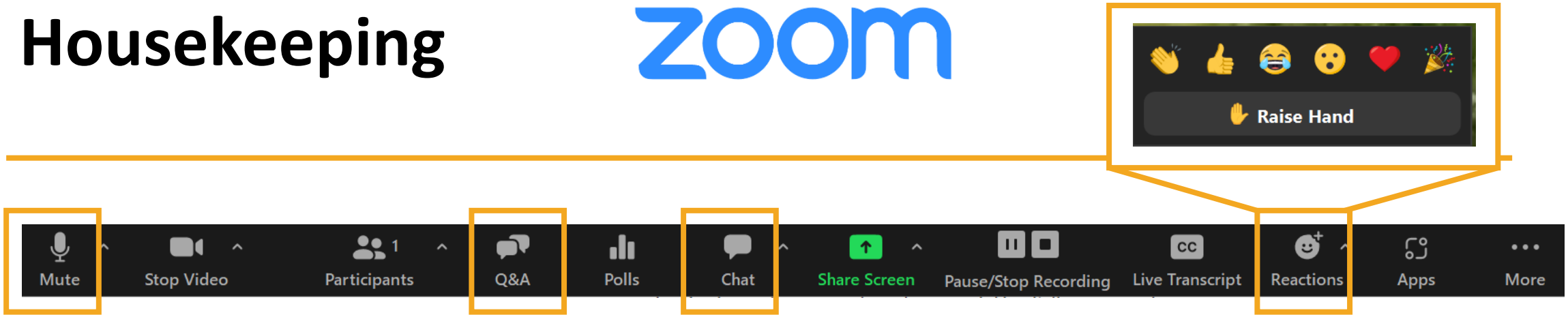
Co-Designing an AI Decision Support tool with Alliance Members: The Journey So Far and Next Steps

Alliance Lunch ’n’ Learn Webinar | May 17, 2024

Housekeeping



- Microphones are muted by default. Please keep yourself muted when not speaking.
- You may enter questions through the Q&A panel at any time. You can also upvote or comment on others' questions.
- If you wish to speak, please use the "raise hand" function.
- Please use the chat function for technical assistance.

Acknowledgement of Traditional Indigenous Territories

We recognize that the work of the Alliance for Healthier Communities and our members takes place across what is now called Ontario, on traditional territories of Indigenous people who have lived here since time immemorial and have deep connections to these lands. We further acknowledge that Ontario is covered by 46 treaties, agreements and land purchases, as well as unceded territories. We are grateful for the opportunity to live, meet and work on this territory.

Ontario continues to be home to vibrant, diverse Indigenous communities who have distinct and specific histories, needs, and assets as well as constitutionally protected and treaty rights. We honour this diversity and respect the knowledge, leadership and governance frameworks within Indigenous communities. In recognition of this, we commit to building allyship relationships with First Nation, Inuit and Métis peoples in order to enhance our knowledge and appreciation of the many histories and voices within Ontario. We also commit to sharing and upholding our responsibilities to all who now live on these lands, the land itself, and the resources that make our lives possible.

Presenters

Dr. Jacqueline (Jaky) Kueper
Senior Research Epidemiologist
Scripps Research Translational Institute

Sara Bhatti
Research & Evaluation Lead
Alliance for Healthier Communities

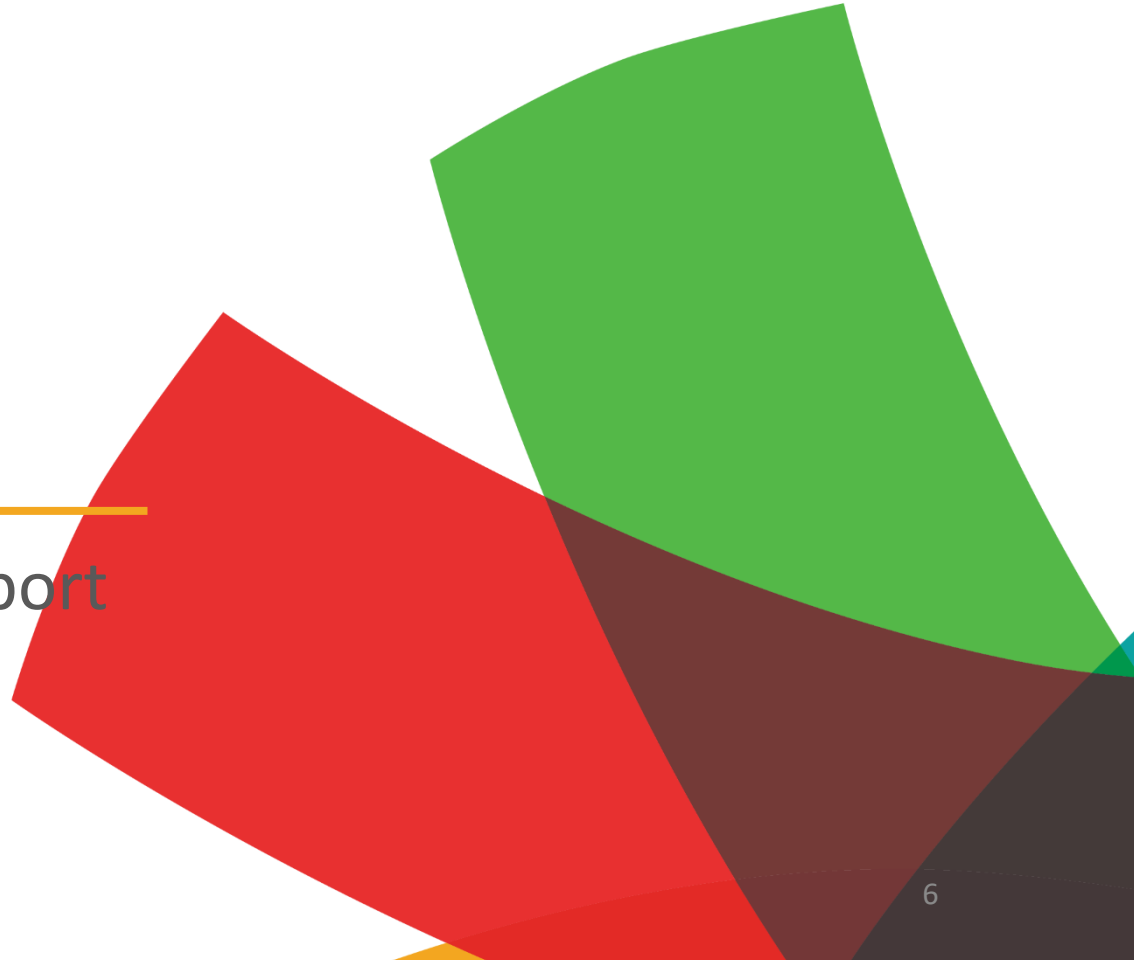
Outline

This webinar is focused on co-development of a diabetes and mental health care decision support tool with and for CHCs.

1. Where we started
2. What we have done so far
3. Where we are going
4. What do you think
5. Questions and discussion

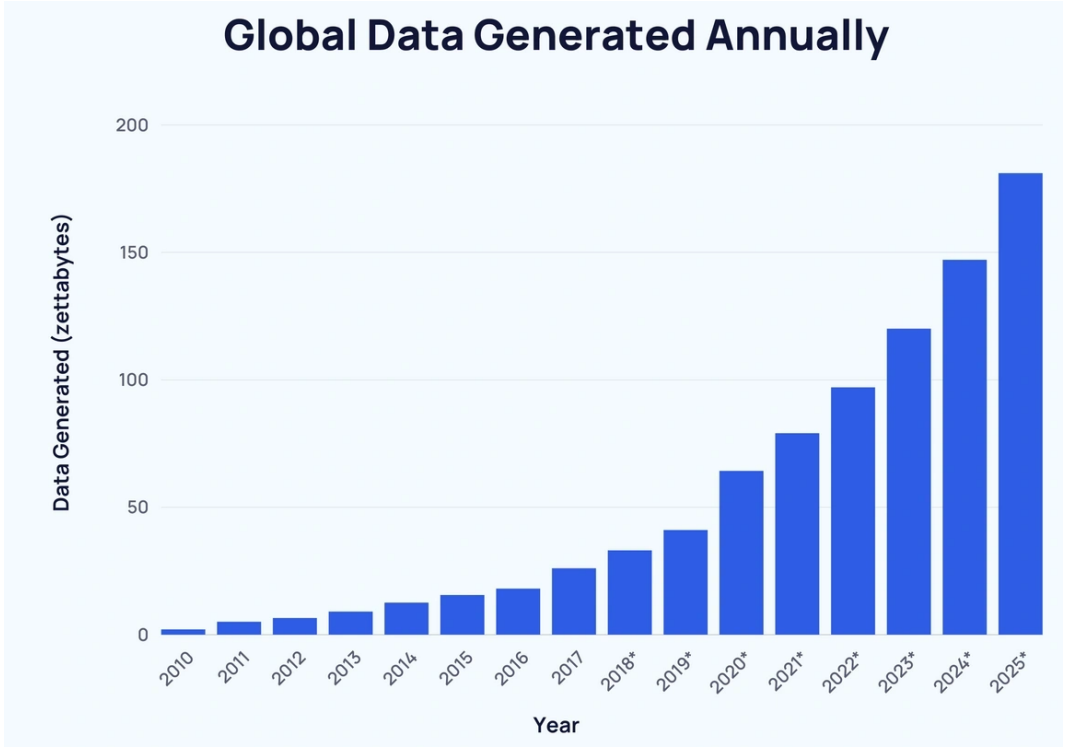
Where We Started

Introduction to EMR-based decision support tools



Everyday Data

- Increases in “everyday data” and computing resources



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Everyday Data

- Potential to use these data to support health care, e.g.,
  - Ask or answer questions to understand what has happened in the past
  - Build tools that can make predictions to help inform care prospectively

