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# Informatics for One Health

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## Summary

**Objectives:** To introduce the 2023 International Medical Informatics Association (IMIA) Yearbook by the editors.

**Methods:** The editorial provides an introduction and overview to the 2023 IMIA Yearbook where the special topic is “Informatics for One Health”. The special topic, survey papers and some best papers are discussed. The section changes in the Yearbook editorial committee are also described.

**Results:** IMIA Yearbook 2023 provides many perspectives on a relatively new topic called “One Digital Health”. The subject is vast, and includes the use of digital technologies to promote the well-being of people and animals, but also of the environment in which they evolve. Many sections produced new work in the topic including One Health and all sections included the latest themes in many specialties in medical informatics.

**Conclusions:** The theme of “Informatics for One Health” is relatively new but the editors of the IMIA Yearbook have presented excellent and thought-provoking work for biomedical informatics in 2023.

## Keywords

Medical Informatics; health information technology; one health; IMIA Yearbook of Medical Informatics.

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## 1 One Health and Medical Informatics

Health informatics, in the context of a global pandemic, led to the development of ways to collect, standardize, disseminate and reuse data worldwide: public health data but also information from social networks and scientific literature [1]. Last year, the International Medical Informatics Association (IMIA) Yearbook focused on “Inclusive Digital Health” [2] with particular emphasis on social inequities and the COVID-19 effect on healthcare services. Also last year in the Yearbook, Hagli *et al.* [3] defined the concept of “One Digital Health”. One Digital Health aims to digitally transform future health ecosystems, by implementing a systemic health and life sciences approach that considers broad digital technology perspectives on human health, animal health, and the management of their surrounding environment. This approach allows for the examination of how future generations of health informaticians can address the intrinsic complexity of novel health and care scenarios in digitally transformed health ecosystems. This year, while we continue to see informatics work on COVID-19, the special topic IMIA working groups and editors chose is “Informatics for One Health” to expand and pursue upon the work currently going on in this new and important scientific study.

While the theme of the 32<sup>nd</sup> edition of the IMIA Yearbook is “Informatics for One Health”, not all sections include articles on this new topic. We are fortunate that the IMIA One Health Working Group leaders Arriel Benis and Oscar Tamburis [4] provide a detailed review of advancements

in technologies regarding individuals, societies, and ecosystems. As they outline in their synopsis [5], there is a particular urgent need to transform health systems to be more sustainable and resilient to the impacts of climate change. They highlight that an effective response to climate change includes deployment of data-driven science in generating massive datasets for biodiversity and environmental indicators.

For this special section, Scott *et al.* [6] wrote a survey paper entitled “One Health in a digital world: technology, data, information and knowledge”. The authors performed their review on recent works in the One Health domain with a particular focus on: (i) data and efforts to make them FAIR (findable, accessible, interoperable, and reusable), (ii) the implications of antimicrobials in the food chain and the ecosystem in general, and (iii) data sources and apps related to the exposome. The authors finally urge our community to consider implementing “Learning One Health Systems”, in the same way of “Learning Health Systems” (as discussed in the 2017 Yearbook special topic [7]), which will integrate the data and knowledge concerning the three pillars of One Health: humans, animals, and the environment.

## 2 Highlights of the 32<sup>nd</sup> Edition of the IMIA Yearbook

In this 32<sup>nd</sup> edition of the IMIA Yearbook, you will find valuable contributions from IMIA Working Groups related to the significant topic of One Digital Health showing how digital health contribute to the One

Health unifying approach in order to balance and optimize the health of people, animals and the environment, *ie.* for preventing, predicting, detecting, and responding to global health threats such as pandemics. To name a few, Nursing Informatics [8], Telehealth [9], Primary Health Care Informatics [10], and a joint paper from three working groups Technology Assessment & Quality Development, Organizational & Social Issues, and Human Factors Working Groups [11].

The Bioinformatics and Translational Informatics (BTI) section also highlighted papers to include in the realm of One Health. Editors Mary Lauren Benton and Scott McGrath discuss three important trends from reviewing papers in the One Health theme this year within BTI: 1) applying proactive models of risk to prevent disease and enhance patient outcomes; 2) capturing the environmental and molecular heterogeneity of disease; and 3) considering the scalability of computational models in clinical settings [12]. The BTI survey paper by Cooper *et al.* [13] also provides an interesting “One Health and bioinformatics” review of literature on the microbiome and nutrition. From a bioinformatics perspective, there is great potential for continued microbiome research and its relationship to dietary patterns to enhance human health. The literature reviewed on microbiome research in this survey demonstrates a need for methods to compare and aggregate data, a need for reporting standards, workforce training, and needs for understanding challenges in both experimental and computational reproducibility and generalizability in microbiome analysis.

