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The Virtual NHS Data Conference

THE NHS DATA CONFERENCE 2023

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23rd March 2023 - 10:50am – 15:00pm – Virtual Conference

Conference hosted by Convenzis Group Limited

THE NHS DATA CONFERENCE 2023

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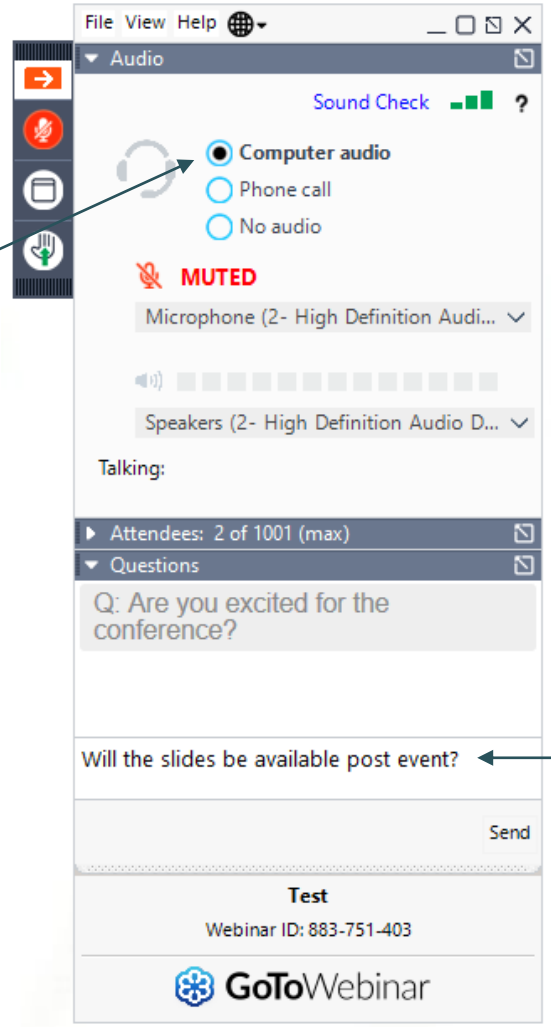

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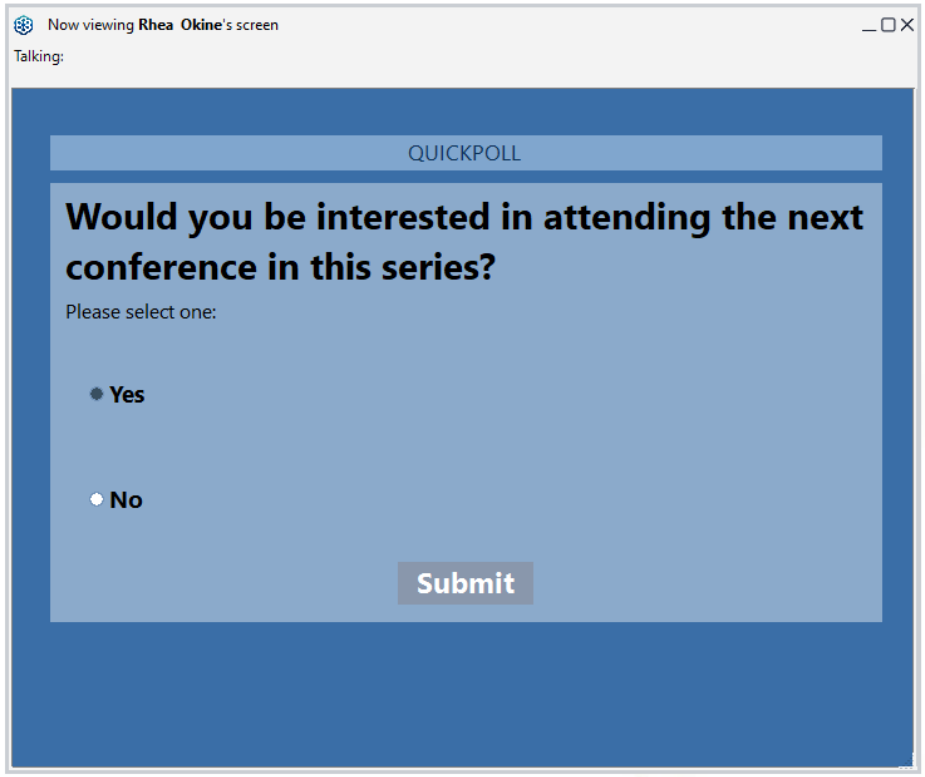

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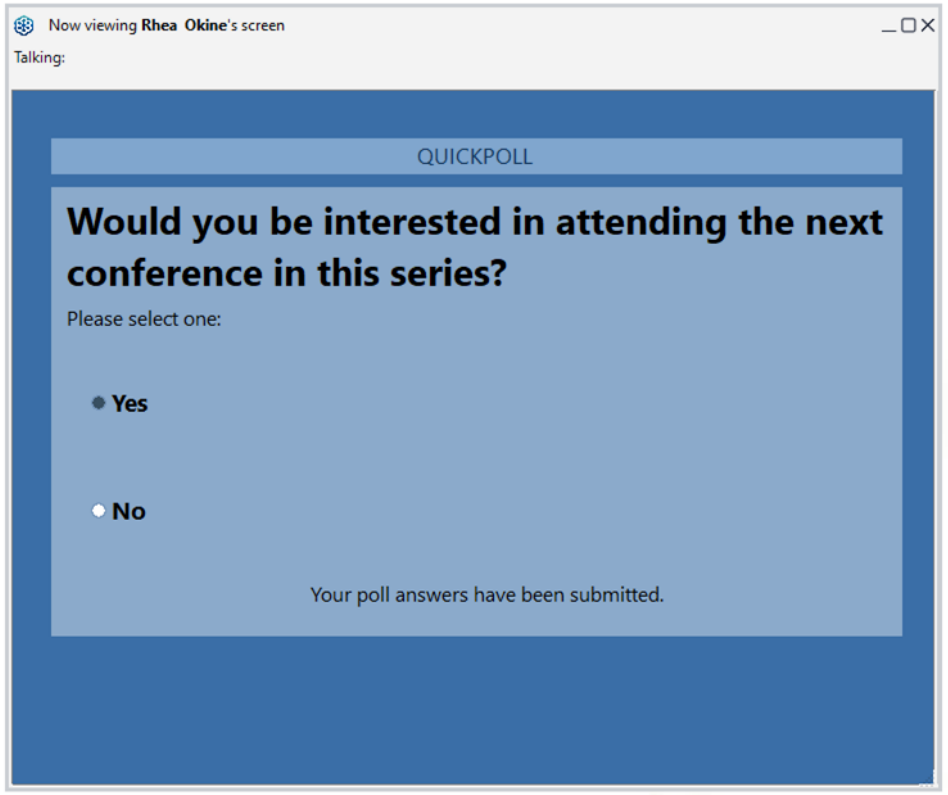

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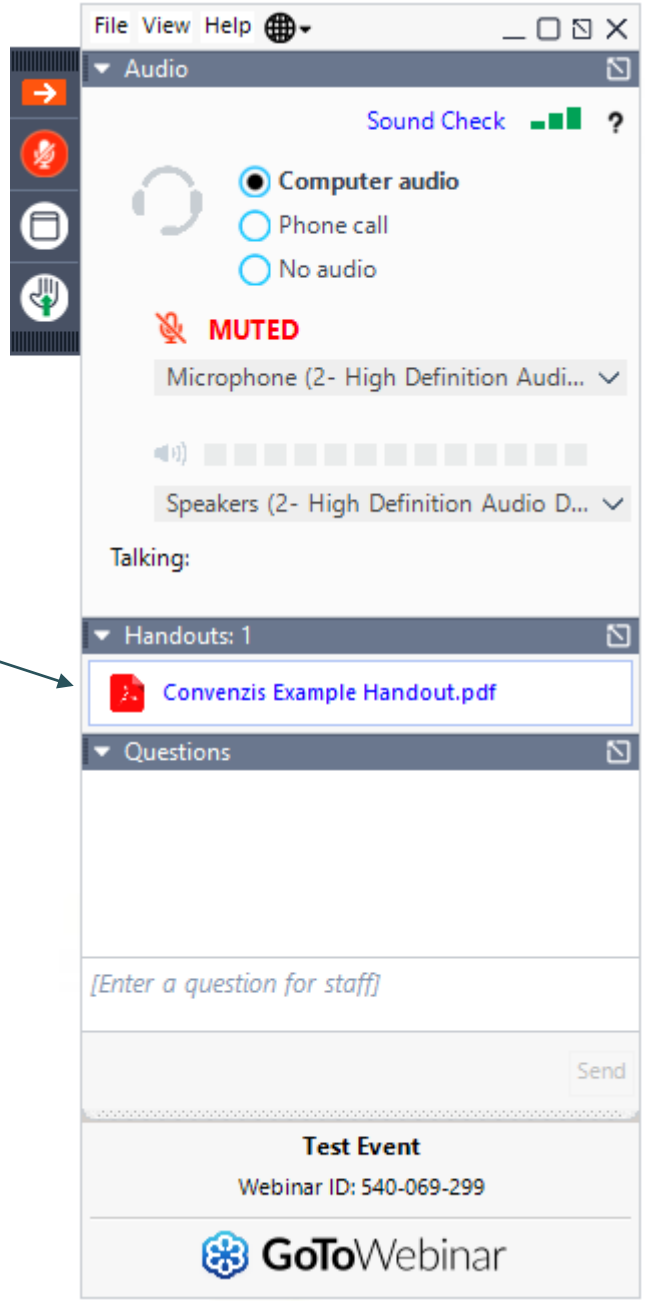


THE NHS DATA CONFERENCE 2023

SPEAKING NOW

Ming Tang

Chief Data and Analytics Officer
NHS England

I will be discussing…

"Harnessing the power of data to change in the NHS"

Harnessing the power of data to drive change in the NHS

Better Insights. Better Decisions. Better Health.

Ming Tang
Chief Data and Analytics Officer
NHS England

Context – The NHS is a complex ecosystem

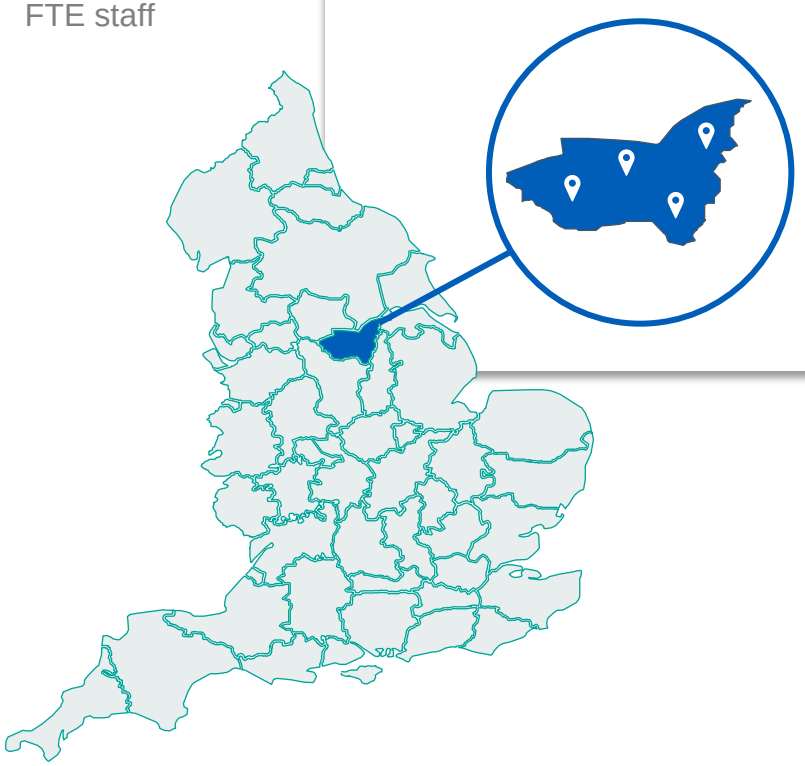
NHS England

Care Quality Commission

Place Based Partnerships

£190.3 billion

1.227 million
FTE staff



Integrated Care Systems
(42)

Integrated Care Boards

Commission and deliver joined-up approaches to improving health and care outcomes

Local authorities
(152)

GP practices working together with community, mental health, social care, pharmacy, hospital and voluntary services (1,250)

Integrated Care Partnerships

Providers work together to deliver care by agreeing to collaborate rather than compete.

NHS Providers

Acute Trusts
(124)
250,000 daily outpatient
47,000 daily inpatient
67,500 daily A&E attendances

Mental Health
(50)
1.6m contacts

Community
(826)
0.38m daily care contacts

Ambulance
(10)
30,000 daily 999 calls
20,390 daily call-outs

Other Providers

GP Practices
(15,119)
1.3m daily appointments

Voluntary Sector

Social Enterprises

Private

Primary Care Networks

Joining of NHS England, NHS Digital and Health Education England

NHS England

NHS Digital

NHS Health Education England

Beginning of a transformation journey that provides the opportunity to:

Create one function to drive the use of data within health and social care.

- Review what health and social care data is captured.
- Consider the ways we collect data and its purposes.
- Minimise the movement of data across system to enable a rapid analytical pipeline.
- Invest in architecture to implement FDP, SDEs.
- Empower systems to lead locally.
- Professionalising the Data and Analytics workforce.
- And do this all in a smarter way.

Provide secure access to data for analytical insights that support decision making to improve care delivery and system planning, and to support research into new treatments.

Underpinned by Strategies to support the power of data

Data Saves Lives: Reshaping Health and Care with Data

Building and Maintaining Public Trust

Patients	NHS Services	NHS and Adult Social Care Systems	Medical Research
Improving Individual Care	Speed up diagnosis	Plan local services	Life saving medical research

Goldacre Review: Better, broader, safer: using health data for research and analysis

- Platforms and security
- Modern, open working methods for NHS data
- Data curation and knowledge management
- NHS data analysts
- Governance
- Approaches and strategy

Making data more accessible whilst upholding the highest standards of privacy and security

Moving to self-service access using secure environments to underpin everything we do using a federated model with data as an infrastructure, as well as a product.

1. **Secure Data Environments for operational use, planning and population health management.**
   For example: a federated data platform for NHS staff and care providers.

2. **Secure Data Environments to support research by academia and industry.**
   For example: research environments to support medical research.

Secure Data Environments will improve:

- ✓ **Patient privacy**: removing personal detail to keep patient information confidential.
- ✓ **Security:** ensuring that systems have high level of protection.
- ✓ **Efficiency:** connecting data to speed up decisions and discovery of new treatments.

Data storage and access platforms built to uphold the highest standards of privacy and security - adhering to the five data safes.

- **Safe people**
- **Safe projects**
- **Safe settings**
- **Safe outputs**
- **Safe data**

Data Capability Framework – our “navigation”

Data Capability Pillars

Population	Place	Channel	Workforce	Clinical	Commercial
Citizen	Place	Services	Workforce	Registry / Medicines	Category

360˚ data

Citizen / patient journeys: build trust with citizens and patients and manage their relationships and interactions with NHS entities.

Channel optimisation: optimisation of access, service delivery, funding mechanism and channel preference to improve health and care outcomes.

Capacity planning: plan and manage key capacity constraints to reduce costs and make investments to improve inequalities.

Clinical variation: understand and improve clinical variation in pathways and clinical practice.

Value for money: maximise our return in funding through the delivery of services in most cost-effective manner.

Key activities will be enabled by:

- Core reference data.
- Events architecture.
- Federated data model.

Four key uses of data

Designing appropriate data governance and processes for different uses of data.

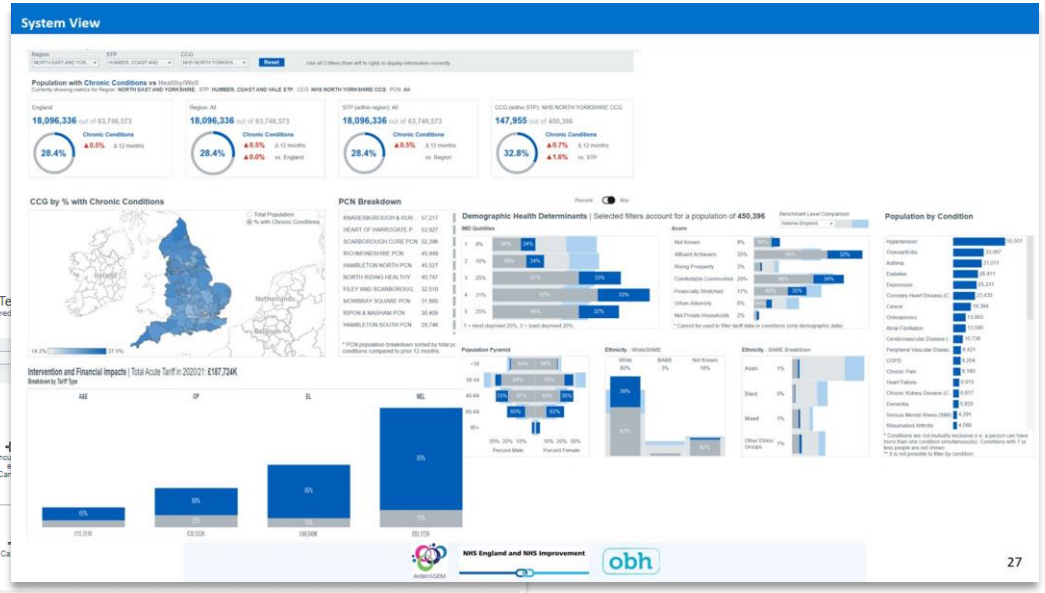
	Direct Care	Population Health	Planning & Service Improvement	Research & Innovation
Uses of Data	Direct Care	Population Health	Planning & Service Improvement	Research & Innovation
User types	Clinical & Care Staff Clinicians	Health & Care Staff	Health & Care Staff Local Authorities Arms length bodies e.g. CQC Public	Academics Charity Sector Industry Researchers
Outcomes	Improved patient safety, effectiveness, productivity, experience	Improved population health, reduced health inequality	Improved patient safety, productivity	Improved population health, reduced health inequality, economic impact

Case Studies

Population and Person Insight (PaPI)

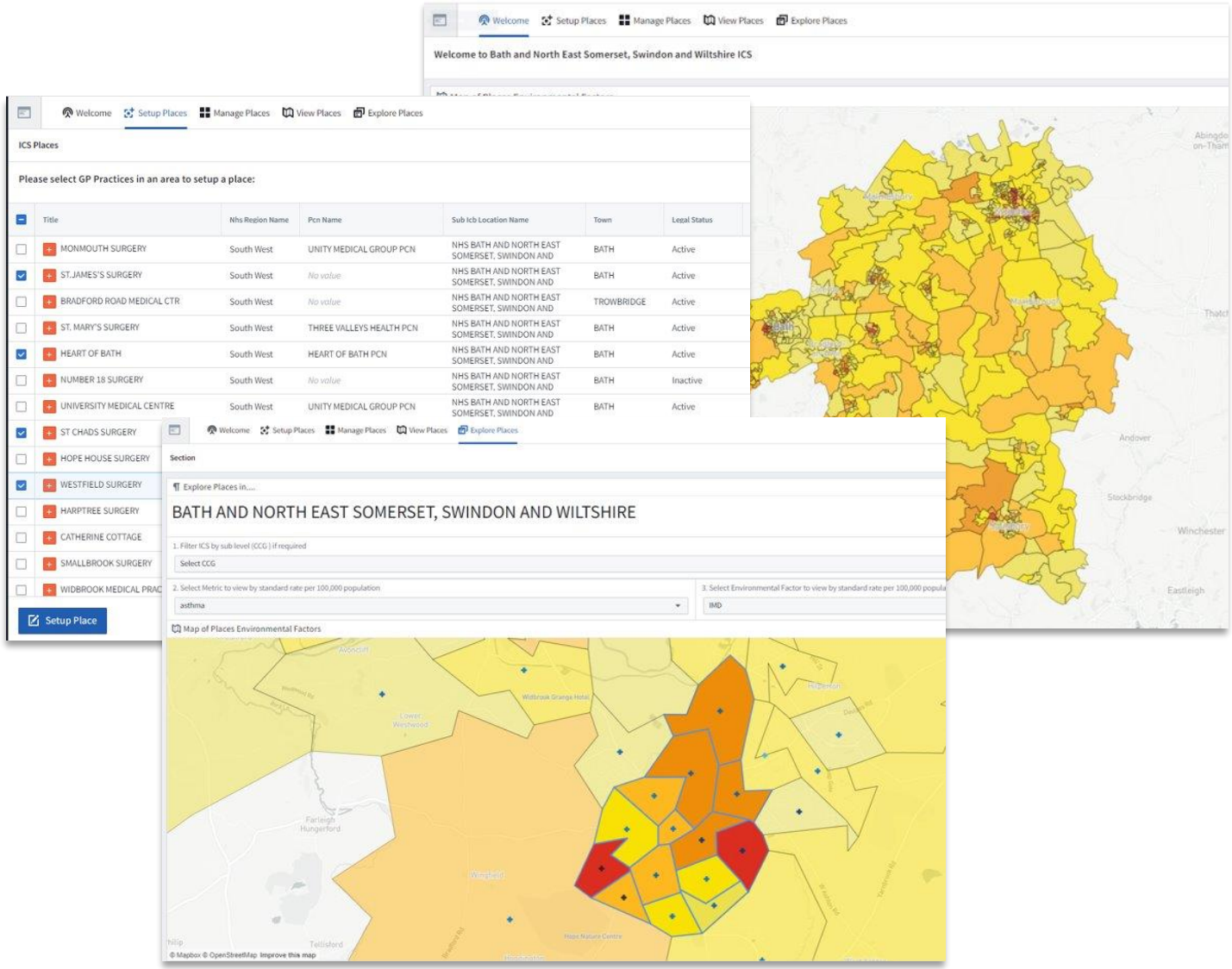
National datasets cut by segments based on common healthcare needs

- Includes secondary, emergency care, community services and specialised services data.
- Understanding the population by cohorts of similar health and care needs enables person-focussed health system.
- Data can be viewed through several lenses; from national right through to PCNs.



