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Inaugural Artificial Intelligence for Public Health Practice (AI4PHP) Retreat: Ontario, Canada

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Abstract

The Artificial Intelligence (AI) for Public Health Practice Retreat was a hybrid event held in October 2022 in London, Ontario to achieve three main goals: 1) Identify both the goals of public health practitioners and the tasks that they undertake as part of their practice to achieve those goals that could be supported by AI, 2) Learn from existing examples and the experience of others about facilitators and barriers to AI for public health, and 3) Support new and strengthen existing connections between public health practitioners and AI researchers. The retreat included a keynote presentation, group brainstorming exercises, breakout group activities, case studies, and interspersed breaks for networking and reflection. There were 38 attendees from across Ontario, and a guest speaker from New York. Major themes that emerged from discussions included the need for greater attention to AI applications in public health given the potential benefits and enthusiasm; rigorous data collection, data quality, and data accessibility as a foundational factor that needs urgent attention; and the need for an equitable systems-thinking

approach to AI amidst the breadth of public health functions, interventions, and population-based applications. Attendees expressed a desire for continued engagement and collaboration between public health practice and AI researchers.

Introduction

Artificial Intelligence (AI) methodology has recently found itself in the limelight, with interest coming from people in many areas of research and application. These various AI methodologies and approaches all come with an eye to assessing how AI techniques can support their endeavors. In public health practice, AI presents an opportunity to use both established and new sources of large, highly complex data (sometimes termed "big data") to develop and tailor population-level interventions, and there is a growing number of examples of AI applications in key areas of public health practice.[1–3] However, many organizations that support public health have not yet been at the table for discussions about how AI can and should impact their work.

In response to this issue, we organized the Artificial Intelligence for Public Health Practice (AI4PHP) Retreat with *the overarching goal of engaging public health practitioners and AI researchers to discuss how AI could be used to support activities of public health practice*. Specific objectives included:

1. Identify both the goals of public health practitioners and the tasks that they undertake as part of their practice to achieve those goals that could be supported by AI methods.
2. Learn from existing examples and the experience of others about facilitators and barriers to AI for public health.
3. Support new and strengthen existing connections between public health practitioners and AI researchers.

To achieve these goals, we organized a series of small and large group activities with breaks interspersed throughout the day to allow for more casual conversations and collaboration building. The retreat was held on October 24 & 25, 2022 in London, Ontario with an option for virtual participation through Zoom. During breakout group sessions all virtual attendees were kept together, with one dedicated virtual-only facilitator and additional in-person participants logging on to join the virtual discussion from an on-site computer. We set up a Slack channel for communication before, during, and after the event, and we distributed an AI for public health primer in advance of the event.[4] The primer was a live document outlining the major functions of AI with public health examples; attendees were able to edit the document to add their own examples or questions. There were 38 people in attendance from across Ontario, as well as New York (Table 1), including 12 AI researchers and 26 public health practitioners (see Table 2 for more refined breakdown of roles). In the following, we describe the structured sessions of the retreat, relate the major things we learned, and identify future directions for integrating AI into public health practice.

Table 1. Attendee Geography.

Geographical Location	Number of People
Ontario (Province-wide organizations)	3
Kingston	2
London	11
New York	1
Ottawa	4
Peel	1
Thames Valley	2
Toronto	6
Thunder Bay	2
Waterloo	6

Table 2. Summary of Attendee Roles.

Position Type	Number of People
Artificial Intelligence Research	12
Leadership Position within Public Health Unit, e.g., Manager or Director	7
Epidemiologist	3
Public Health Research/Scientist	8
Other Public Health Practitioners, e.g., Case Manager	5
Primary Care	3

Summary of Retreat Sessions

The retreat was organized by a series of structured sessions and less structured activities to allow for additional reflection and mingling among participants. Moderation was primarily done by DJL. The meeting agenda is in the Appendix; descriptions of each structured session with key takeaways is presented below in order of occurrence.

1) Keynote Presentation (Day 1)

To provide context and inspiration, the first session of the retreat included an introduction and keynote presentation, "Introduction to AI for Public Health" by Zoé Haskell-Craig from the Center for Health Data Science at New York University.[5] This included an introduction to AI with examples of how it can fit into public health, risks of AI such as racial bias, and examples of bringing fair AI and public health goals together.

