NATIONAL ELECTRONIC HEALTH RECORD
SINGAPORE

INTRODUCTION

Singapore's Ministry of Health Holdings (MOHH) initiated the National Electronic Health Record (NEHR) program to improve healthcare quality and patient safety, lower healthcare costs and develop more effective health policies.

The NEHR currently enables patient health records to be shared across the nation's public healthcare ecosystem.

SCALE **L**

COMPLEXITY **M**

- ✓ ACUTE CARE
- ✓ PRIMARY CARE
- ✓ MENTAL HEALTH CARE
- ✓ COMMUNITY CARE
- ⊘ SOCIAL CARE

Scale:
S = < 5 organisations
M = 5-10 organisations
L = 10+ organisations

Complexity:
L = Healthcare (HC) only
M = HC + community or social care
H = HC + community + social care

TIMELINE

2009
NEHR programme commenced

2011
First phase of NEHR launched, with 15 care organisations

2012
NEHR nationwide roll-out

Plan for 2017+
Data Analytics to support point of care decision making

INVESTMENT OBJECTIVES

"TO IMPROVE THE OVERALL HEALTH OF THE POPULATION THROUGH BETTER TARGETED INTERVENTIONS AND CONFIDENCE THAT CLINICIANS HAVE IMMEDIATE CRITICAL INFORMATION AVAILABLE TO DELIVER HIGH QUALITY CARE."

438 healthcare organisations, including GP practices

Approx. **13,000** end users

Approx. **5.76 million** population

SOLUTION

- The National Electronic Health Record provides access to a shared patient record for a number of different users across health and care settings.
- All hospitals, speciality outpatient centres, polyclinics, community hospital are connected as well as many GPs, nursing homes and hospices.
- End-users can access the patient's record through a portal or a "one-click button" embedded within existing clinical systems.
- The information displayed depends on the user's access permissions.
- There were 820,000 patient records accessed in the month of February 2017.
- Patients can access a mobile application known as the Health Hub App to view their personal clinical records.

BUSINESS CAPABILITIES

RECORDS ACCESS

- The National Electronic Health Record provides a read-only view of the patient's summary record. The NEHR record includes access to:
  - Hospital attendance
  - Diagnoses
  - Immunisations
  - Allergies
  - Test results
  - Demographics
  - Recent health related events
  - Medication

- Currently, authorised health and care professionals have write access to patient records, but limited to the following information:
  - Medication
  - Ongoing medical problems

SELF CARE

- Patients can access their personal clinical records. This is currently read-only.

CARE PLANNING AND COORDINATION

- Health and Care professionals can subscribe to receive notifications when patients on their worklist are admitted, discharge, or went into A&E.

TECHNICAL SOLUTION

CENTRAL REPOSITORY ARCHITECTURE

SOLUTION FEATURES IN USE

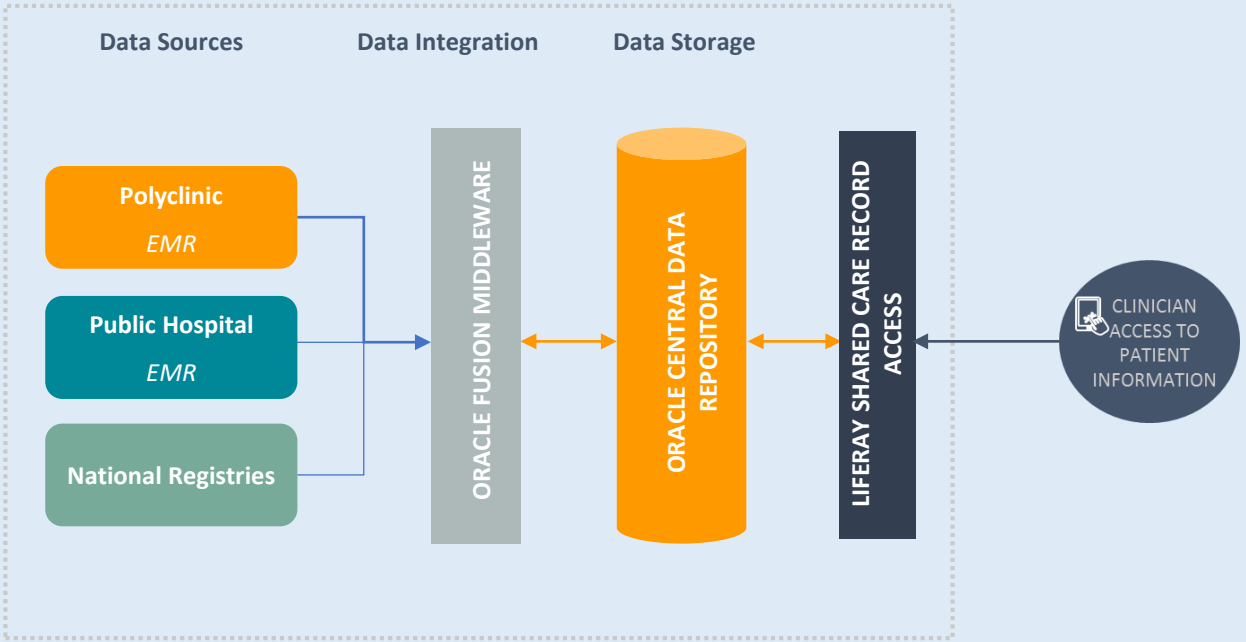
FEATURE	IN USE
Coded data	✔
Free text data	⊘
Bi-directional	✔
Real time	✔
Role-based access	✔
Clinical Portal	✔
Analytics	⊘
Write access	✔
Notifications/Alerts	✔
Patient Portal	✔

- The NEHR uses a suite of Oracle databases and Oracle middleware.
- The portal uses the Liferay product for the user interface.
- IBM's Initiate (MDM) maintains Initiate's Enterprise Master Patient Index, which then maintains patient demographic information.
- When a user accesses a patient record the Master Patient Index identifies and sources the information in the central data repository.
- Data in the central database is updated with the individual clinical systems, on a range of timescales.
- The information available to a user is determined by their role in a patient's care.