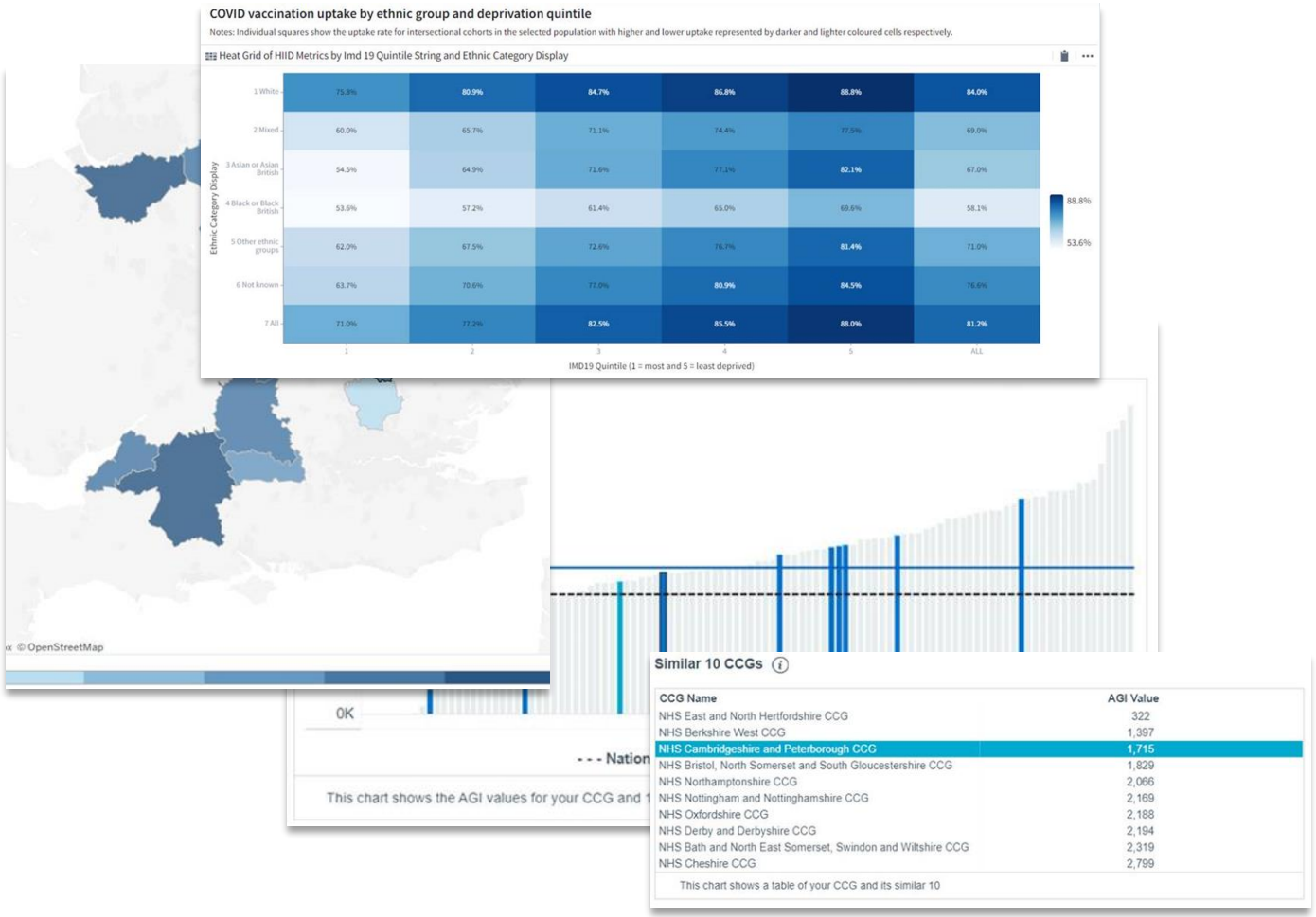
ICS Place Tool

- Build a Place, or multiple Places, within an ICS's geography.
- Explore and visualise data and metrics relevant to health and care.
- Inform where to deploy resources to reduce health access inequity and achieve PCN level targets.



Health Inequalities Improvement Dashboard

Descriptive statistics through the lenses of ethnicity and deprivation



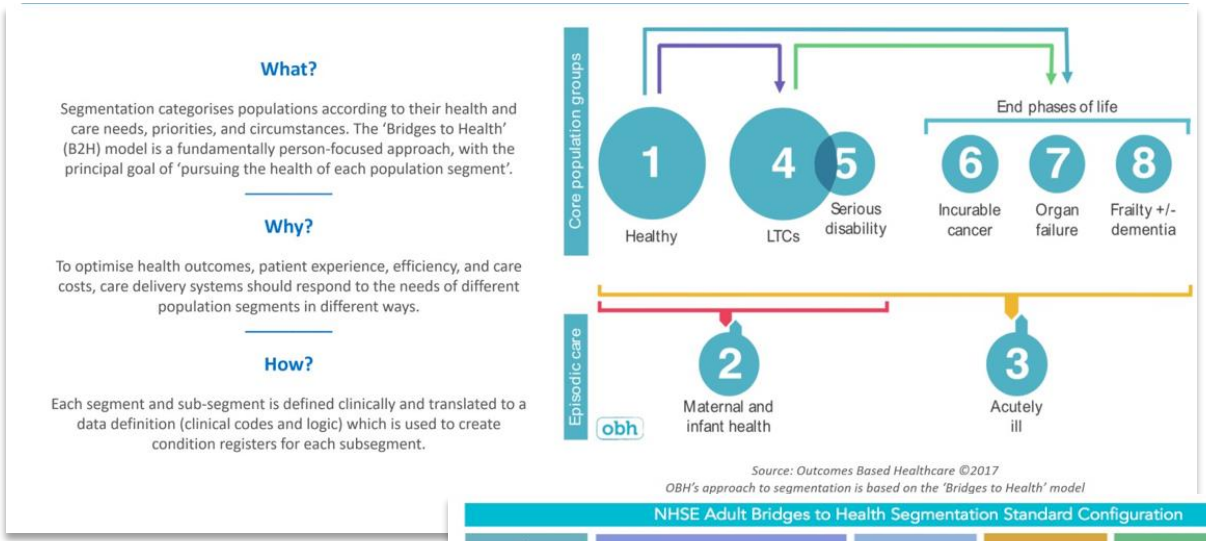
Provides data cut by ethnicity and deprivation, to enable the NHS to take concerted action to improve health inequalities.

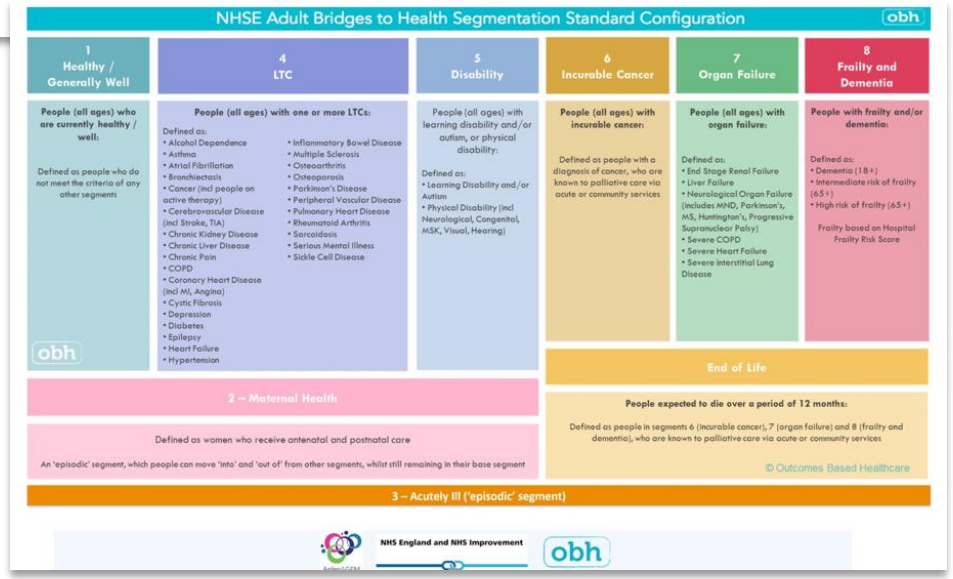
- **Dashboard** measures, monitors, and informs actionable insight to make improvements to narrow health inequalities.
- **Support** the NHS to prioritise what matters through the lenses of ethnicity and deprivation, where inequalities are in their area.
- **Focuses** attention on the CORE20PLUS5 approach, including the five clinical areas.

Bridges to Health Dataset

Bridges to Health segmentation dataset enables deeper insight into:

- People who are healthy,
- People with long term conditions,
- People with disability,
- People who are nearer the end of life with cancer, organ failure, frailty and dementia.





Data Navigator Tool

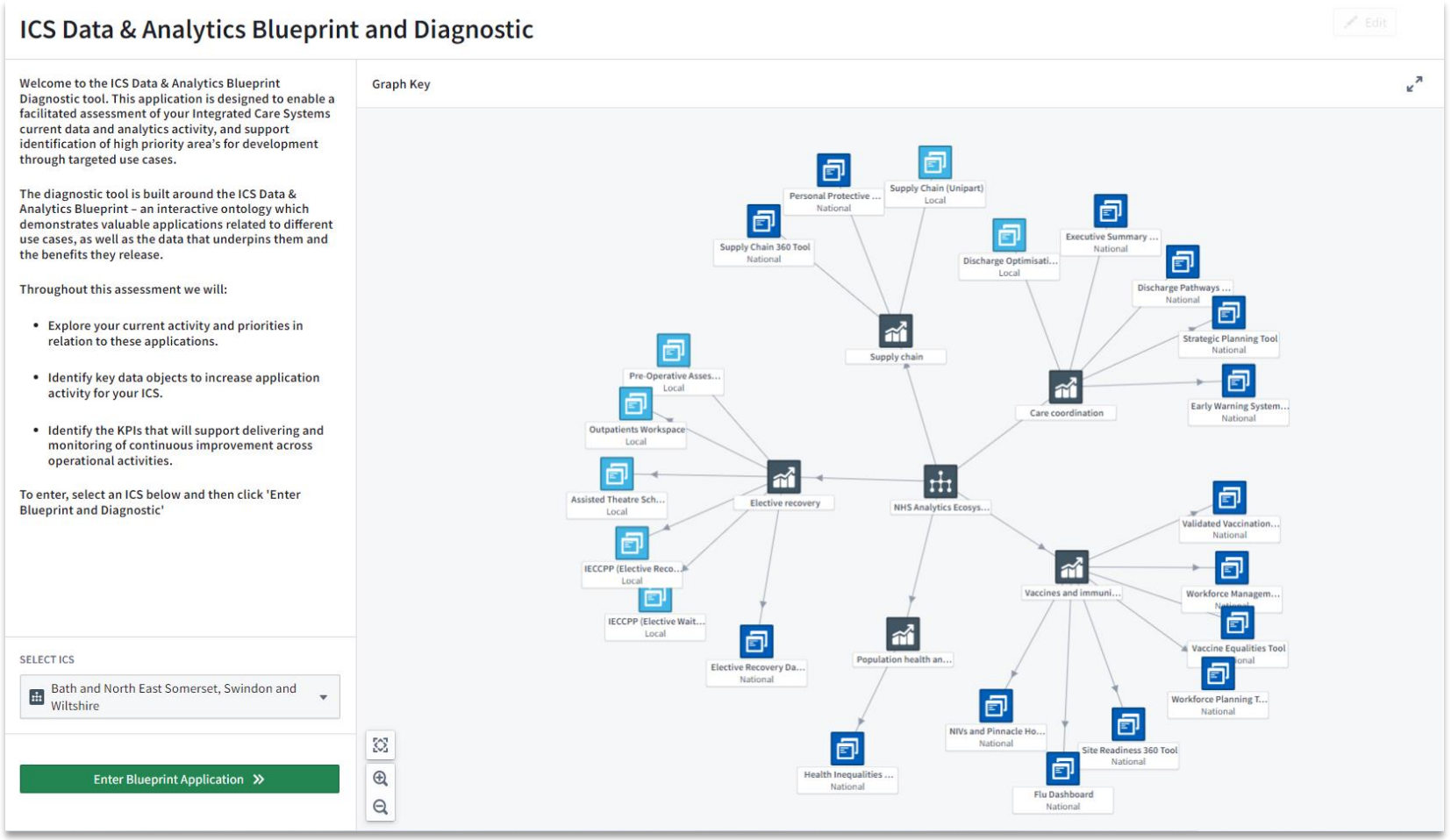
ICSs will initially assess themselves across 5 use cases:

1. Elective Recovery
2. Supply Chain
3. Care Coordination
4. Vaccines & Immunisations
5. Population Health

ICSs will be able to:

- Determine what data they collect.
- Which KPIs to monitor to support their delivery.

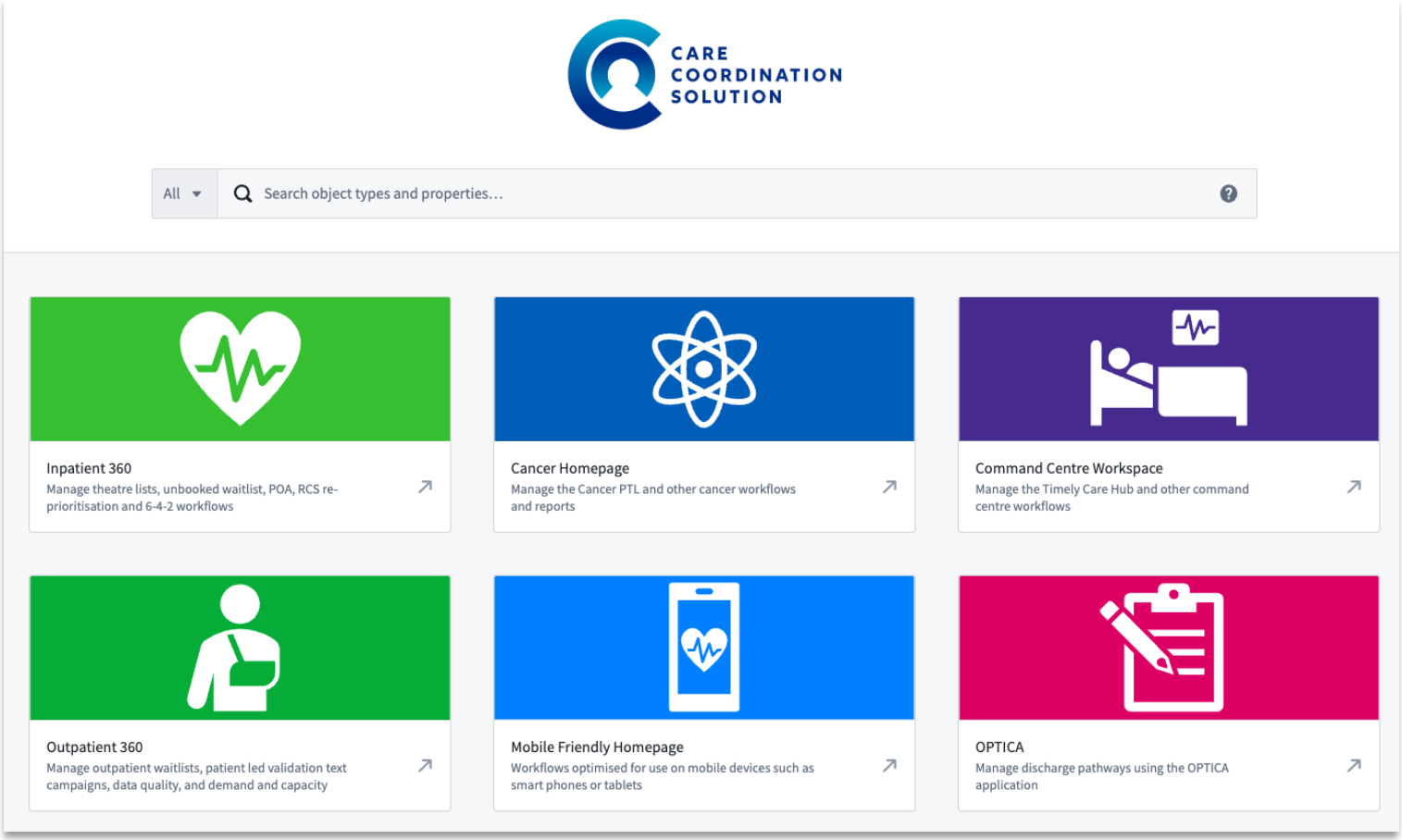
ICSs can also include any local data collections supplementing their insight capabilities.



Care Coordination Solution

Everything in our hands

Information from multiple sources presented in-context and actionable for faster treatment of patients in most need



Better, faster, information-based decisions.

Operational tools for waiting list management, patient prioritisation and theatre scheduling workflows.

Clinicians, operational staff schedulers and data quality specialists have high quality waiting list data to treat as many different people as possible.

Simpler Processes for Improving elective waiting list data.

Data quality teams can clean and correct data.

Implementing changes back to source systems improves information for all system users.

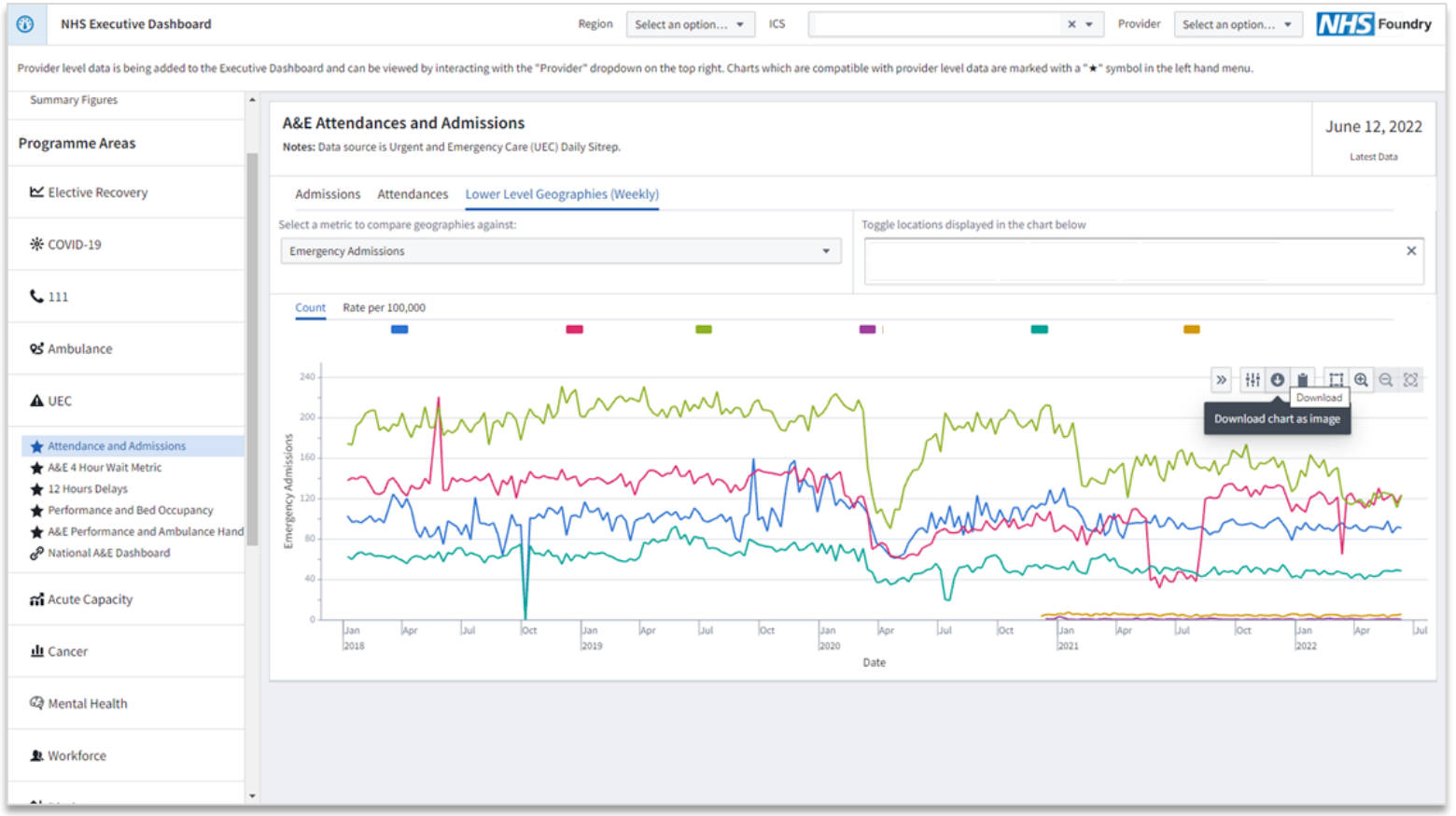
Better Care Coordination at all levels.

Securely share pseudonymised data within one platform.

Leaders at system, regional and national levels can make better decisions, improving the coordination of care across trusts.

