

Assessment of Key Benefits of Introducing Automation in
Canterbury District Health Board, New Zealand

By

Priyanshi Argal

*Dissertation submitted for the partial fulfillment of the
MBA Hospital and Health Management*

Academic year, 2016-2018



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TO WHOMSOEVER MAY CONCERN

This is to certify that Ms. Priyambi Agarwal student of MBA Hospital and Health Management from The IIHMR University, Jaipur has undergone internship training at Monilek Hospital & Research Centre, Jaipur from 1st Feb to 4th May .

The Candidate has successfully carried out the study designated to her during internship training and her approach to the study has been sincere, scientific and analytical.

The Internship is in fulfillment of the course requirements.

I wish her all success in all his future endeavors.



Dean, Academics and Student Affairs

The IIHMR University, Jaipur



Col. (Dr) Ashok Kaushik

The IIHMR University, Jaipur

The certificate is awarded to

Dr. Priyanshi Argal

In recognition of having successfully completed her 3 months of
Internship in the department of

Product Management – Enterprise Hospital Information System (HIS)

And has successfully completed her Project on

**Key benefits of introducing greater automation in Canterbury district health
board, New Zealand**

Date: 7th of May 2018

Organization: Orion Health, New Zealand

She comes across as a committed, sincere & diligent person who has a
strong drive and zeal for learning

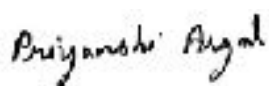
We wish her all the best for future endeavors

Shrikant
Shrikant Shrivastava
Product Director - Enterprise
ORION HEALTH

THE IIMMR UNIVERSITY, JAIPUR

CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled Assessment of key benefits of introducing automation in Canterbury District Health Board, New Zealand and submitted by Dr. Priyanshi Argal Enrollment No. IIMMR-U/01/2016-18/0475 under the supervision of Dr. Ruchi Garg for award of MBA in Hospital and Health of the University carried out during the period from 05/02/2018 to 07/05/2018 embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.



(Dr. PRIYANSHI ARGAL)

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1. OVERVIEW OF ORION HEALTH

Founded in 1993 **Orion Health** is an award-winning, global provider of healthcare information technology. Today, there are vast levels of waste in healthcare all around the world and clinicians and caregivers are not empowered with the right information to deliver the best possible care. The purpose at Orion Health, is to revolutionize global healthcare so every individual receives the perfect care for them.

Orion Health employs more than 1,200 open minded challengers in the relentless pursuit of a healthier world. While their head office is based in Auckland, New Zealand, their teams can be found in 24 offices across 15 countries. Today their healthcare information technology solutions are implemented in more than 30 countries and used to facilitate healthcare for more than 100 million patients.

Orion Health is of a belief that software needs to do more than serve up data, it needs to provide insights in real time to the people that need it and when they need it. That is why they are building thinking software for life – a smart suite of applications, built on new generation technology, that will give everyone healthier, happier and longer lives.

Orion Health | At a Glance



Page 14-20 © Orion Health Group of companies

Figure 1

1.1. VISION AND VALUES OF ORION HEALTH

What does their future vision of healthcare look like? Imagine a world where patients receive the perfect care for them. Where they are at the center of their own healthcare, making key care decisions themselves, supported by research, education and the guidance of their trusted circle of care including family and physicians.

This is a world where information is easily shared between caregivers and clinicians, to ensure that patients receive the best healthcare possible. Individuals will have the tools to keep themselves well and monitor their progress, sharing any sign of deterioration or concern with their circle of care to ensure immediate preventative action.

With advances in genomics and DNA sequencing, the potential to practice preventative medicine based on predictive modelling is enormous. Precision Medicine starts now. Information gleaned about an individual's health from their DNA and other factors such as their environment, family history and social situation are immensely powerful to determine the best treatments they should receive throughout their lifetime to maximize their chances of staying well and preventing serious illness from developing.

Orion Health's solutions capture the vast amounts of health data available and provide the tools to support healthcare professionals and health insurers who manage their member's wellness programs to make more effective decisions – through applying analytics and employing care management and patient engagement.

Orion Health are excited to revolutionize healthcare, delivering modern technology to ensure that every individual receives the perfect care for them.

1. ABOUT SOUTH ISLAND ALLIANCE OF NEW ZEALAND

The **South Island Alliance** enables the region's five DHBs namely Nelson-Marlborough DHB, Canterbury DHB, South Canterbury DHB, Southern DHB and West Coast DHB to work collaboratively to develop more innovative and efficient health services than could be achieved independently. By using combined resources to jointly solve problems, South Island Alliance are better positioned to respond to changes in the technology and demographics that will have a significant impact on the health sector in the coming years.

Alliance aims to be able to achieve better health outcomes for the people of the South Island, New Zealand. Their vision is a sustainable South Island health and disability system – *best for people, best for system*. The Alliance is focused on keeping people well and providing equitable and timely access to safe, effective, high-quality services, as close to people's homes as possible.

Some of the successes of the Alliance so far have been the development of a South Island wide early intervention eating disorder service; savings of \$15 million through regional procurement; a regional training hub to recruit and train staff for the South Island, particularly rural health professionals, and a number of integrated information service programs that will improve regional patient administration.

Major projects that are underway include the regional rollout of information systems that enable electronic prescribing, electronic referrals and a single patient administration system across the South Island. Work has also begun on the Faster Cancer Treatment Plan to ensure patients journey from diagnosis to treatment is as streamlined and quick as possible.

These projects sit amongst a huge range of service improvement, training and development and efficiency processes that are all proving that we can provide better health services for our community by working collaboratively.

1. SOUTH ISLAND PATIENT INFORMATION CARE SYSTEM (SI PICS)

The **South Island Patient Information Care System (SI PICS)** is becoming the South Island solution for patient management and administration across the five South Island DHBs.

It will connect health workers with coordinated, consistent access to a single region-wide solution, resulting in improved quality and safety systems, and a more streamlined patient journey from the community to the hospital and beyond.

Led by the South Island Alliance Information Services, SI PICS is based on a core principle of providing a safe and efficient health care foundation, flexible enough to meet the ever changing demand of health care services provided across the South Island.

2. ORION HEALTH'S PARTNERSHIP WITH SOUTH ISLAND ALLIANCE

In 2015, Orion Health signed a commercial agreement with all five South Island District Health Boards (DHBs) for a single South Island-wide shared patient administration system (PAS).

The South Island Patient Information Care System (SI PICS) aims to become the regional solution for patient information management at Canterbury, Nelson Marlborough, Southern, South Canterbury and West Coast DHBs, which are all members of the South Island Alliance. Orion Health continues to work with South Island Alliance to deliver and roll-out a state-of-art Patient Administration System (PAS) across all the 5 DHBs of South Island.

At the time of writing this document, Canterbury DHB has been using Orion Health's PAS solution since 2016 and the Nelson-Marlborough DHB would soon implement and go live with it.

1. ORION HEALTH ENTERPRISE HOSPITAL INFORMATION SYSTEM (HIS)

A functionally rich, single vendor hospital solution with unique cost advantages.

Orion Health Enterprise is a functionally rich, single vendor solution platform that connects patient, clinical, ancillary, and finance workflows across the hospital.

Hospitals can get up and running quickly in six to nine months with a pre-configured best practice solution, using our rapid implementation approach. Workflows can then be refined to meet the most demanding clinical and administrative needs.

Hospitals can seamlessly integrate and share clinical information between existing or new systems. Designed by Clinicians, Enterprise enables the creation and presentation of trusted clinical information that maximizes the clinician's ability to deliver individualized patient care.

Enterprise offers a low hardware footprint while providing a highly responsive scalable multi-site solution, to accommodate growing patient volumes. Our software is intuitive, supporting multiple languages that can be customized at an organizational or individual clinical level, and rolled out with minimal end user training.

1.1. BRIEF HISTORY OF ORION HEALTH ENTERPRISE

In 2011, **ORION HEALTH** signed an agreement with Microsoft to acquire **Microsoft** software suite formerly known as Amalga HIS and Amalga RIS/PACS. This acquired Microsoft product was re-branded as ORION HEALTH ENTERPRISE and has retained its name till date.

Since this acquisition, Orion Health continues to work with Microsoft's existing customers in South-east Asia and on-boarded a number of customers in middle-east, South-east Asia and New Zealand.

Orion Health Enterprise, being a complete hospital information system (HIS) solution, continues to provide following valuable modules as a part of its offering in the healthcare industry:

- Patient Administration System (PAS)
- Back Office
- Clinical
- Pharmacy
- Radiology Information System (RIS)
- Laboratory Information System (LIS)
- Surgical Management
- Business Intelligence/Reporting

2. KEY FEATURES/BENEFITS OF ORION HEALTH ENTERPRISE

Patient Administration: Enterprise enables efficient patient flow, supporting the booking of resources in the health system. It optimizes the processing of patients from registration, to referral, waiting list, admission and the allocation to a queue of waiting patients. All paper forms related to the patient are electronically captured with point-of-service scanning. Built in support for barcode identification enables automatic recognition of the patient, visit, caregiver, and form type when scanned back into the system.

Clinical Record: Enterprise delivers a comprehensive clinical workstation for a unified view of patient information. From the creation of patient records and documents through to Orders, Clinical workflows, Care pathways and Problem lists. The Clinical workstation offers comprehensive viewing and doing functionality that supports clinician workflows, all of which are integrated into the Patient Chart. Doctors can access relevant information including a patient's demographics and medical history, and can view, compare, and update data in ways never possible with paper charts.

Back Office: Enterprise's integrated back office solution encompasses the full revenue cycle, enabling charge authorization, invoicing, claims, and support for electronic submission to payers. Enterprise supports the pre-authorization of services combined with charge estimates, while real-time charge capture allows the monitoring of authorizations and deposits, as well as the reduction of late charges.

Surgical Management: Scheduling of equipment and resources as well as the capture of consumables and high-cost disposables all contribute to accurate reporting of cost, and improved management of the Operation Suite. Surgical checklists can be built to support the local needs of the healthcare organization, and in-theatre billable activity can be captured for submission to revenue management.

Pharmacy: Enterprise Pharmacy enables order fulfilment within the hospital setting and provides a closed-loop medication management solution to deliver safe and effective care. Pharmacy delivers automation, workflow management and integration with prescribing, and Medicines Administration Record (MAR).

Laboratory: Enterprise LIS (Laboratory Information System) is fully integrated within the ordering process, and includes order tracking, flagging and notification of critical results, cumulative test displays, specimen and result auditing. Orion Health Rhapsody Integration Engine is used for lab analyzer interfaces and allows for rapid results turnaround and report generation.

Radiology: Enterprise RIS (Radiology Information System) manages the entire radiology department, also interfacing with third-party solutions. The workstation interface is optimized for radiologist workflow, and includes support for predefined report templates, voice-recognition, and dictation with transcription capabilities; all designed to reduce results turnaround. Reporting capabilities include state-of-the-art change tracking functionality to clearly identify any corrections made. Enterprise RIS optimizes the use of radiology equipment by automatically adjusting conflicting bookings and conversing with the other departments to avoid appointment clashes.