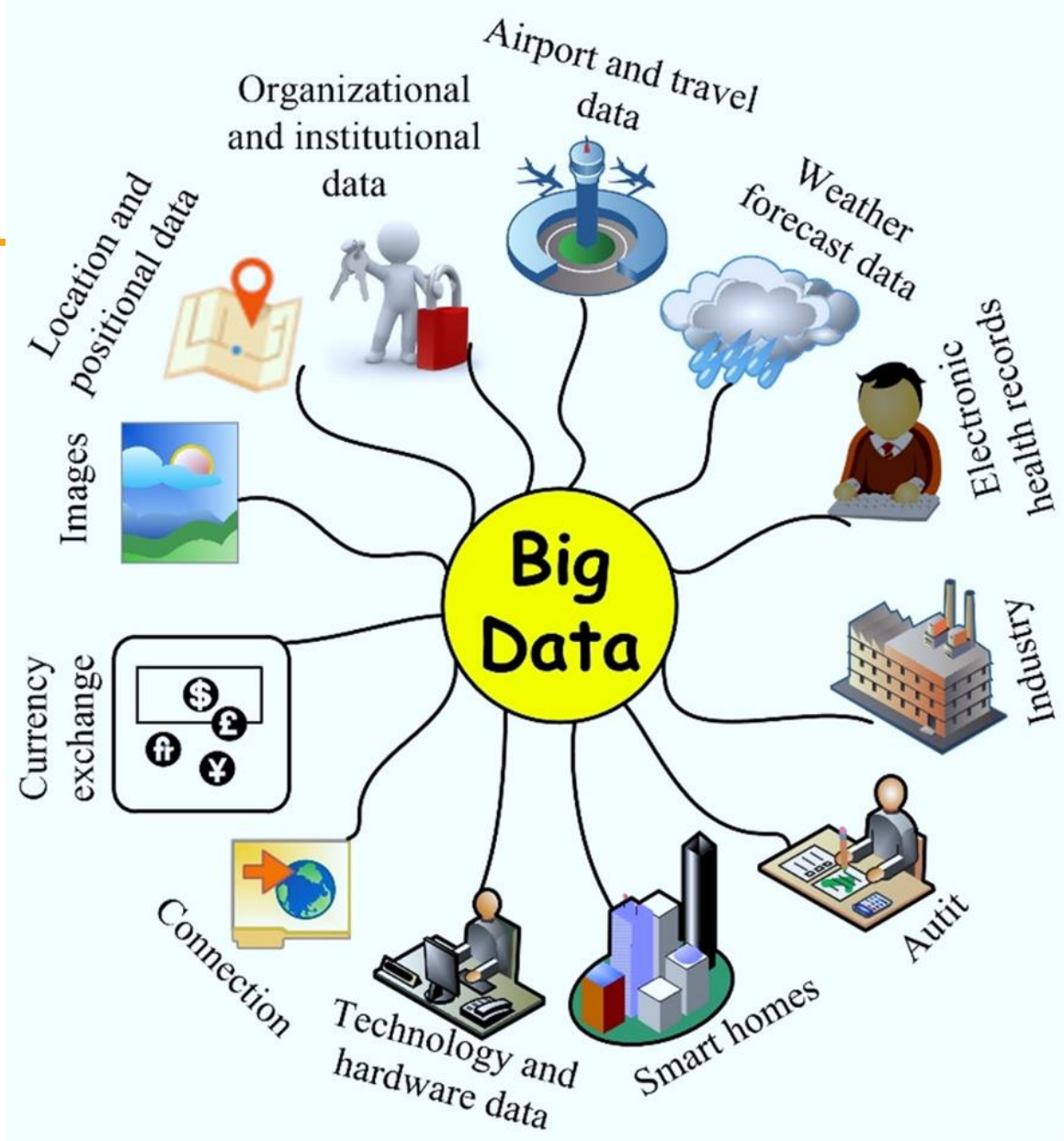
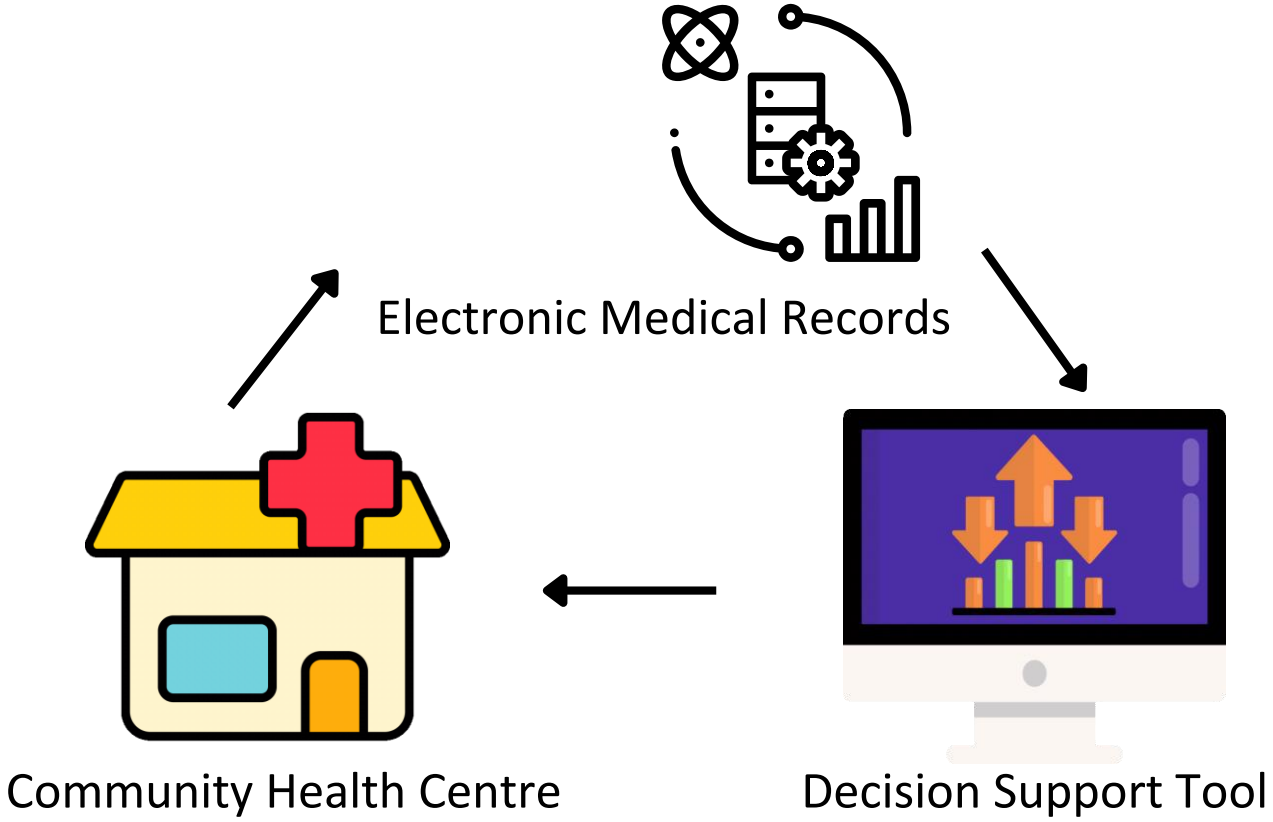


