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Health Service Executive

# Evaluation of the Implementation Process of E-Rostering System In Letterkenny University Hospital

*(Saolta University Health Care Group)*



Tús Áite do  
Shábháilteacht 1 Othar  
Patient Safety 1 First



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Nursing & Midwifery  
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# Table of Contents

Foreword	6
Acknowledgements	8
MEMBERSHIP OF RESEARCH ADVISORY STEERING GROUP	8
LIST OF ABBREVIATIONS	9
GLOSSARY OF TERMS	10
EXECUTIVE SUMMARY	12
SECTION 1: PROJECT INTRODUCTION	16
SECTION 2: EVALUATION PURPOSE & OBJECTIVES	19
SECTION 3: METHODOLOGY	21
SECTION 4: LITERATURE REVIEW	28
Part 1 e-Rostering initiatives	28
Part 2 Implementation of digital healthcare technologies	36
SECTION 5: EVALUATION FINDINGS	41
Part 3 Interviews with key stakeholders	41
Part 4 Focus groups with front line staff	64
Part 5 Cross sectional online survey of front line staff	82
Part 6 Examination of the e-Rostering programme on KPIs & quality care metrics	90
SECTION 6: CONCLUSIONS & RECOMMENDATIONS	119
REFERENCES	124
APPENDICES	131
Appendix 1. Search strategy	132
Appendix 2. Key stakeholder telephone interview schedule	133
Appendix 3. Key stakeholder face to face interview schedule	135
Appendix 4. Front line staff focus group schedule	137
Appendix 5. Front line staff cross-sectional online survey	140
Appendix 6. Ethical approval	143

# Tables and Figures

## Tables

1	Sequence for questionnaire/ instrument development	23
2	Five themes relating to implementation of e-Rostering system	24
3	Key Performance Indicators (KPIs)	25
4	SafeCare Module and Interface Project KPIs	25
5	Common rules used in wards studied by Drake (2013b)	31
6	Classification for rostering processes according to Ernst et al. (2004)	32
7	Summary of good practice guidance for rostering developed by NHS Improvement (McIntyre 2016)	33
8	Summary of key considerations	37
9	Summary of identified papers	38
10	Interview themes and sub-themes	42
11	Demographic characteristics of front line staff participants (n=34)	64
12	Focus groups themes and sub-themes	65
13	Adjustments and additions	80
14	Demographic characteristics of respondents (n=203)	82
15	Frequency of responses to the items within the questionnaire	83
16	Databases sources	90
17	Composition of three units in LUH	91
18	Technical and business requirement for implementation of SafeCare	107

## Figures

1	Step model of inductive category development (Mayring 2000, p11)	27
2	Mean scores of construct 'Assessment of Needs' according to profession	84
3	Mean scores for construct 'Training Issues' according to profession	85
4	Mean scores of construct 'Organisational Support' according to profession	86
5	Mean scores of construct 'Benefits of eRostering' according to profession	87
6	Mean scores of construct 'Satisfaction with e-Rostering' according to unit size	87
7	Sick leave (%) over 24-month period across all 3 units	92
8	Annual leave over 24-month period across all 3 units	93
9	Study leave (%) over 24-month period across all 3 units	94
10	Parenting leave over 24-month period across all 3 units	94
11	Total unavailability over 24-month period across all 3 units	95
12	Requested duties (%) over 24-month period across all 3 units	96
13	Changes to rostering once approved over 24-month period across all 3 units	97
14	Roster approval (full) lead time days over 24-month period across all 3 units	98
15	Unused hours (4-week) over 24-month period across all 3 units	99
16	Extra hours paid according to health care professional in ED across period Jan 2016 to Oct 2017	100
17	Staff nurses' extra hours in Paediatric unit in period Aug 2015 – April 2017	101
18	Total avoidable costs across all three sites	101
19	Auto-rostering over 24-month period across all 3 units	102
20	Bank / agency use over 24-month period across all 3 units	103
21	Request of bank staff in Surgical 2 according to job title	104
22	Reasons for bank requests in Surgical 2	104
23	Bank requests in Surgical 2 across period Oct 2015 to June 2017	105
24	Conversion of WTE to Irish settings	109
25	Dependency levels of patient requirement and acuity in Gynaecological unit	109
26	The required vs actual hours for staff on Gynaecological unit	110
27	Care Left Undone Events (CLUE) over a 12-week period	111
28	Pathway for identification and escalation of CLUE's	112
29	Total avoidable costs for CCU Dec 2014 – Nov 2016	115
30	Total avoidable costs (£) for CCU Dec 2016 – Nov 2017	115
31	Percentage unused hours per 4-week period in CCU	116
32	Breakdown chart of additional duty hours for CCU by grade and weekday split	116
33	Breakdown chart of additional duty hours for CCU by reason and unit	117

# Foreword

The Nursing and Midwifery Planning and Development Unit commissioned the research evaluation of the implementation process of an e-Rostering system in Letterkenny University Hospital and are delighted to present the findings in this report.

For the first time in Ireland, a robust study has been undertaken in nursing and midwifery that demonstrates the implementation of a rostering technology solution, to better enable them to have the right staff, in the right place, at the right time, collaborating to deliver high quality, efficient patient care.

The use of rostering technology is limited within the context of the Irish healthcare system, and this report helps us to better understand the key ingredients to embed and harmonise technology into everyday practice so that it becomes a real-time mechanism for patient safety. I anticipate the findings from this study will provide a comprehensive background to other health care disciplines and organisations who are exploring e-rostering.

I wish to acknowledge the leadership and commitment of all of the healthcare professionals who contributed to the e-rostering journey. Additionally, I wish to acknowledge the range of stakeholders who participated in the e-rostering steering committee, the research advisory group and the research team from University of Ulster. This final report is a testament of their shared ownership approach for e-rostering from ward to board.

Yours sincerely



**Dr. Anne Gallen**

Director, Nmpd

# Foreword

I am pleased to present the findings of this evaluation of the implementation of the e-Rostering system in the Letterkenny University Hospital (LUH), an acute general and maternity Hospital, located in Health Service Executive North West Region.

In Ireland, health care staff costs represent a substantial proportion of overall expenditure. How those staff are rostered and how their time is managed has implications on the delivery of patient care and costs. Recognising this, the Irish Department of Health (2013) published its eHealth Ireland Strategy which created a vision for the health system to be supported by digital infrastructure. Building upon this Strategy, the Knowledge and Information Plan (Department of Health 2015) outlined five focus areas summarising the capability requirements one of which recommended the use of e-Rostering as a means of promoting an efficient workforce.

In 2015, LUH became the first Irish pilot site for implementation of the Allocate HealthRoster software. The HealthRoster, an e-Rostering cloud hosted system, was initially launched across five wards and since then, roll out has continued across the hospital. The e-Rostering implementation consisted of five work packages, broken down into the following deliverables: HealthRoster, Bank Module, Roster Perform, SafeCare Module and Interface project.

This evaluation highlights the productivity benefits of an electronic rostering system and the wealth of key analytical information it can provide. Findings provide evidence that e-rostering enables management to effectively and efficiently use their workforce resource to meet patient needs. At an employee level, HealthRoster and Employee Online provides for fair and open rostering to occur whilst making it easier for staff to choose a better work-life balance.

This report shared learnings from the implementation of e-rostering which highlighted the complexity of integrating systems and managing change, across a large acute general and maternity hospital. The evaluation highlights the importance of technical, social and economic support, underpinned by a clear implementation and communication strategy to ensure success. It also assists in creating a blueprint for others, when implementing digital change. Consideration around the findings of this research evaluation will provide the next steps in relation to the further development of e-rostering within the Irish healthcare system.

I wish to acknowledge the staff from all participating services that supported the implementation of e-rostering and contributed feedback. I am particularly indebted members of the e-Rostering Research Advisory Group for their guidance and support throughout the project's duration.



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We would like to express our gratitude to the members of the e-Rostering Research Advisory Group, in particular Michelle Donnelly and Deirdre Keown, e-Rostering Project Manager and e-Rostering Administrator, for their help and support with data collection, extraction and other aspects of the research.

We would also like to extend our thanks to the Nursing & Midwifery Planning and Development Unit, Health Service Executive, North West for funding the evaluation.

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# List of Abbreviations

AU	Australia
CA	Canada
CCU	Coronary Care Unit
CFI	Confirmation Fit Indices
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CLUEs	Care Left Undone Events
CMM	Clinical Midwife Manager
CMOD	Centre for Management and Organisation Development
CNM	Clinical Nurse Manager
DH	Department of Health
DK	Denmark
DPER	Department of Public Enterprise & Reform
ED	Emergency Department
EMBASE	Excerpta Medica dataBASE
EWTD	European Working Time Directive
HCA	Health Care Assistant
HPPD	Hours Per Patient Day
HPSA	Human Resources/ Payroll Systems Analytics
HBS	Health Business Services
HSE	Health Service Executive
IBM	International Business Machines
ICT	Information and Communications Technology
INMO	Irish Nurses and Midwives Organisation
ISA	Integrated Service Area
IT	Information Technology
KPI's	Key Performance Indicators
LUH	Letterkenny University Hospital
MD	Mean Difference
Medline	Medical Literature Analysis and Retrieval System Online
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
NMPD	Nursing and Midwifery Planning and Development
OCNO	Office of the Chief Nursing Officer
ONMS	Office of Nursing and Midwifery Service
OoCIO	Office of the Chief Information Officer
PIS	Participant Information Sheet
RCN	Royal College of Nursing
RM	Registered Midwife
RMSEA	Root Mean Square Estimations of Approximation
RN	Registered Nurse
SA	South Africa
SD	Standard Deviation
SIPTU	Services Industrial Professional and Technical Union
SNCT	Safe Nursing Care Tool
SCADT	Safe Care Acuity and Dependency Tool
TW	Taiwan
UK	United Kingdom
US	United States
WTE	Whole Time Equivalence

# Glossary of Terms

Term	Definition
<b>Bank Module</b>	An application designed to help improve and streamline the process of identifying and deploying staff to fill available shifts.
<b>Care left undone events</b>	Missed care/care left undone are referred to as “Safety CLUEs” (Care Left Undone Events) (DH 2016).
<b>Employee On-Line</b>	A portal that allows members of staff to view all aspects of their roster in the past, present and as far into the future as the rosters have been published. It allows staff to make requests for duty and annual leave electronically.
<b>Headroom Allowance</b>	Relates to the percentage of days colleagues are unavailable to work on a ward/department (due to sickness, training, annual leave) which is incorporated into each staffing establishment (Mersey Care NHS Foundation Trust 2017).
<b>Health Roster</b>	An employee scheduling software used for creating, monitoring and managing e-Rostering produced by Allocate Software.
<b>Interface project</b>	Provide a seamless interface of time and attendance from HealthRoster for SAP HR for accurate payments to staff, and interface employee HR and contract details (automated nightly) to HealthRoster.
<b>Key Performance Indicators</b>	Key Performance Indicators commonly referred to as KPIs are quantifiable indicators or measurements that help an organisation achieve an objective e.g. high-quality rostering in all wards/ departments by measuring the progress towards achievement of this.
<b>Planned absence</b>	Expected absence such as annual leave, maternity leave and mandatory education leave (DH 2016).
<b>Unplanned absence</b>	Unexpected absence such as sickness absence (DH 2016).
<b>Roster approver</b>	The person who is responsible, pre-publication of roster, for confirming to a manager that skill mix and staffing is planned for, to deliver service needs.
<b>Roster creator</b>	The person responsible for creation and coordination of the development of rosters.

<b>Roster finalizer</b>	The person who is responsible for verifying hours worked and absences logged in the master copy roster in advance of being sent to payroll.
<b>Roster maintainer</b>	The person who has authority to edit a published roster in real time.
<b>Roster approval (full) lead time days</b>	The number of days between the full approval of the roster and the go live date (Allocate Software 2017).
<b>Roster approval (partial) lead time days</b>	The number of days between the partial approval of the roster and the go live date (Allocate Software 2017).
<b>Roster perform</b>	A tool that enables users to review, report and manage staffing behaviour through a series of reports, helping to ensure that services are delivered safely, with minimum risk.
<b>Roster policy</b>	A formal document that codifies which rules and procedures are to be used while preparing staff rosters (Drake 2017; Lo et al. 2007).
<b>SafeCare</b>	A tool that allows nursing staff to capture actual patient numbers by acuity and dependency and see if their staffing levels match this demand.
<b>Study leave</b>	Includes mandatory and non-mandatory training and educational study days.
<b>Unit</b>	Ward, department or team.
<b>Unavailability</b>	Relates to days that staff are not available for the roster i.e. leave, study days, management days, sickness, paternity leave, maternity, carers leave etc. (Mersey Care NHS Foundation Trust 2017).

# Executive Summary

## Background:

In 2013, the Irish Department of Health launched the eHealth Ireland Strategy which created a vision for the health system to be supported by digital infrastructure. Building upon this Strategy, the Knowledge and Information Plan (Department of Health 2015) outlined five focus areas summarising the capability requirements. The use of e-Rostering was recommended as a means of promoting one capability; that of care delivery enablement. In 2015, Letterkenny University Hospital (LUH) became the first Irish pilot site for implementation of the Allocate HealthRoster software to roll out to the wider Saolta University Health Care Group. The HealthRoster, an e-Rostering cloud hosted system, was initially launched across five wards and since then, roll out has continued across the hospital. The e-Rostering implementation consisted of five work packages, broken down into the following deliverables: HealthRoster, Bank Module, Roster Perform, SafeCare Module and Interface project. However, to date, the availability of policy and guidance regarding the implementation process remains scarce and few independent evaluations of the e-Rostering solutions exist. In response, the Nursing Midwifery Planning and Development Unit - Health Service Executive, North West, commissioned this report.

## Evaluation purpose:

To evaluate the implementation of the e-Rostering system in the Letterkenny University Hospital across nursing, patient, staff and organisational outcomes.

## Evaluation method:

A six-part collaborative approach with key stakeholders was adopted:

- 1 Part 1: Brief literature review of policy initiatives regarding e-Rostering.
- 2 Part 2: Brief literature review of implementation of digital healthcare technology evidence.
- 3 Part 3: Interviews with a representative sample of key-stakeholders.
- 4 Part 4: Focus groups with a sample of front line staff.
- 5 Part 5: Cross sectional online survey of front line staff.
- 6 Part 6: Examination of secondary data examining modules within the e-Rostering system and benchmarking standards of care against national standards, KPI's and quality care metrics.

## Evaluation findings

### Part 1 & 2: Review of the literature:

In recent years, e-Rostering systems, have been implemented by an ever-increasing number of health care organisations around the world. However, there is a dearth of empirical and policy research and few independent evaluations of e-Rostering solutions in the literature. Whilst new technology has the potential to improve quality, efficiency and effectiveness of health care services, introducing new technology is far from straightforward. Findings highlight several barriers and facilitators that can influence the process and experience.

### Part 3: Interviews with key stakeholders:

In total, twelve key stakeholders participated. Findings revealed that prior to implementation it was perceived that no internal scoping, economic evaluation or consultation exercise was undertaken. This was believed to have had consequences for the development, implementation and engagement process of the project. Most key stakeholders were not involved in the tendering and procurement process and their relationship with the software provider varied. Different expectations of the role of the steering group from being active to passive members, led to misunderstandings and to the gradual disengagement of stakeholders. The implementation of HealthRoster was based upon a three-phased approach, introducing incremental functionality slowly, guided by a set protocol from Allocate Software. Some key stakeholders praised the array of engagement strategies adopted, however, the need for standardised training for front line staff was recommended. The SafeCare Module implementation within LUH was postponed and the interfacing of HealthRoster with existing hospital systems took precedence as this was scoped as a complex and resource heavy activity, requiring multi-disciplinary/ professional involvement.

#### **Part 4: Focus groups with front line staff:**

A total of 34 front line staff, representing RN, RM, CNMs and HCAs participated in six focus groups. Findings revealed that during the deployment and early use of the technology, front line staff did not feel engaged, resulting in ownership remaining with management. Information about e-Rostering was gained via several routes and staff training varied according to professional grade. Staff mainly accessed rosters during their own time using personal devices. Staff with information technology skills found the system easy to use and praised its accessibility. Facilitators and barriers were cited that related to personal and professional characteristics of the users, the technology or operating procedures and consequences of how the technology was implemented.

#### **Part 5: Cross sectional online survey of front line staff:**

Of the total population sampled (n=638), 203 respondents replied which resulted in a response rate of 31.8%. Most participants felt confident about using the e-Rostering system, reported that the system was easy to use and that they were supported during implementation. In addition, many felt that sufficient training and support was available for front line staff. However, respondents were uncertain about the benefits of using the system and did not feel their needs (training, computer access and time) were assessed prior to implementation. Half of participants felt that the e-Rostering system did not work well in the hospital. There was ambivalence regarding the visibility and clarity of the e-Rostering system within current hospital policy and how the system was embedded into existing hospital rules, regulations and legislation. Positive aspects of the system identified were: accessibility, schedule in advance and personnel monitoring whilst negative aspects of the system identified related to poor shift allocation, limited requests and the roster/request window not being released on time.

#### **Part 6: Examination of the e-rostering programme on KPI and quality care metrics:**

Evidence was identified and extracted from the e-Rostering database to help examine six key performance indicators across three clinical settings (Surgical 2; Emergency Department and Paediatrics) in LUH. In addition, two case studies were developed, focusing on SafeCare Module and its application within the Gynaecology unit and the Interface Project and the integration with e-Rostering and SAP HR system within the CCU unit. There is a lack of evidenced Irish national standards upon which to measure current performance indicators. Findings demonstrate that HealthRoster datasets can provide a very strong evidence base of metrics at unit, directorate and hospital level: thereby enhancing visibility, efficiency, accuracy and accountability. The findings reported from the analysis of datasets indicate that HealthRoster is still in the process of being embedded among staff members, policy and systems within LUH. The lack of evidenced Irish national standards upon which to measure current performance indicators requires attention. At present, the extraction of the data helps to ensure proof of concept, demonstrating the capabilities of e-Rostering software within selected units in LUH.

## Conclusions:

This is the first study in Ireland that has evaluated the implementation of e-Rostering for a healthcare workforce. This work programme has been a substantial undertaking, in terms of the scale and capacity to manage the change and it is a phenomenon that is still unfolding. Factors related to successful implementation include, access to technical support, positive staff attitudes and beliefs, leadership support, staff champions and evidence of the advantages of the new system. Barriers included: limited engagement and consultation, lack of assessment of prior skills and resources, unstandardised training and a lack of communication regarding e-Rostering benefits and consequences on work practice.

Analysis of secondary data from HealthRoster datasets demonstrate that it can provide an overwhelming amount of 'live', easily accessible management level information. The provision of such organisational intelligence has the potential to provide managers with the knowledge base upon which to strategically evaluate strengths, and, more importantly weaknesses. However, implementation of e-Rostering does not, by itself, guarantee that it will be used in a manner that leverages its full potential. Therefore, the need to carefully consider how best to make use of the knowledge captured and to make it easily accessible is recommended.

In conclusion, the implementation of e-Rostering requires technical, social, organisational and economic support, underpinned by a clear implementation and communication strategy to ensure success. e-Rostering, therefore, is not a function undertaken in isolation, rather it is only as good as infrastructure that supports it; the organisations wider systems, the leadership, staff engagement and investment in technology. To be successful, it must sit at the heart of the organisation to ensure its effective and appropriate utilisation.



## SECTION 1

# Project Introduction

In an era of global economic austerity, there is increasing scrutiny of the level and distribution of allocated health care funding. Globally, health services staff account for a substantial part of the assigned budget for example, in Ireland, staff costs accounts for over 70% of the healthcare budget (O'Halloran 2010). It is no surprise therefore, that there is a high level of interest as to how healthcare staffing is organised and how it can be used most effectively and efficiently without compromising a high standard of care delivery. However, evidence reported by the Irish RN4CAST Study (Scott et al. 2013) highlighted a lack of data intelligence at organisational level on nursing staff profiles and a lack of a decision support tool to aid decisions in either a systematic or consistent manner. Similarly, in the United Kingdom (UK), a report by the London School of Economics stated that a lack of systems to record accurate staffing levels served to compromise efficiency and safety with the National Health Services (NHS) (Hockley et al. 2014).

Technologies are increasingly seen as forming part of the solution for transforming the delivery of health care and management. For example, electronic rostering software, utilised in health care organisations around the world (Hubner 2011) offers opportunities to enhance productivity, workforce flexibility, and efficiency by reducing the dependency on bank and agency staff. Electronic rostering (or e-Rostering) is essentially an electronic management tool which enables staff requirements to be planned to ensure the assignment of the right staff to the right task at the right time and place (Rocha et al. 2012). In the UK, Lord Carter (Department of Health 2016) concluded that there was substantial unnecessary variation in how resources were used and that most healthcare trusts were not exploiting technology or its functionality fully. The report made it clear that while optimising productivity and efficiency within healthcare settings are challenging, e-Rostering can ensure that staff is utilised efficiently and effectively to provide a high standard of patient care.

In Ireland, in 2010, the Public Service Agreement 2010-2014 (Croke Park Agreement) was negotiated to ensure the continued contribution of the Irish Public Service to the growth of the Economy. Within the Health sector part of the agreement, the need for staff rostering that was flexible enough to meet the growing needs of the service was recognised and agreed upon. This was advocated and promoted by the former HSE Nursing and Midwifery Services Director Dr. Siobhan O'Halloran at a national level. The following year, the Public Service Agreement Health Sector Annual Progress Report (2011) highlighted the impact of the economic downturn on the health service with reductions in the previous two years HSE budget of €1.75 billion with further substantial savings required going forward. This had necessitated large reductions in staff numbers while protecting vital front-line services (Health Service Executive (HSE) 2011). In part, it was reported that these savings were achieved through nursing roster changes. An update on a proposed e-Rostering pilot in the Donegal Integrated Service Area (ISA) was also provided.

'Future Health – A Strategic Framework for Health Reform' (Department of Health (DH) 2012), outlined how healthcare structures should be reformed to improve the efficiency of and access to healthcare. The Health Minister in 'Healthy Ireland', A Framework for Improved Health and Wellbeing 2013-2025 (DH 2013a) recognised that there were significant challenges for Ireland's society, its economy and health service. However, through the new health reform, he envisaged that there would be enhanced and 'more effective co-operation and collaboration within the health sector' (DH 2013a, p26). The eHealth Ireland Strategy (DH 2013b), created a vision for the Irish health system to be supported by digital infrastructure. Building upon this Strategy, the Knowledge and Information Plan (DH 2015) report outlined five focus areas summarising the capability requirements, identified through engagement with HSE Leadership and Clinicians. These included care delivery enablement, electronic health records, cross setting information integration, health services insight and national support systems. The use of e-Rostering was recommended as a means of promoting one capability; that of care delivery enablement.

In 2015, Letterkenny General Hospital (LUH) was nominated as the first Irish pilot site for a national eRostering project initially for Nursing & Midwifery. A national procurement team was commissioned and completed their work in April 2014. A comprehensive and robust procurement process based on a comprehensive functional requirements analysis resulted in 6 companies being entered onto a national framework for future eRostering systems throughout Ireland. A mini competition was then commenced to award a contract for Letterkenny General Hospital. The successful company was Allocate Software. The HealthRoster – e-Rostering cloud hosted system was initially launched across five wards and since then, roll out has continued across the hospital site. The e-Rostering implementation consisted of five work packages, broken down into the following deliverables, HealthRoster, Bank Module, Roster Perform, SafeCare Module and Interface project. Other significant milestones within this programme were as follows:

- 1 National agreement with all unions through Croke Park Agreement for roll-out of system.
- 2 Funding secured from ONMSD for Nursing & Midwifery, funding for NCHDs to be sourced nationally.
- 3 Project Governance Board commissioned, and meetings held.
- 4 Project Manager and System Administrator appointed
- 5 Human Resources Systems Analytics (HPSA) have developed their end of an interface and will work with Allocate Software to link this to their interface to allow data transfer between SAP HR /Payroll and eRostering system.

However, to date, the availability of policy and guidance regarding the implementation process remains scarce (McIntyre 2016). Indeed, few independent evaluations of the e-Rostering solutions exist in the empirical literature (Soomro et al. 2017; Imison et al. 2016). In response, the Nursing Midwifery Planning & Development Unit - Health Service Executive, North West, commissioned this evaluation report. The aim and objectives of the research are detailed in the next section.

## SECTION 2

# Evaluation Purpose & Objectives

### Evaluation purpose

The aim of the evaluation is expressed as follows:

To evaluate the implementation of the e-Rostering system in the Letterkenny University Hospital across nursing, patient, staff and organisational outcomes.

### Evaluation objectives

The objectives of the evaluation are to:

- 1 Undertake a brief review of the literature and policy initiatives regarding e-Rostering and implementation of digital healthcare technology
- 2 Understand the dynamic of the role and working relationship between Allocate HealthRoster and Letterkenny University Hospital in the implementation process
- 3 Examine the e-Rostering implementation process and preparation for future implementation activities from key stakeholder's perspective
- 4 Determine the impact of the e-Rostering interface process on front line staff and their perceptions of the implementation and interface process
- 5 Benchmark standards of care against national standards, good clinical practice key performance indicators (KPIs) and evidence-based practice
- 6 Examine the impact of the SafeCare module (within e-Rostering system) in relation to acuity and dependency demands on staffing and quality of care.

