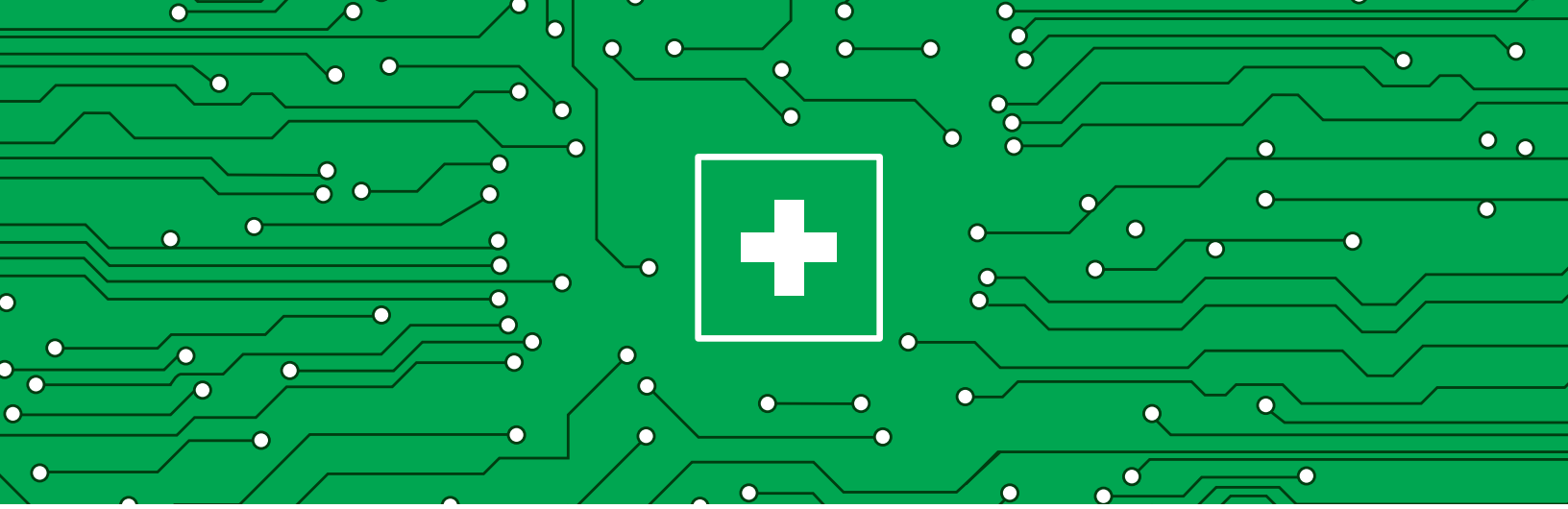

APPLICATION OF ARTIFICIAL INTELLIGENCE APPROACHES TO TACKLE PUBLIC HEALTH CHALLENGES

WORKSHOP REPORT

January 19, 2018 | Toronto, ON

CIFAR

CIHR IRSC Canadian Institutes of Health Research / Instituts de recherche en santé du Canada

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BACKGROUND

Advances in artificial intelligence (AI) and machine learning (ML) have proven useful in many research domains and have been applied successfully in various health-related fields, including: genetic research, medical diagnostics, drug discovery, image recognition, and personalized medicine. However, far less attention has been given to public health applications. Yet, the potential for use of AI and ML methods is promising and offers opportunities to infer new knowledge on trends and complex interactions from large sets of heterogeneous data using integrated analyses in public health.

Through an environmental scan commissioned by CIHR-IPPH, it was found that the variety of schools in Canada publishing in this area is limited, with active teams based in British Columbia and Quebec contributing unique publications in the field of AI and public health. The top three universities identified as publishing in the AI and public health field included McGill University, the University of British Columbia, and Université Laval. However, the low rate of academic output across Canada to date suggests that there is limited expertise at the cross-section of AI and public health. Therefore, there is a need to invest in training opportunities and skill development for public health researchers in AI approaches.

