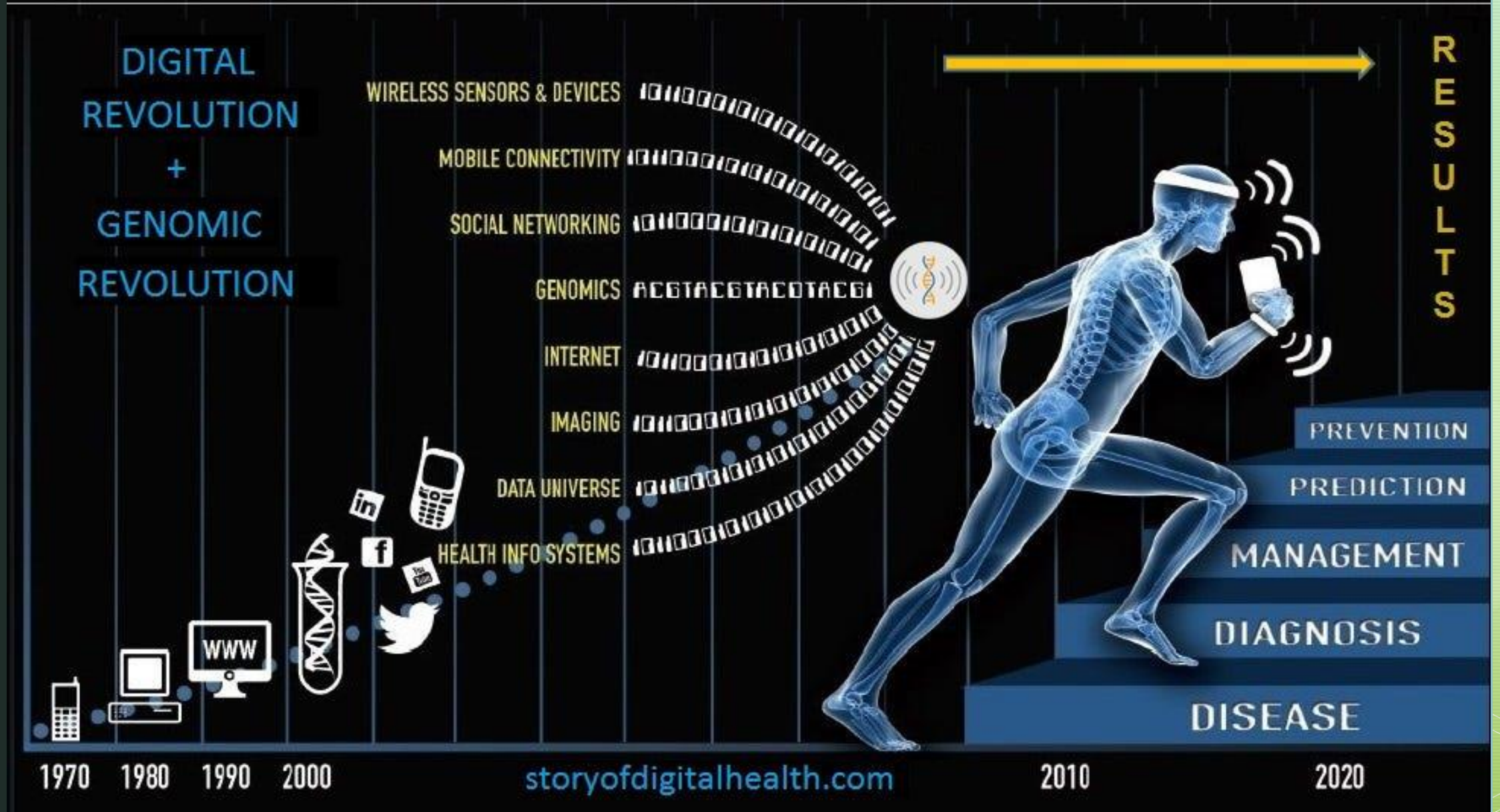
Roseanne Harris

The digital health revolution and what it means for the actuarial role in health risk management

THE DIGITAL HEALTH REVOLUTION

Infographic by Paul Sonnier



Agenda

1. Making sense of data from disparate sources
2. Digital health tools applied to health care
3. Application of analytics for optimal care
4. Risk management applications
5. Regulatory and ethical considerations
6. Key considerations for actuaries to add value to the digital health revolution

Disclaimer

- This presentation includes a number of examples sourced from Discovery Health but is made in my individual capacity and does not reflect the views of my employer. Any errors or misrepresentations are my own.
- My presentation intends to raise points for discussion and does not necessarily provide the solutions!

AI: Helpful aid or existential threat?

1. Making sense of data from disparate sources

Data is an integral part of providing quality healthcare, and enabling efficiency & innovation in health care sector

Bioinformatics

Health Informatics

BIODATA

Genetics | Genome| Metabolism | Nutrition| Lifestyle | Environment | Behaviour

POPULATION DATA

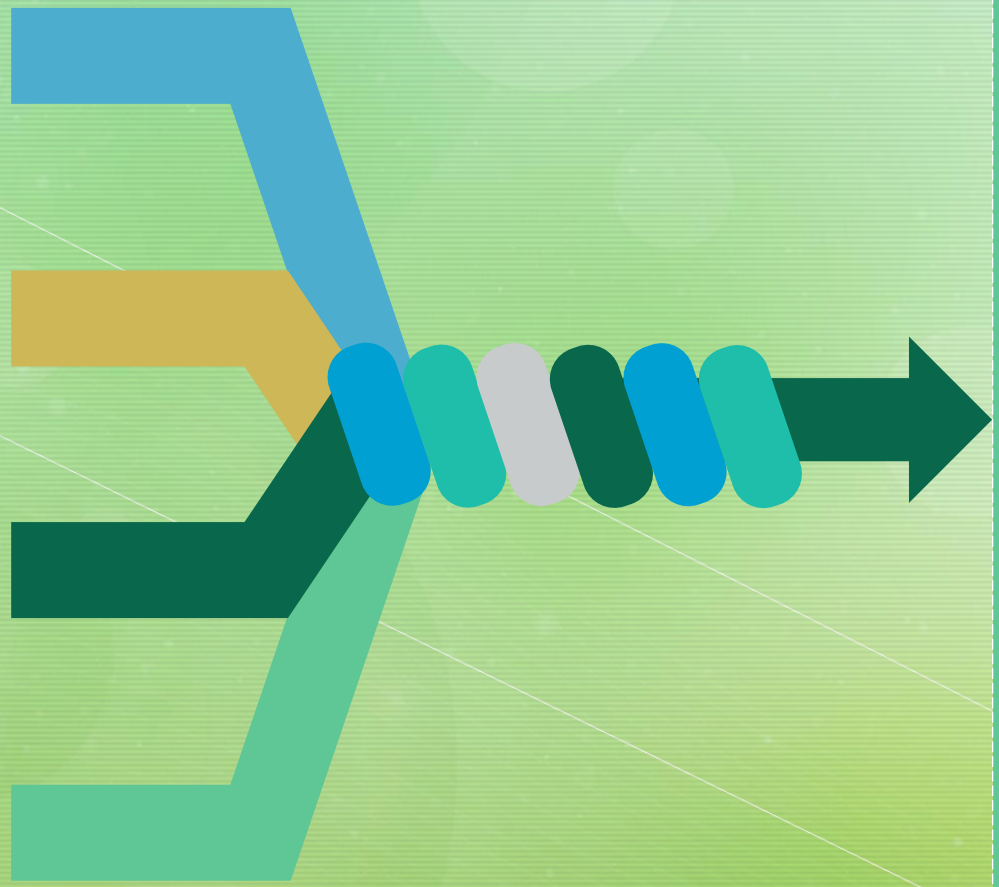
Disease burden | Patient disease registries | Programme enrollment

CLINICAL DATA

Clinical trials | Clinical guidelines | Electronic Health Records | Radiology | Pathology

CLAIMS DATA

Admission rates | Cost per event | Quality ratings | Healthcare utilisation | Claims experience | Patient demographics



KEY STAKEHOLDERS

- PATIENT
- HEALTHCARE PROVIDERS
- RESEARCH & DEVELOPMENT

Data availability – beyond the steps….