## Structure of the report

The report comprises of six sections:

- **Section 1**  
outlines an introduction to the project
- **Section 2**  
specifies the evaluation aim and objectives
- **Section 3**  
provides an overview of the methodological approach adopted
- **Section 4**  
provides an overview of the global and national literature and policy initiatives regarding e-Rostering and implementation of digital healthcare technology
- **Section 5**  
presents the findings from the key stakeholder interviews, front line staff focus groups, front line staff questionnaire and analysis of e-Rostering secondary data benchmarked against standards of care
- **Section 6**  
sets out the conclusions and recommendations and key learning lessons for future development

The next section will outline the methodological approach adopted for this study.

## SECTION 3

# Methodology

In this chapter, the research design, methodological and ethical procedures will be described. Data for the study were collected over six phases. For each phase the research method, research instrument, sampling approach, research procedure and data analysis as well as the pilot test are discussed in detail.

### Evaluation purpose

The evaluation employed a sequential exploratory mixed methods research design to address the study objectives. The five phases of the study were as follows:

- Phase 1 provides a brief review of the literature and policy initiatives regarding e-Rostering
- Part 2 outlined a brief review of evidence relating to implementation of digital healthcare technology
- Phase 3 presents the telephone and face-to face interviews with key stakeholders
- Phase 4 presents the focus groups with front line staff
- Phase 5 presents the cross-sectional online survey of front line staff
- Phase 6 examines the e-Rostering secondary data on key performance indicators (KPIs) and quality care metrics

The methodological approaches for each phase of the study will now be outlined.

## **Phase 1 & 2: Review of the literature and policy**

A brief review of the empirical and policy literature was undertaken with specific reference to e-Rostering, implementation processes and national initiatives. A range of databases were searched including Cumulative Index to Nursing and Allied Health Literature (CINAHL), Excerpta Medica database (EMBASE) and Medical Literature Analysis and Retrieval System Online (Medline). Additionally, a search of grey literature was employed using Google. Further literature was identified through searching for key references in papers, policy documents and other relevant grey literature. Details of the search strategies and the inclusion and exclusion criteria can be found in appendix 1. An analysis of the literature was undertaken to help place the present study in the context of what is already known about the topic and to facilitate the comparison of findings and recommendations.

## **Phase 3: Telephone and face to face interviews with key stakeholders**

Telephone and face to face interviews were used to elicit the views of key stakeholders. Telephone interviews were used to obtain Allocate HealthRoster staff views on the working relationship and role in the implementation process. The interviews were guided by a topic guide informed by specification requirements and ten principles of change management (Booz & Company 2004).

Telephone interview questions specifically looked at their views on the identification and response to early concerns and challenges, progress of the plan, realisation of benefits and level and types of support that were provided (see appendix 2). All participants were emailed a letter of invitation, including a participant information sheet (PIS) and a consent form. In total, two telephone interviews were conducted with Allocate HealthRoster staff involved in the planning and implementation of the software in LUH. Interviews lasted between 35 and 70 minutes and were digitally recorded.

A series of face to face semi-structured interviews were used to explore the views of senior leaders/ representatives regarding the approach to implementation. The questions specifically explored their views on the communication and engagement process, challenges and lessons learned, level of organisational support, effectiveness and future implementation plans (see appendix 3). All participants were emailed a letter of invitation, including a PIS and a consent form. In total, ten interviews were undertaken (9 face to face and 1 telephone) with senior leaders/ representatives who were involved in the planning, implementation and management of the e-Rostering system within LUH. Interviews lasted between 45 and 80 minutes and were digitally recorded.

## **Phase 4: Focus groups with front line staff**

Informed by the findings of phase one and two, a series of focus groups were also undertaken with front line staff who engaged in the use of the software on a daily/ weekly basis and were directly impacted by the e-Rostering system. Based on the study's aim and objectives, discussion was guided by a topic guide (see appendix 4). Questions specifically

focused on their views regarding the communication and engagement process, roles and responsibilities, challenges and benefits and level of effectiveness to date. In addition, views regarding project management, policies, governance and lessons learned were also sought. All participants were emailed/sent a letter of invitation, including a PIS and a consent form. A total of thirty-four front line staff took part in six discussion groups. Composition of the groups was determined by professional grouping (Registered Nurses (RN)/ Registered Midwives (RM) n=3), Health Care Assistants (HCA) n=2 and Clinical Nurse Managers (CNM) n=1). Due to staff availability, discussion group size ranged from four to eight individuals. All focus groups were held within a private, dedicated room in LUH, digitally recorded and lasted between 45-75 minutes.

### Phase 5: Cross sectional online survey of front line staff

Phase 5 employed a cross sectional online survey to gauge views and opinions of front line staff regarding the Employee On-Line implementation, views on engagement and benefits, and challenges to using the e-Rostering system. A review of the literature indicated that no validated tool existed therefore a tool was developed using the guidelines for the effective development of questionnaires (Field 2003) (see table 1). This multi-phase strategy involved a combination of qualitative and quantitative research methods to enhance data quality and utilisation of research.

**Table 1. Sequence for questionnaire/ instrument development**

	Five staged approach
1	Identification of themes
2	Generation of items
3	Exploration of face and content validity using expert panel
4	Psychometric testing and amendment
5	Acceptance of final tool

Five themes identified from front line discussion groups (phase 4), helped to inform the themes to explore in the questionnaire (see table 2 for identification and definition of each theme). Based on the definitions, a list of 18 items was generated by the research team to reflect each theme with at least 3 items per construct (see appendix 5). Items were generated to measure each theme. A panel of experts in the field of e-Rostering implementation (n=12; including e-Rostering implementation staff; software providers; implementation of e-Rostering research advisory group) provided content and face validity on the items of the instrument. Based on the feedback provided, minor amendments to the items were made. The statistical fit of the emergent measurement model was generated to test the stability of the theoretical model against the data and modifications were included as required.



**Table 2. Five themes relating to implementation of e-Rostering system**

Theme	Definition
<b>Assessment of needs</b>	Preparation work necessary to determine the skill sets prior to implementation, including: assessment of computer and internet access, and assessment of needs
<b>Training issues</b>	Training and ongoing support with use of the e-Rostering system. This included sufficient training, time to learn and ongoing support from implementation staff
<b>Organisational support</b>	Organisational support at a meso and micro level with use of the e-Rostering system. This included transparent rostering policy, embeddedness and congruent in hospital rules, regulations and legislation and support from colleagues and higher management
<b>Benefits of the e-Rostering system</b>	Tangible benefits of the e-Rostering system for staff, patients and effective health care provision
<b>Satisfaction with implementation process</b>	Satisfaction with use of the e-Rostering system, including confidence and ease of use

The final instrument consisted of 26 items (18 closed items, measured on a 5-point Likert scale ranging from 1 strongly agree to 5 strongly disagree). Higher scores indicated higher levels of disagreement with the statement. Demographic details that emerged from the focus groups as influential on the implementation process were also recorded such as gender, age and profession. Two open ended questions were also included in the final instrument.

In total, all front-line staff, representing RN, RM, CNM, Clinical Midwife Managers (CMM) and HCA, using the e-Rostering or employee online system (n=638) received an email invitation to take part. No power calculation was conducted because the study was accessing the views and opinions of a population. Access was ensured using a current and active work email for employee online users. All members using the e-Rostering/employee online system would regularly access this email system and all corresponding emails. Inclusion criteria were: over 18 years' old, user of the e-Rostering/employee online system; and willingness to participate.

An online version of the questionnaire was generated using Qualtrics, an online questionnaire generation system. A letter of invitation, including a PIS and a link to the online questionnaire were distributed to all staff using their work email. To enhance response rates, a three-week closing date was identified, and two reminder emails were distributed over the course of the survey period. In total, 203 front line staff responded to the survey.

## Phase 6: Examination of the e-Rostering secondary data on KPI and quality care metrics

Based on an international literature review, key national guidelines and targets were identified for examination in collaboration with the Project Team and Research Advisory Steering Group. Six KPIs for three clinical units (Surgical 2, Emergency Department (ED) and Paediatrics) were selected to be reviewed (see table 3).

**Table 3: Key performance indicators (KPIs)**

No	KPI
1	Usage of annual leave, study leave, sickness leave and other
2	6-week roster approval rates as per calendar lead times
3	Loss of contracted hours not used per month
4	Additional shifts (extra hours paid)
5	Auto-roster percentage enable
6	Number of bank/agency staff requests to the total bank hours worked and reasons for booking.

In addition, two case studies were developed. The first case study focused on the extraction of data from SafeCare Module for Gynaecology unit on three KPIs (see table 4 KPI 1-3). The second case study reported on the Interface project for the Critical Care Unit (CCU) unit on the following KPIs (see table 4 KPI 4).

**Table 4: SafeCare Module and Interface Project KPIs**

No	KPI
1	Skill mix at ward level in proportionate of patient dependency and staffing levels and skills mix to actual (live) patient demand (SafeCare)
2	Escalation process (6 flags)
3	Meeting patient needs – shows if you have right staff to meet patient needs, based on hours per patient day (HPPD)
4	Payroll integration – produces pay and absence data using SAP interfaces

Anonymous raw data reports were extracted by members of the e-Rostering implementation team and sent to the research team for analysis using encrypted software.

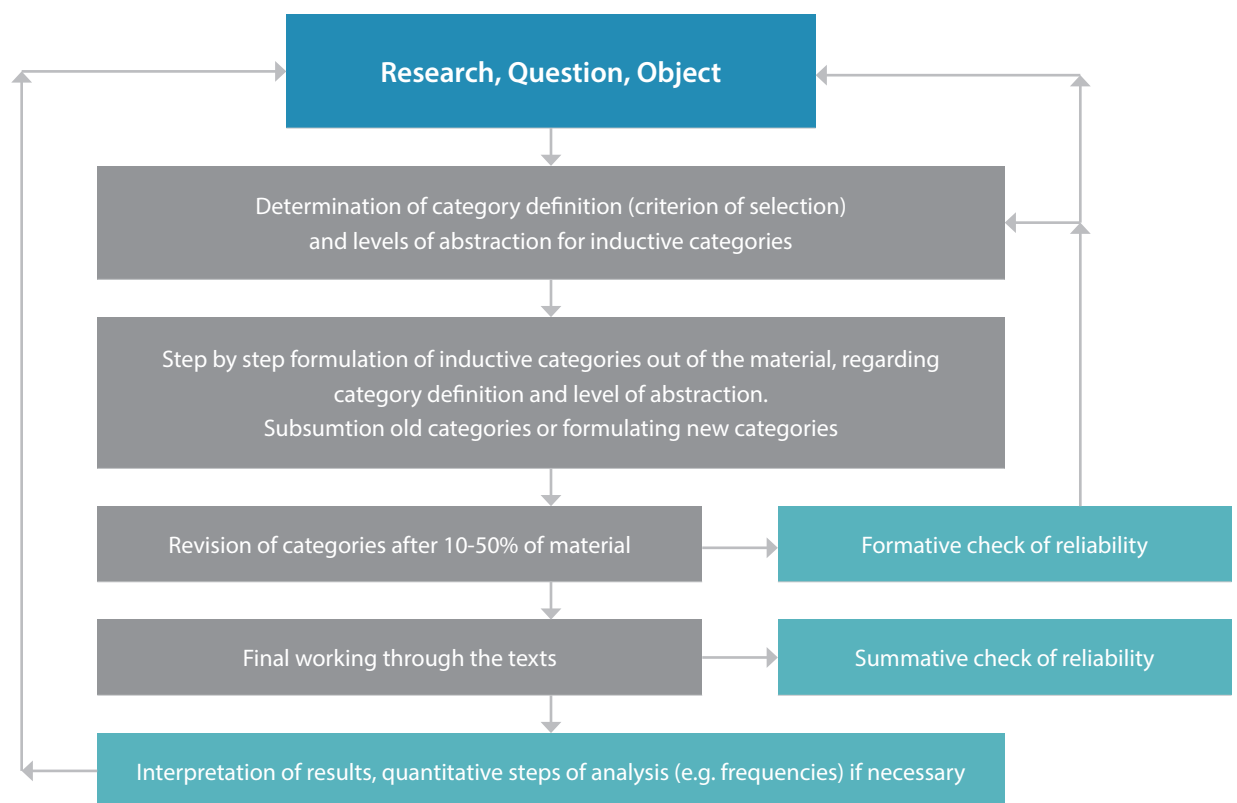
## Data Analysis

**Quantitative:** Phase 5 survey data were analysed using SPSS (version 24.0). Descriptive statistics and measures of normality of distribution were generated according to the measurement type. The 18-itemed instrument was tested for appropriateness by factor analysis using Kaiser-Meyer-Olkin measures of sampling adequacy and the Bartlett's test for Sphericity. The theoretically derived model was tested using confirmatory factor analysis in Mplus. Acceptable factor loadings were based on the sample size were set at 0.45 (Hair et al. 2010). Within factor correlated errors were permitted in model modifications to produce a best fit statistical model. Acceptable fit statistics were set at Root Mean Square Estimations of Approximation (RMSEA) of 0.06 or below; 90% RMSEA higher bracket below 0.08; and Confirmation Fit Indices (CFI) of 0.95 or higher (Hu & Dentler 2009). Cronbach's alpha scores were also generated for the final factor in the model and scores greater than 0.7 were considered acceptable.

The items of the questionnaire were summated to construct level to reduce analysis and the chance of spurious type 1 error in statistical output. The impact of demographics on scoring was also tested. Multiple regression analysis was conducted on constructs and all demographic details were used as variables in the model. Further analysis using inferential statistics (Analysis of Variance) were conducted on statistically significant predictors variables identified by the linear multiple regression analysis. Correlation coefficient scores were calculated for continuous variables. The responses were aggregated to maintain the confidentiality of participants and organisations.

**Qualitative data:** The focus group and interview recordings were professionally transcribed. The data were analysed using Mayring's (2000, p11) approach, which is a 4-stage process for inductive category development (see figure 1). The development of the first preliminary coding scheme was mainly carried out by one author (FH). This coding scheme and the analysis performed were examined by the other two authors (PB and PG) through peer-debriefing sessions, the aim of which was to ensure the trustworthiness of the analysis. Thus, three authors participated in the analysis of the data to reduce the risk of investigator bias and to increase reflexivity. Themes were identified, coded, recoded and classified by examining regularities, convergences and divergences in the data. Pseudonyms are used throughout to maintain anonymity and direct quotations have been selected to illustrate the issues raised by participants.

**Figure 1. Step model of inductive category development (Mayring 2000, p11)**



## Rigour

Measures of trustworthiness of the data were implemented (Lincoln & Guba 1985). For example, confirmability and dependability were enhanced by three independent researchers (FH, PB and PG) analysing and reviewing the transcripts. Creditability was assured by the triangulation of data sources across different clinical settings helping to increase variety of aspects. Transferability was assured by dense description of the research analysis and findings and the inclusion of direct quotations in the findings.

## Ethical considerations

Ethical approval was obtained from Ulster University's Institute of Nursing and Health Research Governance Filter Committee, and Letterkenny University Hospital Research Ethics Committee (see appendix 6). All principles of the Declaration of Helsinki were adhered to. For example, full disclosure of the goals of the study; participants anonymity assured, and participants were provided the right to not partake in the study.

The next section presents the evaluation findings derived from the five phases of data collection. This begins with a review of the literature and policy pertaining to e-Rostering.

## SECTION 4

# Literature Review

This section is divided into two parts. This first part provides an overview of the global and national literature and policy initiatives regarding e-Rostering and the second reports on the implementation of digital healthcare technology.

### Part 1: e-Rostering initiatives

A brief review of the literature examining relevant national and international empirical and policy evidence was undertaken to place the study in the current context and help inform recommendations. Literature for review was identified through a search of key databases and grey literature. The results of these searches are recorded in appendix 1.

The key outcome of the review indicated that whilst e-Rostering software is in use across health care systems globally, there is a dearth of empirical and policy research on e-Rostering and few independent evaluations of e-Rostering solutions in the literature. This corresponds with Imison et al. (2016) findings. Evidence that does exist, mainly stems from the UK and reports on the potential benefits and rationale for e-Rostering software. However, research reporting on the experience of implementing e-Rostering is mainly anecdotal, findings therefore need to be interpreted with caution.

The following section provides an overview of available evidence, presented under the following categories; workforce planning and productivity, e-Rostering and the human factor, rostering practices and transparency and rostering policies.

## Workforce planning and productivity

Effective workforce planning requires the alignment of three factors: the budget for staff, the staff employed, and the number of staff needed to deliver the care required at the point of delivery (Drake 2013a). While the financial implications of budgeting are important, considerations surrounding skill mix and salary levels also need to be included and thus, the number of employed staff, the number of required staff and the cost of those staff are inextricably linked. The objective of scheduling a work roster for staff is to in some way reconcile resources, care need and work-life balance. While the use of e-Rostering is widely recommended as an efficient way to achieve this reconciliation (DH 2016; McIntyre 2016) health care management research into the success of this strategy has failed to keep pace with the drive for implementation.

Part of the Public Service Stability Agreement (2013-2018) focused on enhancing workplace productivity and service quality through better use of technology to support e-Rostering in a drive to improve the efficiency of working practices. The Mental Health Division Operational Plan (Health Service Executive (HSE), 2017) provided for investment in technology systems and infrastructure to improve the availability and management of e-Rostering. The improvement of workforce planning and organisation was recognised by the HSE's (2015) Health Services People Strategy (2015-2018) in the goal of building capacity to support effective staff deployment using e-Rostering alongside efficient use of staff banks.

Despite the readiness to propose the use of e-Rostering as a workforce management initiative, there have been concerns about failure to consistently implement and capitalise on the advantages and data to be gained from e-Rostering. The use of e-Rostering in the NHS in the UK has come under scrutiny. The failure of Trusts to follow through with investment, leadership and staff engagement have been highlighted (Read, 2016). The Carter Review (DH 2016) undertaken in the UK, noted that NHS trusts in England were superficial in their use of e-Rostering and recommended incentivising the use of existing digital systems. Use of full functionality would reduce dependency on bank and agency staff and improve consistency of deployment for staff. This could standardise variation in the management of shift patterns, flexible working and annual leave.

The Nuffield Trust (2016) stated that e-Rostering appeared to be the least successful application of technology in digital health care. Identifying that few independent evaluations were to be found in the literature, a clear statement was made that e-Rostering was not an electronic version of paper rosters but a tool to redesign workforce deployment. Since significant on-going investment is being made in e-Rostering software, under-utilisation is a key problem.

Whether e-Rostering in full capacity is viewed with suspicion as a threat or with optimism as an opportunity for effective care delivery, depends on the source of the evidence considered. The Carter Review (DH 2016) ultimately recommended that all trusts in England use e-Rostering, publish rosters six weeks in advance and review the outcomes

against KPIs such as staff leave, training and use of contracted hours. Cultural change and effective communication were acknowledged to be vital to underpin planning for full implementation.

## e-Rostering and the human factor

The importance of the human factor cannot be overlooked in the rostering process. Paper based manual rostering tends to be more staff orientated and considers tacit knowledge about individuals, their personal circumstances and other needs. The scale and focus of e-Rostering depends on the use of algorithms and patterns designed to meet service demands creating consumer centric processes that lack the individualised touch. In their review of rostering models, Ernst et al. (2004) describe the important influence of the sociological and psychological impact of work patterns on people and recommended taking careful consideration of this when planning changes to rostering systems.

Kerr and Timony (2009) carried out an online review of an automated rostering system from a nurse manager's perspective. They found that despite being highly academically qualified and comfortable with their computer experience, 56% of the respondents had only held responsibility for rostering for up to 2 years and had no previous experience of rostering. Despite this, they had a strong awareness of the importance of skill mix and equity in accommodating duty requests from staff. As a possible consequence, one specific and concerning aspect of rostering was the identification of the multiple changes in the roster that were constantly being made daily and the time-consuming impact this had on their leadership role. Interestingly, 66% of participants adjusted the roster manually after it was produced and 33% indicated that they entered more than 50% of the roster manually. Despite this, 97% of participants considered e-Rostering beneficial.

The number of participants in this single site study was small (n=40) despite a response rate of 80%. The unique blend of electronic and manual rostering undertaken by many of the participants require the findings to be evaluated with caution but highlight the need to recognise the human aspects that influence rostering at practice level. The influence of multiple rescheduling changes was reviewed by Clarke et al. (2013). The authors noted that minimal literature existed on the issue of rescheduling shifts, but it was found that the practice of adjusting the rosters after approval had the potential to impact negatively on effective patient care and staff morale and retention.

The potential differences between an approved roster and a worked roster have been highlighted by Drake (2014). The constraints of time pressure mean that the number and impact of changes after approval have not been examined. This meant that the worked rosters cannot be assumed to be as equitable, efficient or safe as the approval process might have suggested. Drake (2014) studied forty-two 28-day roster cycles from fifteen wards in a Malaysian hospital over a three-year period using linear regression to determine the relationship between the stages of the rostering process (staff requests, automatically

assigned shifts, manually assigned shift and post approval changes) and the robustness of the worked roster (defined by the number of rules built into the system that were broken as a consequence of the variables studied).

It was found that the number of staff requests and the number of shifts automatically assigned by the rostering system did not decrease the robustness of the roster. In contrast, the number of shifts assigned manually and the number of post approval changes to the roster significantly increased the number of rules broken, reducing the ability of the roster to support effective and efficient care. Interestingly, the average rostering efficiency fell over the course of the study resulting in increasing numbers of shifts being allocated manually, in a partial return to previous practices prior to the implementation of e-Rostering.

The influence of demand (unexpected changes in the level of, or need for, care) and supply (unexpected staff absence) must be acknowledged as rostering takes place in the complex context of team dynamics and requires negotiation and consultation. However, it is important to be aware that the process is subject to adaptation until each unit is e-Rostering despite the constraints of the controls of the software used and agreed policies.

## Rostering practices and transparency

The roster itself can be viewed as a form of information politics, particularly when used to influence the behaviour of those whose time is being rostered (Drake 2013b). Rostering fairness requires the development and adherence to specific rules, yet as these are embedded into programme software, the resultant perception among nurses is that the complex automatically generated schedules are far removed from caring concerns. Drake (2013b) carried out interviews with ward managers from 28 wards across 14 Malaysian hospitals. His aim was to capture the information used to develop rosters and to understand the assumptions and values used to direct the process. A lack of clear policy outlining the ‘rules’ of the rostering process was highlighted. Only two hospitals utilised a policy and these were several years old. These rules are listed in Table 5.

Table 5. Common rules used in wards studied by Drake (2013b)

Common rules used in the ward studied:	
<ul style="list-style-type: none"><li>• Maximum continuous days worked</li><li>• Maximum hours worked over the roster period</li><li>• Maximum hours for the week</li><li>• Maximum hours per day</li><li>• Maximum number of these shifts</li></ul>	<ul style="list-style-type: none"><li>• Minimum / maximum weekends allowed</li><li>• Valid shift combinations between day / night shifts</li><li>• Correct grade type</li><li>• Correct skills for the duty</li><li>• Keep staff apart</li></ul>



The importance of the roster on staff morale was emphasised by the ward managers who described staff calling in sick for shifts if their requests were refused. Ward managers who faced similar rostering pressure would resolve them in different ways, with rules being applied and ignored apparently arbitrarily. A policy would have been useful to provide transparency around the rules being applied. While the methods used in this study were considered for rigor, the findings need to be interpreted in the unique context of the country and health care system where the data was collected.

## Rostering policies

As a system of principles to guide decisions and achieve outcomes, the need for an effective policy for e-Rostering has been highlighted by Ernst et al. (2004) who classified the rostering process in a step by step fashion beginning with determining staffing requirements and ending with a specification of the work to be carried out. The components of the classification are outlined sequentially in Table 6.

**Table 6. Classification for rostering processes according to Ernst et al. (2004)**

1	<b>Demand modelling</b> – how many staff are needed at different times – the ability to do this well depends on accurate prediction of demand and can be flexible, task or shift based
2	<b>Days off scheduling</b> – how many rest days are needed between work days or specific shift types
3	<b>Shift scheduling</b> – useful when working to task or shift demand
4	<b>Line of work construction</b> – how shifts should be sequenced – this is subject to constraints according to legislation and other regional or national work-related policies
5	<b>Task assignment</b> – skill mix
6	<b>Staff assignment</b> – assigning individuals to roles within the shift

Following the Carter Review (DH 2016) recommendations, NHS Improvement published a good practice guide for rostering to support the alignment of national rostering policies to a key set of principles that would support implementation and evaluation of the process (McIntyre 2016). These principles are outlined in Table 7.

**Table 7. Summary of good practice guidance for rostering developed by NHS Improvement (McIntyre 2016)**

- **Define the purpose of rostering**
- **Ensure ownership and leadership** across nursing, human resources and finance
- **Develop roles and responsibilities** from Chief Executive to Ward Manager
- **Set outcome measures** – generally structured as KPIs to be reported on monthly:
  - Headroom, use of annual leave, study leave, sick leave, maternity leave and special leave.
  - 6-week roster approval rates
  - Lost contracted hours not used
  - Additional shifts and reasons for booking them
  - Working restrictions
  - Auto-roster percentage enabled
  - Number of bank requests to the total of bank hours worked
  - Number of bank request on weekend and night duty
- **Develop a rostering process** – alignment of the needs of the service to the budgeted establishment, definition of the required headroom to accommodate the identification of working restrictions and flexible working practices and sickness and leave management
- **Creation of the roster** – this requires adherence to skills and skill mix and to other rules and policies that may be individual to each Trust in terms of legislation and working time directives covering long working days, night shifts, use of temporary staff, sickness and absence and escalation procedures. Updates to the roster need to be made in real time with handovers between take charge nurses to identify areas of concern
- **Approval and publishing** – checking that the roster is a good roster (that it adheres to the rules and policies governing roster creation) and is made available to staff in a timely manner
- **Monitoring and maintenance** – this requires a daily staffing review and monitoring the rosters for bank and agency staff use and working time compliance and should ensure capture of the data by audit and appropriate action plans where needed

From a review of the recommendations of Ernst et al. (2004) and use of rules discovered by Drake (2013b) it is clear, that these lie within the rostering process and create aspects of the good practice for rostering set out by McIntyre (2016). What has been added as part of the

wider good practice and because of the Carter Review (DH 2016) is a framework of roles, responsibilities and accountability set out within the context of an auditable process to measure and assess how effective, efficient and equitable a roster is on an ongoing basis.

