



Feasibility Assessment of a Pre-Hospital Automated Sensing Clinical Documentation (ASCD) System

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Abstract

Clinical documentation is challenged by limited resources and fast-paced, high-acuity in the pre-hospital setting.

Military and civilian medics are responsible for stabilizing a patient during transport to a trauma facility and typically provide a report from memory or on an informal source of documentation (e.g. glove or piece of tape). Development of an automated documentation system would increase the accuracy and amount of information that is relayed to the receiving physicians.

This practicum project focused on a 12-week deployment of an Automated Sensing Clinical Documentation (ASCD) system with the Nashville Fire Department EMS paramedics.

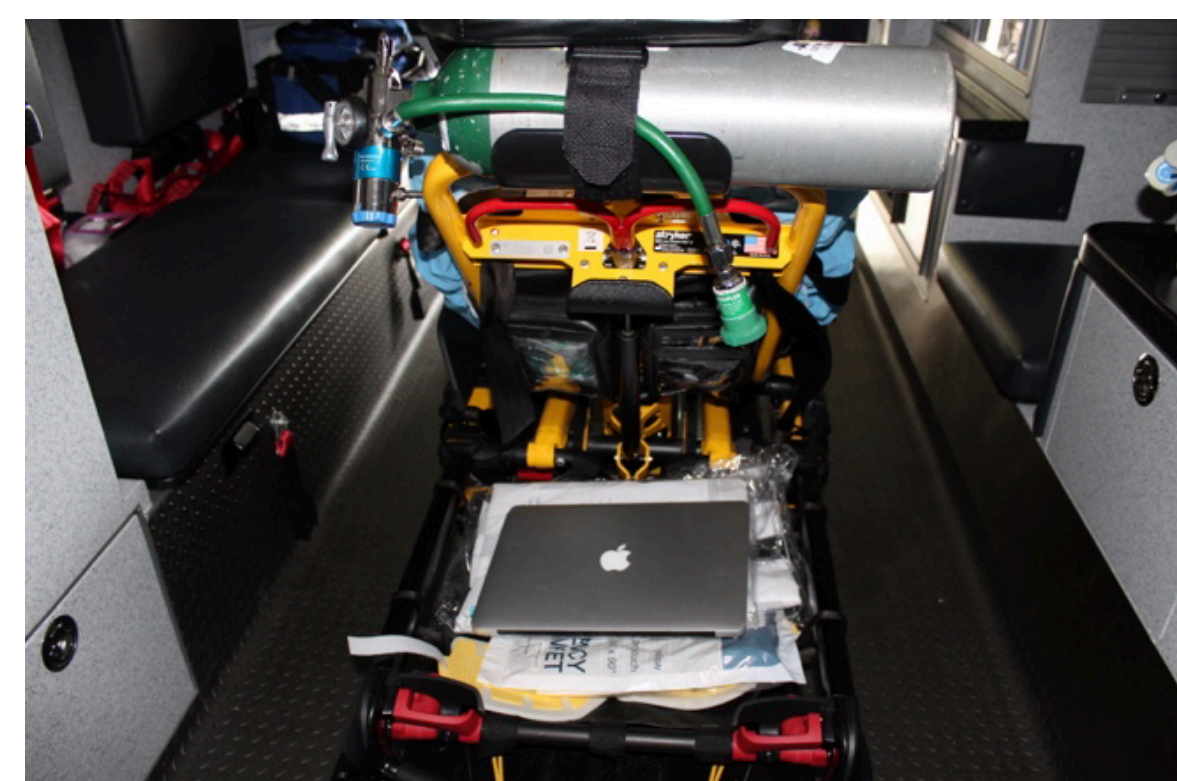
Objectives:

- Assess the feasibility of deploying an ASCD system in the pre-hospital setting
- Determine paramedic's attitudes and beliefs surrounding automated documentation
- Find solutions to the barriers encountered while deploying the ASCD system

