

Technology Challenges & Opportunities

The why and how of digital transformation in health

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New Zealand Health Strategy

Smart system
Access to up to date information enables a learning system where insights are identified from the data to improve performance and effectiveness.

One team
A single source of accurate and up to date information enables a learning system where insights are identified from the data to improve performance and effectiveness.

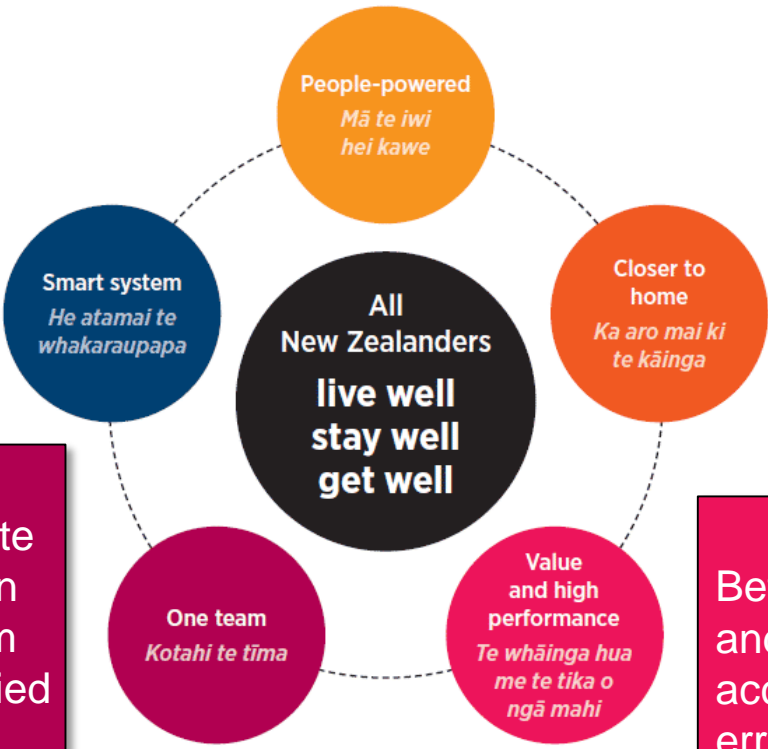
People-powered
Access to reliable information enables health consumers to have an active role in managing their health and more convenient engagement with the system.



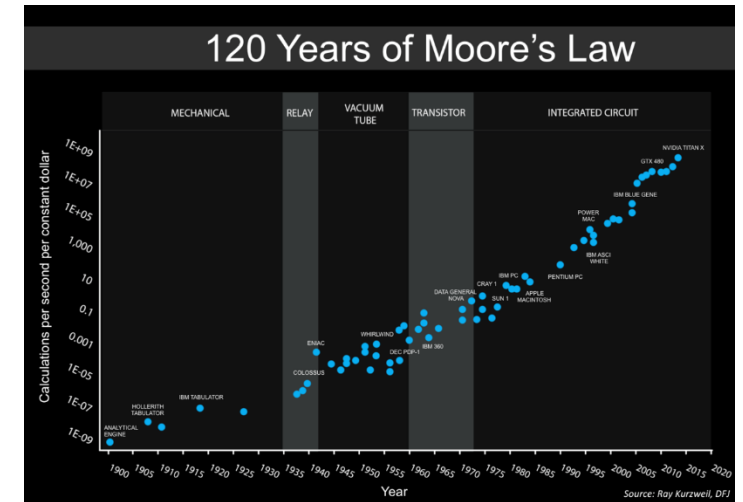
All New Zealanders **live well, stay well, get well**, in a system that is **people-powered**, provides services **closer to home**, is designed for **value and high performance**, and works as **one team** in a **smart system**.

Closer to home
Interaction with health professionals relies on remote access to accurate information, for example, video conferencing and remote monitoring.

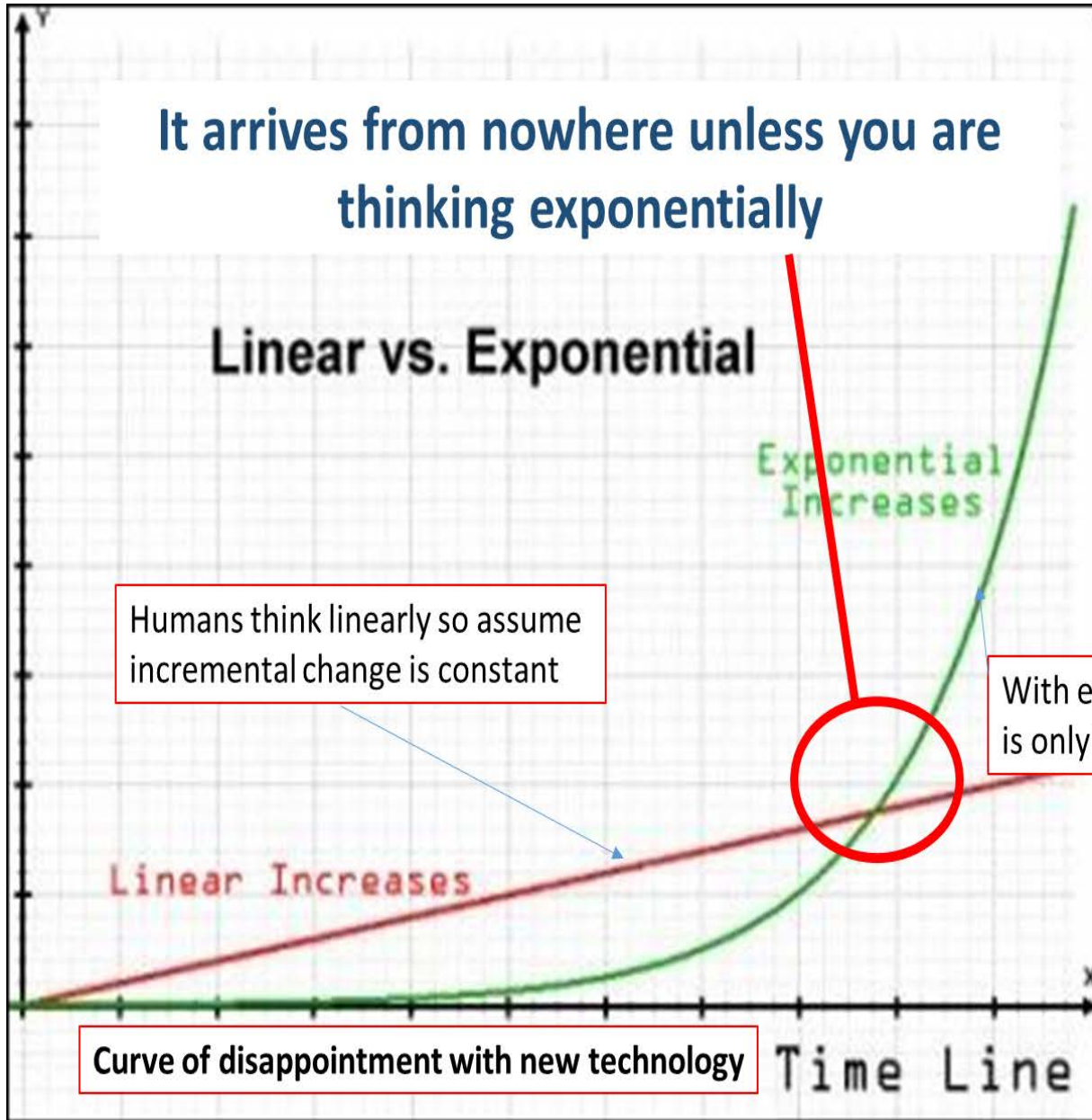
Value and high performance
Better clinical decision making and care coordination based on accurate information prevents errors, improves quality and reduces wasted time leading to higher productivity.



