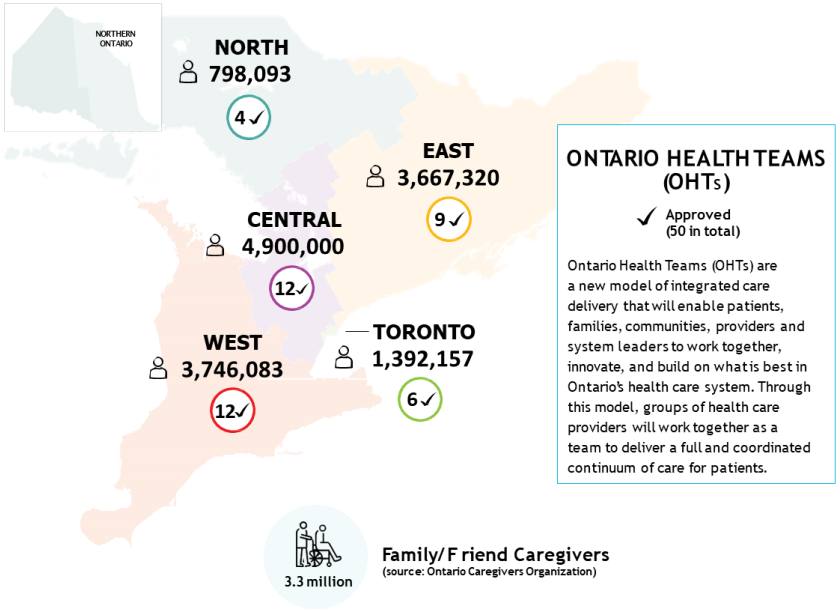
# Ontario Health and OHTs

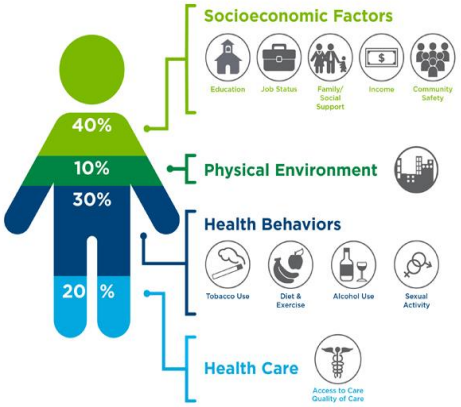
As an agency of the Government of Ontario, **Ontario Health** has been mandated to connect and coordinate our province's health care system in ways that have not been done before.

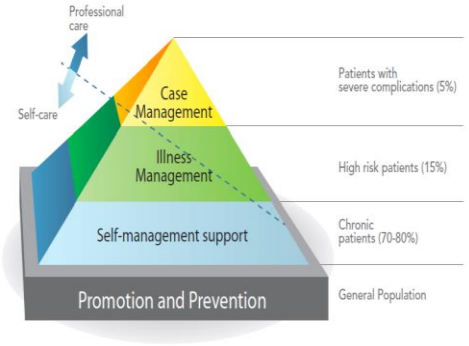

Ontario Health

# Population Health and Value-based Health Systems

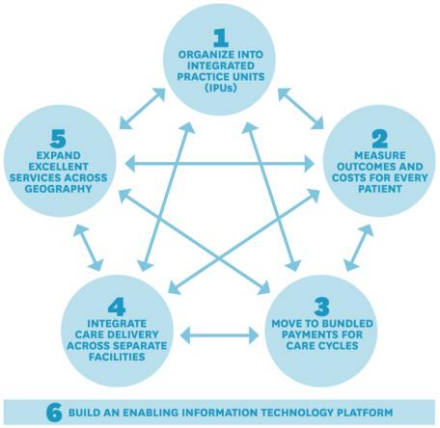
What goes into your health?[1]




Population Health Approach[2]




Value-based Care – outcomes not volumes[3]




1. Institute for Clinical Systems Improvement, Going beyond Clinical Wall, Solving Complex Problems (Oct 2014)
2. Adapted from Kaiser Permanente Risk Stratification Pyramid
3. https://hbr.org/2013/10/the-strategy-that-will-fix-health-care, Michael Porter & Thomas Lee (Oct 2013)

Ontario Health

# Digital and Virtual Health as Enablers

**Digital Infrastructure**

- Provincial Client & Provider Registry
- Clinical Data Repository
- Clinical Viewers
- ONE ID
- Health Report Manager
- CHRIS
- Health Service Directories
- HIS, EMRs …
- DHIEX Standards

- Population Health Management Infrastructure

**(Virtual) Models of Care**

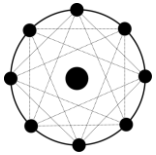
- Video, audio, messaging
- Provincial OTN Clinical programs and Patient Access Sites
- Remote Patient Monitoring for Chronic Disease and COVID
- Virtual Mental Health and Addictions ….
- Virtual Visit Verification

- Appropriate Use & Quality

**Targeted Digital & Virtual Care Funding**

- Remote Care Monitoring
- Virtual Urgent Care
- Surgical Transitions
- Virtual Home & Community Care
- Integrated Virtual Care
- Virtual Primary Care
- Portals
- Online Appointment Booking
- Ontario Standards of Care …

- Spread high impact models



**Digitally Enabled Navigation Tool**

- Will bring Ontarians more modern, accessible and digitally-enabled health care choices
- One website and one number to call and support Ontarians' health care journey, when and where they need it…

- Live in early 2022 with a co-designed roadmap

https://www.ontariohealth.ca/our-work/digital-standards/provincial-funding-opportunities

Ontario Health

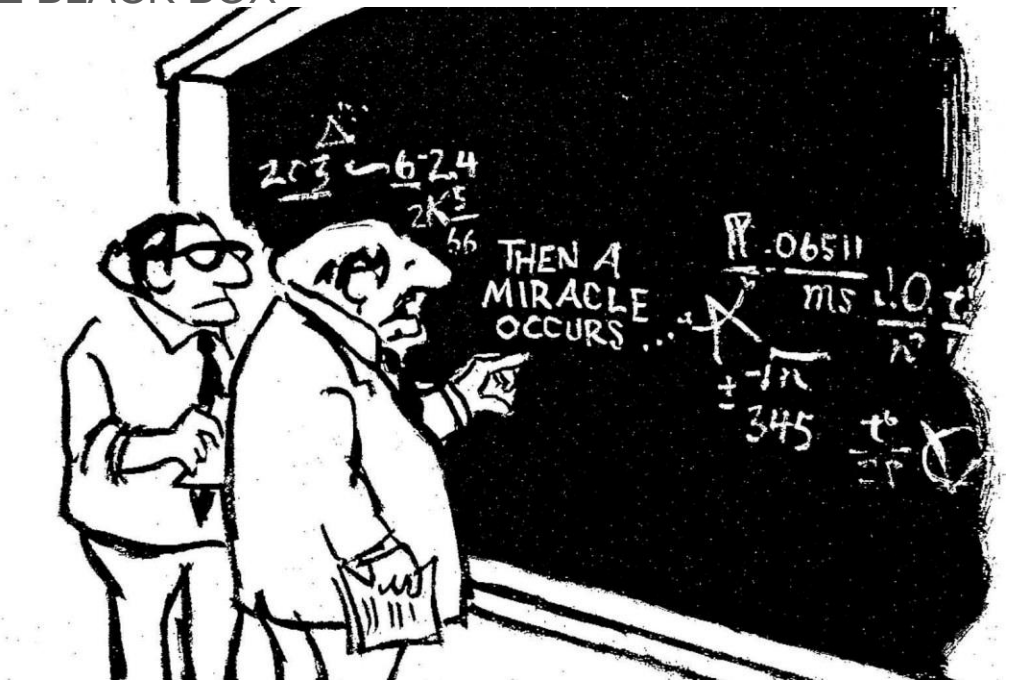
# The Next Big Thing

Laura Desveaux PhD, PT
laura.desveaux@thp.ca
lauradesveaux

Trillium Health Partners
Better Together

# IT'S NOT A QUESTION OF WHAT, IT'S A QUESTION OF HOW

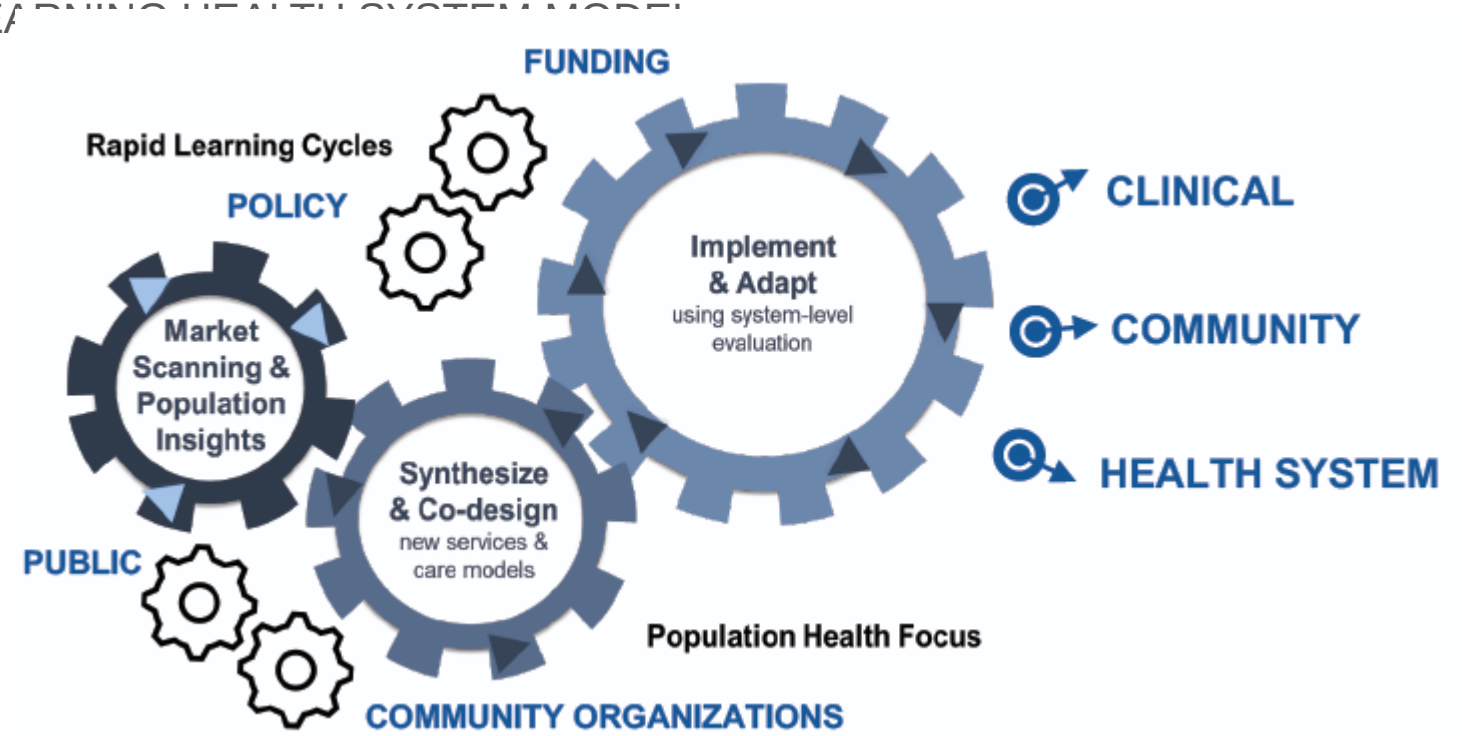
- UNPACKING THE BLACK BOX



- BEFORE WE BUILD IT, WE NEED TO KNOW HOW IT WORKS

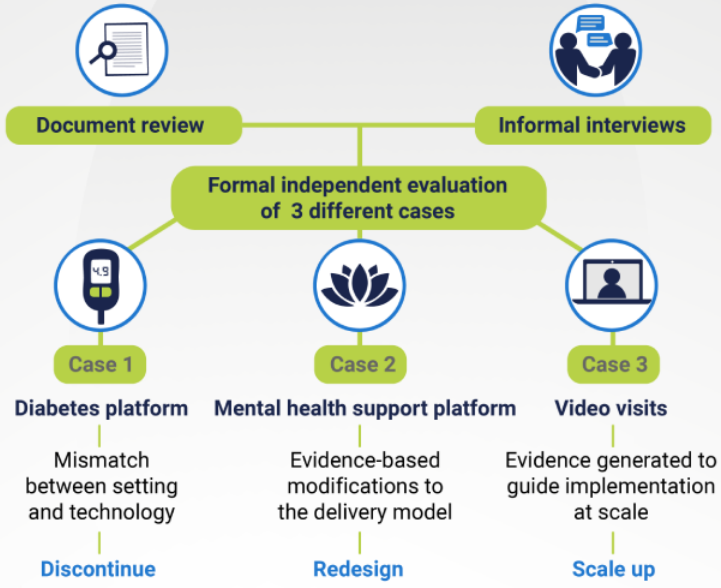
# VALIDATE AND REFINE ASSUMPTIONS THROUGH TESTING

- A LEARNING HEALTH SYSTEM MODEL



# How Do You Design Research to Truly Inform Decision-Making?


**Structured partnerships** and **embedded research** alongside virtual care initiatives are needed to inform the following policy **decisions outcomes:**




Successful partnership with decision-makers relies upon:

Partnership
- Trust
- Shared purpose

Process
- Timeliness
- Tailored reporting
- Adaptability

**Summary:** Embedded research partnerships help close the gap between science and policy. Structured communication drives collaborative problem-solving and contextualizes emerging insights to increase relevance.