Given the rapid development of new computational technologies and wide-ranging potential of application in public health, the Canadian Institutes of Health Research's Institute of Population and Public Health (CIHR-IPPH) and the Canadian Institute for Advanced Research (CIFAR) jointly hosted a workshop on January 19, 2018, to facilitate connections between researchers from the public health and AI fields and collectively identify strategic areas of exploration. This workshop brought together an interdisciplinary group of researchers with expertise in areas including public health, ML, biostatistics, epidemiology, mobile health technology, population health, surveillance, and health informatics.

The workshop was jointly chaired by Dr. Alan Bernstein, President and CEO of the Canadian Institute for Advanced Research (CIFAR) and Dr. Steven Hoffman, Scientific Director of the Canadian Institutes of Health Research's Institute of Population and Public Health (CIHR-IPPH). Sessions were also moderated by Drs. Marisa Creatore (CIHR-IPPH) and Rachel Parker (CIFAR). CIHR-IPPH and CIFAR have developed a partnership focused on encouraging collaborations between researchers working in the areas of population and public health and those in the engineering and computer sciences who are focused on AI methods, in order to build capacity in using AI approaches for public health challenges. As a first step in this partnership, CIHR-IPPH and CIFAR co-hosted this workshop with the objectives of:

- Generating priority research questions that would benefit from using ML and AI approaches at the intersection of public health
- Catalyzing linkages and interactions between interdisciplinary researchers to generate cross-disciplinary collaborations and discuss how such networks can be supported
- Mobilizing the development of grant proposals in this innovative field

The full agenda for the day and workshop participant list can be found in Appendices A and B.

KEY THEMES AND RECOMMENDATIONS

The following key points and suggestions were made in response to Setting the Stage presentations from Dr. John Brownstein (Chief Innovation Officer, Boston Children's Hospital) and Dr. Anna Goldenberg (Scientist, Genetics and Genome Biology, SickKids Research Institute) and group discussion.

Setting the Stage

- **Partnerships with Private Sector:** Participants asked for advice on how to develop relationships, how to achieve buy-in with companies in the private sector, and how to foster connections to access proprietary information. Dr. Brownstein noted cost-related challenges associated with accessing privately-held data and navigating application programming interfaces (APIs) for information access. Dr. Brownstein noted that some private sector companies have policies on health-related queries, and that fair and continuous access is possible through building relationships with the private sector.

- **Access to Data:** How to facilitate access to data in Canada was a central theme of the discussion, and participants stressed that there needs to be a pan-Canadian effort to modernize data strategies across data centres. Data repositories held by institutions such as the Institute for Clinical Evaluative Sciences (ICES) and Manitoba Centre for Health Policy (MCHP) were noted as providing excellent opportunities for researchers to access large sets of data and apply AI methods to this data. The need to modernize older data infrastructure was emphasized in this discussion, and participants indicated that researchers must vocalize the types of infrastructure needed to apply innovative AI methods to research. Participants highlighted that data should be thought of as facilitating both opportunities and challenges.

- **Need for Training:** Participants indicated that finding students with the skills to use and apply ML and AI methods is challenging and noted that this challenge is a key barrier. One idea that was posed was developing a pan-Canadian, tri-council graduate training program, using block funding, to build skills and capacity in ML and AI techniques.

Reflections and comments shared throughout the workshop are summarized below under the three topics discussed during the workshop: exciting opportunities in public health to apply AI approaches; potential challenges related to AI and public health; and what is needed to move forward and how.

Exciting Opportunities in Population and Public Health to apply AI Approaches

Workshop participants shared promising opportunities that exist where AI approaches could be applied to public health. Participants identified two types of opportunities: using AI to improve upon existing methods to answer a question; and addressing a novel question or challenge using AI that could not be done before using traditional methods. Participants also reflected on which of these opportunities could be addressed in the immediate and longer terms. Areas of opportunity identified by participants included:

- **Tools to Support Interventions and Healthy Behaviours:** PParticipants identified exciting opportunities in which AI can be used as a tool to promote healthy behaviours. Participants

mentioned utilizing AI for predictive analytics to identify and predict segments of a population at risk or to predict temporal or spatial patterns of risk, as well as to help inform how to target those risks. These tools can be used at multiple levels, including at the broader health systems level, for public health decision-making. An example raised during discussions was informal care networks (such as family, close friends, individuals with addictions), which often are under-resourced, under-supported, and poorly understood. AI tools embedded in mobile or online technologies can be used to target resources in light of risk, by being able to share information early with individuals, care networks and health providers based on acute need of extra social support. These tools can further engage and empower the public, changing how we communicate in public health. Smartphone and mobile applications are tools that could facilitate healthy decision-making by monitoring behaviours and collecting personal data such as mental health and social networks.

