

# Conference on Health, Inference, and Learning (CHIL) 2022

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## 1. Introduction

This volume contains the proceedings of the third Conference on Health, Inference, and Learn-

ing (CHIL), held virtually on April 7–8, 2022. Among the changes made this year was a transition from Association for Computing Machinery (ACM) to Association for Health Learning and Inference (AHLI). This change enabled CHIL to provide access to our proceedings through open publication models.

Research in machine learning and health requires a cross-disciplinary representation of clinicians and researchers in machine learning, health policy, causality, fairness, and related areas. The goal of the conference is to foster excellent research that addresses the unique challenges and opportunities that arise at the intersection of machine learning and health.

## 2. Conference

The CHIL 2022 program included a set of exceptional keynote speakers, tutorials, roundtables, in addition to the spotlight presentations and posters by authors of accepted works submitted to CHIL.

### 2.1. Keynotes

CHIL 2022 introduced excellent keynote speakers talks, 20 minutes each, that cover a wide variety of topics.

**Rumi Chunara** Dr. Chunara is an associate professor at New York University. The title of her talk was “Algorithmic fairness and the science of health disparities”. In her talk, she introduced the science of health disparities and juxtaposed it with the machine learning subfield of algorithmic fairness. She showed examples of how machine learning and principles of public and population health can be synergized for using data to advance the science of health disparities and sustainable health of entire populations.

**Nuria Oliver** Dr. Oliver is the chief data scientist at DataPop Alliance and the Chief Scientific Advisor to the Vodafone Institute. In her talk titled “Data Science against COVID-19”, she described her work leading a multi-disciplinary team of 20+ volunteer scientists focusing on human mobility and computational epidemiological models, in addition to a large-scale online citizen surveys called the *COVID19impactsurvey*<sup>1</sup> with over 700,000 answers worldwide that helped in understanding the impact of the pandemic on people’s lives.

**Lorin Crawford** Dr. Crawford is a Senior Researcher at Microsoft Research and RGSS Assistant Professor of Biostatistics at Brown University. In his talk titled “Machine Learning for Human Genetics: A Multi-Scale View on Complex Traits and Disease”, he presented flexible and scalable classes of Bayesian feedforward models that provide interpretable probabilistic summaries such as posterior inclusion probabilities. In his presentation, he highlighted the impact of prioritizing biological mechanism to identify associations that are robust across ancestries—suggesting that ML can play a key role in making personalized medicine a reality for all.

**Jure Leskovec** Dr. Leskovec is an associate professor of computer science at Stanford University. In his talk “Reducing bias in machine learning systems: Understanding drivers of pain”, Leskovec discussed two examples how AI can help us reduce biases and disparities. He started with explaining how we can use AI to understand why underserved populations experience higher levels of pain (with an example of osteoarthritis) that stem from factors external to the knee, such as stress. He discussed the deep learning approach they developed with their team to measure the severity of osteoarthritis, by using knee X-rays to predict patients’ experienced pain and show

that this approach dramatically reduces unexplained racial disparities in pain.

**Danielle Belgrave** Dr. Belgrave is a research scientist at DeepMind, Google. In her talk titled “Understanding Heterogeneity as a Route to Understanding Health”, Belgrave addressed representation of the patient state to better understand the patient journey. She provided motivating examples for how good state representations can allow us to visualize deteriorating patients, identify the different pathways for both clinical improvement or deterioration, and discern situations for intervention. In her presentation, she highlighted the importance of understanding heterogeneity of the clinical pathways and data modalities to personalize healthcare interventions.

**Jessica Tenenbaum** Dr. Tenenbaum is the chief data officer at the North Carolina Department of Health and Human Services, and assistant professor of biostatistics and bioinformatics at Duke University. Her talk titled “Machine Learning in Public Health: are we there yet?” addressed the difficulties of adopting predictive models in public health. She highlighted that even the most sophisticated models were of limited use to policy makers beyond basic trends and observations from the front lines, although there was significant interest in predictive modeling to project hospital capacity out in the future. In her talk, she covered a reality check from the trenches of state government on the heels of the COVID-19 pandemic.

## 2.2. Tutorials

CHIL 2022 hosted five tutorials, each 60 minutes.

**Changing patient trajectory: A case study exploring implementation and deployment of clinical machine learning models** by Yindalon Aphinyanaphongs. In this tutorial, Aphinyanaphongs gave insight into the implementation, deployment, integration, and evaluation steps following the building of a clinical model, with a focus on how context inform the design choices of building a model. In their tutorial, they showed their COVID-19 adverse event model as a case study, where they demonstrated the full lifecycle of the clinical model and its impact on the patient’s outcome, in addition to the socio-technical challenges for success.

1. <https://covid19impactsurvey.org>

**Challenges in Developing Online Learning and Experimentation Algorithms in Digital Health** by Walter Dempsey. This tutorial discussed the algorithms underlying mobile health clinical trials, with a focus on the micro-randomized trial (MRT), an experimental design for optimizing real time interventions. Dempsey defined the causal excursion effect and discussed reasons why this effect is often considered the primary causal effect of interest in MRT analysis. During this tutorial, attendees had access to synthetic digital health experimental data to better understand online learning and experimentation algorithms, the systems underlying real time delivery of treatment, and their evaluation using collected data.

