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LETTER TO THE EDITOR

Smart Technology – a Future Field in Acute Cardiac Care

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The concept of mobile Health (mHealth) refers to the use of diagnostic devices which can provide information from a remote distance, via internet pathways, that can influence the therapeutic management in a variety of disorders.

Several electronic tools have been tested and proven useful in simplifying the cardiovascular management of patients, more specifically mobile applications that are compatible with the Android system, which have led to a 25.5% improvement in quality of primary medical care, patient prognosis, as well as better efficacy of measures for secondary cardiovascular prevention.[1]

Such applications include remote monitoring devices for evaluation of cardiac rhythms via iECG, which uses a smartphone (iPhone) with incorporated monitoring electrodes for telemetric cardiac rhythm recordings. Furthermore, such devices include blood pressure measurement tools, which have the configuration of a smartwatch or bracelet that uses the applanation tonometry technique.[2]

For heart failure patients, mHealth applications include a remote monitoring device that records the filling pressures within the left ventricle and the pulmonary artery, which is based on a micro-electromechanical system that is implanted at the level of the pulmonary artery.[3]

Technological advancements have led to the development of a remote cardiac ultrasound system composed of a transducer connected to a smart mobile phone, which has the capacity to store and transfer the acquired imaging data towards a specialized center for further analysis and interpretation within a clinical context.[4]

Telemedicine applications for telephone transmission of ECG recordings from underserved regions have led to a drastic decrease in myocardial infarction-related mortality from 16.4% to 4.8% in 30 days, thus introducing, for the first time, the concept of iICU (internet-based intensive care unit).[5]

Electronic devices applied in cardiac care can be used in every phase of patient management, both in acute and long-term care settings, including mobile health in cardiac arrest, rhythm disturbances, acute myocardial infarction, or heart failure. Out-of-hospital cardiac arrest (OHCA) is related to high mortality rates, and timely initiation of correct resuscitation maneuvers could be life-saving.[6] Mobile life-saver is a smartphone application that can identify and alert volunteers that have been trained in cardio-pulmonary resuscitation, and which led to a faster time from OHCA to chest compression.[7] In acute myocardial infarction, it is well known that a decreased time from onset of symptoms to interventional treatment is associated with a significant improvement in survival, as well as short- and long-term complications.[8] However, although in case of activation of a STEMI network by a non-cardiologist specialist reduces times to treatment, it may also increase the rate of false positive activation of such networks.[9] The use of transtelephonic ECG interpretation by a remote cardiology specialist has been shown to reduce STEMI network times, to improve pre-hospital pharmacological treatment and time to reperfusion therapies, as well as in-hospital mortality for

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STEMI, while decreasing the rate of false activation of such networks.[10–14]

On the other hand, currently there is no mHealth device for secondary prevention in cardiovascular medicine, which would integrate multiple sets of noninvasive data based on ECG tracing, echocardiography, hemodynamic parameters, clinical data, or information related to the patients' adherence to treatment, all combined in a single platform for cardiac risk assessment and therapeutic assistance.

Such an mHealth system with application in cardiology could consist in, for instance, an ensemble of digital mobile applications that would allow several examinations and recordings, including ECG, heart rate and blood pressure, echocardiography and demographic patient information, by using portable smart devices (phones, bracelets, watches, tablets), and storage of recorded information in a cloud platform that allows remote data interpretation by a specialist that can access the platform from literary anywhere.

The introduction of mHealth concepts that are centered on cardiovascular emergencies in regions that are known for a high risk of cardiac diseases, such as areas in Central and Eastern Europe, could lead to an increased use of innovative applications, on large populations, thus improving the medical assistance of such patients, with subsequent decreases in mortality, morbidity, and further healthcare-related costs. Several mHealth applications may be tested in a high cardiovascular risk population such as:

- the use of complex apps that integrate a multitude of remote data (ECG, echocardiography, hemodynamic monitoring devices) in one mHealth device applied in cardiology;
- remote hemodynamic monitoring, cardiac rhythm monitoring, and remote interrogation of implantable cardiovascular devices such as intracardiac defibrillator and pacemakers.

In Romania, a country in which cardiovascular disease in the main cause of mortality and morbidity, the number of medical specialists divided to the total population is one of the lowest in Europe, with an estimated 295 doctors for 100,000 citizens, in comparison to Greece for example, with approximately 627 doctors for 100,000 inhabitans.15

Therefore, the use of alternative organizational tools, based on modern communication devices and mHealth concepts, can compensate for the deficit of medical specialists, especially in remote areas where access to basic or specialized medical care is difficult. Modern mHealth devices are becoming widely used in developed countries, in which access to medical care is not restricted to geographical, logistical, or financial reasons; however, such applications could also lead to an improved medical care in Central and Eastern European countries and a decrease in cardiovascular mortality and morbidity rates.

