Telehealth and the Re-design of Emergency Medical Services

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Abstract. As patient numbers continue to rise Emergency Department's (ED's) are struggling to not only control patient wait times but also to maintain the quality of patient care. Improving patient flow through the ED has been a priority for many years with techniques such as Lean Six–Sigma being implemented specifically to help alleviate the problem. The Institute for Healthcare Improvement recently stated that the best opportunities to improving patient flow relate to the front-end of the ED, namely triage. This contribution examines the use of Telehealth initiatives at the front-end of the ED, specifically tele-consultation, to reduce patient loading, provide timelier healthcare (with improved patient outcomes) and reduce costs.

Keywords. Emergency Department, Pre-hospital Triage, Tele-consultation.

1. Introduction

Emergency Departments (ED's) are for many people the most easily accessed source of immediate, unscheduled care, both primary and emergency. As the numbers of admitted patients continue to increase ED's face major problems with regard to patient overcrowding, waiting times and safety - for example during January 2017 in A&E (Accident & Emergency) departments in England only 82% of patients were seen then admitted or discharged within a 4 hour timeframe - much lower than the designated NHS (National Health Service) minimum of 95% [1].

It has been recognised for many years [2] that speed of service, patient safety and cost of care in the ED have to be improved with quality improvement techniques, such as Lean and Six–Sigma, being applied specifically to help alleviate the problems of extended patient wait times [3]. Recently The Institute for Healthcare Improvement (IHI), stated that, 'Some of the best opportunities to improve ED (patient) flow relate to front-end and back-end flow', [4], with 'front-end' referring to triage and data gathering activities in the ED while 'back-end' refers to access, the use of specialists as well as 'getting patients to where they need to be'. Telehealth is an enabling technological approach that offers many possibilities for not only helping improve both front-end and back-end patient flow within the ED but also the quality of care.

Telehealth refers to the electronic and telecommunication-based expansion of health care services, which include telemedicine and electronic health record (EHR) systems. It has already played a major role, usually via teleconsultation, in the rapid diagnosis and treatment of serious time-critical conditions such as myocardial infarction, stroke [5] and trauma. This contribution discusses the use of Telehealth for

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the re-design of emergency medical services (EMS) with the emphasis being on the use of tele-consultation either for prehospital triage or for triage within the ED. Three initiatives were chosen from the literature to illustrate how telehealth can enable more timely triage activities for both emergency and non-emergency patients.

2.0 Telehealth Applications: Prehospital Triage via Tele-consultation

Three applications of telehealth to triage, both prehospital and within the ED, are described with tele-consultation being the common theme.

Providing patient access to remote specialists in underserved communities: Initial telemedicine-based applications relating to emergency medicine were motivated by the need to provide more timely diagnosis and care to patients in underserved communities – communities with small hospitals which do not support full-time emergency medicine teams. The Western Australia (WA) Emergency Telehealth Service (ETS) is a prominent example of this type of telehealth initiative [6] comprising over 70 regional and remote hospital ED's across the state. The ETS makes specialist emergency medicine physicians available, via videoconferencing, to support regional hospital-based clinicians with the diagnosis and treatment of acute emergency patients. The Cumbria and Lancashire Telestroke Network, - a tele-consultation service that remotely connects a team of 15 stroke consultants who provide 'out-of-hours' advice from their homes to hospital sites across Cumbria and Lancashire is another example of such a service [7].

Pre-ambulance triage, via tele-consultation with probable primary care patients: The Houston Fire Department initiated the Emergency Telehealth and Navigation (ETHAN) programme in 2014 [8]. ETHAN combines tele-consultation, social services and alternative transportation to reduce the numbers of primary-care related patients being transported directly to the ED via ambulance, or in this particular case via fire-engine. As well as reducing ED patient loading the cost savings, through the elimination of unnecessary ambulance journey's to the ED, are substantial (~$2500 per trip). Responding to patient initiated calls all EMS units carry Tablets so the patient can be connected to a hospital-based emergency physician via secure teleconferencing software. The tele-consultation involves synchronous communication via video conferencing and the measurement of vital signs on scene by the field crew with the physician making a preliminary diagnosis as well as outlining treatment options to the patient. The physician, in consultation with the patient, then makes the final decision regarding patient disposition if the patient condition is determined to be non-urgent and of a primary care nature. Figure 1(a) outlines the possible outcomes including referral via taxi transportation (rather than ambulance/fire engine) to the ED, referral via taxi transportation to a primary care facility or a homecare instruction (with follow-up).

