
Abstract

Review of Medical Device Connectivity in Neurocritical Care

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Abstract

Background: Multimodal monitoring is the standard of care in neuroscience intensive care units (neuro-ICUs) and it has led to the creation of a data-rich environment. However, the data collected from each patient still varies from hospital to hospital and is rarely collected in a standardized format; a “plug-and-play” interoperable approach is not yet available for medical devices in neuro-ICUs and this has hindered the creation and adoption of valuable informatics tools such as clinical decision support.

Objective: This paper presents a review of the characteristics of the device interfaces that have been examined by Moberg Research, Inc. for the development of their platform for neurocritical care data integration.

Methods: Neurocritical care device interfaces were reviewed by answering a series of questions designed to describe the adherence to specifications, the acceptance of standards, the overall quality of the protocols and to uncover potential pitfalls.

Results: A total of 26 devices interfaces were examined in this process; 2 were discarded because of their analog nature. Device manufacturers did not provide protocol specification documents for 2 of the 24 device interfaces. In the case of device interfaces for which protocol specifications were provided, an unexpected degree of deviation was encountered. 18% of the protocol implementations exhibited a behavior substantially different from what expected based on the specifications. A large number (32%) exhibited undocumented behaviors. Out of the 24 examined protocol implementations, 3 did not provide a protocol version field in the output and only one was based on an existing communication and nomenclature standard. No form of identification for the device source and/or data types was included in the protocol for 29% of the investigated devices. One device did not specify the units either in the protocol specification or in the transmitted data. While some device protocols provided checksums or at least parity bits, 54% of the devices did not provide either.

Conclusions: The results of this review revealed a lack of adherence to published/provided specifications, creating significant barriers to the development of connected, interoperable systems. Almost no data standardization was implemented in the analyzed protocols, which imposes a high degree of technological overhead for those institutions that want to implement a connected neuro-ICU. Additionally, the lack of transmission error detection schemes or source identification could lead to data misinterpretation and, consequently, to delayed or incorrect treatment of patients. In order to reduce the currently identified barriers to connectivity, it is our recommendation that medical device manufacturers provide a well-designed and documented communication protocol for their devices. We also anticipate that our research will lead to the development of “best practices” that manufacturers could follow in the absence of widely adopted standards applicable to neurocritical care.

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KEYWORDS

Connectivity; Medical devices; Acute medical conditions; Critical care

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Multimedia Appendix 1

Extended abstract.

[\[PDF File \(Adobe PDF File\), 561KB-Multimedia Appendix 1\]](#)

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