- **Understanding Pathways to Effect:** Population health intervention research and implementation science that is currently being done in Canada can be enhanced using AI approaches, to help us better understand why some interventions work and other do not, in different contexts. Analytic and explanatory AI tools offer the potential to better understand pathways that drive intervention outcomes and can allow public health researchers to capture more complex and comprehensive models. Causal inference methods in ML over time can allow us to better understand these pathways.

- **Cross-sectoral Data Applications:** AI tools increase the potential for applying cross-sectoral analysis to datasets related to the broader social determinants of health, such as education and social services. This information can then be used in decision-making by health and social service sectors to identify at-risk cases that need further support. The finer-grained methods of AI also have the potential to aid in identifying social inequities, similar to the Google Flu tracker, using cross-sectoral data.

- **Learning from Observed Patterns in Complex Systems:** Leveraging machines and techniques such as natural language processing (NLP) to find patterns and make connections and linkages across multiple datasets offers advantages to obtain evidence that can help inform decision-making for policymakers and public health organizations.

- **Integrating AI in Research Processes:** Interactions between automated and human decision strategies, also referred to as “human in the loop” strategies, can be used to refine research processes and make them more robust. This can help inform deep learning to guide individuals in their research, and visualization techniques can be utilized to explain findings from AI and ML systems to develop confidence and transparency in the findings. Cross-discipline learning on how to refine research processes will also be important to further integration.

- **Modelling Policy Decisions and Public Health Effects:** There is an opportunity for AI approaches to be used to model policy decisions and to understand the effects of these decisions on public health.

- **Changing Frameworks with Privacy Laws and Policies:** Exploring differences between privacy law changes in Canada, the US, and the EU, there is an appetite for data linkage given these policy changes and an opportunity for a case study on how these differences will play out across jurisdictions.

- **Data Availability and Accessibility:** There is an increasing availability of semantically-aligned data, and with automation using ML, institutions can increase data accessibility, by providing details on why and when the data were collected (meta-data). The availability of data produced by the private sector also poses opportunities for public health to utilize and link these data, as well as market data (ex. food purchasing data) to existing health datasets.
- **Understanding Bias and Social Inequities:** Public health can play a role in trying to understand bias and where it is coming from in AI and ML. Public health is also in a position of identifying key examples of what AI and ML could be used for, and examples of when either its use may not be effective or potentially could introduce inequities.
- **Collectively Explore Solutions:** Although there is no "one-size-fits-all" AI approach, we are now at a point where we can start to identify areas of shared interest for ML/AI researchers and for public health researchers, to determine where these interests intersect so that we can strategically support and act at these intersections.

Additional recommendations and general comments made during group discussion included:

- **Alignment of Tri-Council Objectives:** Collaboration with tri-council funding agencies was mentioned as opportune to advancing the application of AI in public health.
- **Population-level Social Interactions and Behaviours:** At the intersections of systems science and data science, innovative AI approaches may allow for the ability to address broader social and global issues such as climate change, conflict, and instability, from a discovery perspective using computational approaches.
- **Outbreak Management:** There is potential to apply AI approaches to outbreak management, as silos in health information across ministries make it difficult to address pressing outbreaks that have happened in the past (ex. Ebola, SARS, H1N1). Real-time problem solving during infectious disease outbreaks can be supported by ML in the future.

