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Responsible Use of AI for Infectious Disease Surveillance

Hospital Authority Seminar on Application of AI on Infectious Diseases and Infection Control

Hong Kong SAR, 13 November 2024

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Overview

1. Enhancing Infectious Disease Surveillance
2. Recognising Limitations and the Importance of Trust
3. Establishing an Environment of Trust
4. Infodemic Management and Social Listening
5. Looking Ahead

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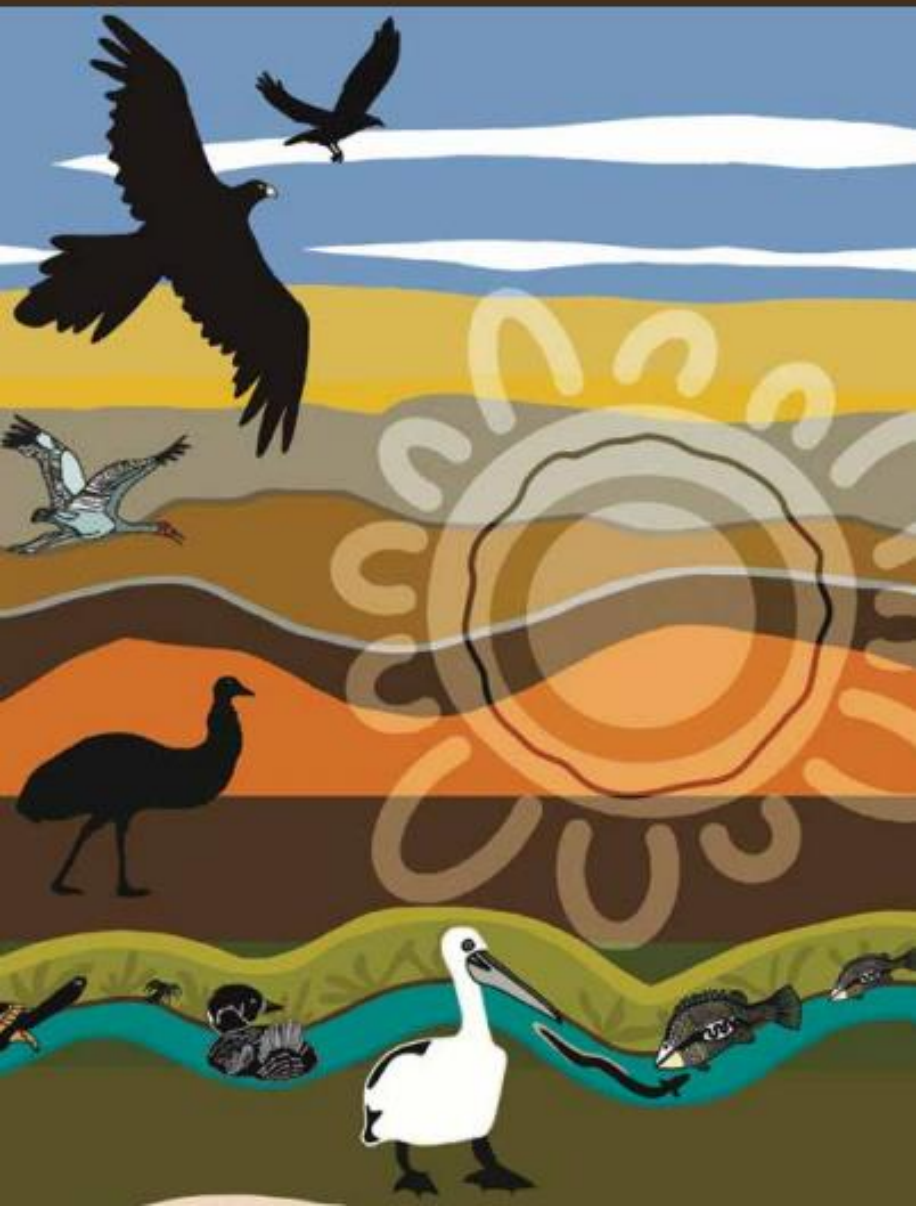

I wish to acknowledge
the people of the
Kulin Nations,
on whose land
we are gathered today.
I pay my respects
to their Elders,
past, present and emerging.

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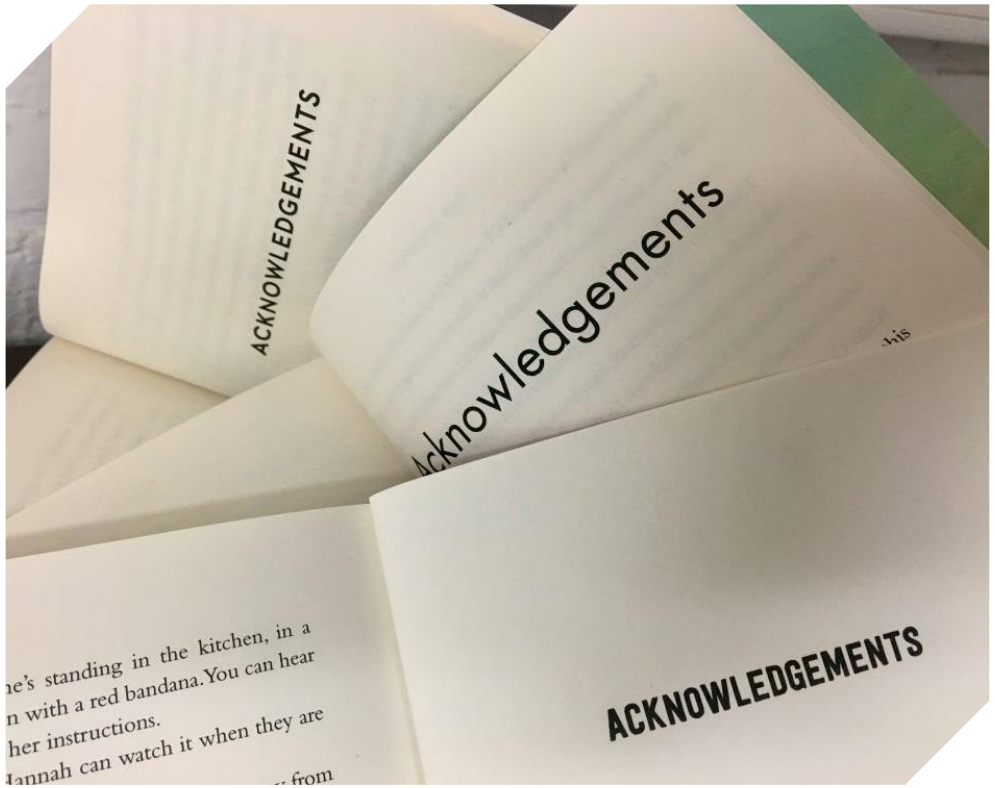

1. The research was supported by a grant (17624622) awarded by the Research Grants Council of Hong Kong in 2022/23, and by a grant from the WYNG Foundation.

2. Grateful thanks to the Hospital Authority of Hong Kong SAR and to Dr Chen Hong for the kind invitation.

3. All views and errors are mine

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1. Harnessing AI-Enhanced Surveillance Capability

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Enhancing Effectiveness

The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

AI IN MEDICINE

Jeffrey M. Drazen, M.D., *Editor*, Isaac S. Kohane, M.D., Ph.D., *Guest Editor*, and Tze-Yun Leong, Ph.D., *Guest Editor*

Advances in Artificial Intelligence for Infectious-Disease Surveillance

John S. Brownstein, Ph.D., Benjamin Rader, M.P.H., Christina M. Astley, M.D., Sc.D., and Huaiyu Tian, Ph.D.

FLORENCE NIGHTINGALE'S INNOVATIVE "ROSE DIAGRAM" OF PREVENTABLE deaths revolutionized data-driven disease surveillance.[1] Raw hospital mortality data collected during the Crimean War were transformed into a compelling, visual insight — poor sanitary conditions killed more people than battle wounds did. This act of synthesizing noisy, complex data into an elegant, effective message was the foundation for a royal commission to track morbidity and mortality and thus launched a new era in which analytic methods were used to better monitor and manage infectious disease. In the more than 160 years since the first publication of Nightingale's rose diagram, tools and technology for translating high-density data and uncovering hidden patterns to provide public health solutions have continued to evolve. Manual techniques are now complemented by machine-learning algorithms. Artificial intelligence (AI) tools can now identify intricate, previously invisible data structures, providing innovative solutions to old problems. Together, these advances are propelling infectious-disease surveillance forward.

The coronavirus disease 2019 (Covid-19) pandemic has highlighted the speed with which infections can spread and devastate the world — and the extreme importance of an equally nimble, expeditious, and clever armamentarium of public health tools to counter those effects. Throughout this crisis, we have witnessed a multitude of AI solutions deployed to play this role — some much more successful than others. As new pathogens emerge or old challenges return to command our attention, the incorporation of the lessons learned into our public health playbook is a priority. In this review article, we reflect on the effects of new and long-standing AI solutions for infectious-disease surveillance. AI applications have been shown to be successful for a diverse set of functions, including early-warning systems,[2,3] hotspot detection,[4,5] epidemiologic tracking and forecasting,[6,7] and resource allocation[8] (Fig. 1). We discuss a few recent examples.[9,11,12] We begin with how AI and machine learning can power early-warning tools and help distinguish among various circulating pathogens (e.g., severe acute respiratory syndrome coronavirus 2 [SARS-CoV-2] vs. influenza virus). We then discuss AI and machine-learning tools that can backtrack epidemics to their source and an algorithmic method that can direct an efficient response to an ongoing epidemic. Finally, we emphasize the critical limitations of AI and machine learning for public health surveillance and discuss salient considerations to improve implementation in the future.

From the Computational Epidemiology Laboratory (J.S.B., B.R., C.M.A.) and the Division of Endocrinology (C.M.A.), Boston Children's Hospital, Harvard Medical School (J.S.B., C.M.A.), and Boston University School of Public Health (B.R.), Boston, and the Broad Institute of MIT and Harvard, Cambridge (C.M.A.) — all in Massachusetts; and the State Key Laboratory of Remote Sensing Science and Center for Global Change and Public Health, Beijing Normal University, Beijing (H.T.). Dr. Brownstein can be contacted at john.brownstein@childrens.harvard.edu or at Boston Children's Hospital, 300 Longwood Ave., BCH3125 Bldg., Boston, MA 02115.

Dr. Brownstein and Mr. Rader contributed equally to this article.

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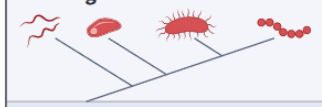
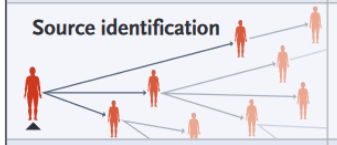
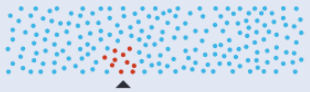
Function	Examples
Early warning 	• Natural-language processing of news sources to identify outbreaks (Freifeld et al., *JAMIA* 2008) • Unsupervised machine learning of social media data to detect unknown infections (Lim, Tucker, and Kumara, *J Biomed Inform* 2017)
Pathogen classification 	• Convolutional neural network model for reading antibiograms (Pascucci et al., *Nat Commun* 2021) • Convolutional neural network model to automate malaria microscopy and diagnosis (Liang et al., *IEEE* 2016)
Risk assessment 	• Reinforcement learning of Covid-19 positivity rates to target limited testing in Greece (Bastani et al., *Nature* 2021) • Machine-learning models including random forest and extreme gradient boosting to use syndromic surveillance for Covid-19 risk prediction (Dantas, *PLoS One* 2021)
Source identification 	• Automated data mining of electronic medical records to uncover hidden routes of infection transmission (Sundermann et al., *Clin Infect Dis* 2021) • Supervised machine learning in combination with digital signal processing for genomic tracing of Covid-19 (Randhawa et al., *PLoS One* 2020)
Hotspot detection 	• Neural computing engine to correlate sound from hospital waiting rooms with influenza spikes (Al Hossain et al., *Proc ACM Interact Mob Wearable Ubiquitous Technol* 2020) • Multilayer perceptron artificial neural network model to detect spatial clustering of tuberculosis (Mollalo et al., *Int J Environ Res Public Health* 2019)
Tracking and forecasting 	• Real-time stacking of multiple models to improve forecasts of seasonal influenza (Reich et al., *PLoS Comput Biol* 2019) • Machine learning to combine new data sources for monitoring Covid-19 (Liu et al., *J Med Internet Res* 2020)

Figure 1. Various Functions of Artificial Intelligence (AI) for Infectious-Disease Surveillance.