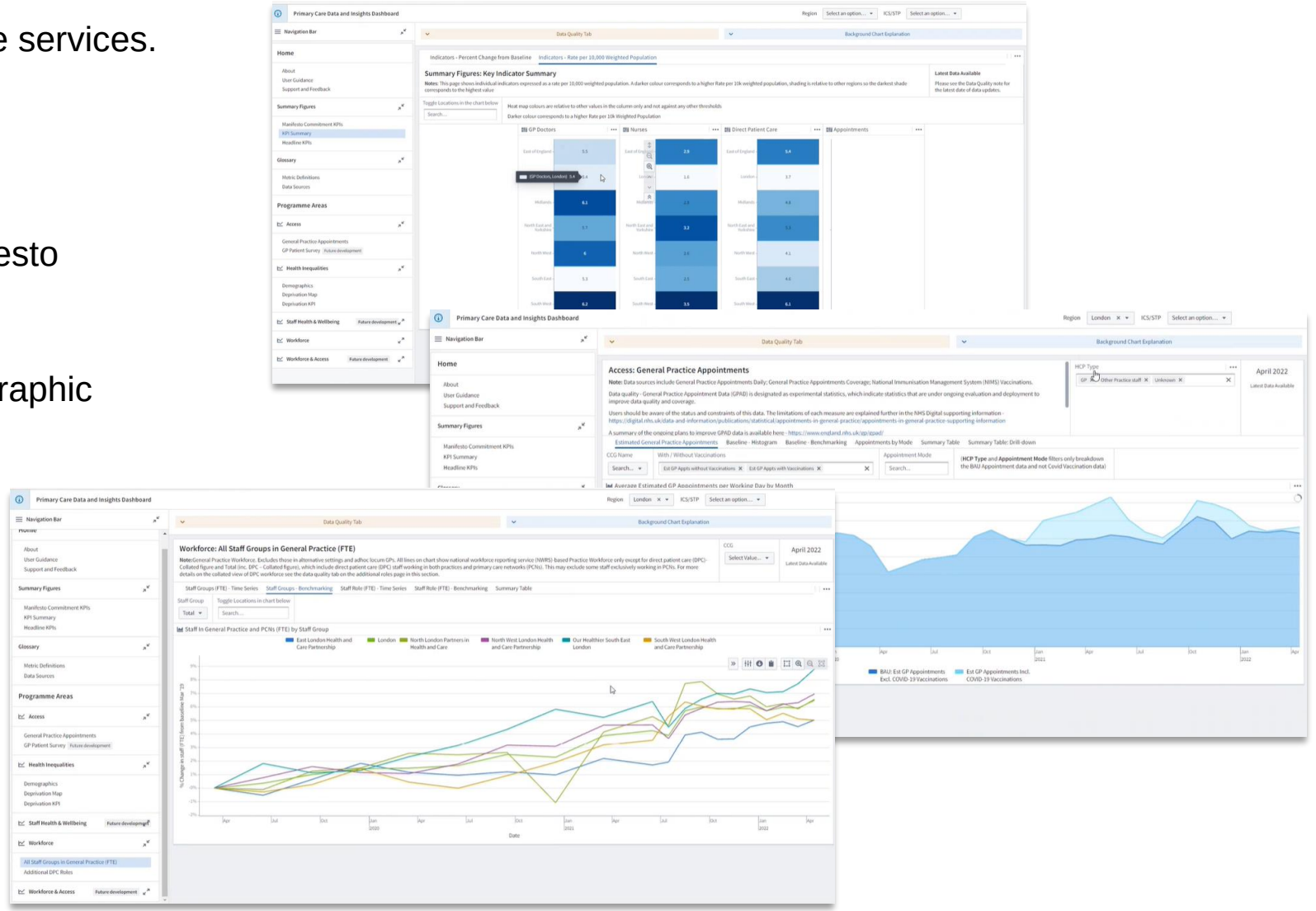
ICB Executive Dashboard

- Support ICBs in strategic planning across the quadruple aim of healthcare.
- Key management information across different areas (acute, primary care, mental health, discharge, capacity).
- One consistent dataset that can be used by all parts of the system.
- Information updated automatically.
- Preparation for Board reporting.



Primary Care Dashboard

- Wide range of data relevant to primary care services.
- Enables improvement and primary care transformation.
- Includes data relating to the national manifesto commitments for primary care.
- Initial health, equity, and population demographic views.
- Ongoing development:
  - GP workforce.
  - Patient satisfaction.
  - Staff health and wellbeing.
  - Community pharmacy.
  - Dentistry.



Thank you.

Better Insights. Better Decisions.
Better Health.

UP NEXT...

insource

BE DATA CONFIDENT

THE NHS DATA CONFERENCE 2023

SPEAKING NOW

Lee Rickles

Programme Director and Chief Information Officer
Yorkshire & Humber

I will be discussing…

"The Value of Standardised data for wider data sharing with NHS and Local Authority partners in the Yorkshire & Humber Shared Care Record.

NHS
Humber Teaching
NHS Foundation Trust

Lee Rickles

CIO, Humber Teaching NHS Foundation Trust

Caring, Learning
& Growing Together

How we do it: Our area

Humber Teaching NHS Foundation Trust

- We deliver our services from more than 80 sites across Hull, the East Riding, North Yorkshire including Scarborough and Ryedale.
- Mental health, children's and community services.
- We annually see;
  - Outpatients : 186588
  - Inpatients : 182702
  - Emergency attendances : 7214
  - Community : 1420
- Budget for 2022/23 is £225m which 4.5% is for digital.
- We use SystmOne and Lorenzo for our EPRs
- Insource data management platform

Caring, Learning & Growing Together

Our Infrastructure

Humber Teaching NHS Foundation Trust

- Lorenzo EPR extract several times a day
- SystmOne with a daily extract
- Insource data management platform
  - ETL which also normalise, de-duplicate, merge
  - Single source of the truth for data
- Apache NiFi for data routing, transformation, and system mediation logic
- Power BI
- Azure based integration, portal and FHIR proxy for YHCR

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ICS & Regional linkage

Humber Teaching NHS Foundation Trust

- Federated Data Platform
  - Front runner
  - Optica Virtual Ward
  - Palantir
- NiFi protocols for encrypted communication to call the Insource data management platform and send to Palantir.
- Working on a subscription model.
- Only to support direct care with ISA/DPIA/MOU.
- Yorkshire & Humber Care Record
  - Shared Care Record
  - Population Health Management Solution
- FHIR Care connect profiles from the Insource data management platform from the FHIR proxy.
- PHM covered via a de-id solution to support the section 251 for secondary usage.

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Future

Humber Teaching NHS Foundation Trust

- Use more open source technologies
- Complete the move to cloud with move of the Insource data management platform.
- Faster data feeds for community & mental health
- Use FHIR messaging from the YHCR for direct care use of the Federated Data Platform
- Current procuring our next generation EPR so I expect a rework of data warehouse
- Move to data lake and lake house model and apply AI
- Feed data into a ICS data layer

Caring, Learning & Growing Together

Thank You & questions

NHS
Humber Teaching
NHS Foundation Trust

THE NHS DATA CONFERENCE 2023

SPEAKING NOW

Prasanth Peddaayyavarla

Head of Data Science
NHS Arden & GEM CSU

Julia Pledger

Nurse Consultant - Diabetes - Bedfordshire Integrated Community Diabetes Services

We will discuss...

"How Better use of data is enabling proactive, personalised care in Bedfordshire, Luton & Milton Keynes (BLMK)"

NHS
Arden and
Greater East Midlands
Commissioning Support Unit

Diabetes Warning System

Prasanth Peddaayyavarla

Head of Data Science

Arden & GEM CSU's Advanced Analytics Unit

Julia Pledger

Consultant Nurse - Diabetes

Bedfordshire Integrated Community Diabetes Service

NHS Data Conference 2023

Arden&GEM
Advanced Analytics Unit
SHAPING DECISIONS FROM DATA

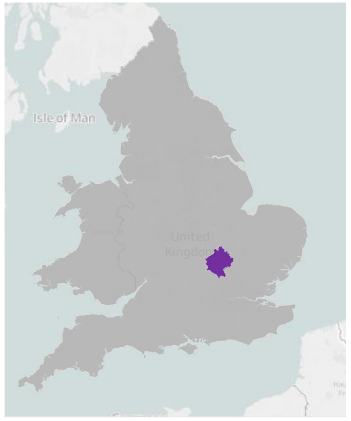
Diabetes background in BLMK

Population: 1.1m

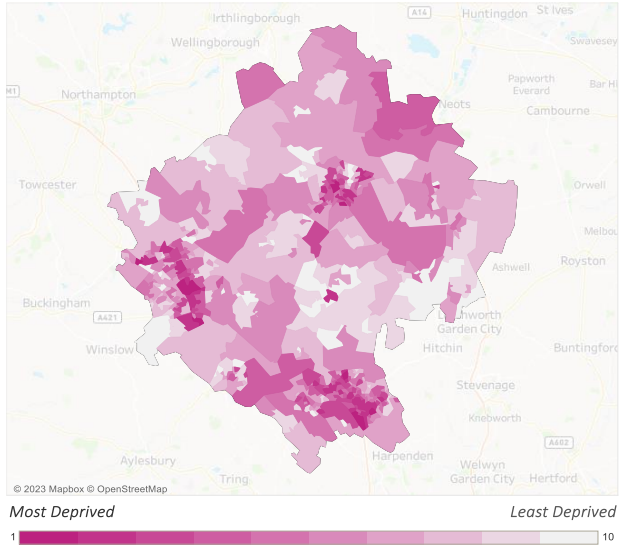
- Ethnically diverse population, with a large Asian and ‘Other White’ population compared to England.
- The ethnicity breakdown varies across BLMK, with the percentage of non-’White British’ ranging from 11% in Central Bedfordshire to 57% in Luton.
- Roughly 24% of the population live in areas in the bottom 3 deprivation deciles.

People living with diabetes in BLMK: 69,167

- Over 27% of those with diabetes live in bottom 3 deprivation deciles.
- Approximately 32% of those living with diabetes are from minority ethnic groups.



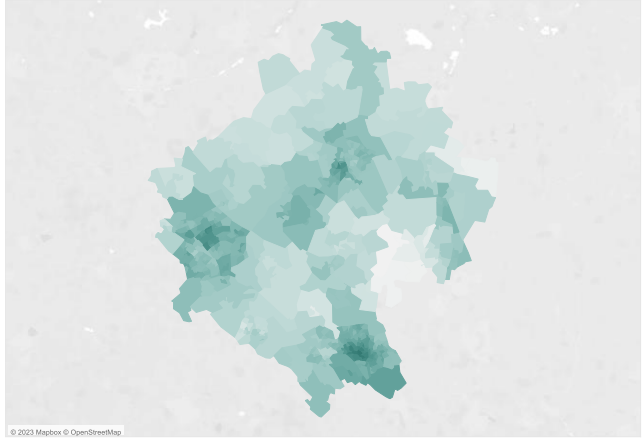
Deprivation in BLMK



Most Deprived — *Least Deprived*

1 — 10

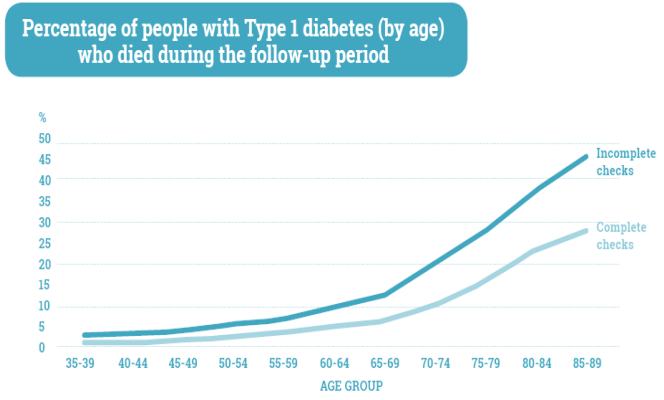
Percentage of Population from Minority Ethnicities by LSOA

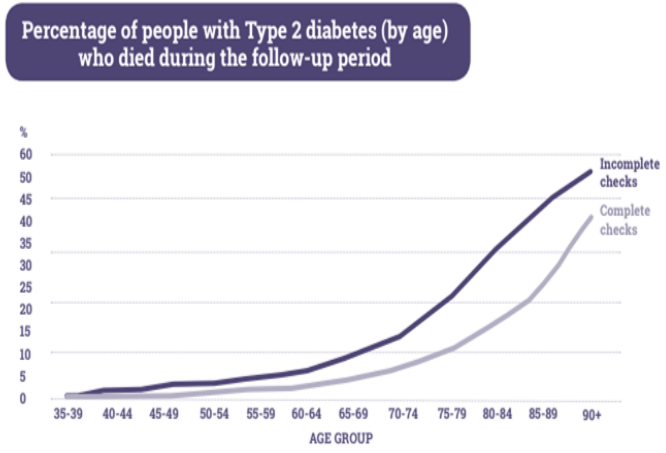


19.0% — 77.1%

National drivers for Diabetes

- Agreed processes and agreed targets nationally reported through National Diabetes Audit (NDA)
  - 8 care processes
  - 3 NICE treatment targets





Source: Diabetes.org.uk using NDA 2006-13

What are 'complete' and 'incomplete' healthcare checks?

So that we could compare those who had regularly received their annual healthcare checks to those who hadn't, the group of people with diabetes was split into two groups:

1. **Complete healthcare checks** includes all those who had three healthcare checks (HbA1c, cholesterol and blood pressure) each year for seven years (ie they had had 21 healthcare checks in total)

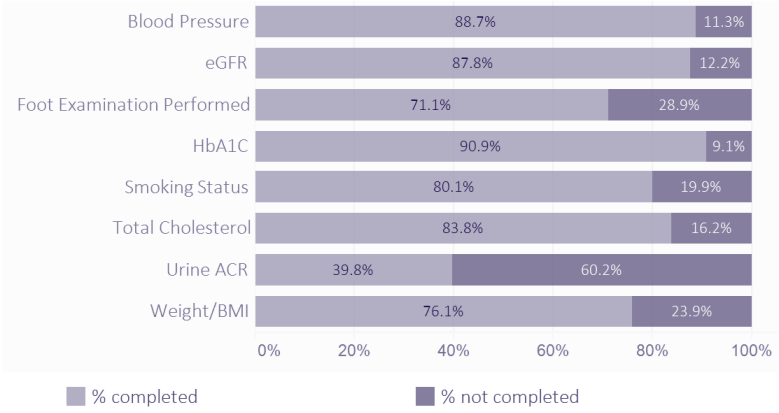
2. **Incomplete healthcare checks** includes all those who had 12 or less healthcare checks over the seven-year period.

BLMK performance metrics

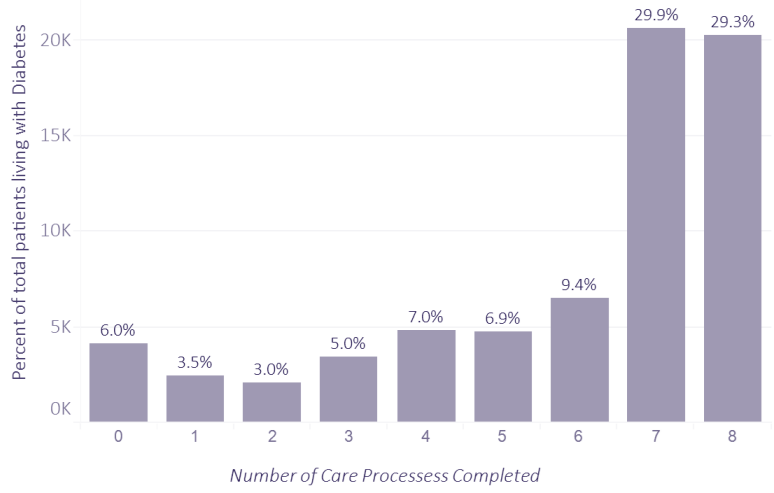
- Variation within BLMK
  - Only 29% of people living with Diabetes have all **8** care processes completed in 2022-23 so far.
  - but a further 30% have completed 7. Urine ACR has least compliance.
  - Practice variation :
    - In 25 GP practices there are at least 10% people with diabetes not having more than 1 care processes completed
    - More than half of the practices have over 10% of people not having more than 2 care processes completed
  - NICE treatment target: HbA1c, Blood pressure and Cholesterol
    - Over 47,000 patients don't achieve at least one (2022-23).

> *Historically, we have used the NDA data to explore performance and variation however it is always at least a few months out of date. Critically, it looks only at population level data and does not support identifying specific patients with unmet need. We have therefore largely used SystmOne reports at practice-level to identify people with greater unmet need, however these are very limited in functionality and do not readily support benchmarking across the system. Having a dashboard which not only provides contemporaneous population level data and benchmarking but also supports identification of people with high unmet need (with the ability to define parameters accordingly) would be extremely helpful for practices in optimising proactive diabetes care and population outcomes.*
>
> *- Chirag Bakhai GP, Strategic Lead for Long Term Conditions, BLMK Integrated Care Board*

Care Process Completion



Number of Care Processes Completed (2022-23)



Purpose of this dashboard

Who will use the dashboard:

- Clinicians from Primary and specialist care
- ICBs and PCNs for benchmarking and strategic planning

Bedfordshire Integrated Community Diabetes Service:

Prioritising patients for review, identify gaps in care and addressing how to rectify this.

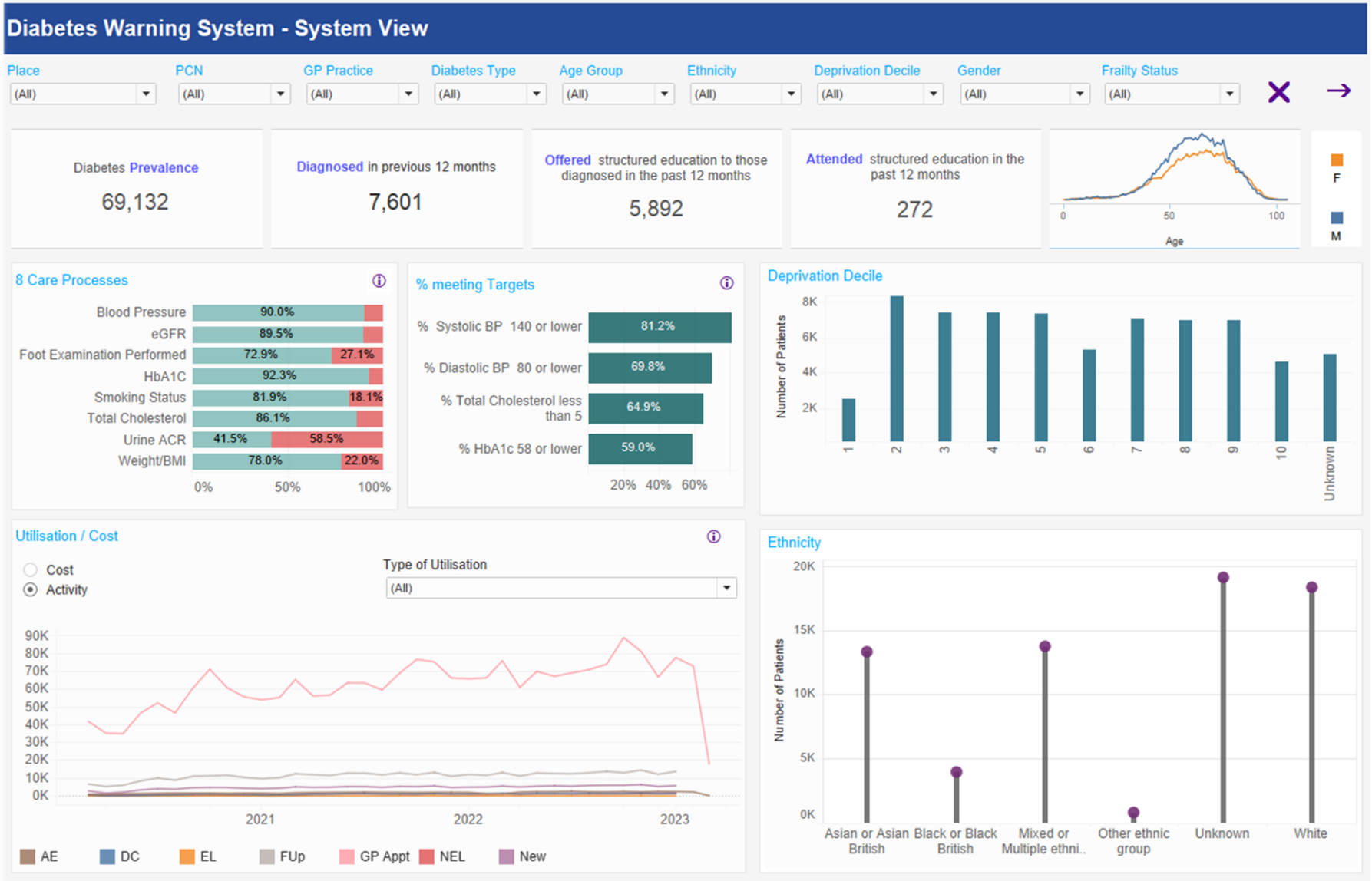
Examples:

Women of childbearing age, look at HbA1c, last review, current medication

Focus on Frailty, HbA1c targets and medication

Look at health inequalities, access to care and outcome in terms of treatment targets.

