We designed and built a novel, open-source, portable, bedside procedural surface through an iterative development process with use testing in simulated and live clinical environments" Zhang et al (2016).

Abstract:

Study objective: A stable and readily accessible work surface for bedside medical procedures represents a valuable tool for acute care providers. In emergency department (ED) settings, the design and implementation of traditional Mayo stands and related surface devices often limit their availability, portability, and usability, which can lead to suboptimal clinical practice conditions that may affect the safe and effective performance of medical procedures and delivery of patient care. We designed and built a novel, open-source, portable, bedside procedural surface through an iterative development process with use testing in simulated and live clinical environments.

Methods: The procedural surface development project was conducted between October 2014 and June 2016 at an academic referral hospital and its affiliated simulation facility. An interdisciplinary team of emergency physicians, mechanical engineers, medical students, and design students sought to construct a prototype bedside procedural surface out of off-the-shelf hardware during a collaborative university course on health care design. After determination of end-user needs and core design requirements, multiple prototypes were fabricated and iteratively modified, with early variants featuring undermattress stabilizing supports or ratcheting clamp mechanisms. Versions 1 through 4 underwent 2 hands-on usability-testing simulation sessions; version 5 was presented at a design critique held jointly by a panel of clinical and industrial design faculty for expert feedback. Responding to select feedback elements over several surface versions, investigators arrived at a near-final prototype design for fabrication and use testing in a live clinical setting. This experimental procedural surface (version 8) was constructed and then deployed for controlled usability testing against the standard Mayo stands in use at the study site ED. Clinical providers working in the ED who opted to participate in the study were provided with the prototype

surface and just-in-time training on its use when performing bedside procedures. Subjects completed the validated 10-point System Usability Scale postshift for the surface that they had used. The study protocol was approved by the institutional review board.

Results: Multiple prototypes and recursive design revisions resulted in a fully functional, portable, and durable bedside procedural surface that featured a stainless steel tray and intuitive hook-and-lock mechanisms for attachment to ED stretcher bed rails. Forty-two control and 40 experimental group subjects participated and completed questionnaires. The median System Usability Scale score (out of 100; higher scores associated with better usability) was 72.5 (interquartile range 51.3 to 86.3) for the Mayo stand; the experimental surface was scored at 93.8 (IQR 84.4 to 97.5 for a difference in medians of 17.5 (95% confidence interval 10 to 27.5). Subjects reported several usability challenges with the Mayo stand; the experimental surface was reviewed as easy to use, simple, and functional. In accordance with experimental live environment deployment, questionnaire responses, and end-user suggestions, the project team finalized the design specification for the experimental procedural surface for open dissemination.

Conclusion: An iterative, interdisciplinary approach was used to generate, evaluate, revise, and finalize the design specification for a new procedural surface that met all core end-user requirements. The final surface design was evaluated favorably on a validated usability tool against Mayo stands when use tested in simulated and live clinical settings.

Reference:

Zhang, X.C., Bermudez, A.M., Reddy, P.M., Sarpatwari, R.R., Chheng, D.B., Mezoian, T.J., Schwartz, V.R., Simmons, G.J., Jay, G.D. and Kobayashi, L. (2016) Interdisciplinary Development of an Improved Emergency Department Procedural Work Surface Through Iterative Design and Use Testing in Simulated and Clinical Environments. Annals of Emergency Medicine. November 14th. .

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