Many examples of NHS roster policies are available online and offer illustrations of how the good practice guidelines have been implemented. Several existing roster policies pre-date the good practice guidelines and it is likely that these will be updated according to those guidelines. Drake (2017) carried out a review of 46 publicly available roster policies approved between 2010 and 2014. Significant areas of duplication were found across policies, and the objectives of the policies could be themed into five areas. Fairness and safety were common across all policies; however, fairness was never defined but the parameters for requests and leave were very clearly specified, often with reference to further policies. Efficient use of resources and ensuring a skill mix to deliver quality care were two objectives that ward managers were deemed responsible for achieving through their use of the roster. Some policies had the objective of minimising spending on bank and agency staff, and this was clearly linked to relevant KPIs. Policies also had roster and payroll integration as a key objective for use of the e-Rostering system, with an emphasis on ensuring that roster details were updated as soon as changes were made.

In some instances, local ownership of rostering was acknowledged in the roster guidelines in recognition of the unique aspects of ward and clinical units and the type of patient acuity, demand and skill mix of staff required. While this appears to acknowledge the human factors discussed earlier, there is a need to ensure that the administrative burden of managing a manual system is not simply just transferred to managing an electronic system.

Care needs to be taken when developing policies that encompass the functions of nursing, human resources and finance to ensure that the need for a common language and experience is recognised, so that the knowledge of staff and patient need that exists at ward level is translated effectively for the use of those on other departments. There needs to be an understanding of the unique way in which each ward or department uses rules and constraints to ensure that equity exists not just within a ward but across areas of practice to ensure that accurate comparisons across a hospital site can be made. Taking care to acknowledge the human factors inherent in successful rostering that supports safe and effective care delivery, alongside fairness and equity for staff in providing work life balance is key to successful implementation, management and evaluation of e-Rostering in practice.

According to the findings of Drake (2017) and the guidance of McIntyre (2016), the Roster Management Policy for Nursing and Midwifery Services in effect at LUH follows the good practice guidelines for rostering. As it provides a clear policy and purpose statement and outlines the responsibilities for employees, roster creators and approvers. In common with the policies reviewed by Drake (2017), the concepts of safety, equity and fairness are not defined despite being key components of the purpose statements. Reference is made to legislation and other policies regarding staff entitlement that are connected to rostering. While audit is mentioned at the end of the roster, it refers to the updating of the policy itself and there is no further reference to the KPIs that could be used as outcome measures or to

how rosters would be monitored or maintained as part of an ongoing audit process.

### Summary of key findings

- This brief review demonstrates the rationale and potential possibilities electronic rostering software offers.
- Whilst arguments about the benefits have been given prominence by several reports such as the Carter Review (DH 2016) empirical and policy guidance regarding its implementation remains scarce.
- There have been concerns about failure to consistently implement and capitalise on the advantages and data to be gained from e-Rostering.
- Rostering is a human-to-human relationship and cannot be treated as a function in isolation, particularly as it relies heavily on integration with other systems.
- Rostering is highly dependent on the infrastructure that supports it, requiring policy and guidelines to be embedded into organisational structures.
- Good practice guidelines for rostering to support the alignment to policy have been developed in the UK (McIntyre 2016).
- The Roster Management Policy for Nursing and Midwifery Services in effect at LUH follows the good practice guidelines for rostering.

## Part 2: Implementation of digital healthcare technologies

A brief review of the literature relating to implementation of digital healthcare technology focusing on the growth, guidance and barriers and facilitators to implementation. As stated, a search strategy was designed and applied to the following databases: Medline, EMBASE and CINAHL and grey literature also searched. Details of the search strategy and the inclusion and exclusion criteria can be found in appendix 1. A total of thirteen digital implementation studies are included in this review, none were undertaken in Ireland.

### Growth and guidance in digital technology implementation

In response to the growing demands facing health services, there has been considerable support at national, regional and international levels for the implementation of digital technologies (DH 2013b; European Commission 2012; Alvarez 2005). Within recent years there has been rapid growth of technologies for patients, such as health apps, telemedicine and wearable devices. While technologies for healthcare staff may include electronic health records, electronic medical administration records, barcode medication administration or electronic roster systems.

These technologies are increasingly being implemented within healthcare organisations due to the opportunities to: improve patient care, transform staff working practices, provide more efficient services and reduce operating costs (DH 2013b). However, for potential benefits to be achieved the technologies must be implemented and utilised effectively (Gephart et al. 2015; European Commission 2010). Cresswell et al. (2013) suggest ten key considerations for successfully implementing health technology from determining the need for change right through to evaluation (see table 8).

**Table 8. Summary of key considerations**

Technology considerations	Technology lifecycle stages
1 Clarify what problem(s) the technology is designed to tackle	Establishing the need for change
2 Build consensus	
3 Consider your options	Selecting a system
4 Choose systems that meet clinical needs and are affordable	
5 Plan appropriately	Planning (Implementation strategy, infrastructure and training)
6 Don't forget the infrastructure	
7 Have a plan to train staff	
8 Continuously evaluate progress	Maintenance and evaluation
9 Maintain the system	
10 Stay the course	

*Adapted from: Cresswell et al. (2013)*

Digital technology implementation is complex, and many challenges have been reported in a range of settings and with various health professional groups (Kruse et al. 2016; Chang and Gupta 2015; Boonstra et al. 2014; Lau et al. 2012; McGinn et al. 2011). Earlier reviews predominantly focused on physicians' perspectives while in recent years some reviews have explored nurses' experiences and perceptions. No reviews were identified which included healthcare assistants. Therefore, this review provides insight into digital technology implementation from the perspective of nurses and/or healthcare assistants within acute care settings.

## Digital technology implementation

The initial search identified 667 papers. After applying the inclusion and exclusion criteria, 13 papers were included for this review (see table 9). Four studies were undertaken in the UK, three in the United States (US), two in Canada (CA) and one each in Taiwan (TW), Saudi Arabia (SA), Australia (AU) and Denmark (DK). No studies were identified in Ireland. Most papers identified discussed involving multiple participants including physicians and nurses with six studies focused solely on nurses. No papers specified involving healthcare assistants.

**Table 9. Summary of identified papers**

Author/ date	Location	Type of digital technology	Staff group
Bossen et al. 2013	DK	Electronic health record	Physicians, nurses, medical secretaries and physiotherapists
Chang et al. 2016	TW	Electronic health record	Nurses
Cresswell et al. 2012	UK	Electronic health record	Doctors, nurses, allied health professionals, administrative staff, managers, information technology (IT) staff, clinical leads, psychologists, social workers and therapists
Cucciniello et al. 2015	UK	Electronic medical record	Member of strategy board, director, finance office staff, clinical advisors, senior nurses, senior clinicians and receptionists
Debono et al. 2017	AU	Electronic medication management system	Nurses
Hoonakker et al. 2013	US	Computerised provider order entry	Nurses, providers and physicians
El Mahalli 2015	SA	Electronic health record	Nurses
Maillet et al. 2015	CA	Electronic patient record	Nurses
McLeod et al. 2015	UK	Electronic prescribing and medication administration system	Nurses
Spetz et al. 2012	US	Computerized patient record system and bar code medication administration	Nurses, pharmacists, nurse managers, information technology staff, and senior management
Soomro et al. 2017	UK	e-Rostering (HealthRoster)	Nurses and senior management
Strudwick 2017	CA	Electronic health record	Nurses
Zadvinskis et al. 2014	US	Electronic health record and bar code medication administration	Nurses

## Factors that influence the successful (or unsuccessful) implementation of digital healthcare technologies

A search of the literature revealed three main factors that hindered or facilitated implementation of digital healthcare technologies. The overarching factors were organisational, individual and technical. A key factor at the organisational level was supportive management. At the individual level factors such as IT competency and attitudes to the technology were highlighted while technical factors such as usability, system performance and functionality were also key. These will now be briefly discussed.

### Barriers to digital healthcare technology implementation

This review identified several technical factors surrounding the functionality, usability and performance of the technology (Soomro et al. 2017; Chang et al. 2016; McLeod et al. 2015; Maillet et al. 2015; Bossen et al. 2013). A significant barrier to the implementation process was that the technology did not improve staff efficiency (Wilberforce et al. 2017; Strudwick 2017; Debono et al. 2017; El Mahalli 2015; Cucciniello et al. 2015; Zadvinskis et al. 2014; Spetz et al. 2012; Cresswell et al. 2012). This resulted in a change of working practices leading to an increase in workload and/or tasks taking longer to complete compared to previous non-digital processes. In addition, the technology was not always designed with end-users in mind. Subsequently, this led to technologies that were not adaptable to individual needs (Chang et al. 2016). To improve efficiency this led staff to not use the technology appropriately or to use 'workarounds' (Debono et al. 2017; Strudwick 2017; McLeod et al. 2015).

Individual factors such as staff attitudes to the technology and IT competency were also highlighted as barriers (Chang et al. 2016; Mahalli et al. 2015). Lack of experience with digital technology and computer literacy meant that staff struggled to use the technology effectively. Other barriers highlighted were slow networks/hardware (Chang et al. 2016) and short timelines for implementation (Wilberforce et al. 2017; Spetz et al. 2012).

### Facilitators to digital healthcare technology implementation

A significant facilitator identified was the role of support from management and IT personnel within the organisation (Soomro et al. 2017; Cucciniello et al. 2015; Spetz et al. 2012; Bossen et al. 2013; Hoonakker et al. 2013). Supportive management enabled access to adequate resources (financial and human) and ensured staff buy-in to use the technology. Spetz et al. (2012) also deemed real-time technical support available 24 hours per day as essential during implementation to deal with difficulties faced by staff. Similarly, Soomro et al. (2017) reported that support from senior management was a critical factor for success in the e-Rostering system implementation.

User involvement was also considered key to successful implementation (Cucciniello et al. 2015; Bossen et al. 2013; Spetz et al. 2012; Cresswell et al. 2012). End-user involvement



during planning, implementation and evaluation ensured that the technology would be designed and implemented to meet the needs of both the organisation and various staff groups. Furthermore, Bossen et al. (2013) also stated that staff engagement must not only occur, but their feedback must be taken on board by management to overcome any problems identified by staff.

Training was also a key-contributing factor to successful implementation (Soomro et al. 2017; Strudwick 2017; Cucciniello et al. 2015; Hoonakker et al. 2013; Spetz et al. 2012). The importance of not only training staff, but also ensuring that the training was ongoing prior to and during implementation were deemed essential. Cucciniello et al. (2015) identified the use of 'super-users' who were competent in IT use who could either train and/or support other staff as being beneficial. Other facilitators included an experienced implementation team (Bossen et al. 2013), committed organisational leadership (Cucciniello et al. 2015), collaboration among staff (Zadvinskis et al. 2014) and that the technology must improve efficiency (Maillet et al. 2015).

In summary, a review of the facilitators for implementation identified user involvement throughout the process (planning, implementation and evaluation) as key. To ensure staff are equipped with the skills to engage with the technology, consideration of the training needs of staff pre and post implementation were also recommended. Finally, IT, personnel and management support are key to enable overcoming difficulties and challenges.

### Summary of key findings

- A brief review of the literature identified a total of thirteen relevant digital implementation studies, none were undertaken in Ireland.
- There has been a rapid growth in the implementation of digital technologies in health care.
- Ten key considerations for successful implementation of health technology have been developed (Cresswell et al. 2013).
- Most implementation studies have sought the views of registered professionals; there is a dearth of research reporting the views of HCA staff.
- Organisational, individual and technical factors have been found to hinder or facilitating implementation of digital healthcare technologies.

The following section presents the findings from the key stakeholder interviews, staff focus groups, staff questionnaire and analysis of e-Rostering secondary data benchmarked against standards of care.

## SECTION 5

# Evaluation Findings

This section is divided into four parts to present the results from the findings from the key stakeholder interviews, front line focus groups, cross sectional online survey of front line staff and an analysis of e-Rostering secondary data benchmarked against standards of care.

### Part 3: Interviews with key stakeholders

This section outlines the key themes that emerged from interviews with stakeholders involved in the implementation process. The aims of the interviews were firstly to, understand the dynamic of the role and working relationship between Allocate as the software provider for HealthRoster and LUH in the implementation process. Secondly, to examine the e-Rostering implementation process and preparation for future implementation activities from key stakeholder's perspective. In total, seven themes were derived and eight subthemes, (see table 10 below), which reflect the language used by the participants. The subthemes are illuminated further by the verbatim comments of participants.

**Table 10. Interview themes and sub-themes**

Theme	Sub-themes
1 Drivers	
2 Procurement process	
3 Implementation preparation	Shared vision Needs assessment Policy development National Steering Group and Project Board Implementation team
4 Perception of engagement, training and system utilisation by front line staff	
5 Relationship with software provider	
6 Work packages	HealthRoster SafeCare Module Interface Project
7 Key lessons and future roll out	Establishing the need for change

## Participants' demographics

A total of twelve interviews were conducted with Allocate software provider staff, hospital managers and administrative staff, hospital-based IT implementation leads, staff from HSE; local service providers' staff and a range of other relevant stakeholders. Most participants were female (n=8), aged between 45-64 years (n=10) and three reported they had received training in the use of e-Rostering.

## Theme 1: Drivers

Many key stakeholders were aware of drivers, internationally, nationally and regionally, for the implementation of e-Rostering. On an international level, many were aware of e-Rostering becoming standard practice across European health care systems and the extension of its use as a key recommendation stemming from the Carter Review (DH 2016) in the UK, in a bid to enhance hospital efficiency. As one participant explained:

*"I am hearing positive vibes about it. The concept of it should be positive, the fact that it is established in many hospitals in England should be positive that it is working."*

*(Participant 6 Key Stakeholder)*

Nationally, a key driver was the impact of the economic crisis and austerity in 2008, on Irish public health services which, initiated an emphasis on efficiency, on the delivery of healthcare was identified by some as key drivers. In addition, whilst not mandatory, the publication of guidance documents to support the introduction of e-Rostering within the HSE (O'Halloran 2010), coupled with the HSE deciding to procure an e-Rostering system were viewed as significant motivators to adopt the technology. Finally, support from various national departments (i.e. Office of the Chief Nursing Officer (OCNO) and independent organisations (i.e. the Irish Nurses and Midwives Organisation (INMO), Services Industrial Professional and Technical Union and National Information (SIPTU) and Information and Communications Technology (ICT) and Office of Nursing and Midwifery Services (ONMS)) was also viewed as an enabler. As stated:

*"...the Chief Nurse, was really keen on the idea and it took off from there. She implemented the funding for an e-Rostering system and we were the pilot site. So, then she came up here with the head of the INO, and the head of SIPTU and it was a really high level, powerful support for this project moving forward."*

*(Participant 5 Key Stakeholder)*

*"It was part of a result of a national piece of work that was done by the [Office of the] Chief nursing officer, in the Department of Health. It was to look to improve efficiencies within the HSE basically."*

*(Participant 9 Key Stakeholder)*

At a regional level, three influences were cited, namely; leadership, internal support and recognition for the need to change. Leadership and direction, particularly from the Director of Nursing, was recognised as being fundamental to make the adoption of e-Rostering a reality. As stated:

*“There was passion there. There was a proof of concept, I believe from Director of Nursing, she’d seen it working and that probably was a driver as well, to bring it forward.”*

*(Participant 8 Key Stakeholder)*

Combined with this leadership, was the support provided from Executive Directors of the Board of the Hospital and senior manager figures across the hospital. Finally, given the limitations of the existing paper / manual rostering system there was a general recognition and acceptance that change was required. For example, manual systems were criticized as being labour intensive, open to human error and did not produce timely and sufficient information on which to base decisions. Therefore, many recognised that the current rostering system needed to be changed. As one participant explained:

*“When I would review rosters, they’re very difficult to understand, they’re very difficult to be meaningful. You’ve handwritten documents that someone scores out a name and puts something or changes the hours. They’re just very difficult and challenging documents to read.”*

*(Participant 6 Key Stakeholder)*

## Theme 2: Procurement process

From the participants interviewed, only two reported being involved in the tendering and procurement process. Several stakeholders explained that they became involved in e-Rostering after this process was complete, while others felt they were excluded and not consulted prior to, during, or after this task was finalised. As stated:

*“I felt there was a gap when by, all of a sudden I realised ‘oh they’re going for tender and this is going to happen.’ I don’t remember the transition, I don’t ever recall being involved in drawing up the document and deciding...It was all talked about very loosely in terms of the concept and what we would do and how it would work and all of this. But there was a gap for a period and then I would have found out now by accident, well we have a proposal pulled together and it’s gone to national procurement and they’re evaluating it for us and sending it out for tender.”*

*(Participant 6 Key Stakeholder)*

Nevertheless, many believed that the process was comprehensive as they were aware it was undertaken in accordance with Irish health services procedures and regulations. The diverse views are illustrated by the following quotations:

*“I was satisfied when national procurement was involved in the process because it was very much procured properly. So, I was comfortable with it.”*

*(Participant 6 Key Stakeholder)*

*“...the Office of the CIO [Chief Information Officer], would have been involved at a national level of procurement and tendering. So, from an organisation support IT of the Office of the CIO, that was critical.”*

*(Participant 9 Key Stakeholder)*

Two stakeholders explained that the process took several years to complete and involved a lot of behind the scenes liaison and work with various external agencies. For example, one participant explained she visited several different healthcare settings that had implemented similar technology throughout the UK, to get an insight into the range of providers, systems usability and supplier's ethos and values. The projects formal beginnings were traced to 2010, when a Project Initiation Meeting took place. A workshop was held with service managers and union representatives to gain their views on LUH leading the pilot. When LUH, as part of the West North-West Hospital Group, was selected as the first pilot implementer in Ireland, several participants believed this established them to be a progressive leader resulting in “transferable learning” to occur. However, some felt that there was a leap between concept initiation and procurement procedures which they did not believe that they were sufficiently consulted upon. As explained:

*“...the tender process just started kicking it all off. It went away for a number of years and then it re-surfaced.”*

*(Participant 3 Key Stakeholder)*

Following approval from the Department of Public Enterprise & Reform (DPER), the Centre for Management and Organisation Development (CMOD), which operates as the sanctioning authority for ICT expenditure in the Irish public service, became involved. A team was put together representing the CMOD, Director of Nursing at LUH, wider HSE representatives, Office of the Chief Information Officer (OoCIO) and Procurement to undertake a tender process. This process was accomplished during 2011-2013 and a framework of five companies was established who were assessed as suitable suppliers to cater for the varying needs within the wider Irish public health services. Only one participant questioned the transparency of the tendering procedure and the ramifications on future health care resources of having five different suppliers.

*“...these tender documents, they're almost too generic, so that the people coming in and tendering, just tick the box and say “Yes, we can do this. Yes, we can do this” without actually going to the company and say, once they've tendered and say, “yes we can do an electronic interface.” Actually, going in and drilling into that statement and saying “right, well show us. Show us where you've done it? Show us how you've done it and show is it working?”*

*(Participant 10 Key Stakeholder)*

One participant explained that following a competitive tendering process, Allocate Software's HealthRoster solution was the preferred tenderer for LUH. A contract was awarded on the 15th April 2015 with an initial term of 12 months with an optional annual extension up to a total period of 60 months. One participant explained that in addition to the implementation fees, Allocate Software payment was based on a subscription-based model with a five-year fixed cost per head calculated with payment and contract reviewed after that period.

## Theme 3: Implementation preparation

Prior to implementing e-Rostering into LUH, participants identified several approaches undertaken to provide a supportive infrastructure and to prepare the implementation site. For example, establishment of a shared vision, prior assessment, development of policy and the formation of a local project board. Shortcomings and areas of opportunities were identified within each of these.

### Shared vision

Some participants recognised that a driver to any project's success, is having a shared vision that is communicated and maintained. Whilst the Project Plan had a documented communication strategy agreed by the Steering Group at LUH, the analysis of the data revealed that there were many different translations for the overall vision of e-Rostering. Whilst two participants believed there were no direct benefits of implementing e-Rostering, others provided a range of examples that focused on organisational, management and system benefits. At an organisational and health environment level, it was believed e-Rostering would provide transparency and a visual overview of real time staff rosters, which could be used to inform budgets and future planning. Managerially, it would aid in the organisation of patient care by freeing up qualified staff to spend time on wards and map staff skill mix to patient acuity. As illustrated:

*"I'd say the driver initially came from management, being able to provide evidence that they're providing value for money, for the service. I mean everywhere now in the HSE, everybody has to be accountable for money and spending money wisely. It's the nature of how the world is evolving. You have to prove that you are using the services wisely, as such."*

*(Participant 8 Key Stakeholder)*

*"From my perspective, the rationale was to try to make a most effective use of the big assignment of our workforce, which was our nursing workforce. In order to more sufficiently use the resources that we have, but also make sure that we maximise patient safety."*

*(Participant 7 key Stakeholder)*

In addition, systems would be refined enabling the workflows of staff to be enhanced by reducing CNM administration workload, enable shift planning, enhance life work balance among front line staff and produce rosters quicker and in advance. As stated:

*“CNMs now have that ownership over how they manage and be supported to do it in a much more efficient way. ...and staff can see this information in Employee Online where they can see their shifts that are rostered for them, what their hours are and if they’re being overworked or underworked, so they can make sense of the hours balanced at the end.”*

*(Participant 9 Key Stakeholder)*

## Needs assessment

To support the development and implementation of e-Rostering some participants were aware that a national scoping study was undertaken prior to implementation. Whilst this provided a national picture of rostering systems utilised in Irish health care, it was criticised as being too generic. Interviewees perceived that no internal scoping, economic evaluation or consultation exercise were undertaken prior to the implementation within the LUH. Many believed this had negative repercussions for the development, implementation and engagement process of the project, and represented a missed opportunity to analyse determinants that may impede or enhance the success of the project. As stated:

*“...e-Rostering wasn’t scoped out correctly from the outset. Nobody understood the huge undertaking that this project was going to be and the amount of people that we needed and extra resources that were needed in order to make this work.”*

*(Participant 2 Key Stakeholder)*

*“It has been determined externally that it will proceed, and it had gone in with no assessment or consideration of the resources required.”*

*(Participant 7 Key Stakeholder)*

It was recommended that a review of organisational resources, capabilities, existing systems, barriers and opportunities, as well as economic implications be undertaken prior to and during any implementation. Doing so would allow for issues to be prioritised and the hospital to deliver and nurture more efficient and effective processes before and during implementation. Furthermore, several participants realised that the implementation process was not complete and feel that such a project had no end date. Consequently, the need to review and scope the future internal contingency and embedding of the technology, was also raised, as a key step which needed to be undertaken.



## Policy development

Policy relating to roster management for staff and project initiation documents were developed prior to implementation. Some participants reported that they were responsible for writing this policy and it was developed in line with standard protocols within the Irish health service. However, a few participants claimed they were not involved in the development of policy and were not familiar with the policy or its details. As illustrated:

*"I don't know if there's any policies implemented."*

*(Participant 2 Key Stakeholder)*

*"Yes, they did produce one of those, you know, once the project was underway and Allocate had been all signed, sealed and delivered."*

*(Participant 3 Key Stakeholder)*

This lack of engagement of all business functions at LUH, had consequences for the understanding of the implementation process and project outcomes among several key stakeholders. Several participants focused on the dissemination of policy to front line staff, explaining that all CNMs were sent a copy and asked to disseminate to staff in addition to copies being left on all clinical units. One participant felt this was an inadequate approach and resulted in many staff not being aware of or having access to such documents. As stated:

*"The fact that policy, people didn't get it, didn't see it and tell us that they didn't see it, there is a problem definitely in communication."*

*(Participant 1 Key Stakeholder)*

## National Steering Group and Project Board

To support the implementation process, participants were aware of the formation of both a national steering group and a local project board with the Office of Nursing and Midwifery Services Director as executive sponsor. The establishment of both groups was supported by most participants, and viewed, by some, as the key cornerstone of implementation. Several participants interviewed were members of the project board and levelled criticism at the lack of diversity and an appreciation of all viewpoints. For example, all were aware that the membership of the project board consisted of directors, departmental managers, front line staff and other key stakeholders. Whilst attempts were made to ensure inclusiveness and representation from a wide variety of staff, criticism that membership was "top heavy" and not representative of all front line or other key management areas were voiced. As stated:

*"...if you look at the committee, I suppose it's heavy with managers, and they're the top-level managers and the front-line people who have to operate it, are in the minority."*

*(Participant 1 Key Stakeholder)*

*“We then had representatives from HR, finance, general managers, then we had a CNM, a staff nurse and an HCA. Basically, we tried to be inclusive of all the different grades of staff in the hospital and that was the steering committee.”*

*(Participant 5 Key Stakeholder)*

Whilst many welcomed being a member and perceived that it would lead to the opportunity to be fully briefed on all implementation aspects, few felt this occurred. Some participants reflected on instances when they raised questions in this forum, which they felt were not answered or were dismissed. This led to misunderstandings arising and gradual disengagement as the involved stakeholders held different expectations of the role of the steering group from being active to passive participants. As illustrated:

*“...just full on, bang on, and any challenge or any questions, or any queries, just shut down.”*

*(Participant 3 Key Stakeholder)*

*“There was a lack of enthusiasm, in fact, - there was a reticence or resistance to actually go down this road.”*

*(Participant 7 Key Stakeholder)*

The perception that some stakeholders were not being sufficiently consulted regarding the implementation and the belief that that key decisions were being undertaken by nursing centrally, influenced the perception of ownership. A mind-set was created that it was a nursing project, and this stemmed from an understanding that it was initiated, developed and is being led by the nursing department. This led to the steering group being perceived as independent of the team responsible for implementing, thus forming a separation between project planning and team building. However, whilst nursing was recognised as playing a crucial role in the innovation process, it was recognised that this group does not work in isolation and are part of an organisation, which in turn is part of the larger health care environment. Therefore, while e-Rostering was being piloted for front line nursing and care staff, the ripple effect within the immediate organisational systems, resources and governance procedures was not fully recognised.

