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CE's Professional Roles and Responsibilities in a Post-COVID World

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Abstract— **This session shows 5 points of view based on the experience of what can be done as part of the clinical engineer's roles and responsibilities in a post-COVID world.**

I. Introduction

2020 was a year of many challenges and lessons for the health sciences community. Concerning clinical engineering, the magnitude of the challenge involved testing the knowledge, skills, and abilities to act with opportunity and effectiveness facing the problems caused by the COVID19 pandemic. Even though this situation has not been ended, the lessons learned have allowed us to propose strategies to deal with the challenges that a post-pandemic scenario will present. This session shows 5 points of view based on the experience of what can be done as part of the clinical engineer's roles and responsibilities in a post-COVID world.

The virus novelty has made healthcare systems cope simultaneously with a high patient rate and the shortage of medical products. The solutions implemented have led to essential medical products being produced by companies from various industries and approved under the emergency. The role of national regulatory bodies becomes crucial. Raising global awareness and knowledge about the importance of respecting the essential requirements is needed to guarantee the appropriate quality, performance, and safety of medical products, especially during outbreak situations. The considerations and experiences presented can guide all possible future events to prevent national regulatory bodies' improvised reactions.

Patients safety has become a priority within hospital settings. Their interaction with sophisticated systems dedicated to the diagnosis of diseases, treatment, and recovery has caused a rethinking of safety aspects in all areas. The role of the clinical engineer in this context becomes strategic. Through a multidisciplinary vision, the essential steps are exposed to address this situation.

The changes brought about by the pandemic are beyond the care of patients. New and evolved defiances are presented that derive proposals for "out of the box" solutions. Hospital engineering can benefit from approaches such as the semantic for the development of its functions, which is why useful tools are shown, some experiences are exposed, and opportunities are raised in this regard.

Clinical engineers acquire the capabilities that enable them to develop an integrative vision based on the convergence of multidisciplinary knowledge and skills. Their professional training allows them to address the opportunities and responsibilities that these post-pandemic scenarios present them. Some of them arise in the areas of health technology assessment and management.

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Emergency Use Authorizations for Medical Products: Risks During the COVID19 Outbreak Situation

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Abstract—**The effects of the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) on people caused that bodies like the World Health Organization (WHO) [2], the United Kingdom National Institute for Health and Care Excellence (NICE) [3], the United States Food and Drug Administration (FDA) [4], and the National Health Commission of the People's Republic of China [5] to publish recommendations and guidelines related to patient treatments and essential medical items. The documents have been updated in to handle the illness in the best possible ways.**

The first issues to focus were oriented to the utilization of mechanical ventilators for the treatment of patients with serious manifestations. They also included the utilization of personal protective equipment (PPE) and home and healthcare considerations. Soon they became fundamental for the care of patients, clinical staff and people in general [6]. A narrative approach to the emergency use authorizations and legal concessions for medical products in this outbreak based on the available documentation is presented.

Raising worldwide awareness and information about the essential COVID19 requirements is a necessity; it will ensure suitable quality, performance and safety of the medical products to be used. Important tasks such as development, import and approval of these medical products should be specific and clearly authorized because the different risk levels that may arise form case to case. And the experience must be taken as a reference for future scenarios.

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A Semantic Approach to Hospital Engineering: Tools, Experiences and Opportunities

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Abstract—**Many fields of engineering are now leveraging data both for accurate design and for efficient management. This data driven approach requires robust methods and protocols for accessing and for sharing knowledge. It also calls for complex tools to exploit all the powerful implications of this approach.**

The COVID-19 pandemic has shown, plastically, that the availability of a lot of information, together with real-time access to it, can make the difference between life and death. A detailed picture of the plant equipment of the premises, integrated with the knowledge of electro-medical devices, their location and state of use, is directly related to the emergency response capacity and to the preparedness to disasters.

The proposed approach is based on the combined adoption of semantic ontologies, extended reality, artificial intelligence, building information modeling and more. Some local and global experiences will be shared and discussed with the explicit aim of reshaping the approach to hospital engineering and the role of biomedical and clinical engineers.

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How COVID19 Changed the way to Teach Clinical Engineering

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Abstract— **The teaching processes changed with the appearance of a pandemic that affected all aspects of life, including professional preparation. This situation presented a scenario for which we were not fully prepared. That forced us to respond quickly to a series of academic, logistics, and interaction challenges that will continue to be present once it passes to a stage of greater control. The author's experience and lessons learned in teaching courses in clinical engineering and medical technology management at the Universidad Autonoma Metropolitana, Mexico City, throughout 2020 and under the context of the working conditions imposed by the COVID19 pandemic**

I. Introduction

Teaching clinical engineering in educational institutions has had a series of changes over time; most of them have followed the evolution of health care concerning technological resources. The progress in medical technology has occurred thanks to the interdisciplinary nature of biomedical engineering in general and clinical engineering in particular.