Shown is a nonexhaustive list of functions of AI-aided infectious-disease surveillance and representative examples from the published literature.[2-13] Each example includes the type of AI algorithm, a brief description of its purpose, and the associated citation. Covid-19 denotes coronavirus disease 2019.

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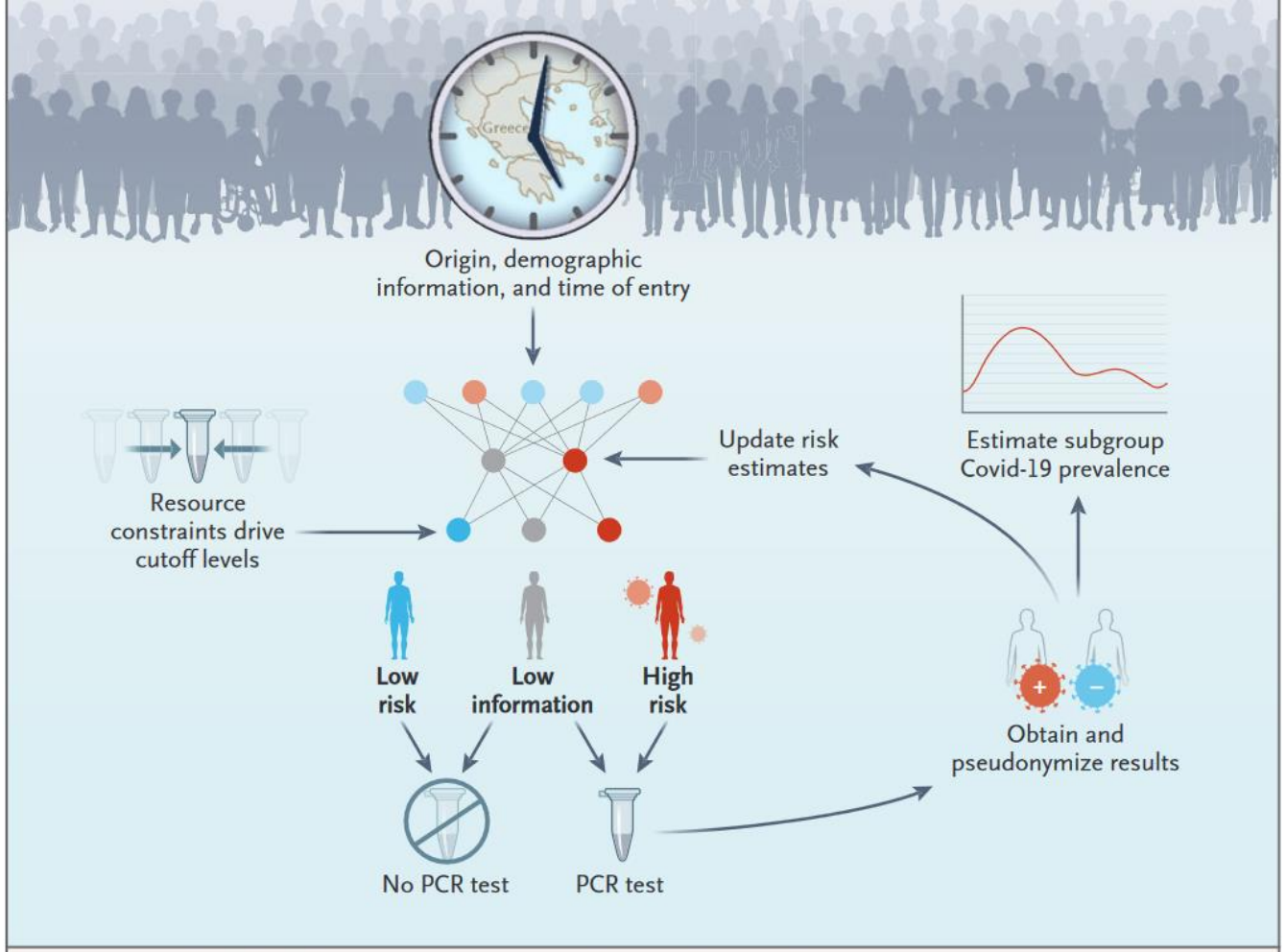

Figure 4. Example of Reinforcement Learning for Covid-19 Border Surveillance.

Eva is a reinforcement learning system used in Greece to allocate a limited supply of Covid-19 tests at the border of the country.[11] The algorithm uses information about the travelers in order to assign them to risk categories, with polymerase-chain-reaction (PCR) tests allocated accordingly. The risk estimate for each category is regularly updated to incorporate new information from the most recent batch of test results. Eva also sets testing cutoff levels, based on both risk and the available supply of tests, and makes Covid-19 prevalence estimates for each risk category. Pseudonymization refers to a deidentification procedure in which personally identifiable information is replaced by other identifiers.

Individual event	Example of signal-generating method	Algorithm category	Signal of possible infectious disease in a population	Surveillance output
Biosignals passively measured by smartwatch	Gradient-boosting decision tree	Supervised classification	A Change in biosignals	Early indication of possible outbreak
Method advantages: • Early warning can direct treatment and prevent spread • Continuously measured without requiring intervention			Method disadvantages: • Disease signal is nonspecific • Requires deployment of device before outbreak	
Cough detected by smart listening device	Regional proposal network	Artificial neural network	B Cough begins	Spike in persons whose symptoms are detected early
Method advantages: • Passively monitor with already adopted devices • Can be used in homes or larger settings (e.g., waiting rooms)			Method disadvantages: • Requires advanced privacy protection schemes • Symptomatic person (i.e., who coughed) may be unknown	
Internet search query for viral testing site	Support vector regression	Supervised classification	C Search query for testing	Hotspot of care-seeking behavior
Method advantages: • Can be inexpensive and centrally monitored • Captures behavior without requiring explicit participation			Method disadvantages: • Testing possibly unrelated to symptom status (e.g., for travel) • Searches may not lead to testing (e.g., resource constraints)	
Symptoms entered into website	Participatory surveillance	Human curated	D Enters symptoms online	Real-time prevalence of possible cases
Method advantages: • Information can be disseminated without bureaucratic delay • Captures mild cases that may not formally test across settings			Method disadvantages: • Participants skew toward persons with high health literacy • Relies on syndromic definitions that may describe many causes	
Test result positive for virus	Traditional public health surveillance	Human curated	E Positive test result returned	Official case counts
Method advantages: • Standard diagnostic accuracy • Mandatory reporting can capture rare and dangerous pathogens			Method disadvantages: • Verification can be slow and expensive • Requires resources that may not be available in certain settings	
Post on social media about diagnosis	Natural-language processing	Supervised classification	F Post diagnosis on social media	Real-time prevalence of confirmed cases
Method advantages: • Rapid collection and dissemination of results • Wide array of users who may be missed by most other systems			Method disadvantages: • Computationally expensive and difficult to parse signal from noise • Symptoms nonverified and can be vulnerable to Internet trolls	
Mask wearing captured by CCTV	Convolutional neural network	Artificial neural network	G Mask wearing starts	Nonpharmaceutical intervention levels
Method advantages: • Not vulnerable to desirability bias (i.e., captures true behavior) • High level of geographic specificity			Method disadvantages: • Highly invasive and susceptible to privacy abuse • Resource intensive, especially outside urban locales	

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ARTICLE

https://doi.org/10.1038/s41467-021-21187-3 OPEN

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AI-based mobile application to fight antibiotic resistance

Marco Pascucci[1,2,3,12], Guilhem Royer[4,5,6,12], Jakub Adamek[7], Mai Al Asmar[8], David Aristizabal[7], Laetitia Blanche[1], Amine Bezzarga[1,9], Guillaume Boniface-Chang[7], Alex Brunner[7], Christian Curel[10], Gabriel Dulac-Arnold[11], Rasheed M. Fakhri[8], Nada Malou[1✉], Clara Nordon[1], Vincent Runge[2], Franck Samson[2], Ellen Sebastian[7], Dena Soukieh[7], Jean-Philippe Vert[11], Christophe Ambroise[2,13✉] & Mohammed-Amin Madoui[5,13✉]

Antimicrobial resistance is a major global health threat and its development is promoted by antibiotic misuse. While disk diffusion antibiotic susceptibility testing (AST, also called antibiogram) is broadly used to test for antibiotic resistance in bacterial infections, it faces strong criticism because of inter-operator variability and the complexity of interpretative reading. Automatic reading systems address these issues, but are not always adapted or available to resource-limited settings. We present an artificial intelligence (AI)-based, offline smartphone application for antibiogram analysis. The application captures images with the phone's camera, and the user is guided throughout the analysis on the same device by a user-friendly graphical interface. An embedded expert system validates the coherence of the antibiogram data and provides interpreted results. The fully automatic measurement procedure of our application's reading system achieves an overall agreement of 90% on susceptibility categorization against a hospital-standard automatic system and 98% against manual measurement (gold standard), with reduced inter-operator variability. The application's performance showed that the automatic reading of antibiotic resistance testing is entirely feasible on a smartphone. Moreover our application is suited for resource-limited settings, and therefore has the potential to significantly increase patients' access to AST worldwide.

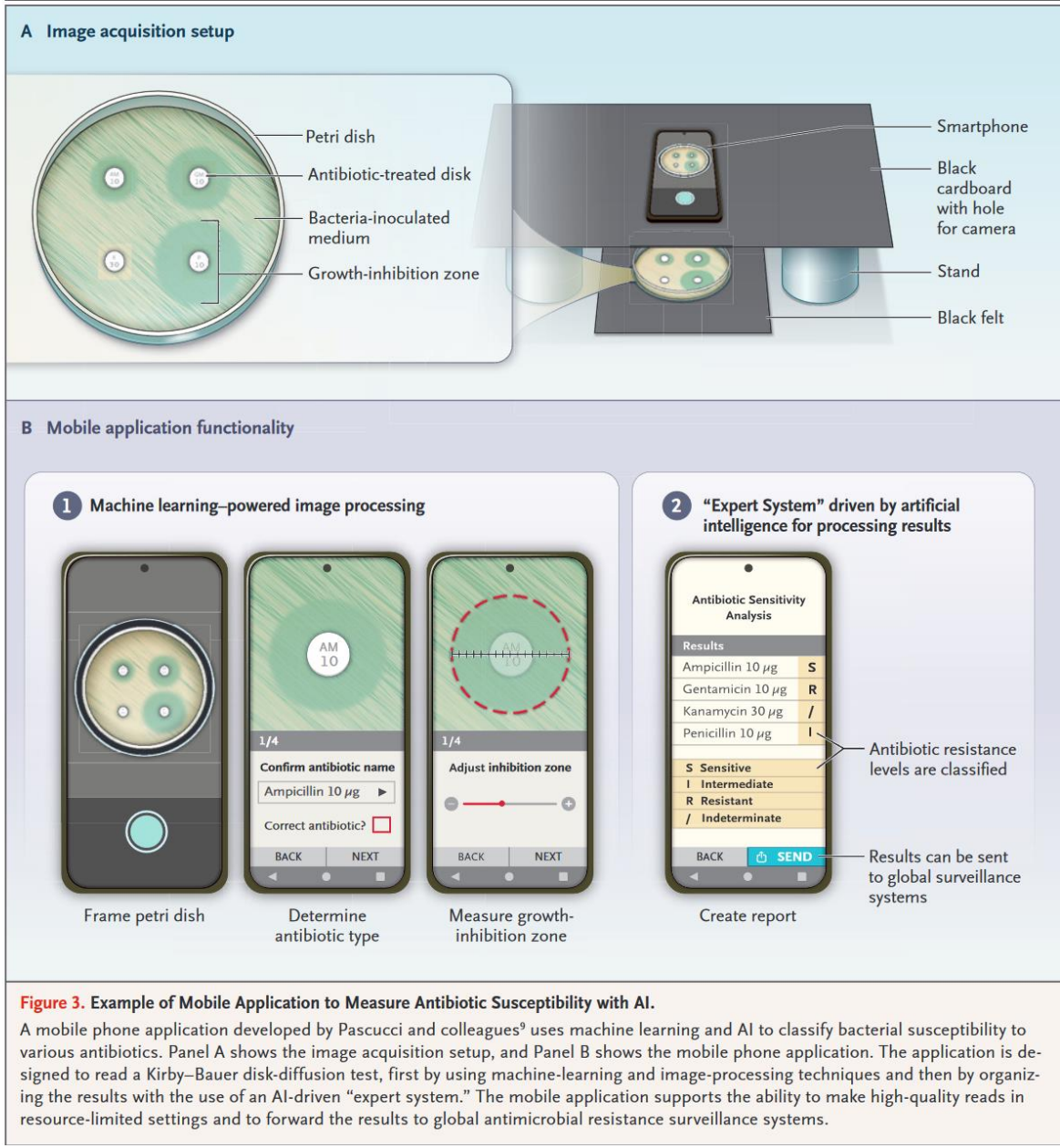

Figure 3. Example of Mobile Application to Measure Antibiotic Susceptibility with AI.
A mobile phone application developed by Pascucci and colleagues[9] uses machine learning and AI to classify bacterial susceptibility to various antibiotics. Panel A shows the image acquisition setup, and Panel B shows the mobile phone application. The application is designed to read a Kirby–Bauer disk-diffusion test, first by using machine-learning and image-processing techniques and then by organizing the results with the use of an AI-driven "expert system." The mobile application supports the ability to make high-quality reads in resource-limited settings and to forward the results to global antimicrobial resistance surveillance systems.

