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Short Commentary

COVID-19 Pandemic and Digital Transformation in ICU

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Throughout the past decades, our Health System has confronted serious epidemics and catastrophes that have challenged our standards of care. From the H1N1 and SARS epidemics, to the natural disasters like hurricane Katrina and Maria, our hospitals and healthcare workers have experienced shortages, resource allocation challenges and personnel exhaustion. Major disasters have been associated to an increase in morbidity and mortality attributed in great part to the burden created in the health care system [1]. Disasters, regardless of their origin, share commonalities such us the volume of patients and population affected and the need for intensive care support and resources such as mechanical ventilators. The pressure created in the healthcare system produces stress and frustration to the professional and causes anxiety and panic to the general population [2].

In the COVID-19 pandemic the rate of hospitalizations has been reported between 5 and 40% of the infected population and it is estimated that up to 25% of those patients will require intensive care admission [3]. The volume of patients could easily overwhelm most healthcare systems, currently not prepared to manage a surge of that magnitude. Typical expansion of the hospital and ICU bedding will provide care for up 20 to 30% of extra patients without compromising specialized personnel or equipment. Patients treated in large volume and specialized ICUs have better outcomes [4]. These standards are challenged by the current Pandemic and creates questions on the minds of most of us, on regards to future developments and our plans.

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As COVID 19 has clustered in some areas surpassing normal and surge-planned capacity, some systems have experienced the collapse of intensive care units with consequent results in mortality, transmission among healthcare providers and significant stress. Therefore, authorities have focused in protocols and policies aimed to mitigate the infection rate, sometimes affecting the mobility of the entire population. It is clear that an overwhelmed healthcare system cannot provide the same level of specialized care thus diminishing the standards.

In this current scenario, the question arising is what can informatics offer? Can informatics supply some of the needs and help in the management of the surge or even impact outcomes? Different systems are currently available, including the basic Electronic Health Records (EHR), Tele-Critical Care or Smart ICU [5]. EHR offer documentation and data base and are widely present in most of the Intensive Care Units and Hospital Systems in the US. Documentation and data collection are the strongest points in their favor. With significant variability among the current available systems, there is minimal additional values.

Tele Critical Care was born as a method to supply with intensivists areas not covered by these specialized services. Since its inception however it has evolved into a complementary care and it has proven essential in standardization of care and improvement in outcomes [6]. In the current pandemic it has been instrumental in allowing access to patient's room minimizing exposure for the healthcare professional. In addition, the presence of the camera and the availability of specialized personnel has served as a safety cushion for healthcare providers bedside while executing treatments or diagnostics. Another added benefit is the possibility to increase the reach of the intensive care personnel and care to an extended group using the standard tools of the system, in a model that has been advocated as "ICU without walls" [7]. Perhaps one handicap of the Tele ICU is the cost and pre-installation requirements associated with the available systems and also the absence of specialized personnel to staff the "behind the camera" as those clinicians are being required bedside.

The concept of Smart ICU is becoming everyday more a reality. Conceived as one of the most important elements of the digital transformation for healthcare, provides important benefits in improving medical care [8]. Smart ICU is capable of integrating data from and to EHR without manual input, real time, directly from the source (iv pumps, ventilators, monitors…), allowing a rapid evaluation of the modifications of treatment and the changing clinical scenario. In addition, by this automated interface, there is a significant decrease in the burden of work for nurses and physicians. Real time data collection and automatic input generates reliable therapeutic and clinical graphics and trends, with minimal room for mistakes, allowing significant more time to spend with patients, bedside, or in clinical interventions. Another major benefit of Smart ICUs is the ability to collect and analyze massive amounts of data, lately mentioned as "Big Data", leading to the opportunity to create patient and disease profiles while individualizing care based on singular factors [9]. When the medical community is confronted with a changing environment and the unknown

territory of a novel disease, searching for patterns become an obsession. Every day we are flooded by anecdotical pieces of information regarding management or treatment of patients and we are obligated to filter increasing amounts of information while being blindsided by the pressure of managing the growing number of patients. The ability to provide predictive algorithms in order to rapidly determine such a changing environment has evolved into a significant added value of Smart ICUs. "Big Data", requires sophisticated data collection systems, and also complicated analysis to convert such data points into "bedside" value. Smart ICU systems are designed to provide digested data translated into action protocols allowing not only a safer environment but also reducing the time and effort by the clinicians.

If our ICUs will be Smart ICUs, the increasing amounts of data could be perhaps better analyzed to determine variables that can escape our understanding. In addition, Smart ICU will decrease clerical work for our personnel, guaranteeing less room for mistakes in documentation and more time to deliver care. Our ICUs would benefit from a safer and more efficient patient care environment. We believe the investment needed to provide a true digital transformation in our ICUs is justified by the enormous range of benefits provided. As we are evaluating our past experiences and prepare to embrace the future, Digital Transformation should be our next step.

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