**Causal Inference from Text Data** by Dhanya Sridhar. This tutorial focused on causal inference and highlighted the unique challenges that high-dimensional and noisy text data pose. Sridhar discussed two text applications involving online forums and consumer complaints to motivate recent approaches that extend natural language processing (NLP) methods in service of causal inference, and any assumptions needed to bridge the gap between noisy text data and valid causal inference.

**‘Are log scales endemic yet?’ Strategies for visualizing biomedical and public health data** by Anamaria Crisan. This tutorial discussed strategies for visualizing data and evaluating its impact with an appropriate target audience. The aim is to build an intuition for developing and assessing visualizations by drawing on theories of visualization theories together with examples from prior research and ongoing attempts to visualize the present pandemic.

**Distributed Statistical Learning and Inference with Electronic Health Records Data** by Rui Duan. Duan introduced several methods for the effective and efficient integration of electronic health records and other healthcare datasets. It focused on developing communication-efficient distributed algorithms for jointly analyzing multiple datasets without the need of sharing patient-level data. The presenter provided examples of implementing the algorithms to real-world clinical research networks.

### 2.3. Roundtables

CHIL 2022 hosted three research roundtables.

**Responsible AI for health** by Leo A Celi. This roundtable focused on the the issues of fairness, biases, and ethics in AI applications for health.

**Human Centered AI for Health and Wellness** by Rosa Arriga. This roundtable focused on ways that AI can be incorporated into computational system design to improve health and wellness.

**Social and environmental determinants of health** by Esra Suel. This roundtable focused on the use of emerging sources of digital data for characterizing urban environmental features and exposures.

### 3. Papers: New Guidelines and Selection

We now discuss new guidelines for paper submissions and then present submission and reviewer statistics.

#### 3.1. New paper submission guidelines

This year, for submitted papers, we added a mandatory requirement of two new sections: (1) Data and Code Availability, and (2) Institutional Review Board (IRB). The Data and Code Availability statement was required to be at the start of the paper. The IRB statement was to go at the end of the paper prior to references and did not count toward the page limit. Authors had to comment on these even if they were not planning on sharing code or data, or if their paper did not require IRB approval. Our goal was to better highlight what data are being used (with citations as appropriate), to promote sharing of code (authors who declined to share code had to explicitly say that they are not sharing code), and to make sure that authors did provide IRB information or clearly state that their research does not require an IRB approval.

#### 3.2. Submission statistics

We received 71 total submissions across three submission tracks. The total number of submissions decreased from 110 in 2021 and 92 in 2020. This is potentially due to transition from ACM to AHLI, as well as the continued virtual nature of the conference.

Out of the 71 papers, 69 made it through the reviewing process. The breakdown for each of the tracks were 39, 30, and 6 for Track 1 (Models and Methods), Track 2, (Applications and Practice), and Track 3 (Policy: Impact and Society), respectively.

There were 4 papers that spanned 2 tracks. A strong set of 23 papers were selected for inclusion in the proceedings (33.3% acceptance rate) and 17 papers were invited for non-archival presentation (24.6%). Each paper received at least two reviews with an average number of 3.67 reviews. Each submission also received a meta-review that reflected collaborative decision making both within each track and across all three tracks. This led to more consistent acceptance decisions.

### 3.3. Reviewer statistics

In an effort to broaden our reviewer pool, we solicited volunteers through social media. We added 27 new reviewers for a total of 146 reviewers. To improve the matching process, we invited reviewers to bid on the papers during a 4-day window prior to paper assignment. 75 of the reviewers used it to bid on papers. Each reviewer was assigned no more than 3 papers to review with an average of 1.73 papers.

## 4. Acknowledgements

We thank AHLI and the CHIL Steering Committee for their support and suggestions for this year’s CHIL.

### 4.1. Sponsors

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### 4.2. List of Reviewers

The proceedings would not have been possible without the diligent and generous work of our reviewers. They provided meaningful feedback and evaluation of all proceedings papers and invited non-archival presentations. We are grateful to all the reviewers: Adam Yala, Agata Foryciarz, Aishwarya Mandyam, Ajinkya K Mulay, Akinori Mitani, Alex Fedorov, Ananth Reddy, Aniruddh Raghu, Ankit Pal, Anna Zink, Antonio Sze-To, Aria Khademi, Arinbjörn Kolbeinsson, Benjamin A Fine, Bobak J Mortazavi, Byung-Hak Kim, Candelaria Mosquera, Charles B. Delahunt, Chen Yanover, Danny Eytan, David Bensaïd, David Bethge, Deepta Rajan, Dimitris Spathis, Divya M Shanmugam, Edward Choi, Elizabeth Tran, Emma Charlotte Rocheteau, Farzan Sasangohar,

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