3. **ABOUT CANTERBURY DISTRICT HEALTH BOARD (CDHB)**

The **Canterbury District Health Board (CDHB)** is the second largest District Health Board (DHB) in the country by both geographical area and population size - serving 510,000 people (12% of the New Zealand population) and covering 26,881 square kilometers and six Territorial Local Authorities. CDHB is a key member of South Island Alliance.

Canterbury's Māori (7.2%) and Pacific (2.0%) populations are younger and have higher fertility rates, but it is our Asian population (6.8%) that is our fastest growing demographic. Projections suggest by 2026 10.8% of Canterbury's total population will be Asian. Ethnicity is a strong indicator of need for health services, and we consider the unique health needs of each of these population groups in our planning for the future.

Canterbury region's ageing population is still the factor that will have the single greatest impact on Canterbury's future health system and present the biggest challenges. The region has the largest total population aged over 75 and will do so for at least the next 15 years. By 2026 one in every five people in Canterbury will be over 65, and the number of people aged over 85 will have doubled.

While their responsibility is primarily for their own population, the Canterbury DHB provides an extensive range of highly specialized and complex services on a regional basis - to people referred from other DHBs where these services are not available.

These specialist services include: eating disorder services; brain injury rehabilitation; child and youth inpatient mental health; forensic services; neonatal services; pediatric neurology; gynecological oncology; specialist diabetes and respiratory services; cardiothoracic services; hematology/oncology; plastics; gastroenterology; neurosurgery; and ophthalmology services.

There are also some specialist services they provide on a national or semi-national basis: laboratory services; endocrinology; pediatric oncology; and spinal services.

Canterbury provides a significant load of regional and national services, and our ability to maintain service delivery is critical to the functioning and sustainability of the whole New Zealand health system.

In all, Canterbury provides over \$100m worth of services to the populations of other DHBs around New Zealand and delivers half of all the surgical services provided in the South Island.

3.1. VISION, MISSION & VALUES - CANTERBURY DISTRICT HEALTH BOARD (CDHB)

Vision of **Canterbury District Health Board (CDHB)** is

Our vision is an integrated health system that keeps people healthy and well in their own homes by providing the right care and support, to the right person, at the right time and in the right place.



Figure 2: Source: [CDHB Mission](#)

Canterbury District Health Board (CDHB) also have a patient safety vision of 'zero harm'.

To achieve this vision **CDHB** have:

- Taken a whole-of-system approach - where everyone in the health system works together to do the right thing for the patient and the right thing for the system,
- Aligned pathways of care between our hospitals and the community to improve information sharing across all providers of health care, and
- Strengthened partnerships and alliances across the Canterbury Health System to improve the way services are delivered particularly through the Canterbury Clinical Network, a visionary alliance of health care professionals from all across our health system

CDHB are focused on creating a health system and community where:

- People take greater responsibility for their own health,
- People stay well in their own homes and communities, and
- People receive timely and appropriate complex care

CDHB's Mission Statement

To improve, promote and protect the health of the people in the community and foster the well-being and independence of people who experience disabilities and reduce disparities.

CDHB's Vision

To improve, promote, and protect the health and well-being of the Canterbury community

CDHB's Values

Care and respect for others

Integrity in all we do

Responsibility for outcome

1. ABSTRACT

TITLE: Assessment of key benefits of introducing automation in Canterbury District Health Board, New Zealand

AUTHOR: Dr. Priyanshi Argal

BACKGROUND: An elaborate 30-60- 90-day upskilling approach was employed at Orion Health that involved:

- Induction in to the organization and extensive training in Orion Health Enterprise Hospital Information System (HIS) followed by
- A 2-day visit/workshop to two hospitals in Canterbury District Health Board (CDHB) i.e. Burwood Hospital and Princess Margaret Hospital located in Christchurch, New Zealand.
- Hospital visit/workshop involved a thorough tour of the hospital, detailed discussions with hospital staff and patients, evaluation of how efficiently and HIS was operational in the hospital and finally
- Collection and analysis of data collected during the 2-day visit, drafting conclusions and recommendations

OBJECTIVES:

- To determine the key drivers and motivation behind CDHB's initiative to allow greater hospital automation by replacing its legacy Patient Administration System (PAS)
- To evaluate the tangible benefits CDHB has already achieved (or will achieve) by replacing its legacy PAS by plotting the:
 - Patient volumes in IPD vs OPD vs ED (Patient Demographic Study)
 - Total turn-around time for a patient (admission all the way through to discharge) in OPD, IPD and ED visits during all the

- Variance in the total cost borne by the hospital before and after the adoption of Orion Health Enterprise HIS after the adoption of Orion Health Enterprise HIS

RESEARCH METHODOLOGY

Study Area: Conducted on 2 hospitals in Canterbury District Health Board (CDHB) – Burwood and Princess Margaret Hospital in Christchurch, New Zealand

Type of Study: Retrospective Cohort Study

Duration: Complete duration of the study was from 5th February 2018 until 6th April 2018 (incl. visits to Burwood and Princess Margaret Hospital on 9th and 10th April 2018 respectively)

Type of Data: Primary data which is defined as data used in research originally obtained through the direct efforts of the researcher through interviews and direct observation.

Sampling Technique: Audited record of patient visits for the following three periods:

- *2nd February 2015* until *27th November 2015*
- *29th July 2016* until *28th July 2017* and
- *7th July 2017* until *30th March 2018* with specific focus on the following
 - Patient volumes in IPD vs OPD vs ED (Patient Demographic Study)
 - Total turn-around time for a patient (admission all the way through to discharge) in OPD, IPD and ED visits
 - Variance in the total cost borne by the hospital for each of the periods above

Tool for Data Collection:

Orion Health Enterprise HIS software - provision of a laptop with all the required software's installation and training for complete installation of the Orion Health Enterprise HIS. An investment of 2 weeks of the time during the internship to learn about the software was scheduled so that I am well-versed with the intended use of the software.

UX Wireframe, mock-ups and Proto-typing – A methodology used within Orion Health where **User Experience (UX)** design team constructs a series of software screen mock-ups and collects user feedback to evaluate the suitability of the screen

Microsoft suite namely MS Word, MS Excel, MS PowerPoint, MS Visio

Flowcharts and workflow diagrams on MS Visio

Atlassian JIRA (Configuration Management Tool)

Google Docs and Spreadsheet

Mac Numbers (Analogous to MS Excel in Apple MacBook)

DATA SOURCE

Complete patient workflow explained (from admission all the way through to discharge) in both the hospitals.

Introduction to all the hospital staff responsible for various stages of patient journey through the hospital e.g. front desk clerk, nursing staff, clinician, pharmacist, radiologist, lab technician, IT help desk etc.

Explanation of their roles, work-procedures during emergency hours, manuals they use when the hospital is switched to a *manual mode*

Exhibition of how Orion Health Enterprise was operational at various kiosks, on front desk reception, in radiology rooms, operation theatres etc.

Interaction with the patients to understand their experience on a regular day to the hospital

RESULTS:

Following were noticed as key benefits of Orion Health HIS adoption by Burwood and Princess Margaret Hospital:

Better patient schedule management

Easy patient record accessibility

Patient record safety

Less human errors

Better coordination between hospital departments

Better resource utilization

Better operational efficiency

Valuable insights for senior hospital management

HIS adoption is valuable for hospitals of all scales

CONCLUSION:

Adoption of Orion Health Enterprise HIS was clearly a wise decision and led to

Better patient experience and less grievances/complaints

Considerably higher return on investment that allows CDHB to invest in other key healthcare areas

Better monitoring of hospital performance and availability of hospital reports for hospital management staff

Transition to an HIS with higher level of automation was successfully achieved by CDHB

2. INTRODUCTION

The patient of today breathes and thrives in a digitally disruptive climate. Armed with apps and tele-services for all his needs including banking, airline check-in and taxis, they expect no less from their healthcare provider. Application of fast evolving technology in a typical hospital setting implies reduced manual intervention at every stage of a patient journey within a typical hospital setting and a greater level of automation that translates in to more efficient and better utilization of resources in hospital operations thereby improving the hospital's return on investment (ROI).

New Zealand has one of the most efficient healthcare systems in the world and a major part of this system is funded by the state that discounts a small presence of private hospitals there i.e. healthcare industry in New Zealand is primarily public. Geographically, New Zealand is divided in to two islands namely North Island and South Island. Each of these islands consists of various district health boards or DHBs where each DHB is accountable for the healthcare needs of a specific region under its jurisdiction. All of these DHBs are governed by the ministry of health (MoH), New Zealand. While these DHBs do operate with a certain element of autonomy, they must also abide by a series of regulations listed by the ministry of health (MoH).

The detailed study this synopsis aims to summarize would primarily focus on Canterbury district health board or CDHB which is one of reputed and biggest of all the five DHBs in South Island of New Zealand and has embarked upon introducing greater level of automation in its hospitals by replacing its legacy patient administration system (PAS) with an enhanced and state-of-art PAS. This study will evaluate the key benefits CDHB intends to (and continues to) derive by introducing this state-of-art PAS in its hospitals.

The study will be carried out as a part of internship at Orion Health, New Zealand that has entered in to a partnership with South Island Alliance (a group of five DHBs in South Island of New Zealand) to iteratively deploy state-of-art patient administration system (PAS) in all the five DHBs. Orion Health is an award-winning, global provider of healthcare information technology. With its head office in Auckland, New Zealand, Orion Health employs around 1,200 people in 25 offices across 15 countries. Today our healthcare information technology solutions are implemented in more than 30 countries and used to facilitate healthcare for more than 100 million patients.

3. **OBJECTIVE**

1. To determine the key drivers and motivation behind CDHB's initiative to allow greater hospital automation by replacing its legacy Patient Administration System (PAS)
2. To evaluate the tangible benefits CDHB has already achieved (or will achieve) by replacing its legacy PAS

4. **RATIONALE OF THE STUDY**

- This study helps evaluate in detail the key drivers and motivation behind Canterbury District Health Board's (CDHB) objective to tie-up with South Island Alliance to introduce greater automation in its hospitals and replace its legacy Patient Administration System (PAS).

- The study involves an in-depth understanding of Orion Health Enterprise that CDHB implemented in two of its key hospitals namely Burwood Hospital and Princess Margaret Hospital in Christchurch, New Zealand in 2016. This study would also evaluate how successful was CDHB almost 2 years after implementing Orion Health Enterprise i.e. tangible benefits of introducing a *modernized* hospital information system and list down some of the key challenges faced by the staff at Burwood Hospital and Princess Margaret Hospital.
- The list of these key challenges is based on a 2-day visit to the hospitals mentioned above.

5. LITERATURE REVIEW

When **Hospital Information Systems (HIS)** were first introduced, in around the 1960's, the focus was constrained primarily to the core financial aspects of the business. This limitation was imposed not for lack of ingenuity, but simply due to the high investment cost of mainframe computing and lack of network capability.

