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Editorial: Insights in systems integration: 2021

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Editorial on the Research Topic
Insights in Systems Integration: 2021

Introduction

Frontiers in Dental Medicine (FDMED) was launched in 2020, with the vision to advance the integration of medicine and dentistry at multiple levels, from basic science to clinical practice, to health policy decision making. I was then invited to lead the section of Systems Integration, and my first assignment was to prepare a Field Grand Challenge (GC) entitled "Systems Integration: A key step toward strengthening oral health" that was published late in June 2021 [1]. In the context of that GC, we considered the concept of a system-based approach as defined by Wanjek [2], with the perspective that a systematic approach would be instrumental to improve healthcare by encompassing multiple elements involved in patient care and also in health.

As we worked to develop the section of Systems Integration in collaboration with FDMED, as well as Frontiers in Oral Health, we were facing unprecedent times for the modern world with the pandemic due to the SARS-CoV-2 virus. This crisis has had an enormous impact on all healthcare professionals, including physicians, nurses, and dentists, making it even clearer that a solid and integrated healthcare system is critical if we are to accelerate progress toward increasing access to healthcare and reducing disparities, with the ultimate goal of improving health outcomes. Despite an established international consensus on the need to improve available healthcare systems and/or create new ones, there is no established framework for doing so. In this context, it became evident that transdisciplinary efforts were needed to bring together public and private sectors, citizens, clinicians, and researchers, and that the use of system-based approaches was a key operational element underlying integrated methods to advance healthcare for all communities.

With that in mind, I am delighted to bring you this e-Collection of three peer reviewed articles highlighting the value of artificial intelligence methods and of the systems biology concept to improve our understanding of major factors involved with oral health and disease conditions. A very brief synopsis of each article included in the Research Topic is provided below.

Artificial intelligence in dentistry

In this e-Collection, two manuscripts focus on the potential of artificial intelligence (AI), including machine learning (ML) techniques, to assist clinicians to systematize and analyse complex sets of information, allowing for the implementation of evidence-based dentistry. Ameli et al. in their article, "An Application of Machine Learning Techniques to Analyze Patient Information to Improve Oral Health Outcomes," aimed to introduce a method to automate the review of patient chart information. As suggested by the authors, using an ML approach would facilitate the ability to identify predictive relationships between patient information described in the chart and relevant oral health outcomes. Although dentists have traditionally used paper patient charts, there has been an increasing pressure for dentists to replace this traditional culture by electronic patient records. Proposed advantages of electronic over paper records include the former's storage capacity, accessibility, and time efficiency, among other factors (3). In this article, Ameli et al. used two ML approaches for chart review, and found that caries risk, occlusal risk, biomechanical risk, gingival recession, periodontitis, gingivitis, assisted mouth opening, and muscle tenderness, could be highly predictable using their approach. Interestingly, the authors showed that the identified statistically significant predictors allowed for the prediction of over 72% of all variables, excluding bruxism and crowding that could still be predicted, though at lower levels. Image quantification approaches are becoming more popular in biomedicine and healthcare due to the advent of modern imaging technologies and increased datasets. Radiographic image analysis may play a pivotal role in the diagnosis of periodontitis and peri-implantitis lesions, as both conditions are characterized by the loss of bone around teeth and dental implants respectively. In the context of determining the value of AI approaches to assist clinicians to better compile and analyze patient information, Sabharwal et al. in their article "Integrating Image Analysis and Dental Radiography for Periodontal and Peri-Implant Diagnosis" reviewed the literature to introduce image analysis and ML in the context of dental radiography and assessed the potential for integration of image analysis to assist with the diagnosis of periodontitis and peri-implantitis. The area of AI/ML tools was identified as an emerging area for dental radiology, with challenges involved in quantitative assessments and the use of classical image analysis tools.

Systems biology

The use of systems biology in periodontics was discussed by Araújo-Silva et al. in their article "Systems Biology in Periodontitis." The systems-based approach uses a collection of analytical tools aimed at examining a given problem as well as the context in which it is embedded (4–6). For instance, a number of interconnected factors may influence the onset and progression of chronic conditions, such as periodontitis, and this complexity requires a system-based approach by which we recognize the role of social, economic and environmental factors and their interactions in order to successfully tackle it. Araujo-Silva et al. present a comprehensive discussion on topics involving systems biology and periodontitis. Topics that are explored include: systemic decoding of periodontal inflammation, applications of genomics, transcriptomics, proteomics, and metabolomics approaches to periodontitis, potential drug delivery systems to treat periodontitis, use of oral fluids for diagnostics, and periodontal medicine. The authors claim that the field of systems biology has a great potential to assist clinicians with the decision-making process as well as to analyze the treatment outcomes.

The e-Collection presented here indicates that, although significant progress has been made toward realizing the potential of systems-based approach to support the practice of evidence-based dentistry and to improve dental treatment outcomes, there are still questions that need to be addressed. We hope this work will help spread the word, as well as promote new investigative work in this field. Even as this collection is released, we understand that there are related submissions that may continue to come in, which will be directed to a new follow-up Research Topic in FDMED entitled "Insights in Systems Integration 2022."

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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