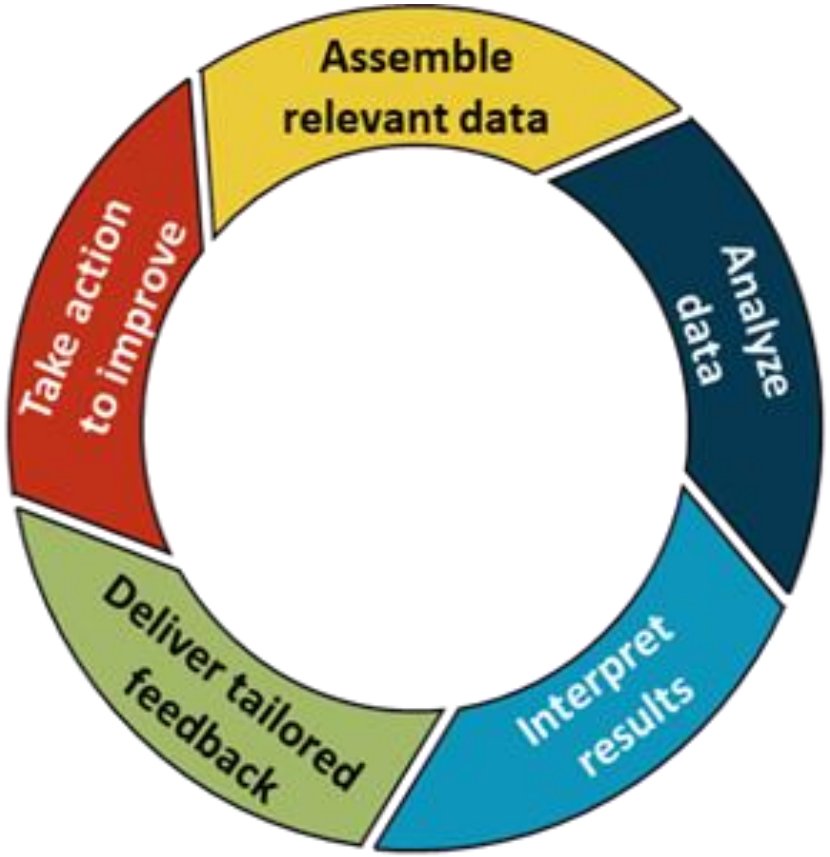
Image: Khan, S., Khan, H.U. & Nazir, S. Systematic analysis of healthcare big data analytics for efficient care and disease diagnosing. *Sci Rep* **12**, 22377 (2022). https://doi.org/10.1038/s41598-022-26090-5

Internal Data-Driven Decision Support Tool



Learning Health System

EPIC
Equity, Performance, Improvement, and Change

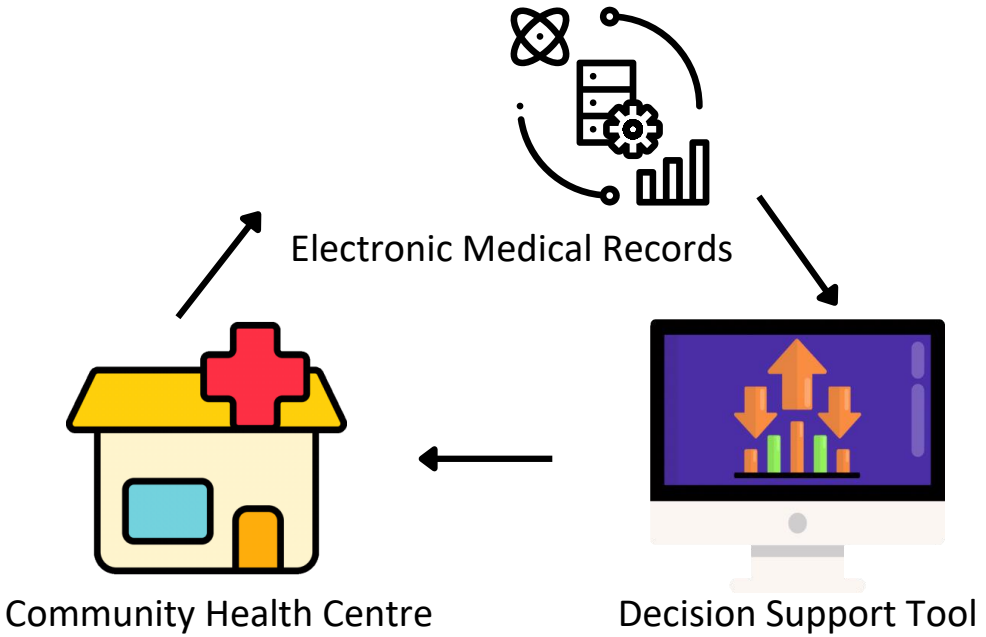


- Commitment to using data to inform or improve care delivery
  - Research studies
  - Quality improvement
  - Decision support tools & personalized insights

https://www.allianceon.org/EPIC-Learning-Health-System

AI-Enabled Decision Support Tool

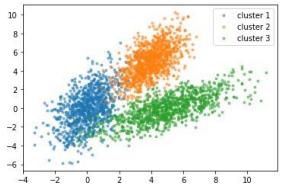
- Sometimes artificial intelligence (AI) techniques are useful to translate large, messy data into human-usable insights



Brief Introduction to Artificial Intelligence

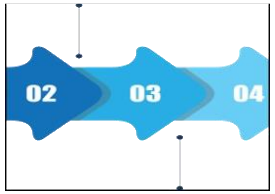
Algorithm – a process or set of instructions a computer can execute to complete a task or solve a problem.

1956 – field of AI is formalized



Exploring & Describing Data

Predicting Prespecified Outcomes



Supporting Sequences of Decisions

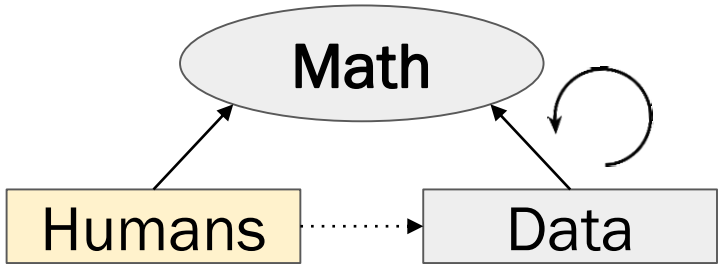
Language Data Processing & Production

Image Data Processing & Production

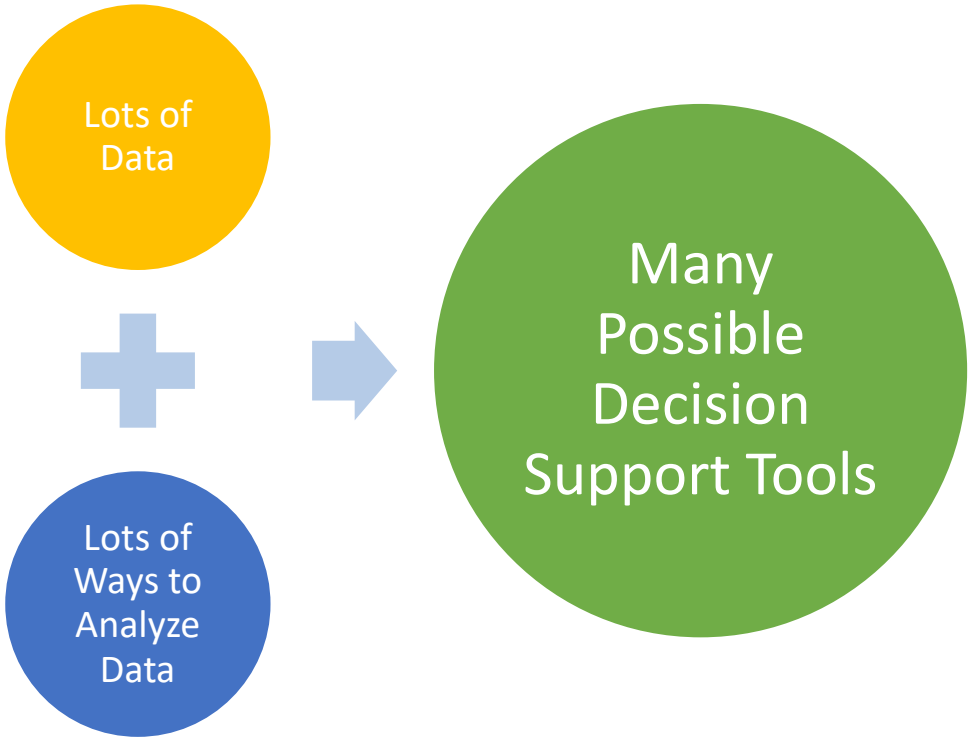
AI - algorithms to get computers to perform “intelligent tasks”

