doi: http://dx.doi.org/10.11606/issn.1679-9836.v100i2pi-iv

Rev Med (São Paulo). 2021 March-April;100(2):i-iv.

EDITORIAL

New technologies and emergency department excellence

Novas tecnologias e excelência na unidade de emergência

Tarso A. D. Accorsi[1], Ricardo Galesso Cardoso[1], Milena R. Paixão[1], Karine De Amicis[1], Karen Francine Köhler[1], José Leão de Souza Júnior[1]

The Emergency Units are a fundamental and strategic part of the complex health system, and, conceptually, they propose to assist patients with acute complaints, which can potentially be manifestations of life-threatening situations[1]. The increase in the population aging rate and complexity of patients is associated with a progressive increase in visits number and the severity of cases in these units. When translated into numbers, the data is impressive. In the United States (2016), 136 million consultations were performed per year (40 million for trauma), resulting in 16.2 million hospitalizations in apartments and 2.1 million ICU admissions[2]. The easy access inherent to the vocation of this service, linked to the needs of other health sectors, is also associated with statistics of overcrowding in emergency centers and inadequate use of resources. Approximately 27% of consultations are performed in less than 15 minutes and, progressively in more complex cases, and there is an increase in the wait for the first contact with a health professional, followed by medical evaluation, first medication, waiting for hospitalization, and length of stay until the high[1,3]. At the same time, the emergency workload leads to high rates of professional dissatisfaction (34% consider abandoning their work) and disbelief about reducing the misuse of the emergency (44% of professionals do not believe in any improvement and 38% understand that the patients do not receive the ideal treatment)[4]. The sum of these factors generates inefficiency, verified by a minimum of 10% of diagnostic errors in the emergency, with progressive increase the more significant the severity, being associated with greater morbidity and mortality from all causes[5].

Excellent management of the Emergency Unit must dedicate itself to improving the prognosis of acutely ill and traumatized patients, to have high-quality care based on the best practices and accurate indicators, to aim for the best possible experience for the patient in a cost-effective way, in addition to providing continuing education and generation of knowledge to health care professionals[6]. Given all the points mentioned above, this complex mission is only feasible with the help of new technologies exponentially in development, accessible, and progressively based on a broad scientific basis.

The most explored potential of new technologies is improving diagnostic accuracy and reducing

1. Emergency Unit, Hospital Israelita Albert Einstein, São Paulo, SP, Brazil. INTEGRATE researchers (EINsTein EmerGency ReseArch TEam). ORCID/email: Accorsi TAD – https://orcid.org/0000-0002-8023-3466, tarsoa@einstein.br; Cardoso RG - https://orcid.org/0000-0002-1935-607X, ricardo.cardoso@einstein.br; Paixao MR - https://orcid.org/0000-0002-1565-3915, milena.paixao@einstein.br; De Amicis K - https://orcid.org/0000-0002-9936-2436, karineamicis@gmail.com; Köhler KF https://orcid.org/0000-0002-8348-4623, kohlsel@gmail.com; Souza Junior JL - https://orcid.org/0000-0001-6017-7682, jose.leao@enstein.br.
Correspondence: Tarso A. D. Accorsi. Secretaria da Unidade de Pronto Atendimento. Av. Albert Einstein, 627. Bloco B, 2º andar. São Paulo, SP. CEP: 05652-900. E-mail: tarsoa@einstein.br

service time, fundamental aspects for obtaining a better prognosis and reducing overload and costs. In this context, the first technological strategies were the "point-of-care" assessments, representing the possibility of obtaining quick complementary blood tests at the bedside[7]. The main fields of study were the availability of troponin dosage for patients suspected of having the acute coronary syndrome, the availability of exams that mark organ dysfunction in suspected sepsis, and trauma-induced coagulopathy. In these situations, the laboratory point-of-care analysis implied an earlier diagnosis and, consequently, earlier treatment and reduced mortality[8,9]. Besides, the Emergency Unit's early safe discharge rate has dramatically increased with this technology.

