Chapter 6

Mobile Health Applications in Prehospital Emergency Medicine

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ABSTRACT

Prehospital emergency medicine treats time-critical diseases at the emergency site to reduce preventable disabilities and deaths. mHealth can assist in prehospital emergency medicine in multiple ways. This chapter provides insights into emergency medicine and presents three different forms of mHealth in this field. One is a retrieval of medical data (e.g., with aid of smartphone applications). A second one uses unmanned aerial vehicles. And the third one establishes real time communication with medical experts. Examples are given to illustrate the variety of mHealth in prehospital emergency medicine.

INTRODUCTION

Prehospital emergency medicine is an integral part of all health care systems worldwide. The goal of prehospital emergency medicine is to treat time-critical diseases and conditions as early as at the emergency site and hereby reduce preventable disabilities and deaths. MHealth offers the opportunity to balance existing healthcare disparities by using mobile information and communication technologies. It has huge advantages in emergency medicine, where the transfer of knowledge in a short time is critical and potentially lifesaving (Amadi-Obi, Gilligan, Owens, & O’Donnell, 2014). Mhealth applications support treatment of emergencies at the place of occurrence, whether it is at a patient’s home or the site of a road accident. Thus, there has been a rapid development in the field of mHealth in prehospital medicine in the last years. The purpose of this chapter is to display different approaches, how mHealth might be beneficial in prehospital emergency medicine.

After introducing the role of paramedics and emergency doctors in prehospital emergency medicine, the three key emergency cases of myocardial infarction, stroke, and trauma are described. These life-threatening diseases belong to the leading causes of death worldwide and have a high economic impact.

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MHealth offers a possibility to increase the quality of treatment starting at the emergency site to save lives potentially. There are three main ways of applying mHealth in prehospital emergency medicine. One is to retrieve data, e.g. by using smartphone applications. Multiple uses of applications will be presented. The second is the use of unmanned aerial vehicles to deliver medical goods.

Moreover, the third way to use mHealth is real-time communication with a medical expert. This communication could be the transmission of audio, vital signs, photos or video. Four projects using high-definition real-time video communication from the emergency site to a remote emergency doctor will be presented and discussed. Experiences in mHealth in the field of prehospital emergency medicine gained in the European Union FP7-funded project LiveCity (Grant Agreement No. 297291) will be described. Within the project, a video camera was developed and tested in a medical simulation center. Key findings of this study will be presented and issues and problems, which arose, will be analyzed and possible solutions discussed. Future research is expected to solve some remaining technical challenges, making mHealth in prehospital emergency medicine very promising.

BACKGROUND

Prehospital Emergency Medicine

Prehospital emergency medicine summarizes all efforts made by medical professionals to treat acute illnesses, life-threatening conditions and pain at the emergency site and to transport the patient – if needed – to a hospital. Prehospital emergency medicine varies between countries (Callese et al., 2015; Roudsari et al., 2007). Most developed countries have an advanced life support system, which can be divided into the Anglo-American model and the Franco-German model. In the Anglo-American model, the prehospital emergency medicine is provided by paramedics (Wandling, Nathens, Shapiro, & Haut, 2016). The Franco-German model is similar to the Anglo-American model but differs in life-threatening conditions (Al-Shaqsi, 2010). The Franco-German model dispatches paramedics and additively dispatches emergency physicians in life-threatening conditions (Dick, 2003).

Three Key Emergencies: Myocardial Infarction, Stroke, Trauma

Medical emergencies, which happen outside a hospital, contribute immensely to the global morbidity and mortality. The World Health Organization published a fact sheet about “the top 10 causes of death”, where ischaemic heart disease and stroke are the two leading causes of death worldwide (WHO, 2014). Myocardial infarction, as the acute and life-threatening form of ischaemic heart disease, is one of the leading causes of hospitalization and mortality worldwide (Filgueiras Filho et al., 2018). The European Society of Cardiology emphasizes the importance of the prehospital phase because this is the most critical phase for the occurrence of cardiac arrest. Early treatment is proven to reduce morbidity and mortality (Steg et al., 2012). Stroke, which also is a common diagnosis in prehospital emergency medicine, depends on early treatment, too. The European Stroke Organisation recommends priority treatment to reduce morbidity and mortality (The European Stroke Organisation Executive & Committee, 2008). In case of stroke, a telemedical consultation from the emergency department increases patient outcome (Bernetti et al., 2018). The implementation of telemedicine in stroke treatment was recommended by the American Heart Association and American Stroke Association already in 2009 (Schwamm et al., 2009). MHealth
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