Brief Introduction to Artificial Intelligence

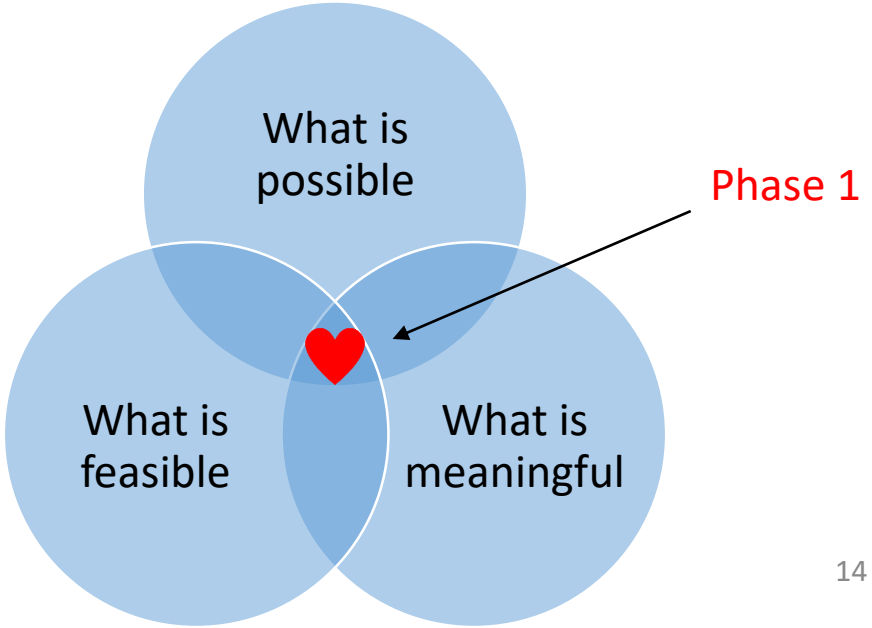
- Collection of techniques centered around computers performing "intelligent tasks"
  - Overlapping, interdisciplinary subfields
- Most common subfield is **machine learning**:



Defining the Target Task to Support is Crucial



- Limited resources and capacity
- Not everything will work well
- Poorly designed tools may make things worse instead of better



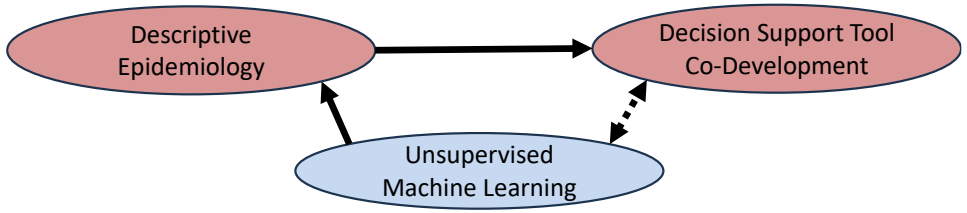
PBLN Co-Development Project

What We Have Done So Far

Phase 1: Six stages of work

Step 1: Population-Level Descriptive-Exploratory Study

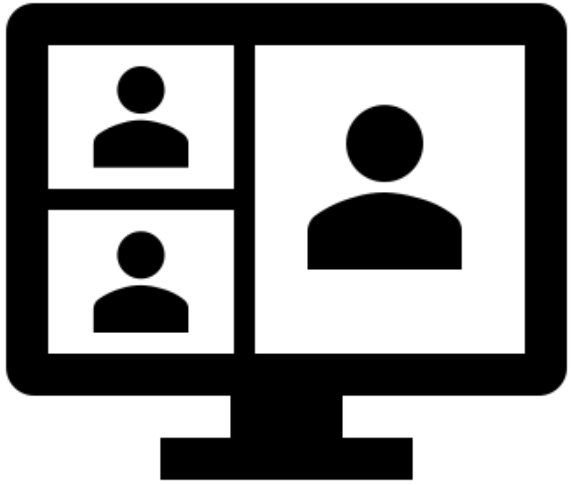
- **Objective:** To summarize sociodemographic, clinical, and health care use characteristics of ongoing primary care clients from 2009-2019.
- **Output:** Foundation for community engagement, and reference point to inform decision support tool problem selection and methodology.



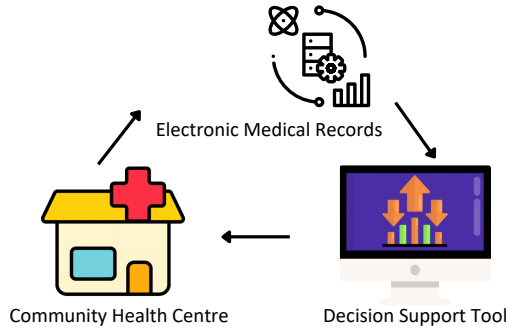
Kueper JK, Rayner J, Zwarenstein M, Lizotte D. Describing a complex primary health care population to support future decision support initiatives. *IJPDS*. 2022;7(1):21. doi:10.23889/ijpds.v7i1.1756

Step 2: PBLN Team Engagement

- **Lunch ‘n’ Learn Webinar:** Share Stage 1 findings and invite discussion on what does (not) match expectations.
- **Invite Additional Team Members:** Webinar and e-mail recruitment.
- **Output:** Initial target problem ideas and co-development team
  - Alliance research leaders
  - PBLN members
  - External academic researchers

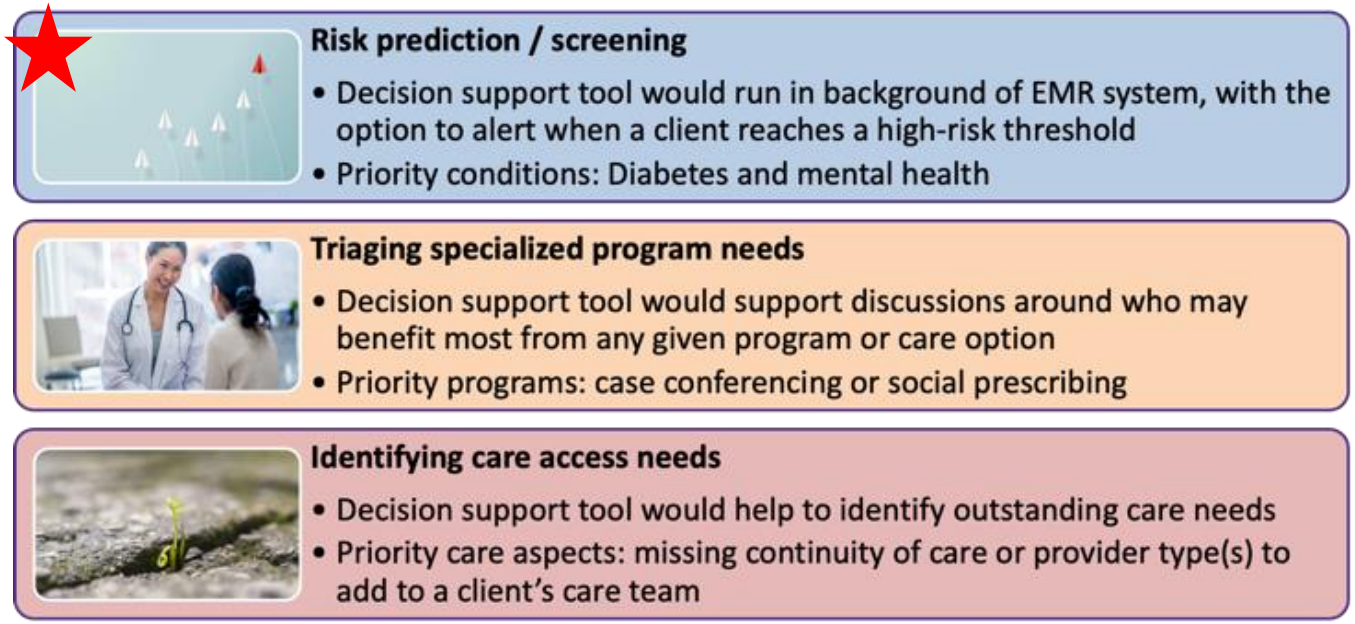


Step 3: Decision Support Tool Problem Selection



Key Question: What would be the best first decision support tool initiative to pursue?