Introduction



- We are in the midst of the 4th revolution of human kind
- The pace of change across society is unprecedented
- Aim to today is to encourage you to embrace the change and get involved



2013

2017- Christchurch



With exponential change the second to last step is only $\frac{1}{2}$ way there

Due NZ this year

Dubai 2017



Passenger-carrying drone to fly in Dubai

JON GAMBRELL
Last updated 08:10, February 14 2017

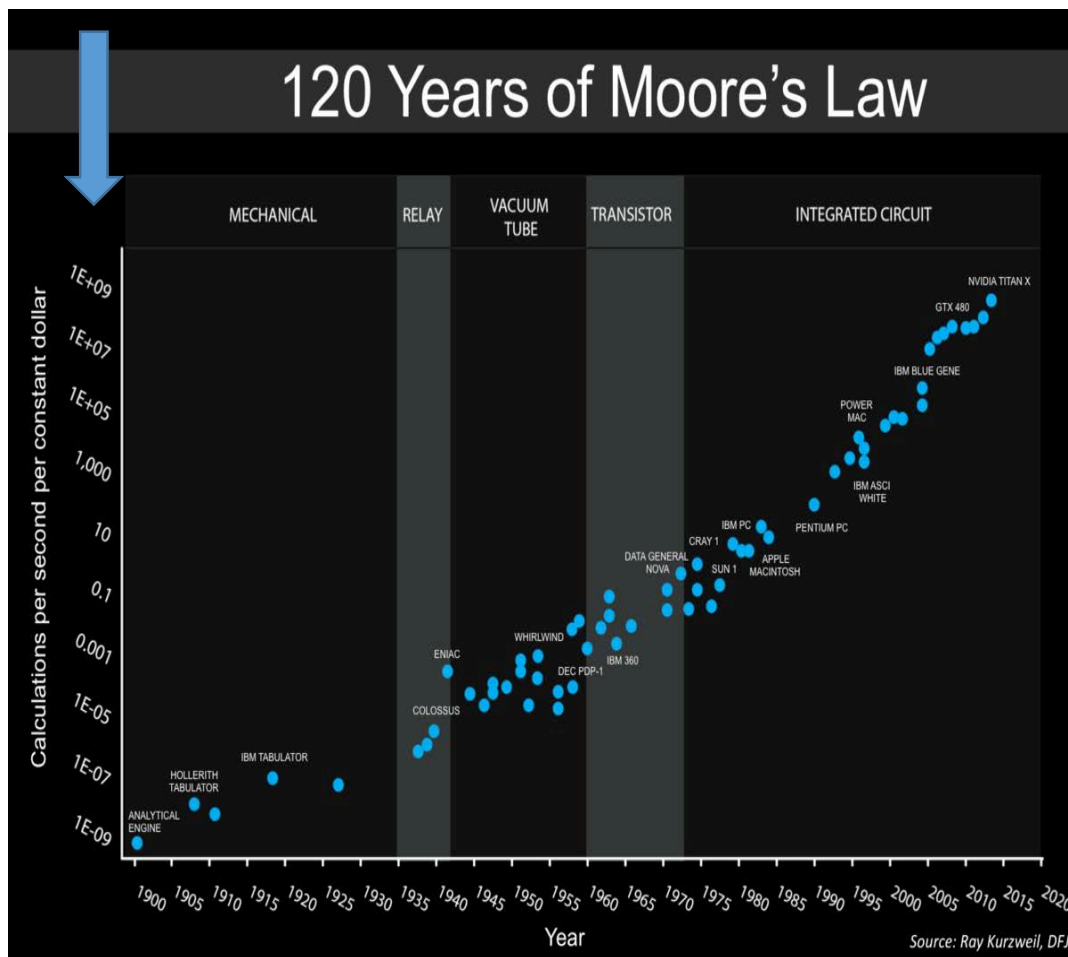



So Why?

Digital transformation


Every 18-24 months **power doubles** and **cost halves**

Exponential change also occurs when technology comes to analogue process






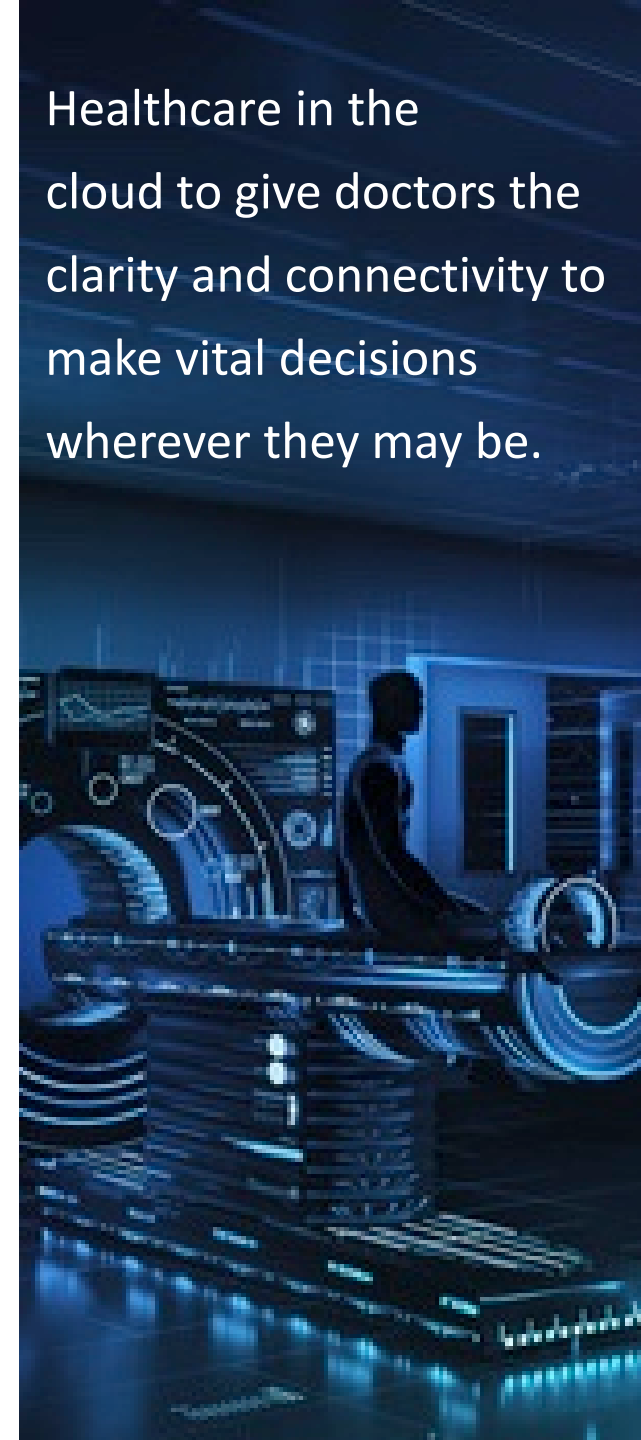
Wind turbines that speak to each other so they harness the most from nature