Improvements (reduction in size and cost, transmission and storage resources, and artificial intelligence) in the equipment for monitoring vital signs also happen progressively and facilitate the dynamics of care and diagnostic assistance. Through the compilation of clinical and laboratory data, the electronic medical record can support the decision after recognizing warning signs. Artificial intelligence can already issue reports with a high correlation with the impression of radiologists for various imaging exams, streamlining the process[10]. Recently, artificial intelligence with "deep learning" was able to identify patients with coronary artery disease with high accuracy through facial recognition [11]. The Emergency Unit of the future will have an increase in the pre-test probabilities with this instantaneous resource. However, the current technological resource that had the most significant impact in improving diagnostic accuracy at the bedside was portable ultrasound (connected to a cell phone or tablet) as an extension of the physical examination. A broad and progressive scientific evidence, mainly in patients with acutely manifested dyspnea and undifferentiated shock, shows that the positive and negative likelihood ratio of the lung, heart, and large veins for diagnosis of various etiologies, is greater than the clinical, electrocardiographic evaluation, radiographic and with biomarkers[12,13]. A good emergency room has an ultrasound device; in a Unit of excellence, ultrasonography is an integral part of clinical evaluation. The ultrasound assessment handled by the on-call physician, in addition to being the best diagnostic resource for numerous situations, is fast, cost-effective, and allows for multiple reassessments[14].

In addition to assisting in the diagnostic process, new technologies also play an essential role in treating acute health problems. One of the most dramatic situations that the emergency physician can face is cardiopulmonary arrest (CPA). Numerous studies have been carried out to identify factors that influence survival and hospital discharge, secondary to a CRP, regardless of its cause. Within this context, a new technological resource has shown promising results: resuscitation aided by an oxygenation system and extracorporeal circulation (ECMO - Extracorporeal Membrane Oxygenation), called E-CPR[15]. This technique consists of installing a cardiopulmonary bypass device in a patient in CPA, offering the team a longer period to find the cause of this CPA and to reverse it, if possible. Selected patients have benefited from this tool, with reports of survival for hospital discharge ranging from 29% to 43%, and more and more cutting-edge services can perform E-CPR in their emergency rooms or even offer this resource to the prehospital level[16,17].

Several applications have been incorporated into the emergency practice, simplifying communication with patients and health units or guiding first care to non-specialized professionals. Apps like Pulsara allow paramedics to communicate with emergency departments in a simple, fast and safe way by informing data about the patient's condition and arrival time, transmitting images and electrocardiogram and thus facilitating the activation of specific teams and institutional codes such as stroke, AMI, trauma, sepsis or any other team involved in the treatment before the patient arrives. AirRx, on the other hand, was designed to help healthcare professionals who face emergencies during a commercial flight by making available the 23 most common causes of triggering in these situations as well as the crew functions of each airline and the legal, medical implications involved.

Emergency training has been revolutionized using mannequins that realistically simulate vomiting, sweat, and bleeding in addition to all motor functions. Realistic video games allow simulation of service with improved techniques and individualized feedback on performance with speed, average time, assertiveness, possible damage, or excess.

The acceleration of Telemedicine in recent years has established itself as an effective and safe strategy for sharing knowledge among professionals, reducing cases of low complexity in emergencies, and optimizing access to health in remote regions[18,19]. In services whose demand for subspecialists is small or low regional availability of professionals, it is economically unfeasible to maintain them in person at each health unit[20,21]. In this context, the exchange of experience in real-time between the emergency room and other specialists at a distance, such as cardiologists and neurologists, can be crucial for the assertive management of highly complex cases[22,23]. In situations of the health system collapse due to catastrophes related to major accidents or infectious diseases, as in the pandemic by COVID-19, the effectiveness of the call center in the management of human and material resources is notable[24,25]. In addition to avoiding the need for emergency care, as in cases where driving must be outpatient, remote care is helpful to reinforce the need for face-to-face assessment for those who have diseases for which rapid intervention is essential. Finally, for populations that live or work in places far from large centers, for which access to the emergency requires long and/or complex commuting, the initial stages of care can be directed by Telemedicine directly to the patient or between health professionals[19,23,26].

The United States Department of Homeland Security has already tested technologies that promise to simplify and make emergency or catastrophe assistance more efficient. Light and functional clothing that protects rescuers against gunshots or punctures and with an instant high-visibility mode in places of low light or darkness, exoskeletons that will allow displacing or lifting patients with less physical effort, sensors applied to the skin of rescuers and patients who collect instant data of vital signs and metabolic parameters as well as geolocation. Autonomous ambulances, utterly independent of human beings, will allow the crew members to contact the victims employing video calls during the route, collecting data even through skin sensors above that will be abundantly available at home, interacting with the patient or his accompanying person to guide the beginning of treatment.