Physiological data
- Heart rate
- Blood oxygen saturation
- ECG
- Blood pressure and body temperature
- Electrodermal activity
- Blood glucose

Other data
- Posture
- Fall detection
- Menstrual cycles
- Hydration

Activity and fitness data
- Step counts and distance
- Exercise vigour and duration
- Stairs climbed

Environment and contextual data
- Location
- Weather exposures
- Noise exposure
- UV exposure

Mental health and wellness
- Stress levels
- Mindfulness minutes
- Focus time

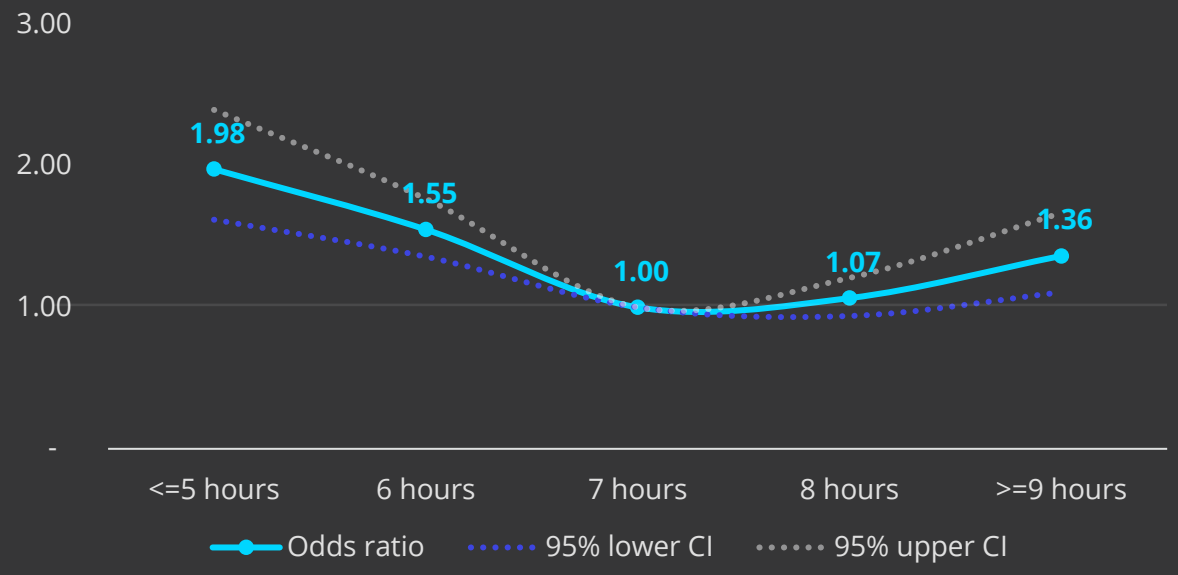
Sleep data
- Sleep stages
- Sleep duration and quality
- Sleep interruptions

The power of sleep

Discovery Health: 225 000 members generated
25 million sleep event data points in 2024

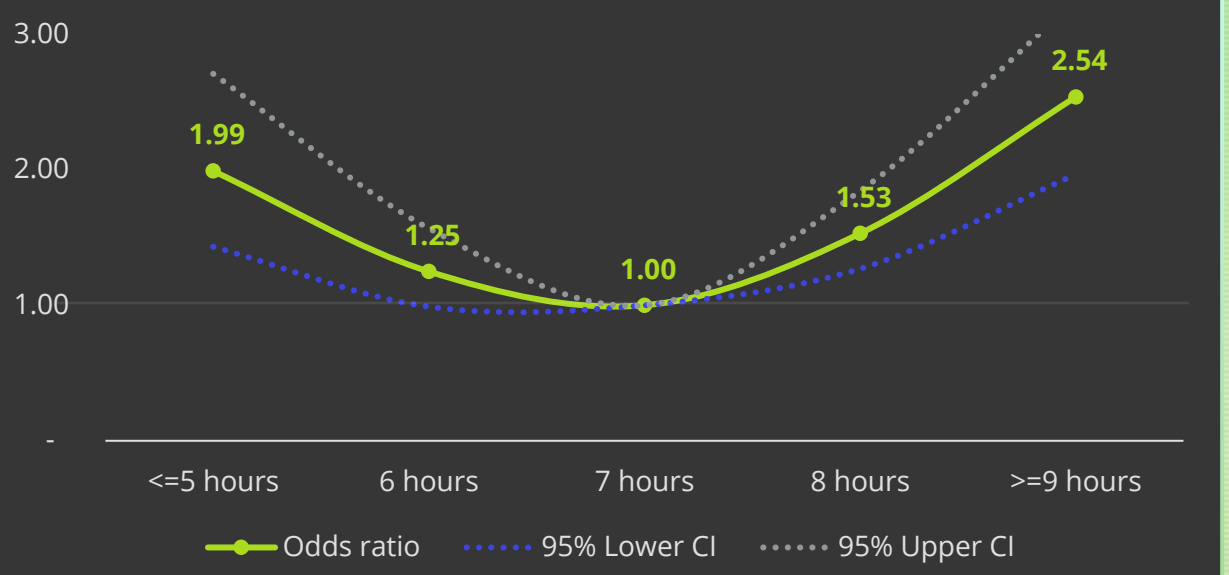
The complex relationship between sleep and mental health severity within the mental illness population

Odds of Having a Moderate to Severe PHQ-9 Test by Hours Slept



Members who sleep 5 hours or less have a **98% higher** risk of having moderate to severe depression compared to those who sleep 7 hours

Odds of Having a Mental Health Admission by Hours Slept



Members who sleep 5 hours or less have a **99% higher** risk of being admitted for a mental health condition compared to those who sleep 7 hours

By further understanding the relationship between sleep duration and depression severity, we can enhance preventive strategies, incentivise good sleep behaviour, and potentially achieve cost efficiencies in the mental health space.

Bringing together structured and unstructured data

Operational Process of Treatment Request
- Work through pages of guidelines
- Benefit availability
- Latest results from clinical studies

Protocols (386 Pages)

South African Oncology Consortium Guidelines

Protocols (333 Pages)

ICON 2025 CLINICAL PROTOCOLS

Benefit coverage

Specialised Appropriate Referral for treatment

Hello! How can I help you today?

Question: What is the recommended number of treatment cycles for Keytruda (Pembrolizumab)?

Answer

According to the provided guidelines, for:

- **Metastatic non-small cell lung carcinoma (NSCLC)**, treatment with Pembrolizumab should continue until disease progression or a **maximum of 35 cycles**.
- **Advanced or recurrent endometrial carcinoma,** treatment with Pembrolizumab in combination with Lenvatinib should continue until progression.
- **Persistent, recurrent, or metastatic cervical cancer**, treatment with Pembrolizumab with or without Bevacizumab should continue until progression or a **maximum of 35 cycles**.
- **Adjuvant treatment of patients with melanoma**, treatment with Pembrolizumab should continue until disease progression or a **maximum of 17 cycles**.
- **Unresectable or metastatic melanoma**, treatment with Pembrolizumab should continue until progression or a **maximum of 35 cycles.**

These guidelines are from the **South African Oncology Consortium.**

Broad applications of electronic health records

- Patient demographics
- Medical history
- Medications
- Progress notes
- Vital signs
- Progress notes
- Vital signs
- Laboratory results
- Treatment plans
- Clinical documentation
- Communication records

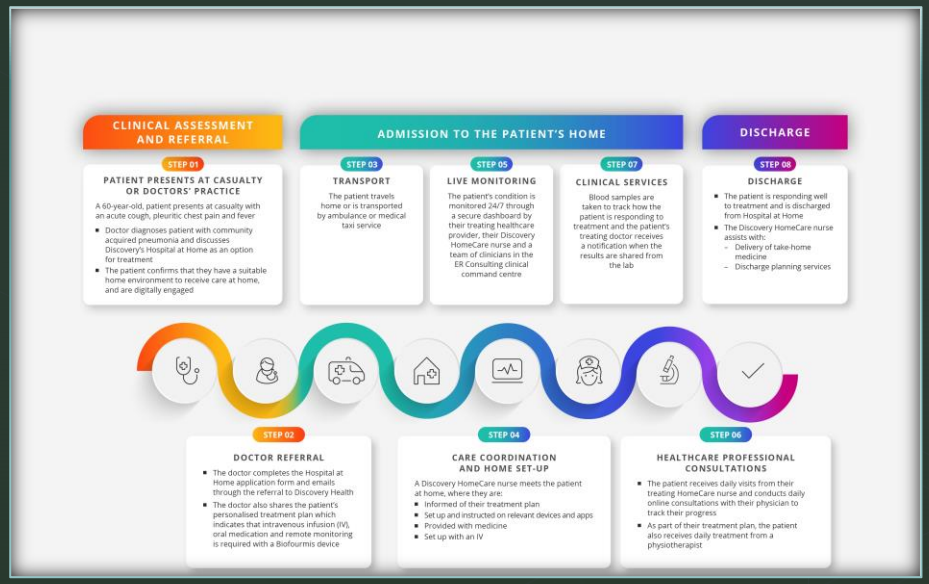
Data is just the raw material. Insight is the product