Planes that manage their own maintenance so passengers take off on time



Locomotives that travel on data-driven, fuel-efficient control systems

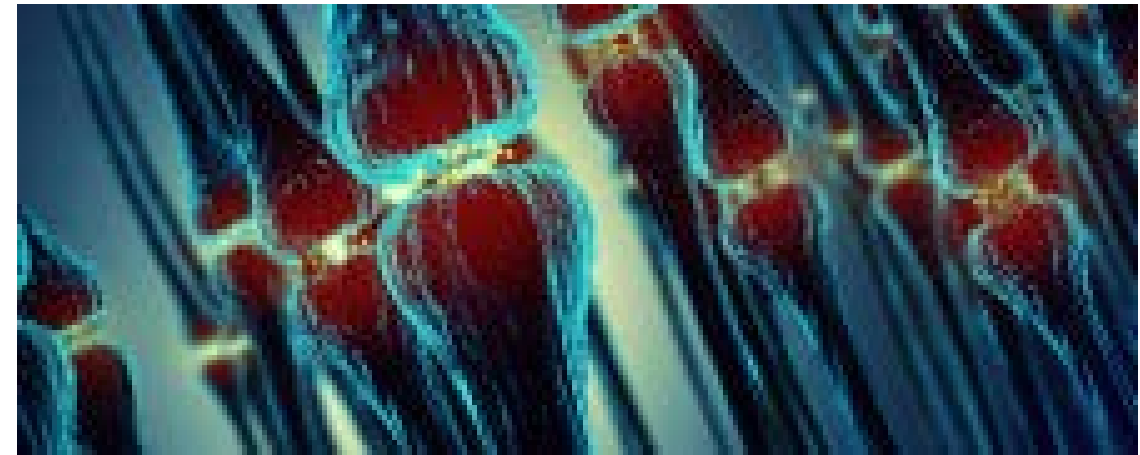
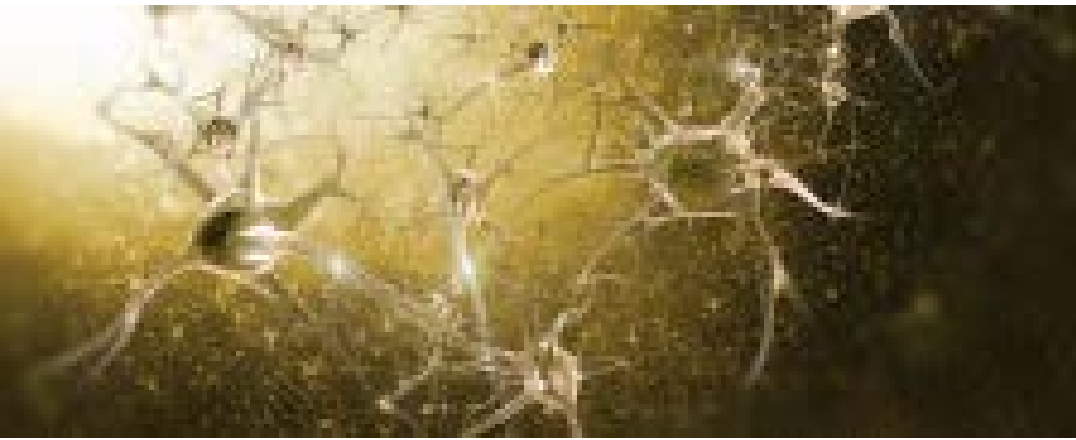
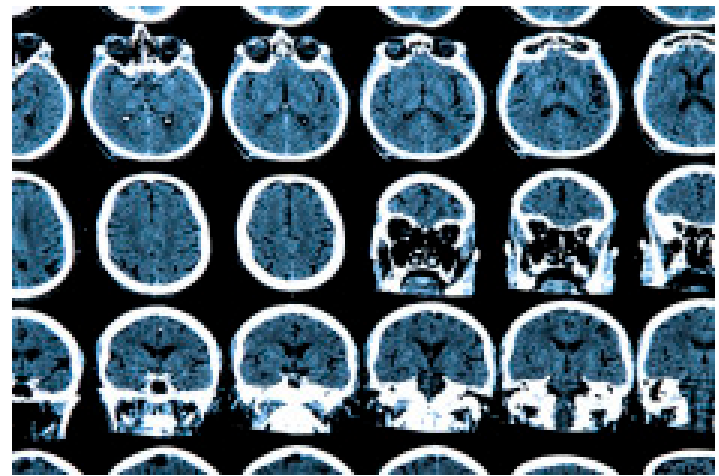


Healthcare in the cloud to give doctors the clarity and connectivity to make vital decisions wherever they may be.