## **Implementation team**

An implementation team, with responsibility to report to the Project Board, consisting of a Project Manager and Systems Administrator was established to work with Allocate. Whilst the development of a project team was praised, and the expertise of the staff acknowledged, several participants felt the number, skill set and future planning required revision. Four participants considered the allocation of two staff to implement e-Rostering as insufficient and recommended more staff be employed. This was informed by the scale of the implementation cycle being undertaken and based on knowledge of other UK hospital

sites that employed a team of personal consisting of three to fifteen staff members, solely responsible for implementing e-Rostering. Many were aware that the implementation team contributed to a range of activities including; project planning, education and training, design configuration, development and testing of work packages. Consequently, several believed inadequate resources meant that the implementation team were stretched, which had a negative effect on engagement and the implementation process. As stated:

*“The rolling out is in five packages, that’s quite challenging.... because there’s only two – and we probably could do with an administration period as such.”*

*(Participant 8 Key Stakeholder)*

*“So, you’re struggling with trying to implement, there’s struggles trying to communicate and you’re to communicate five different strands of work that you were trying to embark on. But also, you were looking to get feedback and trying to improve. So, you are constantly trying to evaluate, communicate and improve.”*

*(Participant 9 Key Stakeholder)*

A second critique of the implementation team centred on the need for greater diversity of membership, reflective of key departments within the organisation. Frequently mentioned from several participants was the need for someone with payroll experience to be part of this team, doing so, they felt, would have smoothed the implementation process. As stated:

*“What I can’t understand, is why the administrative post was not somebody from the clerical/admin background, with IT knowledge and particularly SAP knowledge, because that has been a big problem from day one.”*

*(Participant 3 Key Stakeholder)*

However, the role of the eRostering Systems Administrator is unique in that the specific role and functions were scoped out as the project developed and both HealthRoster and SAP HR expertise / skills sets were required to be developed. Finally, it was recognised that both the Project Manager and Systems Administrator had built up a wealth of experience yet were employed on short term contracts. Several participants believed this represented a lack of forward planning and opportunities for learning to be lost. As explained:

*“One of my issues is that [implementation team members] are not being given permanent contracts and I think they should be. I don’t see a situation, where even when the system is fully in and implemented, we can do without those two. They’re going to need to keep maintaining the system, keep developing the system.”*

*(Participant 5 Key Stakeholder)*

## Theme 4: Perception of engagement, training and system utilisation by front line staff

Most participants were aware of, and highly praised the diversity of engagement strategies provided to front line staff, by the implementation team. Examples provided included; open sessions, newsletters, drop in sessions in the e-Rostering hub, workshops, and email support, provision of training, problem solving and visits to staff on wards to inform them of e-Rostering. As one participant stated:

*"I would say, it's obvious, that the engagement side of things was one of the [implementation team's] strengths. They had already, been very pro-active in terms of getting staff to engage. So, I can remember we were doing open forum sessions and inviting staff in to talk to them about employee online, to try and get them to develop super users within those groups, to help friends, the wider staff groups."*

*(Participant 11 Key Stakeholder)*

Some were aware of the diversity of training options delivered to front line staff and recognised that this was in response to organisational and staff demands, however, questions regarding the lack of standardisation and implications of this were discussed. For example, some participants were aware that training for most CNMs was offered off the ward under protected time, other front-line staff were given access to training whilst on duty, while others received no training at all.

*"But, and I would say that there's insufficient training because if staff, the CNMs are still manually doing the off-duty and inputting it, sure they'd be as well not to have the system and that's what they say they're doing."*

*(Participant 1 Key Stakeholder)*

Some believed this resulted in some front-line staff having insufficient knowledge and skills to access e-Rostering. Furthermore, concerns regarding the future training needs of new recruits and ensuring current staff skills were sufficiently embedded were raised. Several participants called for an ongoing cycle of standardised training to ensure all employees have a consistent experience and knowledge of the system and for procedures to be made available.

During the deployment and early use of e-Rostering, several participants were aware that it caused stress and resulted in changes in shift patterns among front line staff. Some participants did not believe that staff's expectations or criticisms of the technology were well managed, which led to concerns being voiced to management and union officials. It was also evidenced that after implementation, paper persistence existed among CMNs, whereby they would manually design rosters with the aim of entering the data into the e-Rostering system. Criticism of the process of rostering was also mentioned, such as, the late publication of rosters for front-line staff, which had a direct result on staff expectations and perceptions of the technology.

Nevertheless, many participants recognised that bringing about change takes time and requires commitment. After a period of familiarisation and use, several participants reported that front-line staff were starting to enjoy the benefits of e-Rostering. For example, e-Rostering provided flexibility to choose preferences, and shifts where appropriate, along with access to shifts with much more prior notice. This resulted in an increased work/life balance. It also increased visibility and the allocation which was perceived as being fairer, less divisive, and hence more popular with front line staff. Finally, three stakeholders also reported that e-Rostering had helped to ensure front line staff were working contracted hours and aligned to their pay.

## Theme 5: Relationship with software provider

The relationship and communication exchange between key stakeholder participants and the software provider was variable. Certain departments were able to engage in direct communication and found the support to be highly beneficial. Participants praised the on-site assistance from the software provider, the training and guidance, the practical hands on support and the signposting to policy and other resources. The provider also offered telephone and email support to assist with any problems and the implementation team were offered informal ongoing support with progress monitored and reviewed. The designation of named support individuals to facilitate and support throughout the implementation process was also viewed as advantageous.

*“They have been so supportive throughout this whole process. They are always available whenever we need them. Although they’re a UK company, they’re onsite quite a lot. They seem to have real good expertise. Our person is brilliant. Any time we need him, we can ring. The other good thing I like about Allocate is that it’s again like a little family. They have a user’s group and everything. You can network with other users of the product.”*

*(Participant 5 Key Stakeholder)*

*“We had a dedicated implementation consultant that worked on site with us for the first five weeks. And it was up to Letterkenny to choose the clinical units that we wanted that person to be onset to help us with support. That was a very good approach. We took lead from them in that they were the experts really. They may not have understood the operational issues within Letterkenny, but they knew how organisational issues worked in other healthcare services.”*

*(Participant 9 Key Stakeholder)*

However, other participants reported they had no or limited contact (apart from attendance at presentations) with the service provider which led to gradual disengagement. Also contributing to disengagement was the communication cycle between stakeholders and the service provider that was viewed by some, as extended and fragmented. Some felt their

interests and concerns seemed less understood or acted on as implementation progressed. As explained:

*“...some of the issues that I would have raised when they [software provider] were round the table – I would have thought they were actually disregarded or given a flippant answer. But they were very courteous and very professional and were available, I would say to the [implementation] team more.”*

*(Participant 1 Key Stakeholder)*

Moreover, the inconsistency of the software provider’s staff to assist with various work packages was also identified as a limitation, hampering the development of working relationships and implementation process.

## Theme 6: Five work packages

The e-Rostering implementation consisted of five work packages, broken down into the following deliverables:

- HealthRoster
- Bank Module
- Roster Perform
- SafeCare Module
- Interface project

HealthRoster was the first to be implemented, as this was believed to underpin the success of the remaining work packages. As explained;

*“It wasn’t just going to be a case of implementing health roster as a rostering solution. We had five other key strands of work that, they were like five concurrent projects really, that had to be managed. None of it could have worked if the HealthRoster wasn’t right because that’s the spine of the whole application. All the other strands of work come off the back of health roster working well.”*

*(Participant 9 Key Stakeholder)*

At the time of the evaluation, the interface project and SafeCare module were highlighted by participants as key issues within the interviews. Analysis of which will now be discussed.

## HealthRoster

The implementation process for HealthRoster was a three-phased approach introducing incremental functionality slowly, guided by a set protocol from Allocate Software. This established approach was viewed as advantageous by several participants, as it provided a clear structure with each phase building upon, and laying, the groundwork for the next. Moreover, it stipulated the roles and responsibilities for each phase helping to alleviate uncertainty.

Whilst some participants claimed they were not fully aware of the implementation process, half were able to articulate the process describing that in phase one, an implementation consultant, from Allocate Software, was on site to provide guidance and support. During this initial phase current systems were reviewed, reference data established, users' accounts set up and the installation and configuration of software undertaken. This phase also provided the implementation team with product familiarisation and training in how to interact and use the software. This was viewed by three stakeholders as a crucial phase, establishing necessary skills and thus enabling implementation to proceed. As one participant explained:

*“So, we conduct the rollout on a ward by ward basis, but very individual, every rotation. So, we will select three or four wards where the Letterkenny team and the Allocate team work together. We are the ones who implement it with – well see how we roll it out etc. What we do is we hold face-to-face sessions with the CNMs, the managers that will be running the health rosters. At every stage to go through that, is always check on balances, so we don't proceed basically until all the ward managers are happy with what they're doing. So, they're confident that the health rostering has been set up properly, because it's an intricate process.”*

*(Participant 12 Key Stakeholder)*

In the second phase, e-Rostering was implemented into five clinical sites (termed early adopters), selected by being computer literate and open to change. Once the early adopters were identified, CNMs (termed Roster Creators) within each unit were provided with training to develop five electronic rosters created using HealthRoster in line with the agreed demand and European Working Time Directive (EWTD) rules. One participant explained this initial process helped the five clinical sites' CNMs to understand the operational efficiencies that can be gained from using electronic rostering as opposed to a paper-based system. As well as CNMs, front-line staff within each of the five units were introduced to Employee Online (a system which enables staff to submit requests for shifts and annual leave). It was then reported that data from the electronic rosters would then be finalised and used by Finance (payroll). One participant believed this second phase allowed an assessment of readiness from a technical and business perspective to be gleaned prior to full roll out. Doing so, helped to identify facilitators and barriers upon which to build. The final phase involved the roll out of Health Roster and Employee online to the remaining twenty-two clinical areas.



The phased approach was viewed as advantageous and challenging for front line staff. It was perceived by some as beneficial as it enabled knowledge, skills and learning to occur in an incremental fashion. However, others recognised that it resulted in a period of variation within and across, the clinical sites, resulting in some sites rostering electronically while others remained on manual versions. It was believed the variation attributed to the perception of the systems complexity among front line staff and acted “as a barrier to engagement”.

## SafeCare Module

In addition, to HealthRoster, LUH also secured the SafeCare module which allows alignment of patient acuity and dependency data to the appropriate staff levels and skill mix. The procurement of this module was viewed as beneficial by many participants for several reasons. First, it would provide real-time information of visibility across units of staffing levels and patients’ needs whilst preserving safety. Second, operationally it would enable management to re-assign staff and utilise existing resources, thus avoiding unnecessary agency use and rising costs. Three stakeholders viewed the management of LUH as being progressive in obtaining this module, given that it underpins most factors identified in the National Institute for Health and Care Excellence (NICE 2014) guidelines in safe staffing for nursing in adult acute inpatient wards. These participants were also aware that this module was also recommended in the Lord Carter Report (DH 2016) for NHS hospitals and coincides with the Irish Department of Health’s (2016) Interim “Report and Recommendations by Taskforce on Staffing and Skill Mix for Nursing”.

Only one participant articulated that the implementation testing was undertaken prior to SafeCare roll out. This involved the identification of three pilot wards and a census period which enabled protocols to be established to identify red flags, the escalation process and hospital response (if necessary). Two stakeholders explained that the SafeCare system replicated the Department of Health’s (2016) safety CLUEs (Care Left Undone Events) as red flags. Whilst the report was valued, it was recognised that it contained recommendations not yet reflected in Irish policy. As stated:

*“I suppose, at a national point of view, we are watching what’s happening with the Department of Health and the safe staffing recommendations. Because in Ireland, there are no safe staffing ratios or recommendations that have been, certainly up until February of last year. We’ve got recommendations in skill mix. It’s not a policy but its only recommendations at this stage but it is recommendations that we were looking to adopt locally.”*

*(Participant 9 Key Stakeholder)*

However, the implementation of SafeCare at the time of the evaluation was postponed. Two reasons were cited. First, the lack of national policy in line with Safety CLUES / Care Left Undone Events – referred to as red flags in SafeCare resulted in calls for greater national policy to help implement SafeCare within the Irish health care context. The second reason



was attributed to the number and scale of the work packages being implemented into one site during a specific timeline, which meant that resources were stretched, risks and dependencies managed, and deliverables had to be revised.

## Interface project

As part of the tendering process, the need for a HealthRoster to integrate with existing hospital systems was acknowledged. Doing so, would ensure that the systems would share consistent information, enabling disparate systems to operate on the same data. Several key stakeholder participants were aware that the service provider had experience of interfacing and integrating systems in England and Scotland and believed this prior experience would be beneficial. At the time of the evaluation, analysis of the workshops and test script development, business testing and parallel runs had commenced on site, exploring interface between the HealthRoster suite and LUH Human Resource and payroll systems.

An intensive period of interface testing was undertaken on the site and with the support of several external agencies including, Human Resources/ Payroll Systems Analytics (HPSA) staff, International Business Machines (IBM) and the OoCIO, in conjunction with Allocate Software, key stakeholders and the local implementation team.

Overall, the interface process was described as a complex activity for several reasons. First, it required many stakeholders in various departments, often with differing agendas, to integrate software applications that were developed independently into a complex clinical setting. This was further complicated by a lack of communication and resource allocation between the varying departments and agencies. For example, some perceived that the Allocate Software had a contractual commitment to deliver HealthRoster, but they had no specific contractual commitment for interfaces. Analysis of the data revealed varying views regarding Allocate Software input into this process, with some praising their guidance whilst others questioned their interfacing skills and knowledge of the Irish health care system. In addition, some voiced their concern of the expectation that individual departments within LUH were being asked to take on the interface task without consideration of the knowledge, skills and resources required. As illustrated by the following comment:

*“They assumed that what support from a few people, we’ll get this through. Of course, you’re going to have experts in the one system, that’s going to be required to the interface. It’s a whole IT project. It’s not something that certain departments can just do. It’s a whole IT, big massive project. So how did they think that the department was going to be able to provide that expertise?”*

*(Participant 3 Key Stakeholder)*

Second, the process involved social and organisational factors, such as agreements to provide data in a consistent format and to use data to refer to concepts in a consistent manner. Several participants recognised that the interface package had the potential to impact on managerial and administrative staff’s day to day clinical and administrative work

processes. This, they perceived would result in often taken for granted practices within the hospital, having to be changed and staff would have to learn and work out the consequences daily. However, this caused concern and uncertainty for administration staff's jobs, daily responsibilities and future hospital processes. As explained:

*"There's some resistance to change. Ultimately, without doubt, we are taking away at least 90% -- 95% of the manual entry they are currently doing, it's going to be gone."*

*(Participant 10 Key Stakeholder)*

Third, several processes and preparations had to be established to ensure appropriate configuration of interfaces. For example, the task of cleaning and mapping data between the systems highlighted errors and required trade-offs between standardisation and localisation between the Allocate Software system and the hospitals current system. Stakeholders involved in the interface process were aware of this tension and the need to balance the requirements of the LUH with Allocate Software. This resulted in the rewriting and adjusting of the final system with some interface aspects not being resolved. However, the interface work package resulted in "unforeseen benefits" for the LUH system and reporting practices, for example, it enabled process and procedures to be reviewed, data quality to be revisited and errors to be resolved. As illustrated by the following quotations:

"We went back and said "Look, it would be a lot easier if, on your side, you sent the data in this format" and essentially a number of times it was just "No, we can't. That's the core product and we can't change the core project." Some instances we have done it, we said "Well it's relatively small. It won't take that long." Other things we've just had to say "No." If Allocate can't facilitate it, we're not going to facilitate it, and so ...there will be manual processes needed in some instances."

*(Participant 10 Key Stakeholder)*

Finally, the process was hampered by a lack of shared vision and clarity regarding the roles, expectations and resources required. It was felt by several participants that the costs, staff and time frame required for this work package surpassed initial expectations. As stated:

*"We didn't anticipate it taking as long. So, the cost that we had assigned to it, has gone over and above substantially, for a number of frustrating factors, to be frank about it and that's partly on the Allocate side and partly on the Letterkenny business side. At the end of this, Letterkenny will come up with a cost that the interface and e-Rostering cost, that's not the real cost" haven't got the exact figures, but it's not far off three quarters of a million."*

*(Participant 10 Key Stakeholder)*

*“I would suspect it has taken a lot longer than anybody suspected in the first instance and I suspect that’s probably because it has been a learning curve for Allocate, just as much a learning curve for Letterkenny as well.”*

*(Participant 11 Key Stakeholder)*

This resulted in misunderstandings, resistance or reluctance towards using any future integrated system and a withdrawal of support for the system. This had an impact on working relationships, leading to increasingly strained and fractured relationship between stakeholders involved in the interface, implementation team and project board. Gradually the steering group team was viewed as independent of the team that were implementing the project and not all stakeholders were perceived to be effectively liaising with the implementation process. Furthermore, it also led some to be sceptical of the return on investment, particularly in considering the costs associated with this work package. In sum, the combination of the various factors outlined inhibited the progress of this work package.

## Theme 7: Key lessons and future roll out

Analysis of the data identified three key lessons learned throughout this process and offers strategies for other sites to proactively address. First, it was recommended by several participants, that any implementation project needs to engage with stakeholders and front-line staff to foster buy-in, co-ownership and ensure commitment. As stated:

*“Have a good support team in place, for staff, linking in with staff and who they’re going to talk to. I suppose just engaging more. Educating staff more and not just seeing it as your project but expecting everybody to help. See it as a project for the organisation – if that makes sense.”*

*(Participant 2 Key Stakeholder)*

*“I suppose you could say that the best implementations of information technology are where the people it effects, in other words, the business or the service get very, very involved.”*

*(Participant 4 Key Stakeholder)*

*“You’ve got to –with all the management and executive engagement in the world, which still is very, very important, if you’ve not got engagement from the staff involved, who are going to be affected by the change, then you are going to struggle. So that’s absolutely a fundamental foundation layer for me, before you start any health roster roll out.”*

*(Participant 11 Key Stakeholder)*

This was underpinned by having a strategic shared vision based upon continuous and open dialogue that allowed stakeholders to be included in key decisions and policy formation. Initially, many stakeholders did not feel this was done well and was one factor which led to disengagement.

Second, participants recognised the need to allocate sufficient resources to ensure the shared vision was attainable. Resources suggested included: more time to train staff, greater number and diversity of skills and knowledge within the implementation team, more time and financial support and overall organisational commitment. As illustrated:

*"It's about maintaining that system to a high standard and developing it even further. Because I mean, the system is not going to go away anywhere. It's in. Although it is seen as a pilot – you're hardly going to invest in a system and then dismantle it after a couple of years. So, we're always going to need [implementation team] in those positions. So that's something I need to work on."*

*(Participant 5 Key Stakeholder)*

*"Based on Letterkenny, there was two full-time members of staff within the project team and I would have preferred to have seen three whole time equivalents in there. It would probably have been better with another whole-time equivalent person, even if that was just to free up a little bit more time from an admin capacity."*

*(Participant 11 Key Stakeholder)*

Third, in response to being involved in the interface work package some participants emphasised the need for hospitals to review current workflow infrastructure and software customization needs, prior to implementation. The process of cleaning and mapping data and configuring the system was time consuming and it was felt, that much of this could have been undertaken at an earlier time point. As one participant stated:

*"From a business process...it is very important to understand your current process and what your future process should be, in your e-Rostering environment. Any organisation needs to be very clear about that if they are going to try and make something like this work."*

*(Participant 9 Key Stakeholder)*

However, when asked about the future progression of the implementation of e-Rostering, several highlighted challenges nationally and regionally. At a national level, the establishment of five potential suppliers of electronic rostering systems could be problematic. As one participant explained, this could result in other hospitals choosing a different supplier and engaging with a new implementation process. Moreover, the learning and resources directed into the interface work package also had the potential to be lost. Given that in LUH the interface work package focused on integrating SAP payroll system with

Health Roster, it was recognised that other health care sites may not operate this system, and hence, the learning and recourses underpinning this work would disappear. As stated

*“...difficulty with that tender process is, there's five companies, so if they choose any one of the other four companies, because we have no visibility of what that system is and what data and what format that data can be transformed. So, whilst potentially we have an interface that can be tweaked for other companies, we won't know the level of that tweaking, going forward, until we know what system has been chosen and we have to start from scratch.”*

*(Participant 10 Key Stakeholder)*

*“That's the only pitfall with the Republic of Ireland, there isn't one HR system. Everyone has a different one basically. So, they have to be configured separately and written to create a bit of bespoke work to get the interfaces to work properly. But with the Republic, then it will be on a case by case basis.”*

*(Participant 12 Key Stakeholder)*

Finally, there was a recognition from some participants of the lack of evidence to support the organisational, cultural and fiscal value of implementing e-Rostering. Without evidence, many questioned effectiveness and viewed this as hampering national implementation and engagement.

*“They like to claim that it can give a better idea of workforce planning and staff movement and all the rest. I don't see how it's going to actually, from a business perspective, improve how nursing managers manage nursing resource, to be truthful with you.”*

*(Participant 3 Key Stakeholder)*

Regionally, some participants felt that the implementation project should be halted until a full assessment of its value could be attained. However, calls for the consideration and planning of the future implementation and maintenance of the e-Rostering system within LUH were also made. The associated activities, costs and staff required to continue this work were felt to be under recognised, yet crucial for its success. As stated:

*“I was told Letterkenny is a pilot site, so hence there has to be a review. If this system isn't reviewed properly and found to do as it said, that it will do all it can, if the company get the tender, if it goes out nationally, they're going with a system that hasn't been properly reviewed. That could be redundant and be a waste of money. We don't want it to be another white elephant that has cost a fortune.”*

*(Participant 1 Key Stakeholder)*

*“...my other big concern with the project, is ongoing, when it does go live? Who is going to maintain it? Who is going to look after the system?”*

*(Participant 3 Key Stakeholder)*

*“You think, well who is managing the change going forward? So, whilst you’re using health roster, you will always need a [implementation team representative]. So, it needs to be a full-time role essentially.”*

*(Participant 12 Key Stakeholder)*

Finally, it was appreciated that implementing new technology is a change management project which influences organisational, cultural, social and human resources within and across the site. As part of this journey, challenges faced are inevitable. A few participants reflected:

*“I would say, it’s kind of a mixed bag. In terms of the others, yes, the project has remained, from my perspective, largely on track in terms of time lines. We have successfully rolled out across most of the hospital, despite some of the changes. The information process has come up against a few speed bumps along the way, but to be honest with you.... that doesn’t bother me insofar as I’ve very rarely seen implementations that haven’t thrown off speed bumps.”*

*(Participant 7 Key Stakeholder).*

*“The project isn’t an IT project. It’s a change management project.”*

*(Participant 12 Key Stakeholder)*

## Summary of key findings

- A total of twelve interviews were conducted with key stakeholders.
- Motivation for implementing e-Rostering was linked to international, national and regional drivers. There were many different translations for the overall vision of e-Rostering ranging from no direct benefits to organisational, management and system benefits.
- In line with Irish policy, the procurement and tendering process involved several external agencies. Two stakeholders were involved in the procurement process.
- Whilst a national scoping study was undertaken prior to the implementation, no internal scoping, economic evaluation or consultation exercise was undertaken prior to the implementation within the LUH. Many believed this had negative repercussions for the development, implementation and engagement process of the project.
- Policy relating to roster management for staff and project initiation documents were developed prior to implementation, however, questions regarding the dissemination to staff were raised.
- To support the implementation process, a national steering group and a local project board and an implementation team were established. However, there was criticism that membership was “top heavy”.
- Different expectations of the role of the steering group led to misunderstandings and to the gradual disengagement of stakeholders.
- A mind-set was created that it was a nursing project, and this stemmed from an understanding that it was initiated, developed and is being led by the nursing department.

- Calls were made for the employment of more implementation staff with longer contracts and a greater diversity of skills.
- Participants were aware of and highly praised the diversity of engagement strategies provided to front line staff, by the implementation team.
- The need for standardised training to ensure the embedment of skills and engagement of front line staff were recommended.
- Key stakeholder's relationships with the software provider was variable.
- The e-Rostering implementation consisted of five work packages.
- HealthRoster was implemented using a three-phased approach introducing incremental functionality slowly, guided by a set protocol from Allocate Software.
- SafeCare Module implementation within LUH was postponed.
- The interfacing of HealthRoster with existing hospital systems was a complex, resource heavy activity requiring multi-disciplinary/ professional involvement.