For the patient

For broader societal benefit

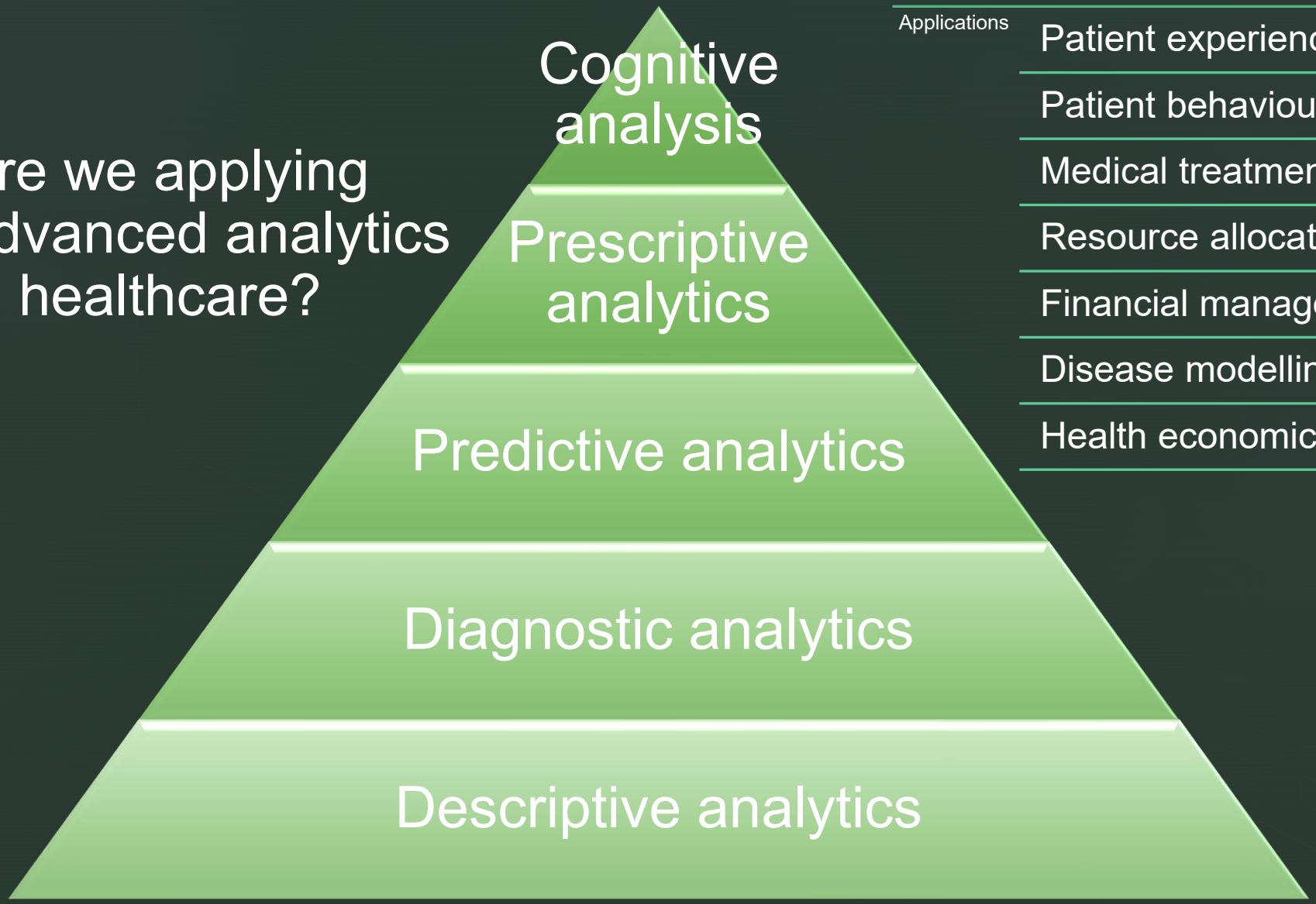
Interoperability – a key enabler for unlocking value

Remote monitoring of patients at home



- Clinical benefits
- Patient-centred benefits
- Health system benefits
- Data-driven care

Are we applying advanced analytics in healthcare?



Applications
Patient experience
Patient behaviour
Medical treatment
Resource allocation
Financial management
Disease modelling
Health economics

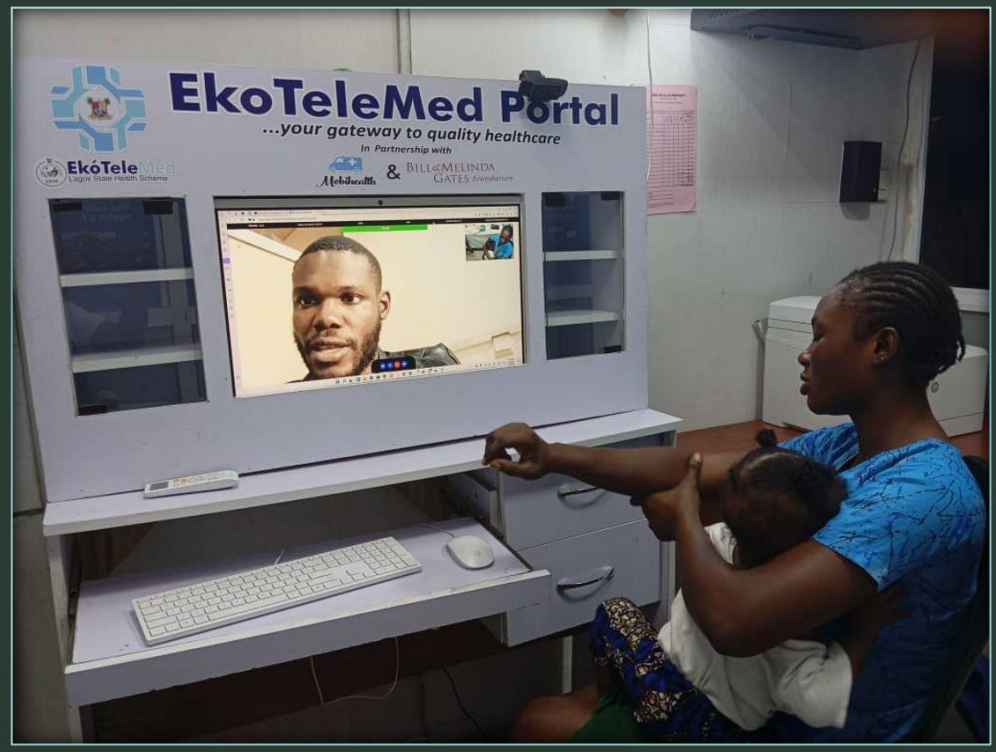
Siriram & Harris (2024) Applications of Advanced Analytics in Healthcare, SAAJ
https://www.actuarialsociety.org.za/assa-news/sa-actuarial-journal-and-articles/#1639404279290-f3b87ba8-42f7