Methods

- **Equipment Selection:** 2 Myo Gesture Control Armbands (EMG and inertial measurement data), 2 Apple Watches (yaw, pitch, roll, and acceleration data)
- Providers performed 45h of procedures in the Center for Experiential Learning and Assessment to refine and validate the algorithm used to detect clinical procedures
- The ASCD system was deployed over a 12-week with Nashville Fire Department
- A clinical researcher recorded medic activity with a custom time-motion capture system
- ESI scores were collected for patients transported to Vanderbilt University Medical Center
- Paramedics completed a debrief questionnaire in REDCap following the conclusion of each shift

Procedure Occurred	Procedure Description
2019-01-09 12:42:13.030240	12 lead start
2019-01-09 12:42:38.984363	12 lead end
2019-01-09 12:43:07.886611	correction 3 lead
2019-01-09 12:44:53.242214	albuterol tx start
2019-01-09 12:45:11.890404	mask applied
2019-01-09 12:45:59.294573	tourniquet
2019-01-09 12:46:02.672012	IV start
2019-01-09 12:46:27.348737	IV in
2019-01-09 12:49:31.370297	IV procedure END
2019-01-09 12:49:54.562230	IV attempt fail
2019-01-09 12:57:29.503253	12 lead
2019-01-09 12:57:48.126144	12 lead end
2019-01-09 12:58:58.214071	albuterol tx end
2019-01-09 12:59:40.566805	check lung sounds



ASCD System: Automatically detects clinical procedures by measuring medic activity