The following part reports on the findings of focus group discussions undertaken with front line staff.



## Part 4: Focus groups with front line staff

This section presents the key themes that emerged from the focus group discussions with front line staff. The aim of the focus groups was to examine the e-Rostering implementation process and preparation for future implementation activities from the perspective of front-line staff. Guided by Mayring's (2000) framework, several themes arose from the analysis and the results are presented according to three main themes. Each theme is sub-divided, described and illuminated further by the verbatim comments.

### Participant's demographics

A total of 34 front line staff participated in six focus groups, representing CNM, CMM, RN, RM and HCA. Eight CMSs took part in one focus group, thirteen RNs/ RMs took part in two focus groups and thirteen HCAs took part in two focus groups. An overview of the demographic characteristics for all staff groups are presented in table 11. The majority were female, with most aged between 45-54 years.

**Table 11. Demographic characteristics of front line staff participants (n=34)**

Demographics		No (%)
Gender	Male	3 (9%)
	Female	31 (91%)
Age *	18-24	1 (3%)
	25-34	5 (15%)
	34-44	9 (26%)
	45-54	12 (35%)
	55-65	6 (18%)
Contract *	Full time	18 (53%)
	Part time	15 (44%)
e-Rostering Training *	Yes	22 (65%)
	No	11 (32%)

*\* One participant did not submit demographics details*

## Themes

Three principle themes with corresponding sub-themes emerged from the analysis of the focus groups (see table 12). Each factor was found to have an influence upon each other.

**Table 12. Focus groups themes and sub-themes**

Theme	Sub-themes
Organisational engagement	Early engagement Engagement strategies
Interaction with technology	Interaction with e-Rostering Impact on workload Facilitators and barriers of the technology
Reactions and recommendations	Perceptions and reactions Technological and implementation adjustments

### Theme 1: Organisational engagement

This theme reports on the level and perception of organisational engagement provided to front line staff. This section outlines two sub-themes, the perception of staff engagement and the opinions regarding the engagement strategies deployed by the organisation.

#### Early engagement

Prior to e-Rostering being implemented, all participants in the focus groups reported that their views were not sought, nor were they included in the initial stages of the e-Rostering project. This resulted in most being unaware of the aims of the project, process of adoption or implementation, or how they could get involved. One participant did acknowledge that she was aware of one front-line staff member who sat on the local project board, whilst another assumed the unions were consulted on the staff's behalf. A few participants also highlighted that staff's IT skills and resources to access e-Rostering were not assessed, yet pivotal to its success. As explained:

*"We had somebody with no mobile and no email address, his wife had set it up for him. Her address, he uses her email...and she has to put in his off-duty [requests] for him."*

*(Participant 4 RN/RM, Focus Group 2)*

*"I don't think anybody mentioned whether people had access to devices at home or that kind of thing. That was never discussed and that obviously has a huge part of it."*

*(Participant 1 RN/RM, Focus Group 2)*

*"I think it was just, the assumption that you should know how to do this, that you should know how to navigate this system and a lot of us hadn't a clue. We knew how to move a mouse and take that from there but not, there's so many things that the system can do. They just assumed that you should be able to take on this role."*

*(Participant 6 CNM, Focus Group 1)*

*"I have one HCA who doesn't have internet at home and wasn't interested but she's fine, because she just leaves me her request."*

*(Participant 1 CNM, Focus Group 1)*

*"But there's still the few staff on the ward that are not computer literate or don't have internet at home and they're still giving you the requests."*

*(Participant 2 CNM, Focus Group 1)*

Overall, the implementation of e-Rostering was perceived as a decision taken by management, which influenced the perception of ownership among front line staff. Some participants felt they should have been given a chance to share their concerns and/or be part of the decision-making process, helping to facilitate engagement and success of implementation. As stated:

*"I was in one of the wards when it was first implemented, and we weren't asked, we were told this is the new system now."*

*(Participant 3 HCA, Focus Group 2)*

*"It was pushed on you. You were told this is the way it is going to be, like it or lump it."*

*(Participant 3 HCA, Focus Group 2)*

*"We weren't actually involved in the package that was picked but I probably would have liked to have a bit more input into the package that was bought. I suppose they would have liked to have been more involved in the beginning"*

*(Participant 1 CNM, Focus Group 1)*

*"The staff nurses weren't consulted at all. I know we were consulted vaguely, but I know the staff nurses definitely were not consulted about the change and what was happening. Given a voice to, which is very important for them because it's their off duty at the end of the day. It was very vague, there wasn't an awful lot of information given out or consultation or sharing whenever it was implemented at the start."*

*(Participant 2 CNM, Focus Group 1)*

*“Apparently, the unions had all been on board with it. But we didn’t know any of this, but apparently it was the union representatives were all there at the tables of discussions.”*

*(Participant 5 CNM, Focus Group 1)*

*“I suppose like any change, I don’t know what it’s like on the other wards and change in our department anyway and it’s just like a red rag to a bull. Why weren’t we brought into this? Why wasn’t this discussed? But things change, and you have to go with it. I suppose the staff should have been informed.”*

*(Participant 4 CNM, Focus Group 1)*

Information about the project was gleaned from several avenues. For example, many reported they attended a staff briefing session held within LUH, whilst others found out about it via word of mouth from people within their unit, within their institution and from searching the web. Those who attended the briefing session reflected that this was a welcome opportunity to gain information and ask direct questions to management and the implementation team. However, word of mouth communications often perpetuated information about e-Rostering throughout the workforce leading to misconceptions and misinterpretation. Consequently, calls for better engagement and communication were made. As examined:

*“When we came in first, somebody on nights, we checked out e-Rostering and nurses in England, everywhere. Good luck not getting their hours, not getting their holidays, everything we’ve said today they had online and they were using it before us.”*

*(Participant 5 HCA, Focus Group 1)*

All participants believed that e-Rostering was a ‘pilot’, however they were sceptical, believing that this would be a permanent, mandated fixture. As focus groups progressed, it became apparent that there was a lack of consistent understanding among staff regarding the rationale for e-Rostering, its benefits and consequences on work practice. All participants articulated a range of theoretical benefits of a computerised e-Rostering system, for example, CNMs felt it could aid in the alignment of staff to staffing requirements, availability and contracts, allowing clear visibility of unit demand levels. On an individual level, it was felt by all that it could help standardise shifts, enhance fairness, reduce ambiguity and errors and save time in devising staff rotas. However, the majority believed it was primarily being introduced in the hospital to reduce CNM workload, whilst some HCAs believed it was being introduced as a mechanism for workplace surveillance of employees. The perception of the usefulness of the system was linked to having a clear understanding of the rational and benefits of e-Rostering.

The sequence of implementation and application were also discussed in the focus groups. All CNMs were aware of the phased approach to implementation, however, other front-line staff were not informed of this process. Moreover participants (HCAs, RNs and RMs)

were aware of variations within individual clinical units in relation to how teams interact with e-Rostering. The variability in how it was implemented led to inconsistency between different working environments and resulted in confusion among front line staff.

## Engagement strategies

Participants were aware of a range of organisational strategies used to facilitate engagement and implementation. For example, e-Rostering policy, support systems and educational and training opportunities were highlighted. Whilst policy had been developed, and CNMs/ CMMs reported being aware of such documentation, all HCAs, RNs and RM participants, claimed not to be familiar with the policy or its detail, despite copies being accessible in each unit by CNMs. Whilst one CNM was familiar with the policy she felt that she was not consulted upon regarding the detail:

*“We were consulted on that but there was a lot of things on that, that didn’t suit us because we were self-rostering, and I don’t think I ever seen the final document then. Whether there were changes made regarding it.”*

*(Participant 3 CNM, Focus Group 1)*

The second form of engagement related to the training offered, which differed according to roles. For the majority of CNMs, e-Rostering had been introduced in a formal capacity, that is off the ward over a 2-day protected period, facilitated by the software provider and/ or the implementation team. During this period, they received most of their training, including how to access and input data into the system. In addition to this training, CNMs reported that they also accessed refresher training and on-going technological support from the implementation team, which was considered invaluable in equipping them with the skills and knowledge necessary to engage other staff and implement the system into their unit. Some CNMs were satisfied with the training providers, however, others were critical recommending that more be delivered. As stated:

*“Two days, which was quite vague really. We didn’t know whether, three of us needed to be there, CNMs or what was the story? So only one of us went. But we all should have been there. And it was to setup the system, to put in everybody’s annual leave and to set up. Like, we had to set the whole system up in those two days.”*

*(Participant 2 CNM, Focus Group 1).*

*“They will always get back to you. They might not be available at that time, I agree, there is plenty of support. Well, any support, if you’ve got an issue with it, you can phone the girls to arrange to meet with you and they’ll correct it for you. And then you can arrange to be shown how to correct it, so you know the next time.”*

*(Participant 1 CNM, Focus Group 1)*

*“There was plenty back up. There definitely was plenty of support, when it did, when we started. Even now, if we have a problem, there is definitely a good support.”*

*(Participant 5 CNM, Focus Group 1)*

*“It’s like the blind leading the blind a lot of the time.”*

*(Participant 6 CNM, Focus Group 1)*

Other front-line staff accessed training on a one-to-one basis and attended training sessions on wards delivered by the implementation team. However, some claimed they received little or no training, instead learning via trial and error or learning from other colleagues on the wards. As stated:

*“This was in the middle of my working day at the desk, this is how you get into it, and this is what you do.... a huddle of us, whoever was on duty that day. Come here and I’ll give you all your usernames and put in your password and off you go.”*

*(Participant 1 RN/RM Focus Group 1)*

*“We did have a session maybe over on the ward, but then it was really busy, and we were getting pulled out of it and put back into it and pulled out again because the ward was really busy.”*

*(Participant 3 RN/RM, Focus Group 1)*

*“But we didn’t have formal training. The managers go off and get a certain amount of training and then they kind of get drip fed through the department and depending on who you got on a day, is as everybody knows, not everybody can teach as well as others. So, some people were getting really good help on it and then there was other people getting very little.”*

*(Participant 4 RN/RM, Focus Group 2)*

*“She did come onto our ward as well and she went through it and explained, and she went over most people’s heads and then the people that did get it, taught the other staff.”*

*(Participant 3 HCA, Focus Group 3)*

*“Presented at the ward as a group and then took individuals and gave her private mobile number out and said, ‘I can help anybody day or night, don’t be afraid’. No, she was very good.”*

*(Participant 1 HCA, Focus Group 1)*

*"Just kind of, five, ten minutes, I was shown on the ward."*

*(Participant 5 HCA, Focus Group 2)*

Consequently, some participants believed training was delivered in an ad-hoc and fragmented manner during busy ward periods, which was not conducive to learning. Some reported that the lack of training resulted in them having insufficient skills to interact with the technology. All participants highlighted the importance of training and many reported that they would have preferred a more in-depth approach.

Staff who attended training and adopted the technology early became staff champions, helping to initiate the adoption of technology by engaging staff and providing extra support and training on the wards. These individuals were viewed as enthusiastic, comfortable with using technology and knowledgeable about e-Rostering and typically spearheaded the adoption and implementation among other staff. This support was considered invaluable and although they acted in an informal capacity, they were viewed as "change champions". As one participant explained:

*"But, it was a couple of people may be trained up, a staff nurse and a healthcare assistant on our ward and they were kind of the people who lead out to the other staff members."*

*(Participant 5 CNM, Focus Group 1)*

*"We were kind of taught from one kind of thing to another kind of thing. It was if you were missing the week that they did the training, it was your colleagues who were showing you how to get in. Even to get it set up on your phone as an icon on the home screen. One girl went around and put it on nearly everybody's phone because they didn't know how to log in."*

*(Participant 4 RN/RM, Focus Group 2)*

Participants reported that the e-Rostering implementation team and management did show commitment and support to front line staff during implementation. All participants were aware they could access help and technical support from the implementation team. Many found the staff drop-in sessions, telephone availability and the helpdesk implementation hub to be essential support. In addition, participants highly valued the pro-active visits from members of the implementation team to answer questions about the technology. Having access to highly skilled and knowledgeable staff who can quickly solve problems helped to facilitate the adoption of the new technology. As stated:

*"X would ring the ward like, asking had someone trained me, like she rang me. They are very good at following up, but I think if people weren't trained ...you are going to have anxiety related to change whenever you have no training. You are going in completely blind."*

*(Participant 1 RN/RM, Focus Group 3)*

*"X was down in the hub, I went down, and they showed me how it worked and how to do it. It is good to go to them because any issue you would have, they can sort it out or they can tell you what is happening. They were very good."*

*(Participant 2 RN/RM, Focus Group 3)*

However, some were uncertain of how to find or access resources available to them. Moreover, most were aware that the implementation team consisted of two people, therefore, their time was limited resulting in a greater "footfall from the people that are organising it".

## Theme 2: Interaction with technology

The second theme reports on front line staff's interaction with e-Rostering technology. Three sub-themes emerged which highlighted diverse experiences and perceptions regarding their interaction with e-Rostering, its effects on workload, and on the facilitators of the technology.

### Interaction with e-Rostering

All focus groups participants were aware that CNMs were responsible for creating the ward roster, and once developed, this had to be further approved by another management tier. This procedure meant that once approved, staff could view the authorised roster. However, as the focus groups progressed it became apparent that this standardised procedure was not always adhered to, with unofficial rosters being accessed by front line staff. As explained:

*"I think we are still very dependent on our hard copy though, to make changes....and we are not meant to be using probably a hard copy. The staff don't have access to health rostering, we [CNM/CMM] only have access to their own shift. So, they do need to have a hard copy to see who they could swap with or if they needed to change a day, they need to see it on the hard copy."*

*(Participant 2 CNM, Focus Group 1)*

*"We are getting to see it on paper but then it's among ourselves, we kind of swap and fix it a bit and they're [CNMs] putting it in. They're not really using e-Rostering you know."*

*(Participant 3 RN/RM, Focus Group 1)*

The majority of CNMs reported that they devised staff rosters at home, due to the lack of time and resources available on busy units. One CNM tried to overcome this by reporting that she blocked booked a 12-hour shift period with another senior colleague, to allow them to plan (on paper) rosters six weeks in advance for their unit. Although it was perceived e-Rostering would lighten CNMs workload, it was still considered a time-consuming responsibility for CNMs.



Front-line participants (HCA, RNs and RMs) stated that they accessed their rosters in their own time, usually at home, as HealthRoster is a web-based application using their own electronic devices, such as lap tops or mobile phones. Only one participant questioned accessing rosters at home:

*“Because I mean, you’re sitting at home thinking about work when you shouldn’t be. You know what I mean like? Sitting at home thinking what will I put in? At least if you could have done it at work and then you leave the hospital and that’s it.”*

*(Participant 5 RN/RM, Focus Group 1)*

Focus group data generally showed that participants felt that e-Rostering technology was straightforward to use and convenient and that this enhanced uptake. Moreover, the system was viewed as being easily searchable and retrievable, with accessibility anytime and anywhere by multiple concurrent users, all of which were highly praised features. As stated:

*“I like being able to look my duty at home and you know sometimes you have that bit of like ‘ah’ in the morning. You just click in and have a look...It is very handy being able to request at home.”*

*(Participant 1 RN/RM, Focus Group 3)*

*“The other things it’s good for, is it shows you when you last did study days.”*

*(Participant 7 RN/RM, Focus Group 2).*

*“It is very valuable for tracking the history of the part where you work so many bank holidays. I think also the CNM, it gives them a good chance to do the thing fair. There is fairness and equality in it and we are happy enough with it.”*

*(Participant 3 HCA, Focus Group 2)*

*“I think it is working. It is nice to be able to say now you can look to September and say, I want that first week off in September or the second week. That is good.”*

*(Participant 4 HCA, Focus Group 2)*

However, for others with limited IT skills, they reported it was time-consuming and experienced difficulties in accessing the system. This resulted in some, particularly HCAs, revealing they relied on others (i.e. CNMs, RNs, RMs and family members) to input and access data on their behalf. They perceived the system as complex and difficult to learn.

Specific criticism of the technology varied but some of the most frequently occurring criticisms related to operational setup which influenced how participants interacted with the technology. Five key limitations were identified as outlined:

- 1 The number of requests. A maximum of four requests per person per roster was available as per the LUH roster management policy for nurses and midwives, however, this was viewed by most HCAs, RNs and RMs as inadequate.
- 2 The definition of a request. The nature and definition of what constitutes a request which related to annual leave and a wish to work a specific shift. This was highly problematic, viewed as unfair and caused widespread frustration.
- 3 The window of opportunity to make requests. Participants were informed that a standardised timeline for making requests would be available to staff, opening and closing at agreed dates, yet many reported that the window for making requests did not open on time. Participants believed this resulted in staff anxiety and the need to be continually logged into the system to ensure they did not miss the opportunity to record their requests.
- 4 The blind system. Repeatedly raised in all focus groups, was the inability of the system to allow visibility to colleagues' requests and to change individual requests once inputted. This was considered a key limitation, as it resulted in staff not being aware of colleagues' needs, and requests viewed as being 'wasted' which led to infuriation among participants.
- 5 Uncertainty of requests. Participants were also aware that workforce requests could not always be guaranteed as the decisions remained at the discretion of management. Whilst staff may input their requests, they were not certain until the requests were signed off. Participants voiced frustration and questioned the work-life balance of the system.

All the limitations caused widespread frustration among HCA, RN and RM staff and was recognised by CNMs as a cause of discontent on the wards which they had to respond to. For example:

*"It got to the stage that our CNM had to put a big notice up in our staff room to say 'please stop contacting me in a panic at twelve o'clock at night on a Sunday or eight o'clock on a Monday morning. You will be accommodated to the best of our ability. There is no need to panic over the roster.' Every month, we spent the Monday that the off-duty opened answering the phone to people with problems with their rosters."*

*(Participant 4 RN/RM, Focus Group 2)*

This led many in focus groups to reflect on the perceived benefits of the manual rostering system, where the number of requests was higher and everyone on the ward could see what leave was being requested, and by whom; suggesting prescriptive rostering by staff in a manual system. However, this has inherent issues around fairness and equity in rostering where staff can develop informal work schedules that are not necessarily service driven.

The discrepancies between the online and paper version led staff to question the rationale, usability and adaptability of e-Rostering systems in the wards.

As the focus groups progressed it became apparent that through a process of adaption and adoption, that some participants reconfigured their ways of working with the technology to accommodate the perceived limitations. For example, prior to inputting individual requests, clinical units used social media apps such as Facebook, What's App and Viber to enable colleagues to discuss and agree on requests as a team. Others took screen shots and posted online to other colleagues to arrange time off, whilst some used calendars or unapproved printed rosters for staff to physically record leave in the unit. In smaller units, staff telephoned other colleagues to arrange and agree requests and leave. In addition, many also reported resorting to pen and paper to record their leave on wards, which other staff could access. As explained:

*"...you can't see anybody else's. So that's why people do send pictures, so you can see everybody's off-duty and you can contact."*

*(Participant 2 RN/RM, Focus Group 1)*

*"But I swear to God, see the e-Rostering, only we have a WhatsApp group among the staff, that we can and are able to just say 'right girls my duty's crap, can somebody, I didn't get this for that wedding, I'm on night duty... That is what's saving us at the minute.'"*

*(Participant 4 RN/RM, Focus Group 1)*

*"We're doing the annual leave on paper and then we're transcribing it to the computer."*

*(Participant 7 RN/RM, Focus Group 2)*

*"But what we done together, we got a yearly calendar... we all write our annual leave on this calendar and then one will know what the other has requested... and we are nearly all sure to get what we want that way. Whereas if we go just behind each other's back and request it online, one doesn't know what the other is requesting. You may not get it, it may not be approved."*

*(Participant 2 HCA, Focus Group 2)*

Not all participants were aware that such systems existed in certain units until they were voiced in the focus groups. Getting to know the limits of the system resulted in front line staff learning how to prepare and compensate. On the one hand, this added an additional tier of complexity to rostering, however, in doing so, they creatively devised strategies to overcome usability issues. This enabled an awareness of what requests colleagues wanted, a level of assurance that requests would not be 'wasted' and also helped to decrease feelings of anxiety that requests may not be approved.

The majority of CNMs were aware that staff were adopting these practices, and several acknowledged their role in making unapproved rosters available to staff and accepting paper copies of staff's requests. Whilst it was recognised as not being ideal practice, it was felt it helped to reduce anxiety, maintained and enhanced working relationships and reduced the workload and complaints CNMs received.

### Impact on workload

Implementation of e-Rostering resulted in changes for participants in the variety of shifts, shift patterns and location of shifts they were rostered to undertake. Some RNs and RMs revealed that implementation of e-Rostering initially resulted in a change of shift pattern, such as being allocated more night duty shifts. Whilst several HCAs reported that it caused changes in shifts allocated, level of working hours and unit location, participants did not understand the reasons why these changes occurred. This resulted in confusion and feelings of frustration. For HCAs, the risk of being relocated to another unit was a cause of distress and anxiety. As illustrated by the following quotations:

*"Shift pattern was mixed at the start, you could have a lot of shifts bunched together, but that seems to have faired out a little bit better now. You could end up working 50 or 60 hours one week and you could end up working very little hours the following week."*

*(Participant 4 RN/RM, Focus Group 3)*

*"I am struggling. I could easily be Monday/Tuesday night, sleeping on Wednesday and back in for an eight to four-thirty on Thursday... it's not great for your family life, not great for you physically or for your body clock or anything. I've never had any issues with duty up until now."*

*(Participant 3 RN/RM, Focus Group 1)*

*"We don't want to be shifted. I was sent to ICU one night, my God, what does HCA do up in ICU?"*

*(Participant 1 HCA, Focus Group 2)*

*"Well I haven't a notion about X job or X job and I am dealing with lines you wouldn't have a clue. But to go to a different specialised area, we are all specialised in one way or another, I wouldn't chance it for one day. If you were to come to renal you wouldn't have a clue or vice-versa."*

*(Participant 3 HCA, Focus Group 2)*

From a CNM perspective the impact on their workload stemmed from three levels. On the unit, many recognised that change caused upset amongst staff and in response they had to deal with the consequences. This involved listening to frustrations, advising and signposting staff to sources of support, releasing staff to access support and responding to queries about the technology. At a personal level, dealing with multiple and overlapping leave requests from staff resulted in CNMs being faced with a dilemma on who to approve. An issue also recognised by other participants, as explained:

*“We would be left with no choice to take. The same people would be requesting the same things all the time and then others are left with no choice. For instance, this morning, I had four people looking for the same weekend on night duty and I only need two, they were all overlapping.”*

*(Participant 6 CNM, Focus Group 1).*

*“... but say half of the unit ask for the same weekend off, who makes the decision, if ten people get it off, or ask for it off, and only five can say can get it off, who makes the decision who are the five? Because prior to that, it was paper based. You went and saw who asked for the weekend off first.”*

*(Participant 7 RN/RM, Focus Group 2)*

Finally, managerially CNMs referred to staff rostering becoming more prominent and an immediate issue. Examples of two CMNs being contacted and questioned by the personnel from senior nurse management office on the day rosters were submitted were highlighted, leading to feeling pressured.

*“...because this is live, it goes to the nursing office. And the senior managers down there have a look at it and then they’re ringing saying, ‘Why’s this person doing days and nights in the one week?’ but that’s at the request of that person because she has something she had to do or whatever it may be. But we’re still getting this.”*

*(Participant 4 CNM, Focus Group 1)*

## Facilitators of the technology

Throughout all the focus groups several facilitators were cited that related to personal and professional characteristics of the users, the technology, or operating procedures and consequences of how the technology was implemented.

In relation to the personal and professional characteristics, facilitators which enhanced adoption included the participants’ baseline abilities with technology, ability to learn quickly, being adaptable, organised and motivated. Whereas barriers were attributed to a lack of IT skills, attitude towards technology, increased workloads and learner fatigue. Some

participants associated a participant's age as one explanation why some staff were not able to engage with the technology, however, others did not see age being a factor.

Other characteristics spoken about, related to the technology and operating procedures, such as its user friendliness, operating system and experiences of the technology. Several benefits of the technology were cited, for example, it provided RNs, RMs and HCAs staff with freedom and control to roster their availability, which enabled them to better plan and use their leisure time. Another benefit of the system was that it allowed staff to track and monitor their work history, annual leave, hours worked and overtime. This resulted in several instances where staff claimed for working additional shifts, enabling pay to be backdated. Professionally it also highlighted the requirements for staff development (i.e. study days) enabling staff to meet their professional and academic needs. As stated:

*"For our girls they really love it. They think it's a lot more independence and they've a lot more say and what they get to do with it. They feel it's in their hands more so than the CNMs."*

*(Participant 2 CNM, Focus Group 1)*

The benefits from a CNM perspective centered on managerial issues. For example, the technology provided the ability to access and update rosters daily, oversee that skill mix and patient acuity were balanced, and provide opportunities to plan. This enabled CNMs to be aware of staff's annual leave throughout the year making it easier to ensure such requests were spread evenly across the period, with less impact on service delivery. Moreover, enhanced availability of 'real-time' data, which was easily searchable within one location was considered a key benefit from the CNM perspective, saving time and resources. As explained:

*"Well, I do like it. I think it's easier. It doesn't take any less time but... you don't have to go looking for annual leave entitlements, going to this folder and that folder and making phone calls. Everything's there."*

*(Participant 4 CNM, Focus Group 1)*

However, some features of the technology were viewed as both limiting and enhancing, for example, while e-Rostering enabled the unit's skill mix to be appraised this was perceived to be too generic, based on grade and not the years of hands on experience associated with that grade. In addition, whilst providing requests six weeks in advance enabled for staff to plan, many were critical that this did not reflect the unpredictability of life. Some claimed it also did not reflect the work-life balance advocated in hospital policy. As stated:

*"It's a full month that you're having to request now and you're requesting it that far ahead. Quite often you don't know what's happening that far ahead."*

*(Participant 1 RN/RM, Focus Group 1)*

*“..its six weeks in advance and you don’t know If you’re going to have an appointment yourself or an appointment for your child or your parent or whatever so there’s no room to negotiate. There’s no room to move. So, you must know what, six weeks ahead of you. You know it’s very unfair.”*

*(Participant 4 RN/RM, Focus Group 2)*

## Theme 3: Reactions and recommendations

The final theme reports on how participants reacted to change, which was influenced by several interwoven factors. Analysis of the data also identified two sub themes, staff perceptions and reactions of the system and technological and engagement adjustments, which were felt would improve the implementation of the technology with front line staff.