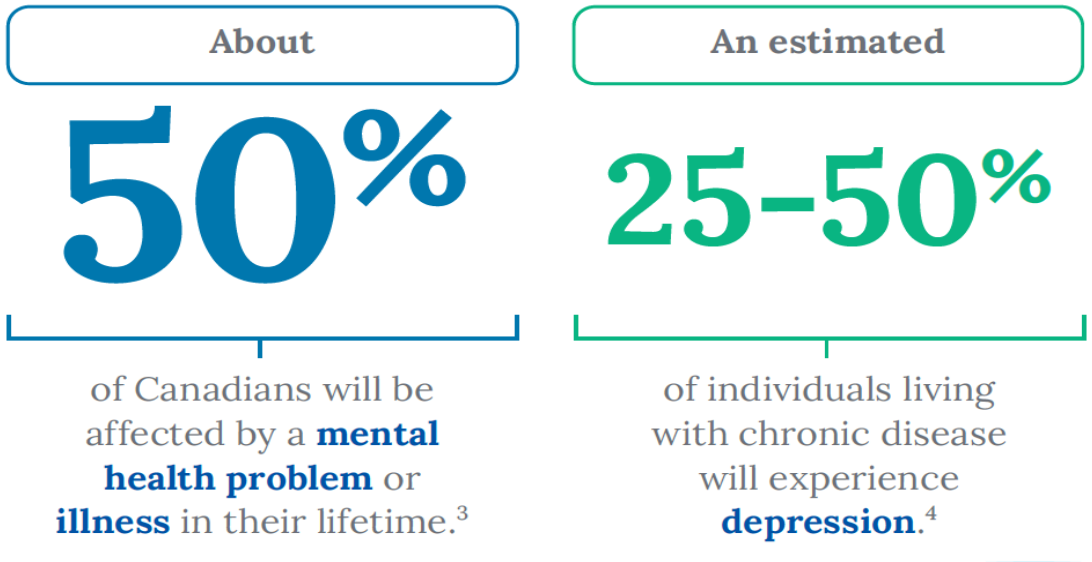
- Longer-term vision to continue to build capacity & avoid fragmented approach as the number of tools increases



Brainstorming criteria:

- Impactful
- Actionable
- Feasible

Mental Health & Chronic Disease



Per Diabetes Canada:

- Many psychiatric disorders are more prevalent in people with diabetes compared to the general population

- People with diabetes and depressive disorders at increased risk for earlier all-cause mortality compared to people with diabetes without history of depression

Sources:
- Mental Health Commission of Canada. Mental Health & Chronic Disease: Quick Facts. Retrieved online Aug 24, 2022
- Robinsn DJ, Coons M, Haensel H, Vallis M, Yale JF. *Diabetes Canada Clinical Practice Guidelines for the Prevention and Management of Diabetes in Canada: Diabetes and Mental Health. Can J Diabetes 2023*

Target Problem: Predicting & Preventing Mental Health Decline after new Diabetes Diagnosis

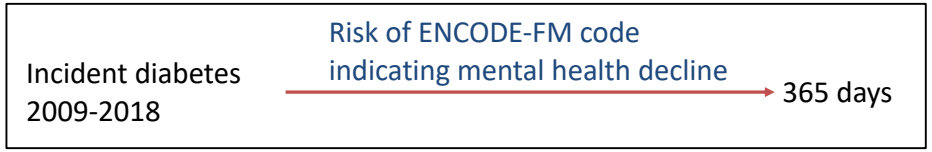
- **Impactful?** High prevalence of diabetes and mental health challenges as a known comorbidity
- **Actionable?** Tools and services exist to support mental health care
- **Feasible?** Relevant care captured in EMR and large advancements in AI methods for risk prediction

1. Primary care client is diagnosed with diabetes.

2. Decision support tool automatically analyzes EHR data to estimate their risk of mental health decline within the next year.

3. Care provider and client discuss existing supports around mental health, and whether additional care (e.g., seeing counselor, joining a group program) would be beneficial.

Step 4: Sandbox Case Study: Individual-Level Risk Predictions



Goal: Develop a model to predict early mental health decline within a year of incident diabetes indication.

Results: Predictive performance was not great, but further discussion:

- Identified additional data sources that may be useful inputs
- Refined strategies to better harness value from CHC EMR data
- Further interrogated the clinical problem

Gather Additional Input

South Riverdale COMMUNITY HEALTH CENTRE

SR CHC Discussion

- Sandra Fitzpatrick led discussion about beneficial tool uses, predictors, outcomes, and data

CONNECTED COMMUNITIES
BUILDING EQUITABLE INTEGRATED HEALTHCARE

Invite Additional Input

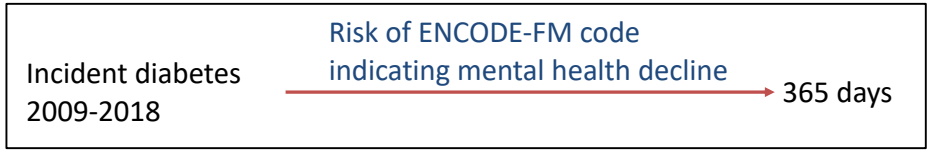
- Alliance Bulletin
- Research poster presentation

Diabetes Action Canada

Diabetes Action Canada

- Meeting to ensure work was complementary to other projects

Step 4: Sandbox Case Study: Individual-Level Risk Predictions



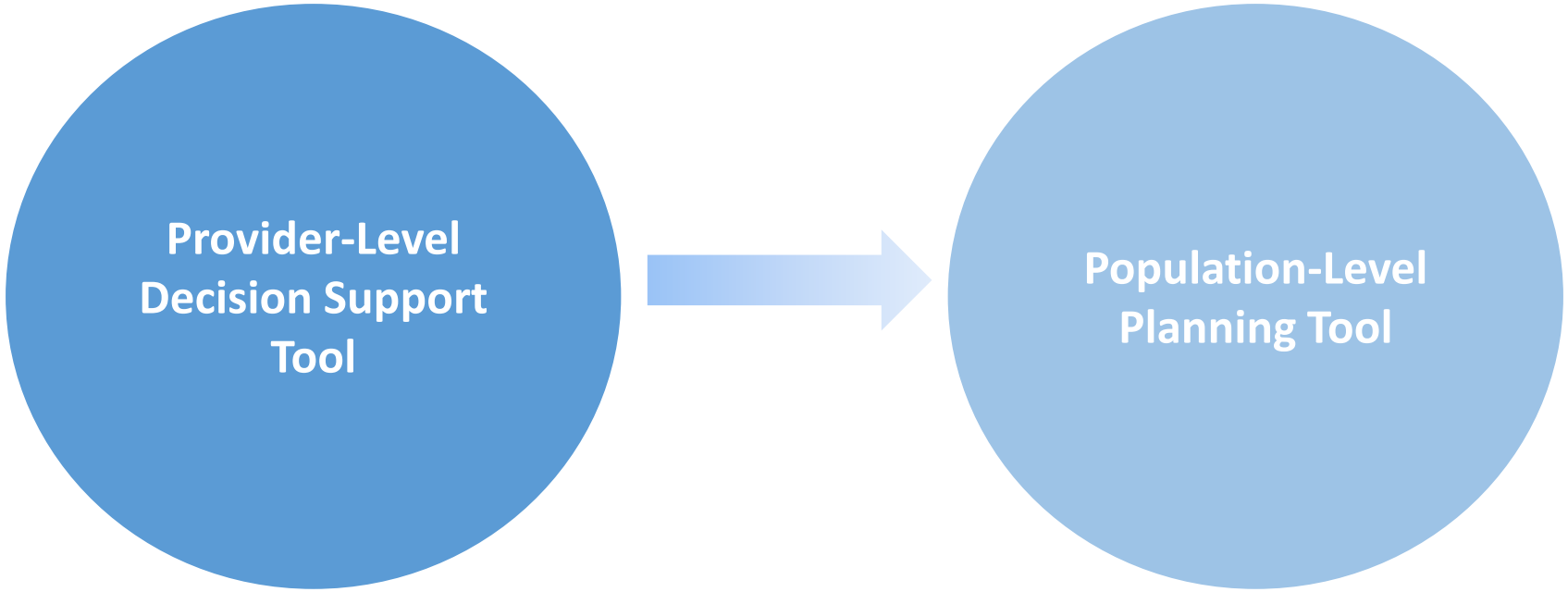
- **Goal:** Develop a model to predict early mental health decline within a year of incident diabetes indication.

- **Challenge identified:** If the tool works, it will identify more an/or earlier stage clients in need of mental health support, potentially pushing CHC mental health services past capacity
  - Risk that we make things worse instead of better

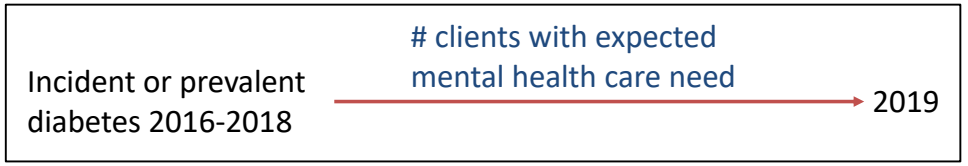
- **Potential Solution:** *What if we tackle the upstream planning and advocacy challenge instead?*

A Diabetes & Mental Health Decision Support Tool – An Evolving Vision

Can AI help to predict risk of mental health decline for people living with diabetes?