Identified Challenges related to AI and PPH

Workshop participants discussed potential challenges that could result from the application of AI approaches to public health research. Participants considered both short-term and long-term challenges, and identified the following challenges as top priorities:

- **Data Sharing:** There is a sense of hesitation to share, store, and link data from public, private, and quasi-public sectors, as well as between, across, and outside jurisdictions. The perceptions of legal challenges and boundaries of social license to operate[1] are unclear and shifts in public perception of data sharing may change how applications of AI are accepted.
  - » *Recommendation:* Principles of open data sharing, including across jurisdictional boundaries, must be clearly defined, and enablers across sectors need to be identified to promote data sharing.

1 Social license to operate (SLO) refers to the nature of relationships between community and industry stakeholders, and societal expectations of how an industry operates.

Moffat, Kieren & Lacey, Justine & Zhang, Airong & Leipold, Sina. (2015). The social licence to operate: A critical review. Forestry - An International Journal of Forest Research. 89. 10.1093/forestry/cpv044.

- **Relationship-building across Disciplines:** Relationship-building between ML/AI and public health fields was mentioned as a key challenge across breakout groups. In particular, participants highlighted the nature of ML as a discipline being more individual, focused, and precise, and how this differs from the population-level focus of public health. Public health research may not always require AI methods, but may benefit from a ML specialist to help apply ML/AI methods to relevant research questions.

  » *Recommendations:* Align disciplines to define research questions that are relevant to both fields, and frame alignments to ensure that novel methodologies are generating impact and adding value. Translate knowledge to avoid field-specific jargon when working in a multidisciplinary space to facilitate relationship-building.

- **Fair and Safe AI & ML:** Recognizing the many ethical challenges that AI approaches may pose, participants noted the potential for abuse of technology, which may lead to negative impacts on populations. Vulnerable systems may be exposed to external threats such as hacked datasets (intentional or otherwise), which must be identified. Equity challenges exist with representation in training datasets, and this is an area where public health can contribute insight and resources. The use of cloud data poses a challenge in maintaining confidentiality and is linked to developing infrastructure for advanced computing needs.

  » *Recommendations:* The use of cloud data and infrastructure in public health research may influence ethics review scoring and resultant funding, therefore this requires clear regulations on its use and applications. Acknowledging added benefit and value to using AI approaches in the public health space should be clearly outlined to ensure a clear benefit for exploring this interaction, rather than adopting unnecessary approaches.

- **Regulation and Access of Information:** Participants questioned access privileges to data and analyses that emerge from applying AI techniques. For example, would private companies or individuals themselves have access to analyses generated through predictions of risk among populations facing public health issues, particularly for sensitive cases such as suicide risk? This information may place burden on at-risk individuals, rather than systems. Furthermore, data collection on personal smartphones, and anonymization and depersonalization of this data was raised as a concern.

  » *Recommendation:* Results produced using innovative AI approaches need to be regulated accordingly to ensure responsible use and privacy standards are followed, given that there is a potential for commercialization of these methods, including interventions, to produce harm.

- **Navigating Private Sector Partnerships:** Collaboration with private entities introduces multiple challenges, including accessing data, sharing data across jurisdictions, and navigating intellectual property agreements in the private and innovation industries.

- **Defining Public Health Applications of AI:** AI approaches may facilitate existing processing power challenges applied to public health data but determining how to implement these approaches still remains unclear. The health field is focused on which computational algorithm to use for data analysis; however, algorithm development is part of the overall implementation process, and this includes data cleaning. Understanding how validation of algorithms are applied to public health research processes will change its impact and incorporate these processes into practice. Depending on what question is asked, public health research may

require AI systems based on predictive analytics, or causal inference methods in AI. Reconciling techniques used in AI with traditional methods used in epidemiology to produce analyses that can be interpreted with confidence is also an existing challenge for public health.

  - » *Recommendation:* Public health and ML/AI researchers need to collaboratively work to define the public health questions, determine the value add of using particular methods, and develop strategies to translate evidence into policies and decisions across disciplines and communities.

- **Fostering AI and Public Health in Education and Training:** Participants raised questions on how to effectively build capacity and train interdisciplinary cohorts of students equipped with skills in both AI and public health. This was categorized as a long-term challenge, and participants noted that trained researchers with comprehensive skillsets in AI are in high demand in academia and the innovation sector. Bioinformatics is one example of a training program that integrates multiple disciplines into a single program, but participants noted that evolving approaches and required skills must be monitored and better understood.