2) Public Health Challenges: Group Brainstorming Exercise (Day 1)

The second session of the retreat followed a two-stage modified nominal group technique process[6,7] to elicit ideas about the most pressing issues in public health. While everyone could participate in the conversation, the focus of this session was on public health practitioners and identifying the broad areas of public health practice where AI could add value. The first stage included five facilitated small group discussions where public health practitioners were each asked to contribute 1-2 challenges that they face in their day-to-day activities, and then the resulting collection of ideas were discussed and refined among the small group. In the second stage, each small group reported back to everyone on their top 1-3 topics that they would like to discuss further bringing in the AI perspective; high-level topics for the afternoon session (described below) were derived in real-time by combining and prioritizing the top topics. After the retreat, we reviewed notes taken from both the small and full group discussions to identify

more granular themes from attendee ideas about public health challenges and support or relevance of AI:

Attendees identified new public health use cases appropriate for AI technologies that may not already be on the radar of AI developers. These use cases primarily related to 1) upstream prevention and 2) earlier detection of threatening events and how to best match resources (e.g., social prescribing to combat loneliness, cooling centres in heat waves) with communities most in need of support. *Equity and social determinants of health* were repeatedly raised as integral components of public health and thus crucial for consideration in any AI application.

Planning for AI applications requires a Systems Thinking approach and infrastructure to support the public, research, and policy. Public health often handles several interrelated or interdependent issues and thus practitioners interact with many different sectors; AI applications will need to support collaborations especially between health and social services. Furthermore, the need for regulation and oversight was raised as a necessary step to help quell fears and support adoption.

Advocacy and perceptions of public health were prominent topics, tied to the subthemes of needing to foster trust in public health with misinformation as a barrier, and the *challenge of defining success or demonstrating the value* of an AI application in public health when a "successful event" is a non-event (e.g., no increase in disease prevalence). While the latter is not unique to AI, it needs to be carefully considered in how to identify and advocate for resources to support continuation of beneficial AI applications. On the other hand, participants identified a potential opportunity to use AI to demonstrate the value of public health interventions in general, e.g., by simulating counterfactual scenarios or documenting program outcomes.

Even though discussion prompts did not restrict to data or AI, much of the discussion revolved around *data concerns related to collection, availability, quality, and accessibility in a timely fashion.* While attendees may have inferred this focus from the nature of the event, it is notable that attendees naturally gravitated towards these issues and that the discussion was rich and uninhibited. Data-related considerations are elaborated on below (Topic A).

3) Connecting Public Health Challenges with Artificial Intelligence: Station Exercise (Day 1)

The goal of the third retreat session was to engage in discussions between public health practitioners and AI researchers about using AI in relation to the top public health topics identified in the second session. The session was designed in terms of stations that each included 1) a group of public health practitioners, 2) a topic to discuss, and 3) two AI researchers. To allow for a range of AI area exposures, station rotations were organized such that each public health practitioner group discussed each topic with a new AI research team. Before breaking off into stations each AI researcher gave a 1-minute (max 1 slide) introduction on their relevant work and experience. Each station was 35 minutes long with the following prompts to help organize the discussion: 1) *Subject matter discussion:* public health practitioners talk about the key challenges on this topic from their perspective and everyday experience; 2) *Methods discussion:* AI research team response with ideas about opportunities for AI to support the

challenge; 3) *Discuss potential facilitators and barriers, including necessary data*, to successful creation of an AI support for the topic. Below are themes we identified for each topic:

Topic A: Data collection, use, and deficiencies.
There is a need and motivation for more complete, individually linked data to better understand and serve populations; however, public and community health is under-resourced in general and there was concern about how the infrastructure needed to create and maintain improved public health data would be funded. It was unclear whose responsibility it is to improve data and where resources (e.g., data engineers) would come from; local public health units in the Ontario context do not have capacity, and this falls outside the scope of AI scientist roles. Additional barriers raised around linkage and better data infrastructure included privacy, ethical, legal, social, and technical considerations; and there was discussion on how data created for public health activities may not necessarily be suitable for research and application development. Using data generated by the public in forms such as social media was raised, and highlights some of the privacy, ethical and potentially even legal challenges of data that is compatible with AI technologies. Examples of positive infrastructure improvements were also raised, such as the Health Data Research Platform[8] and the Rapid Risk Factor Surveillance System[9].

Within this topic, the *systems thinking* theme emerged again. There was a great deal of discussion about relationships among people and organizations and how those relationships influenced possibilities for data linkage by sometimes presenting socio-technical barriers to data sharing. There was also a discussion about data trust, from gathering to analysis to knowledge translation, and a need for data to support targeted interventions that work within larger socio-technical systems. Finally, there was discussion of the position of public health within or beside other sectors, both public and private.

