Going Digital: Transforming Medical Checklists for Improved Patient Care

Panelists
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Organizer & Moderator
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Abstract
This panel is aimed at addressing the implications and challenges of designing, developing, implementing and evaluating digital checklists in clinical settings. Panelists will share their experiences with checklist design and development, and discuss how digital formats may further improve the impact of the checklist in a range of settings. This is an important panel to have at AMIA in order to engage the community in discussing critical questions about advancing the checklist mechanisms in increasingly digital medical environments. Learning objectives include: (a) formulate an approach for designing digital checklists in a clinical setting; (b) formulate an approach for implementing digital checklist in a clinical setting; and (c) evaluate the effectiveness and impact of digital checklists using both simulated and clinical settings.

General Description
Checklists have become increasingly widespread in health care. Because their use has been associated with a significant decrease in omission errors, death rates, and inpatient complications, checklists are now used across different medical settings, including operating rooms (OR),1 intensive care units,2 and anesthesia.3 An example of an effective use of a medical checklist is the WHO Surgical Safety Checklist, which improves team communication and consistency of care, while markedly reducing complications and deaths associated with surgery.4 Most medical checklists used today are paper-based, requiring care providers to manually record the presence or absence of the checklist items. Although paper checklists offer multiple benefits, questions have arisen about their ease of introduction into workflow and their impact on safety; they may complicate tasks, reduce efficiency, and require additional time and attention.5 While many hospitals continue to use paper checklists, some have started implementing computer-based checklists and interactive cognitive aids to improve patient care and augment user experience.6 This trend toward checklist digitization does not come as a surprise as medical work has become increasingly digital over the last decade. Similar to paper checklists, however, introducing digital checklists into clinical settings is not simple, and requires consideration of content, format, timing, trial, and feedback, followed by formal testing and evaluation. In addition, clinical settings pose many challenges to designing digital checklists. Checklist design principles taken from the aviation industry have worked well for static, paper-based checklists,7 but may not be applicable to designing digital checklists for the dynamic and, often more chaotic, medical work.

This panel gathers four researchers and practitioners who have been involved in the design and development of both paper and digital checklists in different clinical settings. Although the work of all panelists focuses on critical care events—surgery, trauma resuscitation and anesthesia crisis—the approaches to designing, implementing and evaluating the checklists are diverse. The four panelists will share experiences in conducting their research and discuss the implications of their studies. These individual stories will then serve as the material for an open discussion with the audience.

Structure & Discussion Topics
The panel session will begin with a ten-minute presentation by the moderator to describe the purpose and format of the panel, and to introduce the panelists. This will be followed by three, 15-minute presentations by panelists detailing experiences, approaches and outcomes of their exemplar studies. We will then open the floor to discussion among panelists and with the audience in the remaining 35 minutes. Although we expect that topics will emerge through the discussion, some of the topics that may help structure the conversation are as follows:
Design principles & issues: Most medical checklists have been designed based on principles adopted from the aviation industry. These principles, however, may not be applicable to designing digital checklists for the dynamic and, often more chaotic, medical work. Panelists will discuss approaches they used to gather design requirements, as well as overcome design challenges they faced. We also recognize that some systems may be built in house, while some may be commissioned or purchased from a third party. Questions arising here relate to managing and overseeing the design process, and ensuring that the final product meets the user needs.

Implementation issues: Prior research has identified several barriers to the successful implementation of paper-based checklists, including poor communication among team members, lack of leadership, inappropriate timing for checking an item, and time taken up by checklist completion. Do the same barriers apply to implementing digital checklists? What are the issues we need to consider when implementing digital checklists?

Evaluation issues: Evaluating the impact and effectiveness of checklists is an important aspect in checklist design. Panelists will present how to design evaluation studies for digital checklists, obtain human subjects protection approvals, collect data, and define evaluation metrics.

Anticipated Audience & Importance of the Topic

This panel session will be of interest to all AMIA members, and particularly to healthcare providers and informatics professionals working in critical care settings. This is a timely topic to discuss given the widespread use of medical checklists and the trend toward digitization of medical care. The panel will educate about the implications and challenges associated with designing, developing, implementing and evaluating digital checklists in a range of clinical settings. Panel members will synthesize their perspectives on these issues and likely future developments in this area, exploring a diverse set of topics and engaging in thoughtful discussion with the audience.