2. Limitations & the Need to Sustain Trust

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The American Journal of Bioethics ›
Volume 23, 2023 - Issue 10

Target Articles

What Should ChatGPT Mean for Bioethics?

I. Glenn Cohen

Pages 8-16 | Published online: 13 Jul 2023

Cite this article | https://doi.org/10.1080/15265161.2023.2233357 | Check for updates

Abstract

In the last several months, several major disciplines have started their initial reckoning with what ChatGPT and other Large Language Models (LLMs) mean for them – law, medicine, business among other professions. With a heavy dose of humility, given how fast the technology is moving and how uncertain its social implications are, this article attempts to give some early tentative thoughts on what ChatGPT might mean for bioethics. I will first argue that many bioethics issues raised by ChatGPT are similar to those raised by current medical AI – built into devices, decision support tools, data analytics, etc. These include issues of data ownership, consent for data use, data representativeness and bias, and privacy. I describe how these familiar issues appear somewhat differently in the ChatGPT context, but much of the existing bioethical thinking on these issues provides a strong starting point. There are, however, a few "new-ish" issues I highlight – by new-ish I mean issues that while perhaps not truly new seem much more important for it than other forms of medical AI. These include issues about informed consent and the right to know we are dealing with an AI, the problem of medical deepfakes, the risk of oligopoly and inequitable access related to foundational models, environmental effects, and on the positive side opportunities for the democratization of knowledge and empowering patients. I also discuss how races towards dominance (between large companies and between the U.S. and geopolitical rivals like China) risk sidelining ethics.

Keywords: ChatGPT | large language model (LLM) | informed consent | privacy | oligopoly | bias | environment

Legal & Ethical Issues

Less New

- **Data Ownership & Consent for Use:** Do AI developers owe monetary or other kinds of obligations of justice (e.g. fair pricing) to the persons whose data is being used?
- **Privacy:** In March 2023, Italy placed a ban pending investigation into alleged data breach involving user conversations and payment information + mass collection and storage of personal data for “training” the algorithms underlying the operation of ChatGPT
- **Data Representativeness & Bias:** In the US context, will an algorithm to target patients for “high-risk care management” programs prioritise white over equally sick black patients?

New-ish

- **Informed Consent and the Right to Know we are dealing with an AI:** Whether and when physicians / public health workers should disclose that an AI was involved
- **Deepfakes:** Create visual images that seem real but correspond to no real person
- **Foundational Models, Oligopoly, Equitable Access & Environmental Effects:** Incumbents create significant barriers to entry and solidifies the position of very large players like Open AI (affiliated with Microsoft) and Google
- **Democratization of Access to knowledge and Individual Empowerment?**

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OPEN PEER COMMENTARIES

Generative AI and the Foregrounding of Epistemic Injustice in Bioethics

Calvin Wai-Loon Ho

University of Hong Kong

OpenAI's Chat Generative Pre-training Transformer (ChatGPT), Google's Bard and other generative artificial intelligence (GenAI) technologies can greatly enhance the capability of healthcare professionals to interpret data across different data sources and locations with a simple query, as well as advance medical research through its ability to generate synthetic data (The Lancet Regional Health-Europe 2023). However, the performance of these technologies depends on the data they are trained on. Existing data may be seriously biased due to a lack of gender, ethnic, racial, social and/or religious diversity, and is a concern that the Global Alliance for Genomics & Health (2023) seeks to address in a recent initiative to promote global diversity in datasets within genomic research. If used in clinical medicine, the results from GenAI technologies present serious normative challenges that Cohen (2023) has clearly and succinctly set out, quite aside from the direct impact that they could have on human health and wellbeing.

While it should come as no surprise to anyone that emerging health technologies tend to present normative and regulatory challenges, many of the "new-ish" problems that are anticipated to arise from the use of GenAI technologies in healthcare and research foreground intransigent concerns with epistemic injustice. I provide three reasons why GenAI's clinical use is a big deal in bioethics. First, it highlights that bioethics does not adequately account for the impact that power dynamics and systemic biases have in knowledge production and dissemination. Marginalized individuals and communities still lack the capability to participate

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Epistemic Justice

Epistemic injustice arises when AI contributes to the credibility of a speaker's testimony being discounted by her interlocutor due to prejudice against her social identity.

Testimonial epistemic injustice:

- The speaker is harmed in her capacity as a knower or a valid source of knowledge. The speaker could lose self-confidence or the intellectual capacity of forming beliefs.
- Testimonial epistemic injustice may become structural when institutional arrangements or practices continue to give effect to such exclusions.

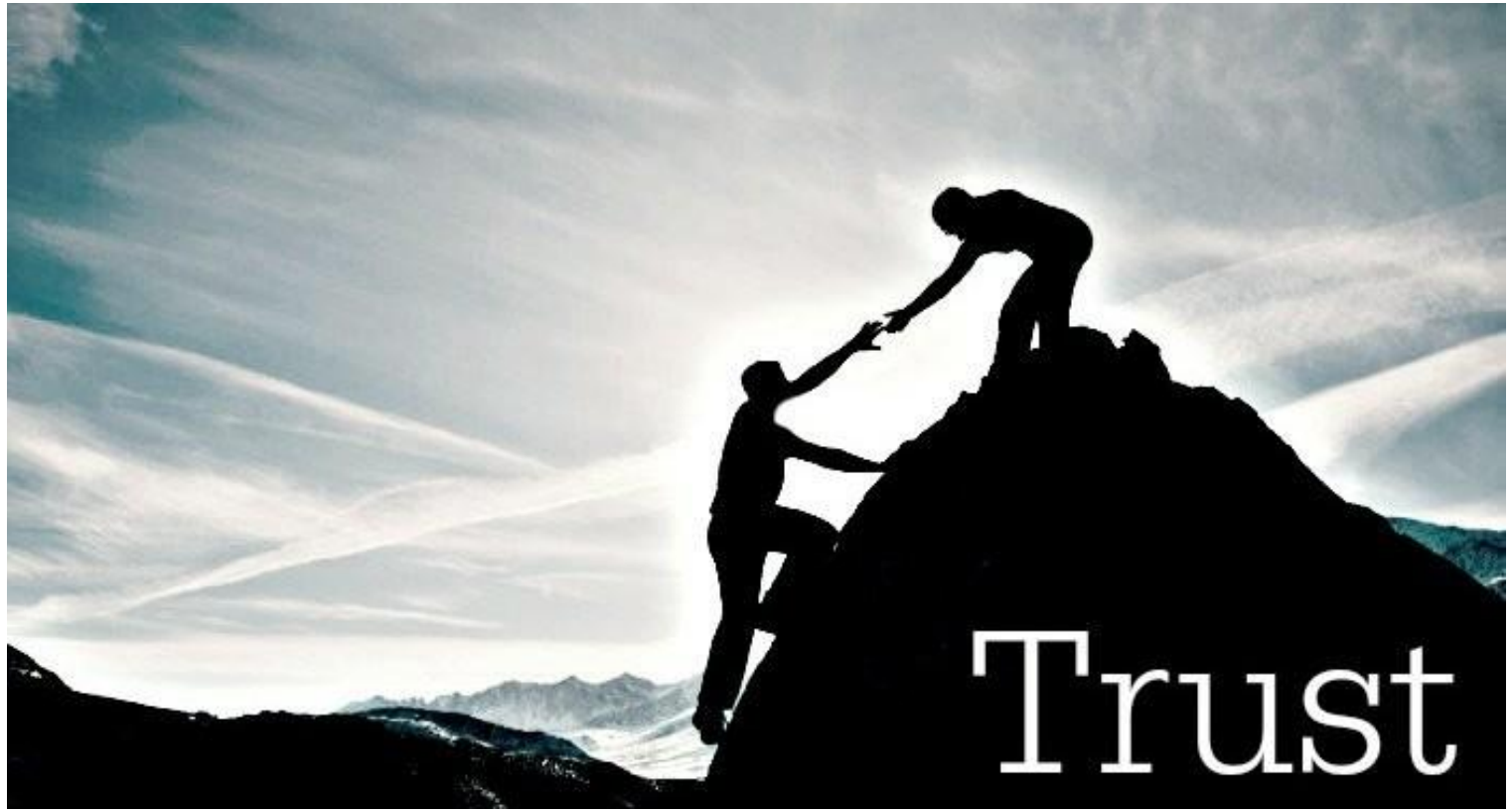
Hermeneutic epistemic injustice:

- Always structural
- Points to the interpretive resources that a society lacks in order to make sense of important aspects of a speaker's experience because she belongs to a social group that has been unfairly marginalised in meaning-making activities.
- Includes differential access to the markers of credibility, ethnocentrism and shared reality biases.

Shared Reality Bias

- Tendency for certain viewpoints or perspectives to converge based on groups of individuals who tend to interact frequently together.
- When such groups of individuals and their viewpoints or perceptions are segregated along the same lines that define group inequalities, the shared reality bias tends to insulate members of advantaged groups from those who are systematically disadvantaged.
- The viewpoint or perspective of the disadvantaged makes no sense to the advantaged because the interpretive resources developed by the latter are inadequate for understanding the experiences of those from whom they have been set apart.
- AI developers & users (including public health & healthcare professionals and researchers) are not immune to prejudicial forms of reasoning, since they are social agents whose beliefs and worldviews are embedded in wider social and experiential contexts.