Topic B: Communication and collaboration with end users and beneficiaries.
The importance of co-design of AI applications for public health was raised; however, thus far attendees have seen limited interaction between public health, data engineers, and AI developers. Barriers to engagement included capacity, community "representatives" not always being viewed that way by their communities, different end users and beneficiaries for each specific application or public health situation, and varying stages of readiness for AI development or adoption. Facilitators included education, champions, clear examples or vignettes to motivate work in the area, and visualization as an important component to support tool use. A need for respect was further raised and tied to the idea of respect for differences through the recognition that public health interventions must be targeted to the needs of different populations. Population differences also motivate a need to understand model generalizability to avoid misuse.

In addition to the need to support communication around AI, ideas were raised about how AI applications can be used to support public health communication. Public health is not always the best voice to deliver health behaviour-related messages, due to mistrust. For example, an AI application could help identify relevant data, e.g., infection rates, in timely fashion for public health practitioners to consider in designing or justifying programs, e.g., vaccine clinics in schools; and using AI methods to test and compare different public health communication strategies using online tests, micro-trials, etc.

Topic C: Using data to evaluate programs and advocate for resources.
This topic was related to the theme from the earlier session on how it is challenging to identify successful public health interventions. Again, the systems thinking theme came up, considering how public health can advocate for itself in the broader sociopolitical context. The idea of an accountability gap was also raised in that lots of initiatives exist with unclear directions for the future and sustainability. There were two main ways AI was addressed in this topic: The first included interest in using AI methods to generate data or information about a public health intervention and to assist with its evaluation. This could include using the ability of AI methods to identify complex patterns to better analyze whether an intervention is working, conduct silent trials, or help make sense of the outputs and broader impacts of a program that inherently generates a lot of data. The second was viewing any given AI application as a solution or intervention that will need to be properly evaluated. Example AI applications included using AI to simulate large-scale policy choices, using AI to improve data quality, using AI to support stories as a component of advocacy, and using AI to identify when a public health action on an existing policy is needed (e.g., clearing people from a beach to prevent water-borne infections). The latter idea included discussions around what level of evidence would be needed to take action based on an AI risk assessment.

Challenges and facilitators raised for this topic included data foresight/availability, privacy, and security; trust issues with evaluation when the provider is not the evaluator; political cycle influence; lack of capacity for data engineers and data scientists in public health leading to data gaps; quality improvement versus continuous learning; standardization across settings; education around what AI is and the role it would play in evaluation; need to understand what situations are (not) amenable to AI solutions/benefit; and mistrust in AI and mistrust in data, with concerns that if AI is used for evaluation, the results may not be trusted.

Topic D: Early detection of key events and tailoring responses to needs.
This topic facilitated discussion around more specific public health scenarios that AI may be able to support. Example applications included monitoring climate temperature; outbreak detection especially in rural contexts, for example in northern Ontario, where detection of events has historically been slower than in urban areas; identifying substance related harm before overdoses; identifying emergency department visit spikes (e.g., opioid overdoses or new compounds/medications); monitoring social media and geotags for trends; and child health and development screening. The need for better data collection and value of data linkage came up again, with the idea of being able to gain a more complete picture of whether someone is at risk. The question of who is responsible for newer data types, such as social media, as they interact with catchment areas was identified as a source of complexity for early detection systems. Further facilitators and barriers related to use of a public health AI application included model transparency, governance and oversight, data shift considerations over time and across populations, and third-party detection. Finally, the question of what detection tangibly would look like was raised, as was a theme around the public trust that would be needed to enact early detection and tailoring.

4) Case Study Discussions (Day 2)

The second day consisted primarily of a series of case studies (45 minutes each). Each began with a presentation about an existing public health AI application example and how it was done,

followed by a discussion. A goal for these discussions was to better understand both the example applications but also the processes behind them, such as the nature of collaborations and lessons learned. The case studies included:

- Dr. Brent D. Davis: *Needle in the Haystack: Opportunities and Challenges of Social Media Analytics for Public Health*
- Dr. Joseph Jay Williams and Harsh Kumar: *Adaptive Texting for Learning & Behaviour Change: Mental Health Application*
- Dr. Peter Pulsifer and Amos Hayes: *Geomatics and Cartographic Research Centre*
- Dr. Laura Rosella: *AI for Public Health, Health Research Training Platform Overview*

5) Supporting Public Health Leadership in Artificial Intelligence: Group Discussion (Day 2)

The final session of the retreat was intentionally left open-ended to allow time to address any outstanding topics or questions raised by attendees. We revisited themes raised throughout the retreat, further discussed practicalities of what starting an AI-related project could look like in different public health units, and brainstormed how to support increased public health leadership and capacity around AI.