Step 5: Sandbox Case Study: Population-Level Planning Predictions



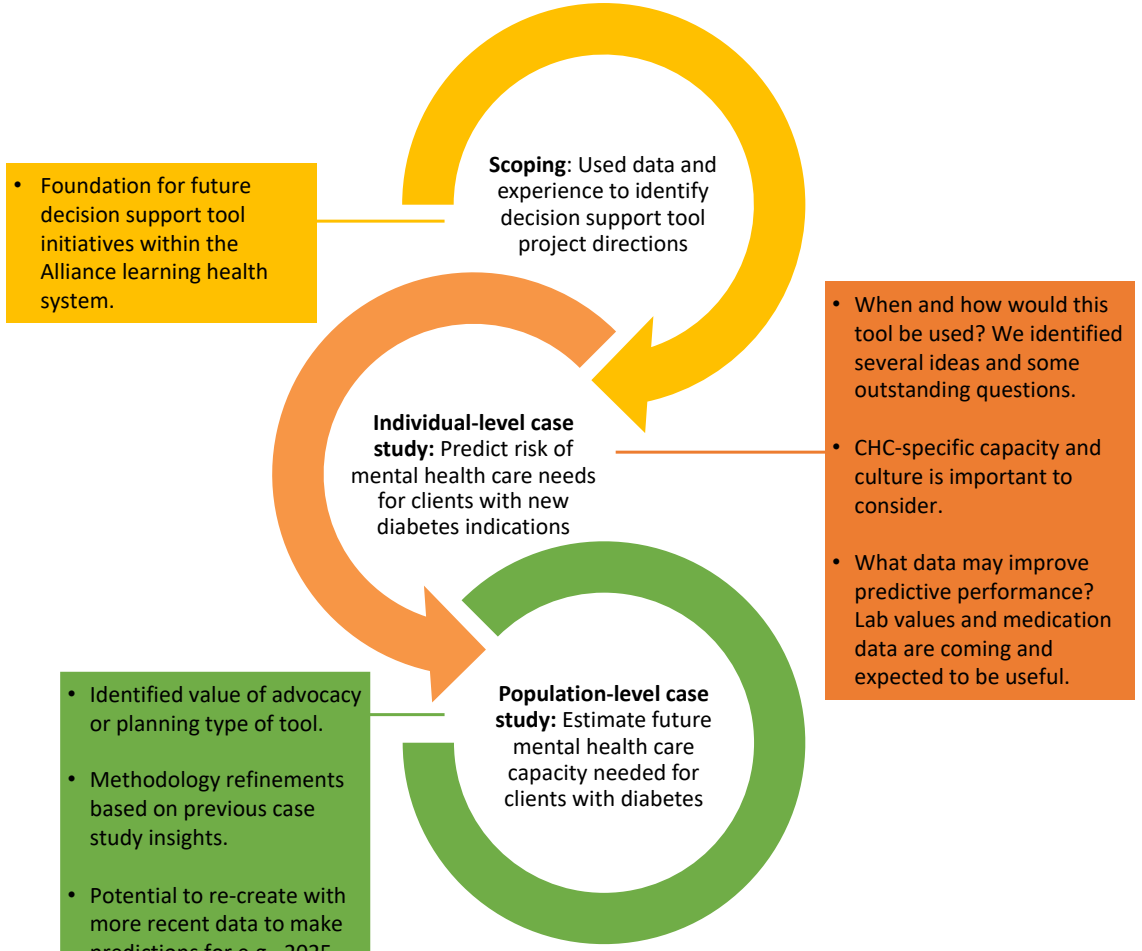
Goal: Predict the number of ongoing primary care clients with diabetes indications that will have mental health care needs in the next year.

- **Output:** Predictive performance shows potential
  - Used what we learned from the first case study
  - Identified areas to gather additional input on

- **Intended use:** Mental health service capacity planning or advocacy tool to be used at the CHC level.

More about this soon!

Step 6: Project Recap and Next Steps Decision



Step 6: Reflections & Lessons Learned

Epidemiology as a foundation for innovation

Importance of an interdisciplinary team

Sandbox case studies supported deeper discussion sessions

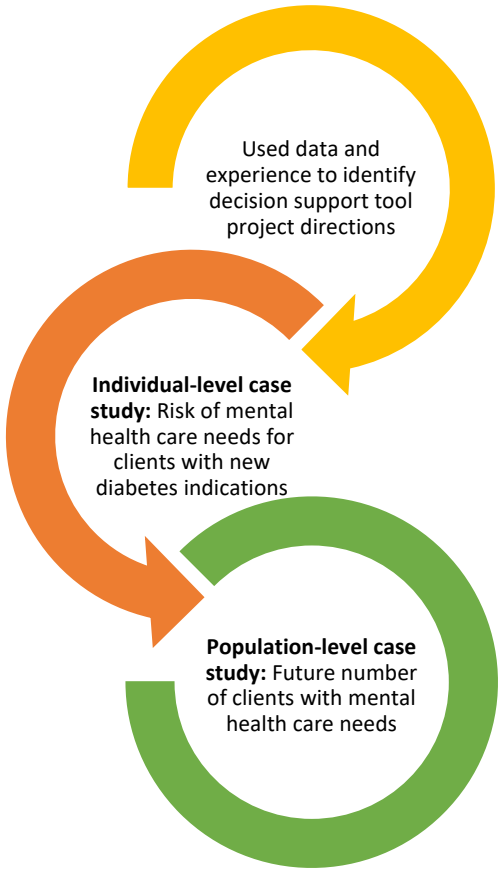
Problem scoping around data availability

Multiple engagement strategies are needed

Working towards a broader decision support tool initiative

Furthering The EPIC Learning Health System Work

Step 6: Project Recap and Next Steps Decision



1) Pause & Share

- **Activity:** Document our processes and decisions to date, with a section on lessons learned for future initiatives
- **Data resources:** N/A
- **People resources:** Current team

2) Continue Individual-Level Tool

- **Activity:** Seek additional input towards use cases and data decisions
- **Activity:** Re-develop a prediction model with potentially large deviations from case study
- **Data resources:** New data extract with extra fields (medication and lab data) – wait time
- **People resources:** New research assistant and/or data analyst

3) Continue Population-Level Tool

- **Activity:** Seek input on how and when the tool would be used (reach out to more people)
- **Activity:** Refine second case study model and re-train using more recent data
- **Data resources:** Recent data extract (e.g., 2020-2024) so can make predictions for future; same elements
- **People resources:** Current team

Summary & Next Steps Discussion

Done!

Used data experience to identify decision support tool project directions

Individual-level case study: Risk of mental health care needs for clients with new diabetes indications

2-pager & EPIC Newsletter

1) Pause & Share

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Research Publication

Alliance for Healthier Communities
Alliance pour des communautés en santé

EPIC

EPIC Practice Based Learning Network

Data-Driven Decision Support Tool Co-Development Project Phase 1: Problem Scoping

A rapid increase in the amount of health care data being generated and collected, coupled with advancements in data-analysis methods and technologies, is transforming healthcare. Artificial intelligence (AI) and related

F1000Research

Check for updates

CASE STUDY

Data-Driven Decision Support Tool Co-Development with a Primary Health Care Practice Based Learning Network [version 1; peer review: awaiting peer review]

Jacqueline Kueper[1,2], Jennifer Rayner[3,4], Sara Bhatti[3], Kelly Angevaare[5], Sandra Fitzpatrick[6,7], Paulino Lucamba[8], Eric Sutherland[9], Daniel Lizotte[1,2]

Summary & Next Steps Discussion

Now!

1) Pause / Stop Project

- **Activity:** Document our processes and decisions to date, with a section on lessons learned for future initiatives
- **Data resources:** N/A
- **People resources:** Current team

2) Continue Individual-Level Tool

- **Activity:** Seek additional input towards use cases and data decisions
- **Activity:** Re-develop [illegible] with potentially large deviations from case study
- **Data resources:** New data extract with extra fields (medication and [illegible]) – wait time
- **People resources:** New research assistant and/or data analyst

3) Continue Population-Level Tool

- **Activity:** Seek input on how and when the tool would be used (reach out to more people)
- **Activity:** Refine second case study model and re-train using more recent data
- **Data resources:** Recent data extract (e.g., 2020-2024) so can make predictions for future; same elements
- **People resources:** Current team

Where We Are Going

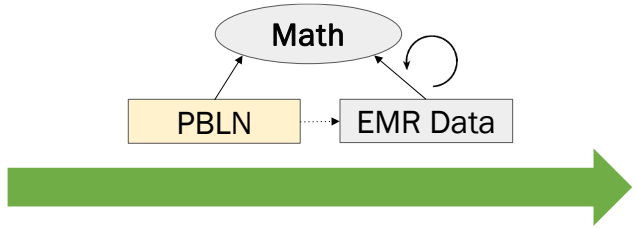
Next steps towards Advocacy & Planning Support for Diabetes and Mental Health Care Needs