  - » *Recommendation:* Consider how to bring trained AI researchers in to the public health field. Further guidance and training needs to be built into research ethics boards and peer review processes, as innovative AI methods pose complex issues requiring reviewers to better understand the concepts behind what is reviewed.

- **Implementation and Infrastructure:** With innovative AI methods comes the need for high-powered computing and the use of cloud data. Limited validation and implementation of existing algorithms, and infrastructure is needed that often involves privately-owned software and customized, configured control settings. It was also mentioned that smaller provinces may not be prioritized for receiving infrastructure to conduct innovative public health research using AI and ML, but they have unique contexts and features that may enable exciting opportunities for exploration. Participants also acknowledged that implementation science is a concern for policymakers around the world and argued that current funding mechanisms do not offer enough resources to effectively carry out implementation science. AI approaches may help facilitate the implementation science of intervention research which needs exhaustive energy and resources.

  - » *Recommendation:* Since Canada is a leader in implementation science, there is an opportunity to act. This requires infrastructure that involves privately-owned software and customized, configured control settings. A potential solution to address this challenge would be the development of non-project specific data infrastructure that could be accessed and used across public health research. This identified challenge warrants further discussion and collaboration with the Canada Foundation for Innovation (CFI), which invests in research infrastructure across Canada.

What is Needed to Move Forward, and How?

Participants continued the discussion by focusing on actions and next steps needed to move forward with applying AI approaches to public health research. Participants were divided into three focus areas:

- **Know-How and Resources:** training and capacity building
- **Networks:** interdisciplinary partnerships and collaborations across industries and sectors

- **Policy & Society:** policy considerations, ethics and equity considerations, and societal implications of applying AI to public health research

Actions and next steps recommended by participants are highlighted below:

KNOW-HOW AND RESOURCES

- Identify knowledge gaps within public health that are urgent and transformative, that are not easily addressed using traditional public health research methods
- Develop continuum of expertise with respect to training across public health and AI research fields (such as the existing continuum between statistics and public health)
- Facilitate connections between AI/ML and public health researchers with compatible interests to increase capacity
- Educate research ethics boards on innovative AI techniques to provide precedent on how to judge applications appropriately

NETWORKS

- Incentivize institutions and academia to facilitate networking opportunities for cross-disciplinary connections and learning
- Include frontline practitioners such as public health practitioners and community advocates in cross-disciplinary networking activities
- Engage remote and rural communities, in Canada and globally
- Ensure that partnerships with companies are reciprocal through use of resources (such as IBM Watson) that facilitate the implementation of solutions, and monitor partnerships over time
- Consider incentive models and training for private-public partnerships, given historical challenges with data sharing and intellectual property considerations (such as those faced by 23andMe in the United States)

POLICY & SOCIETY

- Need for responsible interpretation of knowledge generated through AI/ML models to ensure policy uptake and implementation is relevant and beneficial to public health
- Engage policymakers from across jurisdictions early in discussions with interdisciplinary groups of researchers to identify public health challenges that could be effectively addressed using AI approaches, as this is an integral step in the uptake of generated knowledge through policy measures
- Leverage greater public awareness to incentivize policymakers' participation
- Address concerns about regulation, including what steps to take after identifying algorithm errors and what errors should or should not be tolerated
- Utilize the **Grand Challenges model** as a framework to understand implementation and scale of interventions using AI approaches in public health and define key questions that lead to identified intersections between public health and AI

FINAL REFLECTIONS & NEXT STEPS

Take-away messages were summarized by both Dr. Steven Hoffman (CIHR-IPPH) and Dr. John Hepburn (CIFAR), and both posed a call to action to researchers for continued engagement and highlighted the **op-ed co-published by Dr. Hoffman and Dr. Bernstein in the *Globe and Mail*** on the day of the workshop to mobilize this call to action.