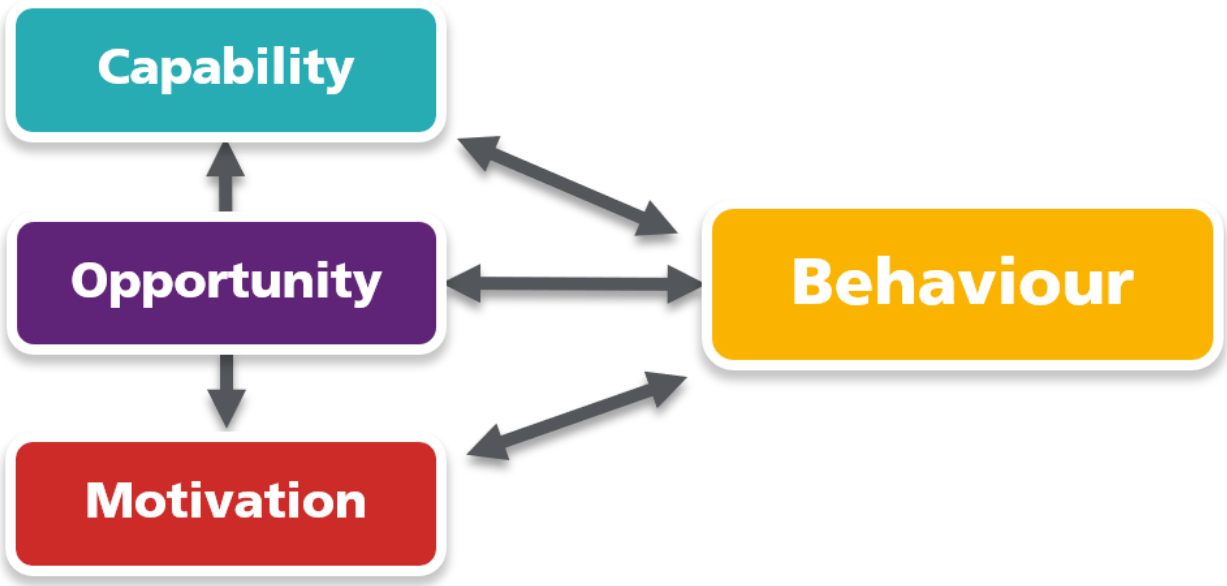
Desveaux L, Budhwani S, Stamenova V, et al. Closing the Virtual Gap in Health Care: A Series of Case Studies Illustrating the Impact of Embedding Evaluation Alongside System Initiatives
J Med Internet Res 2021;23(9):e25797
URL: https://www.jmir.org/2021/9/e25797
DOI: 10.2196/25797

JMIR Publications
Advancing Digital Health & Open Science

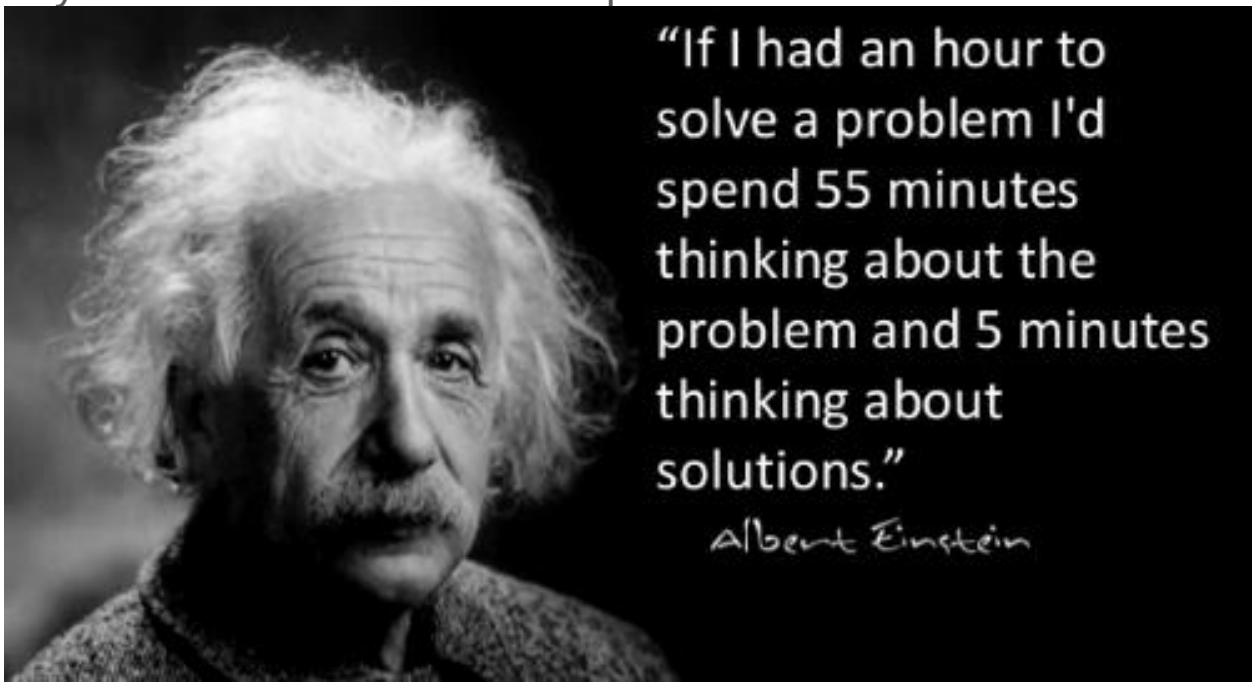
# HEALTH AND HEALTHCARE ARE DRIVEN BY HUMAN BEHAVIOUR


ISLAGIATT

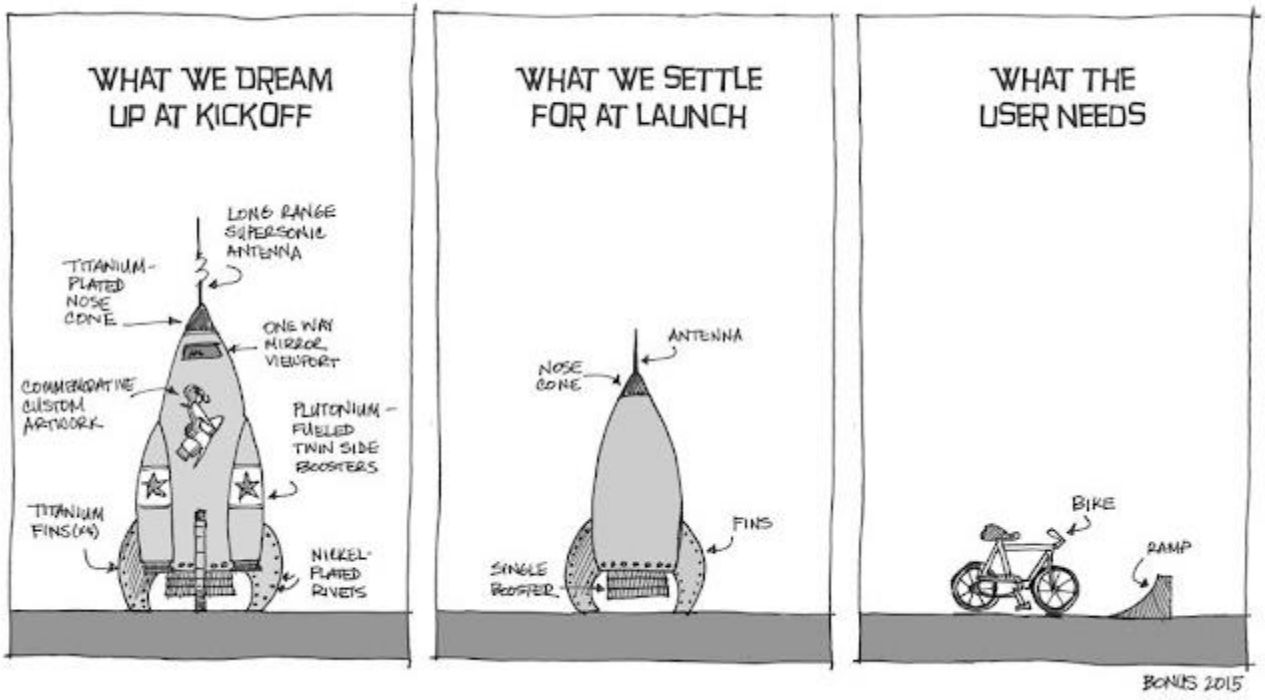
- What drives behaviour?



- Systematically listen and assess. Then respond.



- Be clear about the purpose and design for it



# Applied Artificial Intelligence in Health: From Compute to Care

Muhammad Mamdani, PharmD, MA, MPH

Vice President – Data Science and Advanced Analytics, Unity Health Toronto

Director – Temerty Centre for Artificial Intelligence Research and Education in Medicine (T-CAIREM)

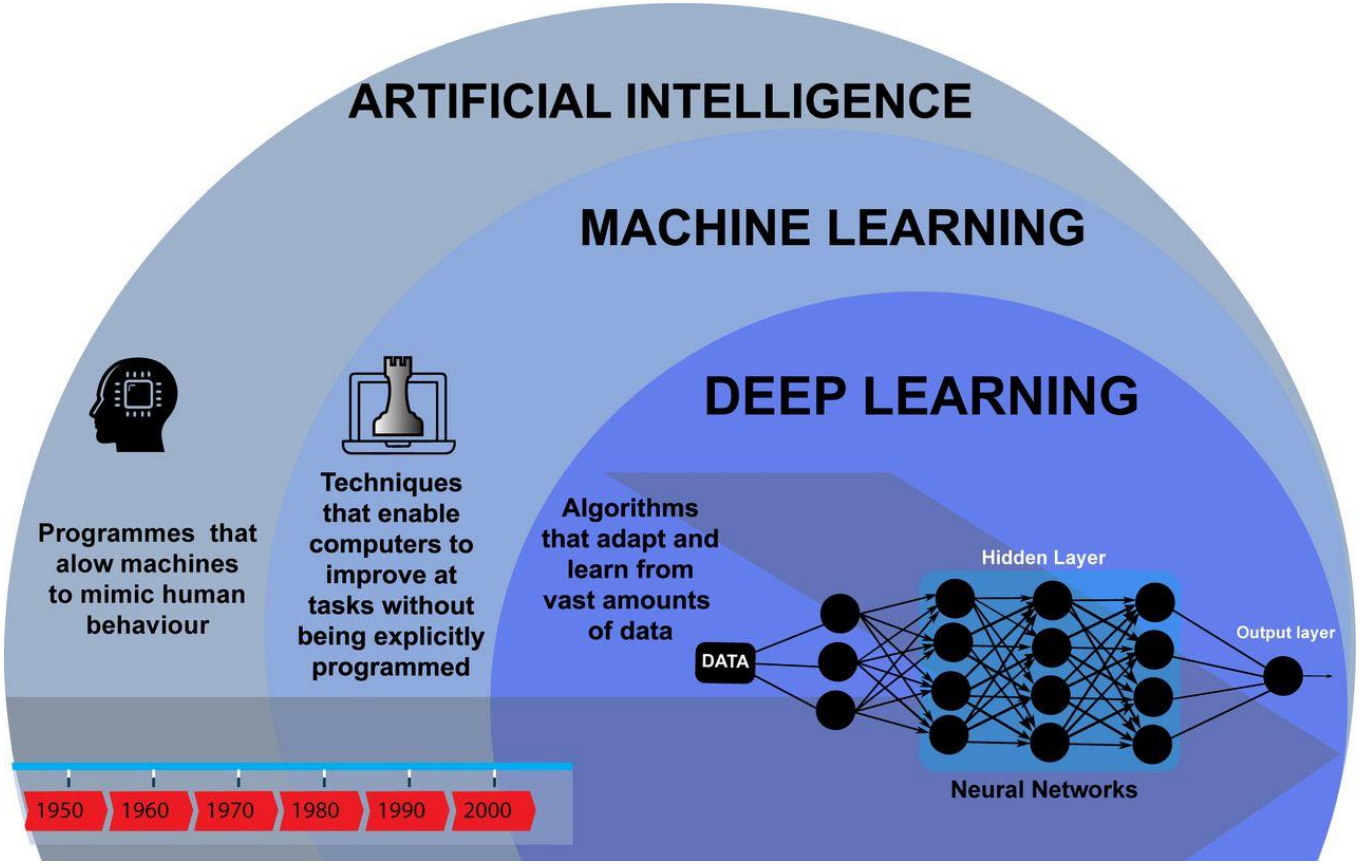
Faculty Affiliate – Vector Institute

Adjunct Senior Scientist – Institute for Clinical Evaluative Sciences

Professor – University of Toronto

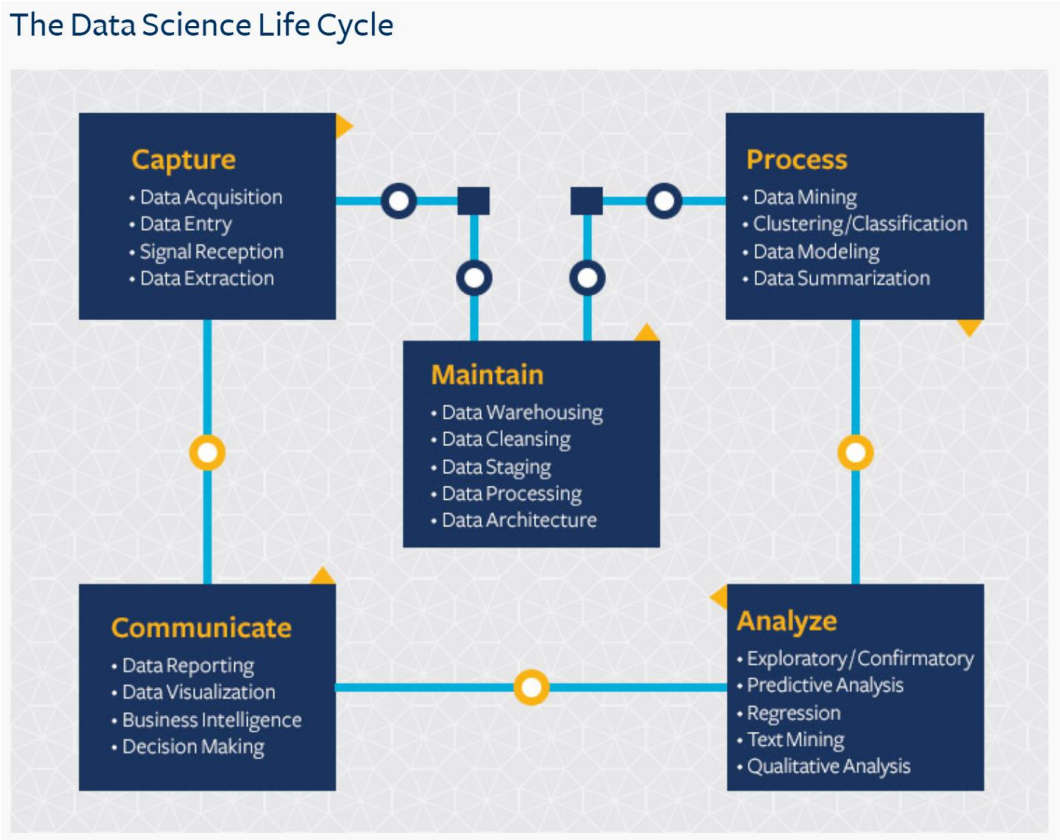
October 2021

# Terminology




Marvao et al
BMJ 2020

# The Foundation of AI: Data



# Learning from AI Failures

GIZMODO We come from the future

LATEST REVIEWS SCIENCE IO9 FIELD GUIDE EARTHER DESIGN PALEOFUTI

Stay conne

MICROSOFT

## Here Are the Microsoft Twitt Rants

Sophie Kleeman
3/24/16 11:43AM • Filed to: GARBAGE FIRES


Join Extra Crunch
Login
Search
Startups
Videos
Audio
Newsletters
Extra Crunch
Advertise
Events
—
More