Expanding the reach of care

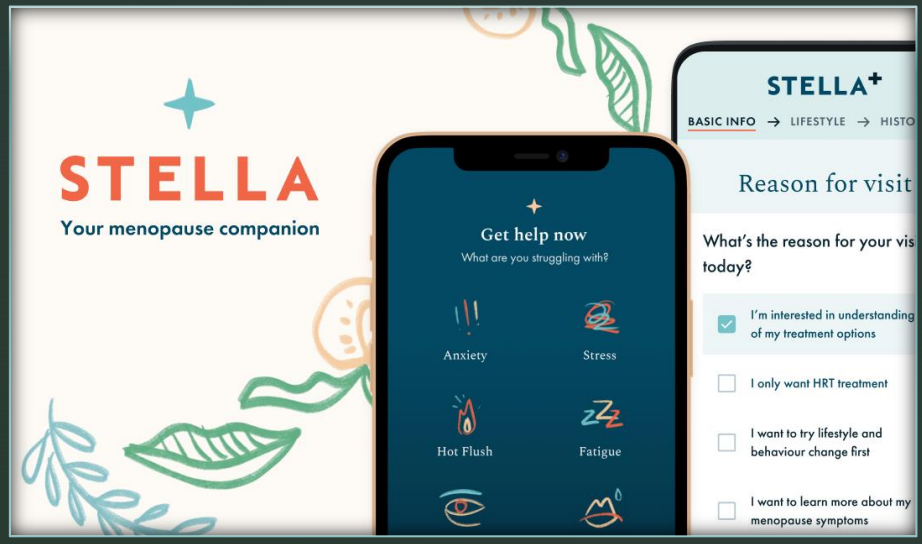
2. Digital tools for expanding access

Telemedicine improving access to care

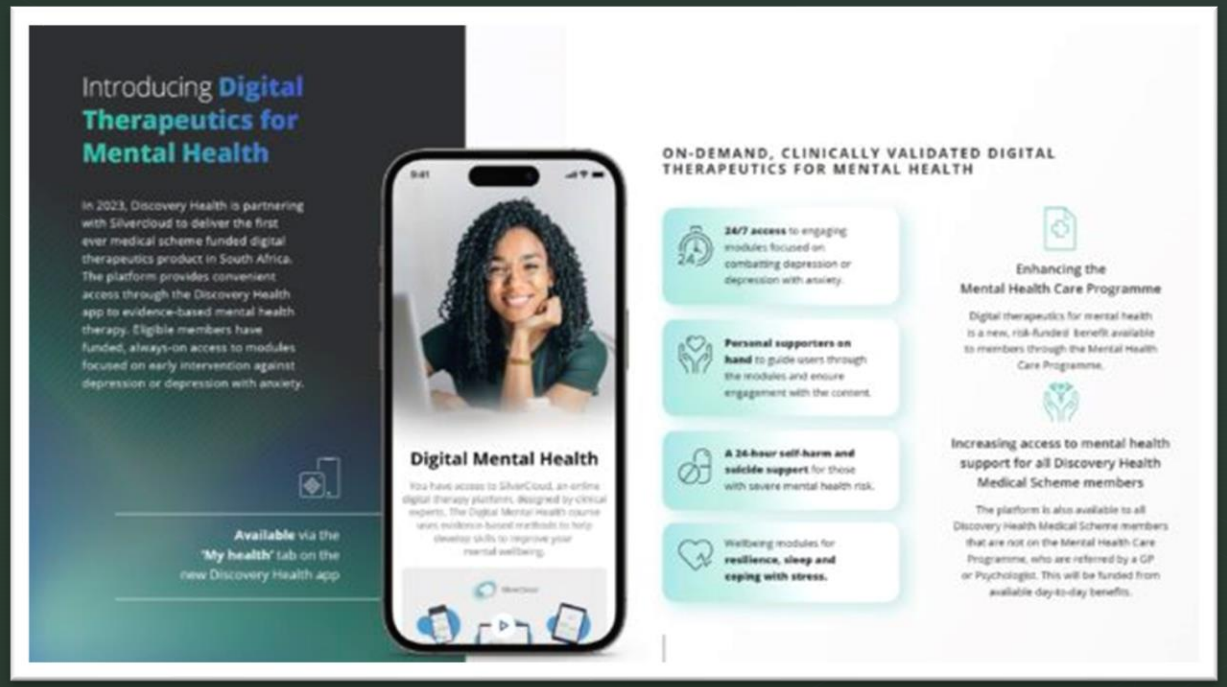
- Reaching rural areas which lack access
- Removing barriers such as transportation costs
- Improved outcomes because of the accessibility of follow-ups
- Access to specialist care not otherwise accessible
- Challenges to overcome:
  - Awareness
  - Connectivity
  - Infrastructure
  - Digital devices



Since its launch in 2017, Mobihealth has impacted thousands of lives, connecting patients with doctors and healthcare professionals across Nigeria and beyond.



- Tailored, real-time interventions
- Accessibility and scalability
- Continuous monitoring and feedback
- Patient engagement
- Data driven insights
- Risks:
  - Privacy and data security
  - Digital divide
  - Clinical evaluation concerns
  - Over-reliance and interpretation
  - Integration



Applying cost effectiveness analysis to new technology

$$\text{ICER} = \frac{\text{Cost of new intervention} - \text{Cost of comparator}}{\text{Effectiveness of new intervention} - \text{Effectiveness of comparator}}$$

- **Cost**: Total costs associated with the intervention (e.g., software, hardware, training, maintenance).
- **Effectiveness**: Measured in QALYs (Quality-Adjusted Life Years), DALYs averted, or other health outcomes.

Adapting the ICER to be iterative and context aware

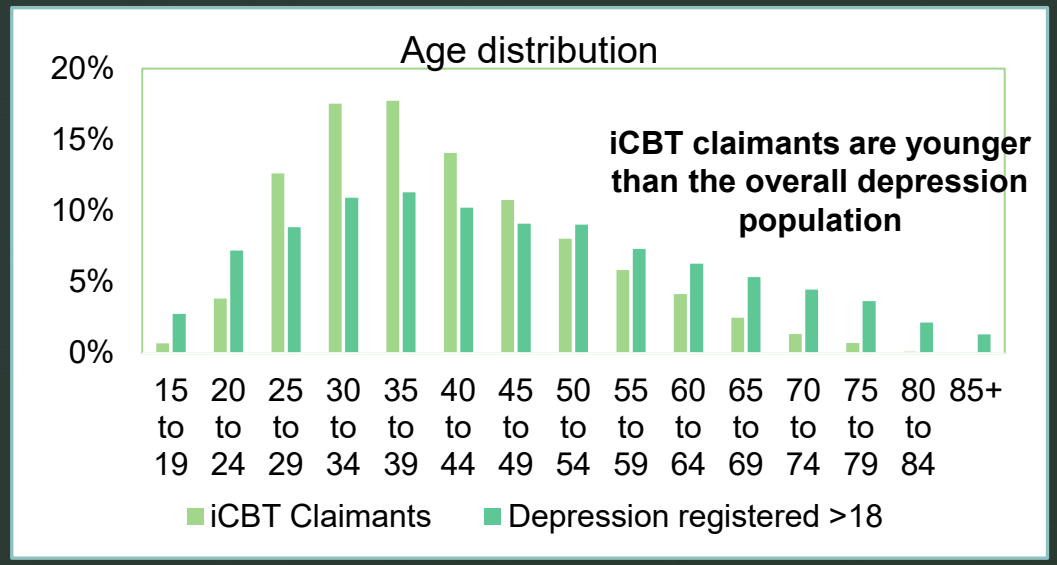
- Broader elements included
  - Convenience and accessibility
  - Equity impacts e.g. reaching underserved populations
  - Real world evidence from observational studies
  - Regular re-assessment as evidence develops
  - Consider digital literacy barriers
  - Scale effects on cost as adoption increases
- Multi-criteria decision analysis (MCDA) to weight additional factors

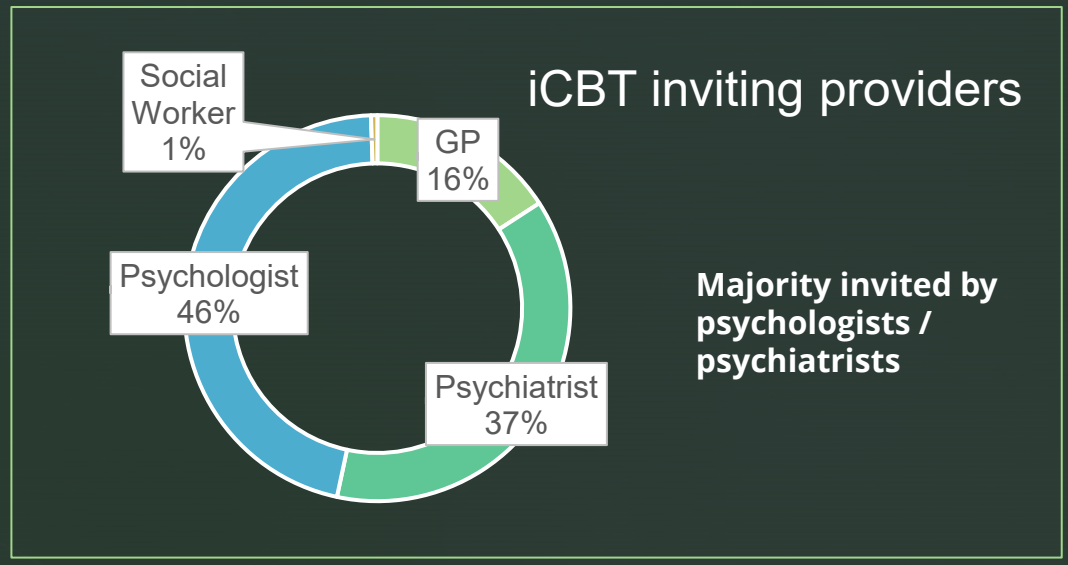
Examples:

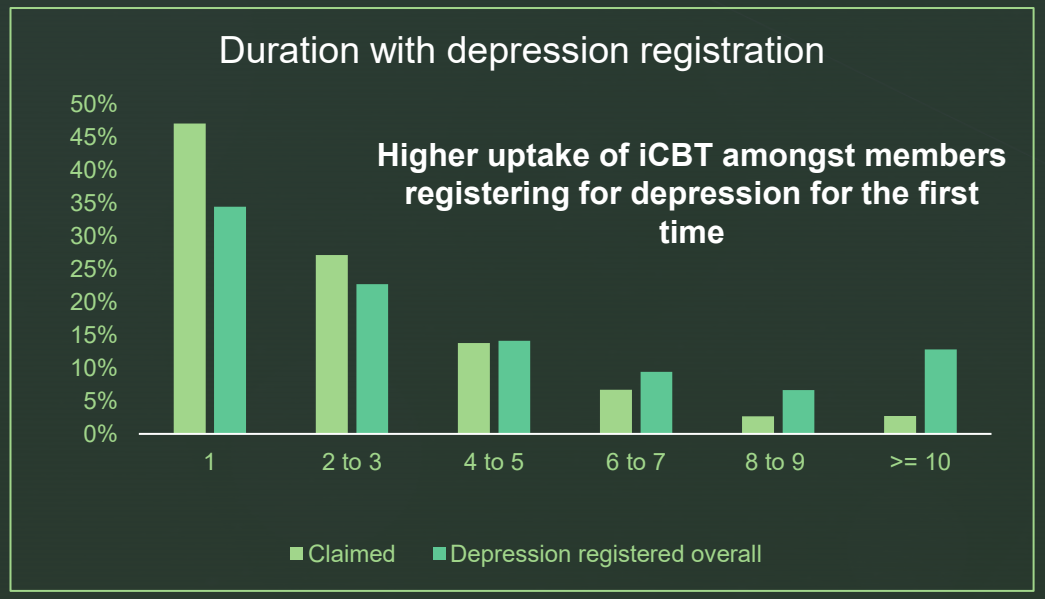
- NICE in the UK has adopted a tiered evidence standard for digital health tech
- Germany has a DiGA fast-track
- CADTH (Canada) includes real-world data and patient involvement
-

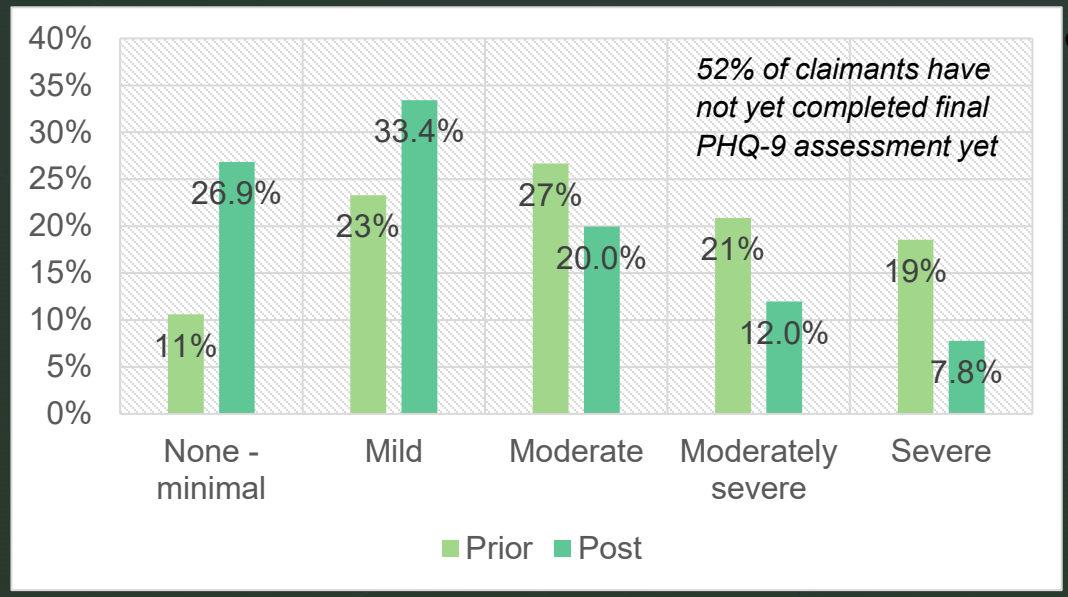
Internet based cognitive therapy (iCBT) uptake is on the rise –who is taking this up, and who is being left behind and how do we monitor for effectiveness?

Source: Discovery Health, South Africa



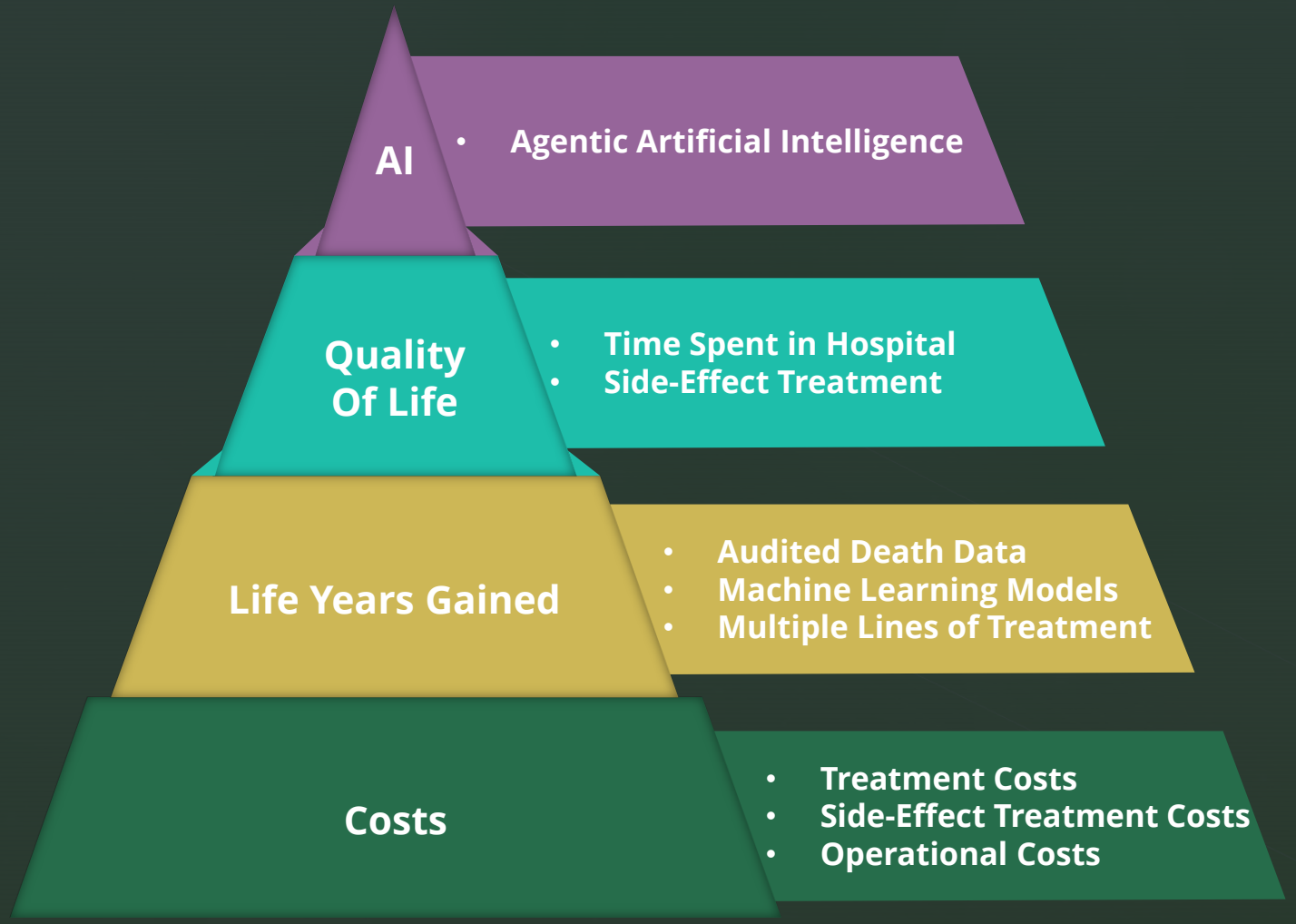






on

Cancer treatment support tool



Leveraging AI, ML and real-world data, to transform Cancer care and optimise efficiency in treatment
→ improved outcomes