OPEN STANDARDS

STANDARD	COMPLIANT
HL7 FHIR (partial)	✔

HIGH LEVEL TECHNICAL ARCHITECTURE DIAGRAM



IMPLEMENTATION

The NEHR was implemented over the course of 2 years, starting in 2010. The key steps for implementation were creating a detailed blueprint of the business, information, application and technology architectures, as well as testing new features with pilot projects before a system-wide roll out. Following the NEHR Go-Live, additional data sources have been added and security enhancements have been made. Targeted stakeholder engagement campaigns, gamification and usage scorecards were used to embed the change.

PROGRAMME SPONSOR

Ministry of Health Holdings

PRIMARY FUNDERS

Ministry of Health

DELIVERY APPROACH

Multiple-phased project with continuous improvements over the course of 8 years

GOVERNANCE

Ministry of Health Holdings

GOVERNANCE

The implementation team had 3 governance arms in place:

- Technical solution: Architecture, Security and Operations
- Clinical solution: Usability, User Functionality and Clinical Risk
- Information governance: Data Standards and Data Quality

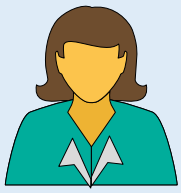
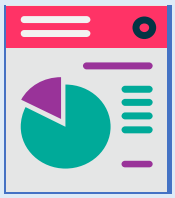
FUTURE AMBITIONS

In the future, there are specific plans to include the following features within the NEHR system:

- A Continuity of Care Record (CCR) functionality to allow care organisations to share a patient's ongoing problem list and care plan [Pilot programme launched in 2016 and in progress].
- Data analytics to support point of care decision making, and national policy planning for the Ministry of Health.

SOLUTION BENEFITS

The MOHH identified the following direct and indirect benefits of the NEHR:

DESCRIPTION	PATIENT	CLINICIAN	OPERATIONAL
DUPLICATE TESTS Healthcare professionals have access to patient's previous test results, reducing the number of unnecessary duplicate tests	Experience improves as action can be taken without delay	Saves time chasing information	Reduces costs from duplicate tests
DOCUMENT SHARING Patient information can be shared in digital form across public hospitals and polyclinics	Experience improves as they can be treated sooner, without needing to recall information themselves	Saves time waiting for important patient information	Increases care organisation productivity; reduction in postage costs and courier fees
ADMISSION Clinicians have implicit access to patient information when patient is admitted to A&E if the patient is unable to respond	Higher probability of successful emergency treatment and faster treatment	Saves time diagnosing patient during emergencies	Frees up bed spaces, increases care organisation productivity
CARE COORDINATION More comprehensive, up-to-date patient information can lead to better coordination of patient care between care providers	Experience improves as they are aware of their situation, and can be treated sooner	Saves time waiting for patients who do not turn up	Reduction in duplicated administrative work

These benefits are assumption based and there has been no known evaluation of the NEHR solution to validate them.

SUCCESS FACTORS

DESIGN

CLINICALLY-LED DESIGN

- The project team shared screen mock-ups of the NEHR with clinicians at the start of the programme.
- Clinicians helped identify features and functionalities that were useful.
- By engaging with the clinicians at the start of the project they prioritised the scope effectively.

DELIVERY APPROACH

INCREMENTAL APPROACH

- Singapore's Ministry of Health have an ambitious roadmap, however, they have structured their plans into a series of manageable phases.
- Their incremental approach focused the delivery effort, and has enabled the early realisation of patient benefits.

GOVERNANCE

RESPONSIVE SUPPORT DESK

- The project implementation team staffed a well-trained, 24/7 service desk support team.
- This supported a fast roll-out as any deployment issues could be resolved quickly.

ENGAGEMENT

ADOPTION CAMPAIGNS

- The project team carried out a robust adoption campaign amongst healthcare organisations following the successful implementation of phase 1.
- The number of patients benefiting from NEHR increased by 11-fold.

LESSONS LEARNED

TECHNOLOGY ASSESSMENT

Challenge: There were a large number of complexities integrating data because of different standards across the variety of different data sources. Some data sources were unstructured, while others where poorly defined.

Approach: The project team carried out a technology assessment to fully understand the different data items: they assessed the various data publishing systems to identify the various subtleties involved in their codification, structure and meaning. Understanding the existing data-model was an important pre-requisite. The project subsequently introduced a standard data model.

DESIGN

Challenge: There were a number of national policies that impacted the solution design privacy policies, patient enrolment, data sensitivity considerations.

Approach: The policies were analysed early in the project to understand where the design would be impacted. The solution architecture was designed to be flexible to make it easier to implement as policies evolved over time.

PROJECT MANAGEMENT

Challenge: The NEHR was implemented in a short space of time, effective project management needed to be in place.

Approach: Together with the MOHH, the project team set up:

- Clear procedures for granting role based access to the system
- A controlled process for deployment of new upgrades, to facilitate a continuous improvement approach
- A change coordination process
- Detailed analysis of data to triage and resolve errors

FURTHER INFORMATION

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INFORMATION CORRECT AS OF 06/04/2017

REFERENCES
Ministry of Health (Singapore) website
Accenture official publication

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