## Google medical researchers humbled when AI screening tool falls short in real-life testing

Devin Coldewey @techcrunch / 5:03 pm EDT • April 27, 2020

Comment

# Health AI Examples in Action

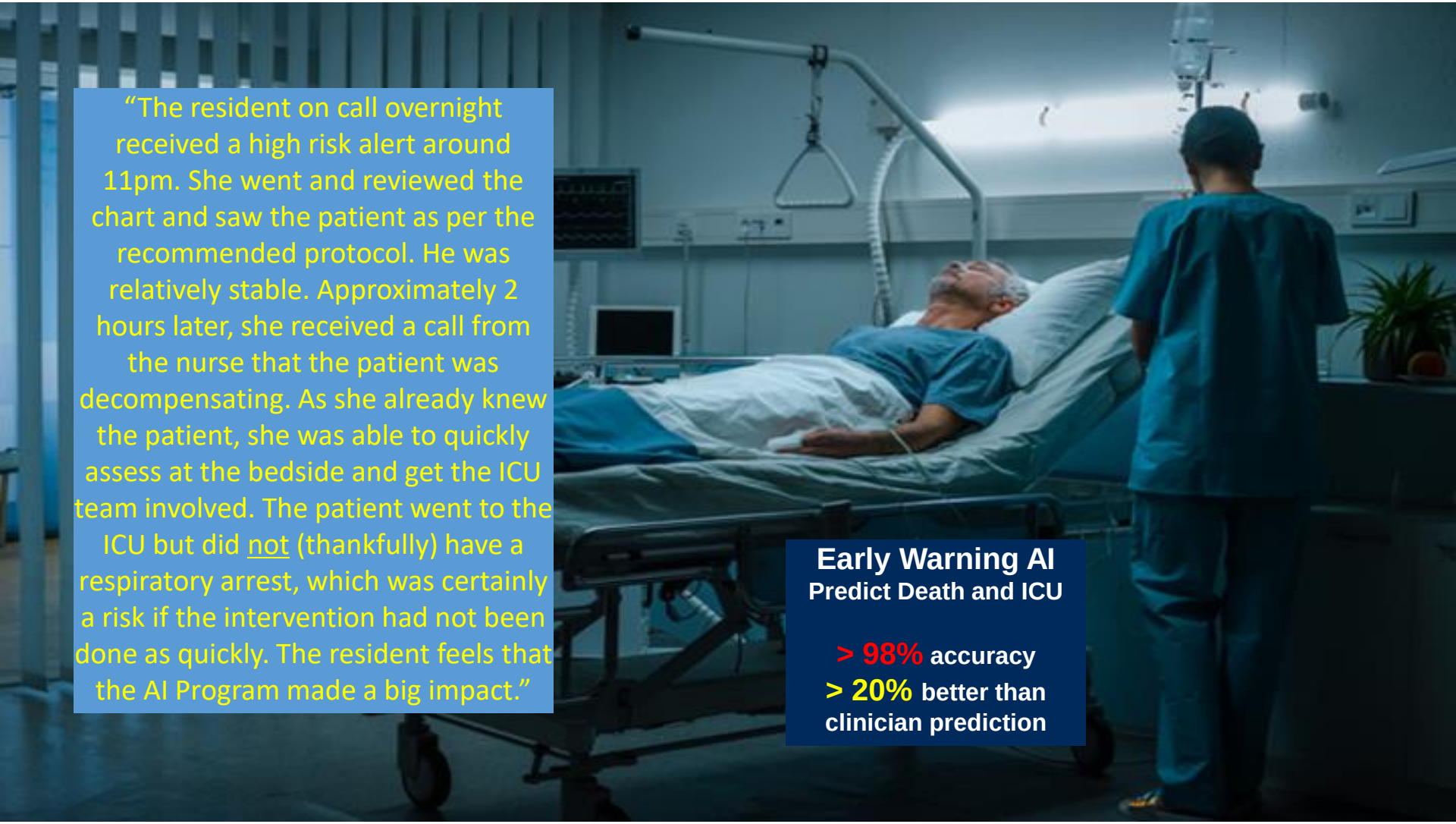
1 in 12 internal medicine patients will die in hospital: what can be done?

# MS. RW

- ↑ Monitoring
- Antibiotics?
- CCRT
- Palliative Care
- Communicate

Can we predict who will die so we can intervene earlier?

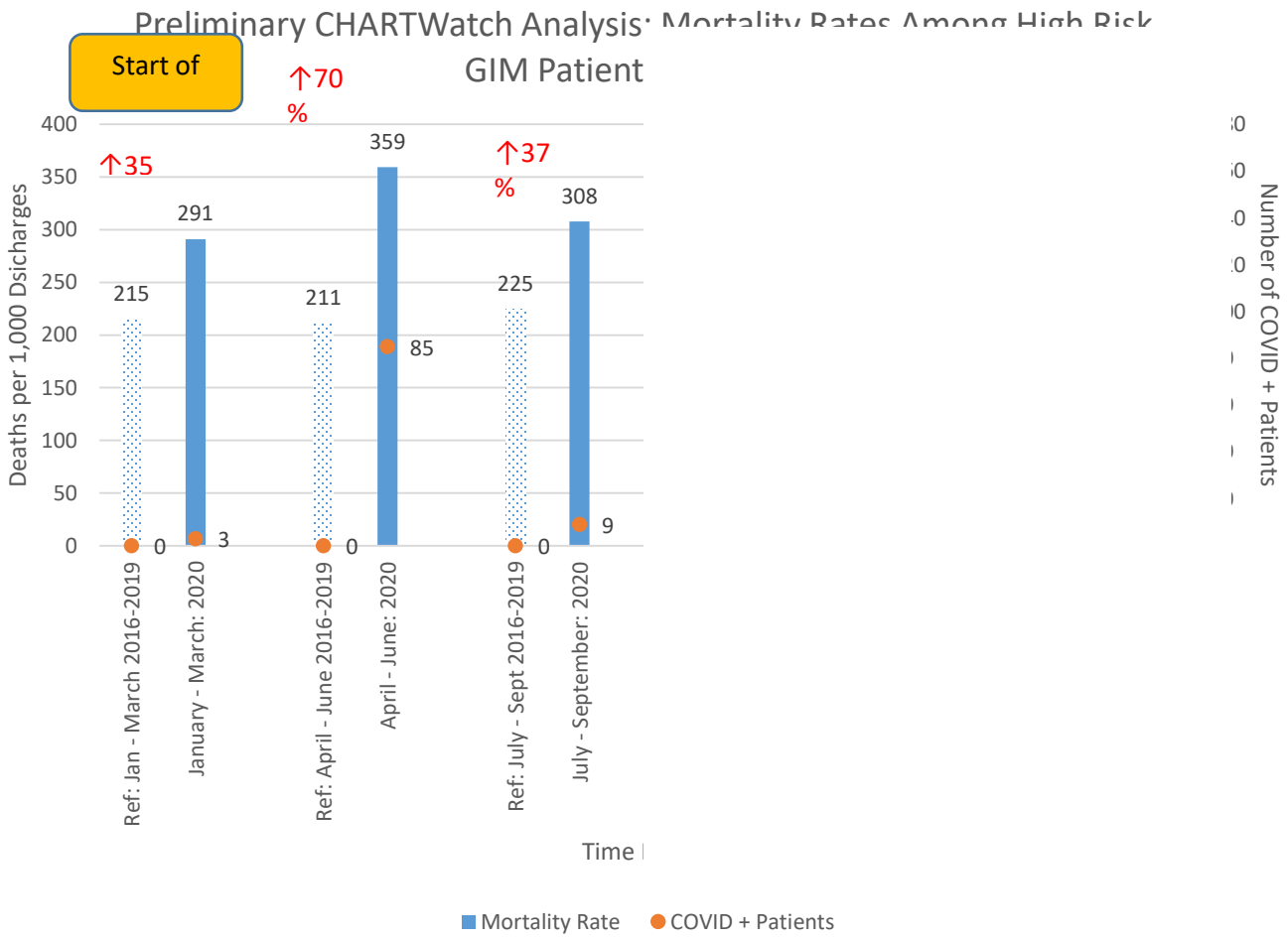
- [illegible]
- Had diagnostic procedure: ERCP (endoscopic retrograde cholangiopancreatography)
- MD called at 18:30
- Ms RW had shortness of breath, MD ordered chest cx-ray and labs
- Vital signs checked twice overnight (midnight and
- MD called at 08:30 for decreased blood pressure, distress; patient transferred to step-up unit, and
- Ms. RW did not want ICU and died in step-up that
- Family understandably distraught at sudden deterioration. "We would never have left her



"The resident on call overnight received a high risk alert around 11pm. She went and reviewed the chart and saw the patient as per the recommended protocol. He was relatively stable. Approximately 2 hours later, she received a call from the nurse that the patient was decompensating. As she already knew the patient, she was able to quickly assess at the bedside and get the ICU team involved. The patient went to the ICU but did not (thankfully) have a respiratory arrest, which was certainly a risk if the intervention had not been done as quickly. The resident feels that the AI Program made a big impact."

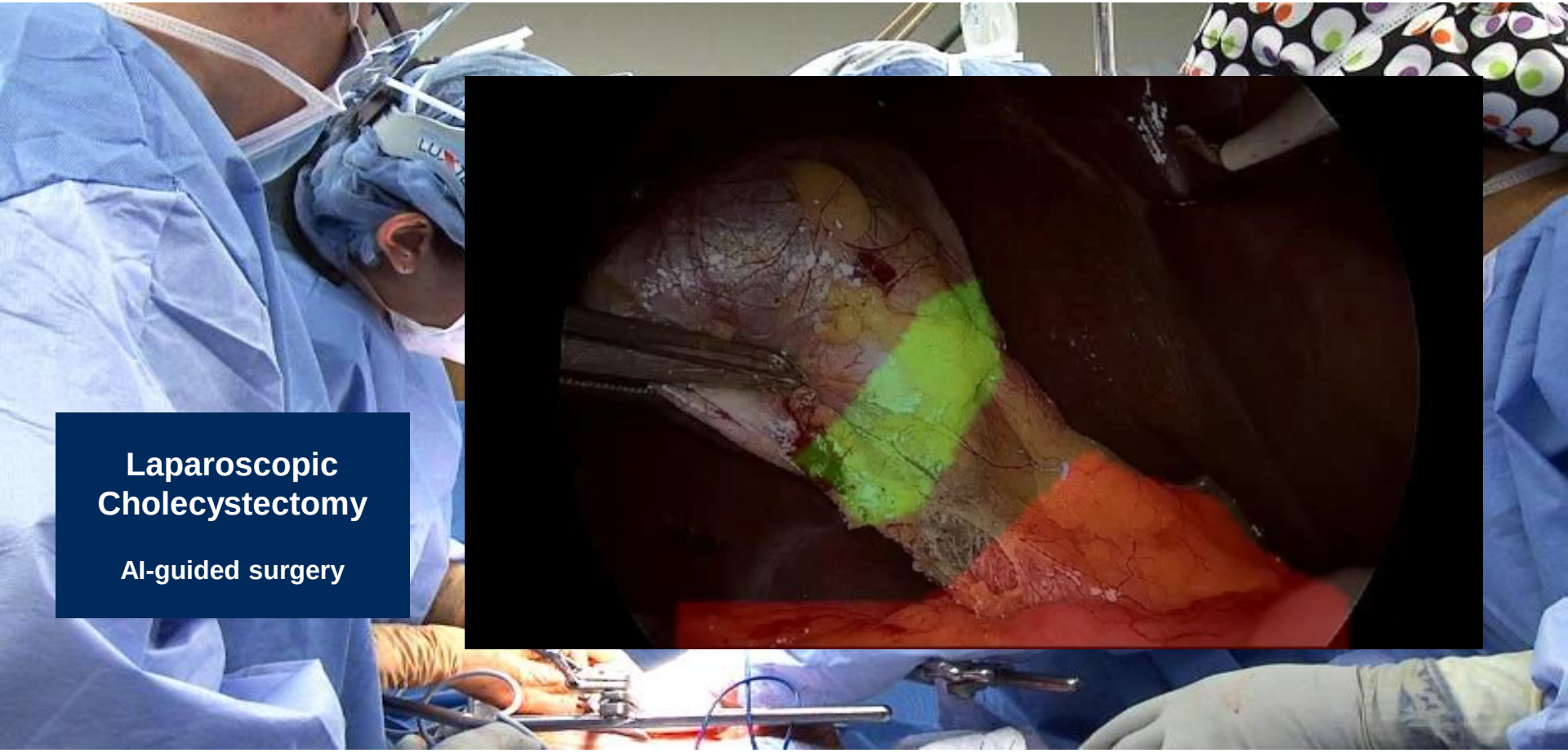
**Early Warning AI**
**Predict Death and ICU**

**> 98% accuracy**
**> 20% better than clinician prediction**


Preliminary CHARTWatch Analysis: Mortality Rates Among High Risk GIM Patient
Start of
↑35
↑70 %
↑37 %
Deaths per 1,000 Dsicharges
400
350
300
250
200
150
100
50
0
215
291
211
359
225
308
0
3
0
85
0
9
Ref: Jan - March 2016-2019
January - March: 2020
Ref: April - June 2016-2019
April - June: 2020
Ref: July - Sept 2016-2019
July - September: 2020
Time
Mortality Rate
COVID + Patients
Number of COVID + Patients

