

Resuming HealthCare Informatics Research after CoViD-19: the HealthCare System Perspective

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Abstract—The CoViD-19 pandemic tested many research endeavors and revealed limitations, especially where research results had an immediate impact on the social and health habits of people. The research community is called to perform a deep analysis of steps already taken, and to rethink future steps to capitalize on the lessons learned from the pandemic. In this direction, on June 9th-11th, 2022, a group of twelve international health informatics researchers, including 4 Editors-in-Chief of informatics journals, met in Rochester (MN). The meeting was initiated by the Institute for Healthcare Informatics (IHI) and hosted by Mayo Clinic Institute. The researchers discussed and proposed a new research agenda for biomedical and health informatics, in light of the changes and the lessons learned from the pandemic.

This panel reports about the research and healthcare policy directions with a greater emphasis on the implications on the healthcare system perspective.

Index Terms—Biomedical and Health informatics, Artificial Intelligence in Medicine, Research Trends, CoViD-19

I. INTRODUCTION

This panel reports some of the results of an international meeting held on June 2022, initiated by the Institute for Healthcare Informatics (IHI) [1], and hosted by Mayo Clinic. The researchers discussed and proposed a new research agenda for biomedical and health informatics (BMHI), in light of the changes and the lessons learned from the pandemic.

The panel reports and expands upon the result of that meeting [2], and gathers experts in knowledge representation, clinical decision support, artificial intelligence (AI), and machine learning (ML) in healthcare. The panel explores the research challenges in developing large-scale, robust AI-based methods for supporting the care and well-being of individuals, healthcare organizations, and populations.

Research in BMHI has been evolving for several decades and has achieved a level of maturity [3]. Important driving forces include (i) evidence-based medicine, (ii) personalized medicine, (iii) patient participation and empowerment, and the (iv) biopsychosocial model of health that stresses the importance of mental and social well-being. These perspectives acted as enablers for BMHI applications and research that follow the data revolution movement. This movement brought about a focus on big data and ease of storage, maturing and effective artificial intelligence (AI) based techniques for data analysis, mobile health, and the Internet of Things (IoT).

These foci became more pervasive and potentiated since the pandemic [4]. Other needs became more evident due to CoViD-19. These needs include (i) prospective and retrospective global data collection for learning, (ii) data and IT as essential elements for society and individuals, (iii) citizen-centered health and well-being care systems, (iv) telehealth and virtual care systems, and (v) social information systems, including data and procedures regarding contexts (e.g., containment rules for citizens, vaccinations procedures), cultural differences among countries, world wide strategies and policies. The urgent need of addressing social and mental health, the incidence of which increased during the pandemic due to isolation, should be supported by a continuum of care involving different systems: education, social work and welfare, and the healthcare system.

II. POST-COVID-19 HEALTHCARE REQUIREMENTS

Thinking about the post-CoViD-19 informatics research agenda, new requirements play a key role. However, thinking about the research agenda systematically and comprehensively

necessitated a methodology. The Rochester research group started discussion about healthcare requirements via email and on the first meeting day a brain-storming session elicited more ideas related to challenges and needs that CoViD-19 brought along. Some ideas related to health and well-being challenges became more perverse during isolation (e.g., mental health, social interaction), some related to existing technologies that proved as enablers during the pandemic (e.g., IoT, telemedicine), some to opportunities to involve the public and citizens in contributing to citizen science, due to the great interest of the public in data science and health. During the meeting, the researchers worked in three groups of participants, touching base in all-participants meetings to align the results of the internal discussion. Each group defined a focus for their discussion, with one group focusing on AI and analytics, a second group on data as an enabler for citizen-centered health and well-being, and the third group focusing on the idea of a learning health system.

To organize, structure, and visualize the contributions of each group, the researchers arranged the ideas internally discussed by each group according to three axes [2]. One axis posed the ideas as *research questions* and then conceived *policy implications* needed to translate the results of such research into real-world applications, with particular attention to healthcare organizations and processing issues as well as healthcare management related research topics. The second axis asked what level was the research question addressing: the *individual/citizen* level, the *healthcare system* level, or the *population/public health* researcher level. Then, a third axis tried to examine all of the stages of the data science process: from the inception of a problem that could be solved using BMHI methods, through data collection and integration, through model building, explainability [5], [6] and visualization of results. Such a process is repeated in the cycles of a learning health system that analyzes the results, acts on them, and poses new problems that need to be studied. While addressing these stages, ethical and technological needs arise, including privacy, quality, responsible AI, digital disparity, and trust.

III. THE HEALTHCARE SYSTEM PERSPECTIVE

The panelists focus on the perspective of the healthcare system. Thus, according to the three major axes of [2], the attention is devoted to research questions and policy implications at the healthcare system level, and at the stages of the data science processes.

In detail, the major topics dealt with by the panel are:

- i. *research methods* that were used: these research methods could be extended to other application scenarios and adopted by other groups of researchers;
- ii. *background*: the driving forces pre- and due-to-CoViD-19, that are shaping the new BMHI research and policy agenda;
- iii. *current research directions* related to data and AI: the topics consider both the research questions and the policy

implications from the healthcare system perspective, and include:

- a) prospective and retrospective data collection;
- b) data sharing and integration;
- c) quality of data and of ML models;
- d) explainable and responsible AI;
- e) quality assessment of AI models;
- f) learning health systems.

From the above issues, research questions impact on a), d), b), e), and f); policy implications impact on c), b), e), and f).

IV. LESSONS LEARNT

The goals of the panel are to raise awareness of the informatics researchers, health policy professionals, and clinicians about the new health and well-being challenges, needs, and opportunities that CoViD-19 has brought to the table; and of the new research agenda that stems from them and from the latest advances in big data and AI methods.

Take home lessons learned are:

- i. *data collection*: recognize challenges in supporting health and well-being during a pandemic;
- ii. *methodologies*: recognize the new and emerging healthcare informatics methodologies, including those related to data and AI;
- iii. *approaches*: discuss and recommend several approaches to increase international sharing of high-quality and timely data and to support AI explainability;
- iv. *approaches*: understand a scoping approach for the informatics agenda according to (a) research questions vs. policy implications; map challenges and solutions to (b) the stage of data science life-cycle and to (c) the care level.

ABOUT THE PANELISTS

The participants in the panel are Carlo Combi, Hongfang Liu, Jochen Meyer, Giuseppe Pozzi, Pierangelo Veltri, and Christopher C. Yang.

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