Diabetes Warning System – System View



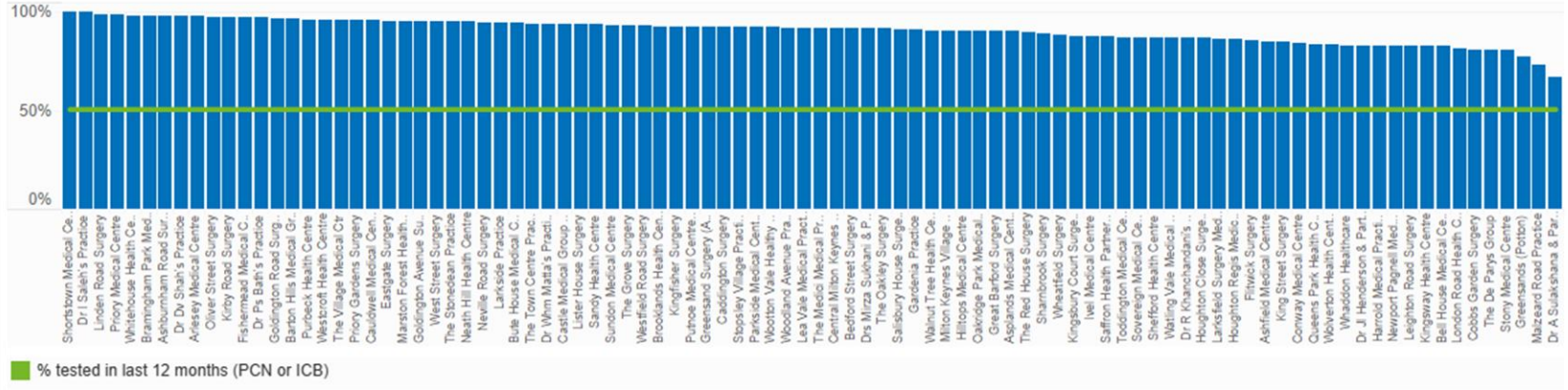
Diabetes Warning System – Benchmarking

Diabetes Warning System - PCN and Practice Benchmarking
% care process completed

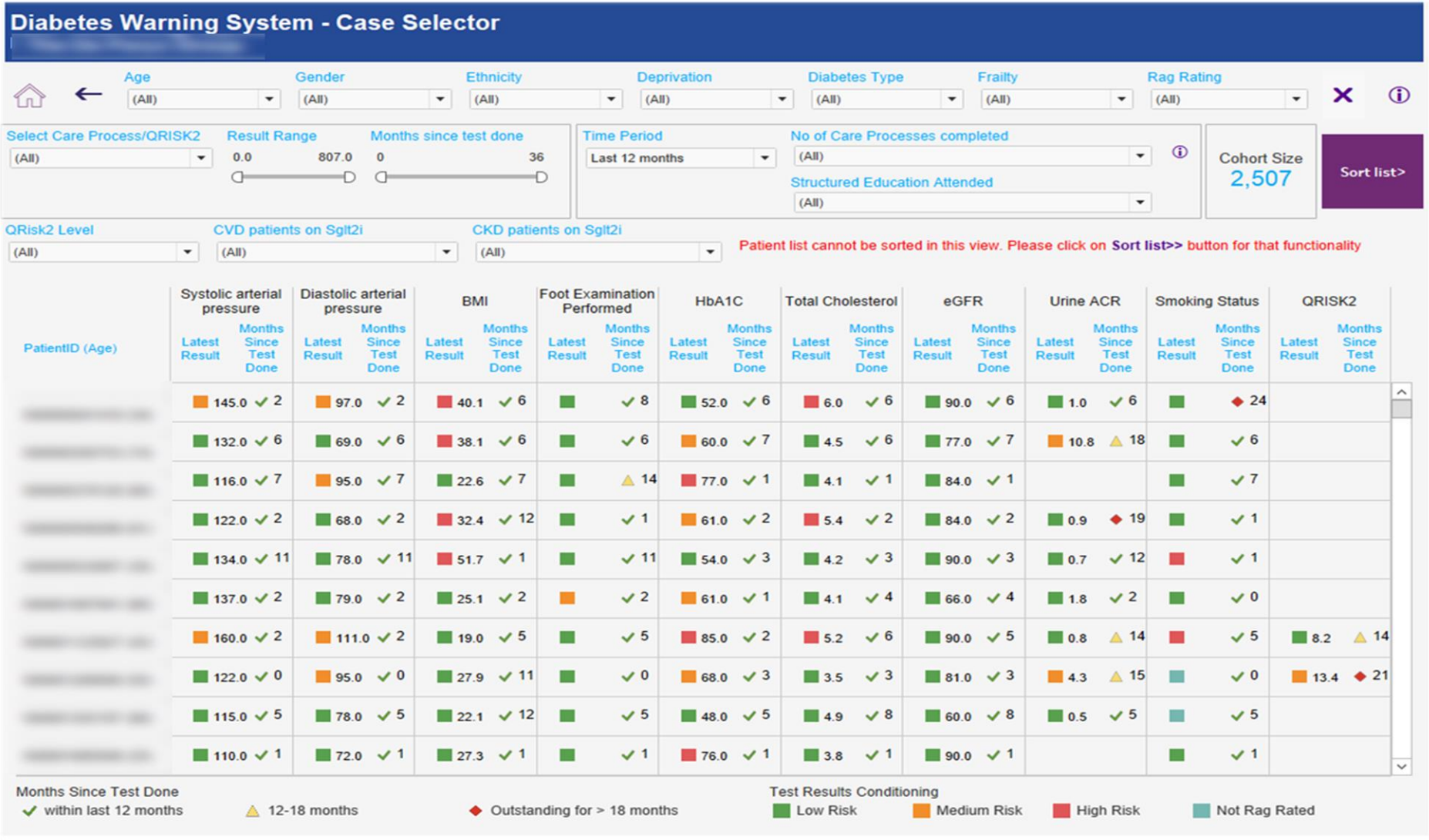
Place: (All) | PCN: (All) | GP Practice: (All) | Diabetes Type: (All) | Gender: (All) | Deprivation De..: (All) | Frailty Status: (All) | Ethnicity: (All) | Age Group: (All) | Time Period: Last 12 m...

PCN	GP Practice	% with no care processes	% with all care processes	Blood Pressure	Weight/BMI	Foot Examination Performed	HbA1C	Total Cholesterol	eGFR	Urine ACR	Smoking Status
U93573: THE BRIDGE MK PCN	K82016: Newport Pagnell Med.Ctr.	6.5%	26.6%	84.1%	80.6%	68.1%	90.2%	82.0%	90.6%	33.2%	75.6%
	K82074: Kingfisher Surgery	1.4%	20.2%	88.2%	78.6%	77.9%	86.4%	77.9%	84.6%	26.8%	84.6%
	Y02900: Brooklands Health Centre	6.1%	17.7%	90.7%	75.0%	75.4%	91.8%	85.2%	89.4%	25.3%	79.2%
U91286: LEA VALE PCN	E81032: Lea Vale Medical Practice	2.7%	43.1%	93.1%	89.6%	80.3%	93.1%	88.4%	89.2%	53.8%	93.4%
U90309: NORTH BEDF..	E81037: The De Parys Group	4.7%	23.1%	85.5%	75.5%	67.6%	91.4%	88.3%	90.9%	34.4%	73.2%
U86258: SOUTH WEST PCN	K82039: Bedford Street Surgery	3.7%	23.1%	92.5%	73.2%	65.9%	87.0%	81.7%	87.9%	26.5%	84.4%
	K82015: Parkside Medical Centre	3.2%	50.8%	94.6%	86.4%	85.1%	94.5%	91.3%	93.8%	59.3%	88.9%
	K82059: Westfield Road Surgery	2.9%	25.2%	95.2%	86.1%	73.0%	94.6%	89.1%	93.1%	32.7%	89.5%
	K82633: Westcroft Health Centre	0.9%	32.8%	96.3%	88.7%	89.7%	96.0%	94.3%	95.7%	37.7%	90.9%
U83511: HILLTON PCN	E81046: Dr A Sulakshana & Partners	3.9%	5.4%	80.7%	39.5%	28.0%	89.9%	79.2%	86.3%	16.6%	51.7%
	E81074: Houghton Close Surgery	2.1%	33.7%	92.6%	76.5%	76.1%	94.5%	86.5%	90.8%	42.1%	82.9%
	E81002: Greensand Surgery (Ampthill)	0.2%	34.2%	94.0%	80.4%	79.8%	96.3%	88.8%	93.0%	45.7%	88.0%
U79932: HATTERS HEALTH PCN	E81040: Sundon Medical Centre	5.0%	23.0%	89.4%	75.7%	70.6%	92.2%	84.4%	91.3%	41.5%	65.4%
	E81016: Lister House Surgery	2.0%	44.3%	89.8%	83.6%	83.2%	95.9%	92.3%	94.6%	54.6%	87.8%

Select a care process: Urine ACR



Diabetes Warning System – Case Selector

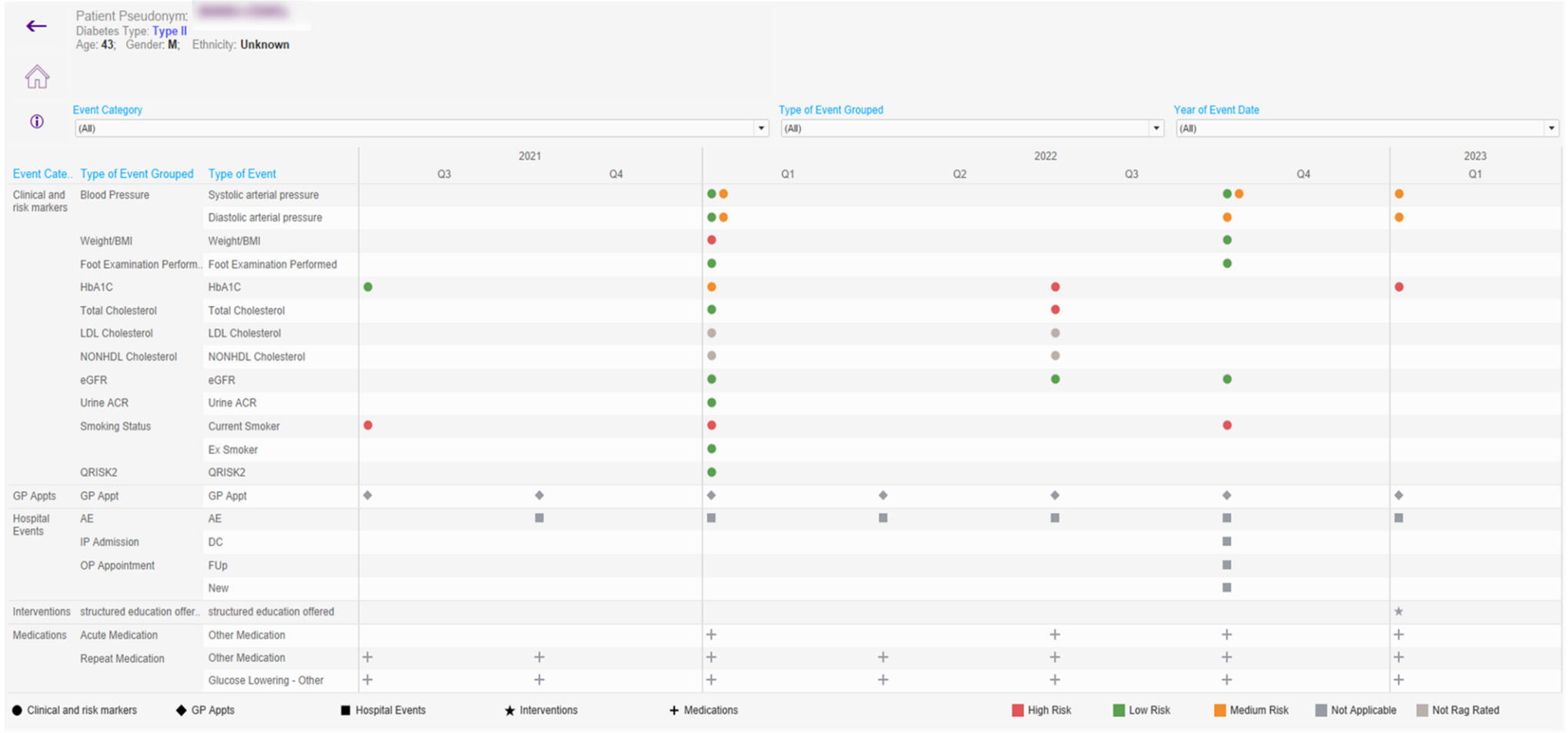


Diabetes Warning System – Patient View

Arden&GEM Advanced Analytics Unit
SHAPING DECISIONS FROM DATA

NHS Arden and Greater East Midlands Commissioning Support Unit

Diabetes Warning System – Theograph



Arden&GEM Advanced Analytics Unit
SHAPING DECISIONS FROM DATA

NHS Arden and Greater East Midlands Commissioning Support Unit

Development process

Taking advantage of linked datasets

Churning 16m records daily from primary and secondary care datasets

A team of 4 developers

GEMIMA - A live deployment platform

Scheduling for live deployment

Polly Chandler

Robbie Deegan
(previous team member)

Kamil Barczak

GEMIMA Team

Data and Systems Team

Other AGEM Advanced Analytics projects

1. A social prescribing case find tool powered by Machine Learning models
2. An evidence based COPD case finding tool powered by Machine Learning models
3. Applied Analytics and Health Inequalities
4. Population Segmentation
5. Forecasting and Clustering Models

Benefits and aspirations

A vehicle to help improve outcomes for people living with diabetes

Allows benchmarking at ICB, PCN and practice level

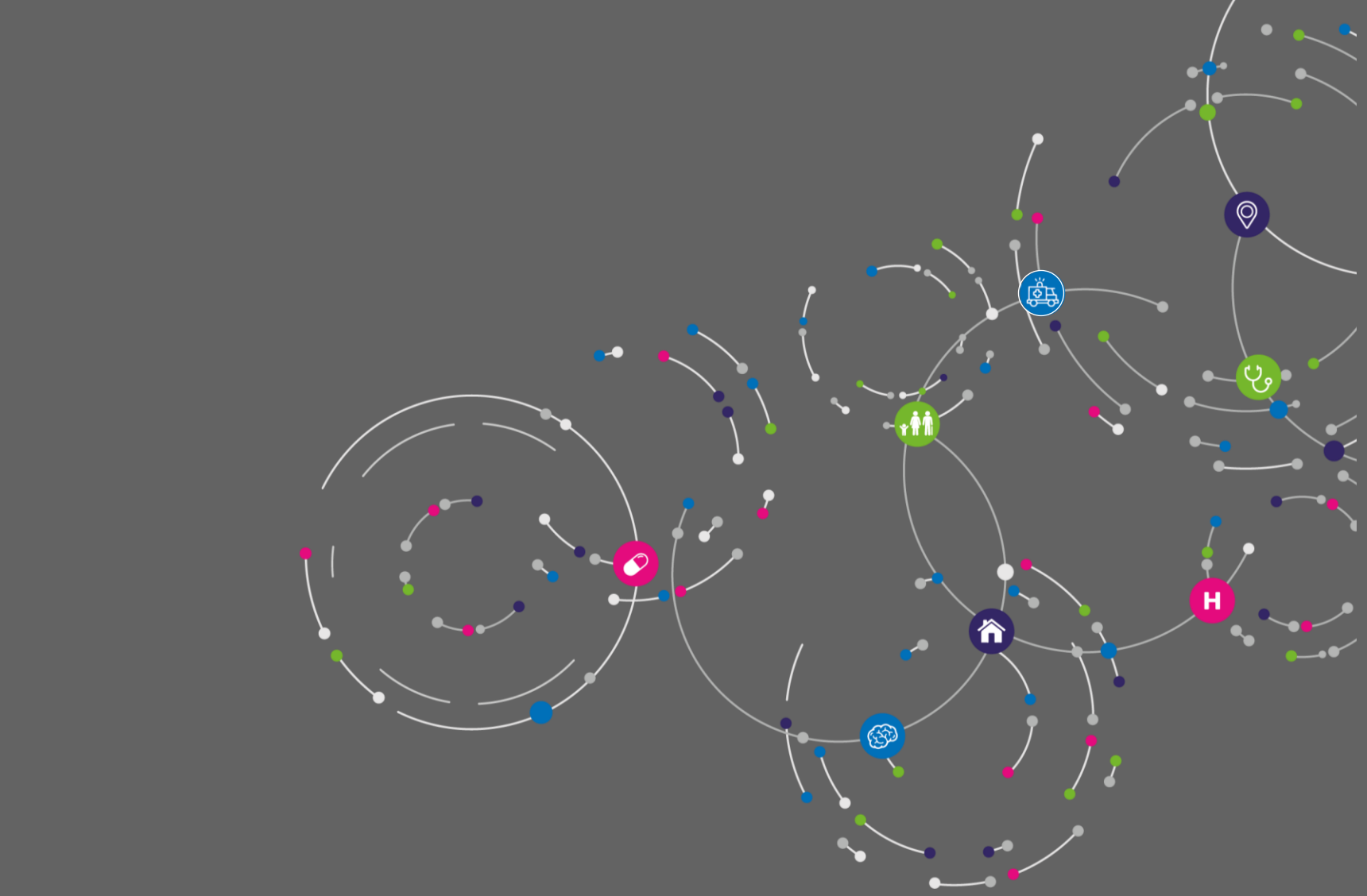
Target patient groups with the benefit of live data

Utilise resources effectively

A tool for strategic planning

Plan workstreams

Questions



Get in touch with us at:

www.ardengemcsu.nhs.uk

@ardengem

agem.advanced.analytics@nhs.net

Arden&GEM
Advanced Analytics Unit
SHAPING DECISIONS FROM DATA

UP NEXT...

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THE NHS DATA CONFERENCE 2023

SPEAKING NOW

Darren Challender

Director of Healthcare Advisory
Hitachi Vantara

I will be discussing…

"Using Digital Twins in Healthcare"

Digital Care & Operations

Using Patient Digital Twins in Healthcare

Darren Challender
Director Healthcare

March 2023

Content

HITACHI
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1. Hitachi – what we do
2. Global Challenges
3. Digital Twin
4. Next Steps for Patient Digital Twins

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Digital Care & Operations

Hitachi

Healthcare – what we do

Hitachi Healthcare Focus Areas

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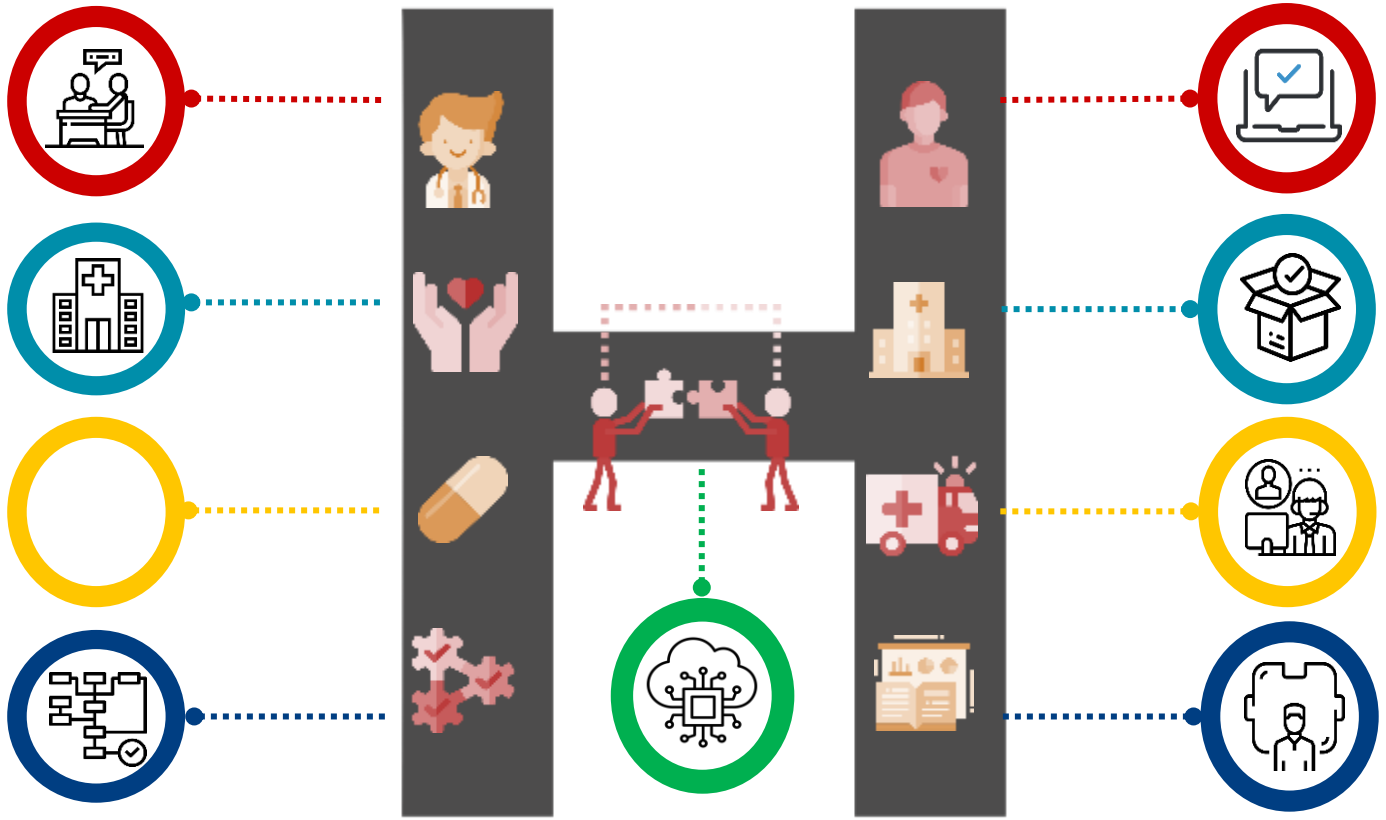
Digital Experiences

Regenerative Medicine
- Automated cell culture system
- Hitachi Value Chain Traceability Solution for Regenerative Medicine

Precision Medicine
- Precision Medicine Platform
- Risk Simulator
- Clinical Process Visualizer

Robotic Automation (JRA)
- Pharma, life sciences manufacturing, processing, testing, dispensing

Digital Infrastructure



Health Infrastructure
- Hitachi Application Reliability Centers
- Hitachi Digital Care Infrastructure

Digital Solutions

Digital Operations & Care
- Care System Transformation
- Digital Hospital
- Digital Diabetes Prevention

Oncology
- Carbon / Proton Therapy
- Radiation Oncology
- Liquid Biopsy

Digital Eco-System
- Remote Patient Engagement
- Decentralized Clinical Trials
- Novel Drug Discovery

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Digital Care & Operations

Healthcare

Global Challenges

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Today's Global Challenges

1

Capacity

Increased and more complex demand is challenging available operating capacity with organizations frequently at > 95%. Increased backlogs, waiting lists and bottlenecks are delaying care and impacting quality.

2

Workforce

Growing demand for care is outpacing supply putting strain on healthcare systems globally. COVID19 has exacerbated this challenge. Staff retention is a growing challenge.

3

Performance

Increasing cost of care demands continuous improvement in operational performance despite the challenges to capacity & workforce.

Delivery Challenges

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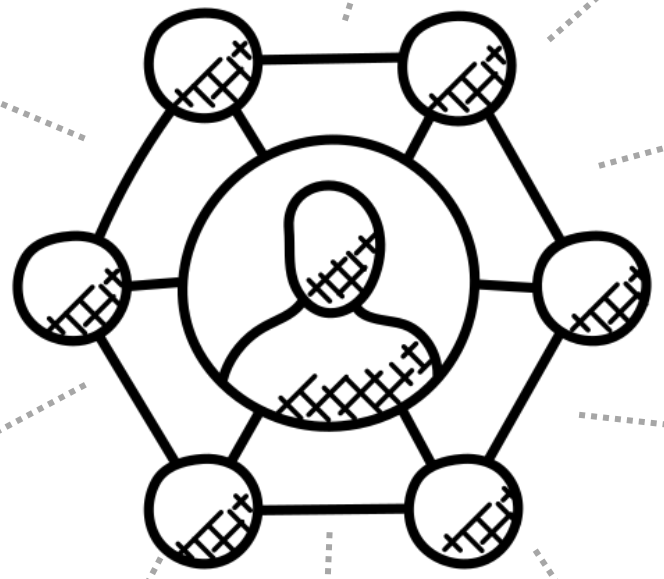
ADOPTION, ADOPTION, ADOPTION !!!!

Changing behaviours

Digital Maturity in healthcare- varies widely !!!