# Some Considerations

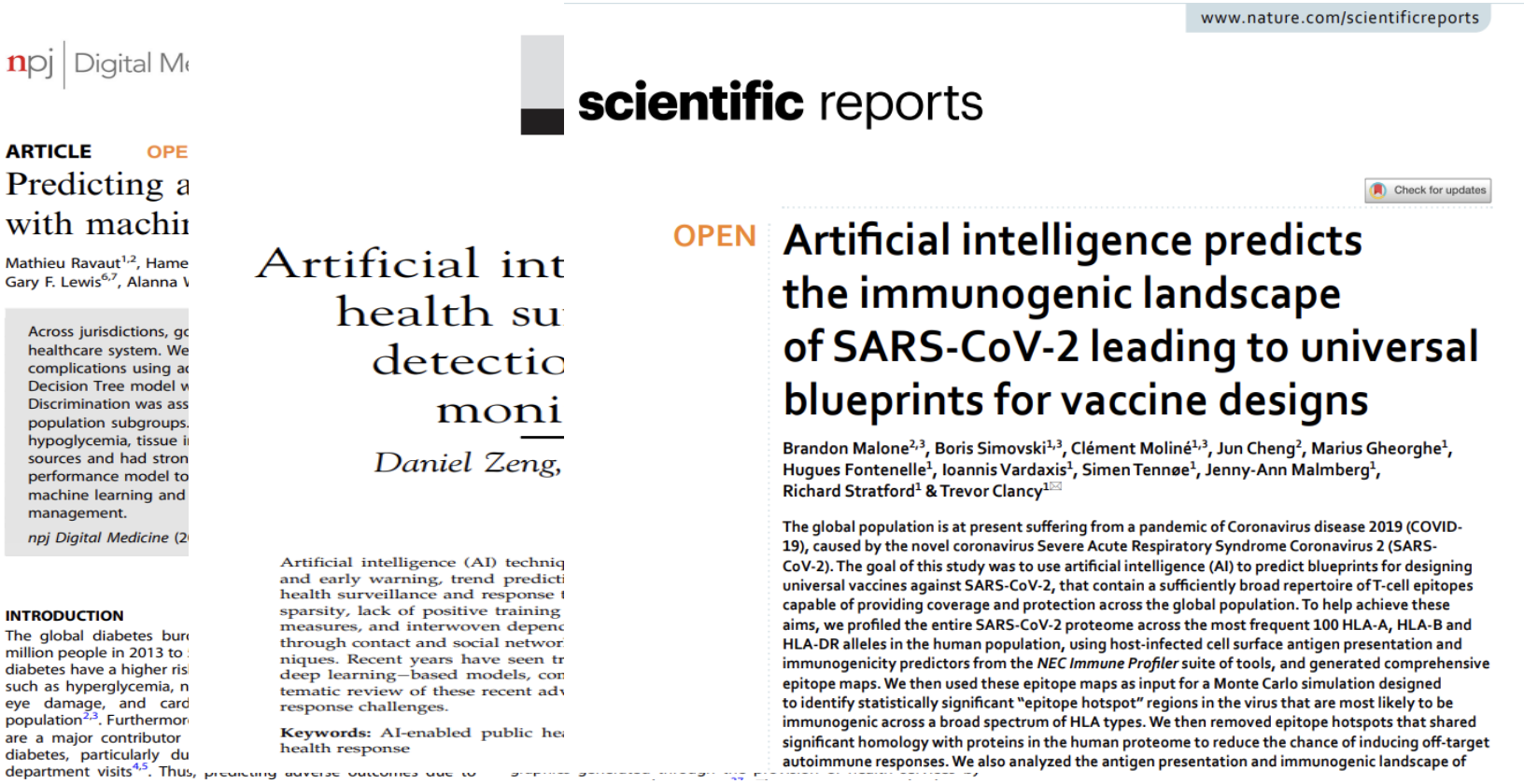
- Privacy and use of data for quality improvement : identified vs de-identified
- Transparency
  - Notify the clinical team, patient, caregivers, all of the above if high risk status?
- Unintended consequences
  - What if ICU admissions increase?
  - Self-fulfilling prophecy problem – adverse behaviours resulting from model predictions
- Risk and liability
  - What happens when the clinician doesn't agree with the AI prediction and someone dies?
- Intent of AI: prediction vs prescription; supplemental with human decision-making
- Trusting AI
  - Explainability vs Demonstrating Better Performance Than the User
- Overreliance



# Laparoscopic Cholecystectomy

**AI-guided surgery**

# AI Examples in Population Health and Therapeutics



npj | Digital M

ARTICLE OPE

Predicting a
with machi

Mathieu Ravaut[1,2], Hame
Gary F. Lewis[6,7], Alanna V

Across jurisdictions, g
healthcare system. We
complications using a
Decision Tree model w
Discrimination was ass
population subgroups.
hypoglycemia, tissue i
sources and had stron
performance model to
machine learning and
management.

*npj Digital Medicine* (2

**INTRODUCTION**

The global diabetes bur
million people in 2013 to
diabetes have a higher ris
such as hyperglycemia, n
eye damage, and card
population[2,3]. Furthermor
are a major contributor
diabetes, particularly du
department visits[4,5]. Thus,

www.nature.com/scientificreports

scientific reports

Artificial int
health su
detectio
moni

*Daniel Zeng,*

Artificial intelligence (AI) techniq
and early warning, trend predicti
health surveillance and response t
sparsity, lack of positive training
measures, and interwoven depend
through contact and social networ
niques. Recent years have seen tr
deep learning–based models, con
tematic review of these recent adv
response challenges.

**Keywords:** AI-enabled public hea
health response

Check for updates

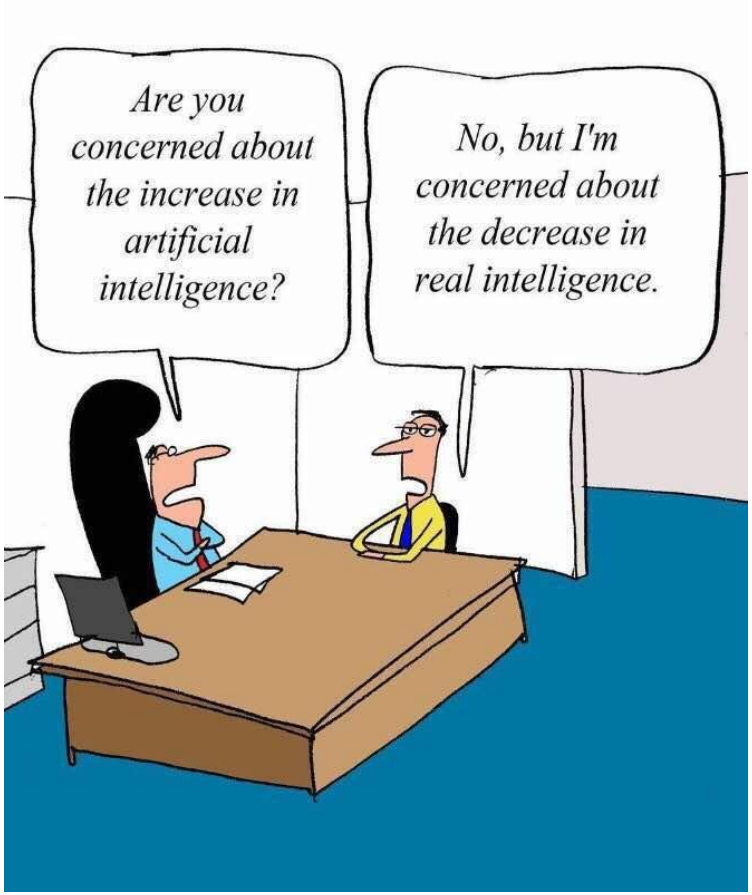
OPEN

## Artificial intelligence predicts the immunogenic landscape of SARS-CoV-2 leading to universal blueprints for vaccine designs

Brandon Malone[2,3], Boris Simovski[1,3], Clément Moliné[1,3], Jun Cheng[2], Marius Gheorghe[1], Hugues Fontenelle[1], Ioannis Vardaxis[1], Simen Tennøe[1], Jenny-Ann Malmberg[1], Richard Stratford[1] & Trevor Clancy[1]✉

The global population is at present suffering from a pandemic of Coronavirus disease 2019 (COVID-19), caused by the novel coronavirus Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). The goal of this study was to use artificial intelligence (AI) to predict blueprints for designing universal vaccines against SARS-CoV-2, that contain a sufficiently broad repertoire of T-cell epitopes capable of providing coverage and protection across the global population. To help achieve these aims, we profiled the entire SARS-CoV-2 proteome across the most frequent 100 HLA-A, HLA-B and HLA-DR alleles in the human population, using host-infected cell surface antigen presentation and immunogenicity predictors from the *NEC Immune Profiler* suite of tools, and generated comprehensive epitope maps. We then used these epitope maps as input for a Monte Carlo simulation designed to identify statistically significant "epitope hotspot" regions in the virus that are most likely to be immunogenic across a broad spectrum of HLA types. We then removed epitope hotspots that shared significant homology with proteins in the human proteome to reduce the chance of inducing off-target autoimmune responses. We also analyzed the antigen presentation and immunogenic landscape of

# Thank You!


Are you concerned about the increase in artificial intelligence?
No, but I'm concerned about the decrease in real intelligence.

## The Next Big Thing

# Perspectives from Ophthalmology

CAPT Annual Conference

# Tina Felfeli

Dr. Tina Felfeli is a resident physician in the **Department of Ophthalmology and Vision Sciences, University of Toronto**.

She completed her medical school training at University of Toronto where she received the J. P. Boley Prize in Ophthalmology for the highest academic standing in her graduating class.

Currently, she is completing a PhD degree in Clinical Epidemiology at the **Institute of Health Policy, Management and Evaluation**, **University of Toronto** as a part of the Integrated Physician-Scientist program.

FIGHTING BLINDNESS CANADA

VISION SCIENCE RESEARCH PROGRAM

Bourses d'études supérieures du Canada Vanier Canada Graduate Scholarships

Tina Felfeli

01

Understanding Disease Patterns

using health administrative data

02

Access to Eye Care

with automated and portable devices

03

Resource Planning

using modelling

04

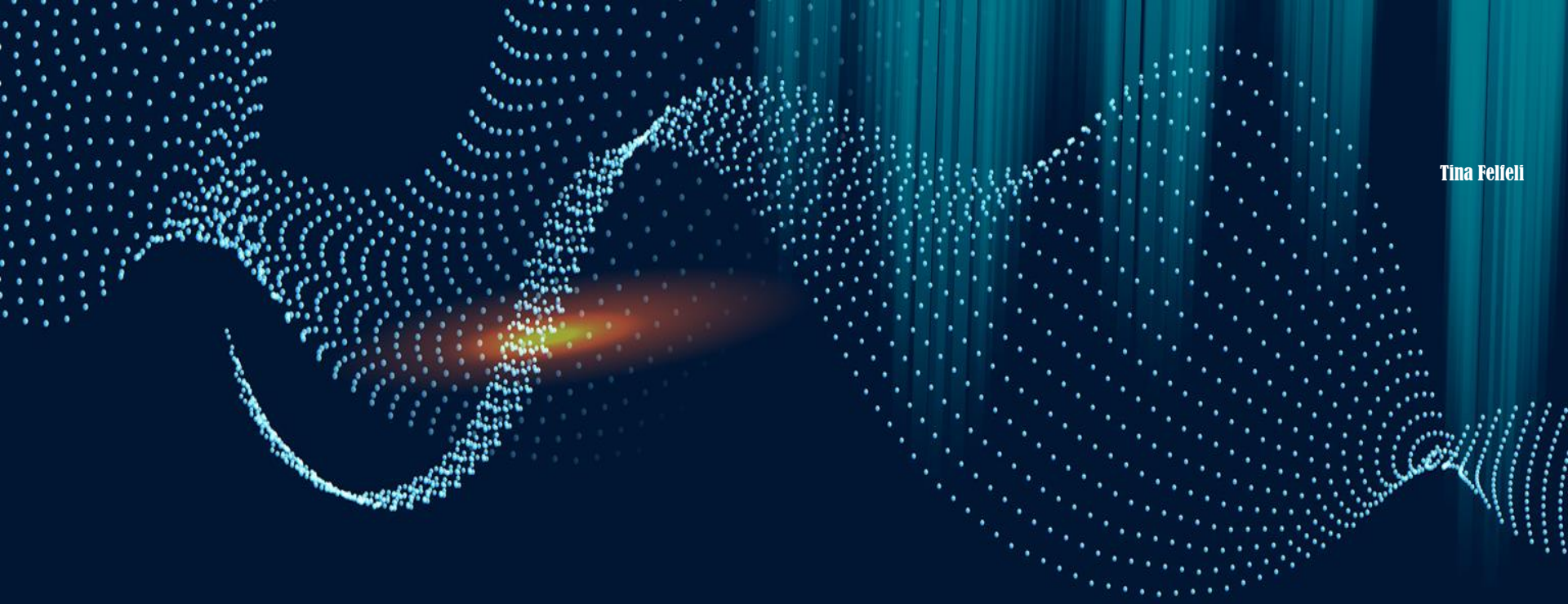
Personalized Treatment Options

using biomarkers and AI

05

Surgical Performance

enhanced with AI



Tina Felfeli

# 01 Understanding Disease Patterns

Using health administrative data

Tina Felfeli

# Burden of Diabetic Retinopathy

Diabetic Retinopathy is the leading cause of blindness among adults aged 20-74 years.

## 2.5 million

Canadians have been diagnosed with diabetes mellitus.