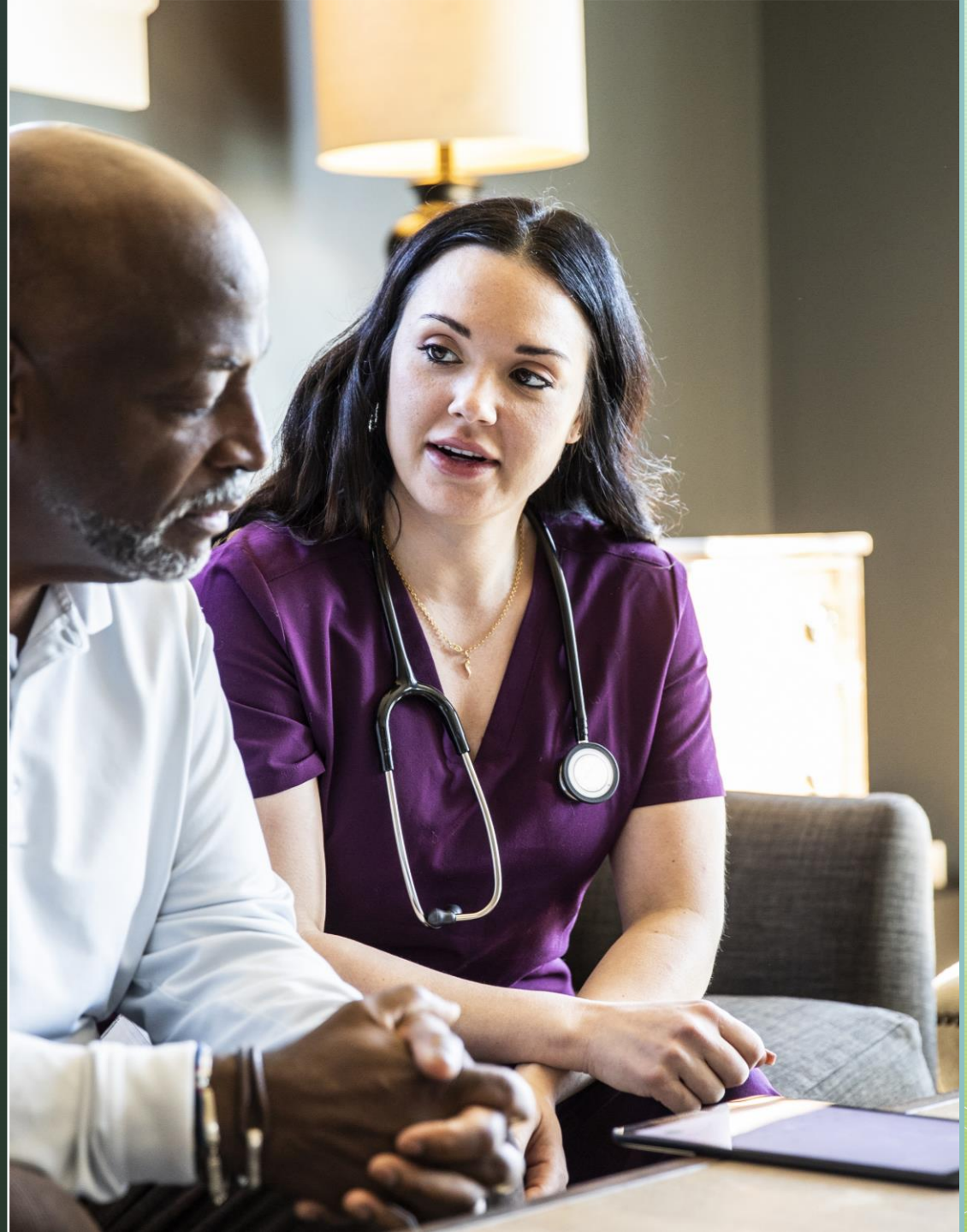
Endorsement: ICON/SAOC, Cancer research conference (Boston), Qorus awards submission

Personalized medicine and beyond

3. Applications of analytics for optimal care

Data analytics supporting personalized medicine

- Identifying individual risk factors
- Tailoring treatments based on genetics
- Monitoring and adapting care in real-time
- Improving diagnosis accuracy
- Decision support for clinicians
- Nudging behaviour change



Personal Health Pathways provide personalised next best actions for each member using advanced machine learning and data science

HEALTH DATA

CLINICAL DATA
Family History | Chronic Conditions | Medication | Doctor Visits| Admissions

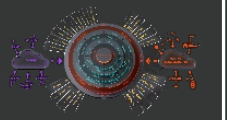
LIFESTYLE DATA
Exercise | Sleep | Nutrition

BEHAVIORAL DATA
Engagement | Propensity | Resilience | Intervention Response

EVIDENCE-BASED CLINICAL EXPERTISE

POPULATION HEALTH MANAGEMENT

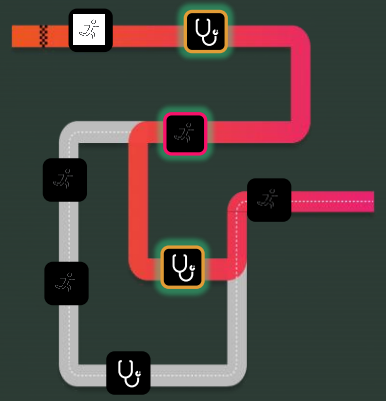
HEALTH PATHWAYS



CLINICAL GUIDELINES

LIFESTYLE AND BEHAVIOUR INSIGHTS

PERSONAL HEALTH PATHWAYS



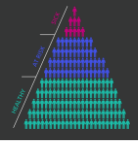
Personalised and dynamic health care pathways which adjust to the member's unique health status, behaviour and needs as the member engages in their actions

ENABLED BY ADVANCED MACHINE LEARNING AND DATA SCIENCE CAPABILITY

PERSONALISED RISK ALGORITHM

ACTUARIAL, RESONANCE & HABIT OPTIMISATION

PERSONALISED PATHWAYS



NEXT BEST ACTIONS

Extending the actuarial role

4. Risk management applications

Where should we be applying these tools?

- Underwriting
- Claims management
- Risk assessment

Risk selection

Applications in underwriting

Risk assessment and profiling

Automated decision making

Predictive modelling

Fraud detection

Dynamic pricing

Risks and ethical concerns

Bias and discrimination (“Black box” decision making)

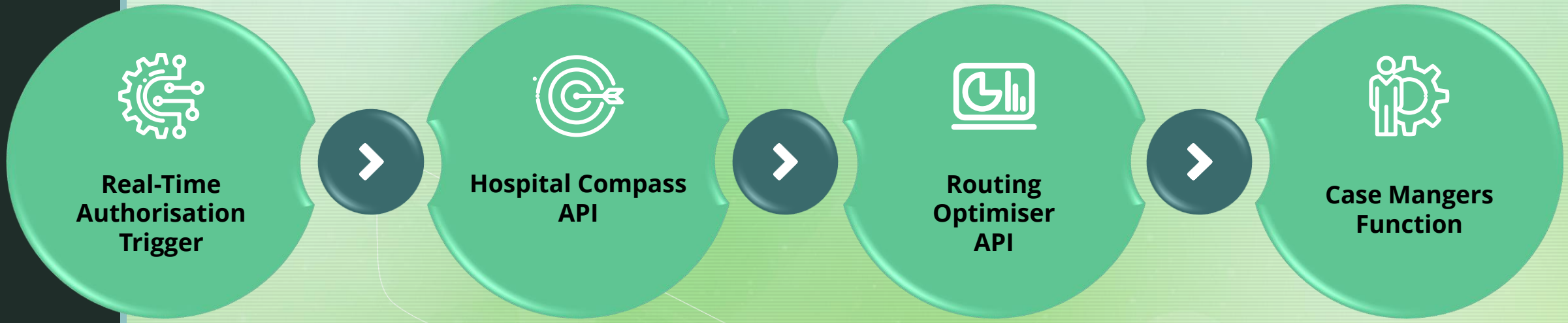
Privacy and data security

Rapid deployment may outpace regulatory frameworks

Over reliance on automation

Claims management application – concurrent review

Implementation of intelligent models for precision, efficiency and optimised admission management



Real-Time Auth

- Hospitals Submit Update/Re-Authorisation: via B2B or manual capture
- Information validated: Benefit Check/Provider Validation Rules
- Triggers Hospital Model

Personalised Length of Stay

- Dynamic LOS/LOA Benchmarking
- Update LOS/LOA: approves and closes processes when cases do not exceed Compass AI prediction
- Case Routing: routes cases exceeding Compass AI predictions to case managers for review