Ambulance-based Triage: Tele-consultation using remote specialists in underserved communities takes place after the acute emergency patient is transported to the hospital. It is recognised that if prehospital triage and care of the acute emergency patient can be carried out within the ambulance, during transportation to the ED, then patient outcomes especially with time-critical conditions such as myocardial infarction and a stroke could be positively affected. One such study, into the safety, feasibility and reliability of an ambulance-based telemedicine triage system, was carried out in Brussels [9]. A prototype 3G telemedicine system (PreSSUB 3.0) was used to provide real-time bidirectional audio-video communication between the patient in the ambulance and the remote physician, see Figure 1(b). A preliminary prehospital

diagnosis was formulated in 90.2% of cases with satisfactory agreement with in-hospital diagnoses. Failures resulted mainly from limited mobile connectivity. Other functionalities included the automated transmission of patient vitals as well as pre-notification of the ED team using SMS. Figure 1(c) shows the remote physician examining real-time patient data obtained from the ambulance.
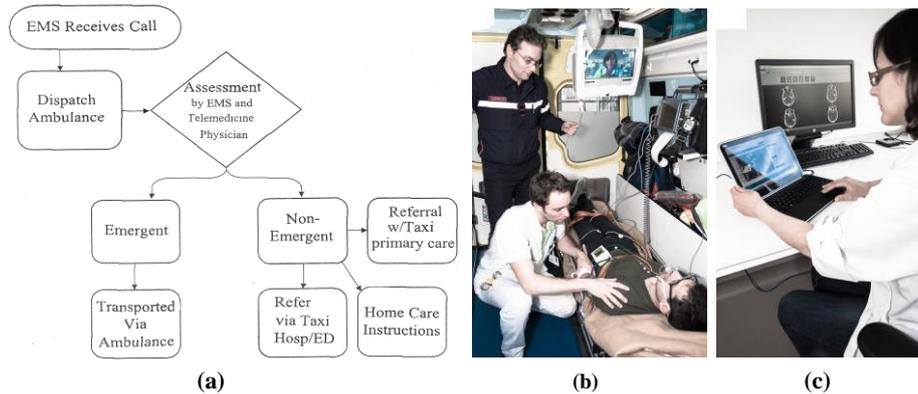

Figure 1. (a) Pre-ambulance Triage of Probable Primary Care Patients, adapted from [8], Ambulance-based prehospital triage showing (b) Tele-consultation with remote physician [9], and (c) The remote physician examining transmitted real-time patient data [9].

The three applications highlight how Telehealth can make a positive contribution to EMS. The ETHAN programme is a nice standalone initiative that conceivably could be used to complement either of the other two described Telehealth applications in the re-design of the EMS. Providing patient access to specialists via in-hospital tele-consultation is a well-established service, especially for stroke victims in rural areas, that is also being applied successfully in urban areas not only to access remote specialist care but also to provide a degree of flexibility in ED staffing arrangements [10]. Ambulance-based triage can potentially provide the most timely diagnosis and care, though the initial financial outlay, to convert and equipment a number of ambulances is higher than the other described Telehealth initiatives [9].

3.0 Discussion and Conclusions

The three reviewed telehealth initiatives have made a substantial difference to not only delivering timely specialist care but also, in the case of ETHAN, intercepting primary care patients and providing them with a number of primary care options as an alternative to being transported to the ED. ETHAN has reduced ED loading as well as saving a substantial amount of money for each ambulance trip not taken. Though all these initiatives relate specifically to the 'front-end' of the ED there is also the potential to apply Telehealth initiatives throughout EMS. .

Though research has shown that tele-consultation is as safe and effective a method as face-to-face consultation between the patient and the physician [11] there are a number of challenges that need to be overcome. Technical challenges, relating to connectivity and the transmission of real-time data and video images still remain, though the expectation is that these will be re-solved with the introduction of 5G in 2020. Other challenges are financial and relate not only to the initial investment that a tele-consultation system may need. Current payment models in user-pays healthcare systems are currently affecting the expansion of Telehealth initiatives. The lack of re-

imbursement for non-ED transports is currently a barrier to the expansion of the ETHAN programme - Medicare currently only provides reimbursement when a patient is transported to the ED [9]. The proposed U.S. 'CONNECT for Health Act of 2017' aims to 'remove roadblocks to telemedicine expansion by giving providers the freedom to experiment with telehealth in alternative payment models' [12].

Another challenge is the lack of awareness, and perhaps understanding, relating to how Telehealth can improve EMS. Northumbria NHS Trust provides healthcare for over half a million people across a mainly rural area in the North-East of England. Northumbria NHS Trust decided to centralise emergency care by building a specialist emergency hospital while downgrading the four A&E departments within the region to 'walk-in' facilities [13]. The centralising of Emergency Care within a rural area seems a retrograde step as this increases patient journey times as well as reducing access. There was substantial public and medical professional criticism of this strategy, for example, see [14, 15]. Even if specialist care is now available 24/7 at the new facility the Telehealth initiatives reviewed here, especially the fairly low cost tele-consultation initiatives in both Western Australia and Cumbria and Lancashire, could have instead been applied to improve quality of care across the region (by providing tele-consultation across the region 24/7) while maintaining the lower travel times and improved patient access to the original four A&E departments.

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