## 35%

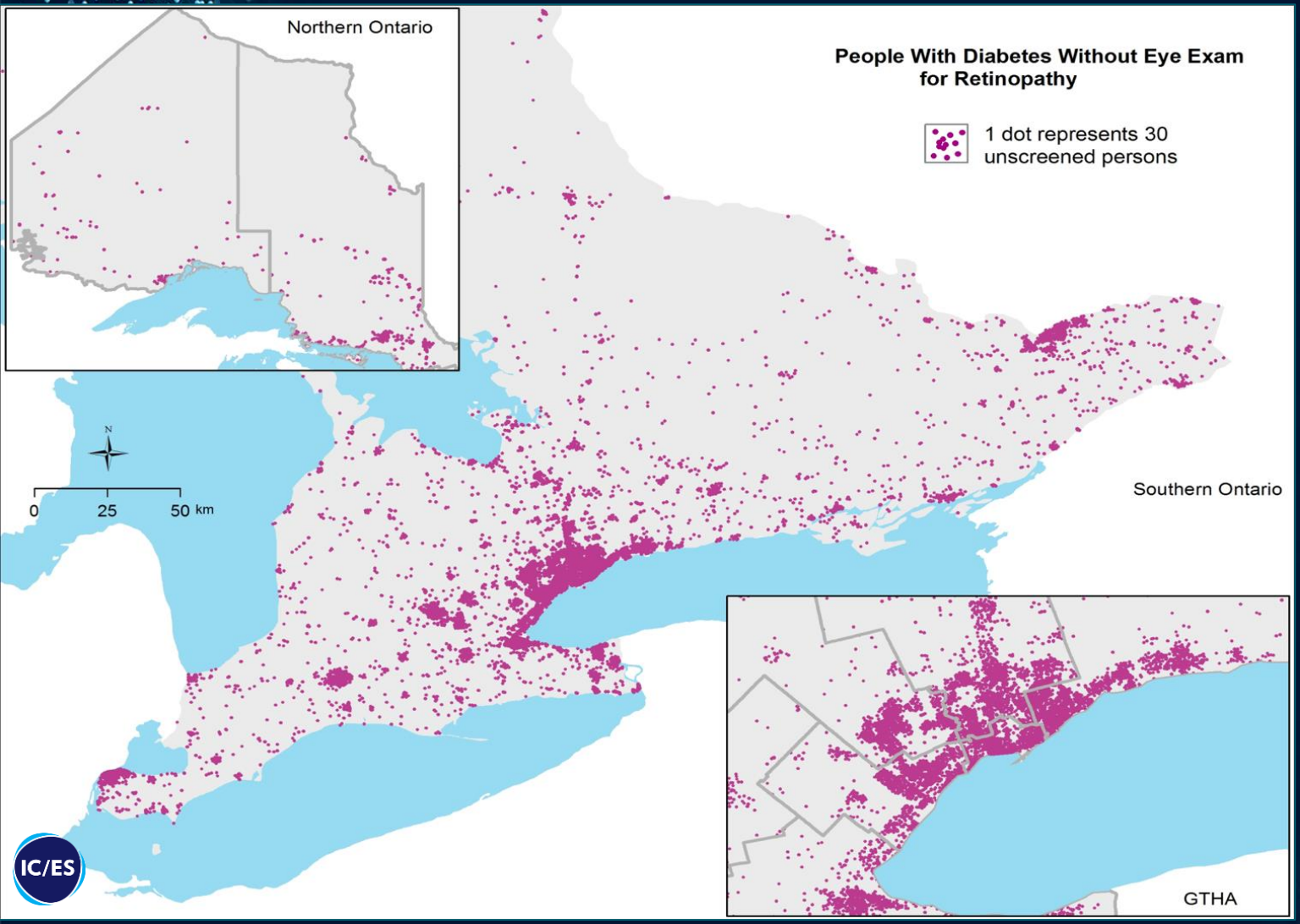
of those with diabetes have diabetic retinopathy.

https://www150.statcan.gc.ca/
*Canadian Journal of Cardiology* **34**, 552–564 (2018).
*Lancet* **369**, 750–756 (2007).

# Diabetic Retinopathy Screening Guidelines

| | Type 1 | Type 2 |
|---|---|---|
| Initial Screen | 5 years after diagnosis in all individuals ≥15 years | children, adolescents and adults at diagnosis |
| Repeat Screen | rescreen annually | rescreen every 1 to 2 years |

Diabetes Canada Clinical Practice Guidelines Expert Committee.




**Felfeli T**, et al. Can J Ophthalmol. 2019 Apr;54(2):203-211.

Tina Felfeli

# Diabetic Retinopathy Screening in Ontario

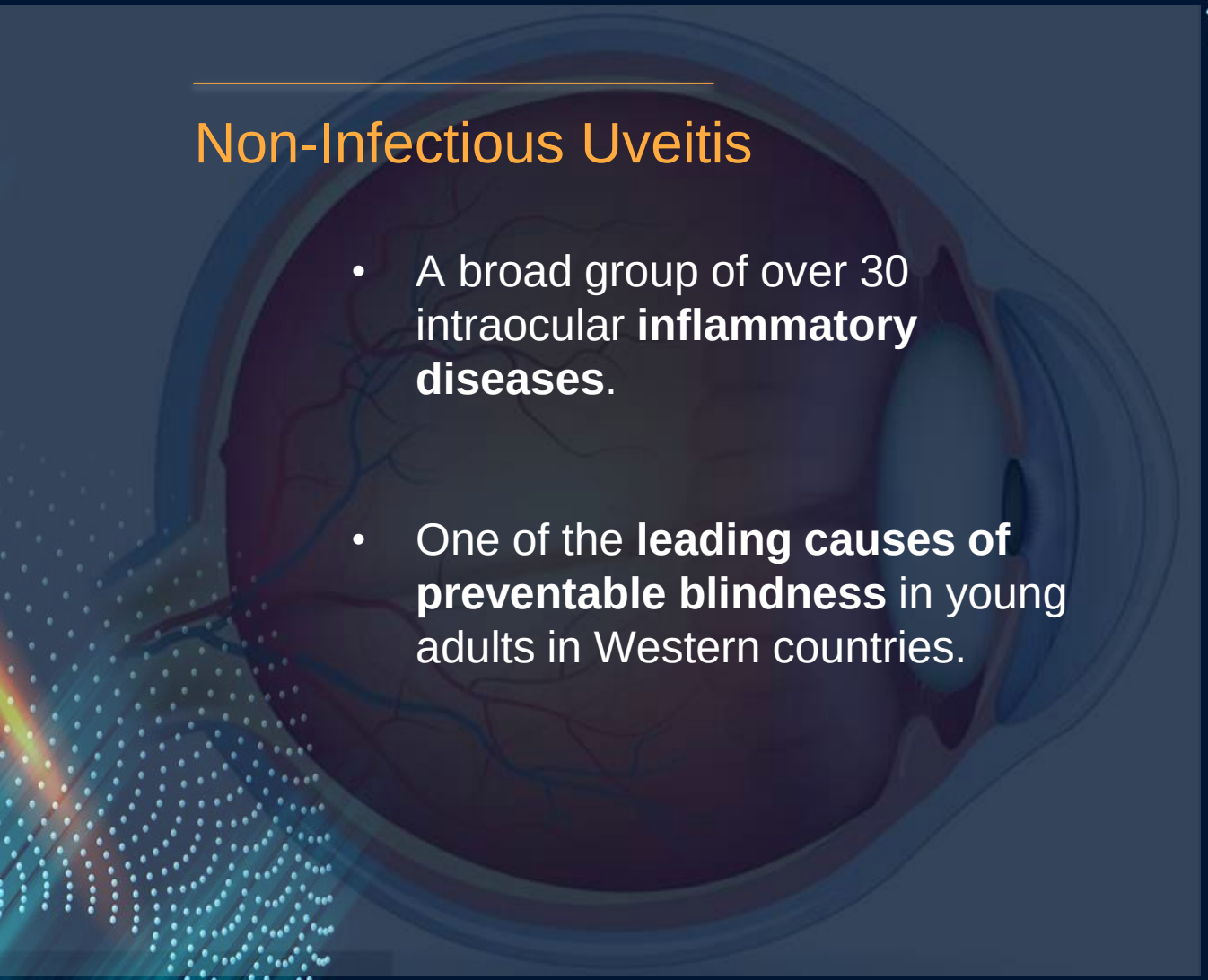
**1/3**

of patients with diabetes in Ontario have not been screened.

↑ risk of for young adults, immigrants and those not under the care of family physicians.

Felfeli, T, et al., presented at the Association for Research in Vision and Ophthalmology annual meeting which took place virtually in May 2021 and the American Retina Society annual meeting virtually in October 2021.

# Non-Infectious Uveitis



- A broad group of over 30 intraocular **inflammatory diseases**.
- One of the **leading causes of preventable blindness** in young adults in Western countries.

**38–200**
per 100,000

is the estimated prevalence of non-infectious uveitis.

Am J Ophthalmol. April 2021.
*JAMA Ophthalmol.* 2016;134(11):1237-1245.
*Ophthalmology.* 2004;111(3):491-500.
*JAMA Ophthalmol.* 2013;131(11):1405.
*Acta Ophthalmol.* 2015;93(6):561-567.

# Non-Infectious Uveitis

Tina Felfeli

## Referral characteristics and wait times for uveitis consultation at academic tertiary care centres in Toronto

Felfeli T, et al. Can J Ophthalmol. 2018 Dec;53(6):639-645. doi: 10.1016/j.jcjo.2018.03.006.

**Table 2—Characteristics of all uveitis cases according to anatomical classification**

| Variable | Anterior Uveitis | Intermediate Uveitis | Posterior Uveitis | Panuveitis | Total |
|---|---|---|---|---|---|
| Number of referrals | 55 (34%) | 19 (12%) | 61 (38%) | 18 (11%) | 159 (100%) |
| Age at presentation, years Mean ± SD (range) | 47 ± 16 (15-79) | 40 ± 18 (18-75) | 51 ± 19 (12-87) | 54 ± 23 (19-96) | 48 ± 19 (12-96) |
| Female sex | 34 (62%) | 12 (63%) | 35 (57%) | 7 (39%) | 91 (57%) |
| Laterality | | | | | |
| Unilateral | 30 (55%) | 6 (32%) | 32 (53%) | 7 (39%) | 77 (48%) |
| Bilateral | 23 (42%) | 12 (63%) | 26 (43%) | 11 (61%) | 73 (46%) |
| Unknown | 2 (4%) | 1 (5%) | 3 (5%) | 0 (0%) | 9 (6%) |

**5,600** patients with non-infectious uveitis in Ontario

Reported prevalence of uveitis (38–200 per 100,000)
Reported population of adults in Ontario of 14,745,04093

Tina Felfeli

# 02 Access to Eye Care

With automated and portable devices

# Toronto Tele-Retinal Screening Program

**2017**

775 patient screens

27% of patients had DR

**Felfeli T**, et al. Can J Ophthalmol. 2019 Apr;54(2):203-211.

**2019**

1,374 patient screens

25% of patients had DR

Cao J, **Felfeli T**, et al. Can J Diabetes. 2021 May 8:S1499-2671(21)00132-5.