3. Establishing an Environment of Trust



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How the EU AI Act Seeks to Establish an Epistemic Environment of Trust

Original Paper | Open access | Published: 24 June 2024

Volume 16, pages 345–372, (2024) Cite this article

Calvin Wai-Loon Ho & Karel Caals

Abstract

With focus on the development and use of artificial intelligence (AI) systems in the digital health context, we consider the following questions: How does the European Union (EU) seek to facilitate the development and uptake of trustworthy AI systems through the AI Act? What does trustworthiness and trust mean in the AI Act, and how are they linked to some of the ongoing discussions of these terms in bioethics, law, and philosophy? What are the normative components of trustworthiness? And how do the requirements of the AI Act relate to these components? We first explain how the EU seeks to create an epistemic environment of trust through the AI Act to facilitate the development and uptake of trustworthy AI systems. The legislation establishes a governance regime that operates as a socio-epistemological infrastructure of trust which enables a performative framing of trust and trustworthiness. The degree of success that performative acts of trust and trustworthiness have achieved in realising the legislative goals may then be assessed in terms of statutorily defined proxies of trustworthiness. We show that to be trustworthy, these performative acts should be consistent with the ethical principles endorsed by the legislation; these principles are also manifested in at least four key features of the governance regime. However, specified proxies of trustworthiness are not expected to be

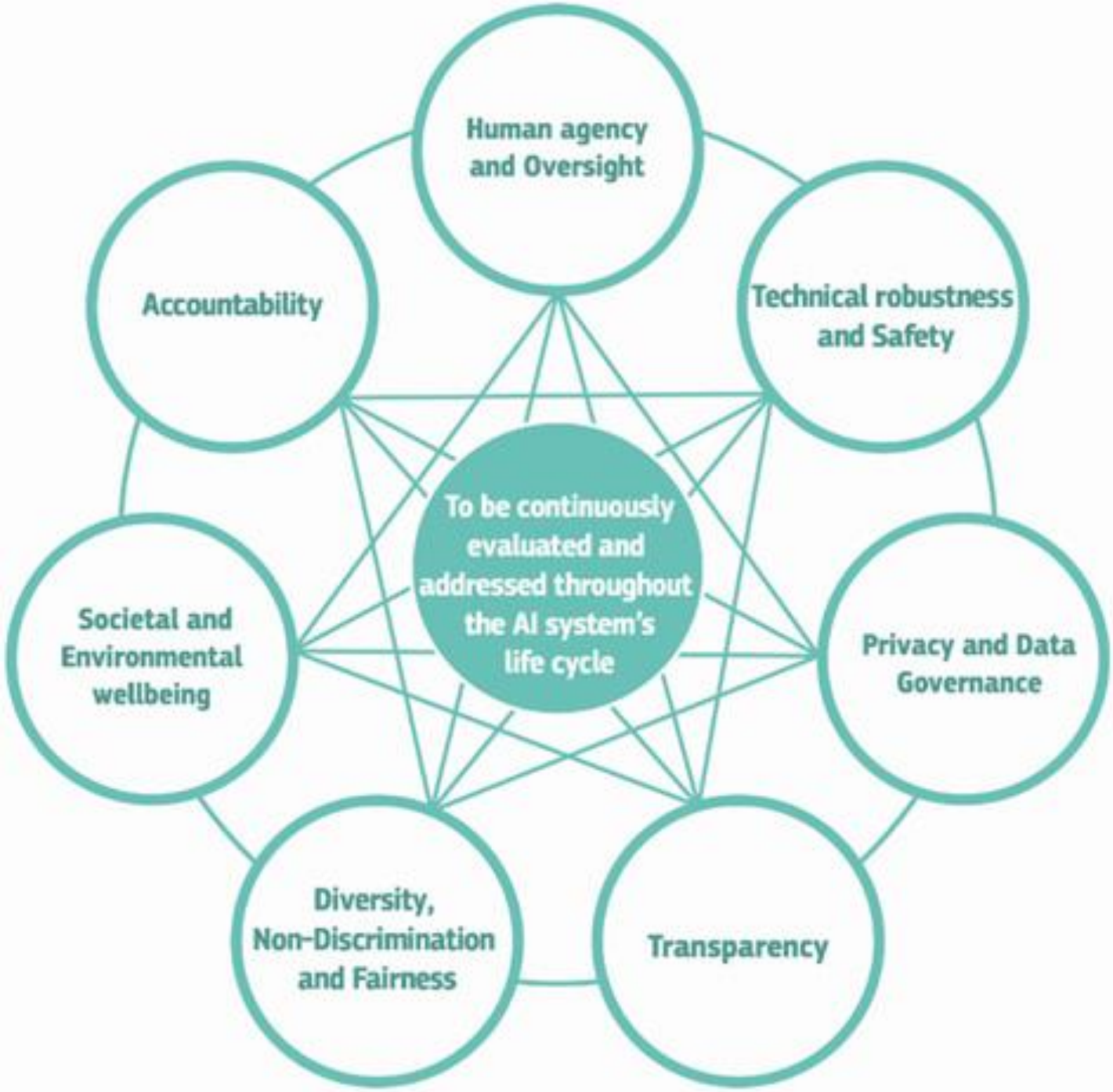
European Commission

INDEPENDENT

HIGH-LEVEL EXPERT GROUP ON ARTIFICIAL INTELLIGENCE

SET UP BY THE EUROPEAN COMMISSION

ETHICS GUIDELINES FOR TRUSTWORTHY AI

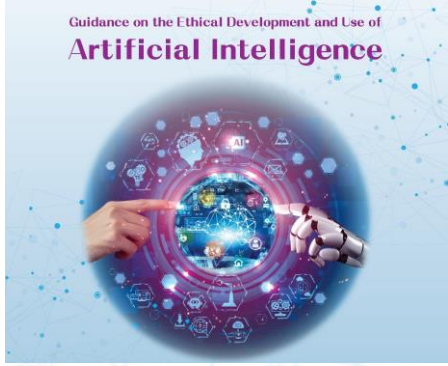


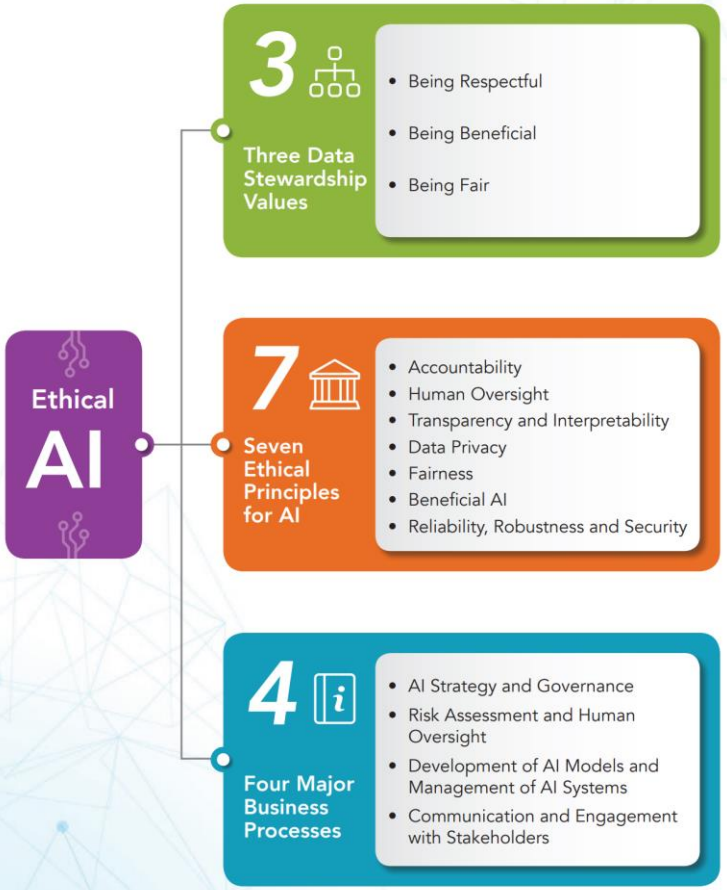
Data Privacy in Hong Kong

Personal Data (Section 2)

- Data that relates directly or indirectly to a living individual;
- From which it is practicable for the identity of the individual to be directly or indirectly ascertained; and
- That is in a form in which access to or processing of the data is practicable.
- Data is any representation of information (including opinion) in any document and includes a personal identifier.
- Must relate to a data user (i.e. controls the collection, holding, processing or use of the data) (Eastweek Publisher Ltd v PCPD [2000])
- Does not apply to deceased people or corporations.

PCPD (August 2021): Ethical Development and Use of AI





	Data Stewardship Values	Ethical Principles for AI
1	Being Respectful	• Accountability • Human Oversight • Transparency and Interpretability • Data Privacy
2	Being Beneficial	• Beneficial AI • Reliability, Robustness and Security
3	Being Fair	• Fairness

PCPD (August 2021): Oversight & Governance

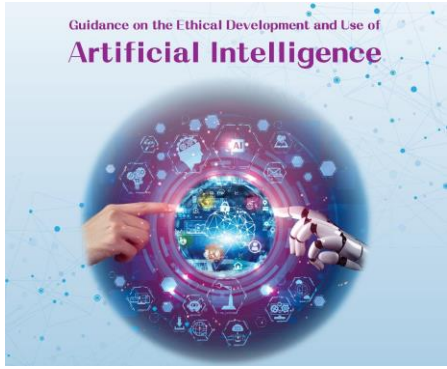


Figure 7 *Risk-based Approach to Human Oversight*

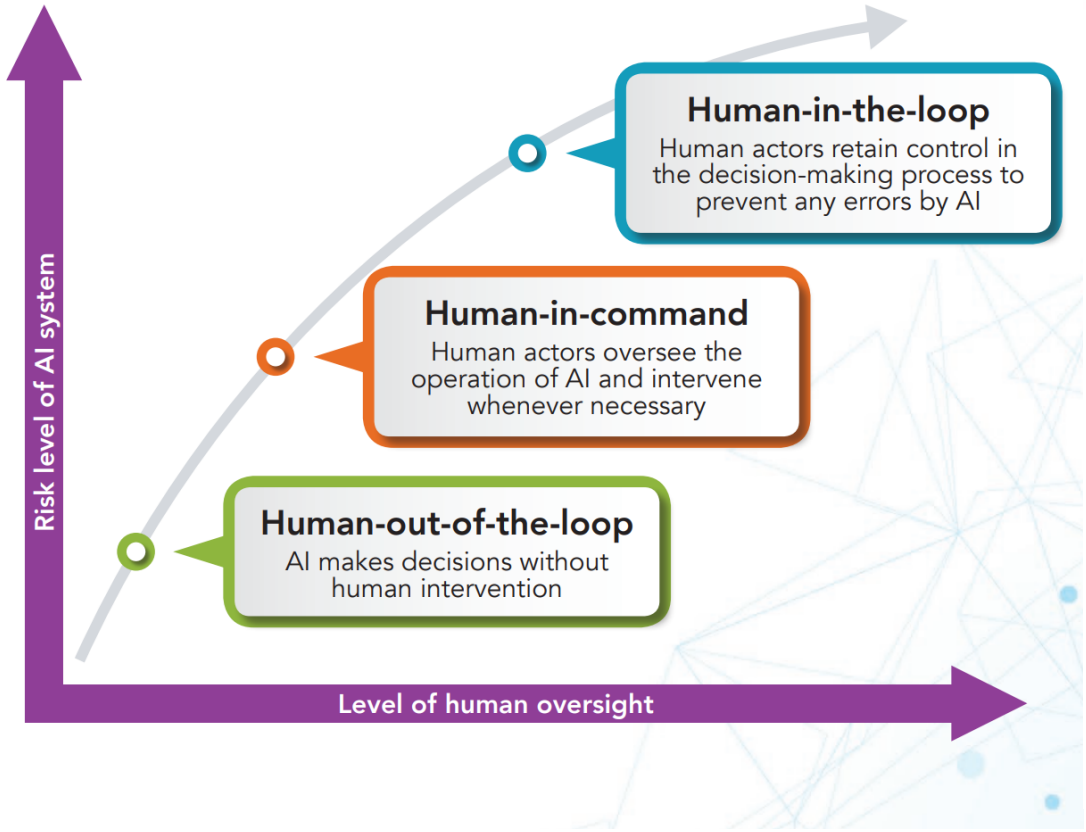
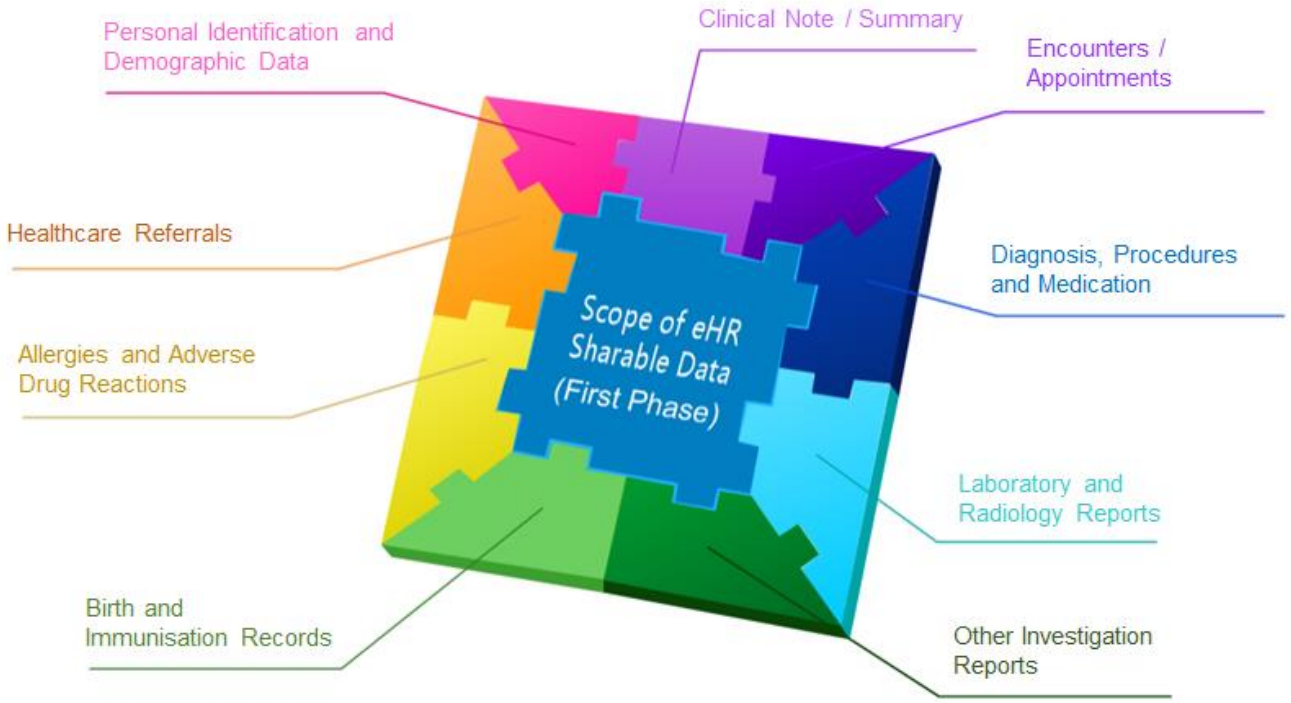