The 80's brought increased availability of local area networks (LAN), the introduction of smaller personal computers and a lower investment barrier, providing the initial triggers for change. Vendors were now able to link disparate internal systems allowing a more encompassing approach to the management of healthcare services within a facility.

The introduction of the Wide-Area Network (WAN), enabled connectivity between different hospital sites, forming the initial foundations for digital data sharing. Tech now provided us the ability to send and receive data electronically. Having the capability to transfer data from one system to another is not enough in itself. For data to be successfully shared between disparate hospitals and data systems, the data format needs to be consistent and predictable. System A and System B need to understand data in the same way - this is where Health Level Seven International (HL7) stepped in to fill the gaps. HL7 provides an international standard for the exchange, sharing and retrieval of electronic health information. It is simply a protocol or agreement that enables better collaboration between multiple organizations and systems.

The adoption of HL7 facilitated standards in sharing of health information, enabling the creation of a National Health Information Network. Let's look at New Zealand as an example.

The NZ Ministry of Health (MoH) provides a national dataset for all patient demographic data, known as the National Health Index (NHI). The premise of NHI is that every patient has a single national identifier to be used to store all health information for that individual. This prevents data duplication, increases security around data access and facilitates national data collections for analysis. For the concept of a

national index to work, healthcare providers accessing patient data need to act as data stewards – updating any demographic information that may have changed for a patient. Utilizing the HL7 standard for data transfer, health organizations and facilities are able to fire update messages off to the NHI.

Traditionally, a patient's Electronic Medical Record (EMR) – that is their medical history – tests, diagnosis, treatments etc. have been stored and 'owned' by the facility that provided the treatment. The exchange of patient data between disparate facilities is often facilitated again using standards like HL7 or Fast Healthcare Interoperability Resources (FHIR) – however due to data validation and process disparities between different systems, we often fail to facilitate a deep copy of patient data. Any integrations require a significant amount of custom mapping to ensure the data sent by the publishing system is correctly validated and inserted into the subscriber. These integrations are often undertaken in a piecemeal fashion limiting the reliability of real-time access to up-to-date patient information. In a nutshell, if a patient was to receive care from multiple facilities (perhaps due to a specialist referral for example), care providers could not use the local copy of the patients' EMR to make clinical decisions with confidence.

But what if all healthcare providers across the continuum made use of a single, centralized system? If GP practices, hospitals, community care providers all made use of a single database – a single source of truth. Anyone providing care for a patient, updates the patient record and any changes are immediately accessible. Not only would this remove the need for expensive custom integrations, but it would provide clinicians with confidence when making any decisions on patient care – ultimately facilitating better health outcomes for all.

Governments with public health schemes are constantly faced with an ever-growing aging population, a shift from treating infectious diseases like cholera and smallpox to long term chronic conditions such as heart disease and cancer. This increase in demand is paired with reduced funding, a lack of medical care providers and ever-increasing patient expectations. In order to meet demand, health systems need to increase

efficiencies by reducing waste, enabling faster treatment times and improving patient outcomes.

Let's take a brief look at how a centralized, single HIS deployment addresses these issues.

5.1. Enabling collaborative care

It is rather common for patients to need transfer to different facilities for treatment. Especially in cases where a patient requires specialist treatment not offered at their local hospital. With a unified HIS, transfers and referrals across facilities is facilitated with ease.

Targeted funding for identified needs

A centralized system with BI reporting capability allows for the analysis of service demand across different population cohorts. Enabling the analysis of diagnosis across different patient demographics, ethnicities, regions etc. Not only do these factors help ensure that public funding is appropriately distributed – they also identify areas where early intervention, patient education and preventative care programs would be of value.

5.2.. Population Health Management

A system that links both administrative and clinical information across multiple care sectors enables quick access and data sharing between primary, secondary and community care providers. Facilitating collaboration by providing a comprehensive, longitudinal patient record, enabling the co-ordination of care - increasing the effectiveness of chronic disease management.

5.3.. Big Data Analysis

Big Data analytics in healthcare provides more detailed, personalized insights allowing a shift to individualized patient care. These systems extrapolate outcomes from vast data sources, to provide treatment options and their associated success probabilities based on cohorts of patients sharing the same demographic, diagnosis and treatment plan.

5.4.. Precision Medicine

5.5.The approach to healthcare is radically changing worldwide. Where we used to focus on understanding and treating disease, we now realize the power of providing individualized, patient-centric care. Through the Human Genome Project, we have come to understand the importance of considering genetics when making clinical decisions. Sequencing of the DNA can help us understand diseases, including genotyping of specific viruses to understand the best treatment plans for the individual, identification of mutations linked to different forms of cancer, an understanding of the likely effects of specific drugs and more accurate prediction of outcomes for the individual.

Genomic data is not the only non-clinical data relevant to health however. If we really are to revolutionize healthcare, we need to be looking at all the relevant health determinants which include social, cultural, financial, behavioral and economic data.

When looking to replace or employ a HIS system, it is worthwhile understanding the vendor's current capability in comparison to the market – but also their positioning for the future of precision medicine.

6. **ARCHITECTURE OF HOSPITAL INFORMATION SYSTEM**

Hospital Information System architecture has three main levels, Central Government Level, Territory Level, and Patient Carrying Level. Generally, all types of hospital information system (HIS) are supported in client-server architectures for networking and processing. Most work positions for HIS are currently resident types. Mobile computing began with wheeled PC stands. Now tablet computers and smartphone applications are used.

Enterprise HIS with Internet architectures have been successfully deployed in Public Healthcare Territories and have been widely adopted by further entities. The Hospital Information System (HIS) is a province-wide initiative designed to improve access to patient information through a central electronic information system. HIS's goal is to streamline patient information flow and its accessibility for doctors and other health care providers. These changes in service will improve patient care quality and patient safety over time.

The patient carries system records patient information, patient laboratory test results, and patient's doctor information. Doctors can access easily person information, test results, and previous prescriptions. Patient schedule organization and early warning systems can provide by related systems.

1. **FUNCTIONAL SPLIT**

HIS has data warehousing as the main topic, hence it is a more static model of information management. HIS is often composed of one or several software components with specialty-specific extensions, as well as of a large variety of sub-systems in medical specialties from a multi-vendor market. Specialized implementations name, for example Laboratory Information System (LIS), Policy and Procedure Management System, Radiology Information System (RIS) or Picture archiving and communication system (PACS).

Architecture is based on a distributed approach and on the utilization of standard software products complying with the industrial and market standards must be utilized (such as: UNIX operating systems, MS-Windows, local area network based on Ethernet and TCP/IP protocols, relational database management systems based on SQL language or Oracle databases, C programming language). Portable devices such as smartphones and tablet computers may be used at the bedside.

7. OBJECTIVE OF HOSPITAL INFORMATION SYSTEM

Hospital Information Systems provide a common source of information about a patient's health history. The system has to keep data in a secure place and controls who can reach the data in certain circumstances. These systems enhance the ability of health care professionals to coordinate care by providing a patient's health information and visit history at the place and time that it is needed. Patient's laboratory test information also includes visual results such as X-ray, which may be reachable by professionals. HIS provide internal and external communication among health care providers.

The HIS may control organizations (a Hospital in this case), official documentations, financial situation reports, personal data, utilities and stock amounts. The HIS also keeps in a secure place: patients' information, patients' medical history, prescriptions, operations and laboratory test results.

The HIS may protect organizations, handwriting errors, overstock problems, conflict of scheduling personnel, and official documentation errors like tax preparations errors.

8. OBJECTIVE OF THE STUDY

- To determine the key drivers and motivation behind CDHB's initiative to allow greater hospital automation by replacing its legacy Patient Administration System (PAS)
- To evaluate the tangible benefits CDHB has already achieved (or will achieve) by replacing its legacy PAS

9. RESEARCH METHODOLOGY

The **retrospective study** looks backwards and examines exposures to suspected risk or protection factors in relation to an outcome that is established at the start of the study. In this study, the outcome of interest has already occurred at the time the study is initiated.

There are two types of retrospective study: a *case-control study* and a *retrospective cohort study*. A retrospective study design allows the investigator to formulate hypotheses about possible associations between an outcome and an exposure and to further investigate the potential relationships. However, a causal statement on this association usually should not be made from a retrospective study.

While this study is commonly applied to patients under research and employed to examine their illness data, the scope of the study in this particular dissertation is applied to the tangible benefits of introducing greater automation in two large hospitals in Christchurch, New Zealand.

This study would still utilize benefits to patients (along with hospital staff) of the hospitals under study.

Retrospective cohort study was employed in the research which has following advantages for this particular dissertation:

- They are conducted on a smaller scale i.e. ideal for university projects such as this particular dissertation study
- They typically require less time to complete
- They are generally less expensive, because resources are mainly devoted to collecting data
- They are better for analyzing multiple outcomes
- In a medical context, they can potentially address rare diseases, which would necessitate extremely large cohorts in prospective studies

1. RESEARCH STUDY DETAILS

Following research study details are noteworthy:

- The complete study (conception to conclusion) was conducted in 3 stages in the following sequence:
 - Training on ***Orion Health Enterprise Hospital Information System (HIS)*** software and a typical hospital workflow in a New Zealand public hospital from ***5th February 2018*** until ***6th April 2018*** (initial training was conducted online followed by classroom sessions in Auckland, New Zealand) to gain an understanding of all the HIS terminologies, theoretical understanding of current hospital workflow in Canterbury District Health Board (CDHB) hospitals.
 - A full day visit and workshop in **Burwood Hospital, Christchurch** (New Zealand) on ***9th April 2018*** and in **Princess Margaret Hospital, Christchurch** (New Zealand) on ***10th April 2018*** that involved a tour of all the hospital departments, detailed discussions with the hospital staff, hospital senior management, cyber security experts and occasionally patients and viewing the Orion Health Enterprise HIS software in operation at different stages of patient workflow within the hospital environment
 - Various workshops with Enterprise product management team over a period of 2 weeks to better interpret all the conversations and observations gathered during 2-days hospital visits and drafting conclusions
- Participating hospitals:
 - **Burwood Hospital, Christchurch** (New Zealand) – all the departments including front desk, IPD and OPD clinics, Radiology section, Laboratory, patient wards, in-house pharmacy stores, surgery theatres, X-ray rooms, IT monitoring department
 - **Princess Margaret Hospital, Christchurch** (New Zealand) – all the departments including front desk, IPD and OPD clinics, Emergency department (ED), Radiology section, Laboratory, patient wards, in-house

pharmacy stores, surgery theatres, X-ray rooms, IT monitoring department

- Participants in the study:
 - Orion Health Enterprise HIS product management team
 - Orion Health Education Team
 - IT managers in Burwood and Princess Margaret Hospital
 - Clinicians/General Physicians
 - Cardiac Surgeons
 - Nursing staff assisting physicians and surgeons
 - Front desk receptionists and clerks
 - Radiologists
 - Laboratory technicians
 - Pharmacists
 - Cyber security experts
 - IT help desk staff
 - Board members of Canterbury District Health Board (CDHB)
 - Product Director - Enterprise
- All the records and data collected during the hospital visit was thoroughly screened by the cyber security experts in the hospitals (mentioned above) to ensure that government regulation setup on Ministry of Health, New Zealand are not violated
- This study is conducted solely for academic purposes and shall not be used in form for commercial gain