Differing groups across the healthcare sector



Standardization

Single version of the truth

Data literacy and maturity

Ways of working

Trust

Data quality, accuracy

Limited standard integrations

Data delivery and pipelines (near real time)

The volume of systems that we could connect to 200 - 1400+

Digital Healthcare – Meeting those Challenges

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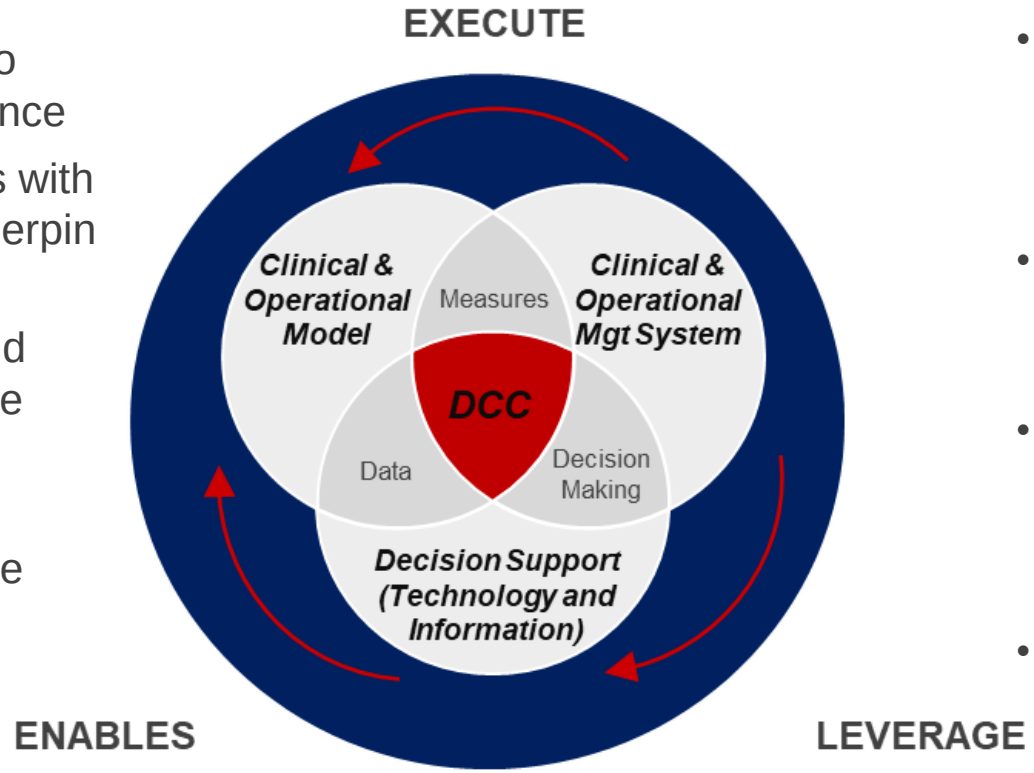
New Ways of Working

- Create a new operating model to drive a step change in performance
- Development of new behaviours with staff to drive innovation and underpin the new operating models
- Integration of existing clinical and operational information within the DCC to drive new insights and opportunities for improvement
- Creation of a decision excellence approach to support clinical and operational staff



New Ways of Managing

- Using Data, AI, ML and new technology to support new behaviours using decision support tools
- Providing insights and measures to drive and realise new outcomes and track value
- Enhanced operational insights driving an improvement culture to provide a step change in performance
- Agile model development approach to “fail fast and learn faster”.

New Ways of Making Decisions

- Single source of the truth for demand, capacity and flow through the system
- Data driven decision support tools to enable the organisation to focus and prioritise action
- Tracking of patients, staff and assets within the system

Decision Support tools

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D&C Live ™ + ED Live ™

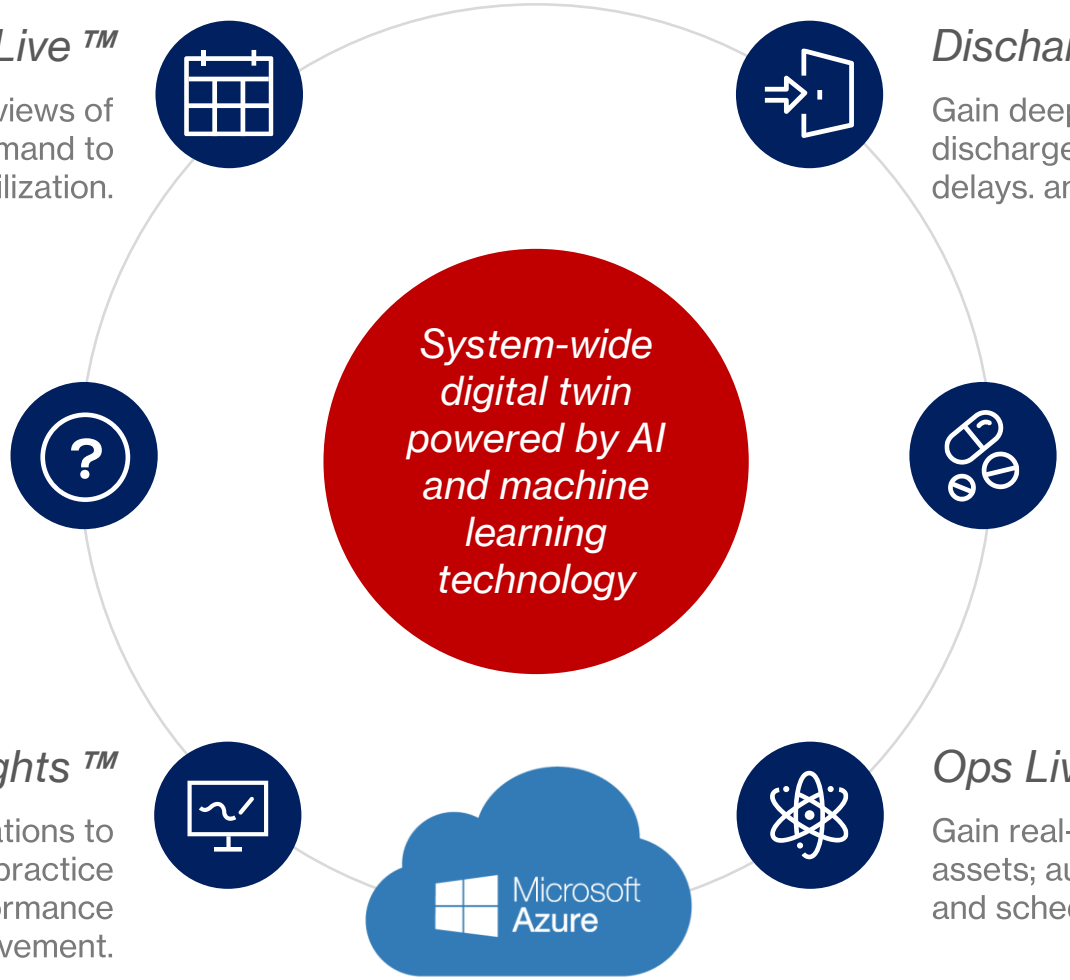
Use 72-hour predictive views of emergency and surgical demand to optimize flow and capacity utilization.

Discharge Insights ™

Gain deep insights into patients and their discharge plans to identify risks, mitigate delays. and improve pathways.

Clinical Insights ™

Provide staff with insights so they can better understand clinical variation, patient risks, and deterioration to reduce harm.



Care Flow ™

Improve staff efficiency and productivity through real-time optimization and management of care.

Operational Insights ™

Embed data-driven insights into operations to support daily decision-making and the practice management software to drive performance and continuous improvement.

Ops Live ™

Gain real-time visibility into patients, staff, and assets; automate workflows; respond faster, and schedule activity to improve coordination.

Hitachi Application Reliability Centers
Hitachi Digital Care Infrastructure

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Digital Care & Operations

Digital Twin

Patient Centric View

Digital Twin – Our View

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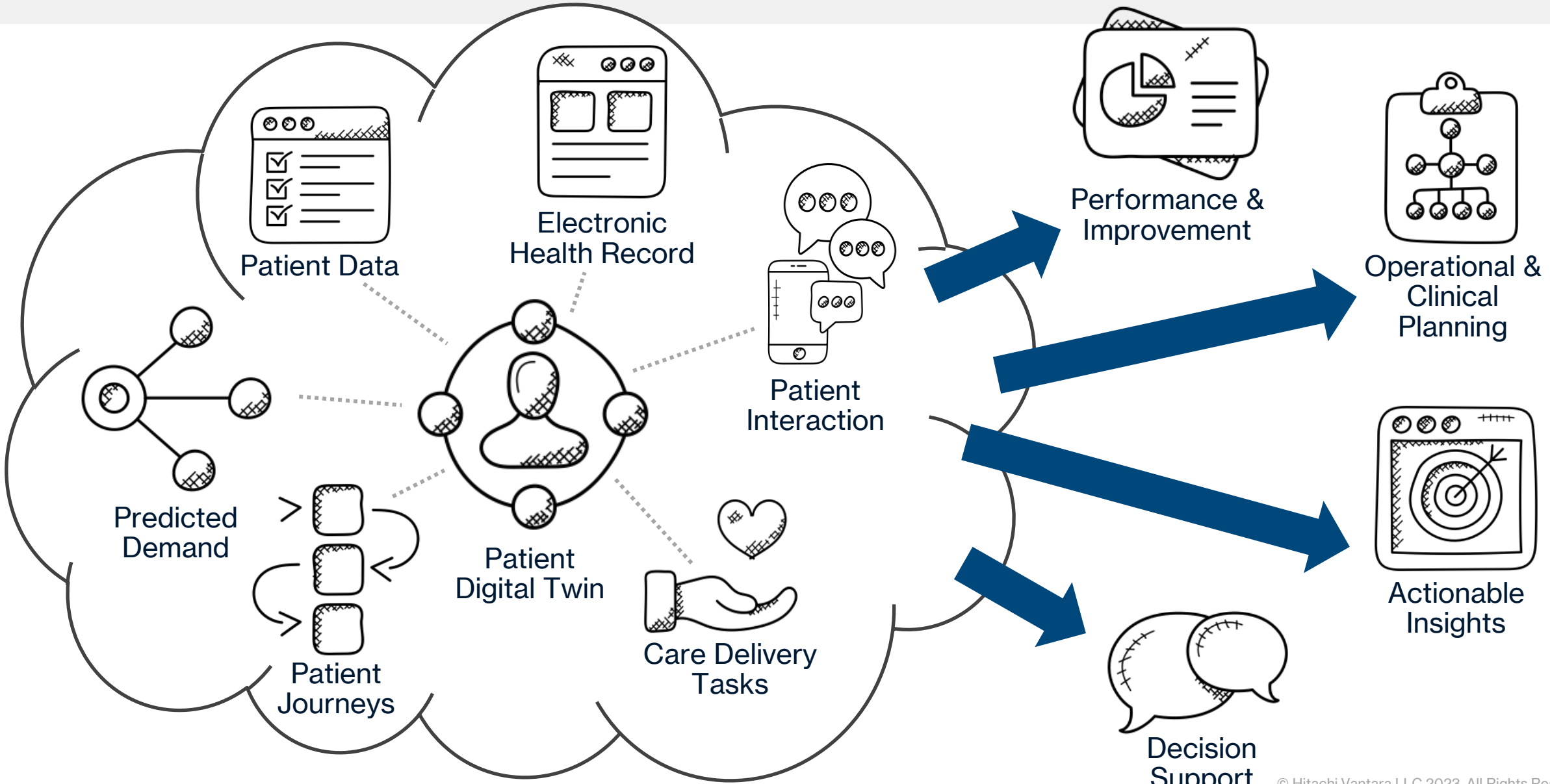

Typical Patient Journey & Digital Twin

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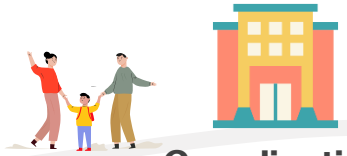
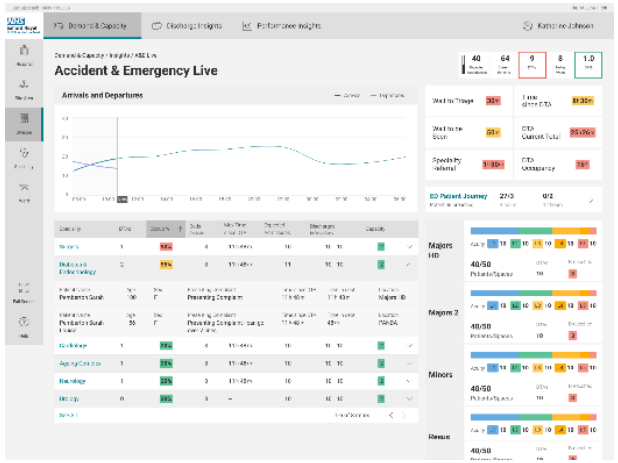
Anticipating Primary Care

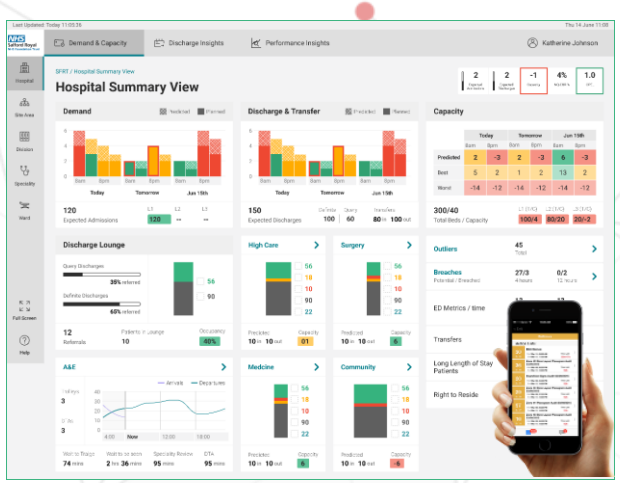
Optimising Secondary Care



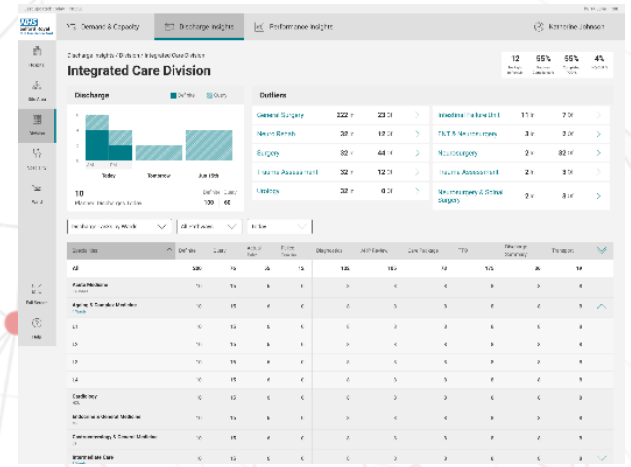
Coordinating Ongoing Support in the Community



- Predicted demand forecasting
- Front door / back door A&E
- Patient streaming & rerouting
- Patient flow management.
- AI/ML risk assessment



- Proactive demand & capacity mgmt.
- Proactive bottleneck resolution
- Smart scheduling of resources
- Operational insights
- Real time task management



- Proactive care pathway management
- Patient risk stratification
- Community staff allocation
- Discharge insights & optimisation
- Tertiary flow management
- Proactive demand & capacity mgmt.

New ways of working, data-driven, digitally-enabled

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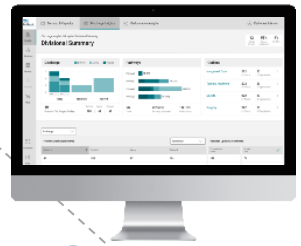
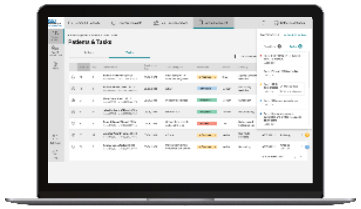
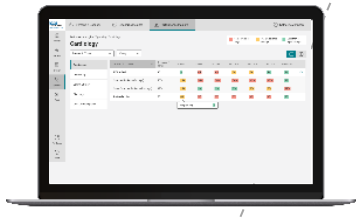
1 **Early visibility of discharge demand.** Allows care teams to plan & coordinate discharge from admission, facilitating earlier engagement with supporting care teams to address complex needs.

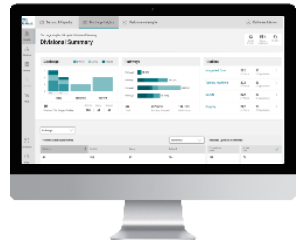


3 **Real time visibility and smart scheduling of discharge tasks.** Care Flow™ enables staff to define, track and coordinate tasks. Operational Insights™ delivers actionable insights to proactively address resource & capacity constraints, to optimize length of stay.





4 **Coordinated planning of simple & complex discharge.** Care Flow™ & Discharge Insights™ used to prioritize discharge activity and smart schedule discharge based on forecasted demand in D&C Live™ to optimize patient flow and predict demand & capacity requirements post acute care services.



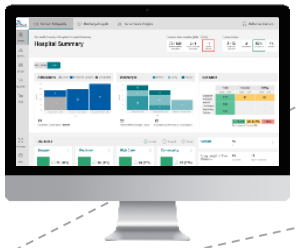
Attendance

Admission

Board & Ward Rounds

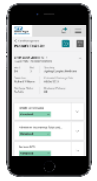
Board & Ward Rounds

Discharge or Transfer



2 **Predicted EDD, schedule & validation.** EDD predicted based on condition and validated through D&C Live™ at every board & ward round to improve organizational planning, prioritization and risk management.

5 **Early visibility and engagement of social & community care teams for complex care needs.** Discharge Insights™ provides early visibility to enable coordination between care providers, facilitated by unified task scheduling and management in Care Flow™.



Predictive Model development

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Admission Specialty

Models are trained to predict the most likely outcome for a patient after triage assessment in A&E. The outcome can be either predicted 'discharge' or the predicted admission to one of 25 hospital specialties.

Early warning of if the patient will be admitted to one of the hospitals 25 specialties or discharged, is pivotal for the proactive planning and management of patients. The aim of predicting admission specialty or discharge is to improve the flow of patients through the hospital.

Length of Stay models

Models are trained to predict how long a patient will stay in the hospital at the point of admission.

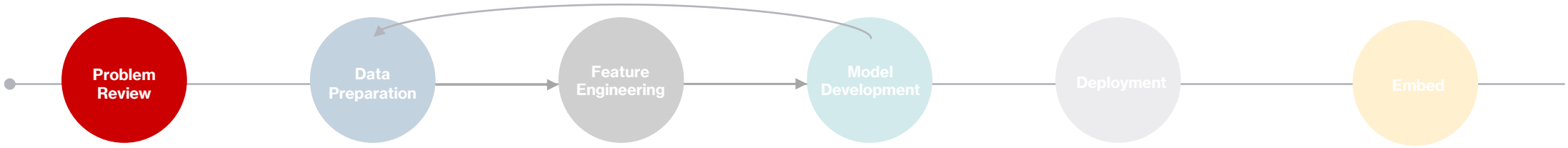
Length of Stay (LoS) of patients is a crucial factor for the effective planning and management of hospital resources. The aim of predicting the LoS of patients is to improve patient care, control hospital costs and increase service efficiency.

LoS is calculated as the time in minutes between a patient's admission and discharge.

72-hr Predictive Demand & Capacity Forecasting

Models are trained to produce 72 hours of forecasts for demand for each of the hospital's specialties.

Whilst the Length of Stay and Admission Specialty model support planning and management of resources for patients that are currently at the hospital, the Admission and Discharge forecasts provide a longer horizon on which to understanding the upcoming demand on the hospital system.



Next Steps for Digital Twins

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1

Capacity

Increased and more complex demand is challenging available operating capacity with organizations frequently at > 95%. Increased backlogs, waiting lists and bottlenecks are delaying care and impacting quality.

>10%
CAPACITY UPLIFT

Better care coordination and flow

DC&O improves visibility, planning and coordination by giving care teams predictive insights on demand and capacity, enabling them to optimize capacity utilization, proactively address bottlenecks and accelerate flow.

2

Workforce

Growing demand for care is outpacing supply putting strain on healthcare systems globally. COVID19 has exacerbated this challenge. Staff retention is a growing challenge.

ZERO
DUPLICATION

Simplified ways of working

DC&O connects care teams with unified task management, real time intelligence and actionable insights to improve efficiency, productivity and staff experience – giving your staff more time to care for patients.

3

Performance

Increasing cost of care demands continuous improvement in operational performance despite the challenges to capacity & workforce.

>10%
REDUCTION IN ALOS *

Better patient experience & outcomes

DC&O drives system-wide improvement and transforms care delivery by embedding a digitally enabled operational management system. Reduced delays, cancellations, readmissions, outliers and stranded patients – improve patient flow, experience & outcomes

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Digital Care & Operations

Digital Twin

Next Steps and the Future

What else could be done?

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1 Capacity

Increased and more complex demand is challenging available operating capacity with organizations frequently at > 95%. Increased backlogs, waiting lists and bottlenecks are delaying care and impacting quality.

2 Workforce

Growing demand for care is outpacing supply putting strain on healthcare systems globally. COVID19 has exacerbated this challenge. Staff retention is a growing challenge.

3 Performance

Increasing cost of care demands continuous improvement in operational performance despite the challenges to capacity & workforce.

