Impact of new technologies on neurology in Spain. Review by the new technologies Ad-Hoc committee of the Spanish society of neurology

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ABSTRACT

Introduction: In biomedicine, new technologies are becoming more prevalent. Based on communications delivered at SEN Annual Meetings, we assessed the impact of these technologies on Spanish neurology using the consensual definition of new technologies developed by the New Technologies Ad-Hoc Committee of the SEN.

Materials and techniques: A novel technology or novel application of an existing technology, distinguished by a certain degree of coherence lasting across time, with the potential to have an impact on the present and/or future of neurology, is what we classified as new technology in neurology. From 2012 to 2018, we performed a descriptive assessment of scientific communications presented at SEN annual meetings, examining the type of technology, the subject of neurology, and the geographical provenance of the studies.

Keywords: Technology; Biomedical; Technology; Neurology; Spain

INTRODUCTION

Technology is described as a body of theories and methods that allow the practical application of scientific knowledge. Technology is enhancing traditional methods of modern medicine in the sphere of healthcare. It has enormous growth potential in the upcoming years and provides new instruments for education, recording, analysis, and distribution of objective knowledge in both clinical practice and research. In the context of the current digital revolution, the creation of new technologies used in healthcare has been made possible by the advent of new information technology systems and devices, as well as innovative applications and software. It is debatable what constitutes a novel technology given the variety of criteria that are utilized. However, the use of new technologies in biomedicine generally and in neurology in particular. This study examines a number of the game-changing technological advancements that define the digital revolution. The use of mobile devices like smartphones and tablets to deliver healthcare or health information is one example of mobile health, or mHealth. Because they incorporate a variety of sensors and applications, these gadgets are portable, easily available in developed nations, and adaptable. We should also talk about technology. Improvements in information systems and the creation of big data analytics technologies like artificial intelligence, deep learning, and machine learning. The research of neurological illnesses has a great deal of potential with these technologies. A wide range of neurological ailments and objectives, such as movement disorders, cerebrovascular diseases, sleep disorders, cognitive impairment, epilepsy, demyelinating diseases, and neuro rehabilitation, can benefit from the use of wearable devices incorporating inertial biosensors. Similarly, advances in communication technologies, including internet access *via* portable devices, offer a significant advancement in tele neurology. A richer understanding of human neuroanatomy, neurophysiology, and neuropathology in vivo is provided by developments in neuroradiology and neurophysiology, on the other hand. Robotics and virtual reality are promising technology for the neurorehabilitation of patients with mobility impairment. New opportunities in neurology are made possible by the exploration of novel materials and the miniaturization of equipment that could be produced *via* 3D printing. The construction of a tool and its use in clinical practice are delayed by the lengthy process involved in developing and clinically validating these and other emerging technologies. It is challenging to research new technologies as a whole because of the tremendous diversity and frequent development of new instruments, which slows their possible adoption in clinical practice. Thus, when new technologies are being clinically validated, they continue to undergo enhancements that also need to be clinically verified at the same time, thereby expanding the temporal gap to facilitate and expedite this procedure and shorten the distance between the parties involved, efforts should be made. Several collaborative studies that were published and the creation of technological solutions for neurological patients in the public and private sectors demonstrate the convergence of clinical and technical expertise, despite language barriers. In the upcoming years, close multidisciplinary cooperation between technicians and physicians is anticipated. Several initiatives to study new technologies have been launched by several scientific societies, including the Spanish society of neurology, the American academy of neurology, and the international parkinson and movement disorder society, in light of the need to deepen our understanding of them for application in such clinical disciplines as neurology. These seek to exchange technological information with doctors and vice versa in order to advance and enhance healthcare. These technological endeavors, such university courses on biomedical and healthcare applications of technology, complement these clinical initiatives. Our study attempts to analyze how new technologies are affecting neurological care currently provided in Spain. In order to achieve this, the new technologies Ad-Hoc committee of the Spanish Society of Neurology (SEN) has developed a consensus definition for the term "new technology" and assessed how these technologies have changed neurological care over time in Spain using data from communications distributed at the SEN's annual meeting [1].

LITERATURE REVIEW

A group of experts from the SEN's new technologies Ad-Hoc committee developed a consensual definition because there was no official term for "new technology" in place. A unique technology or a new application of an existing technology, distinguished by a specific level of coherence that endures across time, and having the potential to significantly affect the present and future of neurology, was characterized as new technology in neurology. This definition states that Electroencephalography (EEG) is a current technology whose use is well-established in clinical practice and that telecommunications technology has made it possible for the development of new medical technology. The many different criteria that are taken into account when defining a technology as novel cause debate. However, the use o f new technologies in