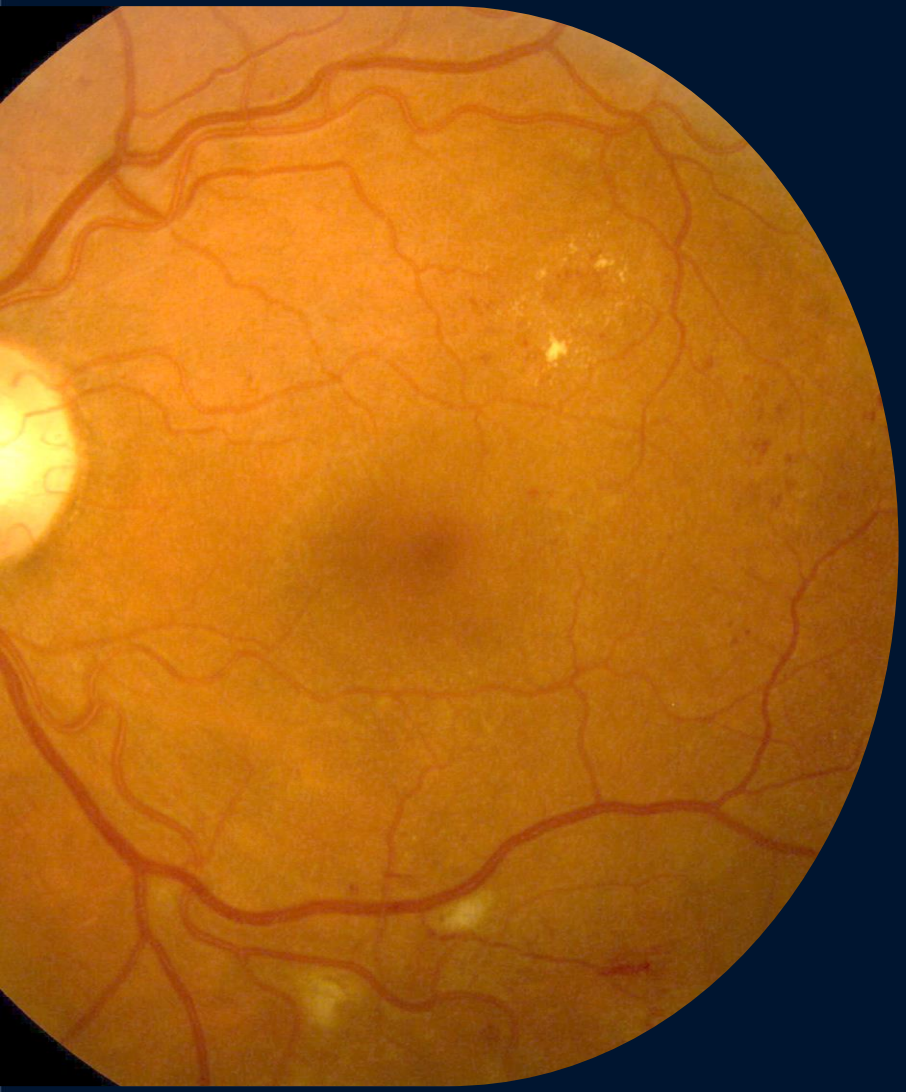
**2021**

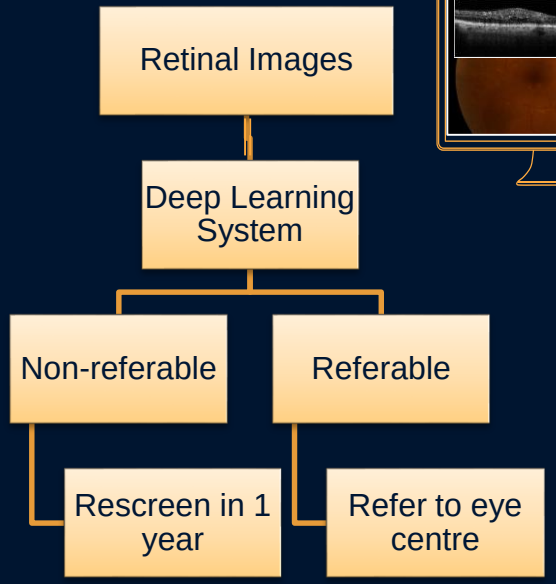
3,000+ patient screens

# Traditional Toronto Tele-Retinal Screening Program

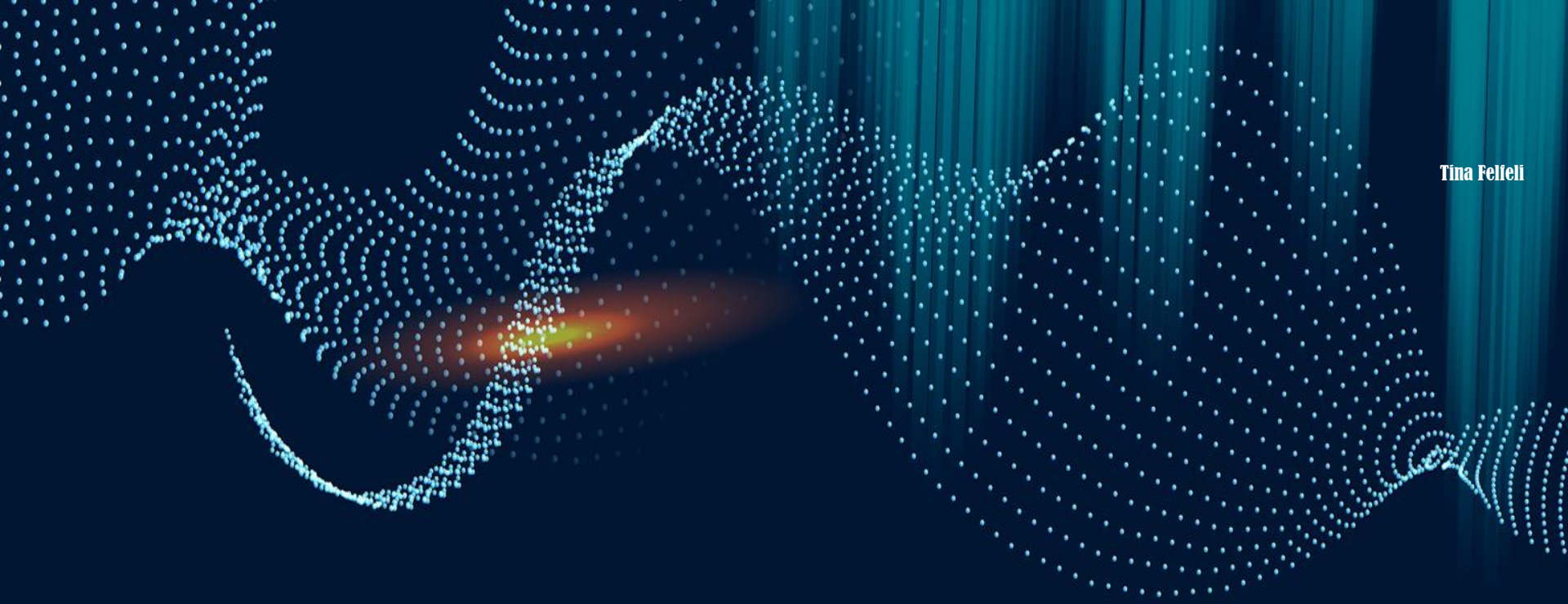
Tina Felfeli

# Automated diabetic retinopathy screening






Back
Home
Reload
Brightness
Lucy Smith
Jul 09 1964
Voice Capture
Capture
VISTA
VIEW



Tina Felfeli

# 03 Resource Planning

With modelling

# Ophthalmic Surgeries in Ontario

Tina Felfeli

- On March 15, 2020, Ontario's Ministry of Health directed hospitals to begin a measured "ramping down elective surgeries and other non-emergent activities."

- In that month, over 56,000 patients were waiting for ophthalmological surgeries in Ontario.

- It is important to understand the impact of interrupting surgeries on the waiting time for ophthalmic surgeries.

Ontario Health

**Felfeli T**, et al. CMAJ Open. 2021. In Press.

Tina Felfeli

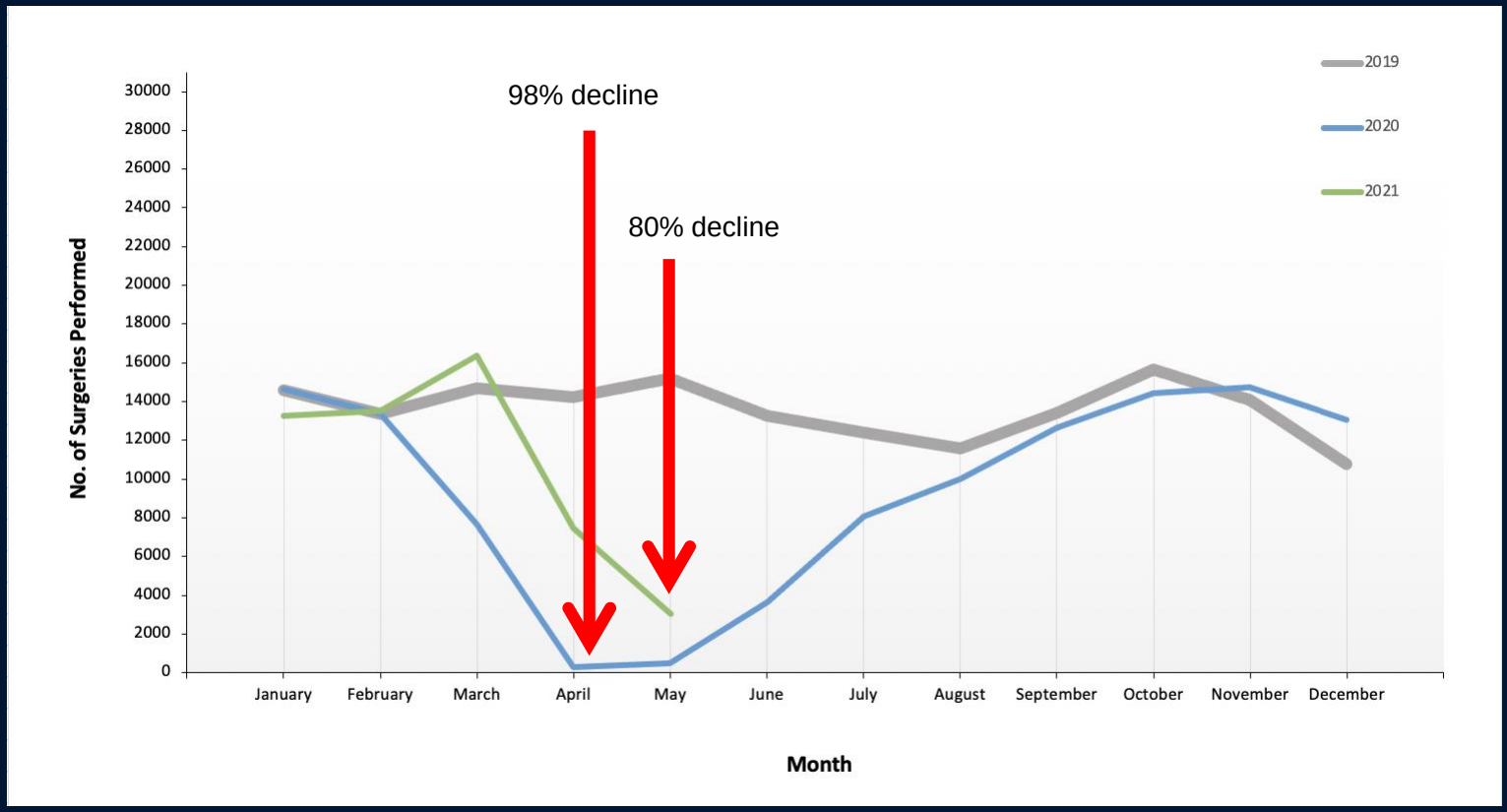


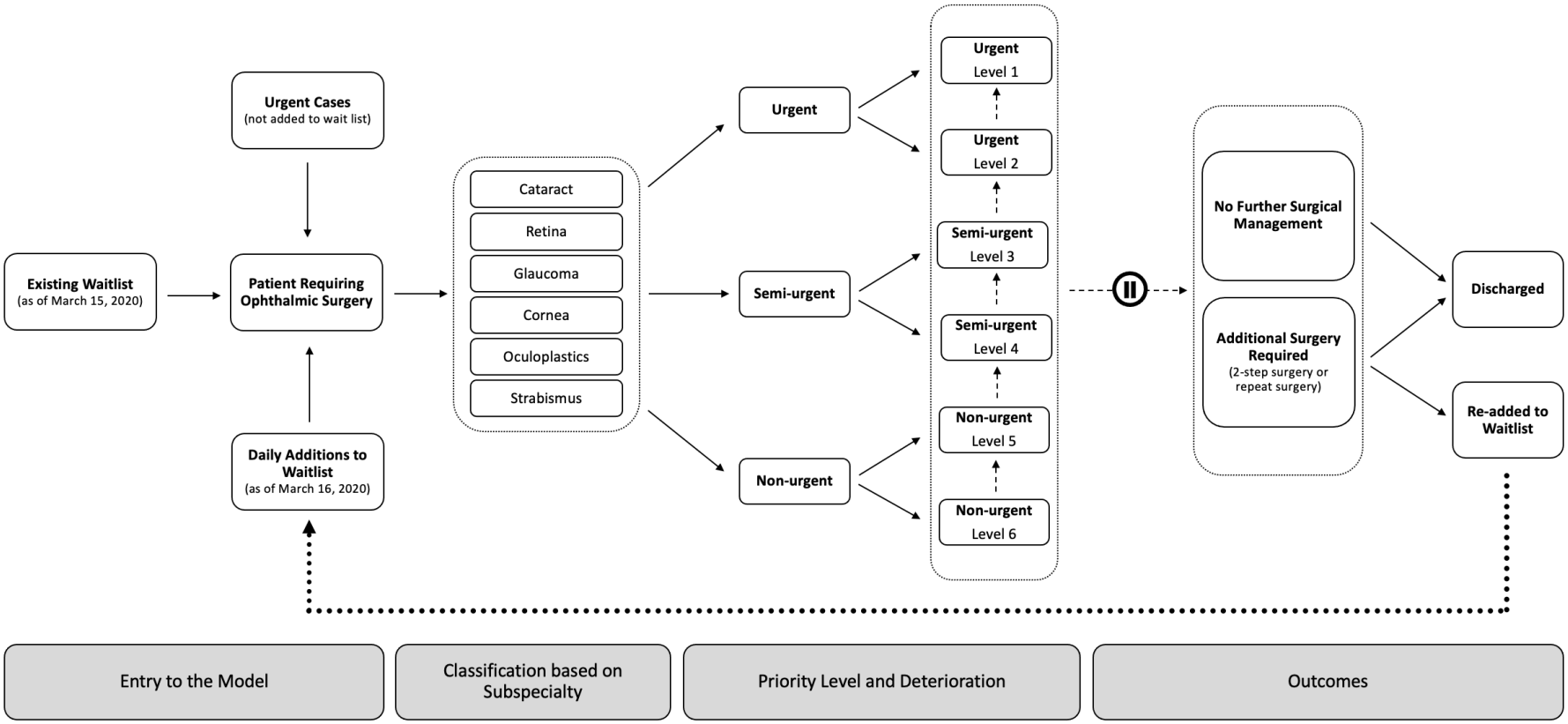

Figure depicts the comparison of the surgical throughput during the pandemic phase compared to historical data from 2019. The decline in surgical throughput was most notable for non-urgent surgeries compared to semi-urgent surgeries (semi-urgent, 76% decline versus non-urgent, 99% decline in May 2020 from May 2019).

Ontario Health

COVID-19 ModCollab

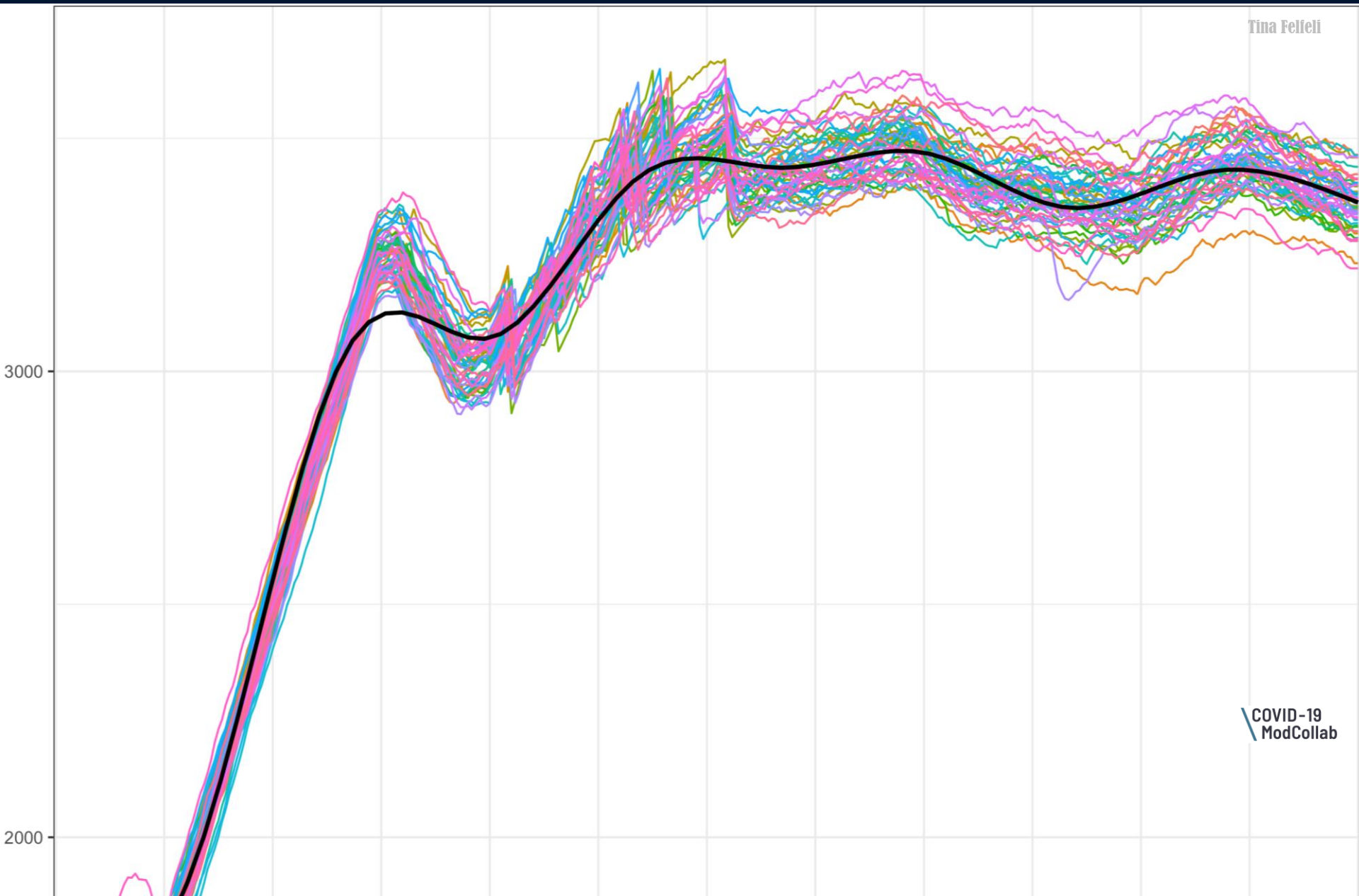
**Felfeli T**, et al. CMAJ Open. 2021. In Press.