Future Digital Twin Usage

There are multiple areas where the use of a digital twin when integrated with other digital capabilities such as AI/ML could rapidly change the way the healthcare system currently works, such as:

- **Strategic Scenario and options analysis – multi-level**
- **Hospital and healthcare system design**
- **Population health management**
- **Disease progression**
- **Resource optimisation**
- **Capacity analysis**
- **Operational efficiency**
- **Value & benefit analysis**
- **Clinical outcome / variation analysis**

The outcomes of these types of use of Digital Twins could lead to:

- **New models of care**
- **New healthcare systems**
- **Optimized clinical pathways & diagnostics**
- **Automated scheduling of care**
- **Enhanced data science models**
- **Better patient outcomes**
- **Reduced costs**
- **Etc.**

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Thank You

Darren.Challender@Hitachivantara.com

Director Healthcare
Hitachi Vantara

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Digital Care & Operations

Appendix

Hitachi, 70 years in Healthcare

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Hitachi Hospitals (Japan)

- Operates 5 Hospitals (>3000 beds)
- Healthcare Insurer, using Big Data Risk Analytics
- Digitally Integrated Community Care for 3 cities (Japan)

Medical Equipment (Globally)

- MRI, CT, Ultrasound, Particle Therapy (e.g Proton)
- AI Predictive Maintenance
- AI Imaging & Diagnosis, Smart Operating Theatres

IoT Facilities Optimisation (Global)

- Advanced Analytics, RTLS, LiDAR
- Ward / Theatre Optimisation
- Asset tracking and smart scheduling

Precision Medicine Platform (Global)

- Cloud based secure data exchange
- Supports diverse data-sets, facilitates research collaboration and accelerates research activities

Clinical Process Variation (Japan / UK)

- Clinical Process Visualiser
- ML-based identification of clinical / operational variation

Breast Cancer Screening (UK)

- Outsourcing provider for UK National screening
- Supporting 3M women for screening annually
- Assisting with transformation of the service

Lifestyle Disease Management (Japan)

- Lifestyle service for citizens at risk of lifestyle related diseases (type 2 diabetes, Hypertension, etc.)
- Served 40,000+ patients since 2007

Digital Diabetes Prevention (UK)

- Co-Designed with NHS (Salford CCG / SRFT)
- CATFISH Clinical Service Trial (2014-17)
- UK National Digital Diabetes Programme (2019)

Smart Hospital (DCO) (Global)

- Transformation / Change programme enabled through digital modules which span the entire hospital (A&E, In-Patient settings, and Discharge lounge)

Clinical Analytics (Global)

- Cardiac Readmission Risk Prediction (Partners)
- Pharmacology Outcome Prediction (PDSS, Utah)
- Precision Medicine Platform (AHA)

One Hitachi Digital Healthcare

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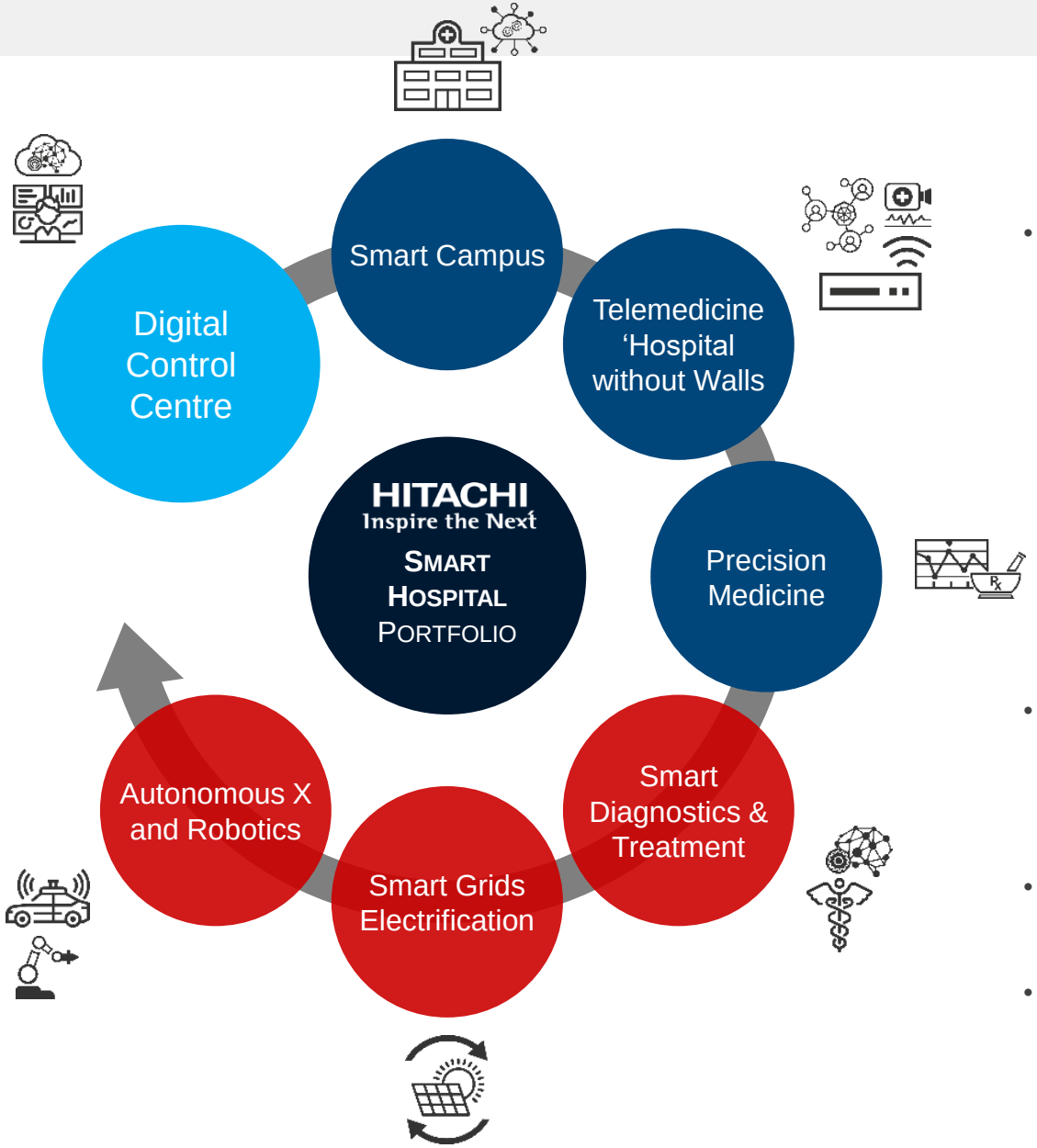
Provider Transformation

- **Digital Control Centre** delivers the core platform and foundation for IoT and Connected Care expansion
- **Hitachi Smart Campus capabilities** (facilities, security, vehicles, retail, IoMT) and centralised visualisation for integrated care operations

Sustainability & Innovation

- Leverage / expand **Smart Campus** through **Hitachi Group** extensions
- Address decarbonisation in healthcare with **Smart Grids** / renewable energy
- **Hitachi mobility / fleet electrification** solutions for ambulance / transport
- **Hitachi Automation & Robotics** to expand autonomous patient transport, guided medical equipment, etc.



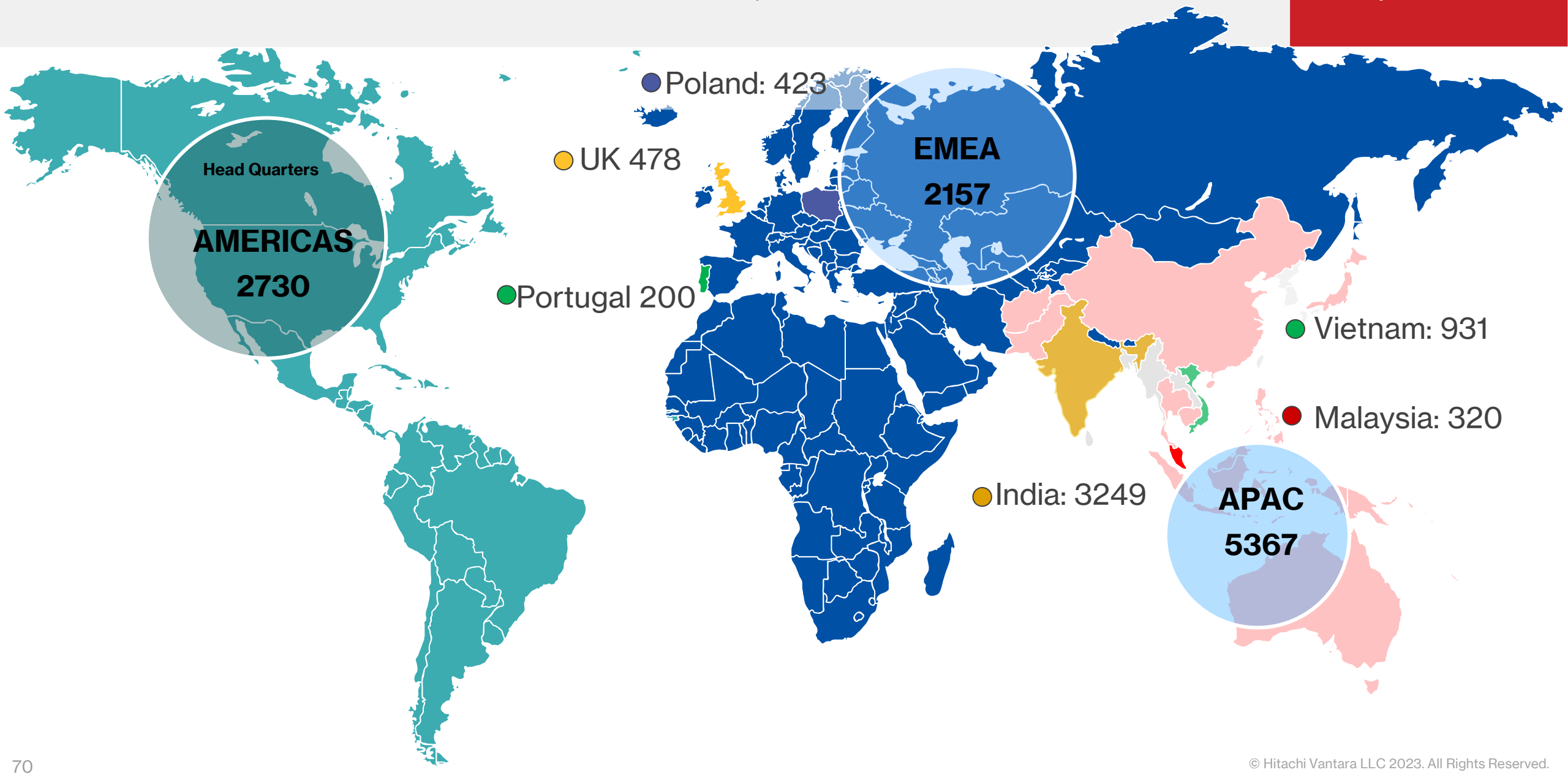
Connected Care

- Delivering the 'Hospitals without Walls' capability by leveraging **Hitachi groups companies, Industry partnerships and Eco System partners** to deliver telehealth across integrated care systems

Personalised Care

- Development of **Hitachi personalised care** and **population health management** through the development of AI capabilities and products with **Hitachi R&D**
- **One Hitachi collaboration** and ecosystem for Precision Medicine from research to operations
- **Hitachi Smart Life offerings:** PBT, Regenerative Medicine, Cancer Diagnosis

HV Global Headcount: Over 10,000



Innovating Healthcare, Embracing the Future

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Digital Healthcare

DIGITAL HEALTH AGE
HEALTHTECH FOR HEALTHCARE

Hitachi & NHS collaborate to fight diabetes with digital health

Digital Transformation

WIRED

The digital tools that could save the NHS

NHS hospitals face smaller budgets and more patients — but there are digital tools that can lower costs while significantly improving care.

Data-Driven Healthcare

NEXT 2020

NOVEMBER 16-18 | LAS VEGAS

Cloud Technology Brings the American Heart Association Precision Medicine Platform to Life

Case Study - Hospital – Digital Transformation – (Digital Care & Operations)

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We partnered with a digitally advanced acute Hospital in the North of England with 840 beds and approximately 8000 clinical and operational employees, to transform siloed systems and processes into a Smart Hospital. We combined design, advanced analytics, and healthcare strategy to launch a first-of-its kind digital control center, enabling clinical decision making and operations to improve the delivery of care.

Client Background & Challenge

- The acute healthcare sector has been under intense pressure in terms of demand, capacity, workforce and cost challenges, all of which have been exacerbated by the global pandemic
- The client was particularly challenged with respect to its ability to meet the increasing demand on its capacity and the flow of patients through the hospital
- Therefore, a vision and a series of requirements was created which it believed would address these challenges, this included:
  1. Vision - Create a learning Healthcare system and culture across the organization and to become the most digitally advanced organisation in the world
  2. Improve outcomes and experience for the Patients and users across the organization
  3. Create a quality-based culture of learning and improvement across the organization
  4. Implement a data-driven digital transformation, to support enhanced decision making for operational and clinical staff
  5. Co-create digital tools and services to enable staff to work more efficiently and effectively across the hospital.
  6. Embed sustainable ways of working to enhance patient and user experience
  7. Provide decision support and operational insights from across hospital systems

Solution

Hitachi worked with the clinical & operational teams and patient advocates utilizing a patient and user centric design service design approach to address these challenges; which culminated in the development of; a new operating model, a digital control center to support decision making and an underpinning management system to improve the delivery of care and to drive continuous improvement across the organization and an outline implementation plan.

A joint team worked in partnership to create and implement a detailed design and change program which outlined the operational & clinical processes, the organizational structures, operational & clinical routines, services and products required to deliver the operating model and the new ways of working.

This resulted in:

- The creation and deployment of a new digital operating model and supporting operational management system that utilised lean & quality thinking and new technology products to support decision making
- New core products to manage, demand, capacity, flow, discharges, care tasks and ED; and analytical products to generate operational, discharges and performance insights in near real time
- The creation of a data engine and KPIs to create a single source of truth regarding the patient journey and the integration of existing and new clinical and operational systems and information within the control center to derive new insights.
- Implemented machine-learning & AI to drive efficiencies within the management of hospital demand & capacity and to generate predictions of LOS and discharges
- Implemented a real-time location system increasing the visibility and operational efficiency of clinical and operational workflows.
- The creation of a new Centre of Excellence to own, develop and continuously improve the operating model, management systems and products across the organisation
- Implemented a modular solution, to enable scaling of products across the control center and the wider organisation

Digital Transformation

- Effectiveness Benefits
  - Improved flow
  - Released Capacity
  - Enhanced Decision making through decision support
  - Single line of site
  - Enhanced operational management system driving continuous improvement
  - Near Real time hospital performance
  - Predictive capability
  - Enhanced board and ward rounds
  - No lost tasks
- Efficiency Benefits
  - Reduced Length of Stay
  - Increased Bed Utilisation
  - Reduced stranded and super stranded patients
  - Released value / benefits
- Qualitative Benefits
  - More time to focus on patients, quality and safety improvements
  - Increased morale
  - Better patient experience
  - Finding ‘lost’ equipment

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COMFORT BREAK

Please remain logged into the platform.

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THE NHS DATA CONFERENCE 2023

SPEAKING NOW

Graham Beales

Head of Business Intelligence
NHS Greater Manchester

I will be discussing…

"NHS Greater Manchester - Adopting cloud first data management with our fantastic team, Snowflake and Matillion"

snowflake®

MATILLION

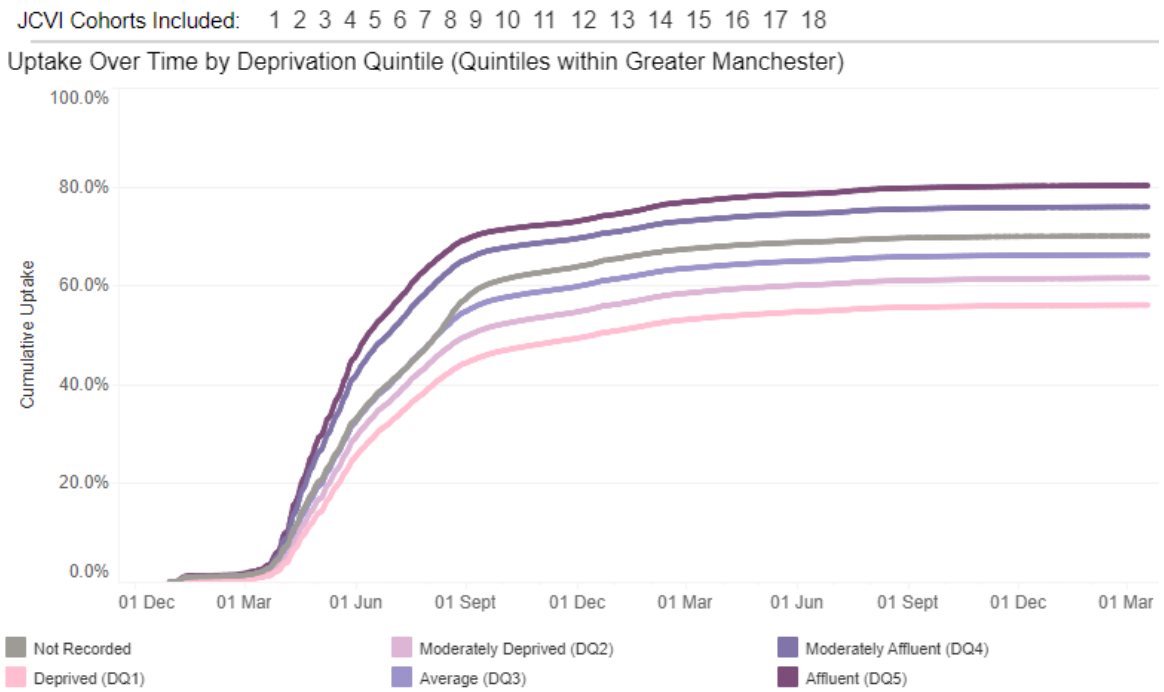
Graham Beales | NHS Greater Manchester

Using Data to Support People's Health & Social Care

NHS
Greater Manchester
Integrated Care

ABOUT US

NHS Greater Manchester Integrated Care



Case for Devolution

- GM (Greater Manchester) has typically worse health outcomes than the England average.
- GM has some significant pockets of deprivation
- The City of Manchester has an unemployment rate of 7.3% nearly 50% higher than the UK average.
- North Manchester areas are also all higher than the average of 4.8%

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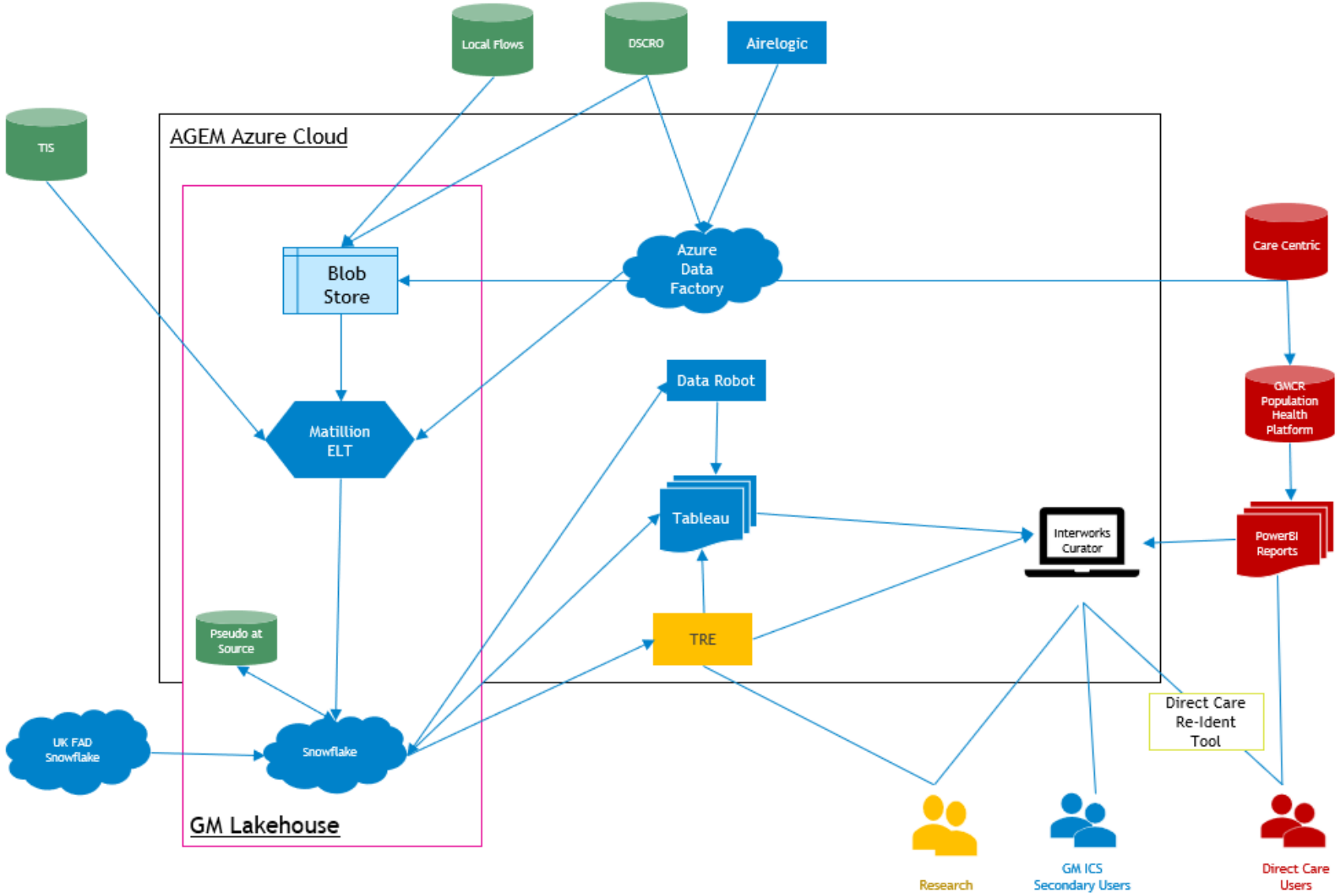
ABOUT US

Case for Devolution

- Round 1 Devolution – GM Heath and Social Care Partnership
- More control over budgets and how they were spend
- Many transformation projects inc. CYP Dental, Social Care, Mental Health & Cancer.
- My role was to build collaboration & deliver as a system, building on strengths, encouraging transformation
- GM Tableau was one of my first objectives to deliver a shared platform.
- As a Local Health & Care Exemplar region we have expanded beyond many regions to include some mature data capabilities including Snowflake, Matillion & Data Robot.
- Today the GM ADSP (Analytics and Data Science Platform) has significant investment and capability with over 6k registered users across the GM system.

NHS GM ADSP (SDE)



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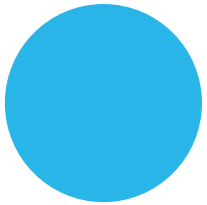
What has changed?

Everything!

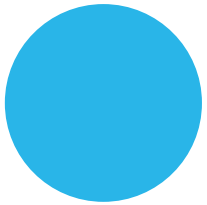
A perfect storm has created the conditions for change, but how we have approached it as a team has enabled us to take advantage.