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biomedicine in general and neurology in particular is growing. This study examines a number of the game-changing technological advancements that define the digital revolution. The use of mobile devices like smartphones and tablets to deliver healthcare or health information is one example of mobile health, or mHealth. Because they incorporate a variety of sensors and applications, these gadgets are portable, easily available in developed nations, and adaptable. We should also point out that some technologies are not brand new. Virtual network analysis based on EEG signals with neural mass models, on the other hand, is seen as a novel application of an existing technology. Then, in order to create a comprehensive picture of the state of these technologies in the neurological community, we conducted a descriptive analysis of all communications delivered at SEN annual meetings from 2012 to 2018, choosing those that examined the use of new technologies in accordance with our agreed upon definition. There were two steps to the selection process, each involving two raters, and any conflicts were settled by consensus: Initial selection: Review of the titles of the communications in accordance with the consensus criteria (ASR and MM); and review of the abstracts of the selected communications (RLB and MM), excluding any communications that did not provide enough details about the technology used or were preoccupied with technologies from a different biomedical discipline (genetics, molecular biology, immunology, etc.). We gathered information on three key variables: The subspecialty of neurology, the type of communication, and the type of new technology according to a set of pre-established categories (communications may focus on more than one type of technology). Secondary variables included 32 cooperation between research centres, participation of technology institutes (e.g., polytechnic universities, non-clinical research institutes), and the involvement of the health. Distribution of the research groups by autonomous community in absolute and relative numbers with regard to population size (official population count according to the local population register on 1 January 2019 published by Spain's National Statistics Institute) was one of the secondary variables [2-5].

RESULTS

299 (3.7%) of the 8139 messages that were presented between 2012 and 2018 have to do with emerging technologies. 179 spoken presentations and 120 posters were distributed. From 17 in 2012 (1.6% of the total of 1056) to 81 in 2018 (6.8% of the total of 1185), communications have been given. The recent year saw a significant surge in messaging about new technology. Advanced neuroimaging (new neuroimaging techniques, including recently developed MRI sequences or advanced neuroimaging analysis techniques, such as principal component analysis or classification population), Cantabria (12.0/million population), and Catalonia (10.4/million population) are the different new technologies that were used. The supplementary material offers more in-depth demographic data. Collaborations between centres produced 22% of communications: 12.3% between centers in Spain and 9.7% between centres in Spain and abroad. In 77% of the communications, the collaboration with the healthcare industry was not disclosed; in 11% of the communications, the collaboration with the healthcare industry was disclosed; and in the remaining 12% of the communications, the collaboration with the healthcare industry was not disclosed. In 31.1% of the communications, research groups collaborated with technology institutes [6-8].

DISCUSSION

A starting framework for assessing the influence of new technologies on neurology in Spain is provided by the consensus definition of new technology established in this study. In order to achieve this, we assessed the communications delivered at the SEN's annual meetings from 2012 to 2018. Over the examined time span, there is an upward, albeit erratic, trend in the impact of new technology on research [9,10].

Advanced neuroimaging, biosensors, electrophysiology/neurostimulation, telemedicine, and information applications are the technology categories most frequently utilized, while movement disorders, cerebrovascular illnesses, and dementia are the neurology subspecialties that benefit most from new technologies. The above technologies have led to advancements in disciplines like neuroradiology and neurophysiology, which serve as key

foundations of neurological diagnosis and are also starting to be relevant in the treatment of neurological illnesses. Therefore, it is anticipated that these developments will have a significant impact on neurological practice in the years to come. Biosensor research is advancing quickly, and this new technology is emerging as an objective and potentially minimally intrusive tool for the assessment of neurological illnesses as healthcare becomes more digitalized, telemedicine and information applications are developing as crucial technologies that can make it easier for people to get specialized treatment. As a result, it is anticipated that research in this area will grow, helped along by social isolation policies put in place in response to the COVID-19 epidemic. Madrid, Catalonia, and Andalusia were the autonomous communities with the most communications. Navarre, Madrid, Cantabria, and Catalonia were found to have the next largest number of communications per million inhabitants after the distribution was corrected for the population of each municipality. The quantity of messages displayed does not directly correlate with the population of different locations. Strategic partnerships with the healthcare sector, academic institutions, or research facilities are also important, as are local regulations that support technology advancement and may encourage the use of these technologies. Almost a quarter of the communications involved multiple research centers, whether they were located in Spain or elsewhere, and nearly a third involved a technical institute. This highlights the value of interdisciplinary and cross-disciplinary research as well as the simplicity of data exchange enabled by these new platforms. In addition, 48% of the communications that said whether there was collaboration with the healthcare business in the abstract disclosed that the industry did take part; however, this should be viewed with caution as a significant portion of the messages did not clarify this information [11,12].

CONCLUSION

The rise in communications on new technologies given at SEN's annual meetings in recent years is evidence that new technologies are having an increasing impact on Spanish neurology. Along with recent developments in fields of technology that have historically had an impact on neurology (such as neuroimaging and electrophysiology), new technologies and methods (such as biosensors, mobile apps, and artificial intelligence) also hold great promise for being applied in clinical settings in the years to come. All neurology subspecialties are impacted by this trend, although movement disorders, cerebrovascular illnesses, dementia, and neurocognitive disorders are most severely impacted. Research organizations interested in these cutting-edge technologies are spread out across a wide geographic area. However, after controlling for population, Navarre, Madrid, and Cantabria or Madrid, Catalonia, and Andalusia produce the most communications. These variances could be a result of other sociological, political, and economic issues that affect how research groups collaborate with the healthcare sector, technological companies, and biomedical universities.

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