Goals for Phase 2

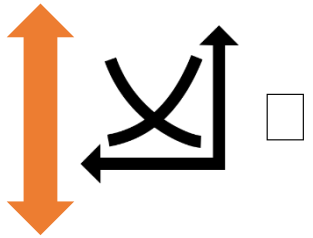
1. Refine the model to predict future mental health service needs for clients with diabetes.
   - Additional end-user input
   - Retraining on more recent data extract
2. Share the decision support tool with intended end-users.
   - Pilot test, e.g., 2025 predictions for a few CHCs
3. Identify avenues for future expansion of the decision support tool initiative

Population-Level Prediction Tool Envisioned Use

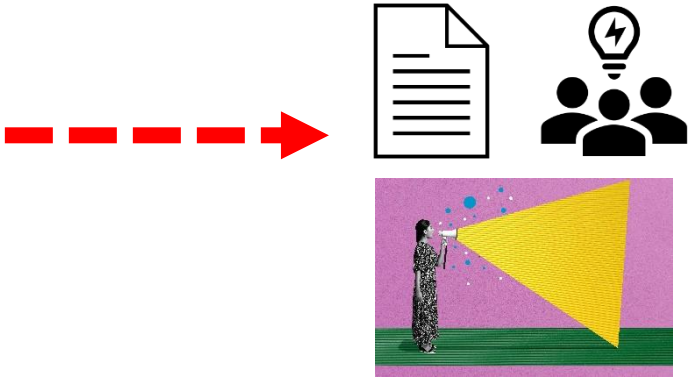
Current clients with diabetes



Estimated # clients with future mental health care needs

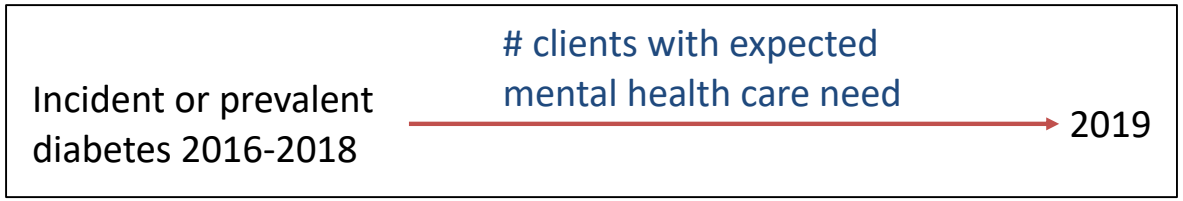


Planned mental health service capacity



Action, if needed

Sandbox Case Study Methods



Eligible Cohort: 20,329 clients across 70 CHCs

- Ongoing primary care clients
- Incident or prevalent diabetes
- Received diabetes care 2016-2018

Methods: Compared three prediction models in a nested cross-validation procedure

- Logistic regression, Lasso Regression, CatBoost

Outcome: at least one ENCODE-FM code in 2019

- Emotional symptoms
- Symptoms involving appearance
- Suicidal ideation
- Affective disorder
- Anxiety

Input Data: sociodemographic, health care use, and care history information

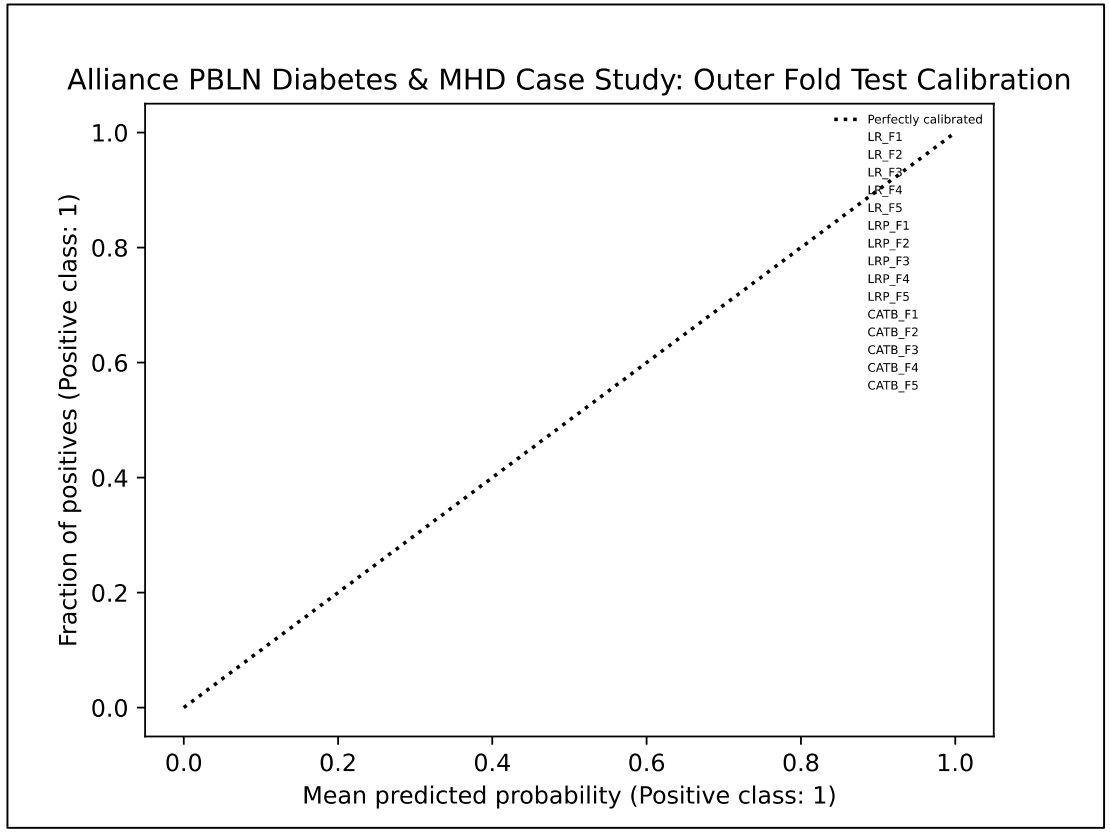
- EMR data from BIRT

Sandbox Case Study Results

Incident or prevalent diabetes 2016-2018 → # clients with expected mental health care need → 2019

Overall Performance:

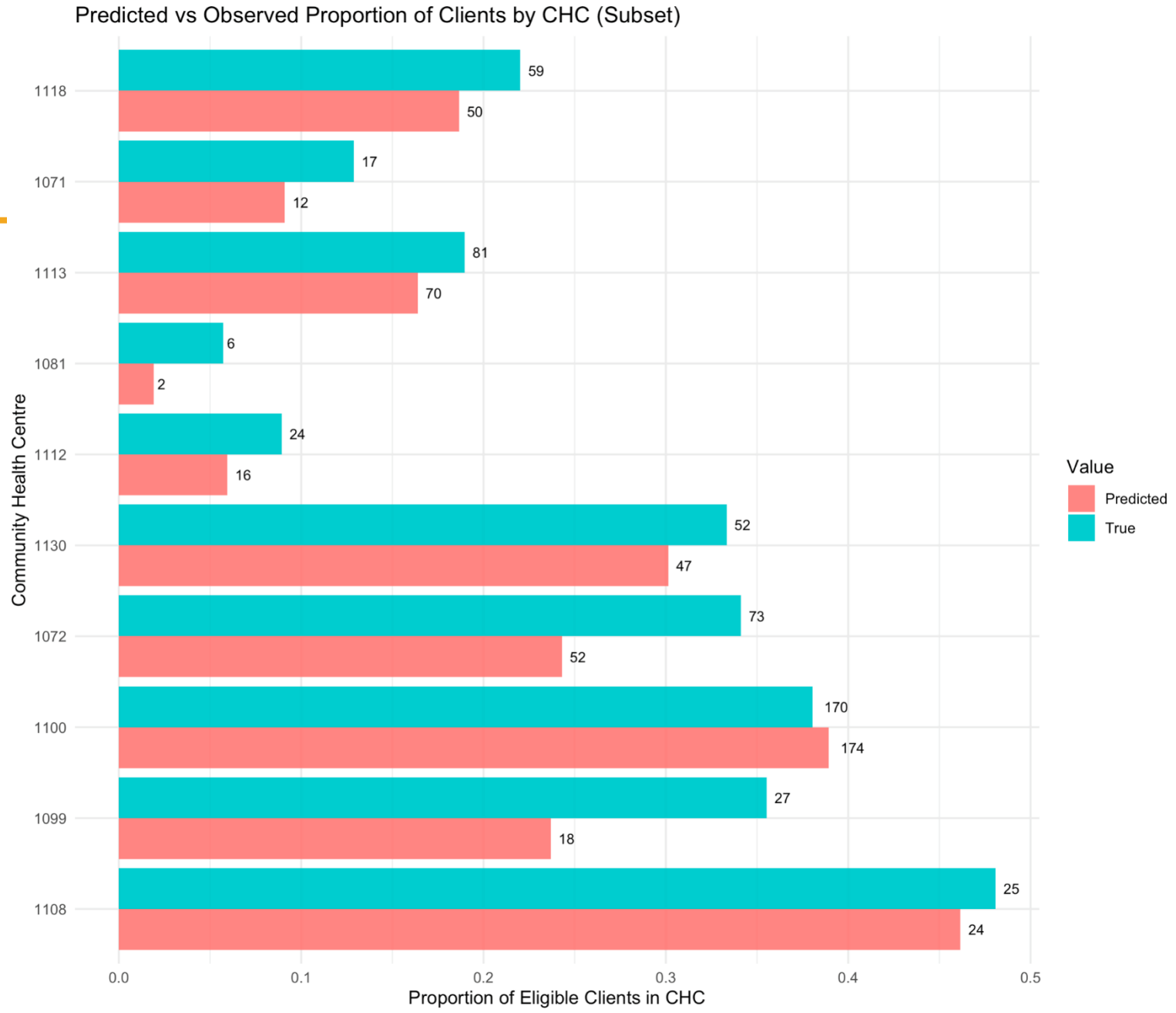
- Clients predicted to have mental health care indications: *3,116*
- Clients who actually received care indications: *4,521*
- Accuracy of 'best' prediction model: *86%*
  - Using 0.5 probability cut-off