Next steps that were identified included:

- CIHR-IPPH to examine and integrate recommendations from workshop to determine pathways and activities to mobilize in order to identify intersecting areas of interest
- Follow-up with participants and plan to co-organize future workshops for networking among researchers and stakeholders in the AI/ML and public health fields

APPENDICES

Appendix A:
Workshop Agenda

Appendix B:
Workshop Participant List

APPLICATION OF ARTIFICIAL INTELLIGENCE APPROACHES TO TACKLE PUBLIC HEALTH CHALLENGES

IPPH-CIFAR Joint Workshop | Meeting Agenda

Friday January 19, 2018 | CIFAR (MaRS Centre, West Tower, Suite 505) 661 University Avenue, Toronto, ON

WORKSHOP OBJECTIVES:

- Generate priority research questions that would benefit from using machine learning and artificial intelligence approaches at the intersection of public health
- Catalyze linkages and interactions between interdisciplinary researchers to generate cross-disciplinary collaborations and discuss how such networks can be supported
- Mobilize the development of grant proposals in this innovative field

TIME	AGENDA ITEM	LEAD(S)
8:45 – 9:00	Registration & Breakfast	
9:00 – 9:25	Welcome and Introductions • Background, Meeting Purpose and Objectives of Workshop • Review Agenda	**Alan Bernstein** (CEO & President, CIFAR) **Steven Hoffman** (Scientific Director, CIHR-IPPH)
9:25 – 9:55	Setting the Stage • Inspirational talks from AI and PPH perspectives	**John Brownstein** (Chief Innovation Officer, Boston Children's Hospital) **Anna Goldenberg** (Scientist, Genetics & Genome Biology, SickKids)
9:55 – 10:30	Setting the Stage: Discussion/Q&A	Moderator: **Steven Hoffman** (CIHR-IPPH)
10:30 – 10:50	Activity: Three Corners	
10:50 – 11:00	Health Break	
11:00 – 11:45	Breakout 1 – Exciting Opportunities in Population and Public Health to apply AI Approaches • Discuss opportunities for applications of AI in the PPH field	
11:45 – 12:30	Report Back and Discussion about Opportunities	
12:30 – 1:30	Lunch	
1:30 – 2:30	Breakout 2 – Identify Challenges related to AI and PPH • Discuss potential challenges stemming from applying AI methods to PPH	
2:30 – 3:15	Report Back and Discussion about Challenges	
3:15 – 3:30	Health Break	
3:30 – 4:15	Breakout 3 – Actions & Next Steps: What is Needed to Move Forward, and How? • Identify ways to build capacity and develop networks, collaborators and stakeholder engagement, funding ideas, policy actions, potential solutions	
4:15 – 4:45	Report Back & Group Discussion on Actions and Next Steps • Next steps and longer-term planning • Brainstorm topics for future meetings or workshops	
4:45 – 5:00	Wrap-up and Adjournment	**Steven Hoffman** (Scientific Director, CIHR-IPPH) **John Hepburn** (VP, Research, CIFAR)
5:00 – 6:00	Reception | Location: CIFAR	

APPLICATION D'APPROCHES D'UTILISATION DE L'INTELLIGENCE ARTIFICIELLE POUR SURMONTER LES DÉFIS DE SANTÉ PUBLIQUE

Atelier organisé conjointement par l'ISPP et l'Institut canadien de recherches avancées (ICRA) | Ordre du jour

Vendredi 19 janvier 2018 | ICRA (Centre MaRS, tour Ouest, bureau 505) 661, avenue University, Toronto (Ontario)

OBJECTIFS DE L'ATELIER

- Générer des questions de recherche prioritaires qui puissent tirer profit d'approches d'utilisation de l'apprentissage machine et de l'intelligence artificielle en santé publique
- Susciter des liens et des interactions entre chercheurs de différentes disciplines en vue de créer des collaborations interdisciplinaires et d'envisager des moyens de soutenir de tels réseaux
- Favoriser l'élaboration de propositions de recherche dans ce domaine novateur