### Perceptions and reactions

All focus groups questioned the efficiency and economic effectiveness of the e-Rostering system. Some CNMs reported that to date it had not reduced their workload, and this reflected the belief held by HCAs, RNs and RMs. Whilst CNMs recognised it had multiple theoretical benefits they voiced concern of the lack of integration of e-Rostering within the wider organisational structures and systems such as payroll.

Participants reaction to change varied and it should be noted that there was some variation of findings between specific roles, for example, staff in leadership roles (i.e. CNMs) reacted more positively than those in direct caring roles (i.e. HCAs). Such differences were attributed to differences in knowledge, training and involvement in the change process.

In response to the change, participants, reacted emotionally and/or behaviourally. Emotionally, participants reported being fearful of e-Rostering, being suspicious of why it was being introduced and sceptical of its benefits. For example, several HCA participants believed it was a staff surveillance tool and feared it would result in a change of role or relocation to an unfamiliar unit across the hospital. Whilst some RNs and RMs were critical of the finances being spent on e-Rostering and questioned why such resources were not being used to increase staff numbers or investment in equipment. Reports of clinical units being inadequately staffed and high attrition rates resulting in inconsistency of staff were underlying themes in group discussions. As stated:

*“Yes, but then you’re wondering what was all the money to buy the whole thing is for? You’re wondering...like we’re over there with equipment that falling apart. That’s what annoys me.”*

*(Participant 3 RN/RM, Focus Group 1)*



*"I work in a 37-bedded unit, we should ideally have each nurse to six patients, with a nurse in charge. But very often we have either nobody in charge or we will be down a healthcare assistant. So that is one healthcare assistant to 37 patients. Weekends is no one in charge...but we very commonly have a nurse down at the weekend. So, it is two nurses to eighteen patients."*

*(Participant 3 RN/RM, Focus Group 3)*

*"It has been flagged.... they don't have the staff. They see this coming weeks in advance and they are trying to offer overtime, but when you are here five days a week, you don't want overtime. You just want to do your hours and go home. I don't know if that is a particular issue with e-Rostering, I think that is more staffing."*

*(Participant 3 RN/RM, Focus Group 3)*

*"I can see the whole e-Rostering thing, but it is robbing Peter to pay Paul, to solve the problem. You are not addressing the proper issue that is shortness of staff."*

*(Participant 3 HCA, Focus Group 2)*

Behaviourally, some participants (HCAs, RNs and RMs) reported feeling anxious and distressed and actively resisted engaging with e-Rostering software. For example, several RNs stated that they 'dreaded' e-Rostering being implemented in their wards claiming that it caused widespread distress among colleagues. This contributed to a prevailing air of scepticism and a disinclination to embrace change. As illustrated by the following quotations:

*"Every time it was mentioned, we dreaded it, we don't want it. Like I remember the whole anxiety related to it coming out."*

*(Participant 1 RN/RM, Focus Group 3)*

*"It's desperate, we were very negative about it, our side when we were coming in. We were very distressed."*

*(Participant 3 RN/RM, Focus Group 1)*

*"...you are regularly being told, no you can't have that, because you are over your limit of requests or whatever, you are going to get so disheartened. You are going to get pissed off and say, well I am going somewhere that I will get what I want to work."*

*(Participant 3 RN/RM, Focus Group 2)*



## Technological and implementation adjustments

At the end of the focus groups all participants identified several adjustments or additions to e-Rostering technology or the implementation process that they felt would enhance engagement. They have been classified as preparation and functions of the system (see table 13). Some participants suggested revisions should occur before further roll out of e-Rostering in LUH to ensure future lessons are learned.

**Table 13. Adjustments and additions**

Demographics	No (%)
Preparation	Host information days throughout the projects lifespan
	Provide more consistent, standardised and ongoing training, such as designed study days for all staff
	Increase visibility and awareness of support services available to staff
	Establish a designated implementation hub in one location
	Provide more IT support
	Establish CNM peer support system
	Formally identify and support super-users/ champions
Functions of system	Increase the number of requests available to staff
	Flag up colleague's requests on the system by using different shades of colour
	Increase size of display lines on the system
	Provide staff with HSE emails
	Email staff to let them know the request window has opened.
	Email staff to notify them their request have been approved

## Summary of key findings

- A total of 34 front line staff participated in six group discussions.
- Analysis identified three principles themes: organisational engagement, interaction with technology and reactions and recommendations.
- Findings suggest that whilst implementing and managing change was acknowledged as challenging, engaging staff was crucial for it to be successful. However, during the deployment and early use of the technology front line staff did not feel engaged, resulting in ownership remaining with management.
- Information about e-Rostering was gained via several routes, however, word of mouth communication often perpetuated information throughout the workforce. Consequently, this impacted on front line staffs' perception of the rationalised engagement and implementation process.
- Several engagement strategies were adopted which were considered invaluable in enhancing engagement and aiding the implementation process.
- Staff training varied and was influenced by provision and professional grade. All participants highlighted the importance of training, preferring a more in-depth approach available for staff.
- Rosters were mainly accessed during staff's own time and using their personal devices. Staff with IT skills found the system easy to use and praised its accessibility.
- Through a process of adaption and adoption staff developed strategies to overcome usability issues.
- Implementation of e-Rostering resulted in changes in shift patterns and location of shifts for some staff.
- Facilitators and barriers were cited that related to personal and professional characteristics of the users, the technology or operating procedures and consequences of how the technology was implemented.
- Change caused emotional and behavioural reactions from staff.
- Several adjustments or additions to e-Rostering technology and the implementation process were identified which would enhance engagement.

The next part presents the results from the cross-sectional online survey of front line staff.

## Part 5: Cross sectional online survey of front line staff

This section presents the findings from an online survey undertaken with front line staff. A cross sectional survey was employed to gauge views and opinions of front line staff regarding the Employee OnLine implementation and interface on five areas: assessment of need, training issues, organisational support for implementation, benefits of the e-Rostering system and, satisfaction with the implementation process.

### Respondent demographics

Of the total population sampled (n=638), 203 responded which resulted in a response rate of 31.8%. Most respondents were female (90.6%, n=184), a registered nurse/registered midwife (74.4%, n=151) and aged 35 to 44 years old (35.5%, n=72). The average length of time for staff using the e-Rostering system was 14.5 months (SD 7.8, n=195) with a range from 1 to 48 months. The average number of work colleagues within the respondents' own profession was 25.96 (SD 17.89, n=180) with a range from 0 to 80 staff members (see table 14).

**Table 14. Demographic characteristics of respondents (n=203)**

Demographics		Number (no.)	Frequency (%)
Gender	Male	19	9.4
	Female	184	90.6
Age category (years)	18-24	8	3.9
	25-34	33	16.3
	34-44	72	35.5
	45-54	69	34.0
	55-65	21	10.3
Professional title	Healthcare assistant	31	15.3
	Registered Nurse/ Registered Midwife	74.4	151
	CNM/ CMM	21	10.3
Size of unit	<20 staff	27	13.3
	21 – 60 staff	152	74.9
	>60 staff	24	11.8

## Statement scoring

The following sections will summarise the findings of the survey in relation to the individual statements within each of the five areas (assessment of needs, training issues, organisational support for implementation, benefits of the e-Rostering system and, satisfaction with the implementation process). Throughout this section reference is made to positive scores which refer to 'strongly agree' and 'somewhat agree' and negative scores which are 'strongly disagree' and 'somewhat disagree'. A full description of the frequency of responses are provided in table 15.

**Table 15. Frequency of responses to the items within the questionnaire**

	STATEMENT	Strongly Agree	Somewhat Agree	Neither	Somewhat Disagree	Strongly Disagree
1	My ability to use e-Rostering was assessed prior to implementation?	11.3% (n=23)	24.1% (n= 49)	9.9% (n= 20)	19.7% (n=40)	35.0% (n= 71)
2	I was asked about my access to computer facilities to use e-Rostering?	16.7% (n=34)	16.7% (n= 34)	8.9% (n= 18)	19.2% (n= 39)	38.4% (n= 78)
3	I received sufficient training to use the e-Rostering system?	16.7% (n=34)	23.6% (n=48)	9.9% (n=20)	21.2% (n=43)	28.6% (n=58)
4	I have sufficient internet access to use the e-Rostering system.	44.3% (n=90)	35.5% (n=72)	8.4% (n=17)	7.4% (n=15)	4.4% (n=9)
5	There was support available to help me deal with any difficulties I had with the e-Rostering system.	26.6% (n=54)	35.5% (n=72)	12.3% (n=25)	15.8% (n=32)	9.9% (n=20)
6	The e-Rostering system fits into existing hospital rules, regulations and legislation.	18.2% (n=37)	23.2% (n=47)	34% (n=69)	15.3% (n=31)	9.4% (n=19)
7	I was given sufficient time to learn the e-Rostering system?	10.8% (n=22)	24.1% (n=49)	16.3% (n=33)	24.6% (n=50)	24.1% (n=49)
8	I find the e-Rostering system easy to use?	29.6% (n=60)	39.9% (n=81)	6.9% (n=14)	14.3% (n=29)	9.4% (n=19)
9	Rostering management policy for nurses and midwives at LUH was presented at a ward level?	10.8% (n=22)	30% (n=61)	22.7% (n=46)	19.2% (n=39)	17.2% (n=35)
10	The hospital policy relating to e-Rostering was clear?	10.3% (n=21)	22.2% (n=45)	23.2% (n=47)	25.6% (n=52)	18.7% (n=38)
11	I feel confident using the e-Rostering system.	34% (n=69)	36% (n=73)	8.9% (n=18)	13.3% (n=27)	7.9% (n=16)
12	There was support for colleagues in implementing the e-Rostering system?	16.7% (n=34)	30.5% (n=62)	24.1% (n=49)	13.8% (n=28)	14.8% (n=30)

13	There was support from higher management in the organisation as to the implementation of e-Roster...	12.8% (n=26)	26.6% (n=54)	24.1% (n=49)	15.5% (n=31)	21.2% (n=43)
14	The e-Rostering system supports sufficient staff numbers are on the ward each day?	11.3% (n=23)	16.7% (n=34)	25.1% (n=51)	18.7% (n=38)	28.1% (n=57)
15	The e-Rostering system helps provide a consistent skill mix on the ward to provide efficient care?	7.9% (n=16)	15.8% (n=32)	25.1% (n=51)	23.6% (n=48)	27.6% (n=56)
16	The e-Rostering system supports effective use of staff to ensure patient safety.	9.9% (n=20)	14.8% (n=30)	25.6% (n=52)	23.6% (n=48)	26.1% (n=53)
17	The e-Rostering system works well in the hospital.	12.3% (n=25)	18.7% (n=38)	20.2% (n=41)	18.2% (n=37)	30.5% (n=62)
18	I am satisfied with the e-Rostering system.	20.7% (n=42)	19.2% (n=39)	12.8% (n=26)	17.7% (n=36)	29.6% (n=60)

## Assessment of needs

'Assessment of Needs' examined whether there was sufficient preparation work completed to determine the skill sets prior to implementation. There were a similar number of respondents who reported negative scores for assessment of ability to use the e-Rostering system (54.7%, n=111) and access to computer facilities (57.6%, n=117). While most respondents reported a positive score for having sufficient internet access to use the e-Rostering system (79.8%, n=162).

When this construct was analysed according to demographic characteristics, statistically significant differences between mean scores were noted for professional title ( $F(2,200) = 6.63$ ,  $p < 0.002$ ). Further analysis revealed that CNM/CMMs statistically significantly scored the construct (see figure 2) more positive compared to staff nurses/midwives ( $p < 0.002$ ). There were no statistically significant differences found for the other demographic characteristics.

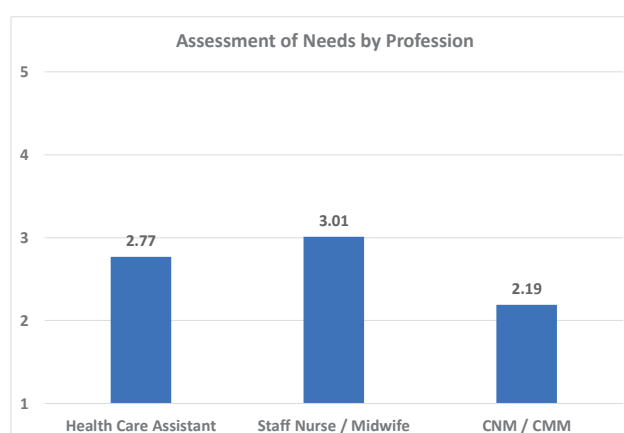


Figure 2. Mean scores of construct 'Assessment of Needs' according to profession

## Training issues

Training and ongoing support to use the e-Rostering system were examined including whether training was sufficient, having time to learn and ongoing support from implementation staff. Half (49.8%, n=101) of respondents reported a negative score when asked if they had received sufficient training to use the system and only one-third (34.9%, n=71) of respondents felt that they were given sufficient time to learn the system. Almost two-thirds (62.1%, n=126) of respondents felt that they had support to deal with any difficulties related to using the e-Rostering system.

Further analysis of the construct revealed that there were statistically significant differences in the mean scores for professional title ( $F(2,200) = 7.66, p < 0.001$ ). CNM/CMMs scored this construct more positively compared to HCAs (Mean Difference (MD) 0.96, SE 0.32;  $p < 0.011$ ) and staff nurses/midwives (MD 1.06, SE 0.27;  $p = 0.00$ , see figure 3). In addition, there were also statistically significant differences for scoring of this construct according to unit size ( $F(2,200) = 4.91, p < 0.001$ ). Furthermore, statistically significant differences in mean scores were found between smaller sites (<20 staff) compared to larger sites (21 – 60 staff;  $p < 0.042$  and >60 staff;  $p < 0.008$ ). The larger the site, the less positive the score.

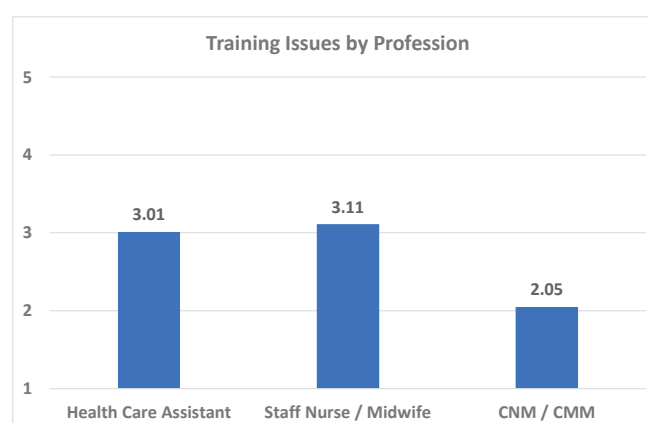


Figure 3. Mean scores for construct 'Training Issues' according to profession

## Organisational support

Organisational support at the meso and micro level were examined in relation to the transparency and presence of the rostering policy within the hospital and whether the policy was congruent with hospital rules, regulations and legislation. Support from colleagues and higher management were also assessed. Four in ten (41.4%, n=84) of respondents reported a positive score for the rostering policy fitting in with the hospital rules, regulations and legislation. However, thirty-four per cent (n=69) neither agreed nor disagreed with this statement. There were similar positive (40.8%, n=83) and negative scores (36.4%, n=74) in relation to the policy being present at ward level. Forty-four per cent (n=90) identified a negative score relating to the clarity of e-Rostering within hospital policy. Almost half

(47.2%, n=96) of respondents agreed that there was support for colleagues in implementing the e-Rostering system. Similar positive (39.4%, n=80) and negative (36.7%, n=74) scores were reported for support during implementation from management within the organisation.

Analysis according to demographic characteristics revealed a statistically significant difference in means scores for professional title ( $F(2,200) = 5.62, p < 0.01$ ). Further analysis highlighted that CNM/CMMs scored this construct more positively when compared to staff nurses/midwives ( $p < 0.004$ , see figure 4). There were no statistically significant differences between mean scores according to age of the respondents ( $F(2,200) = 2.37, p < 0.054$ ). However, it was noted that more positive scores were reported among the younger age groups.

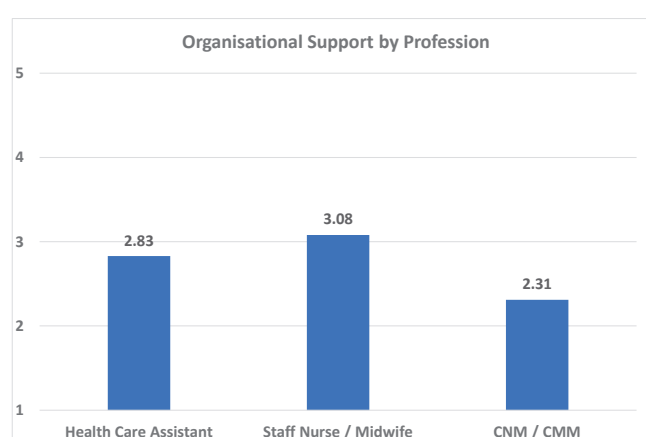


Figure 4. Mean scores of construct 'Organisational Support' according to profession

## Benefits of the e-Rostering system

Tangible benefits of the e-Rostering system for staff and patients as well as effective health care provision were examined. Half of respondents reported negative scores for e-Rostering ensuring a consistent skill mix on the ward (51.2%, n=104) and sufficient staff for patient safety (49.7%, n=101). Forty-seven per cent (n=95) of respondents felt that the e-Rostering system ensured sufficient staff numbers on the ward each day.

Further analysis showed statistically significant differences in mean scores according to professional title ( $F(2,200) = 3.960, p < 0.05$ ). As shown in Figure 4, CNM/CMMs scored this construct statistically significantly more positive compared to staff nurses/midwives ( $p < 0.028$ ). There were no statistically significant differences found for the other demographic characteristics.

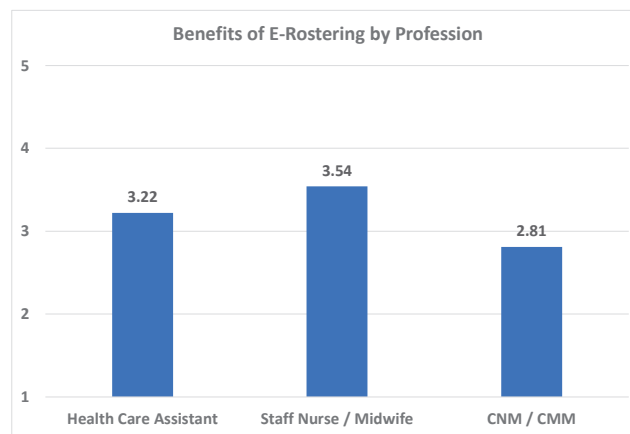


Figure 5. Mean scores of construct 'Benefits of eRostering' according to profession

### Satisfaction with the implementation process

Satisfaction was assessed through ease of system use and confidence to use the system. Similar positive scores were reported by many respondents in relation to the ease of system use (69.5%, n=141) and feeling confident to use the system (70.0%, n=142). Similar negative scores were reported for satisfaction when using the system (47.3%, n=96) and for reporting that the system worked well (48.7%, n=99).

Further analysis showed statistically significant differences in mean scores according to unit size ( $F(2,200) = 13.686, p < 0.01$ ). Statistically significant differences in mean scores were found between smaller sites (<20 staff) compared to larger sites (21 – 60 staff;  $p < 0.003$  and >60 staff;  $p < 0.001$ ). The larger the site, the less positive the score (see figure 5).

As numbers of colleagues in the unit in the respondents' profession increased, the level of satisfaction decreased (Co-efficient -1.077, importance 0.568, Sig = 0.003). This change was at a statistically significant level.



Figure 6. Mean scores of construct 'Satisfaction with e-Rostering' according to unit size



## Qualitative analysis: Free text responses

At the end of the questionnaire respondents were asked two questions about the best and worst aspects of the e-Rostering system. In total, 77% (n=156) responded to the question pertaining to the best aspect of the e-Rostering system while 82% (n=166) provided answers related to the worst aspect of the e-Rostering system. Responses varied in length and depth with some identifying no best or worst aspects.

In relation to positive aspects of the system, the following overarching themes were identified: “the accessibility of the system”, “having the schedule in advance” and “personnel monitoring”. Within the theme ‘accessibility of the system’ respondents described how they were able to see their duty and make requests for off-duty online from home. This also meant that staff did not have to phone or physically go into work to get their shifts/ off-duty. Another advantage to staff was knowing their shifts/ off-duty well in advance. Within this theme, respondents reported that this enabled staff to plan and organise their free time when not working. Another predominant positive aspect described by respondents was that the system kept track of personnel information in one place, such as annual and sick leave, training undertaken, and hours owed or owing. Other best aspects highlighted were: fairness, ease of use and the process for requesting days off.

In relation to the worst aspect of the e-Rostering system, there were two main themes: “system features” and “timing of roster”. Within “system features”, several respondents reported that the auto roster generated poor shift schedules (e.g. single night shift). Many respondents expressed that the process of making requests, as well as the number of requests allowed per month, were particularly frustrating. Having limited requests per month meant that staff could not request certain shift patterns (e.g. working two or three-night shifts in a row). Furthermore, swapping shifts, particularly when unforeseen circumstances occurred, was made difficult due to staff not being able to access colleagues’ shifts/ off-duty on the roster. Finally, several respondents reported that the schedule and/ or ‘request window’ were not released on time. Other worst aspects identified were: lack of flexibility to swap shifts, not user-friendly (e.g. unable to use on mobile phone) and that the system was not always up-to-date.

## Summary of key findings

- Of the total population sampled (n=638), 203 responded which resulted in a response rate of 31.8%.
- Most respondents felt confident about using the e-Rostering system, reported that the system was easy to use and that they were supported (colleagues and technical staff) during implementation.
- Respondents were uncertain about the benefits of using the system for patients and staff in providing effective skill mix, staffing levels and ensuring patient safety.
- Respondents did not feel that their needs (training, computer access and time) were assessed prior to implementation.
- Half of respondents felt that the e-Rostering system did not work well in the hospital and a similar number were dissatisfied with the system.
- There was ambivalence regarding the visibility and clarity of the e-Rostering system within current hospital policy and how the system was embedded into existing hospital rules, regulations and legislation.
- The role of professional title had a significant impact on scoring of all five constructs. CNM/CMMs positively scored the constructs whereas HCAs reported the construct as neutral and staff nurses/midwives scored moderately negative.
- The size of the unit (training issues) and age of respondent (satisfaction with e-Rostering) had a significant impact on construct scores. Respondents in larger units disagreed more with statements relating to training issues and satisfaction with e-Rostering decreased with increased age.
- Positive aspects of the system identified were: accessibility, schedule in advance and personnel monitoring.
- Negative aspects of the system identified were: poor shift allocation, limited requests and the roster/request window not being released on time.

The next part presents an analysis of data from HealthRoster, benchmarking standards of care against national standards, good clinical practice KPI's and evidence-based practice.

## Part 6: Examination of the e-Rostering programme on KPIs and quality care metrics

This section outlines the benchmarking standards of care against available national standards, good clinical practice KPI's and evidence-based practice. In collaboration with key members of the Project Board and implementation team, evidence was identified and extracted from the e-Rostering database to help examine six KPIs across three clinical settings (Surgical 2; ED and Paediatrics) in LUH. In addition, two case studies were developed. The first focused on SafeCare Module and its application within the Gynaecology unit. The second reports on the Interface Project and the integration with e-Rostering and payroll systems within the CCU unit. Quantitative information was extracted from the e-Rostering database and an interpretation presented.

### Sources of Information

Data was extracted from existing documentation and databases relating to the implementation of e-Rostering process and the findings produced from the HealthRoster data base (see table 16).

**Table 16: Databases sources**

KPI information: Existing databases	Case study: SafeCare	Case study: Interface Project (payroll):
<ul style="list-style-type: none"> <li>HealthRoster</li> <li>SafeCare</li> </ul>	<ul style="list-style-type: none"> <li>Feedback from the e-Rostering implementation team</li> <li>Database</li> </ul>	<ul style="list-style-type: none"> <li>Allocate Software (January 2016) Interface Activation Readiness Sign Off</li> <li>Health Business Services (2017) e-Rostering Pilot Project HR/Payroll Systems &amp; Analytics Project 126 report</li> <li>Allocate Software User Acceptance Testing Sign Off (2017)</li> <li>Database</li> </ul>

All findings are based on information provided to the research team and all subsequent analysis is based on this available evidence. Time lines for KPIs vary throughout.