Sandbox Case Study Results

CHC-Specific Performance

- Prediction model accuracy ranged from 97% to 64%.
- The proportion of clients with diabetes predicted to have mental health care needs ranged from 46% (actual 48%) to 1% (actual 13%).



Example PBLN Discussion Points

- The predictive performance looks useful, and we think we can do even better
  - ACTION: gather additional input to further refine technical decisions
- There is a need to advocate for adequate mental health supports
  - ACTION: gather additional input on how this type of tool would be used by health system leaders or others, so that we can tailor set-up and outputs
- This is the first PBLN co-developed decision support tool initiative
  - ACTION: Learn and build on it within a broader vision and strategy

Timeline of Next Steps

CO-DESIGNING THE FUTURE of Primary Health Care

Webinar (today!)

Focus Groups (Join us?)

Conference Workshop #6 (June 5th)

Integrate Input and Refine Model

Test it Out!

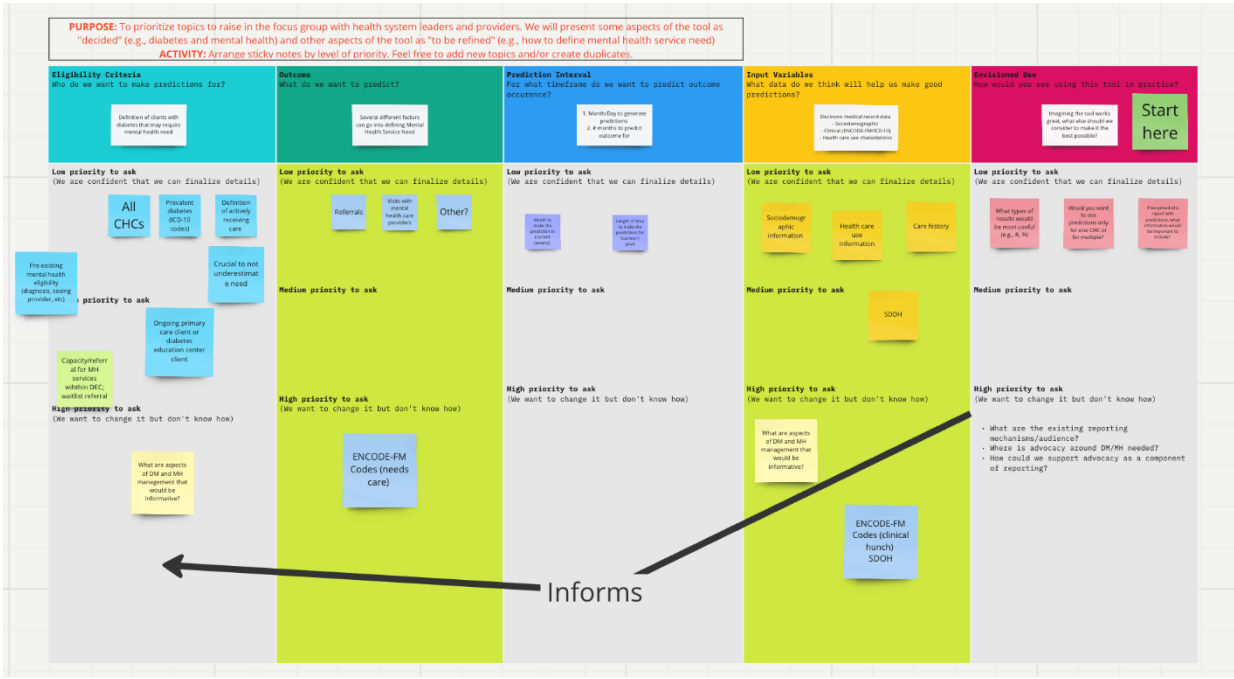
What Do You Think?

Next Steps Discussion

PBLN Team Planning for Phase 2

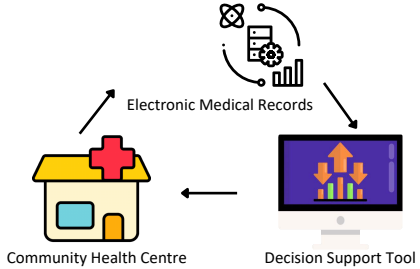
Example question domains:

1. How and when the tool would be used?
2. Who would use the tool?
3. Ideas about the problem set up and data definitions (e.g., outcome, eligibility)?



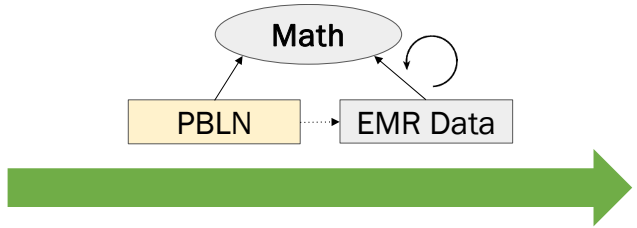
Example discussion document - Some details we are confident in, others we want to explore more for the final tool to maximize the chance of "real world" success.

We Would Love Your Input! (Zoom Poll Time)

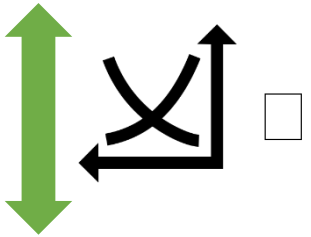


If you want to join a focus group please fill out the form in chat or email Sara: ***sara.bhatti@allianceon.org***

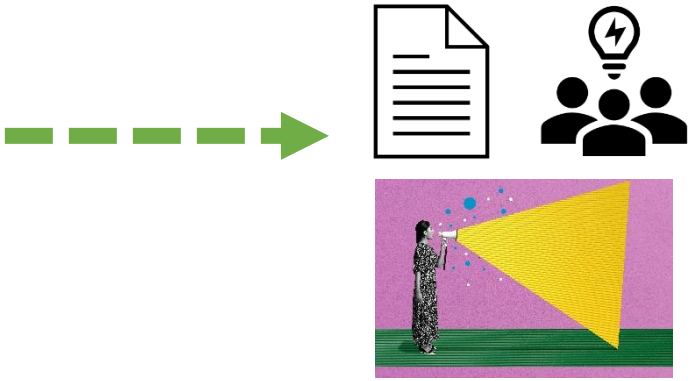
Current clients with diabetes



Estimated # clients with future mental health care needs



Planned mental health service capacity



Action, if needed

Questions or Comments?

- Immediate thoughts to share?
- Questions about the tool or the PBLN program?
- Other feedback or curiosities?

If you want to join a focus group please fill out the form in chat or email Sara: ***sara.bhatti@allianceon.org***

- Initial times: Friday May 31st 12-1 and Friday June 7th 12-1

Thank You

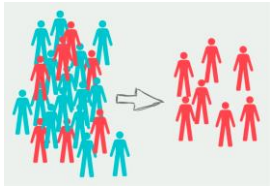
LHS@AllianceON.org
Sara.Bhatti@AllianceON.org
jkueper@scripps.edu

Thanks for joining!

Necessities for Effective and Equitable Applications of AI for Healthcare

Problem Selection

Data Decisions



AI Model Development

Evaluation

Distribution & Deployment

Training & Human Use

Lifecycle Management

**Any given project may not move linearly through these stages.*
**Most do not make it through all the stages.*

Lots of skills and expertise needed!