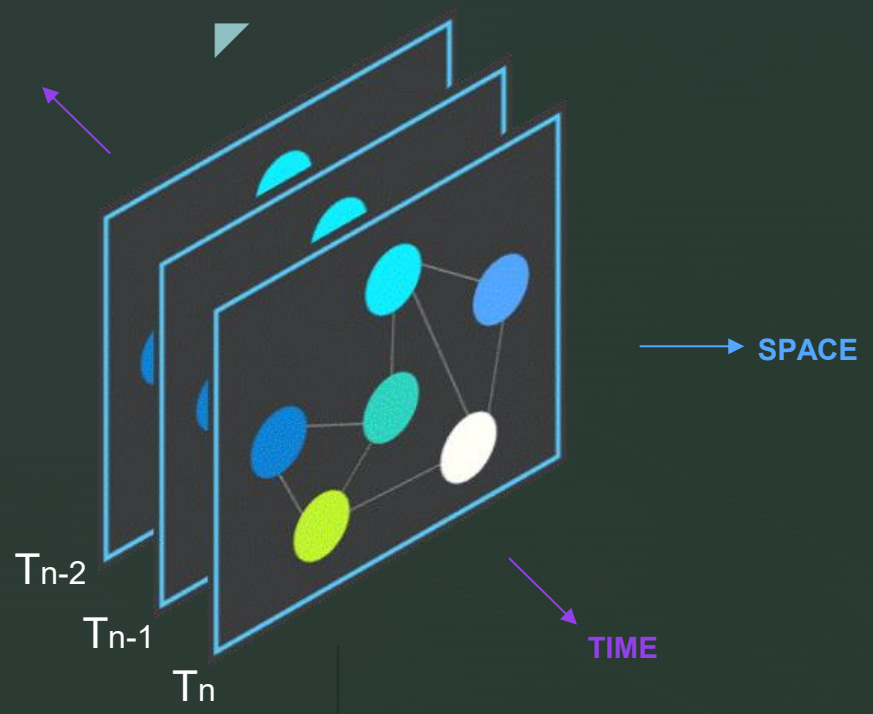
High-Value Ranking

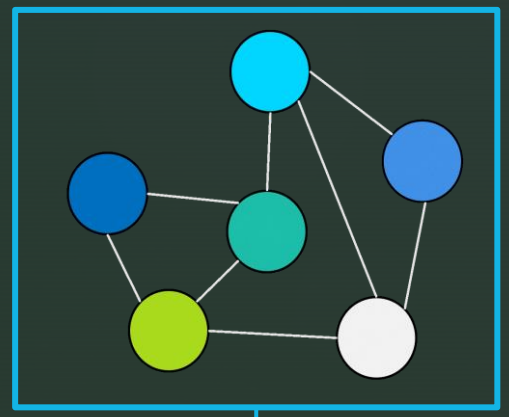
- Case Ranking: ranks cases (HCD, Outlier Providers etc.), based on probability of intervention, expected savings case and time required for review
- Workflow Efficiency: reduces administrative burden by ensuring that necessary cases reach case managers

Intervention on High-Value Cases

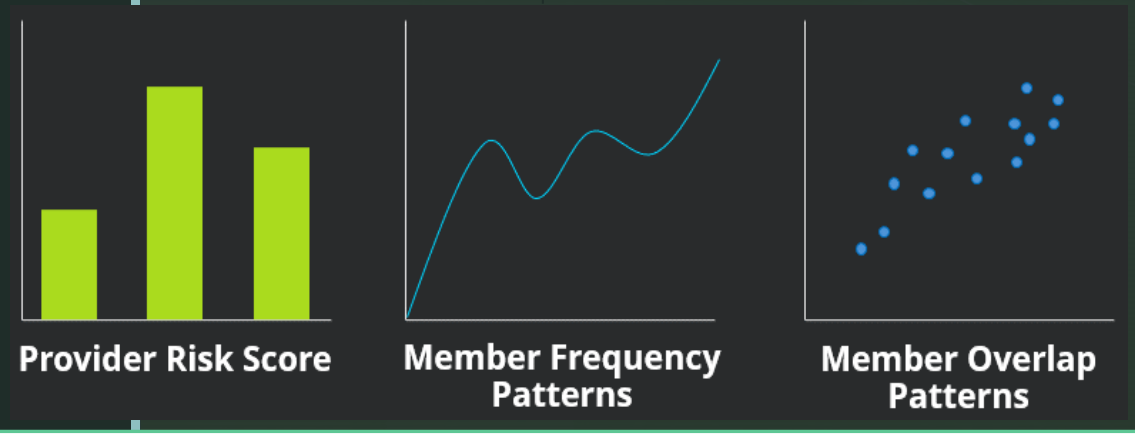
- Case managers will review cases based on the ranking provided by the Routing Optimiser and finalise the case accordingly on DCS platform

Forensics application: Using spatial temporal modelling to detect syndicates

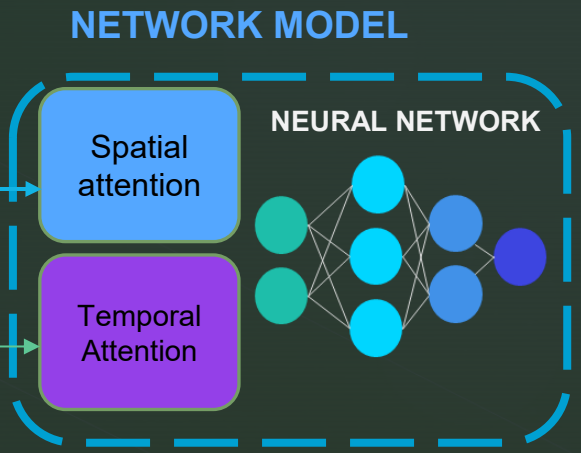




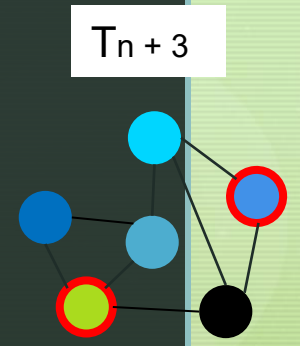
Members play a large part in fraud, knowingly or unknowingly. By considering member movement , before and after fraud detection, we can find new providers linked to fraudulent syndicates



By learning the change in risk metrics and claiming behavior over time , prior to fraud detection, allows for us to flag practices that are at risk of committing fraud in the future.

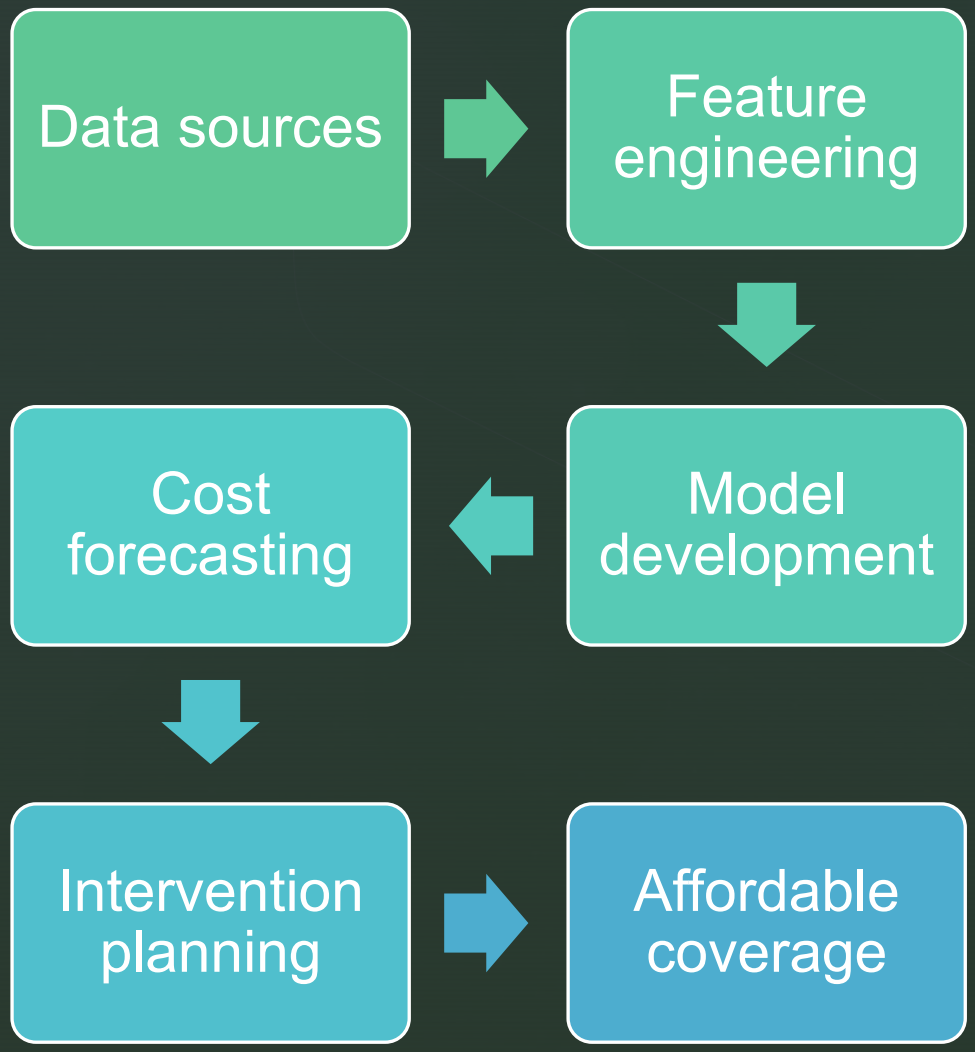


PARAMETERS: 9.43B
+30% LIFT IN ACCURACY VS OTHER ALGORITHMS



Given the spatial and temporal information, future fraudulent providers are predicted