As quickly as an emergency room service, new technologies are made available in the health area. The current challenge will be to deal with the exponential growth of new technologies while the growth of knowledge remains linear. Situations in which time is a crucial factor for the excellent evolution of the patient, and complex decisions must be made as soon as possible, the state-of-the-art technological resources are an essential tool, and together with sound clinical judgment and careful evaluation, they enable the emergency services to offer safe and effective treatment, following current best practices[25,27].

The future of emergency care looks more streamlined, efficient, and faster. There will be a considerable number of data instantly for care and will consider the needs of patients and the limitations of resources and caregivers. Nobody will needlessly wait for the first appointment.

REFERENCES

1. Alnujaidi M, Aldibane R, Alosaimi R, Kashmeeri R, Altalhi E, Shalabi A. 71. Factors predicting hospital admission for non-urgent patients triaged with the Canadian Triage and Acuity Scale (CTAS) in the Emergency Department. A retrospective study in Tertiary Center in Makkah, KSA. Eur J Emerg Med. 2020;27:e16-e17. doi: 10.1097/01.mej.0000697884.22158.2f.

2. Centers for Disease Control and Prevention (CDC). Data for points 1 to 5 are from the CDC “National Hospital Ambulatory Medical Care Survey: 2011 Emergency Department Summary Tables 1, 4, 14, 24.” Disponível em: http://www.cdc.gov/nchs/fastats/emergency-department.htm.

3. ProPublica. Data for points 6 to 9 is from ProPublica’s “ER Wait Watcher” updated May 27, 2015. Available from: https://projects.propublica.org/emergency/.

4. The American College of Emergency Physicians. 2015 ACEP Poll Affordable Care Act Research Results. Data for points 17 to 24. March 2015. Available from: https://www.scribd.com/document/264530627/2015-ACEP-Poll-Affordable-Care-Act-Research-Results.

5. Hautz WE, Kämmer JE, Hautz SC, Sauter TC, Zwaan L, Exadaktylos AK, et al. Diagnostic error increases mortality and length of hospital stay in patients presenting through the emergency room. Scand J Trauma Resusc Emerg Med. 2019;27:54. doi: 10.1186/s13049-019-0629-z.

6. Baker WE, Solano JJ. Quality Assurance in the Emergency Department. Emerg Med Clin North Am. 2020;38:663-680. doi: 10.1016/j.emc.2020.05.002.

7. Brogan GX Jr, Bock JL. Cardiac marker point-of-care testing in the Emergency Department and Cardiac Care Unit. Clin Chem. 1998;44:1865-9.

8. Castro-Dominguez Y, Dharmarajan K, McNamara RL. Predicting death after acute myocardial infarction. Trends Cardiovasc Med. 2018;28:102-109. doi: 10.1016/j.tcm.2017.07.011.

9. Cecconi M, Evans L, Levy M, Rhodes A. Sepsis and septic shock. Lancet. 2018;392:75-87. doi: 10.1016/S0140-6736(18)30696-2.

10. Hosny A, Parmar C, Quackenbush J, Schwartz LH, Aerts HJWL. Artificial intelligence in radiology. Nat Rev Cancer.

2018;18:500-510. doi: 10.1038/s41568-018-0016-5.