Singularity University

- Bugs as Drugs
- Hacking the Brain
- Artificial Intelligence



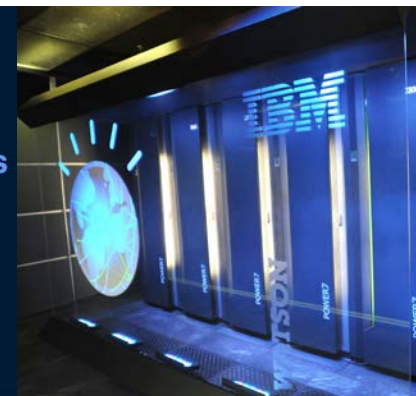
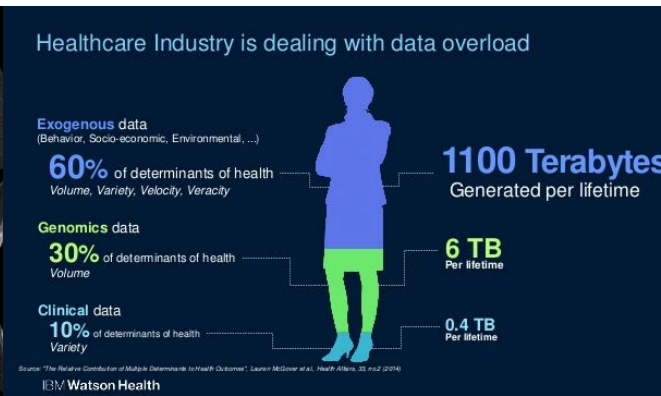
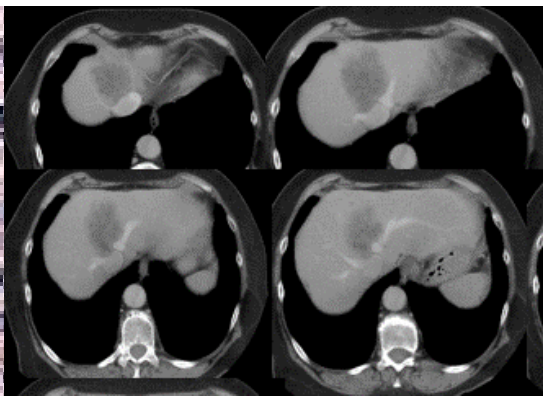
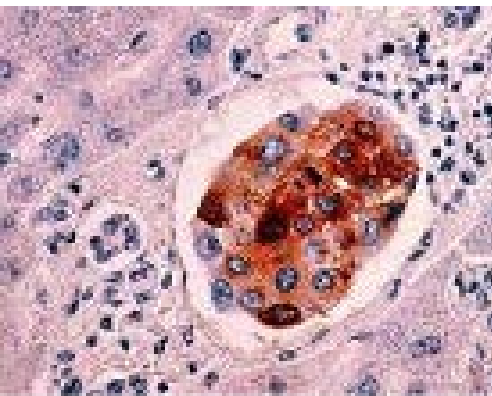
How it works Pricing BU

The country's best doctors, supported by the world's most advanced AI

Register

Virtual GP and specialist visits:
Babylon is across NHS

Automation of diagnostic reporting is starting to
be commercialised



Buddy bots help lung patients

Machines monitor breathlessness and medicine use

The New Zealand Herald 26 Mar 2018 Jamie Morton

Robots can help Kiwis to manage a nasty lung disease. In the latest trial of healthcare robots, researchers observed how cute iRobi bots reminded patients with chronic obstructive pulmonary disease (COPD) to take their medication and exercise.

The study, published in the Journal of Medical Internet Research, aimed to investigate if machines help patients rehabilitate at home — something that had potential to boost quality of life and slash hospital readmission.



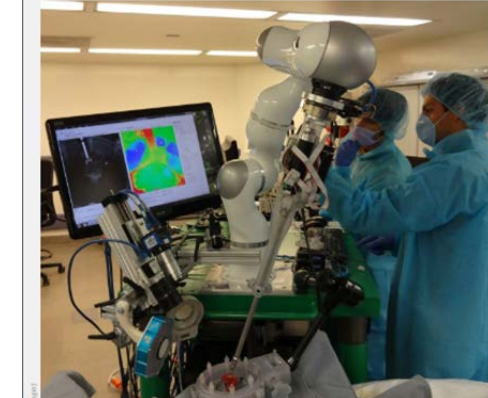
In NZ: robots @ home to
improve compliance with
COPD Rx.
Starting to leverage IoT

Technical specialties are not exempt

First autonomous robot to operate on soft tissue outdoes human surgeons

New surgical robot beat out human doctors at stitching up guts of living pigs.

BETH MOULDER 5/10/16, 5:55 AM



SEDASYS® Computer-Assisted Personalized Sedation System - P080009

This is a brief overview of information related to FDA's approval to market this product. See the links below to the Summary of Safety and Effectiveness Data (SSED) and product labeling for more complete information on this product, its indications for use, and the basis for FDA's approval.

Product Name: SEDASYS® Computer-Assisted Personalized Sedation System
PMA Applicant: Ethicon Endo-Surgery, Inc.
Address: 4545 Creek Road, Mail Location #110, Cincinnati, Ohio 45242
Approval Date: May 3, 2013
Approval Letter: http://www.accessdata.fda.gov/cdrh_docs/pdf/p080009a.pdf

What is it? The SEDASYS System is a computer-assisted personalized sedation device that delivers the drug propofol for minimal-to-moderate sedation. The device provides comprehensive patient monitoring and limits the depth of sedation by adjusting drug delivery accordingly.

How does it work? The SEDASYS System is a computer-assisted device that administers the prescription drug propofol into the blood stream via intravenous IV infusion. The device can detect signs associated with over-sedation and can automatically modify or stop infusion.



The Knowledge base is just too big for a human brain



Population Health Management

(based on Evidence Based Medicine)

Vs.

Precision Medicine

(based on Data Driven Healthcare)