Forecasting and reserving



The battle of the algorithms

The use of processing algorithms by insurers has spawned the development of claiming algorithms (and denial appeals) to optimize claim coverage

Is this market efficiency?

https://www.cityviewnc.com/stories/counterforce-health-an-nc-based-company-uses-ai-to-fight-health-insurance-denials/

Extending the actuarial role

5. Regulatory and ethical implications

Ethical considerations and governance

- Promoting ethical practices
  - Ensuring ethical considerations are inherent in risk assessments and organizational decisions
  - Considerations for use of data
  - Avoiding bias
- Strong governance frameworks
  - Actuaries' role in establishing transparent and compliant governance structures

Regulatory frameworks for personal data protection

Data protection principles	User rights	Legal basis	Security requirements	Accountability
Transparency and purpose limitation	Right to access data and portability	Consent and contractual necessity	Risk based controls and impact monitoring	Record keeping requirements
Collect only what's necessary and keep it secure	Right to be informed and object	Legitimate interests, compliance	Breach notification	Regulatory enforcement and penalties

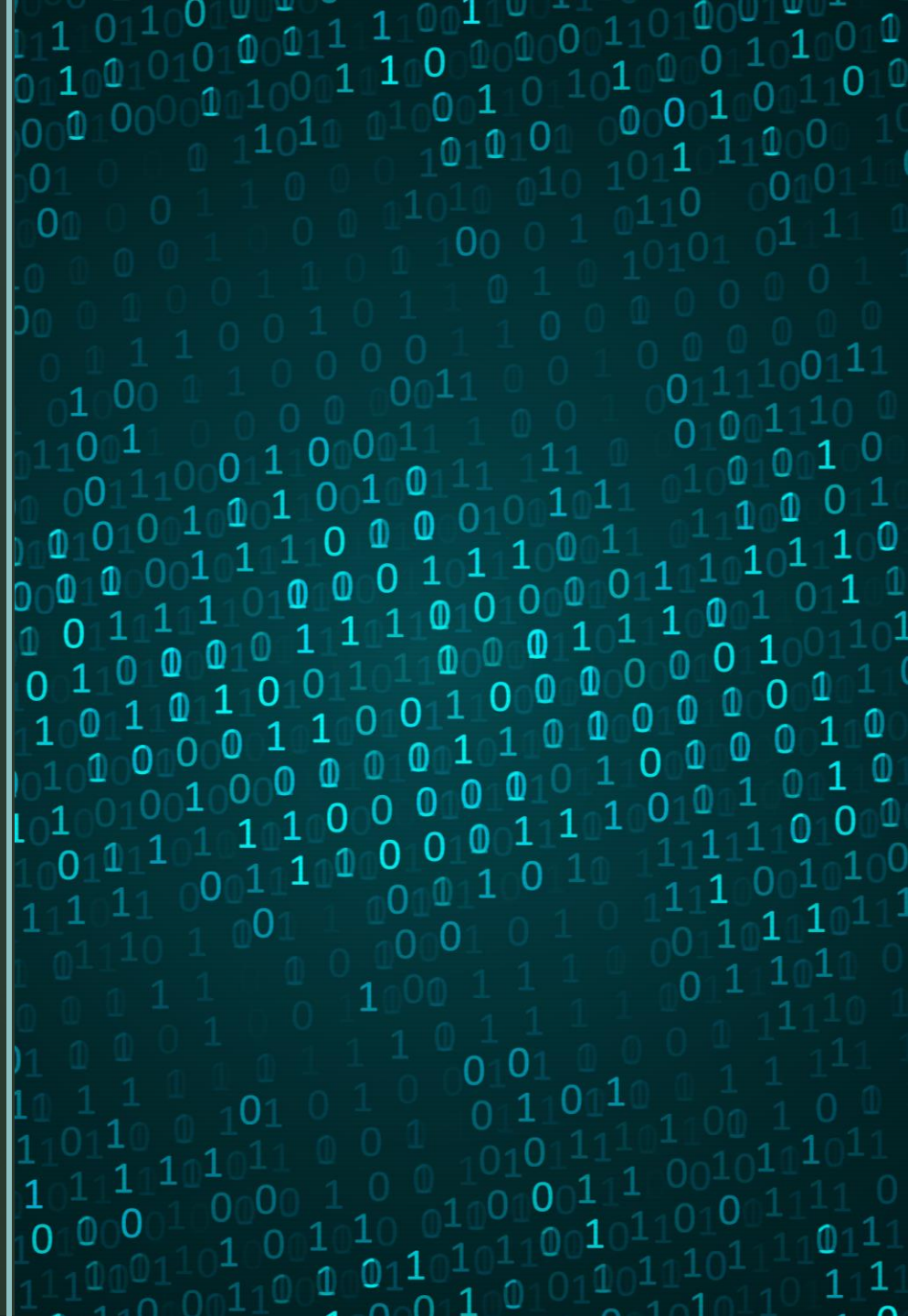
AU **Australia**	Privacy Act 1988
ZA **South Africa**	Protection of Personal Information Act (POPIA)
EU **European Union**	General Data Protection Regulation (GDPR)
US **United States**	HIPAA, CCPA/CPRA (California), others
BR **Brazil**	Lei Geral de Proteção de Dados (LGPD)
IN **India**	Digital Personal Data Protection Act (DPDP)
CA **Canada**	PIPEDA (Federal), with provincial laws
GB **United Kingdom**	UK GDPR
JP **Japan**	Act on the Protection of Personal Information (APPI)
KR **South Korea**	Personal Information Protection Act (PIPA)

The professionalism part

6. Key considerations for actuaries to add value to the digital health revolution

Current role of actuaries

- Traditional responsibilities
  - Risk assessment and pricing
  - Financial modelling and forecasting
- Now evolving to encompass broader roles in risk culture
- Current challenges
  - Managing vast amounts of data
  - Navigating regulatory challenges
  - Adapting to rapid technological advancements



The evolving role of actuaries

Traditional actuarial role

Risk quantification

Solvency and financial metrics

Data analysis and forecasting

Future actuarial role

Risk culture leadership

Leading cross functional risk teams

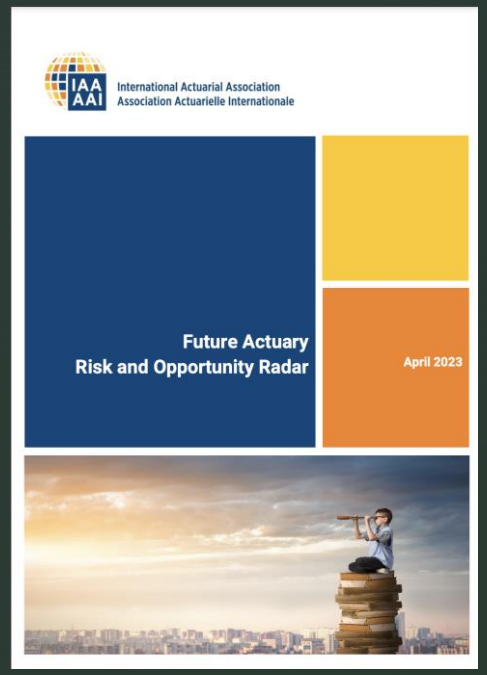
Broader risk assessment (including operational, reputational, strategic)

Holistic risk identification and mitigation

Scenario analysis and stress testing

Advanced predictive modelling techniques

The actuarial skillset of the future



Core skills - statistical analysis, financial modelling, risk quantifications

Systems thinking to understand interdependencies

Behavioural science to understand decision making that affects risks

Communication for strategic inputs

Some thoughts on the actuarial role in the digital health revolution

São Paulo 2025

- Disparate data sources require careful assessment
- Digital tools provide exciting opportunities for expanding access but need robust evaluation
- Holistic risk management to ensure optimise access, include rather than exclude, and nudge effectively
- Navigate regulatory and ethical challenges by considering proportionality and exercising professional judgement