Tina Felfeli




COVID-19 ModCollab

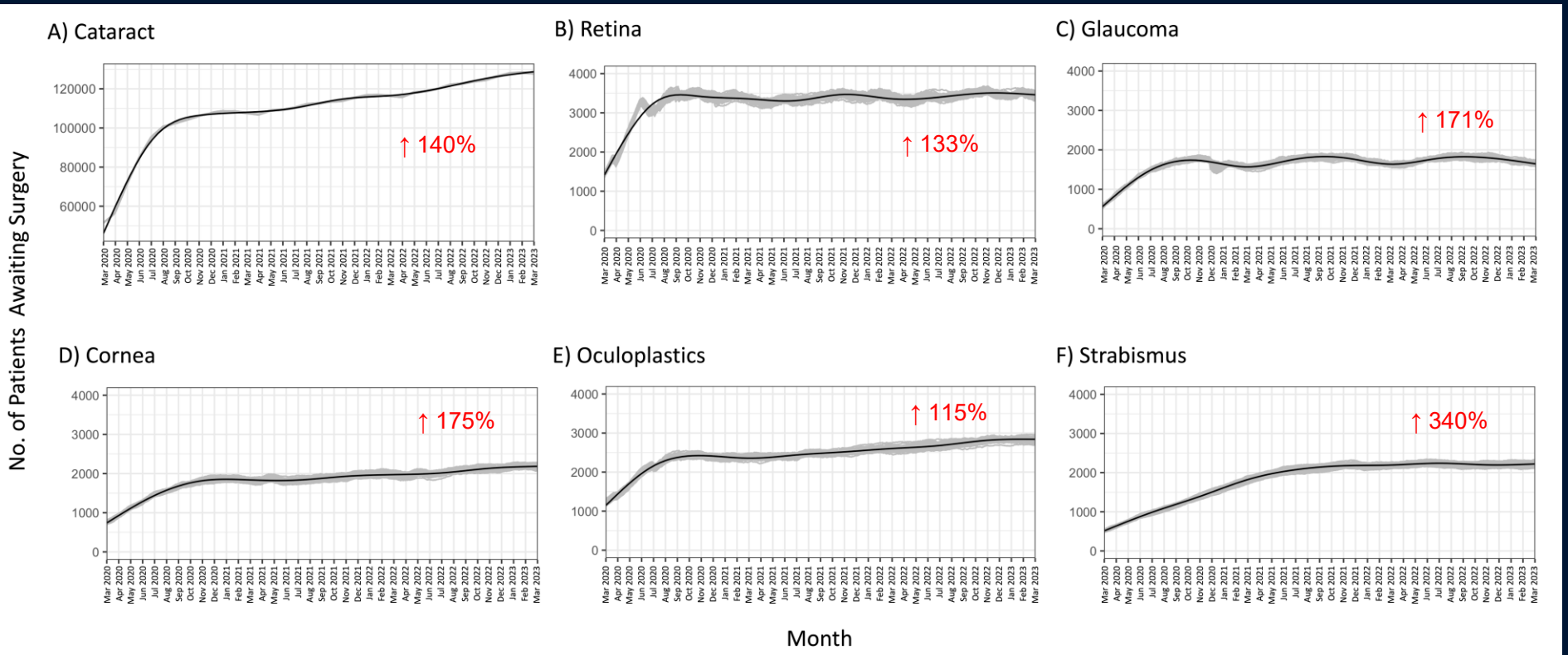
**Felfeli T**, et al. CMAJ Open. 2021. In Press.



**Felfeli T**, et al. CMAJ Open. 2021. In Press.

Tina Felfeli

Monthly accumulation of patients awaiting surgery for all surgeries and subspecialty types since March 2020, to March 2022. The simulations were run 50 times (variations in projected estimated represented by grey lines) for a total of 240,000 patients. No., number.

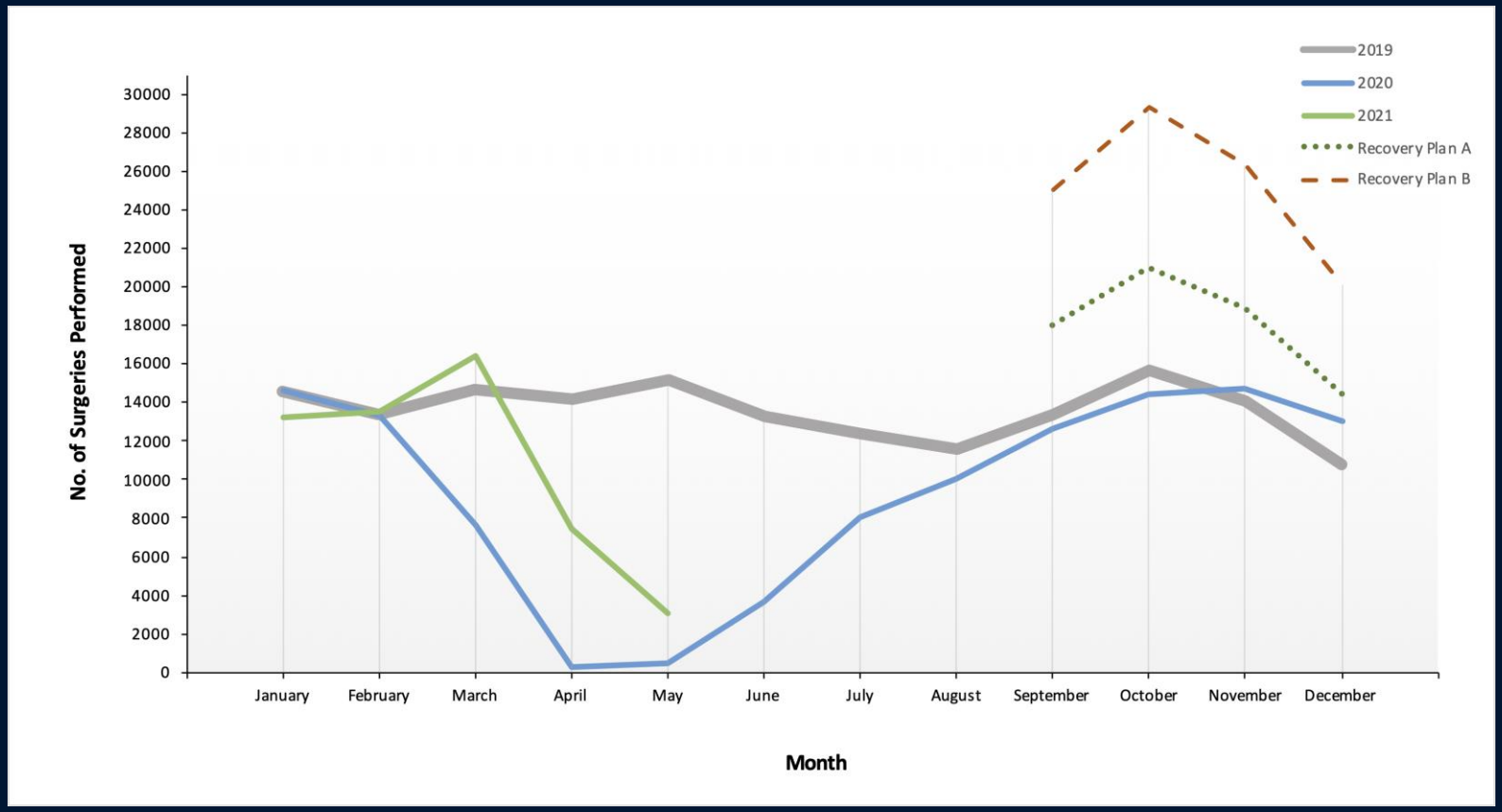



The total number of patients awaiting surgery at exactly 1 year following the pandemic increased by 108% (118,576 vs 56,923) in February 2021 compared to February 2020.

COVID-19 ModCollab

**Felfeli T**, et al. CMAJ Open. 2021. In Press.

Tina Felfeli




| Timeline | Start on Sept/21 |
|---|---|
| Over 2 years | 34% (A) |
| Over 1 year | 87% (B) |