## Key performance indicators

The information was generated to answer the six KPIs and the presentation of evidence relating to two case studies.

- 1 Usage of annual leave, study leave, sickness and other;
- 2 6-week roster approval rates as per calendar lead times;
- 3 Loss of contracted hours not used per month;
- 4 Additional shifts (i.e. overtime/extra hours paid);
- 5 Auto-roster percentage enabled;
- 6 Number of bank staff requests to the total bank hours worked and reasons for booking.

## Contextual unit information

Data was collected from three clinical units namely, Paediatric Unit, Surgical 2 and the Emergency Department (ED), which represent Surgical, Medical and Paediatrics units within LUH. The composition of frontline staff on each unit is highlighted in table 17.

**Table 17. Composition of three units in LUH**

Unit	No of Beds	Skill Mix (RN/ HCA)	Budgeted Whole Time Equivalent (WTE)
<b>Surgical 2</b>	35 beds	80/20	RN 26 WTE HCA 8 WTE
<b>Emergency Department</b>	4 resuscitation beds 4 major trollies 2 Side Rooms 1 Paediatrics room 3 minor cubicles	78/22	RN 32.9 WTE HCA 6.5 WTE
<b>Paediatrics</b>	25 beds	82/18	RN 24 WTE HCA 3.7 WTE

The variability in unit size limited comparability that could be made across settings. Percentages are used where possible to help address this issue.

## National Standards for six KPIs

Examination of the literature highlighted that no Irish national standards were available for many of the six KPI's. Anecdotal information on KPI standards exist, but no written sources were available to support this position. Many of the anecdotal standards were drawn from UK and/or regional policy and not referenced in HSE documentation. As a result, all information relating to the six KPI are descriptive and based on longitudinal change over time rather than against accepted Irish national or regional standards.

## KPI One: Usage of annual leave, study leave sickness and other

This section presents evidence relating to the usage of sickness, annual, study and parenting leave for the three units.

### Sickness Leave

According to the National Service Plan HSE (2012) the target tolerable was 3.5%. All three units had pre-data commencement points well below this threshold. Over time the three units fluctuated between achieving or exceeding the 3.5% target, with Surgical 2 greatly exceeding the target at three-time points.

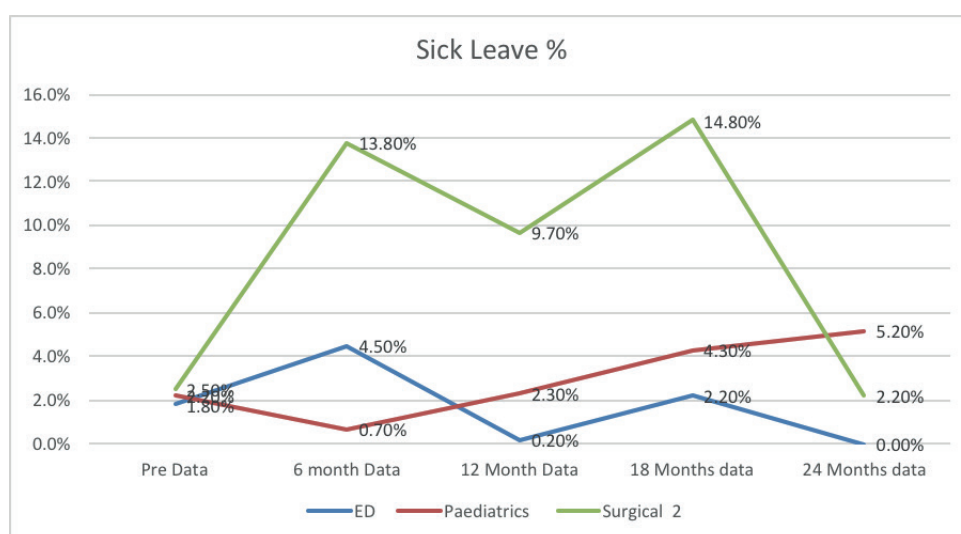


Figure 7. Sick leave (%) over 24-month period across all 3 units

Overall, the trends across the three units varied. Surgical 2 had an average of 8.6% sick level, followed by Paediatrics (2.9%) and ED (1.7%). Both Surgical 2 and ED had a similar pattern of fluctuation from pre-implementation to post implementation (24 months), however, in Surgical 2 this fluctuation was to a much greater extent compared to ED. Surgical 2 had the sharpest increase (11.7%) and decrease (12.6%) over the 24-month period, suggesting the need for further investigation. Paediatrics had a small decrease in percentage of sick leave from pre-implementation to 6 months but then steadily increased from 6 to 24 months.

## Annual Leave

No Irish national standard for annual leave was evidenced, however a 13% average target absence (based on LUH finance calculations) was considered acceptable. No reference source is available to support this 13% standard. However, there is reference to absence rate of annual leave average calculation set out by the Department of Health, in the Policy Document Interim Report of the Taskforce on Staffing and Skill Mix for Nursing.

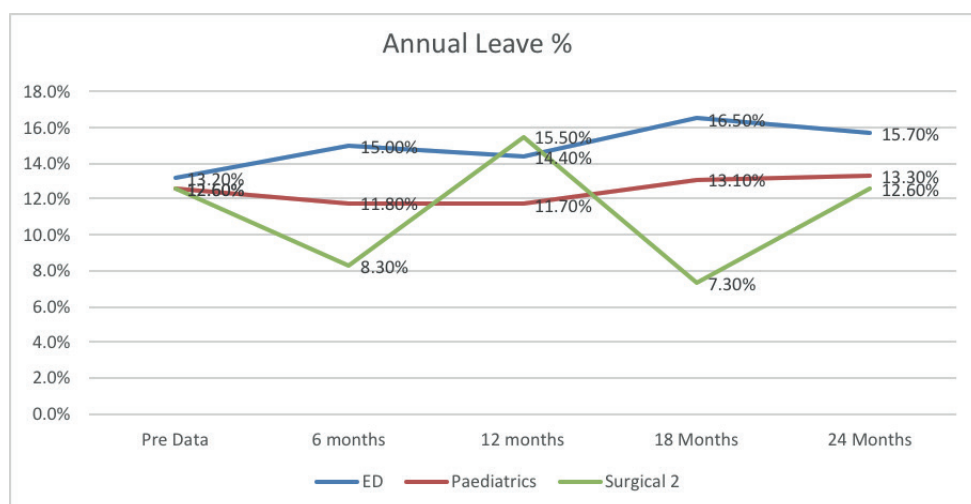


Figure 8. Annual leave over 24-month period across all 3 units

Overall average percentage of annual leave varied from 15% in ED to 12.5% in Paediatrics and 11.3% in Surgical 2. All three units exceeded the 13% target at various points throughout the data collection period (see figure 8). Both Paediatrics and ED had slight increases for percentage of annual leave from pre-implementation to post implementation at 24 months. Surgical 2 fluctuated across time points having the sharpest increase (7.2%) and decrease (8.2%) of all units. All units were similar at 24 months (12.6-15.7%).

## Study Leave

No Irish national standard was evidenced relating to study leave. According to LUH finance calculations, study leave should account for a relatively low level of unavailability on the unit, with rates not exceeding 3.5% of total unavailability. No reference source is available to support this 3.5% standard. However, the DH (2010), Interim Report of the Taskforce on Staffing and Skill Mix for Nursing, refers to a total “absence allowance of 20% (to allow for annual leave, absence leave inclusive of sick leave and other leave, along with mandatory study leave. This 20% as set out in the report is exclusive of Maternity leave” (p43).

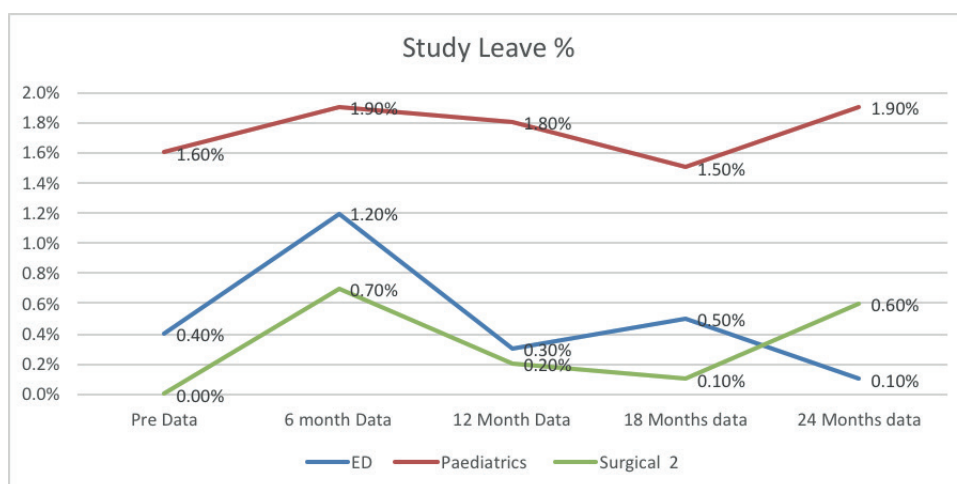


Figure 9. Study leave (%) over 24-month period across all 3 units

Overall, the average number of study leave across all three units did not rise above 2% (see figure 9). Across the data collection period, the percentage of study leave slightly increased for Surgical 2 and Paediatrics and slightly decreased for ED. There were small fluctuations across time points for all units, with Surgical 2 and Paediatrics having similar trends. The largest increase (0.80%) and decrease (0.90%) were found in the ED unit.

## Parenting Leave

Parenting leave comprised a combination of parental leave and maternity leave absence leading to unavailability to roster. No Irish national standard was evidenced relating to parenting leave, however, a total unavailability of 20% score recommendation (DH 2016) was considered acceptable.

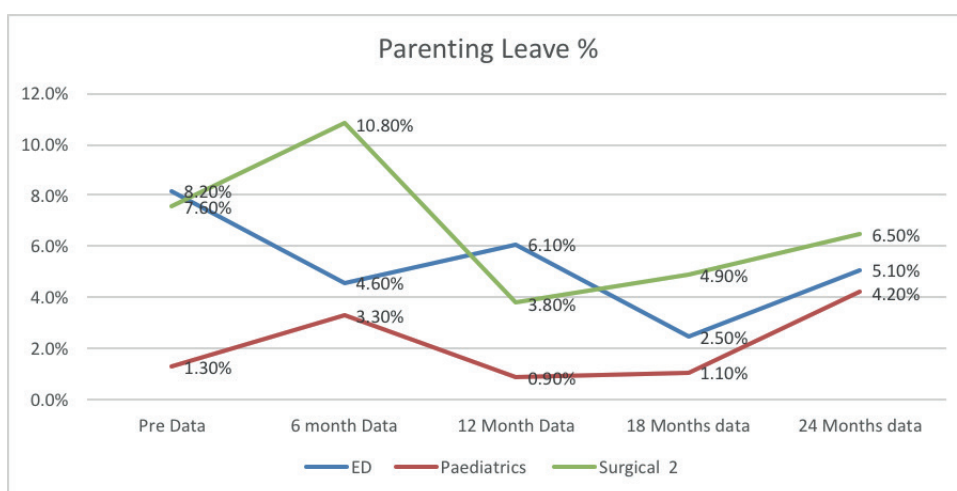


Figure 10. Parenting leave over 24-month period across all 3 units

Overall, there were fluctuations across time points for each of the units (see figure 10). From predate to post implementation at 24 months, all units were well within the 20% target. Surgical 2 and ED had small decreases in the percentage of parenting leave while Paediatrics

increased from pre-implementation to post implementation at 24 months. Surgical 2 had the largest decrease (7.0%) and Paediatrics had the largest increase (3.1%). At 24 months, all units had similar percentages of parenting leave at (4.2% - 6.5%).

## Total unavailability

In Ireland, unavailability of a maximum of 20% (excluding any maternity leave absences) is considered acceptable (DH 2016).

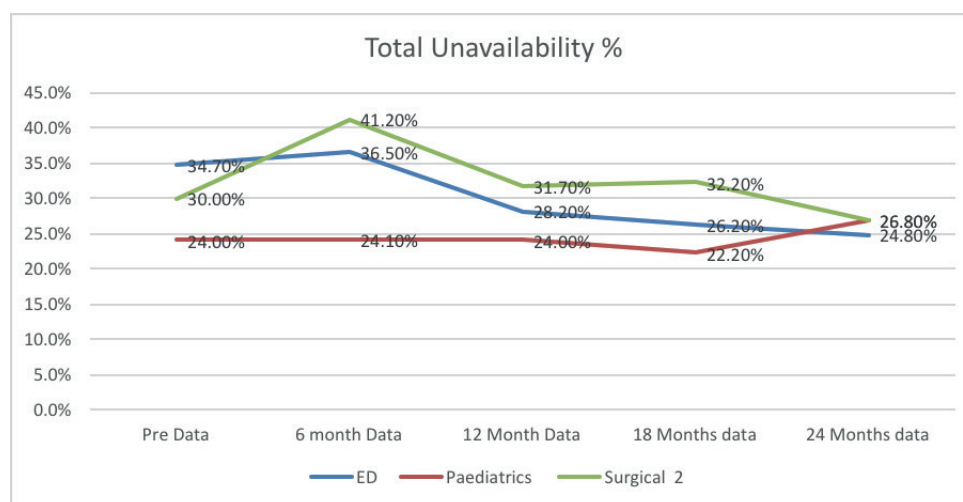


Figure 11. Total unavailability over 24-month period across all 3 units

Total unavailability percentage generated across all data collection points show that all units significantly exceeded the 20% standard (see figure 11). Surgical 2 had the highest percentage with 32.4%, ED with 30.1% and Paediatrics with 24.2%. Furthermore, all three units failed to fall below the 20% threshold at all data points. Percentages decreased from pre-implementation to post implementation at 24 months for ED and Surgical 2 while Paediatrics remained steady with a slight increase at 18 months. The largest increase was found in Surgical 2 between pre-implementation and post implementation at 6 months (11.2%). At 24 months post implementation, all units were similar for percentage of total unavailability (24.8-26.8%).

According to the DH (2016) planned and unplanned absences are a reasonable expectation and should be allowed for to determine nurse staffing and skill mix requirements. It is recognised, however, that maternity rates vary within organisations and as such, the 20% figure does not include maternity leave. In response it has been recommended that "The setting of an absence allowance at organisational level is recommended as organisations will need to increase the allowance to take account of maternity leave rates in their individual organisation" (DH 2016, p43).



## KPI Two: 6-week roster approval rates

The second KPI objective is to provide evidence of the 6-week roster approval rates. For this percentage requested duties and percentage changed since approval data for the three units are presented.

### Percentage Requested Duties

No Irish national standard was evidenced relating to percentage requested duties. An example provided by Allocate Software (2017) indicates “If most rosters have 15% of the roster filled by staff requests, it is expected that 60% or so of the roster would be filled by the Auto Roster – leaving about 25% completed manually. For less complex areas up to 90% of the roster may be Auto Rostered” (p4).

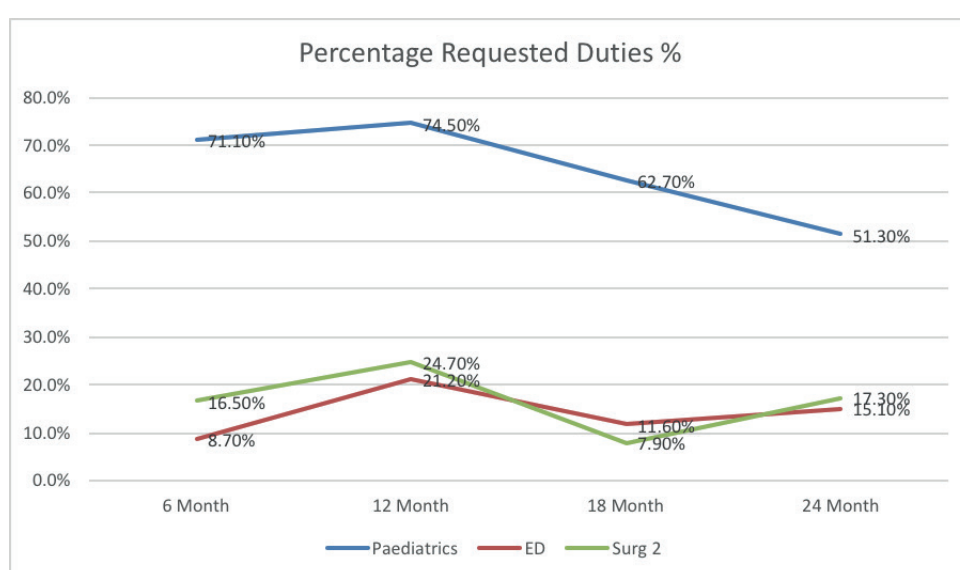


Figure 12. Requested duties (%) over 24-month period across all 3 units

The overall average percentage of requested duties on the Paediatric unit was much higher (64.9%) than Surgical 2 (16.6%) or ED (14.2%) (See figure 12). The Paediatric unit greatly exceeded the 15% threshold. The higher percentage requested duties in Paediatrics unit reflects the self-rostering model that this unit were supported with. The manager/roster creator in this unit, facilitated unlimited requests across the roster 4-week period for all staff. Shifts were requested from core roster demand template. The Paediatrics unit were supported with self-rostering model of rostering, managed by the CNM, as this unit requires specific skills set. There is also an interdependency on staff within the Paediatric unit to fill roster requirements without looking for external resources.

Both ED and Surgical 2 had similar fluctuations across time points and at 24 months. While Paediatrics also had a slight increase from 6 to 12 months, this unit had the sharpest decline in percentage of requested duties from 12 to 24 months (23.2%). ED and Surgical 2 units were supported with the pro rata 4 requests per roster period (i.e. duty requests and days

off/rest days) for all staff as per roster management policy. This limits the requests a staff member can enter via Employee Online. However, it is important to note that a manager can also support staff by manually assigning extra requests where required.

## Percentage Changed Since Approval

No Irish national standard was evidenced, however, guidance from Allocate Software (2017) supporting documentation stipulates that “if it is too low, this indicates that the roster is not being kept up to date, and hence poor data quality. If it’s too high, this too indicates lots of post-approval change, such as shift swaps which can impact on effectiveness and safety. However, they do not define what constitutes too low or too high” (p26).

Once the rosters were fully approved and published for staff to view via Employee Online, it was expected that minimal changes would be required to adjust the published roster. The downward trend reflects continuous roster improvements (see figure 13). However, it is recognised that some post-roster approval changes may be inevitable. The clinical service demand can fluctuate in response to acuity and dependency requirements. Changes to the roster can also occur to support the work-life balance of staff. This was demonstrated by staff swapping shifts, on approval by their manager, after the roster had been published.

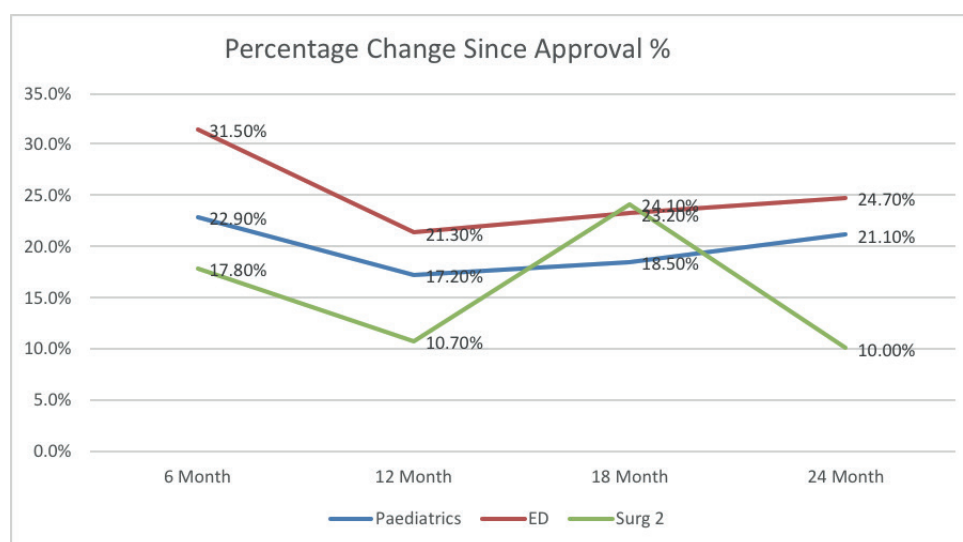


Figure 13. Changes to rostering once approved over 24-month period across all 3 units

Overall, ED had the highest average percentage of change on approval, with 25.2% change, compared to 19.9% in Paediatrics and 15.7% in Surgical 2 across all time points (see figure 13). Both Paediatrics and ED had similar fluctuations across time points. From baseline to 24 months, all units had a decrease in the average amounts of percentage changed since approval. The largest decline was found in the ED unit between 6 and 12 months (10.2%). Surgical 2 had the sharpest increase between 12 and 18 months (7.8%). Reasons for these changes were not documented in the health rostering system. However, anecdotal evidence suggest that such changes were to support staff work life balance needs.

## KPI Three: Loss of contracted hr not used per month

The key objective within this section provide evidence of the roster approval lead times (days) and unused hours (4-week period) percentage.

### Roster Approval Lead time

No Irish national standard was evidenced relating to roster approval lead time. The percentage of fully approved rosters is 100% across all three sites and across all four-time points.

### Roster Approval (Full) Lead Time Days

Roster approval lead time is directed by the LUH roster calendar policy. This policy outlines that lead time target for all rosters to be fully approved and published to staff is 14 days (2 weeks) prior to the first day of the roster to be worked. The roster policy at LUH supports a 14-day lead time to published rosters. However, the Carter Report in the UK (DH 2016) would recommend a six-week lead time to rosters being approved and published. This metric in the UK has been used to demonstrate reduction in bank/agency use with improved planning in roster management

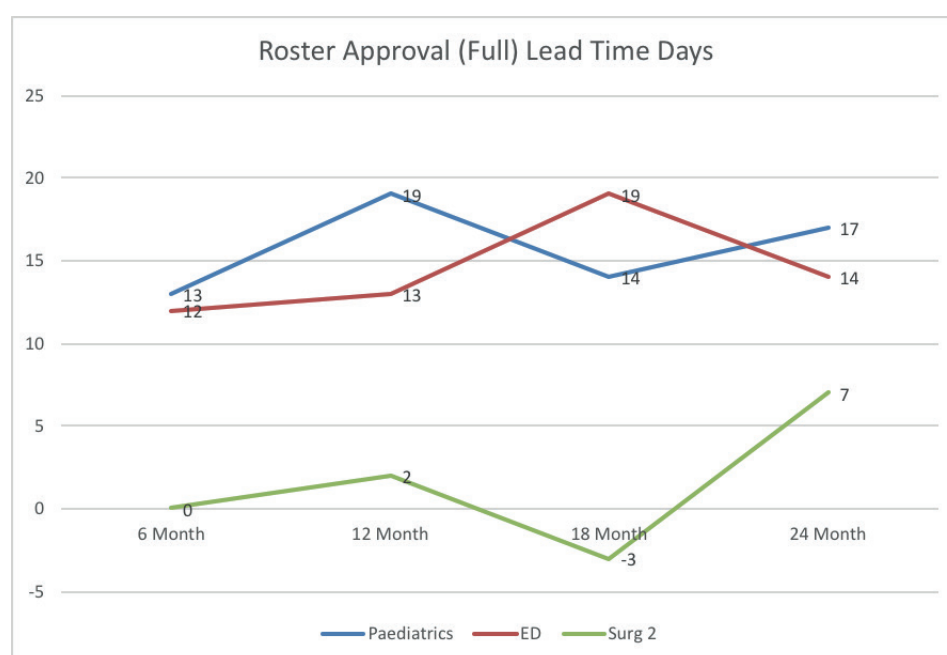


Figure 14. Roster approval (Full) lead time days over 24-month period across all 3 units

Paediatrics (15.75 days); ED had 14.5 days and Surgical 2 had 1.5 days (see figure 14). Lead times in Paediatrics and ED had rates that fluctuated between 12 and 19 lead time days. The Paediatrics unit lead time days were generally low, well below the 14-day lead time. Surgical 2 and ED lead in times fluctuated below and above the 14-day lead time.

## Unused Hrs (4 Weeks) %

RosterPerform metrics descriptors from Allocate Software describe unused hours as “an expressed as a percentage of total contracted hours for the 4-week period” (Allocate Software 2015, no page). No Irish national standard was evidenced relating to unused hrs (4 weeks) percentage.