The academics who have taught clinical engineering courses have gone from mostly theoretical lectures with a small practical component limited to field observation to become facilitators of students' resources. This way, they can develop their learning from experiences and proposals for practical and innovative solutions to hospital environment problems. The pandemic presented a scenario for which we were not fully prepared. Restrictions on access to face-to-face classes and hospitals for internships presented a challenge to the teaching and learning process, both for students and teachers. My experience in teaching clinical engineering and medical technology management courses at Universidad Autonoma Metropolitana (UAM) during 2020 and the lessons learned are presented.

II. Methods

The academic program of Biomedical Engineering at UAM has undergone significant changes throughout the 46 years that it has been taught. In the last stage, the importance of clinical engineering subjects was recognized; it is based on the demand for engineers in the hospital environment. Likewise, key medical technology management issues for the professional training of the students were identified. Elective courses were created to meet this need, as well as term projects on these topics. In 2020, the courses Introduction to Health Economics, Medical Technology Assessment, and Technological Management were taught, as well as 2 terminal career projects were finished and five more started.

The challenges presented were diverse in nature and intensity: creating virtual classrooms for the courses; maintain students' interest in the course during the term to avoid dropping out, create conditions for effective communication between teacher and students, deal with the fact that not all students have the facilities to take an online course, address the part practice of career projects, etc.

III. Results

The courses were taught in asynchronous virtual mode. The virtual classrooms were created under WordPress, and the contents were based on presentations with audios, some support videos, complementary material such as readings, and the creation of online discussion forums to evaluate student participation. Communication with the class took place through virtual meetings arranged at convenient times for everyone to answer questions or give advice for developing the course project. These meetings were mostly in small groups of varying duration, no less than 40 minutes. The group was provided with a telephone number using messaging for direct and immediate communication with the teacher.

IV. Discussion & Conclusion

The time for adapting the courses was short; some practical activities had to be postponed or canceled. The time spent both preparing sessions and attending to students increased considerably.

The uncertainty that this situation generated in all areas of life impacted everyone's academic performance. The new ways of teaching courses should consider the multiple contexts to which we are going to be subjected from now on. It is shown that integrating the experiences generated from academic work with the creation of collaborative networks potentiates resources and presents opportunities to improve teaching.

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Sustaining Virtual Care Innovations in the Post-COVID Era

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Abstract— **Because of the COVID-19 pandemic, man novel forms of virtual care, derived from prior telehealth and telemedicine tools, remote patient care has become an accepted part of modern clinical care. Clinical engineering skills and tools will need to adapt to support these new requirements.**

I. Introduction

In the US, UK, and Australia, many "virtual hospital" and "virtual covid ward" strategies have been designed and approved for patient care in just the first year of the COVID-19 pandemic. [1], [2] In fact, these models are a beneficial outcome of the wellspring of telehealth and telemedicine programs that were developed and deployed to save patient and clinician lives during the pandemic. This is a novel period of Emergency Use Authorizations (EUA) for innovative medical devices and systems with rapid government approval for remote patient care in remarkable forms like teledentistry [3], teleorthopedic surgery [4], teleopthalmology [5], and telerehabilitation [6], and many other forms of remote patient monitoring and care.)

These innovations have been built upon decades of telehealth and telemedicine experience and a large number of technical standards such as IEEE 11073.x, IHE Profiles, and the HL7 FHIR project. The pandemic, however, drove implementation and adoption at an unprecedented rate. For example, Cleveland Clinic's orthopedic surgery virtual patient care visits grew from 0.4% to over 70% of their care during the pandemic. [4]

The opportunity and challenge for clinical engineers who support health and information technologies to help the industry sustain these innovative programs after the pandemic subsides. If the progress can be sustained, future healthcare will benefit by extending access and availability of medical care to more patients while affording better tools for the clinicians.

II. Health Technology Management Post-COVID

The "tools" for virtual patient care now include teleconferencing, electronic medical records, and an ever-growing assortment of mobile health technologies. The mobile technologies included wearable sensors, wireless IoT products, and apps and adapters for physiologic monitoring.

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In order to assure safe and reliable remote patient care, clinical engineering professionals and departments will need to manage flexible inventories of health and information technologies as well as the critical telecommunication and interoperability systems used to link all of the resources together. In addition, some of the technologies may be patient- or clinician owned, or may be provided by medical device rental agencies.

The basic health technology management strategies used by clinical engineers during the past several decades to managing health technology life cycles will still be generally suitable, but will need to be adapted to these new circumstances. i.e., planning, procurement management, inventory management, periodic safety testing, scheduled maintenance, and planned equipment replacement will still provide a guiding framework [7]. In addition, however, many devices will need to be tested within a system of other devices and information systems to assure proper and safe performance. Some devices adapted/adopted from the consumer health field may actually need to be treated as somewhat disposable supplies rather than durable capital equipment. In many cases, device self-test and self-calibration features may need to replace past hands-on testing and documentation.

III. Conclusion

Virtualized healthcare delivery is here to stay. Clinical engineering health technology management techniques must adapt to these new requirements and opportunities.

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