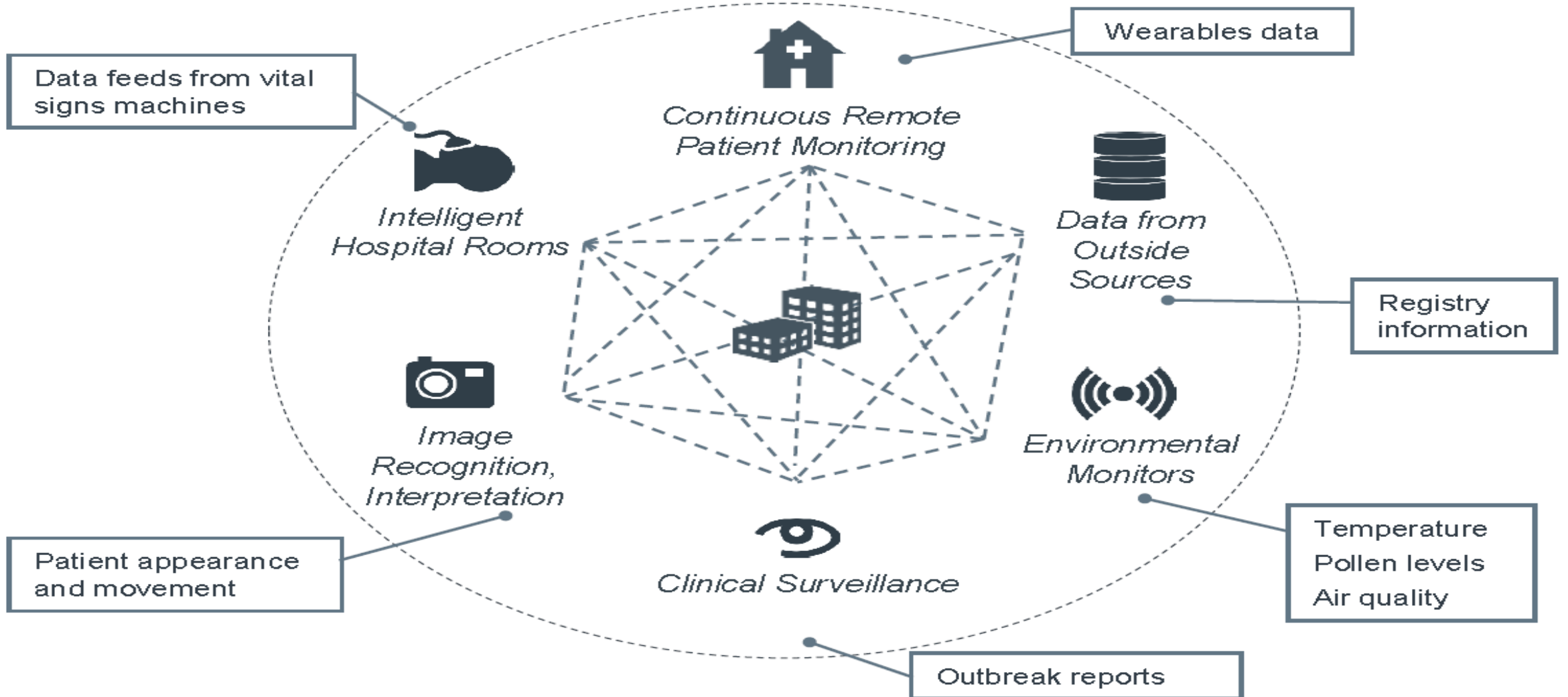


All diabetics are the same

Every patient is unique

Intelligent Info Gathering and Sensing

Many Decisions Made Today Could Benefit from More Information



Source: Advisory Board interviews and analysis.

Canterbury Health System Information Services Strategic (I.S.) Focus 2017-2022

CANTERBURY I.S. STRATEGIC STATEMENT



A digitally enabled health community that assists integration, creates equity of secure access to health information, minimises risk of human error, and supports Cantabrians to remain well and healthy in their own homes.

In alignment with

NEW ZEALAND HEALTH STRATEGY STRATEGIC THEMES



CANTERBURY I.S. STRATEGIC GOALS 2017-2022

- 1 Canterbury health alliance partners agree to make investment decisions using our collective I.S. Strategy Investment Principles.
- 2 All Canterbury healthcare providers have Electronic Health Record (eHR) access by 2020.
- 3 Continue to build on our eHR as a collaboration platform.

CANTERBURY I.S. STRATEGIC PRINCIPLES

The principles that underpin our decisions:

- 1 The consumer and provider experience is our key driver for change – reliability and usability makes them want to engage with the system.
- 2 System information technology planning and decisions enable 'one care team'.
- 3 Data is our system 'Taonga'. The value of data is recognised and protected.
- 4 Our system is digitised, standardised, measurable and can be analysed to achieve continuous improvement.
- 5 System partners are aligned to make decisions based on what is best for the individual and whānau and best for the system as a whole.
- 6 Systems are designed to be future-proofed, secure and optimised for users and support a 'paper lite' approach.

TOOLS TO ENABLE

A connected repository of all health related data accessible to the consumer and their care team.

A secure 'closed loop' communication across the system.

I.S. systems that are informative, efficient and effective enablers of workflow.

STRATEGIC OUTCOMES

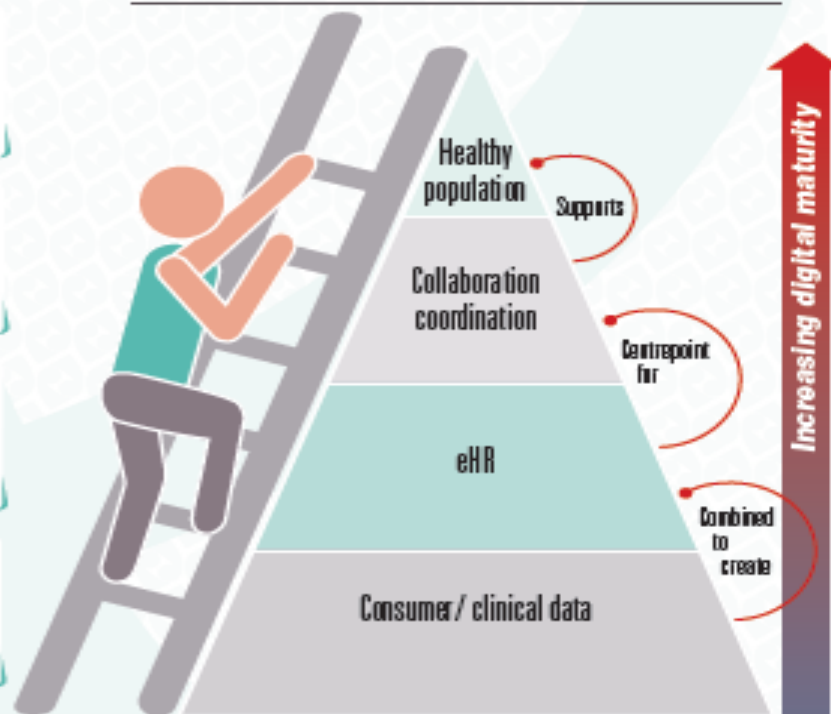
The health system is connected and enables teams to work together.

Consumers are more involved and self-managing of their own healthcare.

Investment in new digital services is principle based and achieves value and high performance.

Consumers experience a seamless, integrated trusted health system through digital enablers.

I.S. MATURITY STRATEGIC GAME PLAN



our health system

Our Digital vision is central to delivering quality healthcare in this rapidly changing environment

