Miscellaneous (for special sections or supplements)

An approach to value-based selection of a simulator selection: the creation and evaluation of the simulator value index tool

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ABSTRACT

Background. Currently there is no reliable, standardized mechanism to support health care professionals during the evaluation of and procurement processes for simulators. A tool founded on best practices could facilitate simulator purchase processes.

Methods. In a 3-phase process, we identified top factors considered during the simulator purchase process through expert consensus ($n = 127$), created the Simulator Value Index (SVI) tool, evaluated targeted validity evidence, and evaluated the practical value of this SVI. A web-based survey was sent to simulation professionals. Participants ($n = 79$) used the SVI and provided feedback. We evaluated the practical value of 4 tool variations by calculating their sensitivity to predict a preferred simulator.

Results. Seventeen top factors were identified and ranked. The top 2 were technical stability/reliability of the simulator and customer service, with no practical differences in rank across institution or stakeholder role. Full SVI variations predicted successfully the preferred simulator with good (87%) sensitivity, whereas the sensitivity of variations in cost and customer service and cost and technical stability decreased (≤54%). The majority (73%) of participants agreed that the SVI was helpful at guiding simulator purchase decisions, and 88% agreed the SVI tool would help facilitate discussion with peers and leadership.

Conclusion. Our findings indicate the SVI supports the process of simulator purchase using a standardized framework. Sensitivity of the tool improved when factors extend beyond traditionally targeted factors. We propose the tool will facilitate discussion amongst simulation professionals dealing with simulation, provide essential information for finance and procurement professionals, and improve the long-term value of simulation solutions. Limitations and application of the tool are discussed.

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During the last 10 years, health care simulation has evolved from an optional or supplemental training modality to a necessity, but it has also provided a new set of challenges for educators and administrators tasked with allocating limited educational resources. Persistent challenges specific to simulation-based education include evaluating the effectiveness of simulators compared with traditional modalities and determining the value of available simulators for the desired educational outcomes. Over the same decade, the number, variety, and cost of available simulators have increased dramatically. Research indicates that educators most often use readily available, manufactured simulators to support their training efforts.[1-4] The decisions associated with selection of simulators, however, are increasingly challenging as more "same-use" simulators (simulators used to target same learning objectives) enter the market and offer different features with varying technical considerations. Procurement decisions become increasingly difficult when multiple stakeholders are involved in the acquisition process. Consensus can be even more elusive when definitions of value diverge and/or priorities are misaligned across the breadth of the stakeholders involved. Having a standardized framework would help align value decisions made by the involved stakeholders across common criteria and support communication amongst all stakeholders concurrently to ensure best simulator selection.

Currently there is no reliable, standardized mechanism to support technicians, faculty, administrators, and leadership during the simulator evaluation and procurement process. One product (KeyIn, https://www.keyin.to/) offers a consensus-based valuation of device purchasing for medical and aviation simulation and training. Their service offers a Web-based rating system for customer review of devices and software programs with written, testimonial-style reviews. Although this type of rating system has become common, there are limitations associated with the product. First, the ratings are limited to averaging the final score across the 3 broad and vague categories (quality, value, and customer service). Also, the tool does not offer a comparison option, and it is unclear whether or not contributors have also interacted with other available products, so scorings may be limited in scope. Further, the rating system lacks the flexibility to account for specific factors that individual institutions may need to consider during their own process for purchase of simulators.

From the categories offered by KeyIn, we might assume that decisions of simulator purchase should consider only a limited scope of factors, such as cost, customer service by the manufacturer, or technical stability of the simulator. Considering that most adults are capable of storing 7 (±2) items in their short term-memory,[5] it's not surprising that other important factors are often forgotten, minimized, or even overlooked naively at the point of decision making. We posit that for some institutions, these 3 factors might suffice, whereas for others, additional factors such as scalability, portability, and/or durability may contribute more directly to long-term value. Regardless, without a standardized mechanism, practices based on convenience, historic relationships with the vendor, and the processes in that institution for clinical procurement may result in undesirable outcomes, such as mismatched alignment of simulator-to-learner needs, decreased use (ie, decreased return on investment), or decreased availability of the simulator because of poor relative reliability or poor manufacturer support. All these factors may lead to unanticipated difficulties of the different simulators purchased to meet educational needs.