CONFLICT OF INTEREST

Nothing to disclose.

REFERENCES

1. Tian M, Ajay VS, Dunzhu D, et al. A Cluster-Randomized, Controlled Trial of a Simplified Multifaceted Management Program for Individuals at High Cardiovascular Risk (SimCard Trial) in Rural Tibet, China, and Haryana, India. Circulation. 2015;132:815-824. doi:10.1161/CIRCULATIONAHA.115.015373.
2. Bohavnani SP, Narula J, Sengupta PP. Mobile technology and the digitalization of healthcare. Eur Heart J. 2016;37:1428-1438. https://doi.org/10.1093/eurheartj/ehv770.
3. Abraham WT, Adamson PB, Bourge RC, et al. Wireless pulmonary artery hemodynamic monitoring in chronic heart failure: a randomised controlled trial. Lancet. 2011;377:658-666. doi: 10.1016/S0140-6736(11)60101-3.
4. Singh S, Bansal M, Maheshwari P, et al. American Society of Echocardiography: Remote Echocardiography with Web-Based Assessments for Referrals at a Distance (ASE-REWARD) Study. J Am Soc Echocardiography. 2013;26:221-233. doi: 10.1016/j.echo.2012.12.012.
5. Gupta S, Dewan S, Kaushal A, et al. eICU Reduces Mortality in STEMI Patients in Resource- Limited Areas. Global Heart. 2014;4:425-427. doi: 10.1016/j.gheart.2014.07.006.
6. Bækgaard JS, Viereck S, Palsgaard Møller T, Kjær Ersbøll A, Lippert F, Folke F. The Effects of Public Access Defibrillation on Survival After Out-of-Hospital Cardiac Arrest – A Systematic Review of Observational Studies. Circulation. 2017;136:954-965. https://doi.org/10.1161/CIRCULATIONAHA.117.029067.
7. Ringh M, Fredman D, Nordberg P, Stark T, Hollenberg J. Mobile phone technology identifies and recruits trained citizens to perform CPR on out-of-hospital cardiac arrest victims prior to ambulance arrival. Resuscitation. 2011;82:1514-1518. doi: 10.1016/j.resuscitation.2011.07.033.
8. Widimsky P, Wijns W, Fajadet J, et al. Reperfusion therapy for ST elevation acute myocardial infarction in Europe: description of the current situation in 30 countries. Eur Heart J. 2010;31:943-957. doi: 10.1093/eurheartj/ehp492.
9. Regueiro A, Fernández-Rodríguez D, Freixa X, et al. False Positive STEMI Activations in a Regional Network: Comprehensive Analysis and Clinical Impact. Results From the Catalonian Codi Infart Network. Rev Esp Cardiol (Engl Ed). 2018;71:243-249. doi: 10.1016/j.rec.2017.06.001.
10. Papai G, Csato G, Racz I, et al. The transtelephonic electrocardiogram-based triage is an independent predictor of decreased hospital mortality in patients with ST-segment elevation myocardial infarction treated with primary percutaneous coronary intervention. J Telemed Telecare. 2018;10:0:1-7. doi: 10.1177/1357633X18814335.

11. Saberian P, Tavakoli N, Ramim T, Hasani-Sharamin P, Shams E, Baratloo A. The Role of Pre-Hospital Telecardiology in Reducing the Coronary Reperfusion Time; a Brief Report. Arch Acad Emerg Med. 2019;7:e15.
12. Brunetti ND, Di Pietro G, Aquilino A, et al. Pre-hospital electrocardiogram triage with tele-cardiology support is associated with shorter time-to-balloon and higher rates of timely reperfusion even in rural areas: data from the Bari-Barletta/Andria/Trani public emergency medical service 118 registry on primary angioplasty in ST-elevation myocardial infarction. Eur Heart J Acute Cardiovasc Care. 2014;3:204-213. doi: 10.1177/2048872614527009.
13. Gonzalez MA, Satler LF, Rodrigo ME, et al. Cellular video-phone assisted transmission and interpretation of prehospital 12-lead electrocardiogram in acute ST-segment elevation myocardial infarction. J Interv. Cardiol. 2011;24:112-118. doi: 10.1016/j.amjcard.2007.07.082.
14. Al-Zaiti SS, Shusterman V, Carey MG. Novel technical solutions for wireless ECG transmission & analysis in the age of the internet cloud. J. Electrocardiol. 2013;46:540-545. doi: 10.1016/j.jelectrocard.2013.07.002.
15. https://ec.europa.eu/eurostat/statistics-explained/index.php/Main_Page