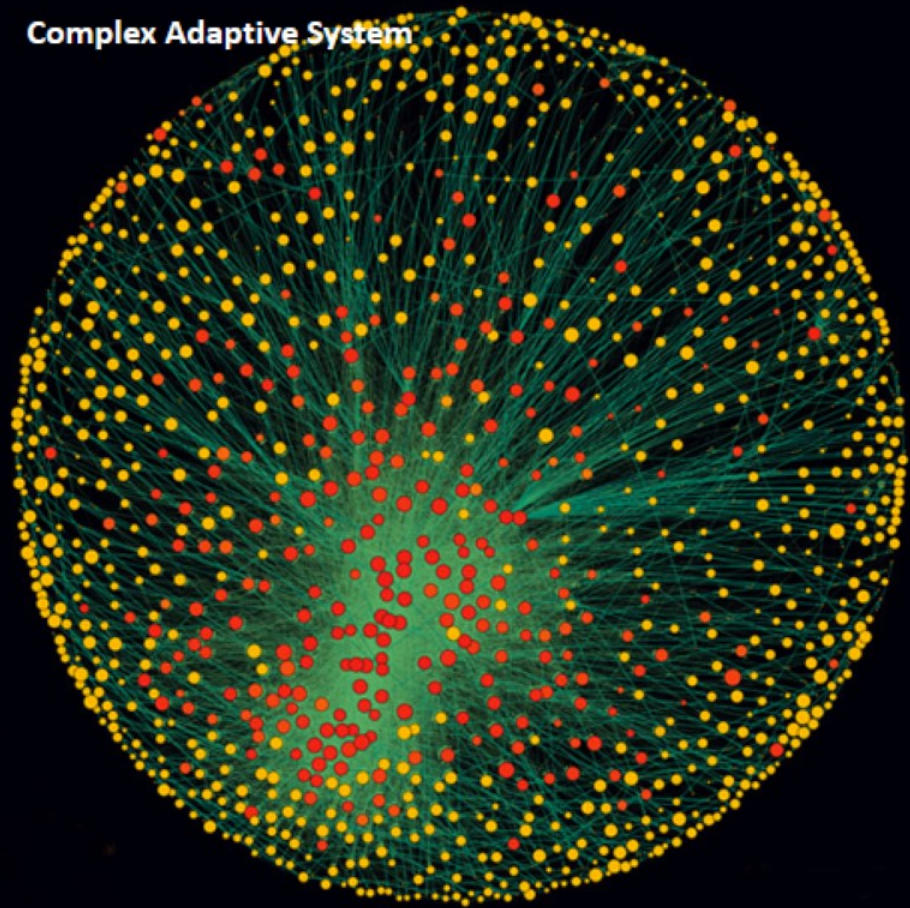
The fundamental principles are:

- Patient centric - **use technology to support health workers** to deliver patient care that is safe, effective, efficient and enhances the patient experience
- Integrates people, systems and technologies
- Deployment of new technologies will be based on clinical and business benefit
- Achieving our vision will require a combination of automation, innovation, health and business analytics, and change management
- Getting there will require a planned and coordinated multi-year programme of work
 - Evolution not revolution
 - Better utilize existing technology investment



Health is a complex adaptive system
Requires a systems thinking approach

Complex Adaptive System



Seek to understand variation in the system

Use data in a dynamic and systematic process of continual improvement

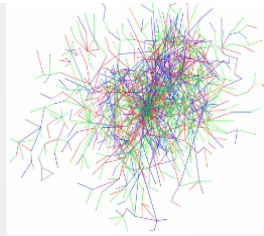
Create an environment of trust , relationships interdependence and shared purpose

Deming's System of Profound Knowledge



Data driven health system

Big Data

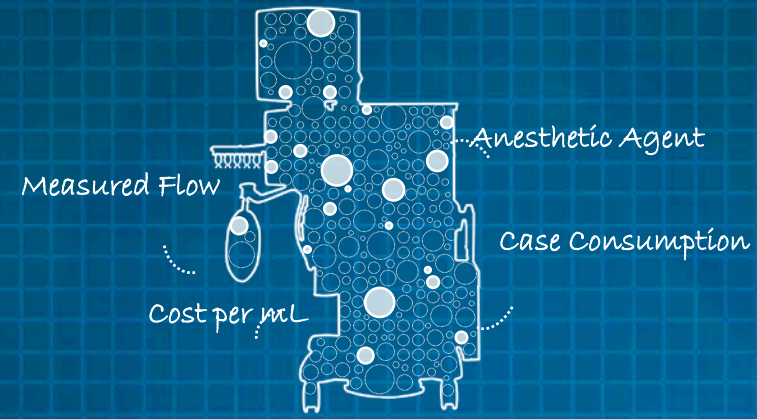


Driving the next wave of change

- Making data available at the front line
- Linking data across multiple providers
- Electronic ordering and tracking of all activity
- Providing the information to plan and improve
- Removing waste and variation



Creating a "Digital Twin"



A digital model, or "twin", leverages data from connected devices and makes it accessible for deep analysis. This technology supports cloud-based analytics applications and dashboards that can transform complex data into actionable insights.

Digital Anesthesia

BRILLIANT MACHINES

Aisys CS2 v11

- Full digital integration
- 300+ data points for every breath
- Connected

ANALYTICS IN THE CLOUD

Carestation Insights

- Suite of Cloud Analytics Applications
 - Agent Cost Dashboard
 - Checkout Dashboard

THE DATA DERIVED FROM CARESTATION INSIGHTS HAS PROFOUNDLY ALTERED OUR UNDERSTANDING OF HOW OUR ANESTHESIOLOGISTS ARE CONDUCTING VOLATILE BASED ANESTHESIA.

-Dr. Richard French
Christchurch

LAUNCH
2017

FW26

FW3 '18

FW26

FW14

FW14

FW18

FW18

FUTURE is DIGITAL

- Find strategic early adopters
- More applications to drive additional outcomes
- Expand connectivity and analytics across portfolio

Virtual Health/Telehealth



Smartphones in healthcare

- Use of texting, WhatsApp, Email or iMessage.
- Take photos, patient info and communicate this with anybody on their phone directory. Inherent risk that goes with this.
- **RISK:** Security, photos can end up in wrong hands, confidential patient photos/results can end up in wrong hands. Recent case in Australia where Paediatric burns patient picture was sent to the wrong person by mistake!



International Study: British Medical Journal

“The use of WhatsApp, which is owned by Facebook, has spread among hospital clinicians. One survey found that 98.9% of UK hospital clinicians now have smartphones, with about a third using WhatsApp or a similar messaging tool.

A Twitter thread started by NHS doctor David Oliver in November 2017 drew 140 responses from health professionals explaining that they use the technology for soliciting second opinions, sharing radiology or echocardiography results, and asking colleagues for cover.”

British Medical Journal 2018



Privacy in healthcare – Legislation

- Health Information Privacy Code 1994
- HISO 10064:2017 Health Information Governance Guidelines
- Agencies must ensure that there are **reasonable** safeguards in place to prevent loss, misuse or disclosure of health information.
- Treat all information about patients as confidential and sensitive.
- Keep patient records
- Patients have rights Under New Zealand’s privacy laws and the Code of Health and Disability with respect to electronic communication, as they do with all other forms of communication.

<http://www.health.govt.nz/nz-health-statistics/health-statistics-and-data-sets/data-protection-and-privacy>



Why can't we WhatsApp, Zoom, Text, Skype etc...



- Data and photos are stored on your personal device in local storage
- The servers for WhatsApp, owned by Facebook, are based in the US
- WhatsApp is not pin protected, device pin is not sufficient
- You often require personal phone numbers to message individuals
- Easily mixed with personal contacts and communications
- No consent for clinical images
- Non healthcare specific, e.g no patient tagging with NHI
- WhatsApp is end to end encrypted, but does not address device security or compliance of data storage.

Celo solves healthcare privacy risks

Authenticated: All Celo users are verified as health professionals working at a verified healthcare organisation.

