

# Options for Tele-Intensive Care Unit Design: Centralized Versus Decentralized and Other Considerations



## It Is Not Just a “Another Black Sedan”

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### KEYWORDS

• Tele-ICU • Design • Technology • ICU

### KEY POINTS

- The decision to acquire and develop Tele-ICU technology should be thoughtful, educated, and consider many of the variables presented.
- Belief in predicted return on investment may falter with time and lead to withdrawal of administrative support, particularly with more expensive programs.
- Failure to develop the medical workforce in a sustainable fashion could lead to failure or additional expenses when hiring intermediary programs.
- If a restrictive Tele-ICU technology is adopted, future growth plans could be stunted and the full value of the technology not realized.

### INTRODUCTION

*Henry Ford built his first “quadracycle” in 1896. It was another 27 years before the invention of the assembly line, in December 13, 1913, when Ford began to produce the Model T in large numbers.<sup>1,2</sup> The production time fell from more than 12 hours to 93 minutes. The innovation depended on using identical and interchangeable parts. Therefore, the first Model Ts were generally identical; there was no variation. The buyer*

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Financial Disclosure: H.N. Reynolds: No current financial disclosures. Previously a paid employee with VISICU in 2000–2001. Served on the advisory board for InTouch Health 2004–2008, completed grant funded research, 2010, and participated in the InTouch Health Research Consortium, all without financial remuneration.

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Crit Care Clin 31 (2015) 335–350  
<http://dx.doi.org/10.1016/j.ccc.2014.12.010>

[criticalcare.theclinics.com](http://criticalcare.theclinics.com)

0749-0704/15/\$ – see front matter © 2015 Elsevier Inc. All rights reserved.

*was left with 1 option: a Model T or none at all. Now, in 2014, there are more than 44 new car brands available in the United States alone,<sup>3</sup> each with multiple models (Ford with 40 models) and each model with “comfort options,” “entertainment options,” “safety options,” “appearance options,” and “performance options.”<sup>4</sup> The choice among all these brands, models, and options does not require technical expertise, such as engine compression ratio or gearing in the differential, just a definition of preferences and characteristics. Similarly, the Tele-ICU has evolved, although not nearly as dramatically as the automobile. Either way, there are significant choices to be made, beyond buying the generic early versions. This article is designed to consider some of those options.*

## **HISTORY OF THE TELE-INTENSIVE CARE UNIT**

Telemedicine was introduced into the intensive care unit (ICU) in the 1970s via early efforts of Grundy and colleagues.<sup>5,6</sup> Subsequently, telemedicine in the ICU has grown exponentially after the first commercial installation in Norfolk, Virginia, occurred in 2000.<sup>7,8</sup> The driving force for the expansion of telemedicine in the ICU evolved from a manpower maldistribution<sup>9,10</sup> shortage within the field of critical care,<sup>11–15</sup> growing value of intensivists,<sup>16–19</sup> recommendations from the Leapfrog group,<sup>20</sup> successes systematizing critical care and the telemedicine in the ICU,<sup>7,8</sup> and support for increasing telemedicine as part of Health Care reform.<sup>21–23</sup> Furthermore, data are emerging that the intensivist can have a significant positive impact on outcomes of critically ill patients when utilizing telemedicine technologies.<sup>7,8,24,25</sup> The literature evaluating Tele-ICU has evolved such that there are now 2 meta-analyses available,<sup>26,27</sup> both of which suggest lower ICU mortality after implementation of a Tele-ICU. Of note, Wilcox and Adhikari<sup>27</sup> conclude that the final structural model remains undefined. All of these data are supplemented by a recent, functional review of the literature<sup>28</sup>; it seems that the Tele-ICU is here to stay.

The Telemedicine examination is visual and not hands on, other than surrogate examinations from on-site nursing. Skeptics have suggested that the lack of a hands-on examination is a critical lack, but data are evolving that the visual examination and visual review of graphical waveforms improves accuracy of decision making.<sup>29,30</sup> There are multiple reports suggesting better compliance with evidence-based medical protocols when a centralized telemedicine process is in place.<sup>31–37</sup> Finally, although it seems intuitive, evidence has evolved that telemedicine in the ICU may have even greater impact in the rural environment.<sup>38–41</sup>

From 2000 to 2010, a single vendor and single design have largely driven growth. To stimulate alternative modalities and designs, a group of national experts in the field of Tele-ICU medicine published a “LEXICON” for the Tele-ICU.<sup>42</sup> The concept was simply to stimulate better descriptive language such that the new participants would ask for more specific design elements. This was followed by an examination of staffing processes<sup>43</sup> designed to expand the associated language and options for different staffing models.

To date, there have been no head-to-head evaluations of the various alternative technologies, networking models, or staffing structures for the Tele-ICU. It remains unclear what informational elements are mandatory to facilitate best diagnostic and therapeutic decisions in the Tele-ICU or what elements are unnecessary, superfluous, or just overengineered.

## **CONSIDERATIONS PRE-IMPLEMENTATION FOR THE TELE-INTENSIVE CARE UNIT**

Before describing some specifics of the Tele-ICU, the following questions should be considered when initiating a Tele-ICU program. The authors have offered caveats

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