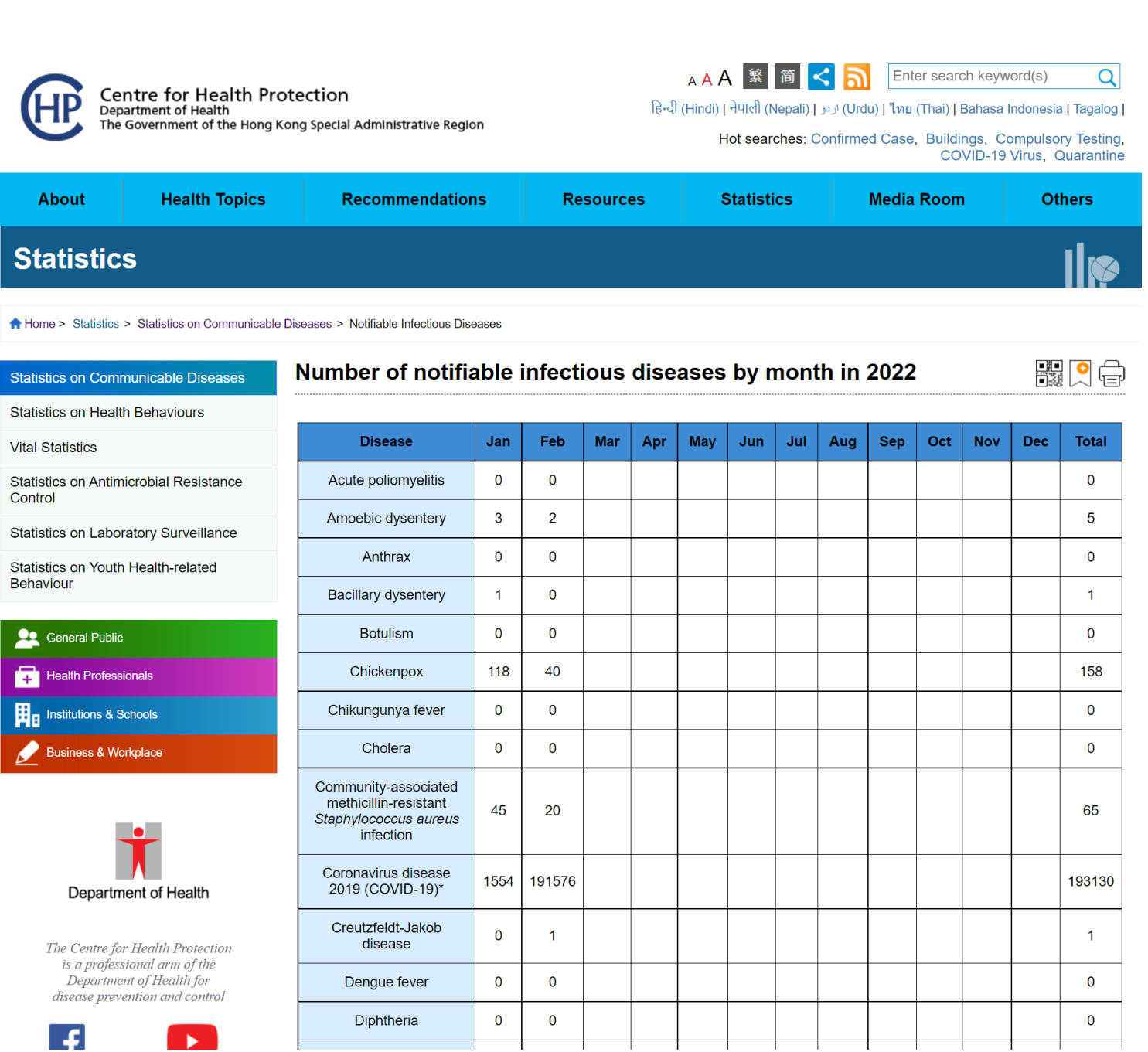
Figure 9 *Development and Management of AI Systems*

eHR in Hong Kong

5 Guiding Principles



- Cap. 625 Electronic Health Record Sharing System Ordinance of Hong Kong.
- eHR development should be government-led and should leverage HA's systems and know-how.
- Data privacy and system security of the eHR Sharing System should be accorded paramount importance and given legal protection.
- Participation in eHR sharing should be compelling but not compulsory for both patients and healthcare providers.
- eHR Sharing System should be based on open, pre-defined and common technical standards and operational protocols.
- Development of eHR Sharing System should be based on a building block approach, involving partnership with the private sector.



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Department of Health
The Government of the Hong Kong Special Administrative Region

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General Public
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Department of Health

The Centre for Health Protection is a professional arm of the Department of Health for disease prevention and control

Number of notifiable infectious diseases by month in 2022

Disease	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Acute poliomyelitis	0	0											0
Amoebic dysentery	3	2											5
Anthrax	0	0											0
Bacillary dysentery	1	0											1
Botulism	0	0											0
Chickenpox	118	40											158
Chikungunya fever	0	0											0
Cholera	0	0											0
Community-associated methicillin-resistant *Staphylococcus aureus* infection	45	20											65
Coronavirus disease 2019 (COVID-19)*	1554	191576											193130
Creutzfeldt-Jakob disease	0	1											1
Dengue fever	0	0											0
Diphtheria	0	0											0

Prevention and Control of Disease Ordinance (Cap 599):

An Ordinance to provide for the control and prevention of disease among human beings; to prevent the introduction into, the spread in and the transmission from, Hong Kong of any disease, source of disease or contamination; to apply relevant measures of the International Health Regulations promulgated by the World Health Organization; and to provide for connected purposes.

Bluetooth technology applied hence user's location data (SHS) or venue check-in data (LHS) only stored in the phone for up to 31 days.

Both apps underwent security and privacy assessment and audit in compliance with the Personal Data (Privacy) Ordinance.

From 1 June 2021, LHS App added the Electronic Vaccination & Testing Record function.

Apps developed by government.

Existing and Emerging Capabilities in the Governance of Medical AI

Letter to the Editor | Published: 24 June 2024

Volume 16, pages 307–311, (2024) Cite this article

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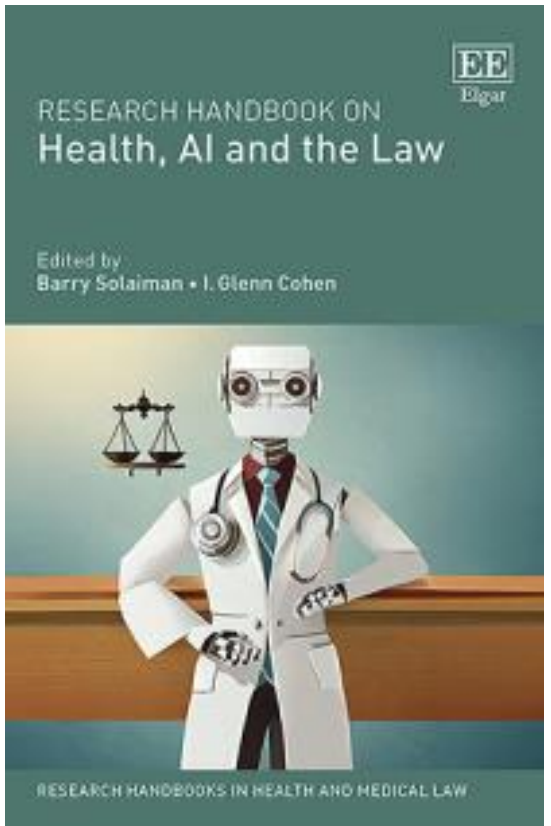
Gilberto K. K. Leung, Yuechan Song & Calvin W. L. Ho

The Centre for Medical Ethics and Law of the University of Hong Kong (HKU) hosted an international conference from 9 to 11 May 2023 on 'Governance of Medical AI'. This event was held in collaboration with HKU's Clinical Trials Centre, the Medical Ethics and Humanities Unit of the LKS School of Medicine of HKU, and the Hong Kong Academy of Medicine. For the purposes of this conference, medical artificial intelligence (AI) was broadly understood as an algorithm, model or software developed with the intent for use in healthcare and in health-related research. Technology governance, as defined by the Organisation for Economic Co-operation and Development (OECD 2023), was adopted in the discussions so that 'governance' refers not only to regulation, but also to a multitude of institutional and normative requirements, standards and mechanisms that steer technological development.

Sections References

- Among the four largest bay areas in the world (the other three being New York City, Tokyo, and San Francisco).
- Total population of approximately 71.2 million people.
- Home to a large number of Chinese technology companies, including Huawei, ZTE Corporation, Tencent (the holding company of WeChat) and SenseTime.
- Key Dimensions: Law, Governance and Values (GBA is a policy construct, not a legal one); Health system and related infrastructures (e.g. data and research); Stakeholders and interests



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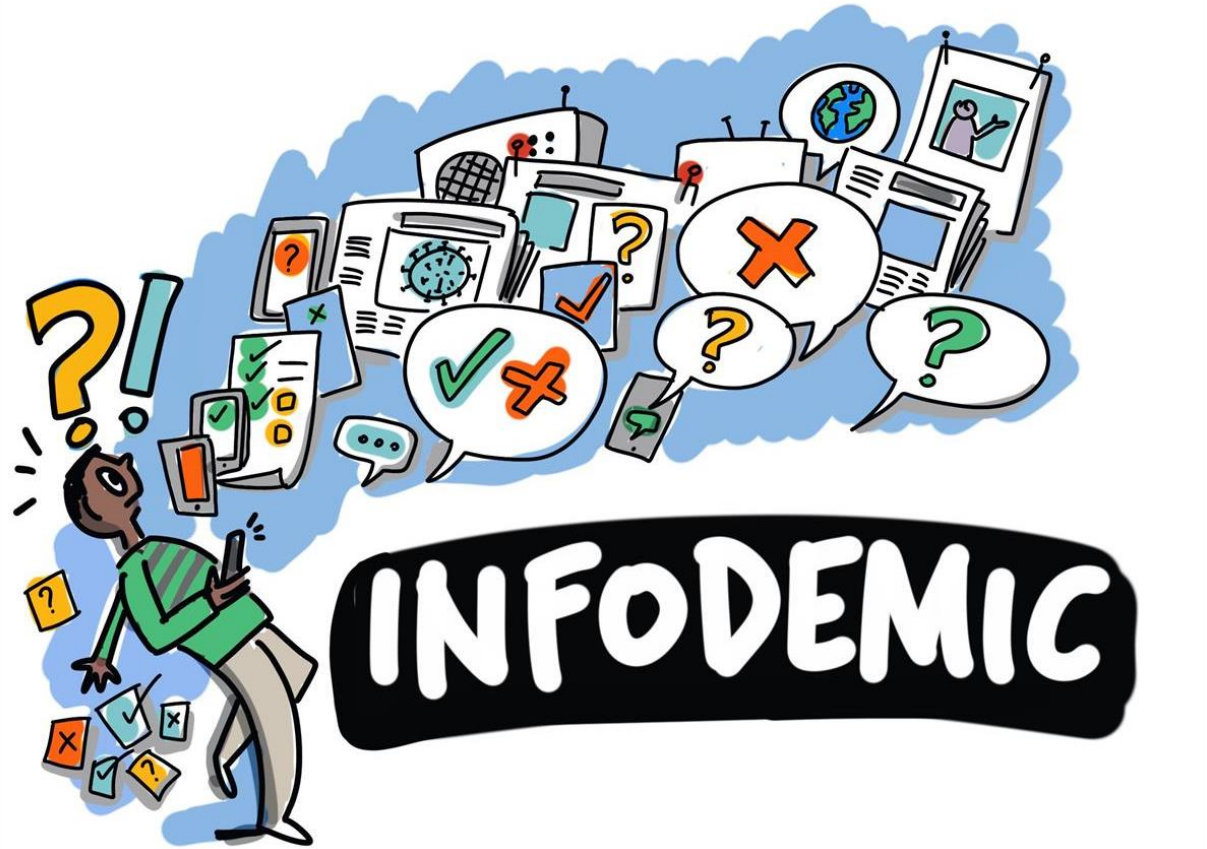
4. Emerging Sub-Field: Infodemiology and Infodemic Management



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Infodemic Management

- During COVID-19 pandemic: mis-information, dis-information, mal-information, information overload
- WHO: An infodemic is an overabundance of information, accurate or not, in the digital and physical space, accompanying an acute health event such as an outbreak or epidemic.
- Only acute health events? Or also non-acute events such as AMR, NCDs, One Health, …?