Secure: All Celo data is stored securely on Celo servers, which are healthcare grade encrypted, in your “Celo secure library”. Data is never stored on the end user’s device. The app is pin protected, or protected with biometrics.

Encrypted: All data is stored in a Microsoft Azure Data Centre that is compliant with ISO 27001, GDPR, HIPAA, HISO regulations and OAIC regulations. All data used by the Celo app and end user is also encrypted using sha256RSA.



Case Study - Avian Tuberculosis - Chatham Islands

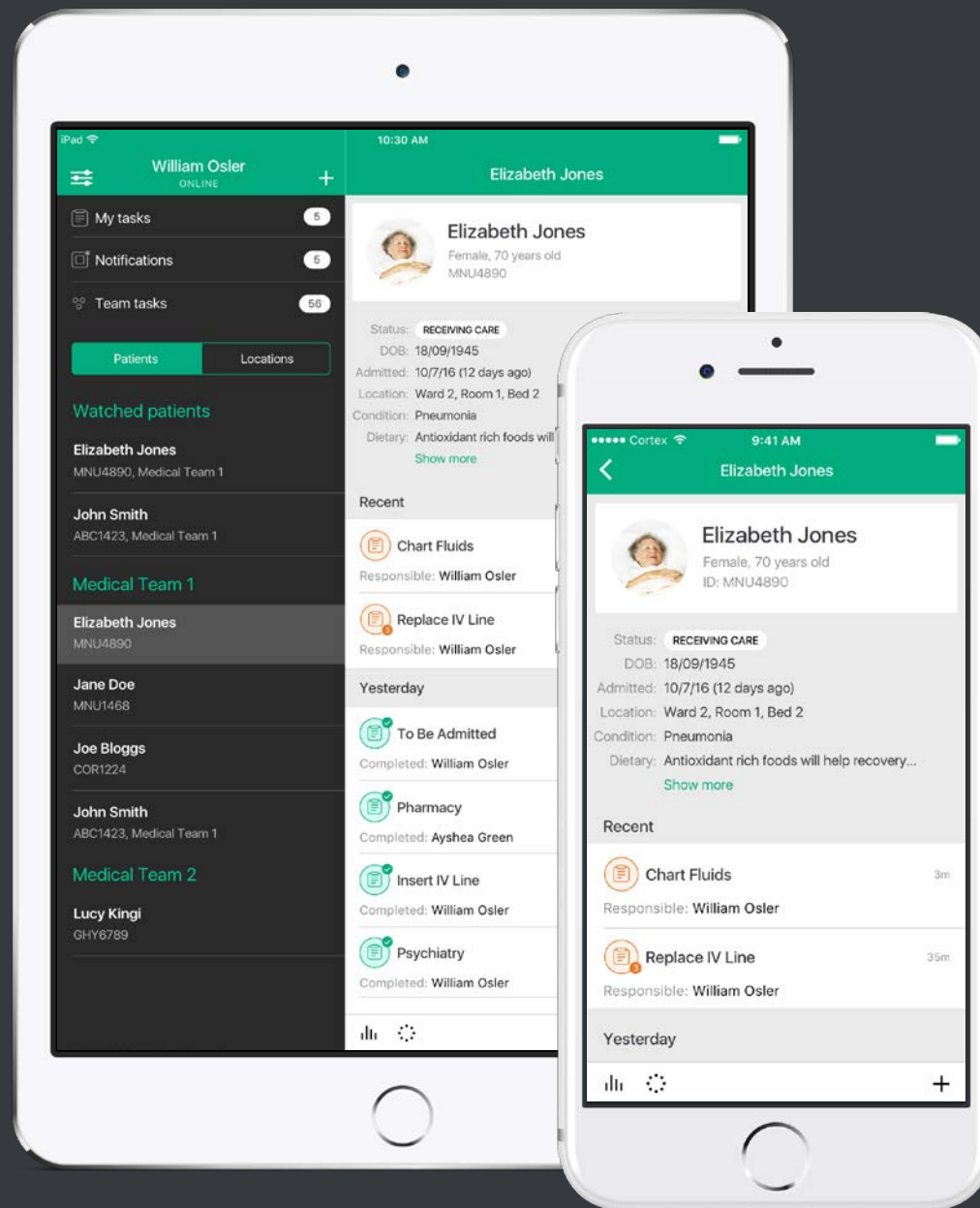
- 4 year old boy with Avian TB, scarring of neck following surgery needed follow up appointment and expert advice.
- Multiple images of boy were sent directly to on call Plastic Surgeon at CDHB via the Celo Directory (Securely).
- Before Celo, patient would have to be transferred to Christchurch via air. Disruptive, expensive, time consuming for patient. 4 days of travel for 15 minute appointment to get told need surgery.
- **WITH CELO: Advice instantly given by Plastic Surgeon and resulted in no need to travel to Christchurch.**





Cortex

Mobile-first care coordination



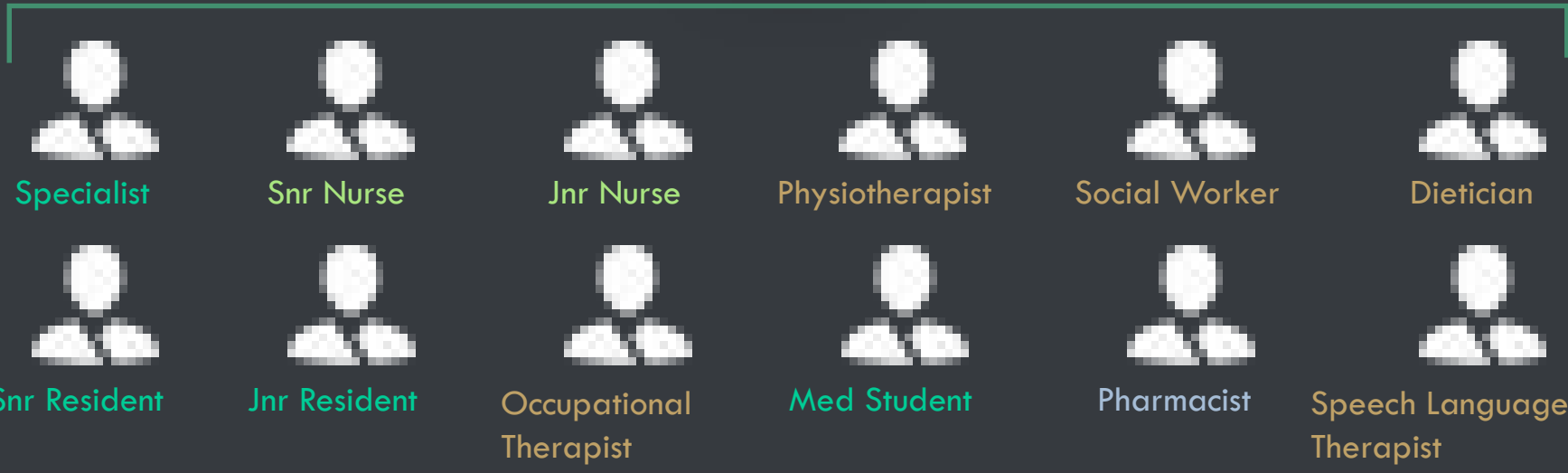


Cortex is a
toolbox
for clinical
workflow

Workflow management platform

Form and document system

Team communication system





NUMBER OF USERS

700+

CLINICAL NOTES CREATED

50,000+

COMPLETED TASKS

30,000+

PATIENT VIEWS

1,000,000+

CONFIGURATION APP

Resource library

(SNOMED CT coded questions e.g. mobility status, diet)