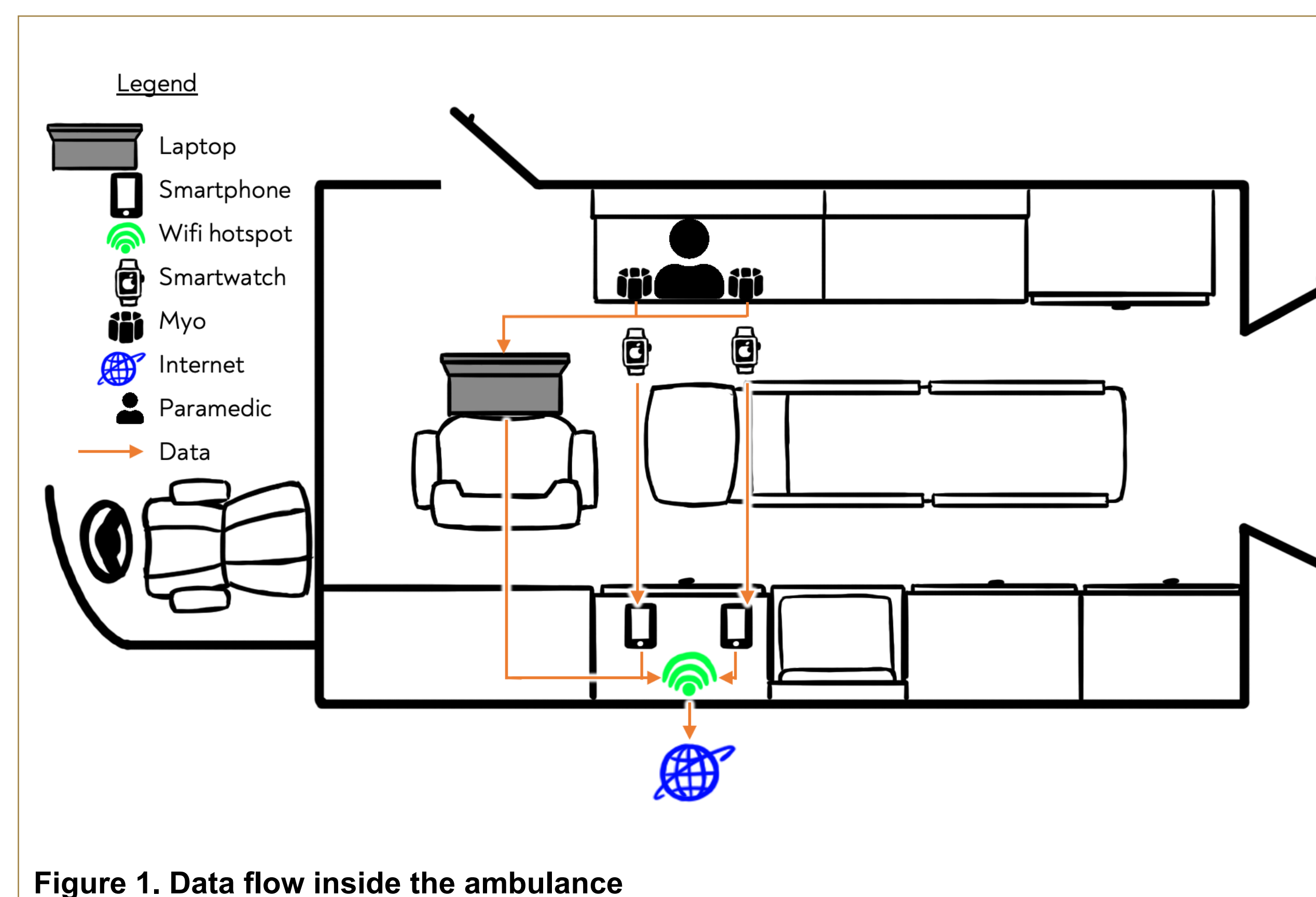


Figure 1. Data flow inside the ambulance

Results

Table 1. Challenges encountered during data collection and their solutions

Barriers	Solutions
Intermittent interruption in Myo Armband connectivity to laptop	Laptop location moved to the head of the stretcher, under the patient's head (Figure 4)
Script programs stopped recording when the laptop lid was shut	Installed disable lid sleep widget
Intermittent interruption in Apple Watch data collection	Implemented a live feedback system to visualize interruptions in data collection
Insufficient hotspot data for data collection	Data use was monitored proactively via web portal; ~1GB was needed per 6-hour observation
Confusing Apple Watch start/stop application	Start/stop feature changed from a tapping mechanism to a slide bar
Concerns of marrying pre-hospital observations to correct paramedic-to-ED handoff	Process developed to ensure consecutive subject data entry; relative time (since the start of paramedic shift) used to identify patients
Myo armbands intermittently vibrate if they are unsynced (caused by displacement of armband)	Paramedics were cautioned that this may occur, and they attempted to not desync the armbands; this vibrating functionality will be removed in future trials.
Systemwide VPN upgrade for VUMC users	We were forced to switch the VPN connection on the laptop; it had no apparent effect on data collection
Original hotspot data plan was canceled by the carrier for an unknown reason	Observations were delayed until we were able to obtain a new hotspot and data plan

“I feel like it would be very helpful in the pre-hospital setting with exact times and interventions” – NFD Paramedic

Table 2: Results from paramedic questionnaires

Factor	Response (N=7 Field Observations)
Ability to wear entire shift	Yes – 7/7
Perceived comfortableness	Neutral – 1/7 Slightly Uncomfortable – 6/7
Likelihood to wear entire shift	Unlikely – 1/5 Likely – 2/5 Extremely Likely – 2/5 <i>Note: 5 responses due to addition of this question</i>
Issues with devices interfering with uniform	“They do not interfere with clothing” “No issues” “There are no complications with uniform and armbands”
Feelings regarding devices tracking movements	“I do not have any concerns” “I do not see any real problems with the devices tracking my movements”
Overall experience	“They get more uncomfortable the longer they are on. Even with all of the links taken out, they are a bit tight” “It has been a good experience”
Perceived feasibility of automated documentation	“I think it's completely feasible to have it automatically document time on action to improve documentation accuracy” “I feel like it would be very helpful in the pre-hospital setting with exact times and interventions”
Perceived usefulness of automated documentation	“It would be helpful on calls that require more hands on the patient where you don't have time to document as you go” “It would be useful when we are dealing with a critical patient or have multiple patients on the same scene. It would also be helpful to have this information to help give a report to the ED”

Limitations

- Number of paramedic participants
- ESI scores only reported for patients transported to VUMC
- Data was not collected for several procedures

Conclusions

- Paramedics indicated that they could wear the armbands for the duration of a 12-hour shift
- We highlighted several barriers to the system's practical deployment
- Additional data is needed to assess the accuracy of the current algorithm

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