HEURE	POINT À L'ORDRE DU JOUR	RESPONSABLE(S)
8 h 45 – 9 h	Inscription et déjeuner	
9 h – 9 h 25	Mot de bienvenue et présentations • Contexte, but de la rencontre et objectifs de l'atelier • Ordre du jour	**Alan Bernstein** (président et chef de la direction, ICRA) **Steven Hoffman** (directeur scientifique, ISPP des IRSC)
9 h 25 – 9 h 55	Préparer le terrain • Discours inspirants selon les perspectives de l'intelligence artificielle (IA) et de la santé publique et des populations (SPP)	**John Brownstein** (chef de l'innovation, Hôpital pour enfants de Boston) **Anna Goldenberg** (scientifique en génétique et en biologie du génome, Hôpital pour enfants de Toronto [SickKids])
9 h 55 – 10 h 30	Préparer le terrain : discussion et période de questions	Animateur : **Steven Hoffman** (ISPP des IRSC)
10 h 30 – 10 h 50	Activité : les trois volets	
10 h 50 – 11 h	Pause santé	
11 h – 11 h 45	Séance en sous-groupes 1 – Possibilités prometteuses d'utilisation de l'IA en SPP • Discussion sur les possibilités d'application d'approches d'IA dans le domaine de la santé publique et de la santé des populations	
11 h 45 – 12 h 30	Compte rendu et discussion sur les possibilités	
12 h 30 – 13 h 30	Dîner	
13 h 30 – 14 h 30	Séance en sous-groupes 2 – Cerner les défis entourant l'IA et la SPP • Discussion sur les défis potentiels découlant de l'application des méthodes d'IA en SPP	
14 h 30 – 15 h 15	Compte rendu et discussion sur les défis	
15 h 15 – 15 h 30	Pause santé	
15 h 30 – 16 h 15	Séance en sous-groupes 3 – Mesures à prendre et prochaines étapes : quelles sont les mesures à prendre pour progresser, et comment faut-il les appliquer? • Déterminer les moyens de développer les capacités et de créer des réseaux, de mobiliser les collaborateurs et les intervenants, de trouver des idées de financement, des actions stratégiques et des solutions possibles	
16 h 15 – 16 h 45	Compte rendu et discussion de groupe sur les mesures à prendre et les prochaines étapes • Prochaines étapes et planification à long terme • Remue-méninges sur des sujets à aborder lors de réunions ou d'ateliers futurs	
16 h 45 – 17 h	Conclusion et levée de la séance	**Steven Hoffman** (directeur scientifique, ISPP des IRSC) **John Hepburn** (vice-président à la recherche, ICRA)
17 h – 18 h	Réception | Endroit : ICRA	

Application of Artificial Intelligence Approaches to Tackle Public Health Challenges
January 19, 2018

Workshop Participant List

Name	Affiliation
Alan Bernstein	CIFAR
John Brownstein	Boston Children's Hospital
David Buckeridge	McGill University
Margarida Carvalho	Polytechnique Montréal
Marisa Creatore	CIHR-IPPH
Anamaria Crisan	University of British Columbia
Daniel Fuller	Memorial University
Vivek Goel	University of Toronto
Anna Goldenberg	The Hospital for Sick Children, University of Toronto
John Hepburn	CIFAR
Steven Hoffman	CIHR-IPPH
Zachary A Kaminsky	The Royal's Institute of Mental Health Research, University of Ottawa
Jim Tom	BlueDot
Maxime Lavigne	McGill University
Joon Lee	University of Waterloo
Andrea Lodi	École Polytechnique de Montréal
Doug Manuel	The Ottawa Hospital Research Institute
Lawrence McCandless	Faculty of Health Sciences, Simon Fraser University
Fiona Manning	CIFAR
Quaid Morris	University of Toronto
Fatima Mussa	CIHR-IPPH
Nathaniel D. Osgood	University of Saskatchewan
Alison Paprica	Vector Institute
Rachel Parker	CIFAR
M. Marit Rehavi	University of British Columbia
Leslie L Roos	University of Manitoba
Frank Rudzicz	Toronto Rehab; University of Toronto; Vector Institute
Laura Rosella	University of Toronto
Nancy Ross	McGill University
Vineet Saini	Alberta Health Services/University of Calgary
Elaine M Sedenberg	UC Berkeley
Elissa Strome	CIFAR
Marie-Pierre Sylvestre	Université de Montréal
Kate Zinszer	Université de Montréal