Both Cancer Informatics (CI) and Human Factors & Organizational Issues (HFOI) delved more specially on the One Health theme of a growing need to understand the diversity of organizational factors for informatics operations to succeed. This theme often appears in papers on the environment and the clinical environment. For HFOI, Kuziemy wrote in the survey paper that organizational factors must span micro level issues such as workflow and communication models to meso and macro level factors (such as change management, politics, and leadership) [14]. HFOI editors Yalini Senathirajah and Anthony Solomonides found

noteworthy publications on all aspects of health and wellbeing, and papers often detailed implementation issues [15].

In the CI survey paper, Aneja *et al.* [16] wrote that despite growing enthusiasm surrounding the utility of clinical informatics to improve cancer outcomes, data availability remains a persistent bottleneck to progress. Difficulty combining data with protected health information often limits our ability to aggregate larger more representative datasets for analysis. CI editors Jeremy Warner and Debra Pratt also wrote that in 2023, the selection of papers in cancer informatics intends to illuminate the current progress of research with a focus on efforts to translate research towards immediate clinical applicability [17].

The survey paper of the Clinical Information System (CIS) section by Magrabi *et al.* [18] is an in-depth review of the use of AI in clinical settings. The authors identified 62 studies published in 2021 or 2022 and listed the medical applications in which AI has been used, the tasks performed in each and how it was evaluated. They also analyzed the level of autonomy of the system incorporating AI, and ultimately concluded that work needs to be done to support One Health. The section editors Werner O. Hackl, Sabrina B. Neururer, and Bernhard Pfeifer concluded in their analysis [19] that the field of CIS will continue to evolve, driven by advances in telemedicine, mHealth technologies, data science applications, and the integration of artificial intelligence. Convinced that artificial intelligence in the clinical setting will become more and more important and helpful, this year they asked an artificial intelligence to create the content summaries of the selected best papers.

This year, the Consumer Health Informatics and Education (CHI) section provides many important papers on One Health. As CHI editors Pascal Staccini and Annie Lau write [20], making the link between “consumer health informatics” and “global health” or “one health” is a promising approach that requires us to move beyond the usual boundaries of care towards preventive human health. The aim is to focus more on behaviours that enable citizens and patients to take responsibility for the environment and become involved in sustainable individual or population projects. The CHI survey

paper by Gabarron *et al.* [21] focused on social media in the realm of mental health. The authors note that the use of social media for delivering mental health interventions is increasing, as evidenced by the growing number of publications and registered trials.

In the Decision Support (DS) section, Douhit *et al.* [22] detailed the diverse work being carried out in healthcare to address health disparities via clinical decision support (CDS). CDS can be built in many formats and on different platforms depending on the use case. They recognized that currently point-of-care alerts/reminders are the most common tool discussed and that it is important to continue developing patient facing CDS so that patients may be empowered to make their own decisions. DS editors Vignesh Subbian and Christoph Lehmann found more CDS options in the annual review of papers. The eleven best paper candidates were analyzed using a range of structural, process, and outcome characteristics. In terms of process characteristics, they primarily analyzed the nature of CDS evaluation (*e.g.*, prospective *vs.* retrospective studies; multisite *vs.* single-site studies; provider-facing *vs.* patient-facing CDS; early-stage *vs.* effectiveness studies) [23].

In the survey paper of the Health Information Exchange (HIE) section, Holmgren *et al.* presented the policy of five different countries (USA, UK, Germany, Israel and Portugal) in terms of HIE [24]. For each country, the authors reported the existing frameworks and the remaining considerations to be considered. Given the common actions that have facilitated the adoption of HIEs, they have finally provided recommendations to guide policymakers in this area. The editors of the HIE section, Meryl Bloomrosen and Eta Berner, have selected ten papers dealing with the factors that affect HIE, the use of HIE in different contexts, and some links between patients and HIE [25].

In the synopsis for the Knowledge and Representation Management (KRM) section, editors Jean Charlet and Licong Cui presented the 15 best candidate papers, which mainly covered works on ontology engineering and its applications [26]. Li *et al.* wrote the KRM survey paper, which is an extensive review of 78 articles published in 2021 or 2022 about graph representation

learning [27]. Among these works, the authors identified three categories of approaches, namely shallow node embedding, graph neural networks, and generative graph models. Finally, they presented the progress made in applications related to drugs and diseases, before highlighting the challenges that remain to be resolved and the avenues envisaged to achieve this.