Social Listening

- The regular and systematic aggregation, filtering and monitoring of conversations and public discourse in a combination of traditional media, digital media, off-line and on-line sources of information that represent different populations and geographies (GAVI, UNICEF, WHO et al. 2021)
- Scale? big data? automatization?
- Analysis (methods) & Synthesis (visualization, reporting)?
- Sources: mass media & social media?

Genealogy of Social Listening

- Social science methods (research)
- Marketing tool in the corporate sector (professional)
- Public health (research & professional)

Context-Based Framework

- GAVI, UNICEF, World Health Organization, et al. 2021: “Finding the Signal through the Noise: A landscape review and framework to enhance the effective use of digital social listening for immunisation demand generation”
- WHO & UNICEF, 2023: “How to build an infodemic insights report in 6 steps”
- Global Health Law Consortium and the International Commission on Jurists, draft of 20 May 2023: “Principles and Guidelines on Human Rights & Public Health Emergencies”
- WHO, 2017: “WHO Guidelines on Ethical Issues in Public Health Surveillance”
- WHO, 2021: “Ethics and governance of artificial intelligence for health”
- Association of Internet Researchers, 2019: “Internet Research, Ethical Guidelines 3.0”

Listen

Pool existing and appropriate data sources for data triangulation and filtering

The ecosystem of immunisation demand data includes a range of structured and unstructured data sources

STRUCTURED

- Household KAP survey
- Routine health system data collection
- Polling and periodic surveys (remote data collection)
- Real-time polling, surveys & exit interview (service experience feedback)

UNSTRUCTURED

- Crowd sourced insights
- Focus groups, interview
- Community sentinel reporting
- Traditional media monitoring
- Real time social media listening & intelligence

Understand

Analyse data, visualise trends, report and share findings

- **AI-Driven Predictive Analytics**
- **Filters**
- **Human insight**

Insights into existing barriers and challenges along the Journey to Health and Immunisation

- Trust, influence, gender & equity
- Intent
- Point-of-service & Experience of Care
- After Service
- Health and Political System

FIG 3: DEMAND DATA

HOW TO BUILD AN

INFODEMIC INSIGHTS REPORT

IN SIX STEPS

World Health Organization

unicef for every child

STEP 6

Disseminate the infodemic insights report and track the actions taken

STEP 5

Develop an infodemic insights report

STEP 3

Conduct an integrated analysis across those data sources

STEP 4

Develop strategies and recommendations

STEP 1

Choose the question that infodemic management insights could help to answer

STEP 2

Identify and select the data sources and develop an analysis plan for each data source

World Health Organization

Health Topics | Countries | Newsroom | Emergencies

Home / News / WHO kicks off deliberations on ethical framework and tools for social listening and infodemic management

WHO kicks off deliberations on ethical framework and tools for social listening and infodemic management

10 February 2023 | Departmental news | Reading time: 1 min (388 words)

WHO has convened a panel of experts to discuss ethical considerations in social listening and infodemic management. The aim of the ethics expert panel is to reach a consensus on ethical principles for social listening and other infodemic management activities and provide recommendations for health authorities and researchers.

The panel brings together experts from academia, health authorities, and civil society, with a wide range of expertise such as in biomedical ethics, data privacy, law, digital sociology, digital health, epidemiology, health communication, health promotion, and media studies.

An infodemic is an overabundance information, including misinformation, that surges during a health emergency. During a health emergency, people seek, receive, process and act on information differently than in other times, which makes it even more important to use evidence-based strategies in response. Infodemic management practice, underpinned by the science of infodemiology, has rapidly evolved in the recent years. Tools and experience that were developed during COVID-19 pandemic response have already been applied to other outbreaks, such as ebola, polio and cholera.

Ethical and Regulatory Challenges

- Power imbalances
- Governance
- Working in conditions of uncertainty
  - Epistemic underdetermination
  - Truth
  - Revisability
  - Reliability
  - Certitude
- Infodemic management effectiveness

Published on 29.8.2024 in Vol 4 (2024)

Preprints (earlier versions) of this paper are available at https://preprints.jmir.org/preprint/56307, first published January 15, 2024.

Ethical Considerations in Infodemic Management: Systematic Scoping Review

Federico Germani[1]; Giovanni Spitale[1]; Sandra Varaidzo Machiri[2]; Calvin Wai Loon Ho[3]; Isabella Ballalai[4]; Nikola Biller-Andorno[1]; Andreas Alois Reis[5]

Abstract

Background:
During health emergencies, effective infodemic management has become a paramount challenge. A new era marked by a rapidly changing information ecosystem, combined with the widespread dissemination of misinformation and disinformation, has magnified the complexity of the issue. For infodemic management measures to be effective, acceptable, and trustworthy, a robust framework of ethical considerations is needed.

Objective:
This systematic scoping review aims to identify and analyze ethical considerations and procedural

Citation

Please cite as:

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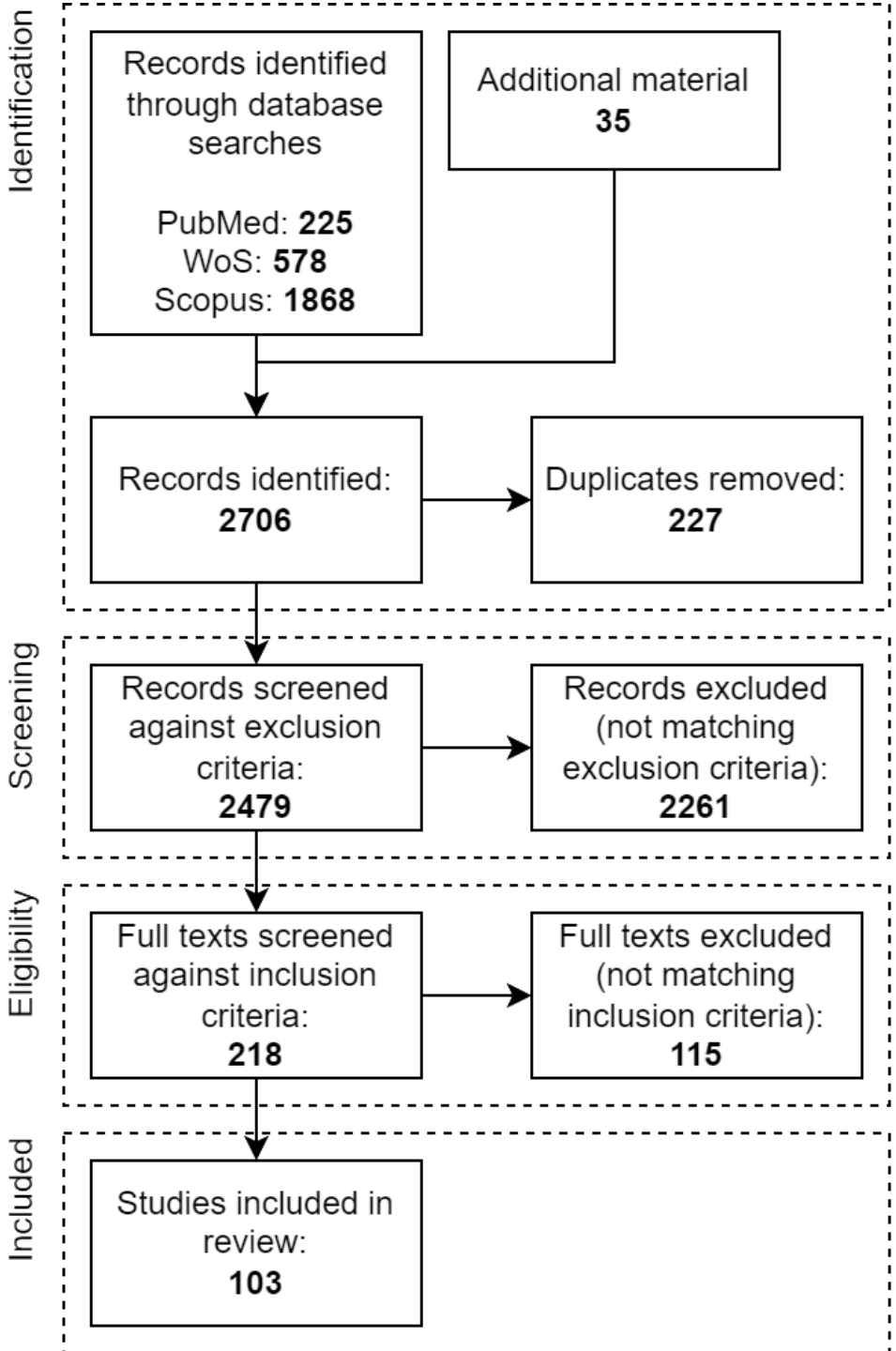
This paper is in the following e-collection/theme issue:

Reviews in Infodemiology (5)



Top 10 ethical issues in the literature includes (see Appendix 1 to Manuscript):

1. Right to be informed truthfully
2. Trust and mistrust
3. [Surveillance & Social Listening represented a composite of issues]
4. Vulnerability and inequality
5. Free speech vs. Regulation
6. Privacy
7. Lack of community engagement
8. Informing vs. Manipulating
9. Honesty vs. Conflicts of interest
10. Lack of education

Top 5 ethical aims of infodemic management includes (discussed in manuscript):

1. Truthful communication and outreach
2. (Responsible and effective) surveillance
3. Community Engagement
4. Trust
5. Transparency