2. DATA SAMPLING PROCEDURE/TECHNIQUE

A 2-day workshop was conducted in Burwood Hospital and Princess Margaret Hospital in Christchurch where following activities were completed:

- Complete patient workflow explained (from admission all the way through to discharge) in both the hospitals.
- Introduction to all the hospital staff responsible for various stages of patient journey through the hospital e.g. front desk clerk, nursing staff, clinician, pharmacist, radiologist, lab technician, IT help desk etc.
- Explanation of their roles, work-procedures during emergency hours, manuals they use when the hospital is switched to a *manual mode*
- Exhibition of how Orion Health Enterprise was operational at various kiosks, on front desk reception, in radiology rooms, operation theatres etc.
- Interaction with the patients to understand their experience on a regular day to the hospital

1. DATA SAMPLE SIZE

- Audited record of patient visits for three periods:
 - ***2nd February 2015*** until ***27th November 2015***
 - ***29th July 2016*** until ***28th July 2017*** and
 - ***7th July 2017*** until ***30th March 2018*** with specific focus on the following
 - Patient volumes in IPD vs OPD vs ED (Patient Demographic Study)
 - Total turn-around time for a patient (admission all the way through to discharge) in OPD, IPD and ED visits during all the
 - Variance in the total cost borne by the hospital for each of the periods above
 - Total number of outages recorded, and time taken to switch to manual mode in both the hospitals
 - Variance in ***per patient*** cost for all the three periods for both the hospitals

The above hospital/patient data samples (in the sequence listed above) are plotted in graphs below:

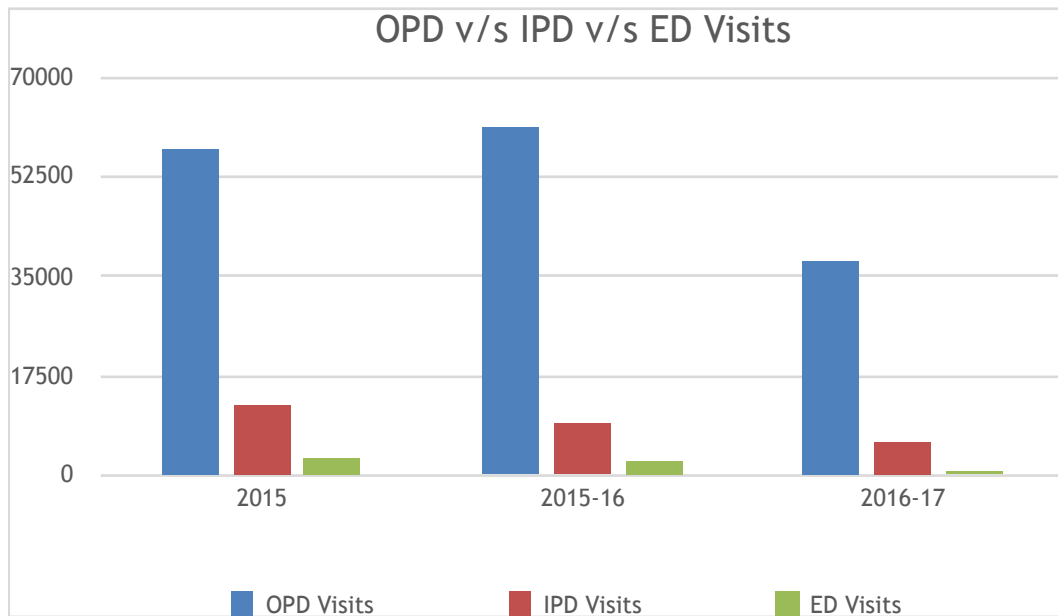


Fig. 3.1. Patient visits in OPD v/s IPD v/s ED

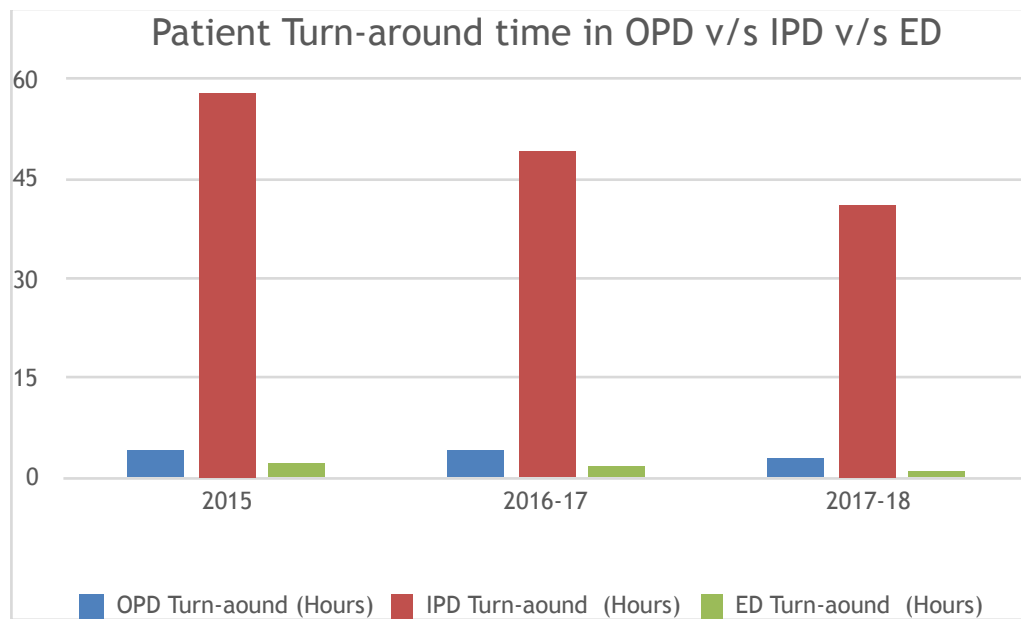


Fig 3.2. Patient Turn-around time in OPD v/s IPD v/s ED

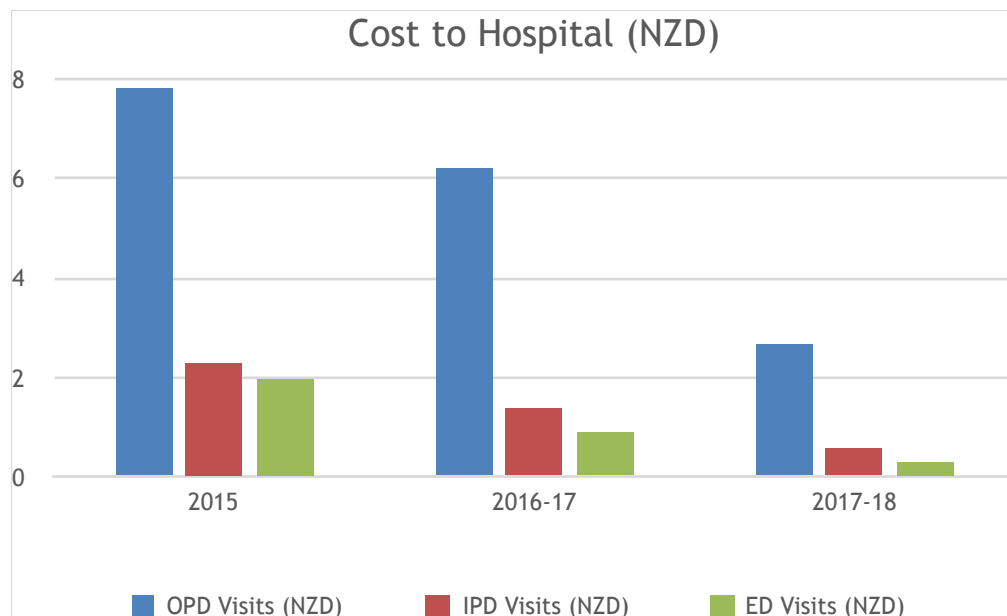


Fig. 3.3. Variance in cost borne by hospital in NZD

2. INCLUSION AND EXCLUSION CRITERIA

- Referrals from hospitals outside of Canterbury District Health Board (CDHB) were not considered
- Patient visit data for holiday periods were excluded due to difference in the hospital staff available during holidays
- Days for scheduled annual hospital outages for events such as fire drills etc. were excluded
- IPD visits for patients with prolonged illnesses (more than 5 years) and undergoing special treatments were excluded

Based on the 2-days visit with the above-mentioned data/inputs at hand, the following tasks had to be completed:

- Evaluation of whether Orion Health Enterprise HIS is utilized for its intended use
- Evaluation of Orion Health Enterprise operations during peak patient volume times without any noticeable issues

- Evaluation of the hospital staff utilizing the Orion Health Enterprise, the software as per the manual provided to them or were they unsure about the software's features
- Evaluation of whether a switch to manual mode of management for minor software issues has to be made.
- Preparation of the list of issues the hospital staff have been continuously facing
- Prioritization and ranking of the list of issues so that Enterprise product management team could inspect these issues and recommend a solution during the course of my internship
- Assessment of further business prospect noticeable within the hospital environment

9.3. DATA COLLECTION INSTRUMENT

Following tools were employed as a part of this study:

- ***Orion Health Enterprise HIS software*** - provision of a laptop with all the required software's installation and training for complete installation of the Orion Health Enterprise HIS. An investment of 2 weeks of the time during the internship to learn about the software was scheduled so that I am well-versed with the intended use of the software.
- ***UX Wireframe, mock-ups and Proto-typing*** – A methodology used within Orion Health where **User Experience (UX)** design team constructs a series of software screen mock-ups and collects user feedback to evaluate the suitability of the screen
- ***Microsoft suite*** namely MS Word, MS Excel, MS Powerpoint, MS Visio
- ***Flowcharts***
- ***Atlassian JIRA*** (Configuration Management Tool)
- ***Google Docs and Spreadsheet***
- ***Mac Numbers*** (Analogous to MS Excel in Apple Macbook)

Following screenshots were taken from Orion Health Enterprise HIS software operational on a *staged* environment on company laptop:

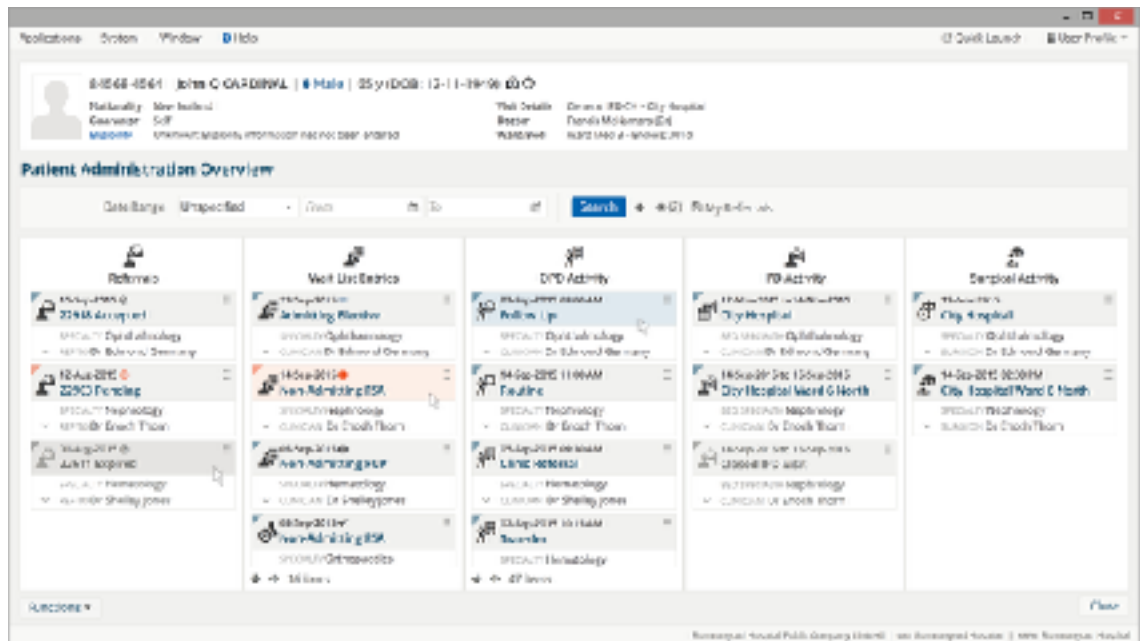


Fig. 4.1.Patient Overview

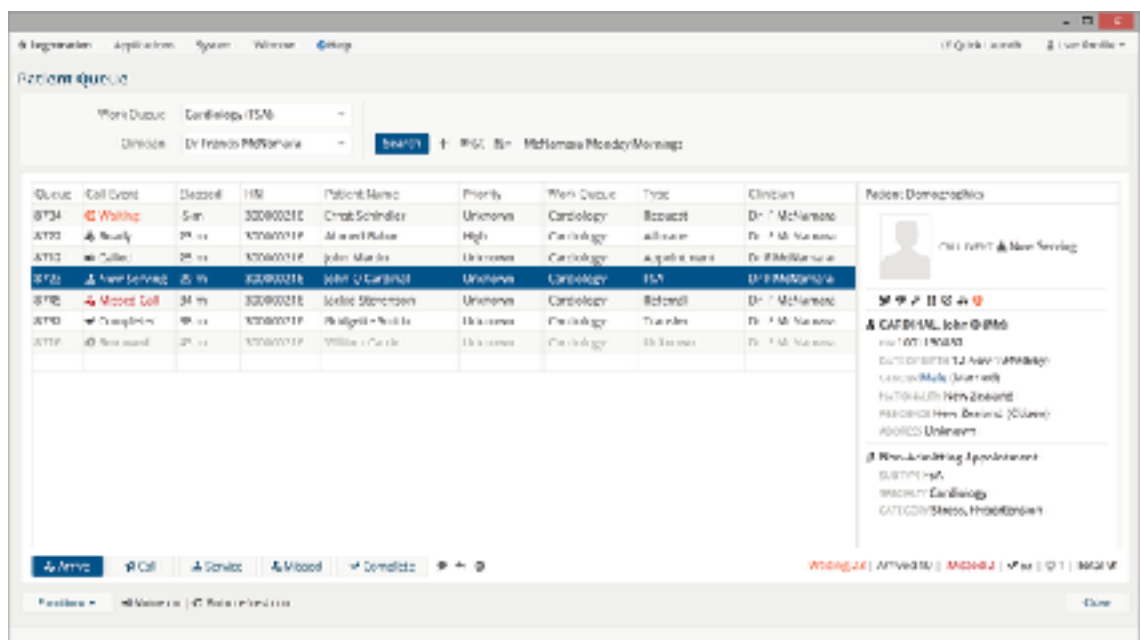


Fig 4.2. Patient Queue

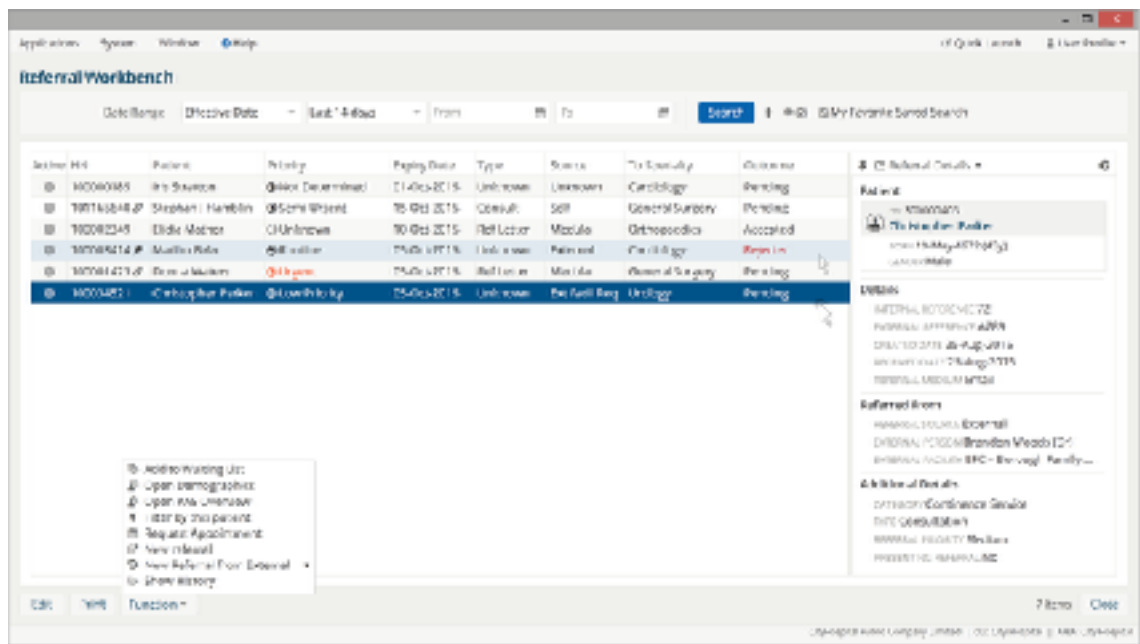


Fig 4.3. Patient Referral Workbench

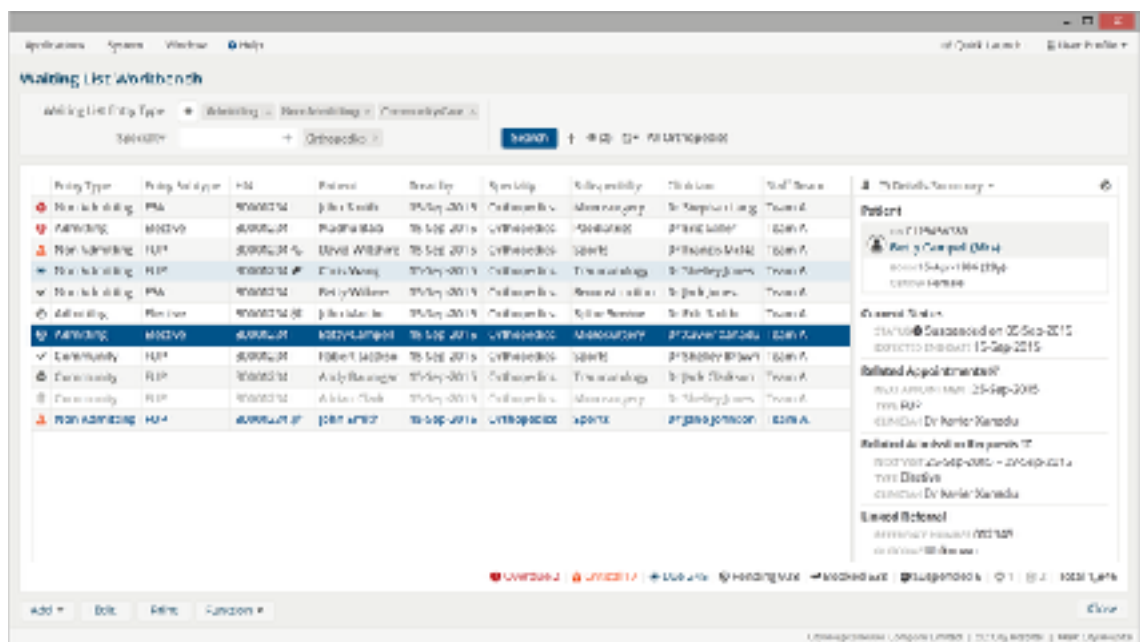


Fig 4.4. Patient Waitlist Workbench

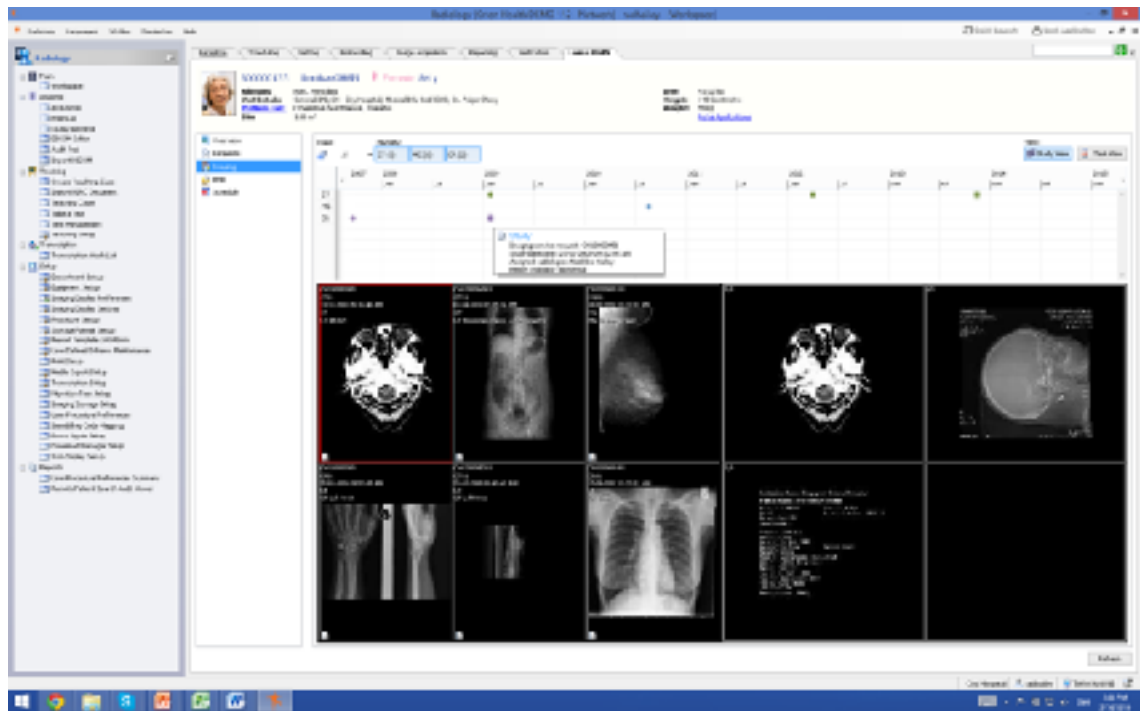


Fig 4.7. Patient Radiology Timeline

Equipped with Microsoft suite and knowledge of Orion Health Enterprise (after the training in Auckland office) a preparation to evaluate how the software was used in the hospitals and if the feedback provided by the hospital staff warranted a noteworthy issue in my list of prioritized issues.