- Solid plan worked up over time
- External support (Interworks) to learn quickly
- Strong leadership
- Investment in training and support
- Shared purpose or mission statement
- Collective subject matter expertise



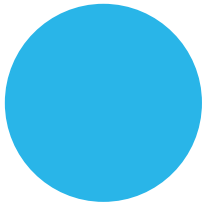
Secure Data Environment

National policy around unified data layer and secure storage of data. GM are part of the wave 1 national programme.



Demand

Reform of services as part of ICS transition, budget pressures and breadth of intelligence to make decisions have grown demand.



Collaboration

Reducing duplication, developing efficient pipelines and progressing as a collective has created conditions for sharing and collaboration.

Transition as an ICS

NHS Greater Manchester Integrated Care

1.

Common

- Be prepared – It's a total change!
- Need a plan to take advantage of whole stack
- Initial fear of Unknown
- Champions help to lead the message
- Empowered to develop own training

2.

Snowflake

- Commonality with the known became quickly apparent.
- Most MS T-SQL developers took to the platform very quickly.
- Formal training gave good grounding with principles.
- Clear approach supported by expertise led to moving in the same direction.

3.

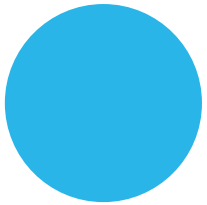
Matillion

- Similarity with SSIS eased concerns.
- Key features made sense quickly
- Web hooks in to MS Teams team to report problems
- Replicable processes enabled rapid onboarding of multiple datasets.

Meta Data Approach

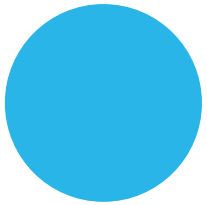
Replicable process

- Data sets are processed driven by accompanying meta data.
- Datasets can change but we will always bring the data in.
- A flexible process but audit is stronger.
- Changes flagged and addressed rather than updates falling over.



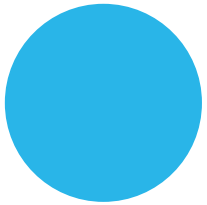
Single pipeline coded

Data is all onboarded using the same pipeline, meta data directs the how.



Multifacited

Works regardless of the provider of the data and sets a standard



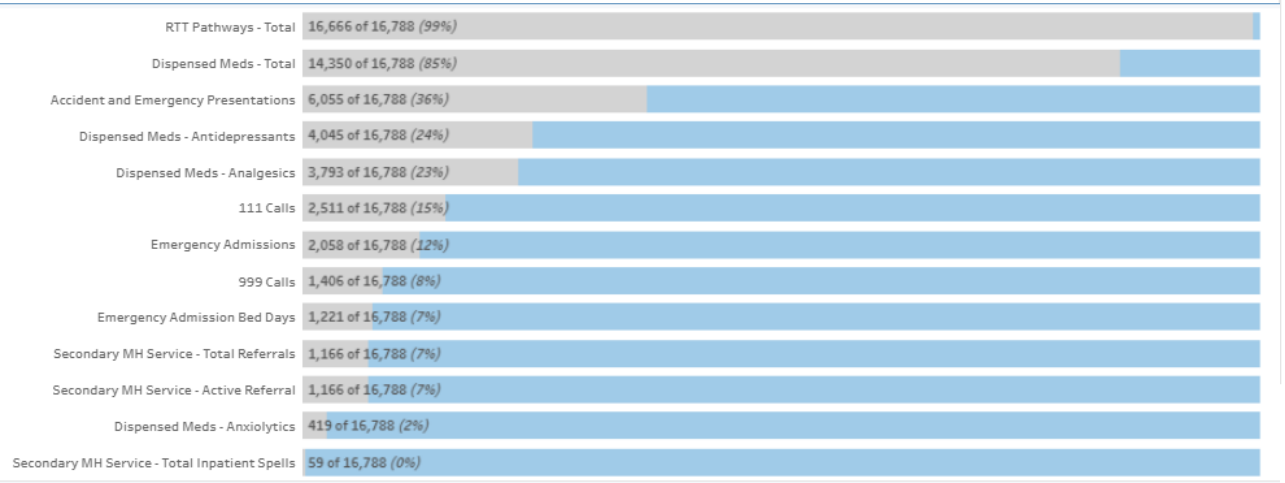
Data Catalogue

Supports a robust data catalogue approach meaning meta data generated as we go populates the catalogue.

Longitudinal Record Analytis

Greater than the sum of parts

We can now take data from hundreds of providers through national and local routes to deliver a view of our patients across all. This enables us to explore risk and equalities for strategic, tactical and operational delivery.



More holistic view

Providers usually cannot see other providers data as part of their analysis but benefit to all

Population Health

Better understanding our patient cohorts through linked data will enable a more intelligent and focused approach

Direct Care

We conduct analysis on pseudonymised data but can enable those clinicians with a legitimate relationship to re-identify where a direct care requirements is identified.

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Elective Use Case

NHS Greater Manchester Integrated Care

Shared View of Waiters

Post covid restrictions people are waiting longer for elective treatment and may wait at another provider than they would usually attend. Shared data enables a view across providers to understand the risk of waiting and service utilisation whilst waiting.

Clinical Engagement

- Clinical groups are stood up across GM to support continous improvement.
- These groups are supporting the process and ittertively feeding back
- Clinical support is vital as they are the ones who will create a change.

Complex Lives

- Patients are people, they do not live to be a patient
- Many patients are waiting on multiple pathways
- Services are quite siloed in comparison
- Common problems identified can support pathway redesign to support access

More to Come

- GP Data to support long term condition understanding
- Social Care Data to support undertanding of risk and complexity
- Wider partner data will offer a view on non clinical risk and complexity

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NRTR Use Case

NHS Greater Manchester Integrated Care

No Reason to Reside

Increased complexity of patients in hospital can cause increased complexity around discharge, espeically due to pressures in community and social care. Averages really skew any analysis of the situation so a granular approach was required.

Whole System View

We can look at the problem through a variety of lenses including from the accountable discharge agency, aiding practical converstations and identify persistent problems.

Long Delays Visible

Some patients had waited significantly longer than the average for discharge, which aggregte numbers somewhat hid. Having them visable daily has supplied the evidence to progress opperationally.

Dispel Myths

Assumptions and commonalities had been applied to cohorts, e.g. less complex pathways would never see long waits. This turned out to not be true as non clinical reasons such as accommodation status also cause delays.

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WHAT'S NEXT

NHS Greater Manchester Integrated Care

Final push to full cloud

A huge amount of work has been done to get us where we are, but there are still some legacy issues to be resolved.

Relational Analytics Data Model

The timing of the noodle model in Tableau has been impecable, enables us to adopt a longitudinal record and more complex data model's without developing specific datasets

Longitudinal Analytics Maturity

We will mature our longitudinal record capability but also harness the power to reform our analysis. The linked data is a world of opportunity but will also support consistency to equalities analysis.

Improved Patient & Population Outcomes

The insights generated to support the development of pathways and interveen with individual patient risks will support our system to identify interventions and focus change where we can demonstrate the biggest impact.

MATILLION

Find Out More About Matillion and Snowflake

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MATILLION

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snowflake®

Graham Beales | NHS Greater Manchester

Using Data to Support People's Health & Social Care

THE NHS DATA CONFERENCE 2023

SPEAKING NOW

Rosie Underwood

Head of Data Security, Privacy and Records Management
NHS Blood and Transplant

I will be discussing…

"Delivering Strategic Change in Data Security and Data Privacy"

UP NEXT...

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THE NHS DATA CONFERENCE 2023

SPEAKING NOW

Andy Spencer

Technical Account Manager, Public Sector Team
Veritas Technologies

I will be discussing…

"Defend your Patient Data - Don't Pay the Ransom"

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Defend Your Patient Data – Don't Pay the Ransom

Andy Spencer

Technical Account Manager

Number of Breaches or Attacks Identified in Last 12 Months

All UK businesses

39%

UK Healthcare Organisations

81%

£

UK Healthcare Organisations who paid a ransom

38%

UK Healthcare Organisations who refused to pay ransom and lost data

44%

Statistics as at 2021, courtesy of https://www.infosecurity-magazine.com/news/healthcare-ransomware-last-year/

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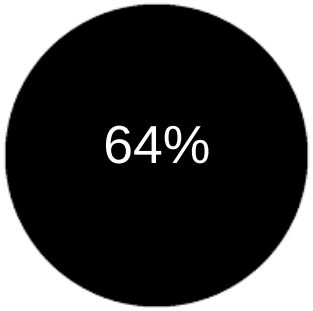
Feared Repercussions of Ransomware Attacks in Healthcare

UK Healthcare Organisations cancelling appointments



UK Healthcare Organisations who fear loss of life

Statistics as at 2021, courtesy of https://www.infosecurity-magazine.com/news/healthcare-ransomware-last-year/

What it’s Like to be a Ransomware Victim?

National Cyber Security Centre - 10 Steps to Cyber Security

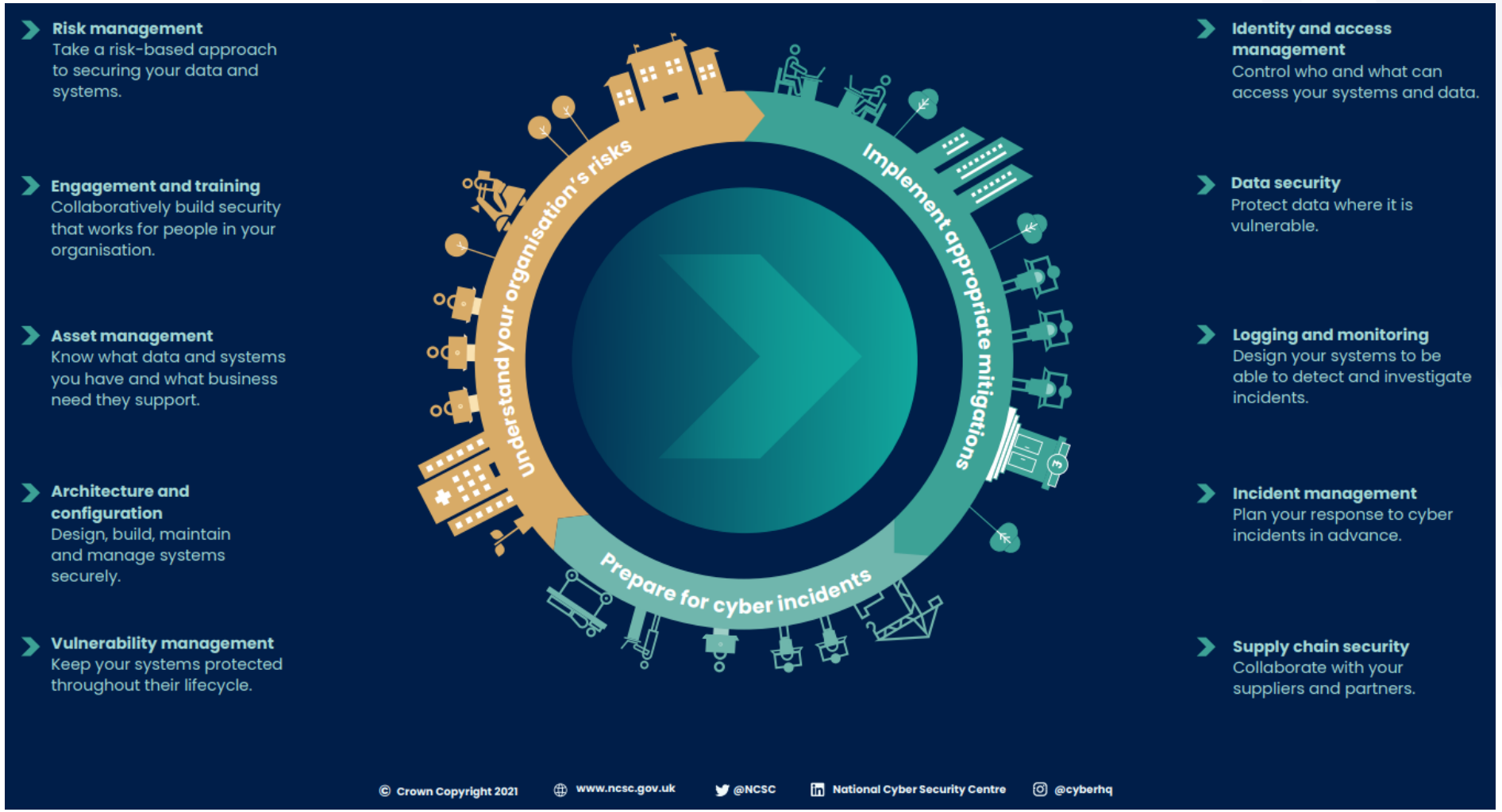


Image from https://www.ncsc.gov.uk/collection/10-steps

NCSC Recommendations for Ransomware Mitigation

National Cyber Security Centre

- Risk Management
- Engagement and Training
- Asset Management
- Architecture and Configuration
- Vulnerability Management
- Identity and Access Management
- Data Security
- Logging and Monitoring
- Incident Management
- Supply Chain Security

Extrapolated from https://www.ncsc.gov.uk/collection/10-steps

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Ransomware – Evolution of Attacks

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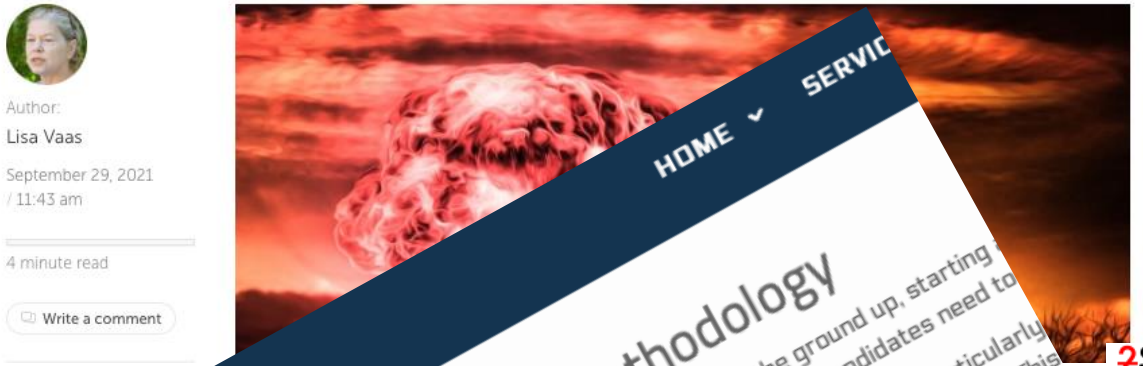
Ransomware Groups – Going After your Backups

Conti Ransomware Expands Ability to Blow Up Backups



Author:
Lisa Vaas

September 29, 2021
/ 11:43 am

4 minute read

Write a comment

HOME

SERVIC

Conti's Backup-Obliteration Methodology

AdvIntel has found that Conti builds its backup-removal expertise from the ground up, starting
gang recruits workers to invade networks, it's clear that penetration-tester candidates need to
"While selecting network intruders for their divisions also known as 'teams,' Conti is particularly
is among their top priorities for a successful pen-tester," according to AdvIntel's analysis. "This
assemble teams, equipped with knowledge and skills aimed at backup removal."

publishing persists," the researchers wrote.

Vivisection

Sep 29 · 5 min read

Backup "Removal" Solutions - From Conti Ransomware With Love

Updated: Oct 8

By Vitali Kremez & Yelisey Boguslavskiy

2SPYWARE

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ADWARE | RANSOMWARE | BROWSER HIJACKER | MAC VIRUSES | TROJANS

Conti ransomware remains dangerous and can now encrypt Veeam backups

by Jake Doevan - - 2021-09-30

UNDERSTAND INSTANTLY

CISA and FBI warns about ransomware that attacked at least 16 networks last year: new tactics ensure failed data recovery

Ransomware removing a major obstacle –

CISA and FBI warns about ransomware that attacked at least 16 networks last year: new tactics ensure failed data recovery

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How do I avoid becoming another statistic?

- Guard against cyber attacks and maintain business continuity
- Recover with confidence and get business back online without delays

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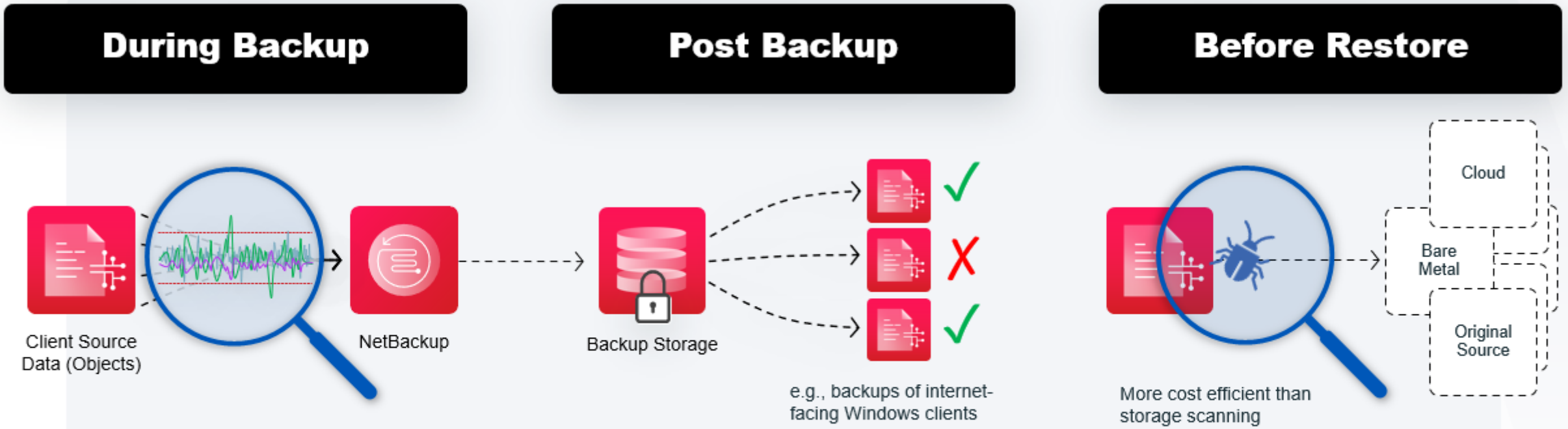
3-2-1 Rule for Data Backup

- At least 3 copies of data, on 2 devices, and 1 offsite
- Enhanced 3-2-1 rule – The 3-2-1-1 rule, where one or more backups are offline

> "Using cloud storage to hold an offline backup is a good idea because it guarantees physical separation from your live environment."
>
> Quote from https://www.ncsc.gov.uk/blog-post/offline-backups-in-an-online-world