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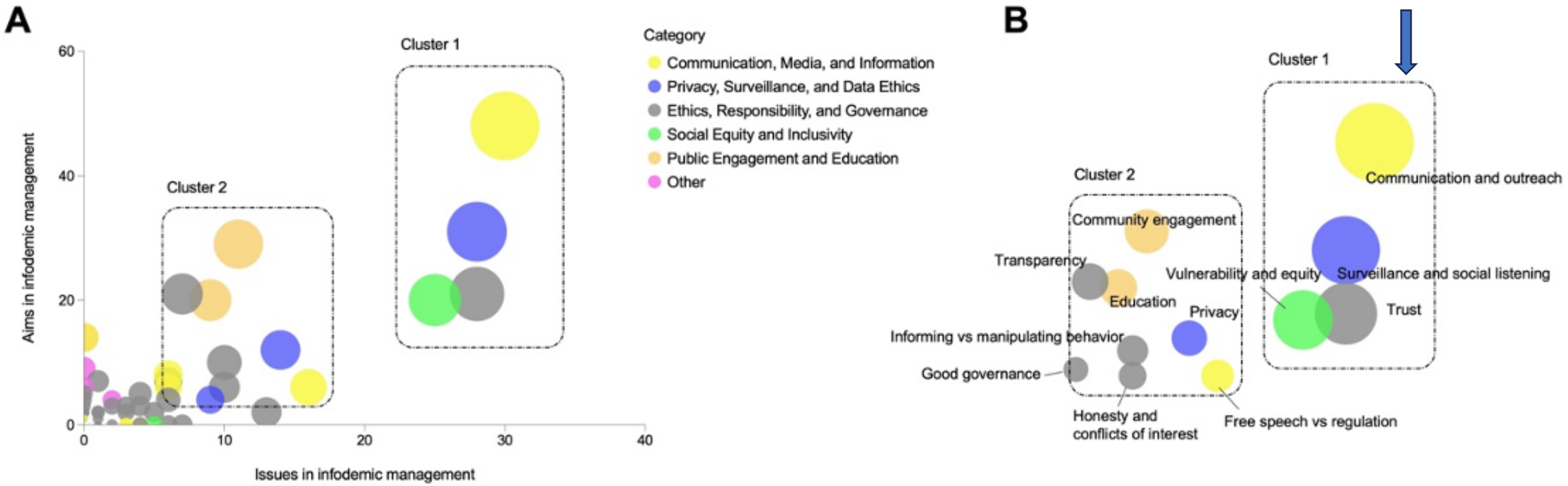
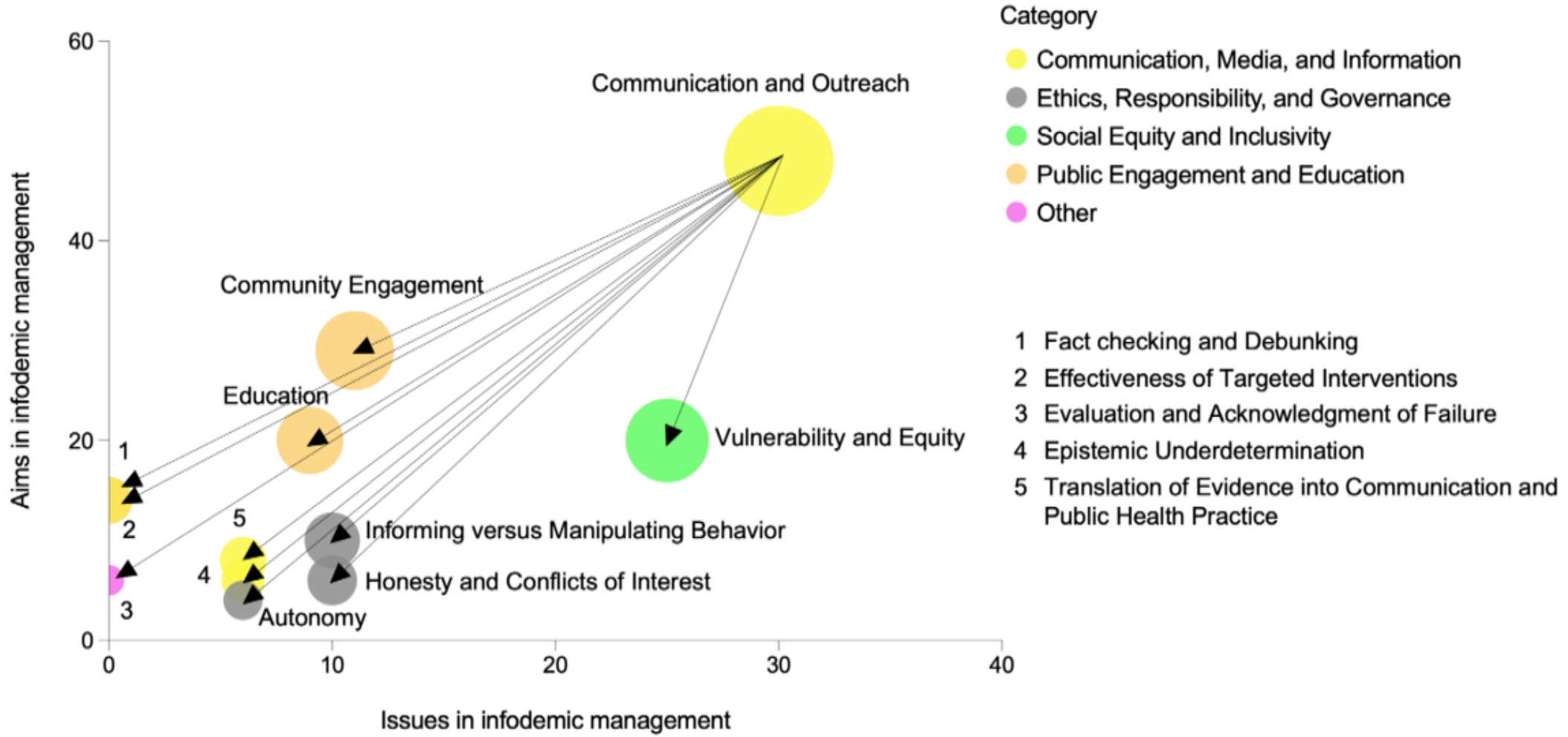
Focus of Manuscript on Ethical Aims

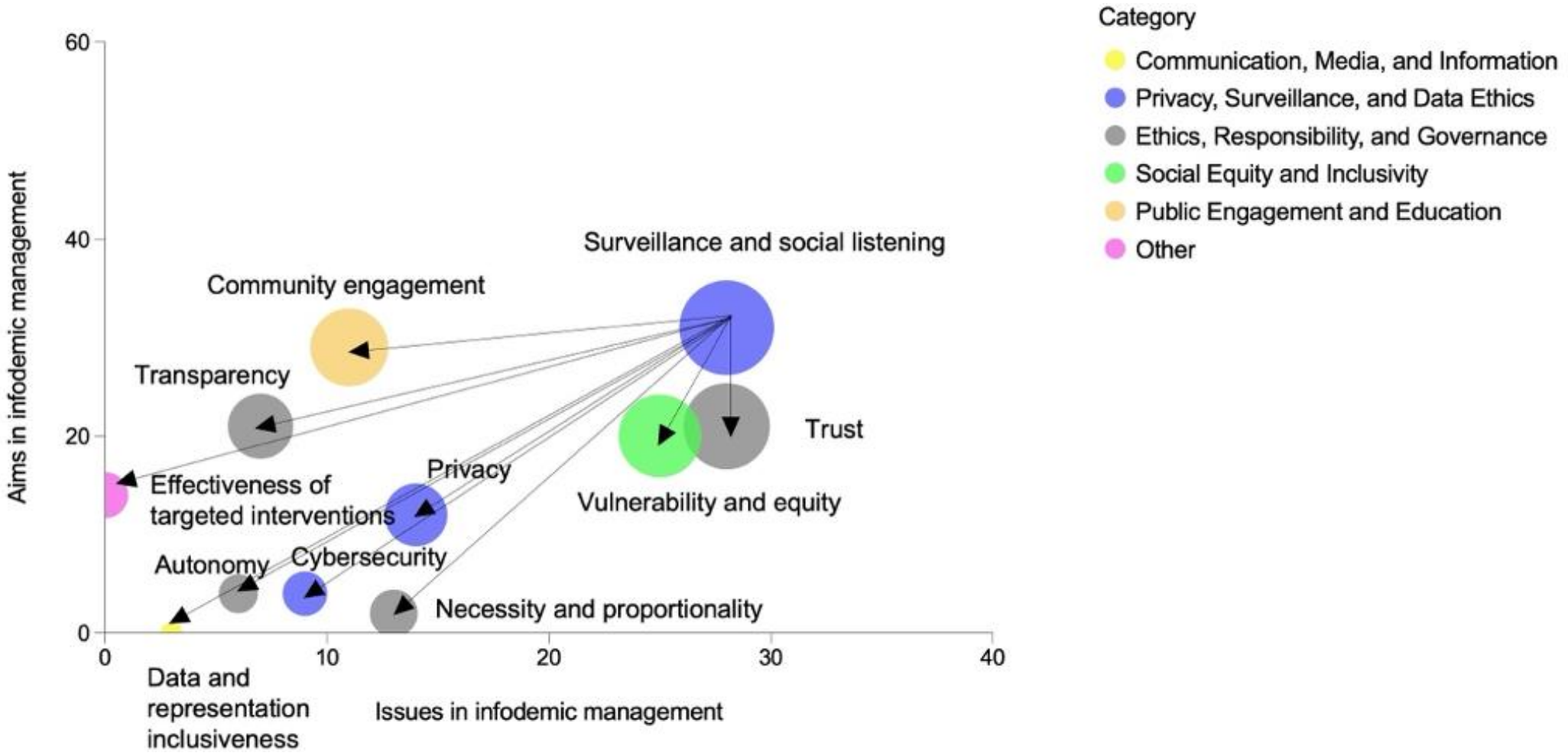


The main categories we identified were linked to “communication, media, and information”; “privacy, surveillance, and data ethics”; “ethics, responsibility, and governance”; “social equity and inclusivity”; and “public engagement and education.”

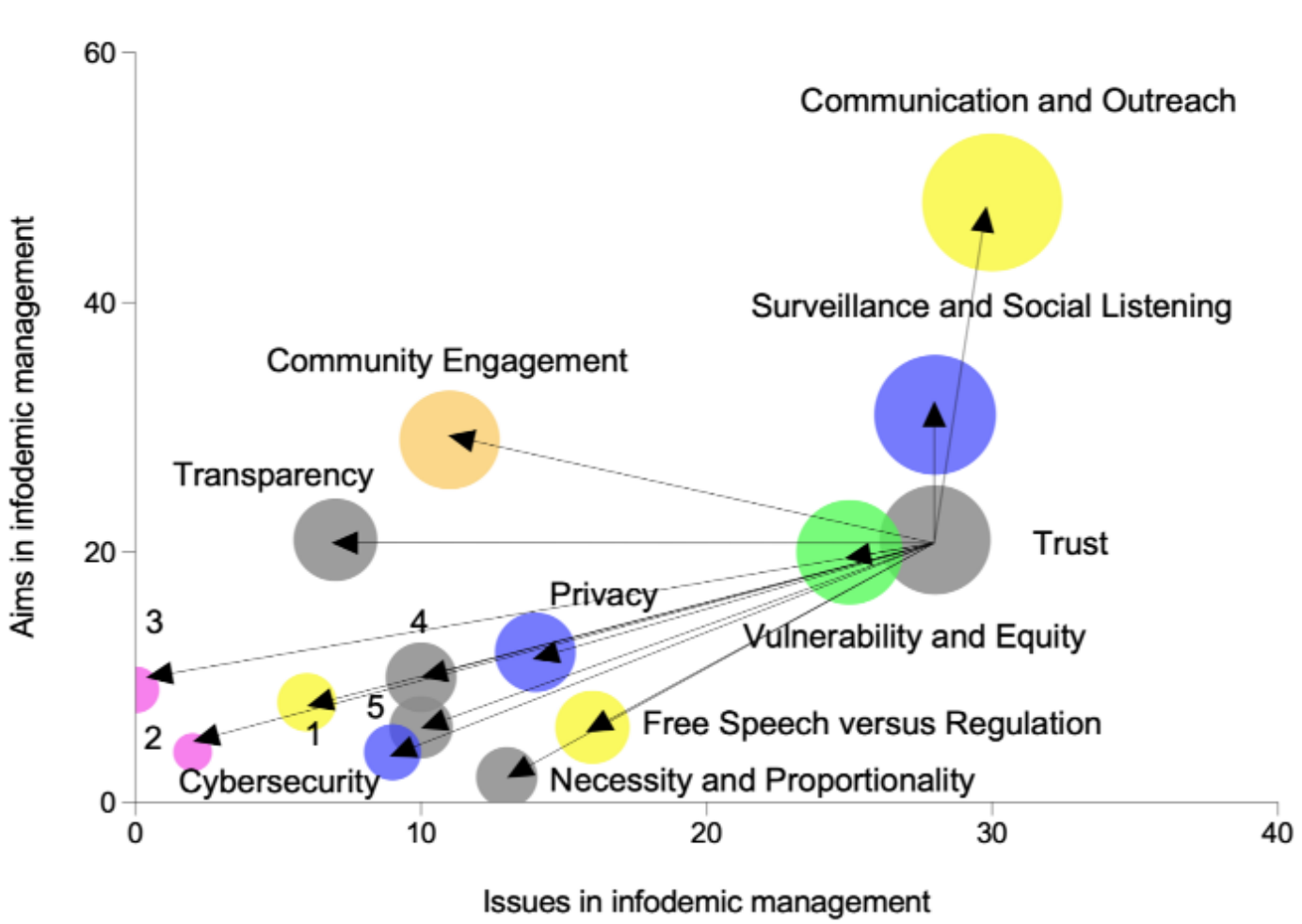
Truthful Communication and Outreach



Monitoring and Social Listening



Trust and Mistrust



Category

- Communication, Media, and Information
- Privacy, Surveillance, and Data Ethics
- Ethics, Responsibility, and Governance
- Social Equity and Inclusivity
- Public Engagement and Education
- Other

1 Translation of Evidence into Public Health Practice
2 Research
3 Cooperation Between Institutions
4 Informing versus Manipulating Behavior
5 Honesty and Conflicts of Interest

Forthcoming WHO Ethics Guidance on Infodemic Management & Social Listening

Literature Review:
Key ethical principles are *community engagement*, empowerment through *education*, *transparency*, *free speech versus regulation*, *informing versus manipulating behaviour*, *honesty and conflicts of interest*, and *good governance*.