The 2-days visit to the hospitals also included breaks for the completion of the notes, simulation of some of the issues raised by the hospital staff and proposing them with a quick alternative solution often times.

All the information during the whole interaction with the hospital staff, some collected patient's personal details, screenshots etc. were screened and validated by the cyber security and quality assurance department of the hospital.

9.4 DATA ANALYSIS

A detailed flowchart of the following scenarios in the patient journey was conducted as a part of 2-day hospital visits:

- Typical patient journey in Burwood and Princess Margaret Hospital, Christchurch
- Outpatient registration workflow
- Inpatient registration workflow

- Emergency department (ED) workflow
- Radiology interaction workflow

Above scenarios (in the sequence listed above) are shown by means of workflow diagrams below

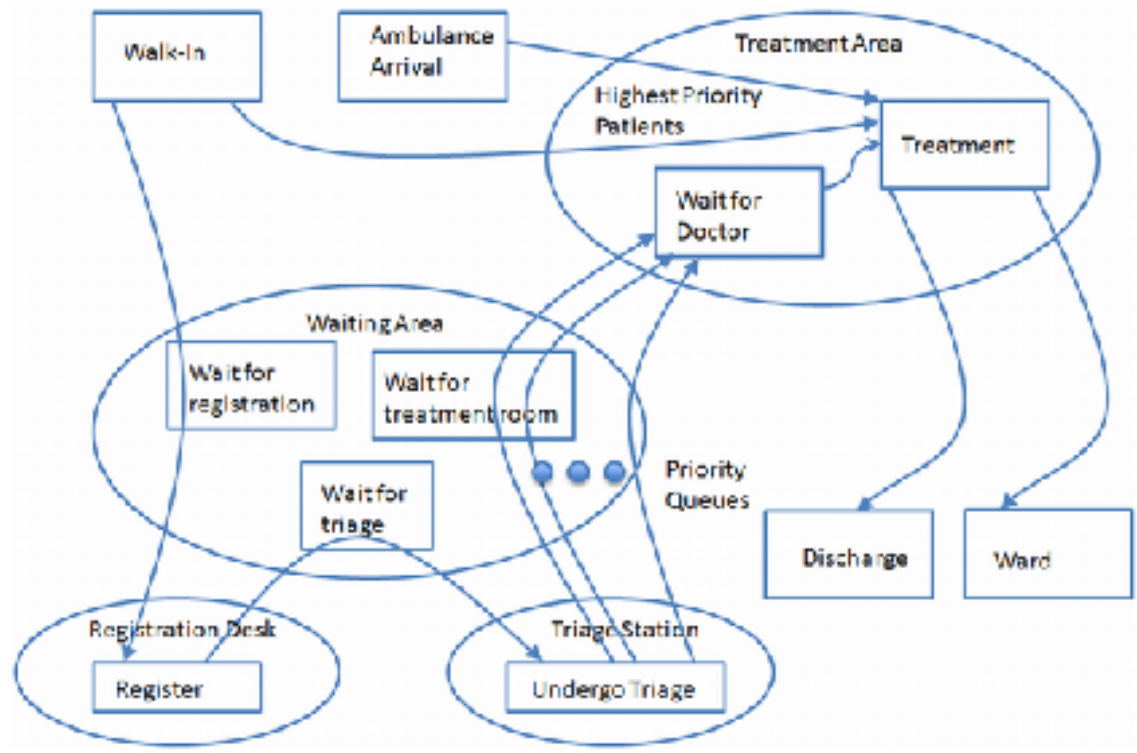


Fig. 5.1. Patient Journey in Burwood/Princess Margaret Hospital

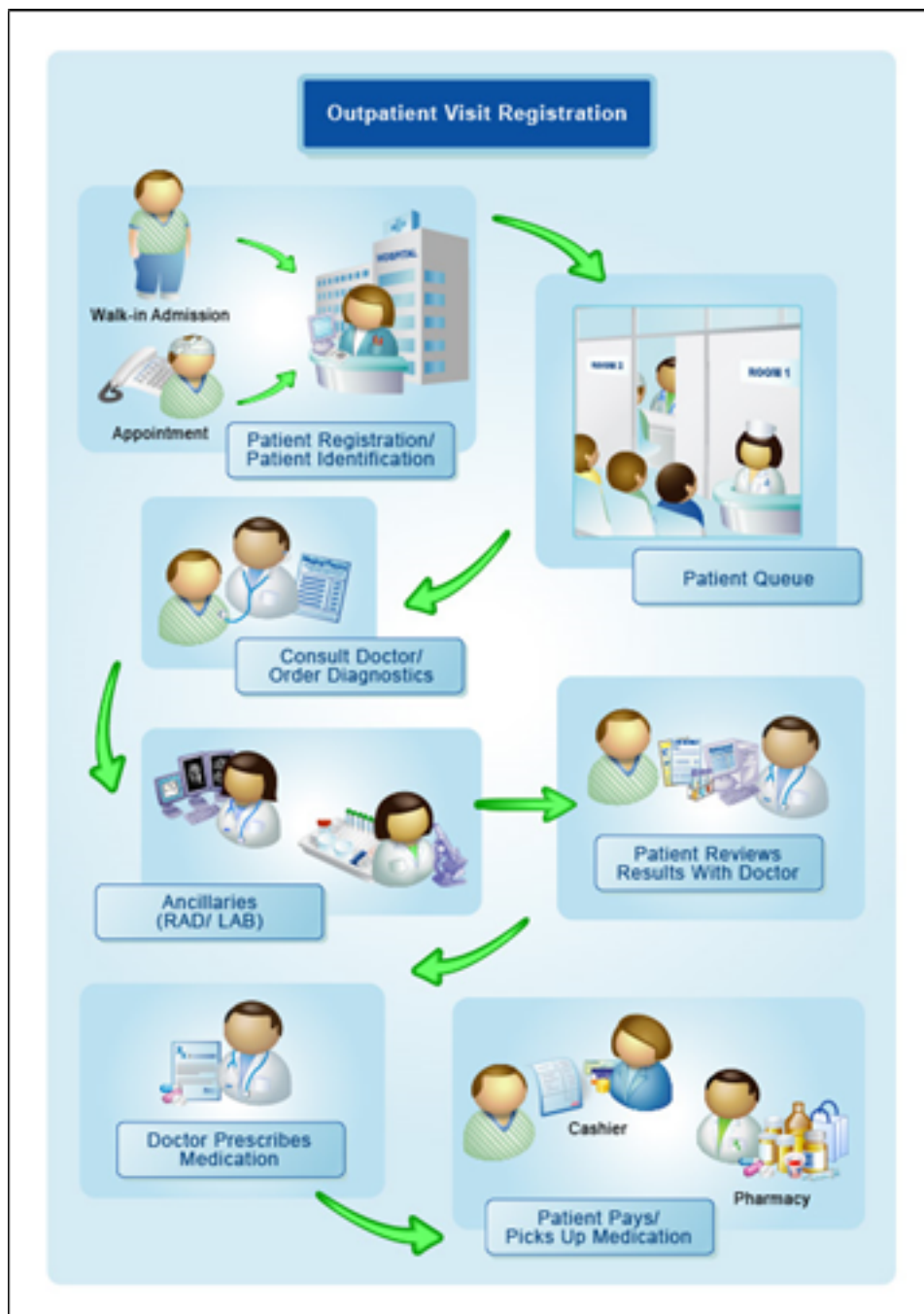


Fig 5.2. Outpatient Registration Workflow

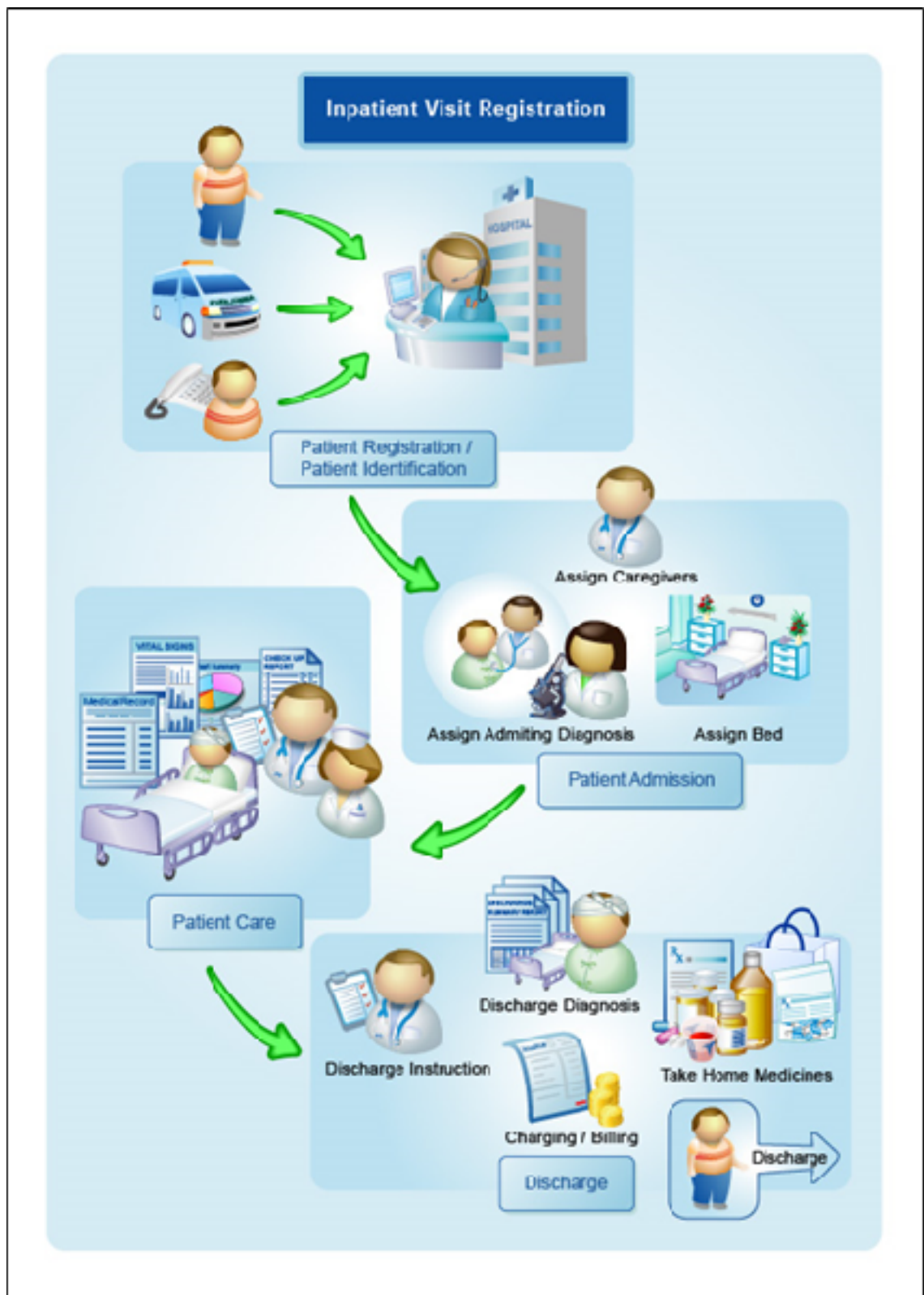


Fig 5.3. Inpatient Registration Workflow

Following points were found noteworthy as a part of the 2-days visit to Burwood Hospital and Princess Margaret Hospital.