- Veritas data protection solutions give you this capability

Best Practice One - Malware Detection



Anomaly detection Enhancements

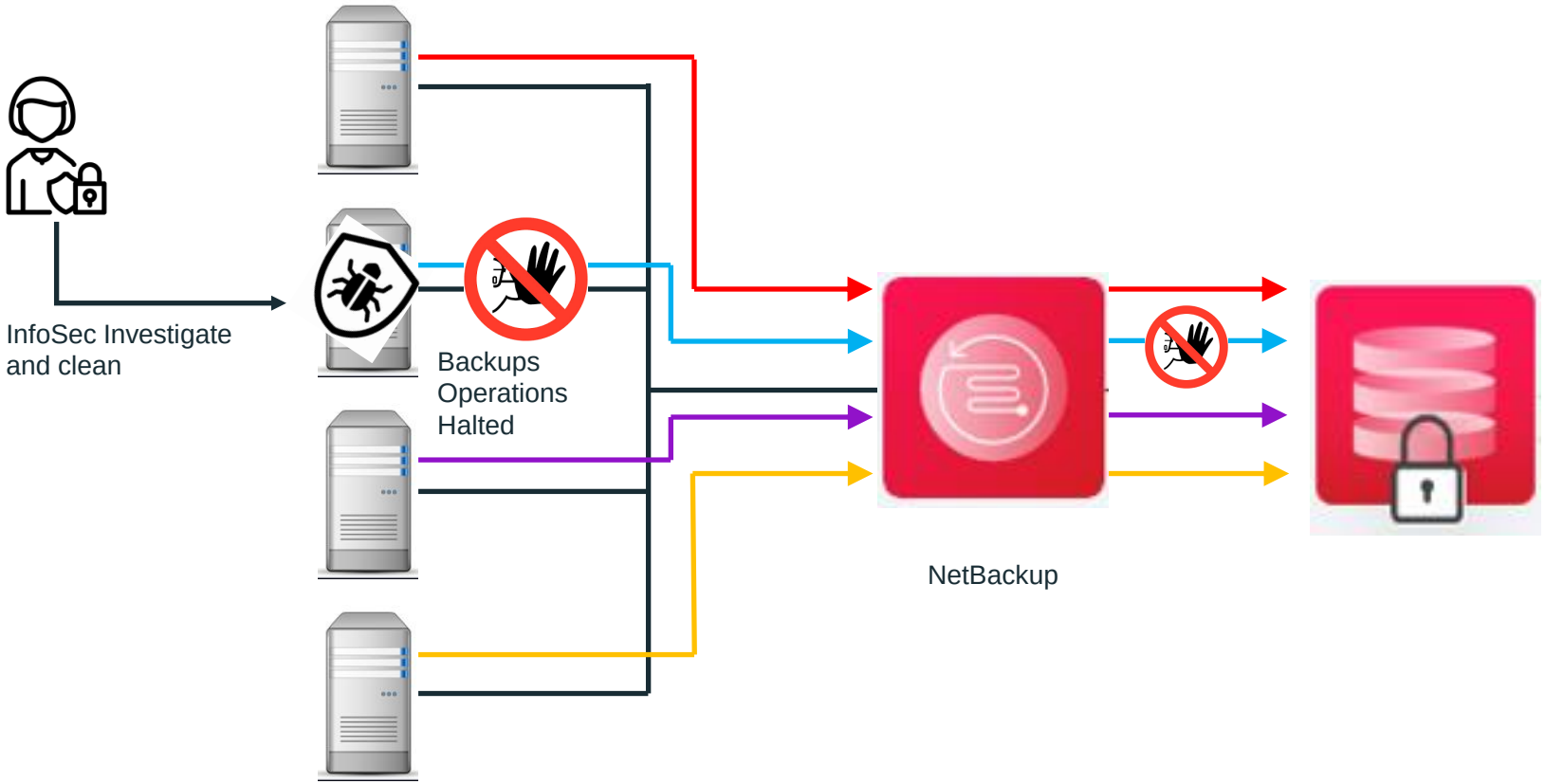
On-Demand Malware Scan

Automated Malware Scan for high-score anomalies

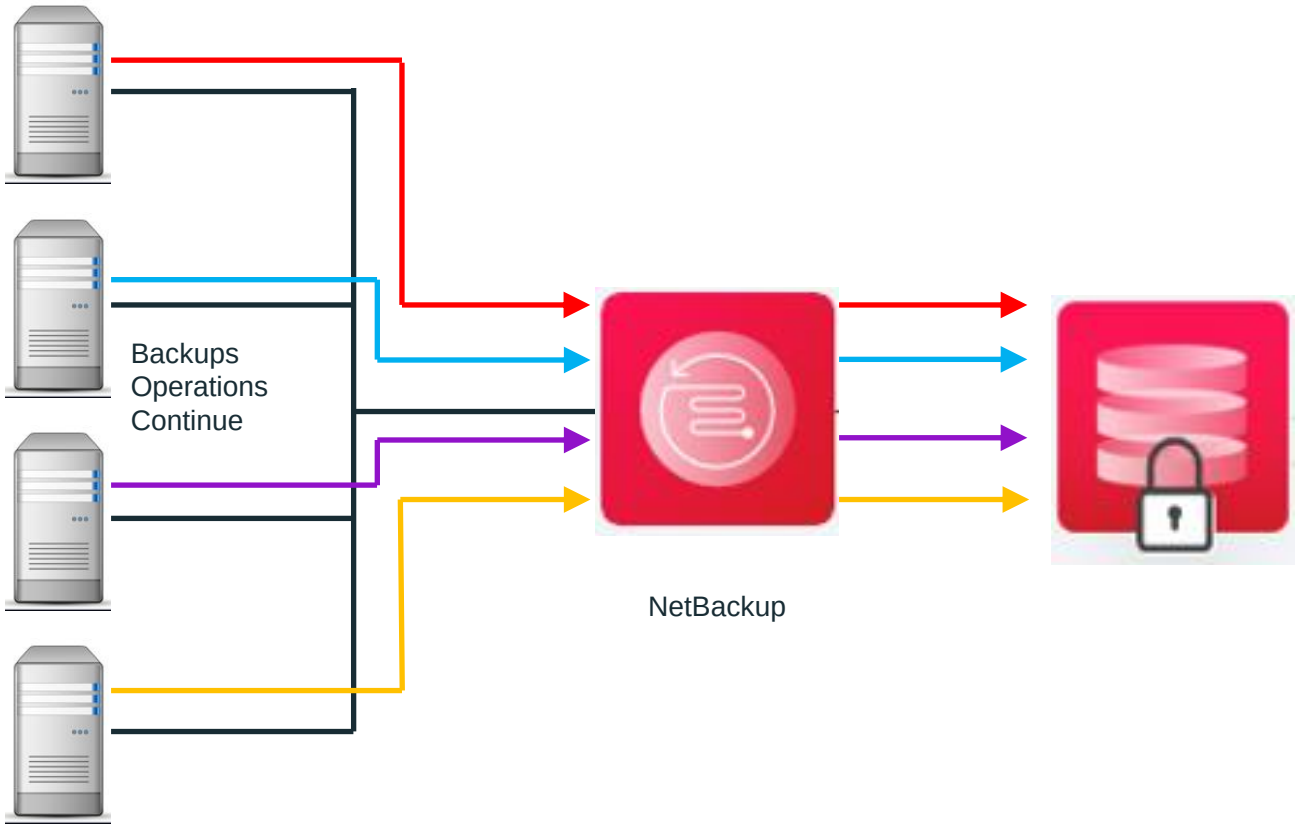
Scan status awareness at restore time

Restore only clean data from backups

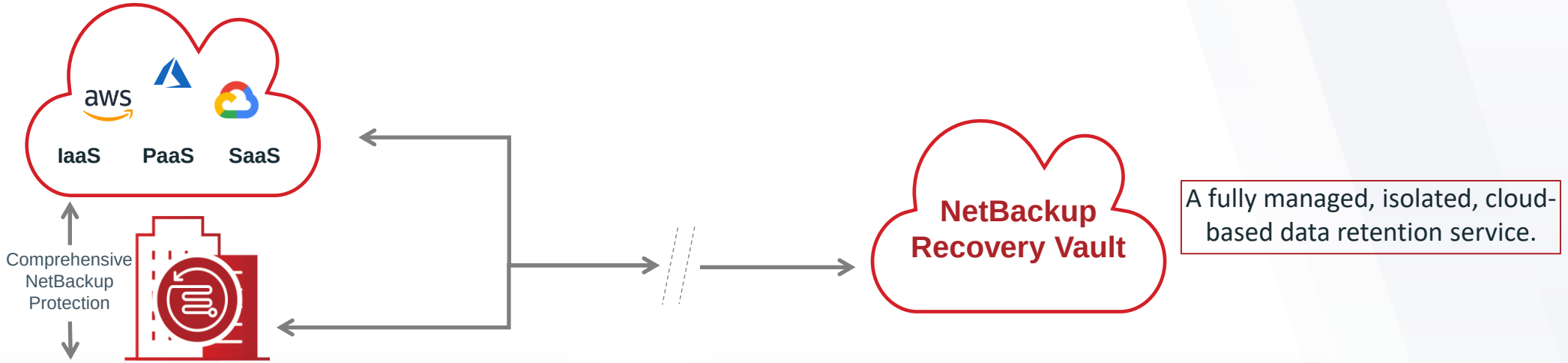
Best Practice Two - Pause Data Protection Workflow On Infection



Best Practice Two - Pause Data Protection Workflow On Infection



Best Practice Three – Secure Backup Repository



Customer's On-Premise Data Center or Cloud Tenant

- Provisioned Securely in NetBackup
  - RBAC Authentication
  - Consumption reporting
- Automated Resiliency

NetBackup Cloud Storage-as-a-Service

- Air-Gapped ransomware protection
- Recover to cloud or data center
- Limitless scale
- Predictable costs
- Immutability

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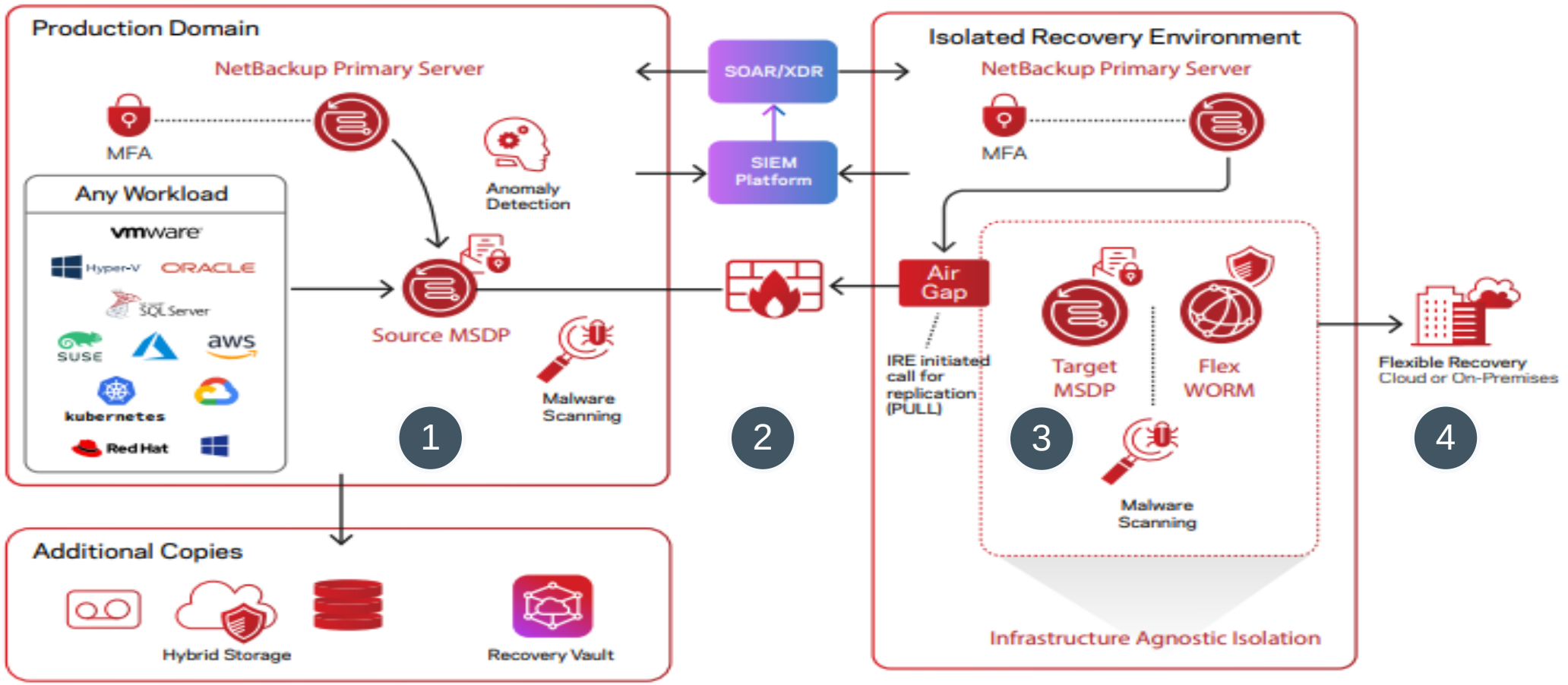
Best Practice Four - Isolated Recovery Environment (IRE)



1. Real-time Anomaly Detection and On-Demand Malware Scan
2. Data Isolation using an operable air gap
3. Data Integrity with multi-tenant WORM storage
4. Recover at scale to Last Known Good State

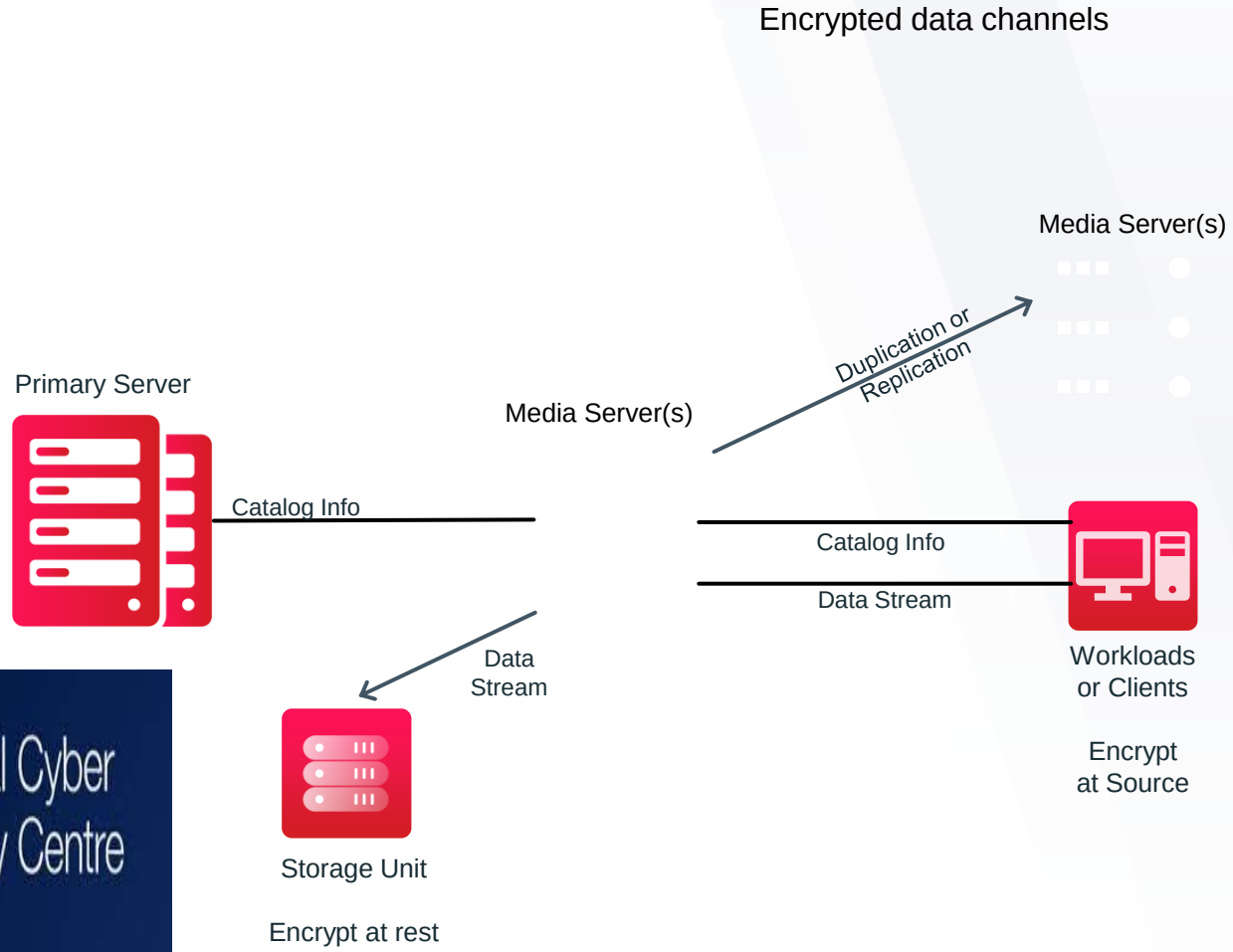
Best Practice Five - Data Channel Encryption

Control communication encrypted using TLS and X.509 certificates since NBU 8.1

- All Data channels encrypted
- Data at rest encrypted

Data Channels

- Backup Data
- Catalog info
- Duplication/Replication activity



"Use current standardised cryptographic algorithms to protect your data."

National Cyber Security Centre

Quote from https://www.ncsc.gov.uk/collection/10-steps/data-security

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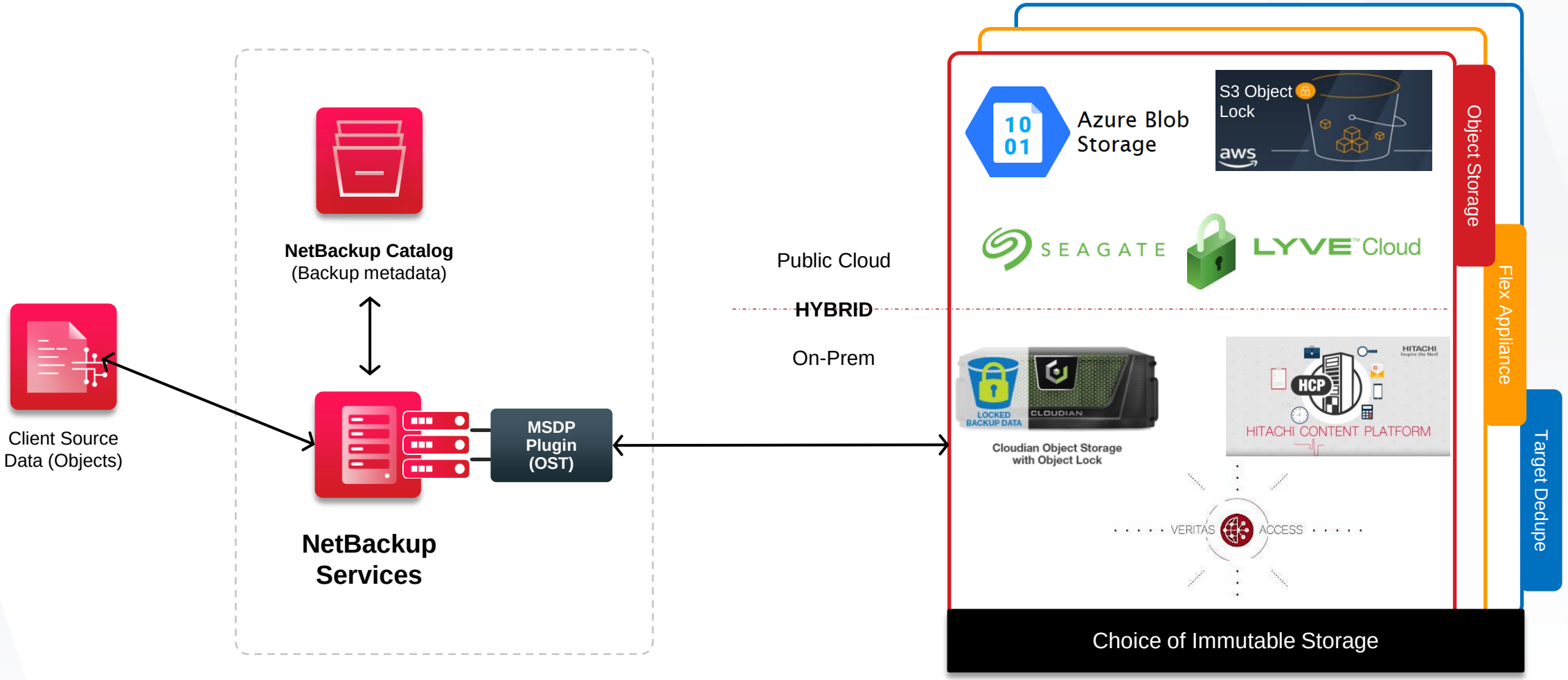
Best Practice Six - WORM / Immutability Support

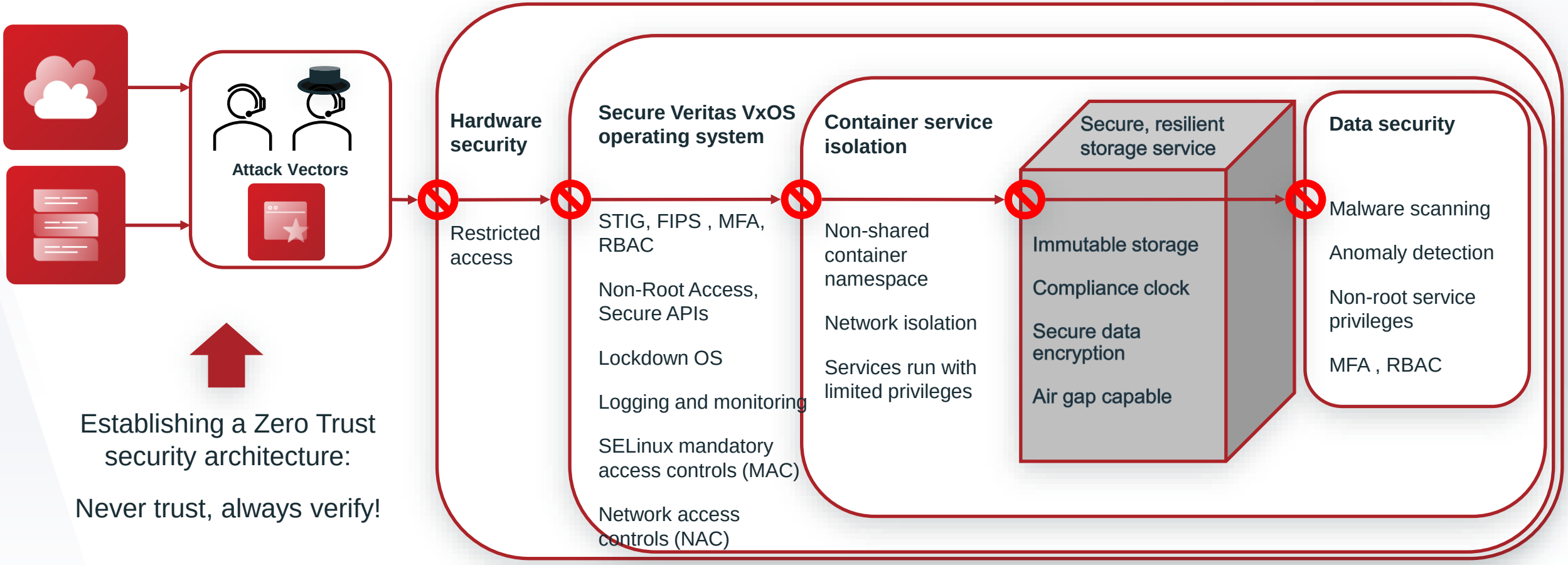
Object Storage - Azure, Veritas Access, Hitachi, Cloudian, Seagate Lyve Cloud



Best Practice Seven - Multi-Layered Security

How to protect against day-zero cyberattacks

FLEX Appliance



Establishing a Zero Trust security architecture:

Never trust, always verify!

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Best Practice Eight – Prepare to Recover at Scale

Have a plan

- Be ready to start from Ground Zero
- Know the recovery priorities for all your IT applications
- Understand the dependencies
- How do you identify the last known good copy?

Ensure you can recover rapidly at scale


- Backup environments are typically sized to backup a fraction of data each day & to restore a few systems at once
- Consider technologies like Snapshots & Continuous Data Protection
- Automate wherever possible

Test at scale

- Identify the last known good copy
- Simulate loss of critical infrastructure services
- Test recovery of complete business services

"Test your backups regularly and ensure you know how to restore files from a backup before you have to do it for real."

Quote from https://www.ncsc.gov.uk/collection/10-steps/data-security

National Cyber Security Centre

VERITAS

Veritas Data Protection Solutions: Confidence Restored

100% recovery success rate for customers that have been hit by a ransomware attack using Veritas Appliances

Ultra Secure Backup

Truly Secure Immutable Storage

VERITAS

Thank You

VERITAS

UP NEXT...

okta

THE NHS DATA CONFERENCE 2023

SPEAKING NOW

Pranam Codur

Senior Solutions Engineer at Okta

I will be discussing…

"Identity and Data"

THE NHS DATA CONFERENCE 2023

SPEAKING NOW

David Sgorbati

Chief Analyst
Health Economics Unit

I will be discussing…

"What about tomorrow? Using data to plan for future morbidity trajectories in our aging population"

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SPEAKING NOW

Dr Austin Tanney

Chief Data Analyst
Health and Social Care Northern Ireland

I will be discussing…

"Health and Social Care Data - The Northern Ireland Perspective"

THANKS FOR ATTENDING

THE NHS DATA CONFERENCE 2023

CONVENZIS

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THE NHS DATA CONFERENCE 2023