

Decreasing Time from Data Collection to Analysis in Simulated Casualty Care Research

Omar Badawi, PharmD, MPH, James Gaudaen, MA, Alix Donnelly, BS, Ian Z. Prevettelattimore, Peter Chung, MS

¹ United States Army Institute of Surgical Research, Fort Detrick, Maryland

Introduction

- The United States Army Institute of Surgical Research (USAISR) initiated an autonomous combat casualty care (C3) portfolio by collecting data from realistic simulations to develop artificial intelligence (AI) models for passive documentation.
- Hypothesis: Migrating from a manual to a standards-based approach with automation would decrease data ready to use time

Methods

- Natural experiments collecting simulated standardized C3 scenarios through manual processes were conducted.
- Steps to achieve RTUT were identified and a strategy to address inefficiencies was implemented.
- Interventions included:
 - Creating a Fast Health Interoperability Resources (FHIR)-complaint data model with REDCap®
 - Creating stitching tool to concatenate split files and then assign globally unique identifiers (GUID)
 - A secure bulk upload process instead of shipping hard drives
 - Automated reporting metrics.
- Time to complete these steps were measured or estimated at the end of the pilot phase and repeated after implementing interventions.
- Wilcoxon signed rank tests were used to assess ten random paired samples.

Identified Challenge	Engineered Intervention
Inefficient & disjointed data capture	Developed a Fast Healthcare Interoperability Resources (FHIR)-compliant data model using REDCap®
Split video files & lack of unique tracking	Created an automated stitching tool and assigned Globally Unique Identifiers (GUIDs)
Physical logistics bottlenecks	Replaced physical hard drive shipping with a secure bulk upload process
Manual progress tracking	Integrated automated reporting metrics

Performance Metric	Manual (Pilot Phase)	Automated (Enhanced Phase)	Operational Impact
Overall RTUT	> 2 Weeks	< 2 Days	Primary bottleneck eliminated
Data Transfer	~10 Days (Physical shipping)	8 Hrs / 100GB (Secure upload)	Drastic reduction in transit latency
Video Stitching	11.9 Min/Video	3.0 Min/Video	p < 0.01
File Management	~1 Min/ Simulation	0 Minutes (Eliminated)	Automation enabled by GUIDs
Weekly Reporting	~10.5 Min/Report	1 Min/Week	Estimated calculation time minimized

Results

- Seventy-eight different steps across nine themes comprised RTUT.
- Overall RTUT decreased from >2 weeks to <2 days, mainly drive by upload vs. shipping (e.g. 8 hours/100GB vs ~10 days/hard drive).
- Stitching reduced from an average of 11.9 to 3.0 minutes per video (p<0.01).
- Using FHIR standards qualitatively improved scalability by reducing curation needs of research partners.

Discussion

While the secure uploading capability drove the most significant quantitative reduction in RTUT, the standards-based architecture yielded crucial structural and qualitative benefits for ongoing military medical research:

Low-Cost Harmonization: Upfront vocabulary mapping to FHIR and the use of GUIDs practically eliminated data curation and harmonization efforts for collaborative research partners.

Reduced Friction: Decreased administrative documentation and security friction facilitated seamless, compliant data sharing.

Searchable Knowledge Base: Created an enriched, searchable database housing complex simulator variables, including environmental factors, utilized devices, and Institutional Review Board (IRB) amendments.



Acknowledgements: The following individuals are acknowledged for their direct and indirect support to this effort: Ericka Stoor-Burning, Jesse Steffens, Moriah Newman, Jeanette Little, Holly Pavliscsak



To learn more, visit:
www.usaisr.health.mil