- Burwood Hospital successfully implemented Orion Health Enterprise HIS in July 2016 followed by Princess Margaret Hospital and were on Enterprise version 17.2 at the time of my study
- The futuristic user interface design of Orion Health Enterprise was greatly appreciated by all the hospital staff
- The training provided by Orion Health product management team was very successful in staff's day-to-day job and they were not applying any workarounds due to lack of software knowledge
- The staff was very keen to learn new technology and was happy with the introduction of greater automation. This was a peculiar behavior as I expected some resistance in accepting the modern technology by the hospital staff
- Some of the clinicians expressed concerns over the performance of clinical record section of the software during peak patient volume hours in the hospitals. They did not suggest any significant or blocker issue with this performance slowness however
- Lack of alignment with other DHBs in the South Island was raised a major concern
- Patient data was very well protected by the hospital authorities and cyber security experts took much time in screening any patient data that was shared as a part of by 2-days hospital visit. This prompted me to conduct some preliminary analysis with my patient sensitive notes that was not allowed to leave hospital premises.

10. **RESULT/OUTCOME OF DATA ANALYSIS AND CONCLUSION**

After the initial training on Orion Health Enterprise followed by 2-days visit to Burwood and Princess Margaret Hospital, the Enterprise product management team indulged themselves in translation of the detailed discussions with the hospital staff in a list of software features that would be valuable for them over the next 6-9 months'

timeframe. Due to the similarity in the work procedures, these features would also benefit other DHBs in South Island.

Following is an academic transcript/record of benefits realized by Canterbury District Health Board (CDHB) since its implementation of Orion Health Enterprise HIS that was conducted to help CDHB achieve its objective of realizing greater automation in its hospitals.

11. KEY DRIVER AND BENEFITS OF IMPLEMENTING HOSPITAL INFORMATION SYSTEM (HIS)

A well designed HIS system such as Orion Health Enterprise HIS enabled many notable improvements in the efficiency and effectiveness of healthcare facilities. The key distinguishing factor with Enterprise HIS is patient centric approach and strategic focus on achieving a greater level of automation in patient lifecycle management. In this transcript, I examined and listed the impact of a hospital automation on a typical patient journey that gave the hospital board a real-time insight in to the value of automating a hospital.

11.1. Enterprise Schedule Management: A patient journey begins with scheduling an appointment where the patient decides how he/she would prefer to contact the hospital for consultation. A fully automated hospital provides multiple options to its patients apart from a traditional walk-in option. These options include availing an online appointment (web or mobile app) or using a telephone to book an appointment over a call with the hospital front desk. An efficient software used to book a patient appointment offers available time-slots, provides advance appointment bookings depending on the availability of physician(s) and asks all the necessary details to make the appointment process as seamless as possible irrespective of the mode of booking (online/telephonic). The level of automation in patient appointment booking and its ease of usage creates the first impression for the patient in his/her journey.

11.2. Patient Records Accessibility: Patients are regarded as valuable customers by the hospitals like any other profitable business. Hence, patient “re-visits” are of major significance to these hospitals. Automation gives easy access to patient data, allows simple inspection and intuitive navigation of patient history. Better user interface design makes the patient data available in few seconds with minimum number of clicks there by enabling “continuity of care” in a hospital eco system. Better software design also allows patient records (and patient history) to be easily search-able by the clinicians and other relevant hospital staff. Easy patient record accessibility also greatly enhances the overall performance of hospital by enabling timely medical decisions, reconfirmation on medications and other procedures during or after medical treatment(s) resulting in better patient satisfaction and outcomes.

11.3. Patient Record Safety: Patient records are sensitive pieces of information and are a subject of government regulations in many countries. Hospital owns the liability to provide the right level of access to the patient records to the right set of people only like clinicians, nurses, radiologists, laboratory technicians etc. Hospital information system software enables digital storage of patient data with a flexibility to configure the right level of access (authorized access) to a selective group of people in the hospital. Such digital storage of patient data reduces the cost of traditional shelf storage and allows the hospital administration to keep a track of authorized and unauthorized logins/access on a regular basis. Such regular supervision of authorized access of patient records provides visibility in to a potential security breach and allows the hospital administration to take appropriate responsible actions as opposed to reacting to a security breach accident.

11.4. Minimize Human Errors: Many unforeseen accidents and human errors occur in a hospital due to carelessness, lack of proper training, improper communication, fatigue, work stress of hospital staff etc. Automation in a hospital essentially implies reduced human intervention and proportionately reduces the likelihood of human errors. Reduced error occurrences also reduce the cost and effort to triage these errors that significantly enhances the

operational efficiency of hospital. Automated patient appointment scheduling is a great example of how human errors can be eliminated i.e. irrespective of whether a front desk clerk books an appointment over a telephone or via a walk-in, no human co-ordination is required to manage a patient queue for a medical treatment.

11.5. Enhanced Coordination Between Departments: A significant portion of patient's time is wasted in coordination between different departments within a hospital e.g. an MRI scan is available in a specific hospital department while the consulting clinician is available in another hospital facility located in a different part of the city. Automation allows a real-time communication between different hospital departments irrespective of their geographical locations. A hospital management software forms the communication channel between different hospital departments, eliminates such painful human coordination, results in faster decision making by hospital staff (clinicians, nurses, laboratory technicians etc.) thereby reducing the total patient wait times. This leads to greater patient satisfaction.

11.6. Efficient Resource Utilization: As we aim for greater level of automation in almost every industry (healthcare included), a well-planned automation in a hospital asks for a balanced mix of automation and manual coordination where there is a considerable reduction of human resources involved at every stage of a patient journey, patient data is stored on servers and accessed on finger tips with minimum number of clicks. This leads to a significant reduction of cost allocated to manage human resources i.e. greater profitability, efficient and trustworthy medical devices (with automatic configuration and calibration etc.) and less errors/accidents.

11.7. Better Operational Efficiency: Reduced utilization of human resources through automation mandates a sea change in the operational workflow in a hospital where software(s) shares the burden of decision making. Be it patient registration, patient billing or appointment scheduling, hospital

management software leads to a better staff performance by assisting the staff at every stage of a typical patient journey.

11.8. Valuable Insights, Better Strategies: The biggest benefit of automating a hospital is the accessibility of patient data and the recognition of patterns that are formed using this set of data. This patient data (including patient history, symptoms, allergies etc.) generate useful patterns that gives valuable insight in to the patient behavior - patient response to certainly medical conditions, patient visit frequency, their awareness of their medical conditions etc. While these insights are valuable in planning an informed medical eco-system to serve the patients better, it also opens doors for commercial prospects for the hospital's executive team. With this patient data patterns, hospitals can now forecast patient behavior, plan expansion of their hospital facilities in other geographical regions and make such commercially viable patient patterns available for other healthcare providers (with specialties like cancer treatments etc.) to use as well.

12. MYTHS ABOUT ADOPTION OF HOSPITAL INFORMATION SYSTEM (HIS)

12.1. HIS is useful only for large hospitals: Electronic Medical Records (EMRs) create value for practices of all sizes as they allow for scalability and customizability to suit the existing administrative and clinical workflows of any practice setting.

- Small (1-4 MDs)
- Mid-sized (5+ MDs)
- Large (20+ MDs) or Multi-Specialty
- Practices supported by Hospitals
- Academic Medical Centers

- Management Service Organizations
- Integrated Delivery Networks
- Federally Qualified Health Centers

12.2. Paper based medical records are easier to handle: Using paper has always been the traditional way a medical practice does things. It is difficult to let go of your comfort zone. However, when deciding on whether to make the transition; you must bear in mind how both methods of documentation compare.

Paper Based Medical Records	Electronic Medical Records
Time Consuming	Time Saving
Susceptible to inaccuracies	Accurate
Physical storage required	Electronic storage
Difficult to find relevant documents	Simplified search
Increased overheads	Cost savings

12.3. HIS is only made for some specialties: Certainly, there is no “one size fits all” solution when it comes to providing an automated healthcare solution. Anticipating this need, health IT organizations have created solutions that come in different versions for different practices depending on their size and the number of specialties involved.

12.3.1. Single-specialty: Single-specialty specific HIS will not be developed according to the specifications of different specialties. They are configurable to suit the specialty specific workflows of physicians.

12.3.2. Multiple-Specialty: Multi-specialty HIS are developed for practices which employ more than one specialty. If a practice employs a dermatologist, an

oncologist and a cardiologist, then the use of multi-specialty HIS would be highly beneficial for it since the software is customized to specialty specific usage.

12.4. Costly investment with slow returns: Adoption of an HIS solution is a step towards greater return on investment. This adoption leads to greater patient satisfaction and better hospital efficiency. However, it would be unfair to expect a return from HIS immediately and a steady transition is involved in receiving satisfactory return on investment from an HIS solution. The healthcare community– including technology vendors, insurance companies, professional associations and others – are equally responsible for finding viable technology solutions. Until now, however, few offerings have proven to overcome the recurring challenges of implementing HIS solution. Access has sought to address each of these concerns, as explained below:

12.4.1. Costs: Lack of financial resources is the number one barrier to implementing IT hospitals, according to HIMSS. And, however important, HIS represents a significant investment to be weighed against other spending priorities. Access's competitive initial price point, education of users to completely own their forms automation solution and scalability contribute to a low total cost of ownership.

12.4.2. Interoperability issues: A complete HIS system is not just one application, but many working together, which might include the EMR, document management system, data entry tools and other components. Many hospitals will continue to use various systems, so it's important that each new application purchased offers flexible integration options with existing technology, providing interoperability within the organization. Access's product family is proven to integrate with virtually any hardware and software system, and can both pull data from and send data to existing applications via HL7 and other industry standard mediums. This helps ensure consistent and current patient and

business data is available from all applications.