11. Lin S, Li Z, Fu B, Chen S, Li X, Wang Y, et al. Feasibility of using deep learning to detect coronary artery disease based on facial photo. Eur Heart J. 2020;41:4400-11. doi: 10.1093/eurheartj/ehaa640.
12. Volpicelli G, Elbarbary M, Blaivas M, Lichtenstein DA, Mathis G, Kirkpatrick AW, et al. International Liaison Committee on Lung Ultrasound (ILC-LUS) for International Consensus Conference on Lung Ultrasound (ICC-LUS). International evidence-based recommendations for point-of-care lung ultrasound. Intensive Care Med. 2012;38:577-91. doi: 10.1007/s00134-012-2513-4.
13. Keikha M, Salehi-Marzijarani M, Soldoozi Nejat R, Sheikh Motahar Vahedi H, Mirrezaie SM. Diagnostic Accuracy of Rapid Ultrasound in Shock (RUSH) Exam; A Systematic Review and Meta-analysis. Bull Emerg Trauma. 2018;6:271-8. doi: 10.29252/beat-060402.
14. Leidi A, Rouyer F, Marti C, Reny JL, Grosgurin O. Point of care ultrasonography from the emergency department to the internal medicine ward: current trends and perspectives. Intern Emerg Med. 2020;15:395-408. doi: 10.1007/s11739-020-02284-5. Epub 2020 Feb 7. PMID: 32034674.
15. Kalra R, Kosmopoulos M, Goslar T, Raveendran G, Bartos JA, Yannopoulos D. Extracorporeal cardiopulmonary resuscitation for cardiac arrest. Curr Opin Crit Care. 2020;26:228-35. doi: 10.1097/MCC.0000000000000717.
16. Richardson AS, Schmidt M, Bailey M, Pellegrino VA, Rycus PT, Pilcher DV. ECMO Cardio-Pulmonary Resuscitation (ECPR), trends in survival from an international multicentre cohort study over 12-years. Resuscitation. 2017;112:34-40. doi: 10.1016/j.resuscitation.2016.12.009.
17. Yannopoulos D, Bartos J, Raveendran G, Walser E, Connett J, Murray TA, et al. Advanced reperfusion strategies for patients with out-of-hospital cardiac arrest and refractory ventricular fibrillation (ARREST): a phase 2, single centre, open-label, randomised controlled trial. Lancet. 2020;396:1807-16. doi: 10.1016/S0140-6736(20)32338-2.
18. Lapcharoensap W, Lund K, Huynh T. Telemedicine in neonatal medicine and resuscitation. Curr Opin Pediatr. 2021;33:203-208. doi: 10.1097/MOP.0000000000000995.
19. Waller M, Stotler C. Telemedicine: a Primer. Curr Allergy Asthma Rep. 2018;18:54. doi: 10.1007/s11882-018-0808-4.
20. Reid S, Bhatt M, Zemek R, Tse S. Virtual care in the pediatric emergency department: a new way of doing business? CJEM. 2021;23:80-4. doi: 10.1007/s43678-020-00048-w.
21. Williams D, Simpson AN, King K, Kruis RD, Ford DW, Sterling SA, et al. Do Hospitals Providing Telehealth in Emergency Departments Have Lower Emergency Department Costs? Telemed J E Health. 2020. doi: 10.1089/tmj.2020.0349.
22. Domingues RB, Mantese CE, Aquino EDS, Fantini FGMM, Prado GFD, Nitrini R. Telemedicine in neurology: current evidence. Arq Neuropsiquiatr. 2020;78:818-26. doi: 10.1590/0004-282X20200131.
23. Miller AC, Ward MM, Ullrich F, Merchant KAS, Swanson MB, Mohr NM. Emergency Department Telemedicine Consults are Associated with Faster Time-to-Electrocardiogram and Time-to-Fibrinolysis for Myocardial Infarction Patients. Telemed J E Health. 2020;26:1440-8. doi: 10.1089/tmj.2019.0273.
24. Rosenfield D, Lim R, Tse S. Implementing virtual care in the emergency department: building on the pediatric experience during COVID-19. CJEM. 2021;23:15-8. doi: 10.1007/s43678-020-00026-2.
25. Hutchings OR, Dearing C, Jagers D, Shaw MJ, Raffan F, Jones A, et al. Virtual Health Care for Community Management of Patients With COVID-19 in Australia: Observational Cohort Study. J Med Internet Res. 2021;23:e21064. doi: 10.2196/21064.
26. Mohr NM, Harland KK, Okoro UE, Fuller BM, Campbell K, Swanson MB, et al. TELEmedicine as an intervention for sepsis in emergency departments: a multicenter, comparative effectiveness study (TELEvISED Study). J Comp Eff Res. 2021;10:77-91. doi: 10.2217/cer-2020-0141.
27. Medford-Davis LN, Singh H, Mahajan P. Diagnostic Decision-Making in the Emergency Department. Pediatr Clin North Am. 2018;65:1097-105. doi: 10.1016/j.pcl.2018.07.003.