Brief Description of Panelists & Presentations

Bradford Winters, MD, PhD is an Intensivist and Anesthesiologist at the Johns Hopkins Hospital and a Core Faculty member of the Armstrong Institute for Patient Safety and Quality at the Johns Hopkins University School of Medicine. His research interests include reducing patient harm through the implementation of Rapid Response Systems, applying broader modalities for patient monitoring and the use of cognitive tools such as checklists and technological solutions to reduce patient harm and adverse events.

Dr. Winters will present a framework for checklist development, and discuss the development and implementation of checklists in the Intensive Care Unit (ICU) environment to improve safety and reduce gaps in the quality of care, including reduction in hospital acquired infections, improved mechanical ventilator care, and appropriate deep vein thrombosis prophylaxis. He will discuss the challenges of implementing and especially digitizing such cognitive tools into the workflow of the ICU.

Randall S. Burd, MD, PhD is the Division Chief of Emergency Trauma and Burn Services and a pediatric surgeon at Children’s National Medical Center in Washington, DC. His research interests are in pediatric trauma, with a particular focus on prehospital prediction of severe injury and emergency department resuscitation. Over the past eight years, Dr. Burd has directed a multidisciplinary team that is developing new analytic and technological approaches for rapidly identifying severely injured children, and providing them with safe and efficient care in the emergency department. His currently-funded research has given him expertise in directing the clinical development and assessment of new technologies to support teamwork during resuscitation, designing and implementing simulation for assessment of new technologies, and analyzing the information needs of resuscitation teams.

Dr. Burd will present his recent work on the checklist development for trauma resuscitation. Adverse outcomes in this domain have been associated with omissions of key steps in the initial management of injured patients despite continued simulation training and didactic teaching. Dr. Burd and his research group have developed a checklist for trauma resuscitation that improves compliance within this process. Dr. Burd will discuss the approach they used to develop and evaluate this checklist in both simulated and clinical settings. He will also discuss how the checklist impacts communication patterns and potential ways in which a digital format may further improve the checklist’s impact in this setting. Finally, Dr. Burd will present how they used digital pen technology to inform the design of a digital checklist, using an approach that allows analysis of the accuracy and timeliness of checkbox completion.

Lawrence Chu, MD, MS is an Associate Professor of Anesthesia on the faculty of the Stanford University School of Medicine. Dr. Chu’s studies how information technologies can be used to improve medical education and how the design of medical information influences the way people use medical checklists in patient care. Dr. Chu collaborates
with researchers in simulation and computer science at Stanford University to understand the effects of cognitive aids on health care outcomes. He co-directs the Stanford AIM (Anesthesia Informatics and Media) Lab and is also the Executive Director of Stanford Medicine X.

Lawrence Chu will present the work on Dynamic Procedure Aids, a project he jointly conducted with computer science and human-computer interaction researchers at Stanford. Dynamic Procedure Aids is an approach for addressing four key problems in the use of medical checklists: ready access to the aids, rapid assimilation of their content, professional acceptance of their use in medical procedures, and limited attention available to their users. To understand the efficacy of Dynamic Procedure Aids for crisis response, Jesse and Leslie created dpAid, a software system for crisis medicine. dpAid’s design was based on a year-long observational study of medical teams responding to simulated crises. dpAid was deployed on tablets and large-screen displays, and evaluated in simulated medical crises using eye-tracking hardware.

Aleksandra Sarcevic, PhD is an Assistant Professor of Informatics in the College of Computing and Informatics at Drexel University. Her research interests are in computer supported cooperative work and medical informatics, with a focus on ethnographic studies of work practices and interface design for safety-critical medical settings. Her recent work is in the area of emergency medical resuscitations, where she hopes to reduce human errors and increase teamwork efficiency by introducing a series of technological interventions. She was awarded a 2013 National Science Foundation Early CAREER Grant to continue her work on information technology design for fast-response medical teams.

Dr. Sarcevic will moderate the panel.

Participation statement: All proposed panelists have agreed to participate in the panel.

References