12.4.3. Conversion of historical documents: Moving to HIS involves more than a new format for newly created documents – it also requires conversion of historical records, in a process sometimes referred to as chart abstraction or migration. Without the right tools in place, this process can be costly and time-consuming. Access helps organizations implement an efficient conversion of paper forms and its Image Portals import electronic forms directly into HIS and document management system repositories without printing or scanning.

12.4.4. Privacy/security concerns: As paper records are converted to electronic data, many believe the information becomes more vulnerable to system failures or the prying eyes of tech-savvy outsiders. Hospitals must put ample security measures in place if the benefits of HIS are to outweigh the risks. Systems such as Access Evolution and PFS enable administrators to restrict forms access and editing to only authorized staff members, via multiple-level user privileges. This protects patient and staff privacy and supports compliance with the requirements of JHACO, HIPAA and other compliance standards.

12.4.5. End user adaptation: Most clinical and administrative staff members are pressed for time and may be reluctant to embrace any significant changes to their daily work habits. Products that are easy to use, such as Access's PFS and Evolution suites, allow users of all skill levels to quickly adopt electronic forms automation. And intuitive forms and workflow designers make administering Access products easy.

For these reasons, the onus falls to technology vendors to develop high quality EMR solutions that include products offering enterprise-wide scalability, integration with existing systems and delivery of early and lasting return on investment at a low

total lifetime cost.

13. CDHB's PHILOSOPHY OF SIMPLIFYING THE TRANSITION TO A MODERN HIS

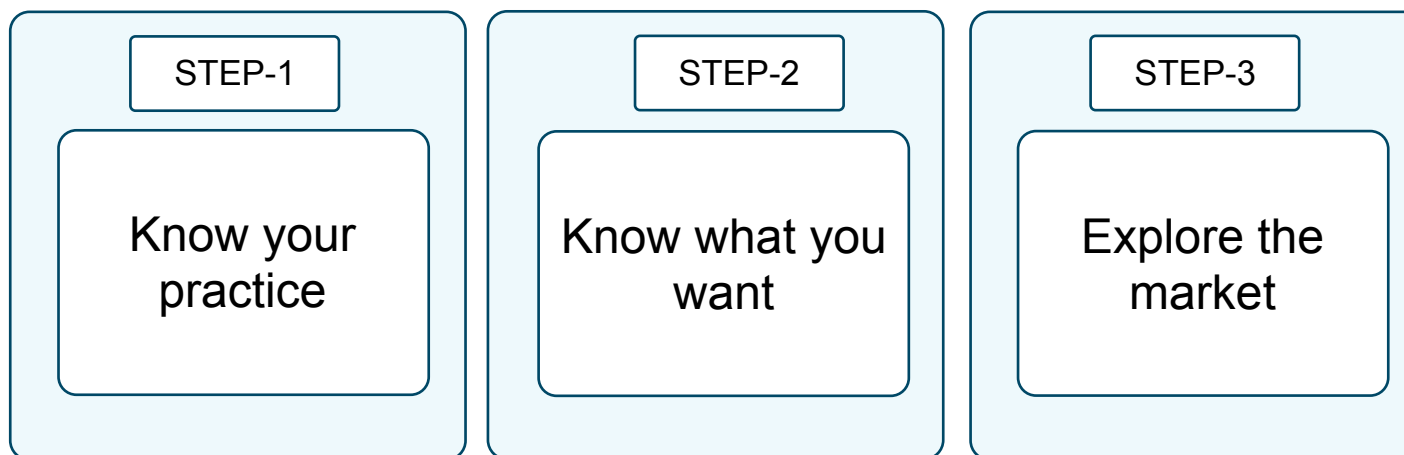


Fig. 6.1.

1. Step-1: Know your practice

- 1.1. **Identify reasons for transitioning from paper** Objectively analyze the problem in the practice and take help from a HIT consultant to identify how these problems can be solved by an EMR. All EMR vendors offer comprehensive EMR demos to help you assess the benefit prior to deciding.
- 1.2. **Ensure financial stability** You must make sure that there is a set budget put aside to avoid unnecessary delays in acquisition.
- 1.3. **Education is the key.** Every relevant person in the office should be

educated about upcoming changes. Special trainings should be held on how to use the software. Provide basic guidelines to the management and how to best use EMR software.

- 1.4. **Question the vendor.** Ask questions about every issue you face with the software and how they think the issue may be resolved. Put in place a single person who will coordinate with the vendor and solve issues at the workplace
- 1.5. **Test the software.** Make sure that you test the software before it is supposed to 'go live'. Initiate the use of EMR throughout the practice a couple of months before the go-live date so that every issue that comes with operating the software is handled before and everyone gets to learn how to use the software effectively.

2. Step-2: Explore the market

Surveys suggest that at times physicians do not ask or take interest in product details, rather basing their purchase decision on low cost or visually appealing solutions. Providers must choose an HIS vendor that can fulfill their long-term practice requirements. Selecting a standalone Practice Management or HIS system, instead of an integrated system can cause compatibility and workflow related issues.

3. Step-3: Decide what you want

There are several HIS vendors in the market today, which can make decision making difficult for providers. The following should help you decide which vendor you will benefit from most.

- 3.1. **Hardware:** Many practices need to upgrade existing hardware to run EMRs. Vendors give out a list of items you need to purchase to get things going. Therefore, it is even more important to look for a vendor who offers web- based services that require limited hardware

installation.

- 3.2. **Maintenance:** Many vendors charge a percentage of the first payment to cover costs of software maintenance and updates. It is therefore important to see if the increased costs due to maintenance are worth your money. Talk to the vendor about this and consult with people who use this vendor. Is the maintenance and update service as good as they say?
- 3.3. **Support and Training:** It is imperative that you choose a vendor who provides live, online and built-in software support services. Many EMR vendors now provide support services with dedicated client account managers.
- 3.4. **Demonstrations:** A vendor who provides detailed demonstrations for their products will further simplify your decision making. Feel free to ask them questions that come to mind.
- 3.5. **Ratings/Certifications/Alliances:** Google the vendor. Look for ratings from credible sources. Look at the vendor website and see if they are compliant with Meaningful Use if they are certified with credible entities and follow the industry standards.

14.CONCLUSION

A complete HIS solution is certainly a useful proposition for a hospital of any size. There are many myths that must be discarded by means of a careful evaluation of different stages involved in HIS adoption within a hospital environment. A successful transition to an automated hospital involves understanding of hospital practice, expectations from the practice and a proper assessment of the market.

Hospitals with limited budgets can choose to implement an HIS solution in a single department, and grow the solution as increased finances become available. Other providers prefer to introduce a customized Access solution to administrative and patient-focused areas across the hospital from the get go.

The realization of a HIS solution in a hospital facility (single or multiple) generates a sustainable and significant return on investment and provides a greater satisfaction for the patients and it is time hospital management pays attention to the details about running a complete HIS solution in their facilities.

15.RECOMMENDATIONS

All the previous software releases of Orion Health Enterprise were studied and combined with interactions with hospital staff, following improvements to the software is recommended

Additional Data Validation – Referral Prioritization Workflow

Additional Data Validation – Service & Service Sub-Type Filtering

Introduction of Capture for Un-Structured Appointments & Visits

Workflow Improvements – Use of Prompts to Invoke Optional Triggering of Forms

Workflow Improvements – Linking of Appointments to the Waiting List

Additional Data Validation – Appointment / Visit Value Filtering

16. **BIBLIOGRAPHY**

1. Orion Health (internationally renowned healthcare technology company) - <https://www.orionhealth.com>

Orionhealthcom. Orion Health. [Online]. Available from: <https://orionhealth.com/> [Accessed 14 May 2018].

2. District health boards of New Zealand - <https://www.health.govt.nz/new-zealand-health-system/my-dhb>

Govtnz. Govtnz. [Online]. Available from: <https://www.health.govt.nz/new-zealand-health-system/my-dhb> [Accessed 14 May 2018].

3. South Island Patient Information Care System (SI PICS) - <https://www.sialliance.health.nz/our-priorities/information-services/si-pics/>

Healthnz. Healthnz. [Online]. Available from: <https://www.sialliance.health.nz/our-priorities/information-services/si-pics/> [Accessed 14 May 2018].

4. Release of new patient information system at Burwood hospital - <https://www.sialliance.health.nz/news-/new-patient-information-system-completes-the-rounds-at-burwood-hospital/>

Healthnz. Healthnz. [Online]. Available from: <https://www.sialliance.health.nz/news-/new-patient-information-system-completes-the-rounds-at-burwood-hospital/> [Accessed 14 May 2018].

5. Quality improvement at CDHB - [2017 Canterbury District Health Board Quality Improvements](#)

6. Burwood hospital's enhanced automation attempt with their inpatient facility - <https://www.pulseitmagazine.com.au/new-zealand-ehealth/3641-canterbury-goes-live-with-si-pics-in-inpatients-finishes-medchart-roll-out>

Pulseitmagazinecomau. Pulseitmagazinecomau. [Online]. Available from: <https://www.pulseitmagazine.com.au/new-zealand-ehealth/3641-canterbury-goes-live-with-si-pics-in-inpatients-finishes-medchart-roll-out> [Accessed 14 May 2018].

7. CDHB's transformation program as a case study - [International report encourages health systems to learn from CDHB](#)

Healthnz. Healthnz. [Online]. Available from: [http://www.cdhb.health.nz/About-CDHB/staff-resources/Documents/Canterbury DHB CEO Update Monday 4 September \(4MB, PDF\).pdf](http://www.cdhb.health.nz/About-CDHB/staff-resources/Documents/Canterbury DHB CEO Update Monday 4 September (4MB, PDF).pdf) [Accessed 14 May 2018].

8. South Island Alliance and its objective <https://www.sialliance.health.nz/Canterbury District Health Board's mission and values> <http://www.cdhb.health.nz/About-CDHB/Who-We-Are/Pages/Vision-Mission-and-Values.aspx>

Healthnz. Healthnz. [Online]. Available from: <https://www.sialliance.health.nz/> [Accessed 14 May 2018].

Healthnz. Healthnz. [Online]. Available from: <http://www.cdhb.health.nz/About-CDHB/Who-We-Are/Pages/Vision-Mission-and-Values.aspx> [Accessed 14 May 2018].

9. Details on South Island Patient Information Care System (SI PICS)

<https://www.sialliance.health.nz/our-priorities/information-services/si-pics/>

Healthnz. Healthnz. [Online]. Available from: <https://www.sialliance.health.nz/our-priorities/information-services/si-pics/> [Accessed 14 May 2018].

10. Acquisition press release for Amalga HIS from Orion Health <https://histalk2.com/2011/10/16/orion-health-acquires-microsofts-former-his-product-companies-will-co-market-offerings/>
11. Histalk2com. Histalk2com. [Online]. Available from: <https://histalk2.com/2011/10/16/orion-health-acquires-microsofts-former-his-product-companies-will-co-market-offerings/> [Accessed 14 May 2018].