COVID-19 ModCollab

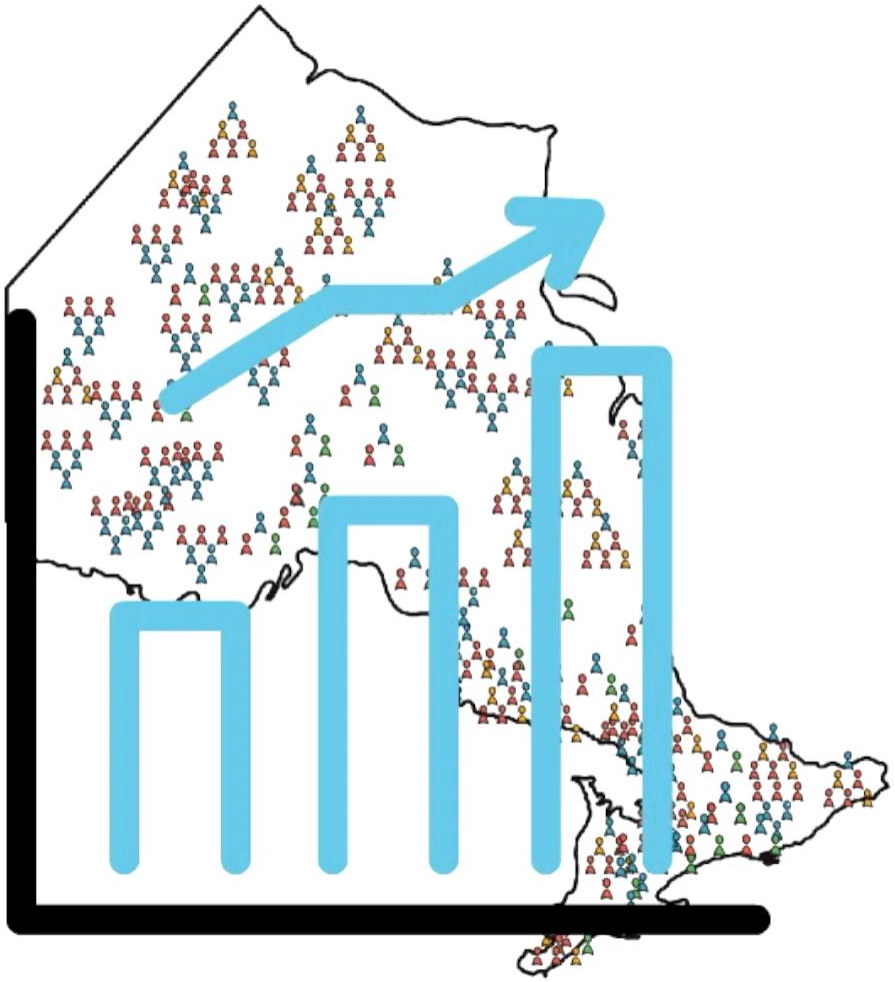
Tina Felfeli

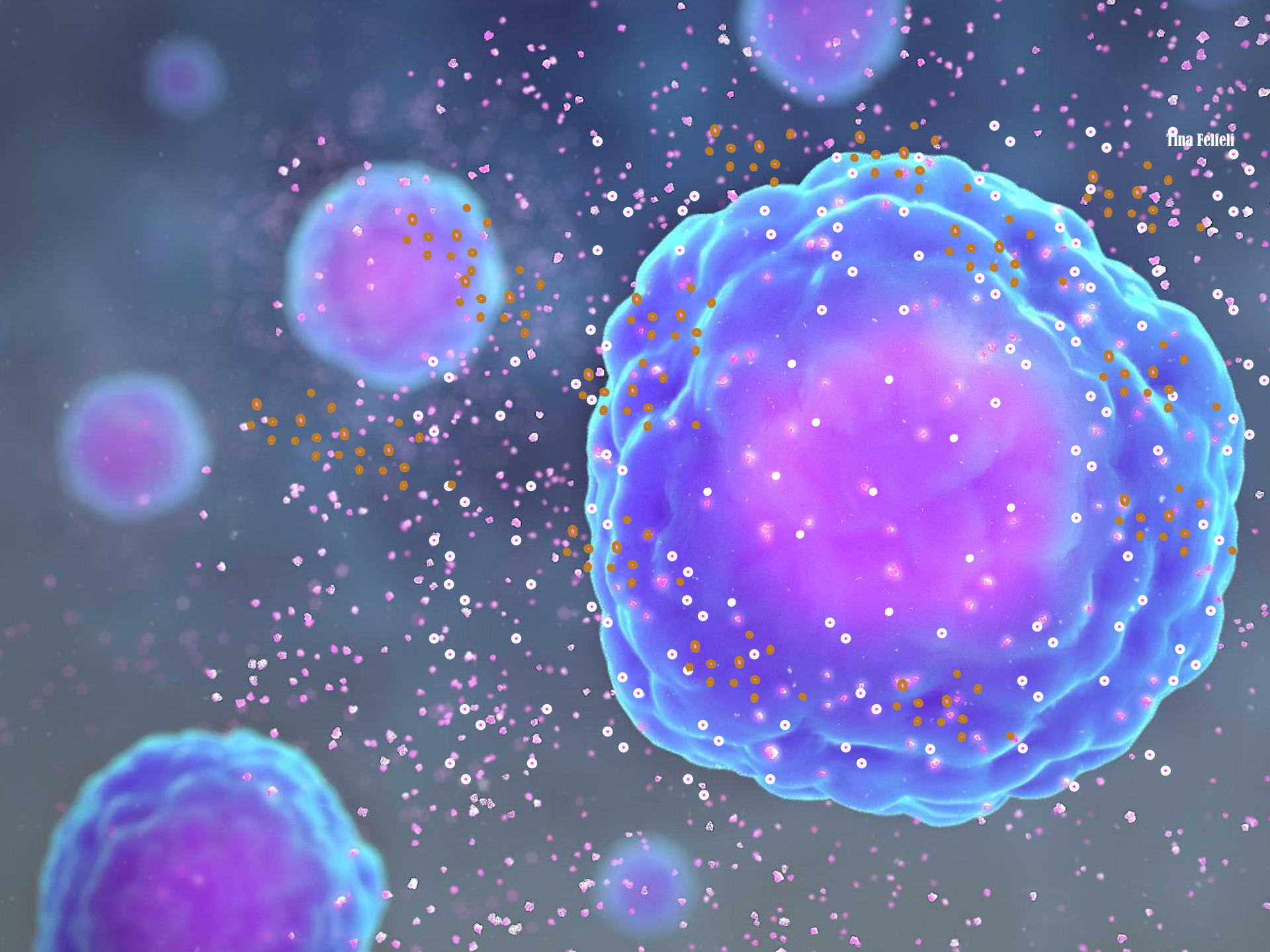
# 04 Personalized Treatment Options

Using biomarkers and AI

Tina Felfeli

Tina Felfeli




Tina Felfeli

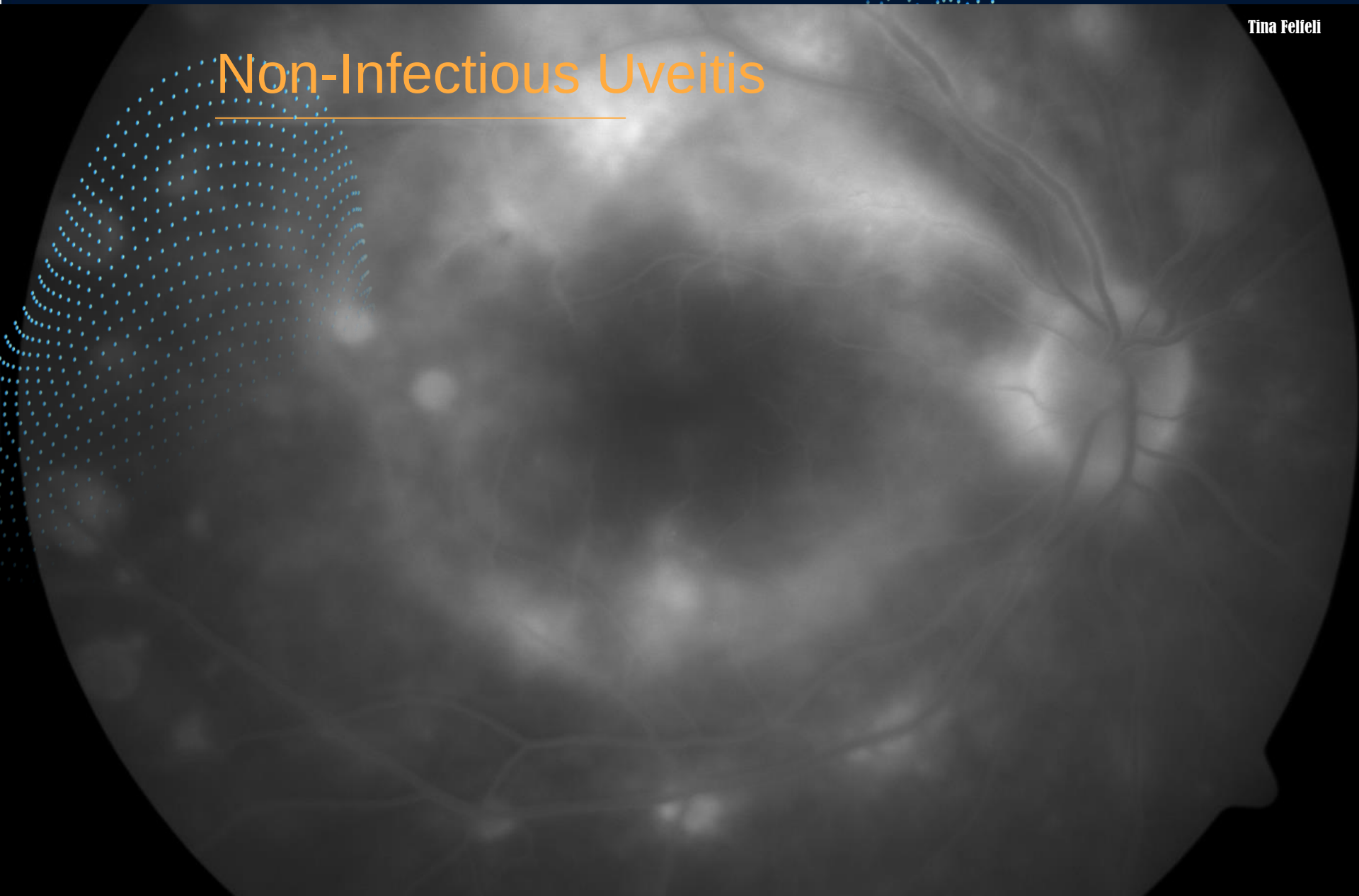
# Aqueous Humor Cytokines and Long-Term Response to Anti–Vascular Endothelial Growth Factor Therapy in Diabetic Macular Edema

**Felfeli T,** et al. Am J Ophthalmol. 2019 Oct;206:176-183. doi: 10.1016/j.ajo.2019.04.002.

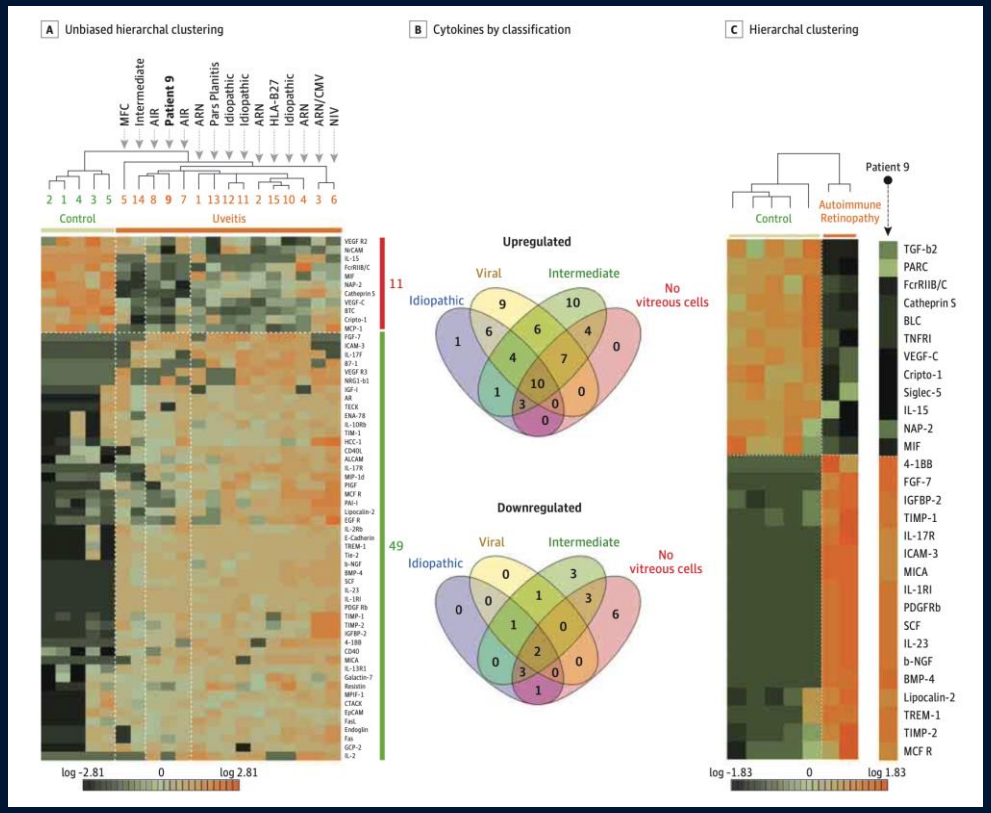
## Early predictors of long-term outcomes

Tina Felfeli

# Non-Infectious Uveitis



Tina Felfeli




*JAMA Ophthalmol.*2016;134(4):444–448. doi:10.1001/jamaophthalmol.2015.5934

Iritis
Para Planitis
Choroiditis
Chorioretinitis
Retinitis
Vasculitis
Scleritis
Acute posterior multifocal placoid pigment epitheliopathy (APMPPE)
Ampiginous choroiditis / ampiginous chorioretinitis
Birdshot / Birdshot choroiditis pars planitis / Birdshot Chorioretinopathy
Idiopathic orbital inflammation
Multifocal choroiditis
Multiple evanescent white dot syndrome (MWEDS)
Punctate Inner Choroidopathy (PIC)
Serpiginous choroiditis
Sympathetic ophthalmia
Vogt-Koyanagi-Harada (VKH)
White dot syndrome
Ankylosing spondylitis (Ank Spon, AK, AS)
Juvenile idiopathic arthritis-associated uveitis (JIA)
Behçet disease
Crohn's disease
Harada disease
HLA-B27–associated disease syndromes
Idiopathic
Multiple sclerosis (MS)
Psoriasis / PsA
Rheumatoid arthritis / RA
Sacroilliitis
Sarcoid
Scleroderma
Spondyloarthritis / SpA
Tubulointerstitial nephritis / Tubulointerstitial Nephritis and Uveitis / TINU

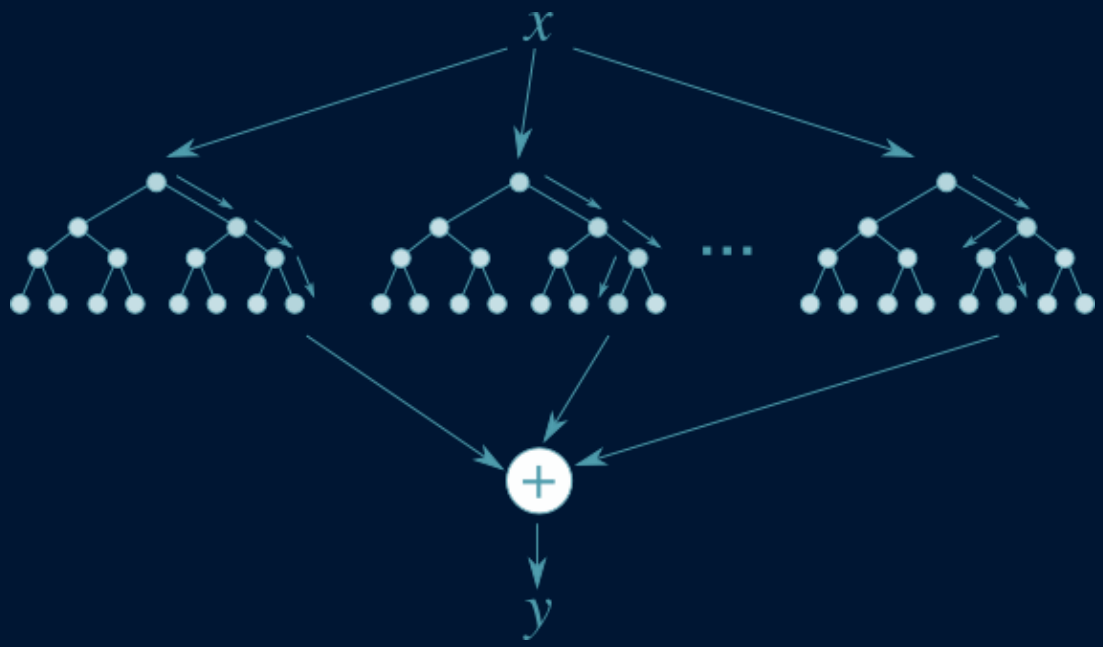
Oral Prednisone

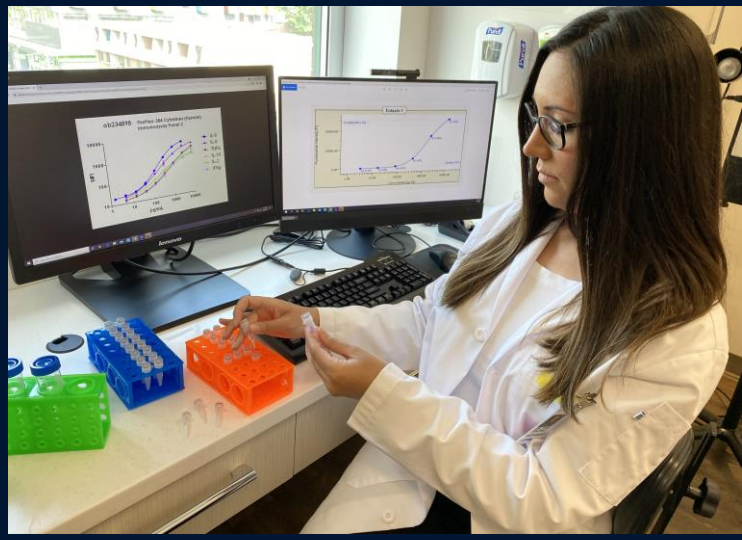
Antimetabolites
azathioprine or AZA
or Imuran
methotrexate or MTX
cellcept or mycophenolate mofetil or MMF
Leflunomide

T-cell inhibitors
cyclosporine or CSA
tacrolimus
Biologics
infliximab or Remicade
adalimumab or Humira
rituximab or Rituxan
tocilizumab or Actemra
certolizumab or cimzia
etanercept or Enbrel
daclizumab or Zenapax
golimumab or Simponi

Alkylating agents
cyclophosphamide
chlorambucil or Leukeran

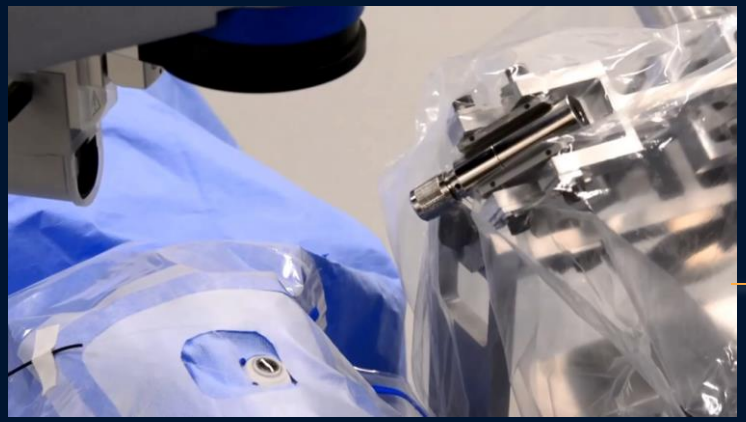
Anti-malarials
chloroquine or Aralen
hydroxychloroquine or Plaquenil


x
y



# 05 Surgical Performance

Enhanced with AI



- **Virtual reality-based simulators**
  (surgical training)
- **Intraoperative guidance**
  (‘smart’ operating microscope)
- **Preoperative planning**
  (artificial intelligence-driven calculations for IOL selection)
- **Deep learning for robotic-assisted surgery**
  (The Johns Hopkins Steady-Hand Eye Robot)

Tina Felfeli

01

Understanding Disease Patterns

using health administrative data

02

Access to Eye Care

with automated and portable devices

03

Resource Planning

using modelling

04

Personalized Treatment Options

using biomarkers and AI

05

Surgical Performance

enhanced with AI

@TinaFelfeli