In both academic medical centers and hospital-based training programs, the educational foundation is shifting to simulation devices and software, placing new demands and responsibilities onto educators, administrators, and purchasing departments to formalize purchase processes, maximize efficiency, decrease cost, maintain and improve educational and health care outcomes, and, ultimately, to improve safety. For example, one tool called the Technology Acceptance Model[6,7] has been developed to predict the acceptance and use of health information technology software in the health care setting among stakeholders. A similar tool founded on best practices and including a full range of factors considered by the multiple stakeholders could be used to guide the simulator purchase process and facilitate discussion among a wide field of health care professionals involved with simulation learning. .

In this multiphase work, we identified typical users and the top factors they consider during the process of simulator purchase through national and international surveys of simulation educators. We then analyzed differences in factor rating among possible stakeholders and developed and evaluated the practical value of the final tool, called the Simulator Value Index (SVI).

Methods

Study design

After a determination of an exempt status by Institutional Review Board at the University of Michigan, we used a multiphase process to develop and evaluate a tool that can be used to guide simulation purchases. Three specific phases were implemented: (1) identification of the typical user and their top factors considered during simulator purchase, (2) evaluation of targeted validity evidence, and (3) analysis of the practical value of the SVI tool at supporting decision making during the simulator purchase process.

Phase 1: Identification of users and their top factors considered during the simulator purchase process

In a multiround, pseudo-Delphi process,[8,9] a comprehensive list of all potential factors contributing to the ultimate value of a simulator acquisition was developed, refined, and validated. As illustrated in Fig, a list of 31 factors was developed by 6 members of the Committee of Technologies and Simulation of the American College of Surgeons Accredited Education Institutes (ACS AEI) and was reviewed and refined by leadership from the Committee of Administration and Management of the ACS AEI. The resulting 31 factors were organized into 6 domains, including cost, impact, manufacturer, utility, assessment, and environment/ergonomics. These factors became the foundation for a 2-part survey of needs assessment. The survey included 4 demographics questions (participant's institution and country, stakeholder role, and level of involvement during the simulator purchase process), followed by a list of the 31 factors (items) organized across 6 domains: Cost, Impact, Manufacturer, Utility, Assessment/Research, and Environmental/Ergonomic (Appendix A). Participants were asked to rate the importance of each factor using a 4-point rating scale, ranging from 1 ("Not considered/not important to me when I consider a simulator purchase") to 4 ("Critical to me when I consider a simulator purchase").

In 2 sequential rounds, we disseminated the Web-based SVI Survey to the general membership of 2 US-based societies of health care simulation and conducted a follow-up focus group with different participants from the membership of the same societies. In round 1, the survey was targeted to the general membership of the Society for Simulation in Healthcare (SSIH; approximate membership = 2,800) (Fig) where top factors were identified using the minimum cutoff score of 3.0 ("Significantly important to me when I consider a simulator purchase"). The follow-up focus group consisting of clinician-instructors, medical educators, and administrators was performed during the January 2014 International Meeting on Simulation in Healthcare and was used to rerate the top 16 items and discuss product development (Fig). During this round, an item (23b—Durability/resistance to wear and tear) was added per participant consensus. In similar fashion, round 2 targeted surgical clinician-instructors, medical educators, and administrators from the ACS AEI (approximate membership = 290) who rated all 32 factors with a follow-up focus group during the March 2014 ACS AEI meeting to rerate the top 17 items and also discuss product development.

Phase 2: Analyses of evidence of targeted validity

To evaluate the evidence of validity relevant to test content, we examined the importance ratings of each factors from all participants. To examine the evidence of targeted validity relevant to internal structure and to determine if there were differences in ratings that might introduce bias across participating groups, we compared ratings from the aforementioned simulation professional participants ($n = 127$) across professional societies, institution type, and the self-reported stakeholder role by the participants using the Wilcoxon rank sum test, with secondary bias analyses using a many-facet Rasch model.[10,11] Large variations in ratings across these groups would suggest that the SVI tool may be used differently across these groups, and therefore limit the value of the tool to be used across