The top nine papers in the Sensors, Signals and Imaging Informatics section were focused on machine learning and deep learning approaches to support decisions, prognosis, and novel therapies. Section editors Christian Baumgartner, Leticia Rittner, Thomas M. Deserno noted that even with the many selections of papers in imaging and sensors, it remains very difficult to identify and select truly novel and groundbreaking approaches [28]. For the survey paper by de Aguiar *et al.* [29], security and privacy aspects of machine learning are very complex and important to consider as more machine and deep learning methods are used.

The survey paper in the Natural Language Processing (NLP) section by Shaitarova *et al.* summarizes recent work (2020-2022) carried out in this area to process non-English biomedical texts [30]. The authors presented numerous annotated datasets and various NLP tasks, with a strong emphasis on the use of pre-trained language models for these tasks. The synopsis of the NLP section, Cyril Grouin and Natalia Grabar, provides a comprehensive description of works published in 2022 [31]. After listing the languages studied in these recent works, they also underline the enthusiasm for large language models and note that the fact that most of them are freely available facilitates the democratization of NLP. In addition, the authors point out that social networks are the most widely used source of information, and that as patients are increasingly involved in their own health, efforts must be made to make clinical documents understandable to them.

Among the two best papers presented by Georgeta Bordea, Gayo Diallo and Cécilia Samieri, the editors of the Public Health and Epidemiology Informatics (PHEI) section [32], the paper from Valentin *et al.* [33] was linked to the One Health topic, more precisely to the annotation of news articles

containing epidemiological information on animal diseases. Following on from the theme of the previous yearbook, He *et al.* have carried out a review of recent works which take account of the social determinants of health to promote equity in health [34]. After describing the methods used to acquire the social determinants of health from data, the authors listed the existing ontologies representing knowledge relating to these determinants and identified the ways in which these determinants have been considered in medical applications.

Be also sure to read the Reinhold Haux's "Reflections Towards the Future of Medical Informatics" [35]!

### 3 Changes in the Yearbook Editorial Team

We are pleased to welcome to the Decision Support section editors Vignesh Subbian, PhD, associate professor of systems and industrial engineering/associate professor of biomedical engineering at the University of Arizona, and Christoph U. Lehmann, MD, professor of Pediatrics, Population and Data Sciences, and Bioinformatics at University of Texas Southwestern. Very good to have Dr. Lehmann back in the IMIA YB universe (he was president of IMIA during 2017-19). Cécilia Samieri, Research Director at the Bordeaux Population Health research centre (France), and Sabrina Neururer, Deputy Director of the Tyrolean Federal Institute for Integrated Care (Innsbruck, Austria), are new editors of the PHEI and CIS sections, respectively.

On the departure side, we bid farewell to Jeremy Warner, MD, MS, FAMIA, FASCO and Debra Pratt, MD who have been editors of Cancer Informatics since the section began in 2018. We look forward to seeing more excellent articles on cancer informatics as Dr. Warner becomes editor-in-chief of JCO Clinical Cancer Informatics. Congratulations Dr. Warner!

Normally, we thank Martina Hutter in the acknowledgements for all the work she does to create the Yearbook in correct format for the publisher and edit little items in the documents editors often forget. However,

this year we have a heavy heart about, but also much appreciation and best wishes for, Martina Hutter who is retiring from her post as editorial assistant (but more like editorial expert) of the IMIA Yearbook. Ms. Hutter was always so helpful in all our meetings and so helpful to those of us traveling very far to come to yearly editorial meetings. We were in Bordeaux this year and this picture (Figure 1) has her front and center next to Lina Soualmia in the front row which is the perfect place Martina Hutter has been for us on the IMIA Yearbook team. Lehmann *et al.* [36] were very sad to announce that Martina was planning to leave the Yearbook in 2017, but she stayed involved. We will use the same words: "Martina will be tremendously missed - she has brought great spirit, continuity, and hard work to the Yearbook" for 24 years! Thank you Martina!!!

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**Fig. 1.** Picture of the selection meeting on May 5th, 2023, with from left to right: Fleur Mougin, Natalia Grabar, Gayo Diallo, Cécilia Samieri, Martina Hutter, Adrien Ugon, Christian Baumgartner, Lina Soualmia, Oscar Tamburis, Mary Lauren Benton, Kate Fultz Hollis.

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