Summary and Next Steps

We conducted the first AI for public health practice retreat in Ontario, Canada. This 1.5-day retreat included a mix of structured sessions reported on above as well as unstructured time to reflect and connect with colleagues, such as birdwatching. Overarching themes that emerged included public health as an exciting and relatively understudied area with many potential avenues for support by AI; data collection, quality, and accessibility as a limiting factor that needs urgent attention; and the need for an equitable, systems thinking approach to AI amidst the breadth of public health functions, possible applications, and target populations. Example challenges to motivating AI for public health include how to identify success when success is often characterized as a "non-event", the need to foster public trust around data and interventions, and how to create and resource teams and infrastructure for knowledge and data sharing between sectors and disciplines. Despite excitement and perceived opportunities for AI to support public health, a key barrier is that many local public health units do not currently have the capacity or resources for dedicated AI-related work. The retreat ended with a discussion about future steps and how to foster public health leadership and presence in AI.
Moving forward, we plan to host further AI for public health retreats in different geographical regions—local and national—and in collaboration with the AI4PH Health Research Training Platform, which is leading increased awareness and capacity around AI for public health in Canada.[8]

Acknowledgements

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Appendix

Table A. Retreat Outline.

Time (EST)	**Topic**			
Day 1: Monday October 24, 2022				
8:00 - 8:45am	**Breakfast (Optional)**			
8:45 - 9:00am	**Introduction & Welcome** *Dan Lizotte*			
9:00 - 9:45am	(Structured Session 1) **Keynote Presentation: Introduction to AI for Public Health** *Zoé Haskell-Craig*			
9:45 - 11:00am	(Structured Session 2) **Public Health Challenges: Group Brainstorming Exercise** *Small Group Breakouts*			
11:00 - 11:30am	(Structured Session 2) **Public Health Challenges: Big Group Report Back and Discussion**			
11:30 - 1:00pm	**Bird Watching and Nature Walk** *Laura Rosella* **Lunch**			
1:00 - 1:30pm	(Structured Session 3) **Explanation of Afternoon Stations: Connecting Public Health Challenges with AI** *Dan Lizotte* **Resource Team Rapid Fire Intros** Daniel Lizotte, Laura Rosella, Sarah Nayani, Brent Davis, Steve Lee, Joseph Jay Williams, Richard Booth, Zoé Haskell-Craig, Peter Pulsifier & Amos Hayes (GCRC), Jacqueline Kueper			
1:30 - 2:05pm	**Station 1:** **Topic A &** **Resource Team 1**	**Station 2:** **Topic B &** **Resource Team 2**	**Station 3:** **Topic C &** **Resource Team 3**	**Station 4:** **Topic D &** **Resource Team 4**
2:05 - 2:40pm	**Station 1:**	**Station 2:**	**Station 3:**	**Station 4:**

	Topic B & Resource Team 4	**Topic C & Resource Team 1**	**Topic D & Resource Team 2**	**Topic A & Resource Team 3**
2:40 - 2:55pm	**Break**			
2:55 - 3:30pm	**Station 1: Topic C & Resource Team 2**	**Station 2: Topic D & Resource Team 3**	**Station 3: Topic A & Resource Team 4**	**Station 4: Topic B & Resource Team 1**
3:30 - 4:05pm	**Station 1: Topic D & Resource Team 3**	**Station 2: Topic A & Resource Team 4**	**Station 3: Topic B & Resource Team 1**	**Station 4: Topic C & Resource Team 2**
4:05 - 4:45pm	**Daily Reflection & Day 1 Wrap-Up** *Dan Lizotte*			
4:45 - 6:00pm	**Break** *Optional: Bird Watching and Nature Walk*			
6:00 - 7:30pm	**Dinner (Optional)**			
Day 2: Tuesday October 25, 2022				
8:00 - 8:45am	**Breakfast (Optional)**			
8:45 - 9:00am	**Day 2 Welcome & Overview** *Dan Lizotte*			
9:00 - 9:45am	(Structured Session 4) **Case Study Discussion** *Brent Davis - Needle in the Haystack: Opportunities and Challenges of Social Media Analytics for Public Health*			
9:45 - 10:30am	(Structured Session 4) **Case Study Discussion** *Joseph Jay Williams and Harsh Kumar - Adaptive Texting for Learning & Behaviour Change: Mental Health Application*			
10:30 - 11:00am	**Break**			
11:00 - 11:45am	(Structured Session 4) **Case Study Discussion**			

	Peter Pulsifer and Amos Hayes - Geomatics and Cartographic Research Centre (GCRC)
11:45 - 12:30pm	(Structured Session 4) **Case Study Discussion** *Laura Rosella - AI for Public Health, Health Research Training Platform Overview*
12:30 - 1:30pm	**Lunch**
1:30 - 2:30pm	(Structured Session 5) **Group Discussion: Supporting PH Leadership in AI**
2:30 - 2:45pm	**Daily Reflection & Closing Remarks** *Dan Lizotte*