Forms

(resources + additional questions/info + images/video/audio)

CORTEX ENGINE

Workflows

Outputs

(HL7, email, PDFs)

CORTEX APP

Clinical notes

Order forms

Referrals

Consent forms

WEB

Lite versions

- Clinical notes
- Order forms
- Referrals

PATIENT DATABASE

Demographics

Biological

Psychological

Social

Clinical pathways

USE OF DATA

Patient summary view

Patient bed boards

Departmental dashboards

Discharge/transfer summaries

Research and audits

Clinical Decision Support

Digital
transformation is
coming to health

Yeah Right.



Anatomy of a healthcare transaction



“...the hospital – altogether the most complex human organization ever devised ...”

- Peter Drucker

Predictions of the future

How we do it now	How it will be	Examples
Care delivered in the clinic or lab Face to face	Patient (person) will be the point of care	Wearables, POC testing, IoT, Bots , Virtual Integrated into normal life
Decisions based on population data “odds medicine”	Precision medicine based on your unique features	Genomics Artificial intelligence to predict and advise
Hierarchy	Partnership	Shared decision making
Prescribe and order	Collaborate	Behaviour modification by giving meaningful real time feedback
Data held by vendor or institutions	Data owned and shared by patient	Blockchain International platforms connecting patients and researchers
Individual experience dominates decision making	Limitless data analysis	Too much for human brain Need Artificial intelligence
Physician as authority	Physician as guide	Data scientists will be in demand
Ivory tower- restricting information created power brokers	Social media	Citizen science
Expensive	Costs driven down by Moore's law	Surgical Robots

But.. What does success look like?

Zero%

Human error rate

Equity

of access and outcomes

**Connecting people
to the data**

Converting data to wisdom

Sustainability

of staff, finances & environment

Challenges:

- Speed and Scale
- Training – planning for new processes that come with the tech
- Health and Safety
- Costs/Failure
- Security/Privacy
- Flood of data
- Inadequate storage of data
- Interoperability

What does successful digital transformation require

	Health Professional	Operational and vendor teams	Leadership
Digitise	<p>Patient experience</p>	<p>Share the data Understand the clinical requirements</p>	<p>Transformational digital culture Clear strategies Embed the IT team in the business</p>
Standardise	<p>Evidence or consensus based</p>	<p>Optimise user interface Automate</p>	<p>Identify decision makers vs. communicators</p>
Measure	<p>Clinical outcomes Process measures</p>	<p>Tools for continuous monitoring</p>	<p>Measure expected vs. observed decisions by governance groups</p>
Analyse	<p>Ask what can do next Continuous improvement Clinical governance</p>	<p>Optimise the metrics Artificial intelligence</p>	<p>Refine the strategy Celebrate successes</p>

Progress to Date.....

Variable	Factors	Why?	Where are we?
Information exchange	<p>Live data shared across system</p> <p>Built within workflows</p>	<p>Because you need complete information at point of care</p>	<p>Talking about interoperability does not make it happen!</p>
Performance monitoring	<p>Analytics, analytics and analytics</p> <p>Patient, staff and system</p>	<p>Because you need to know what is working and where to intervene</p>	<p>Created information but how do we convert to knowledge and then wisdom?</p>
Trustworthy clinical decision support	<p>Narrow and smartly tailored</p> <p>Within the workflow</p> <p>Clinicians believe in and curate</p>	<p>Because you need to act on the information</p>	<p>Very challenging and expensive</p> <p>Automate where possible</p> <p>Better understanding of how to present so that alters behaviour</p>

Most importantly staff who will use it!

Where will educated staff come from?

How do we upskill the current workforce at scale?

Who in the health sector needs to learn coding and machine learning?

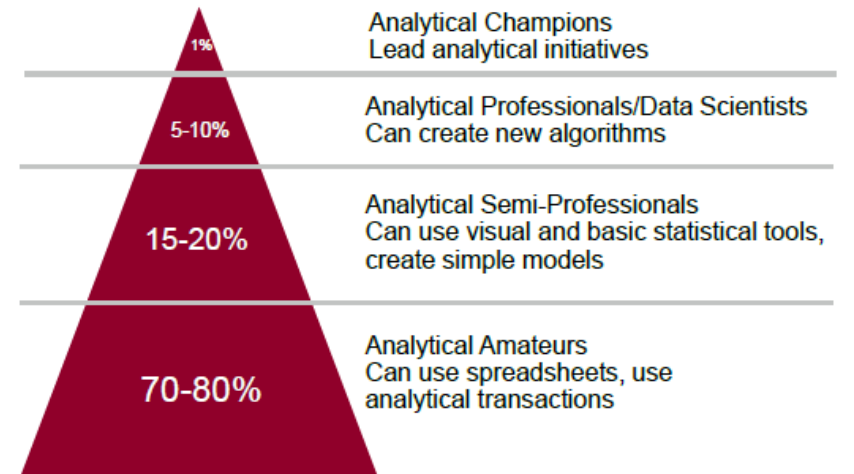
Should there be a minimum data literacy for healthcare professionals?

Do the Universities understand what skills the future health workforce will require?

- genetics data science
- digital health assistants
- behaviour modification experts

Are our training environments agile and adaptive enough?

Analysts



* percentages will vary based upon industry and strategy

The answers to these questions need successfully addressed if we are to be ready for the digital health world.

Workforce reflections – an opportunity for AHST

- Importance of clinical technologists
- Human factors and design thinking re digital world
- Lane swapping – equip for adapting to new roles (retraining)
- Translators – the art of clinical relationships
- Health and Social sector – the scientific review and planning of the data
- Digital Natives
- Innovators and Entrepreneurs
- Change makers and leadership

Conclusion

- **Digital transformation is coming to health**
- **We are at the inflection point of exponential curve**
- **This transformation will challenge all of us in terms of our values and beliefs but also our roles and skills**
- **We all need to engage to deliver a healthcare system that NZ population deserves**
- **As domain experts we need to shape the technology to *enable* the system not *disable* it**