Ethical considerations and aims in forthcoming WHO ethics guidance document:

- Respect for human rights / human rights-based approach
- Preserve & build trust, reciprocal trust, trustworthiness
- Apply fair, equitable and inclusive processes of decision-making
- Guarantee integrity of actors and actions
- Value public engagement
- Pursue understandability
- Driven by beneficence, effectiveness, & community benefit
- Balanced by necessity, utility, proportionality, and least intrusive approaches

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10 ANNIVERSARY

Governance of Social Listening
in the context of
Serious Health Threats

22-24 August 2023
Hong Kong & YouTube

5. Looking Ahead

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Ethics & Governance of AI for Health

The WHO guidance on *Ethics & Governance of Artificial Intelligence for Health* (2021) identifies the ethical challenges and risks with the use of artificial intelligence of health, six consensus principles to ensure AI works to the public benefit of all countries.

Contains a set of recommendations that can ensure the governance of AI for health maximizes the promise of the technology and holds all stakeholders – in the public and private sector – accountable and responsive to the healthcare workers who will rely on these technologies and the communities and individuals whose health will be affected by its use.

6 Consensus Principles

1. Protecting human autonomy
2. Promoting human well-being and safety and the public interest
3. Ensuring transparency, explainability and intelligibility
4. Fostering responsibility and accountability
5. Ensuring inclusiveness and equity
6. Promoting AI that is responsive and sustainable

Health Policy Watch
Independent Global Health Reporting

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Antimicrobial Resistance | Infectious Diseases | Pandemics & Emergencies | Non-Commu Diseases

Pandemic Agreement Talks Extended: One More Year to Resolve Critical Issues

Pandemics & Emergencies 02/07/2024 · Daniela Morich & Ava Greenup

Share this:

Ashley Bloomfield, co-chair of the Working Group on Amendments to the International Health Regulations and Precious Matsoso, co-chair of the Intergovernmental Negotiating Body (INB) on the eve of the World Health Assembly

Following the 77th World Health Assembly (WHA)'s endorsement of a delay of up to one year for finalizing a pandemic agreement, the Intergovernmental Negotiating Body (INB) is set to resume talks on 16-17 July 2024.

COMMENT · Online first, October 24, 2024

Equitable access to pandemic products demands stronger public governance

Adam Strobeyko [a] · Caesar A Atuire [b] · Ruth Faden [c] · Calvin W L Ho [d] · Vitor Ido [e] · Mohga Kamal-Yanni [f] · et al. Show more

Affiliations & Notes · Article Info

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Show Outline

The slow arrival of vaccines to the increasing number of countries ravaged by mpox shows that the COVID-19 pandemic did not result in the structural change needed to address global inequities. The absence of global arrangements to ensure access to health products during emergencies is a gap that governments are seeking to fill through recently agreed amendments to the International Health Regulations (IHR) and continuing negotiations towards a Pandemic Agreement. Pending the outcome of intergovernmental negotiations, WHO created the interim Medical Countermeasures Network (i-MCM-Net) as a temporary measure to coordinate the rapid development of and equitable access to pandemic products. As the global health community debates what longer-term mechanism should follow i-MCM-Net, substantial disagreement remains on governance, particularly the role of WHO. We argue that governments are primarily and collectively responsible for ensuring equitable access to essential health products and should mandate WHO with a more robust role in relation to states and non-state actors.

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世界首部：欧盟《人工智能法案》立法进程梳理与主要内容概览

晒科网
信息技术行业 教师

创作声明：包含 AI 辅助创作

10 人赞同了该文章

2024年3月13日，欧盟议会以 523 票赞成、46 票反对和 49 票弃权审议通过《人工智能法案》（EU AI Act），标志着全球人工智能领域监管迈入全新时代。该法旨在保护基本权利、民主、法治和环境可持续性免受高风险人工智能的侵害，同时促进创新并确立欧洲在该领域的领导者地位。该法规根据人工智能的潜在风险和影响程度规定了人工智能的义务

国务院办公厅关于印发
国务院2023年度立法工作计划的通知

国办发〔2023〕18号

各省、自治区、直辖市人民政府，国务院各部委、各直属机构：

《国务院2023年度立法工作计划》已经党中央、国务院同意，现印发给你们，请认真贯彻执行。

国务院办公厅

2023年5月31日

（本文有删减）

国务院2023年度立法工作计划

2023年是全面贯彻落实党的二十大精神的开局之年，是全面建设社会主义现代化国家开局起步的重要一年。国务院2023年度立法工作的总体要求是：在以习近平同志为核心的党中央坚强领导下，坚持以习近平新时代中国特色社会主义思想为指导，深入学习贯彻习近平法治思想，全面贯彻落实党的二十大和二十届一中、二中全会精神，深刻领悟“两个确立”的决定性意义，坚持党的领导、人民当家作主、依法治国有机统一，加强重点领域、新兴领域、涉外领域立法，完善以宪法为核心的中国特色社会主义法律体系，以良法促进发展、保障善治，为全面建设社会主义现代化国家、全面推进中华民族伟大复兴提供坚实法治保障。

一、认真学习宣传贯彻党的二十大精神，坚持以习近平法治思想指导新时代新征程立法工作

党的二十大是在全党全国各族人民迈上全面建设社会主义现代化国家新征程、向第二个百年奋斗目标进军的关键时刻召开的一次十分重要的大会。党的二十大报告深刻阐释了新时代坚持和发展中国特色社会主义的一系列重大理论和实践问题，描绘了全面建设社会主义现代化国家、全面推进中华民族伟大复兴的宏伟蓝图，为新时代新征程党和国家事业发展、实现第二个百年奋斗目标指明了前进方向、确立了行动指南。要坚持把党的二十大精神贯彻落实到立法工作全过程和各方面，不断推动新时代新征程立法工作展现新气象、实

Incorporating New Datasets like Genomics Requires New Regulatory Capabilities

Comment | Published: 09 September 2024

Defining and pursuing diversity in human genetic studies

Maili C. Raven-Adams, Tina Hernandez-Boussard, Yann Joly, Bartha Maria Knoppers, Subhashini Chandrasekharan, Adrian Thorogood, Judit Kumuthini, Calvin Wai Loon Ho, Ariana Gonzlez, Sarah C. Nelson, Yvonne Bombard, Donrich Thaldar, Hanshi Liu, Alessia Costa, Vijaytha Muralidharan, Sasha Henriques, Jamal Nasir, Aimé Lumaka, Beatrice Kaiser, Saumya Shekhar Jamuar & Anna C. F. Lewis

Nature Genetics (2024) | Cite this article

685 Accesses | 4 Altmetric | Metrics

Calls for more diverse data in genetics studies typically fall short of offering further guidance. Here we summarize a policy framework from the Global Alliance for Genomics and Health designed to fill this gap. The framework prompts researchers to consider both what types of diversity are needed and why, and how aims can be achieved through choices made throughout the data life cycle.

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Regulatory Capability Requires an Anticipatory Character

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The Cambridge Handbook of HEALTH RESEARCH REGULATION

Graeme Laurie, Edward Dove, Agomoni Ganguli-Mitra, Catriona McMillan, Emily Postan, Nayha Sethi and Annie Sorbie

The Cambridge Handbook of Health Research Regulation

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Bridging the Research–Therapy Divide in the Regulatory Governance of Artificial Intelligence as Medical Devices

from Section IIB - Widening the Lens

Published online by Cambridge University Press: 09 June 2021

By Calvin W. L. Ho

Edited by Graeme Laurie, Edward Dove, Agomoni Ganguli-Mitra, Catriona McMillan, Emily Postan, Nayha Sethi and Annie Sorbie

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Chapter Figures

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Summary

Artificial intelligence and machine learning (AI/ML) medical devices are able to optimise their performance by learning from past experience. In healthcare, such devices are already applied within controlled settings in image analysis systems to detect conditions like diabetic retinopathy, for instance. In examining the regulatory governance of AI/ML medical devices in the United States, it is argued that the development and application of these devices as a technical and social concern whether in research or in clinical care must proceed in tandem with their identities in regulation. In the light of emerging regulatory principles and approaches put forward by the International Medical Device Regulators Forum, and endorsed by the US Food and Drug Administration, conventional thinking about clinical research and clinical practice as distinct and separate domains needs to be reconsidered. The high connectivity of AI/ML medical devices that are capable of adapting to their digital environment in order to optimise performance suggest that the research agenda persist beyond what may be currently limited to the pilot or feasibility stages of medical device trials. If continuous risk-monitoring is required to support the use of software as medical devices in a learning healthcare system, more robust and responsive regulatory mechanisms are needed, not less.

The notion of anticipatory governance is especially relevant to reconciling data-driven learning health systems with a human right to science. **Anticipatory governance** may be understood as a broad-based capacity extended through society that can act on a variety of inputs to manage emerging knowledge-based technologies while such management is still possible. (Knoppers 2018)

The possibility for anticipatory governance relies on continuous evolution, where the discovery engine is governed by policies for complex collective innovation, and the negotiation of co-designed innovation futures informed by earlier foresight generated with the inclusion of knowledge generators, end users and evidence (including uncertainty) to imagine the possible multiplex futures for innovations.

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Regulatory Governance Should Be Participatory

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Volume 10, Issue 2
July-December 2023
(In Progress)

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JOURNAL ARTICLE

Implementing the human right to science in the regulatory governance of artificial intelligence in healthcare

Calvin W L Ho ✉ Author Notes

Journal of Law and the Biosciences, Volume 10, Issue 2, July-December 2023, lsad026, https://doi.org/10.1093/jlb/lsad026

Published: 14 October 2023 **Article history** ▾

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Abstract

Artificial intelligence (AI) enables a medical device to optimize its performance through machine learning (ML), including the ability to learn from past experiences. In healthcare, ML is currently applied within controlled settings in devices to diagnose conditions like diabetic retinopathy without clinician input, for instance. In order to allow AI-based medical devices (AIMDs) to adapt actively to its data environment through ML, the current risk-based regulatory approaches are inadequate in facilitating this technological progression. Recent and innovative regulatory changes introduced to regulate AIMDs as a software, or 'software as a medical device' (SaMD), and the adoption of a total device/product-specific lifecycle approach (rather than one that is point-in-time) reflect a shift away from the strictly risk-based approach to one that is more collaborative and participatory in nature, and anticipatory in character. These features are better explained by a rights-based approach and consistent with the human right to science (HRS). With reference to the recent explication of the normative content of HRS by the Committee on Economic, Social and Cultural Rights of the United Nations, this paper explains why a rights-based approach that is centred on HRS could be a more effective response to the regulatory challenges posed by AIMDs. The paper also considers how such a rights-based approach could be implemented in the form of a regulatory network that draws on a 'common fund of knowledges' to formulate anticipatory responses to adaptive AIMDs. In essence, the HRS provides both the mandate and the obligation for states to ensure that regulatory governance

Key source of more specific rights and freedoms to which all humans are entitled in relation to scientific progress and its applications.

- Article 27 of the Universal Declaration of Human Rights (UDHR)
- Article 15 of the International Covenant on Economic, Social and Cultural Rights (ICESCR)

At least three main components in implementation:

- The right of everyone to benefit from and contribute to scientific and technological progress (or HRS in the public interest sense)
- The right of scientists to do research and push forward science and technology (or HRS in a technical sense)
- Countries' duty to provide an enabling environment (or HRS in a governance sense). "right for people to have a legislative and policy framework adopted and implemented which aims at making the benefits of scientific progress available and accessible—both through encouraging new scientific discoveries and through removing barriers for existing scientific knowledge to be used for public benefit". [**Evolving capacity**]

Conclusion: New Environment of Trust & New Governance Capabilities

1. Static to Participatory
2. Passive Review to Collaborative Engagement
3. Public Health Protection to Capacitation
4. Transactional to Environmental
5. Epistemic hybridisation (ethics, law and human rights)


THANK YOU!