation remains difficult due to inconsistent theorisation, programme evaluation, and outcome measurements (Iliopoulou and Xyrichis 2020). With a view to addressing this evidence gap and strengthening consistency in future research, we previously developed a logic model for critical care telemedicine that would be of relevance for telehealth in ICU more broadly (Xyrichis et al. 2021). Here, based on a comprehensive examination of the literature, we proposed key process, structure, balancing, and outcome measures for consideration in telehealth research (Figure 1).

Figure 1: Logic model for research in telehealth in ICU



Future directions for critical care nursing

Considering the rapid deployment of telehealth, critical care nursing has an opportunity, and responsibility, to lead on the evaluation and integration of technology with a patient-centred approach (De Raeve et al. 2017). While evidence peri-pandemic show growing acceptance of telehealth in ICU by patients and families (Xyrichis et al. 2022), implications concerning ICU nurses' workload, staffing models, and training remain relatively unexplored (Rutledge et al. 2021).

There remains a need for ICU workforce planning and modelling around telehealth to ensure patient safety and optimal resource allocation. The potential advantages of telehealth for nurses in ICU have also not been fully realised to date, such as professional development, work enhancement, career advancement, and retention of experienced workers.

In addition, future nursing research and practice insights about patient and family member preference and response to greater utilisation of telehealth in ICU should be carefully monitored. This can aid characterisation of optimal use and avoid diminishing returns associated with technology substitution.

Conclusion

Telehealth in ICU has the potential to contain increasing pressures for critical care, while potentially improve patient outcomes and service utilisation. While the evidence base is growing, we are still missing high-quality randomised trials with qualitative process evaluations that can enable more confident conclusions on its effectiveness and implementation strategies. Critical care nursing research has a special role to play in the evaluation of telehealth in ICU, to enable clarification of its impact on staff and patient experience, as well as service organisation and management.

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