Vitaliy Popov, PhD, Leverages Technology to Improve Teamwork

"We know that good teamwork saves lives…The collection of real-time team behavioral data can potentially allow for the examination of meaningful associations, observe trends, and provide team- and learner-specific feedback to each participant."

The Problem: The past, present and future of medicine is inherently team-based care.

Current standard assessment practices in real-world clinical setting as well as simulation-based team training are based on third party observation consisting of two main approaches: behavioral marker systems and coding schemes, which are labor intensive, obtrusive, prone to personal judgment/error and less replicable or scalable. These current approaches fail to capture team processes, which are innately *dynamic*, *interdependent*, and *multimodal.* It is crucial that institutions use data to inform decisions around educational interventions like instructional design and assessment as well as clinical operations such as team composition, roles, communication procedures, etc.

> **KEY WORDS**
> **Teams**
> **Simulation**
> **Learning analytics**
> **Sensors**
> **Technology**
> **Technical and**
> **nontechnical skills**

The Promise: New high-fidelity sensor technology and computational models can capture discrete, nuanced, and real-time data of team processes (e.g., behavior, visual attention, speech analysis, emotional arousal) that unfold over time e.g., in the operating room or during conventional simulation training. The collection of real-time team behavioral data can potentially allow for the examination of meaningful associations, observe trends, and provide learner-specific feedback to each participant providing a wealth of data, not only to improve evaluations and remediation, but also serve as human factors tools for achieving optimal team performance.

The Project: Working with the departments of Electrical Engineering and Computer Sciences (EECS) and Surgery, Popov and his collaborators use machine learning algorithms to automatically assess the

intraoperative entrustment between surgical faculty-resident pairs who wear specially designed glasses to record their Joint Visual Attention (JVA) during a laparoscopic cholecystectomy surgery. JVA is when two or more individuals are looking at a common target at the same time. Simultaneously, these glasses record speech and continuous measurement of pupil size (indicating cognitive efforts, affect and fatigue when controlling for light changes). This approach aims to capture discrete, real-time data of intraoperative teaching and dyadic visuo-spatial coordination processes as they unfold - previously either difficult or impossible to observe during conventional surgical procedure.

Learning Health System in Action: Gathering quantitative data on both individual and inter-personal actions allows for standardized assessment and feedback during training, understanding markers that may predispose teams to errors or delays in therapeutic interventions, and can provide essential insights into which measures have the greatest impact on effective clinical team performance as well as teaching and learning practices.

The Bottom Line: Good teamwork saves lives. This concept has the potential to address several limitations of current assessment methods and start to unlock the true potential of teamwork training coupled with the power of multimodal learning analytics to train the next generation of healthcare professionals to provide the best care possible to their patients.

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