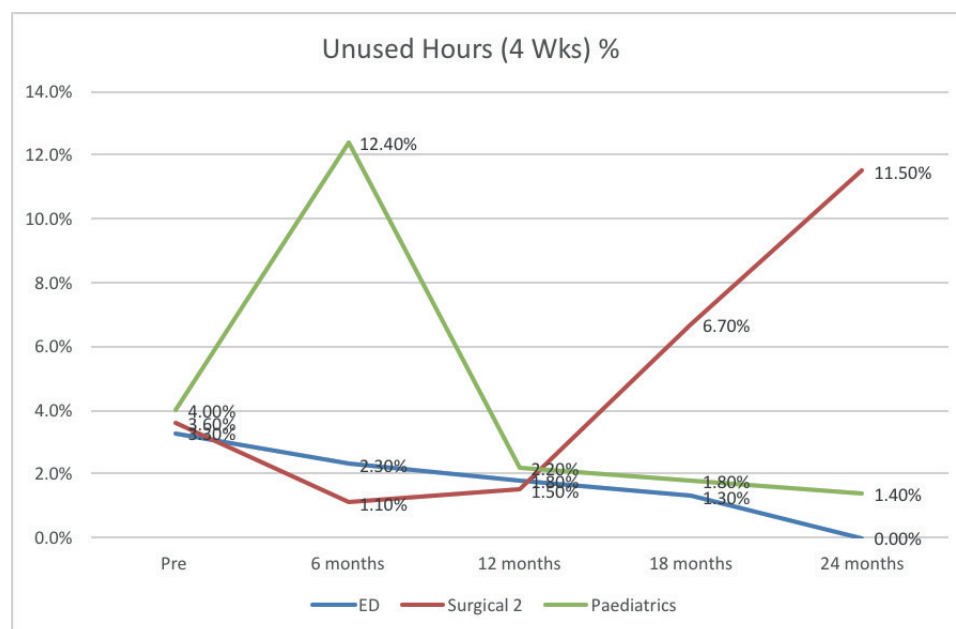


Figure 15. Unused hours (4-week) over 24-month period across all 3 units

Across the Paediatric and ED units, the percentage of unused hours decreased while Surgical 2 had an increase from pre-implementation to final data collection point (see figure 15). Paediatrics had a sharp increase from pre-implementation to 6 months, followed by a significant decrease from 6 to 12 months. Surgical 2 had a slight decline from pre-implementation to 6 months and a sharp increase from 12 to 24 months. It should be noted, that unused hours, per 4-week cycle, were not ‘lost’ hours, as employees observed a rolling net balance to indicate hours owed or owing to the roster.

## KPI Four: Additional shifts (extra hours paid)

The key objective is to report on additional shifts (extra hours paid) and total avoidable costs.

### Additional shifts: extra hours paid

No Irish national standards were evidenced relating to acceptable levels of extra hours paid. Within, LUH it is generally accepted that levels of extra hours paid should be kept to a minimum and reasons for extra hours paid are known e.g. enhanced care requirements, transfers, escalation requirements to support responses to capacity issues. No reference source is available to support this.

## ED (Availability of data January 2-16 – October 2017).

From the analysis of this data, a total of 285 incidents of extra hours paid were approved in this unit during this period (see figure 16). The majority of these were in relation to staff nurse and CNM2 hours (31%, n=86 and 32%, n=90 respectively). Just under a quarter (13%, n=40) extra hours paid claims were from unknown professional background. The remaining 25% (n=69) were made by HCAs.

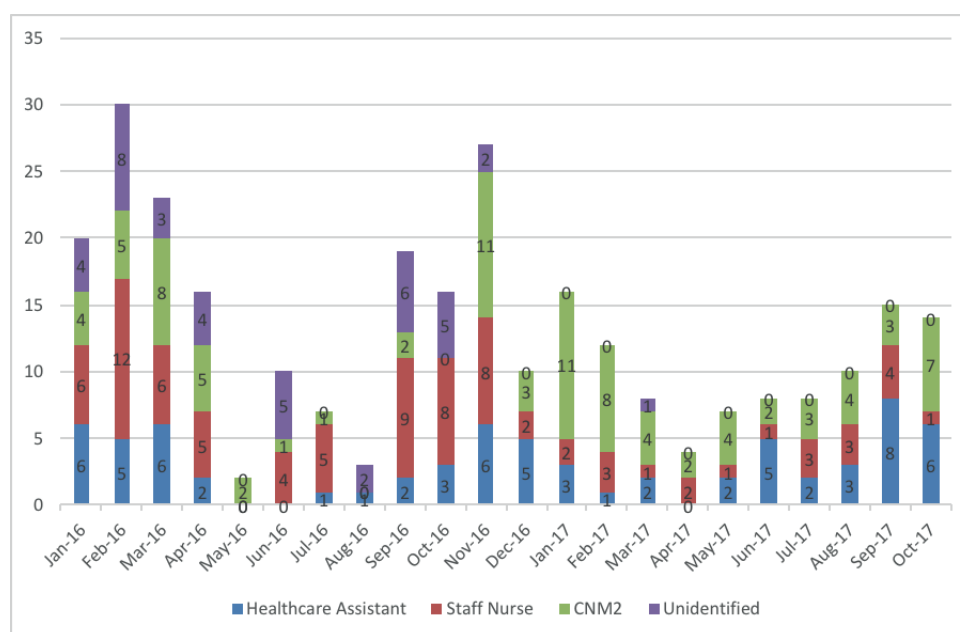


Figure 16. Extra hours paid according to health care professional in ED across period Jan 2016 to Oct 2017

The reliance on CNM2 extra hours paid, and to a lesser extent staff nurse, continued throughout the period of data collection. The number of unknown extra hours paid decreased going into 2017 with no 'unknown' overtime since March 2017. No reasons for extra hours paid requests are recorded.

## Surgical 2 (Availability of data October 2015 – June 2017).

There were 33 incidents of extra hours paid in the 21-month period that data was collected in Surgical 2. From the 33 incidents, two occurred during Oct 2015 – Dec 2015; thirteen took place between Jan 2016 – Dec -2016 and eighteen were recorded between 18 Jan 2017 – June 2017. Most extra hours paid related to staff nurses (46%, n=15) and a third of extra hours paid was unidentified sources. (33%, n=11). HCAs made up the remaining 21% (n=7).

## Paediatrics (Availability of data August 2015 – April 2017).

All incidents of extra hours paid in the clinical setting 'Paediatrics' related to nursing staff and management. No HCA extra hours paid was required in the 20-month period that data were collected. A total of 108 incidents of extra hours paid were accumulated over the 20-month period. An examination of trends shows a slight increase in staff nurse extra hours paid since September 2016 (see figure 17). There were only 3 occasions when CNM2 were required to do extra hours.

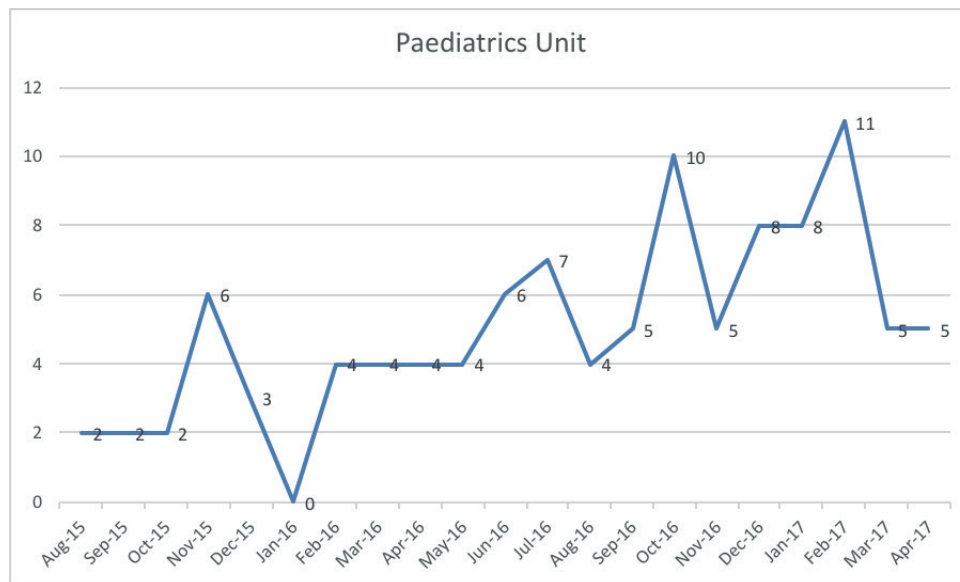


Figure 17. Staff nurses' extra hours in Paediatric unit during period Aug 2015 – April 2017

### Total Avoidable Costs

No Irish national standards were evidenced relating to acceptable levels of total avoidable costs. The calculation for avoidable costs is based on the additional duty cost, wrong grade cost plus net used hours cost.

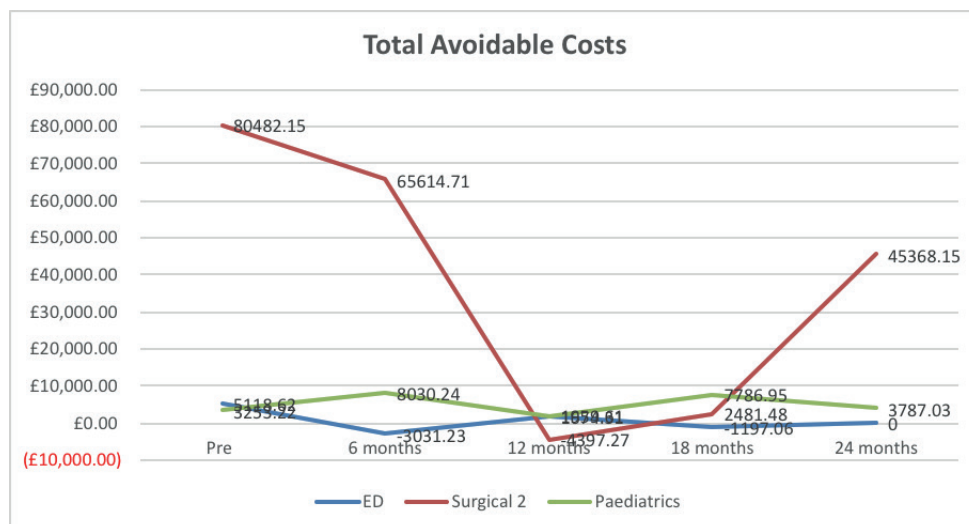


Figure 18. Total avoidable costs across all three sites

Overall, total avoidable costs varied across the three units. Paediatrics remained relatively steady while Surgical 2 decreased from pre-implementation to 24 months. ED had a slight decline from pre-implementation to 18 months. The sharpest decline was found in Surgical 2 from 6 to 12 months which was followed by a sharp increase from 18 to 24 months.

## KPI Five: Auto-roster percentage enable

The key objectives are related to auto-rostering percentage relating to auto-rostering.

### Auto-Roster

No Irish national standard was evidenced relating to auto-rostering. A recommendation from Allocate Software (2017) indicates “a 60% or so of the roster would be filled by the Auto Roster – leaving about 25% completed manually” (p4).

Paediatrics being a specialist skills unit with a stable workforce were supported with their self-rostering model of practice which is attributed to the 0% of auto roster use (see figure 19). Staff who chose to have patterned unavailability auto rostered (e.g. parental leave) were also facilitated in all areas.

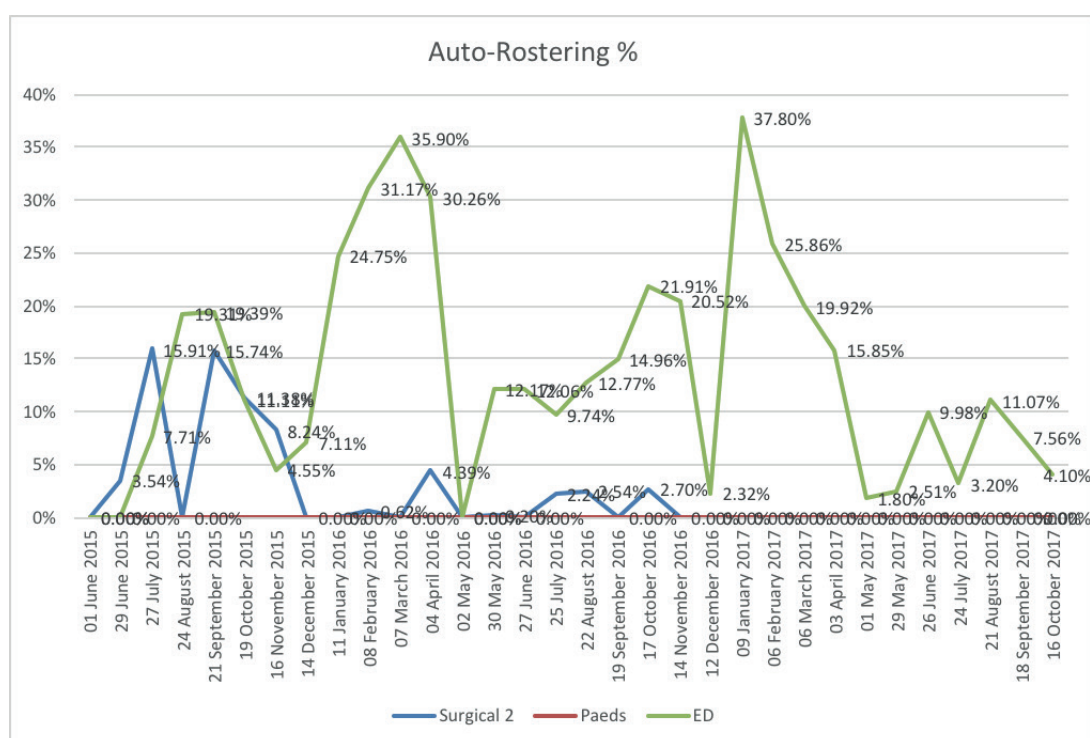


Figure 19. Auto-rostering over 24-month period across all 3 units

Surgical 2 experienced a change in clinical nurse management in early 2016 where staff were provided with re-training and manually assigned shifts on rosters were more evidence during this period. This may have influenced the decline in auto rostering use.

The ED used the auto-roster enabled function best. This is reflected in the personal patterns worked that were supported and facilitated by the CNMs (roster creators).

Overall, there were fluctuations across time points for ED and Surgical 2. ED had the highest percentage (38%) and both units had zero percentage (0%) at various time points (see figure 19). This may be attributed to seasonal trends where service needs and work / life commitments of staff were altered.



## KPI Six: Bank staff requests and reason for booking

The key objective for this KPI relates to the number of bank staff requests to the total bank hours worked, bank staff use and bank request.

### Bank Staff Use

Bank staff total duty hours refers to the percentage duty hours filled by bank staff, indicating a reliance on temporary staffing. No Irish national standard was evidenced in relation to bank staff use.

In October 2015, BankStaff Module was launched to staff at LUH and managed by a BankStaff co-ordinator at LUH. Data extracted from BankStaff system includes:

- actual number of hours requested per unit on a weekly basis,
- the number of hours were filled by available BankStaff,
- what this represented per unit per week in terms of percentage fill, and
- How many hours/percentage of fill performance remained unfilled?

This data also facilitates year on year roster performance and indicates dependency on temporary staffing measures to respond to roster gaps. For example, vacancies, enhanced care needs, unplanned absences (e.g. sickness) to stabilise the nursing workforce requirements per unit.

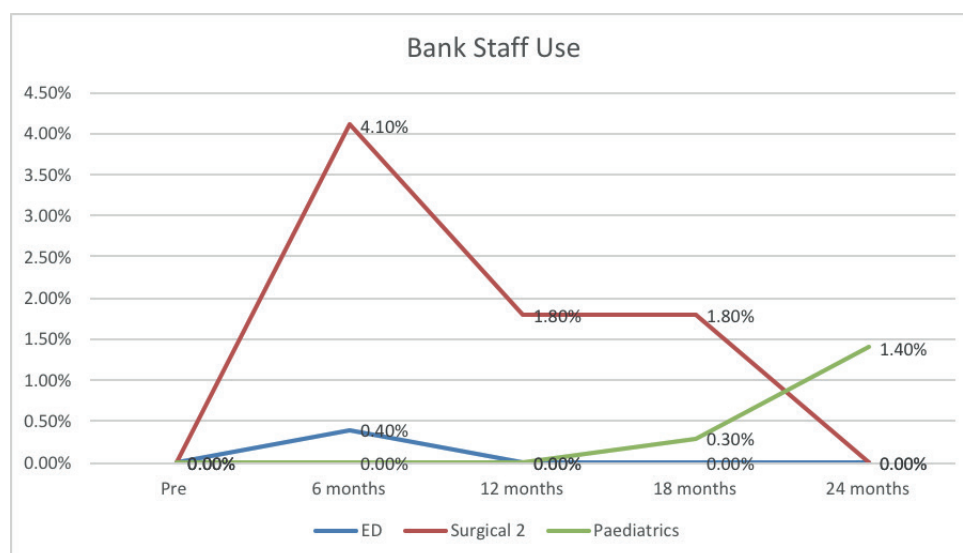


Figure 20. Bank / agency use over 24-month period across all 3 units

Overall, there was an increase in bank/agency use for Surgical 2 from pre-implementation to 18 months (see figure 20). Paediatrics also had an increase, particularly between 18 and 24 months, while ED remained relatively stable from pre-implementation to 24 months. The largest increase was found in Surgical 2 between pre-implementation and 6 months (0-4.1%).



## Bank request

No Irish national standards were evidenced relating to bank requests. A total of 269 bank requests were made across the 3 clinical settings, in the identified period of data collection, with the majority requested by Surgical 2 (81%, n=219); ED with 15% (n=39); and only 4% in Paediatrics (n=11). Each clinical setting commenced data collection at varying start points and collected for varying length of time. Examination of bank requests within each clinical setting is outlined below and is proportionate to available data.

### Surgical 2 (Availability of data October 2015 – June 2017).

A total of 219 requests were made over this 21-month period and this represented a total of 2,343 work hrs. Most requests were in relation to the provision of HCA support (71%, n=156); and the rest relating to RNs (28%, n=62). Only one CNM request was made (see figure 21).

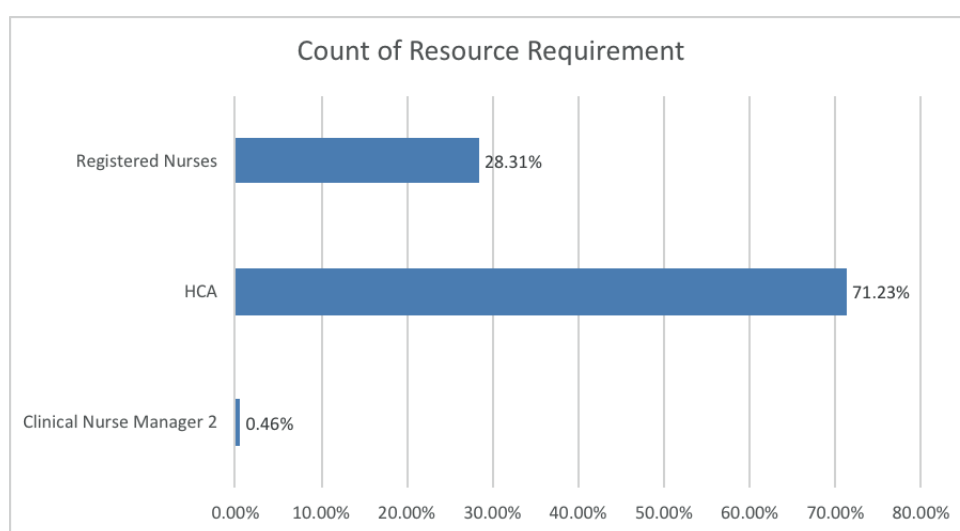


Figure 21. Request of bank staff in Surgical 2 according to job title.

Most reported that bank staff use within Surgical 2 was due to issues relating to high patient acuity (51%, n=112) with the remainder due to sickness (47%, n=103) and vacancies (2%, n=4) (see figure 22).

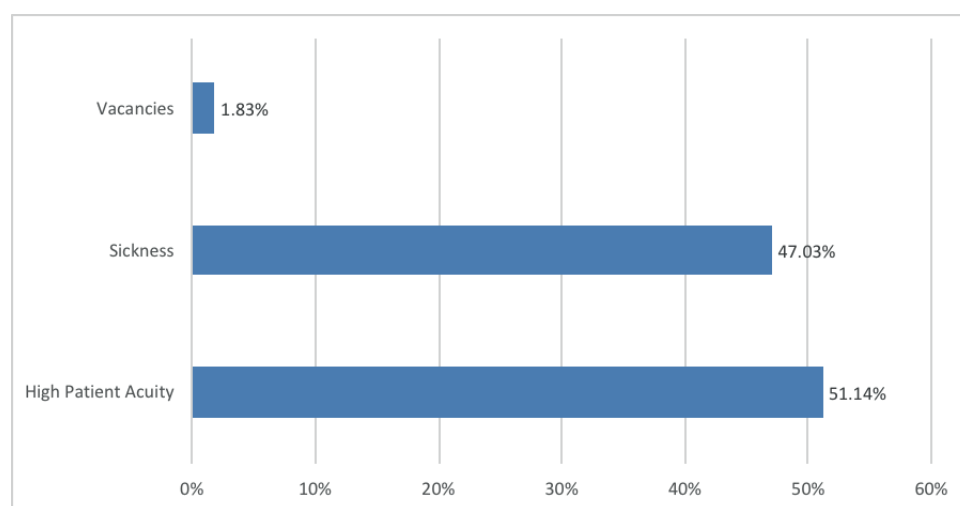


Figure 22. Reasons for bank requests in Surgical 2

Figure 23 shows that by in large, the requests for HCAs always exceeded that of nursing staff across all time points. The highest number of requested bank staff was in April 2017 when 25 requests for bank staff were made (4 RNs and 21 HCAs). Only one request for a CNM2 support was made in March 2017. There were no significant trends on requests across months of the year.

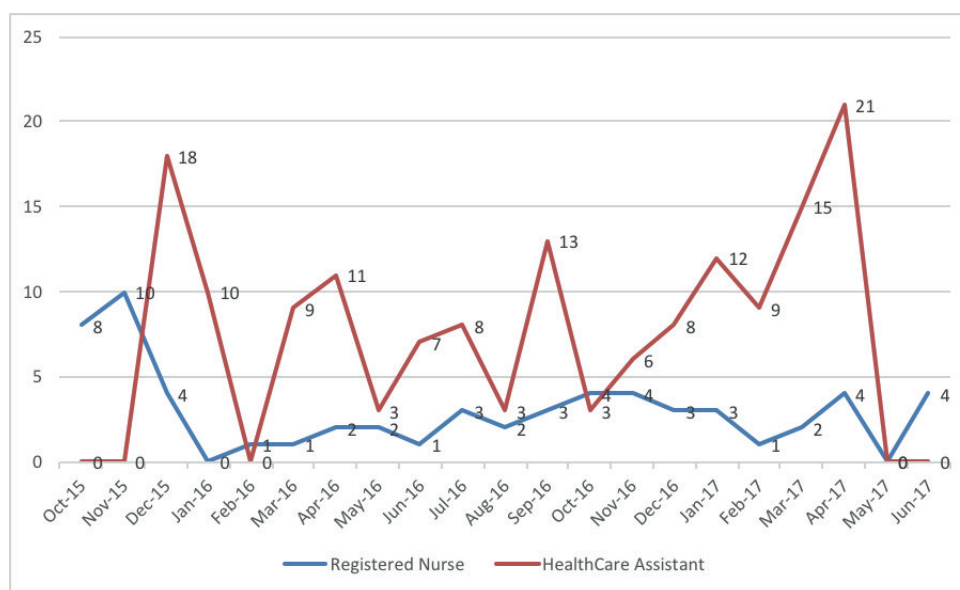


Figure 23. Bank requests in Surgical 2 across period Oct 2015 to June 2017

## CASE STUDIES

The implementation project within LUH consisted of five work packages, broken down into the following deliverables: HealthRoster (with Employee Online), Bank Module, Roster Perform, SafeCare Module and Interface Project. Two case studies were generated to examine two work packages, namely SafeCare Module and Interface Project with SAP HR system. Both case studies will provide a description of the work and an example of a unit using either SafeCare or the live bi-directional interface with the LUH SAP HR. The development and impact of SafeCare was examined in relation to the Gynaecological unit. The evolution of the interfacing Healthsuite project work with the SAP HR system and its impact on the CCU is also described. Key findings are presented for both case studies separately.

## HealthRoster SafeCare: A Case Study

SafeCare provides visibility of staffing levels across wards and departments allowing them to maintain safe and compliant patient care based on patient numbers, acuity and dependency. The software interfaces with HealthRoster. Fully functioning, it can provide SafeCare statistics that can offer information relating to the over and underutilisation of staff, facilitate the redeployment of staff and support bank staff management. In addition, it provides reports that include SafeCare statistics by census, Safety Clues (red flag analysis) whilst supporting safe patient care delivery.

According to Allocate Software (2014) the key benefits of SafeCare are reported as:

- Ensuring correct staffing levels based on patient numbers and needs;
- Provide visibility of staffing levels across wards and directorates in relation to patient numbers and acuity;
- Responds in real time to roster changes, using redeployment and temporary staff;
- Helps avoid over or under-staffing;
- Ensure safe patient care through appropriate information on ward staffing levels.

Theoretically, the principles of SafeCare are sound and well documented in the empirical literature (Royal College of Nursing (RCN) 2012; Rafferty et al. 2007). However, limited empirical evidence exists relating to the actualisation of the benefits.

The key objectives are as follows:

- To support nursing staff to capture actual patient numbers by acuity and dependency and see if their staffing levels match this demand.
- To develop the opportunity to identify escalate and respond to patient safety concerns directly relating to staffing adequacy through documenting Red Flags / Safety CLUEs (Care Left Undone Events).

### Settings

The SafeCare pilot study was introduced to three ward areas that included Medical 2, Coronary Care Unit and Gynaecological unit following a technical and business readiness assessment (see table 18). This case study presents the findings relating to the Gynaecological unit. Advice on suitability of unit / assessment was provided by Allocate Software and discussed at a Steering Group meeting (e-Rostering Research Advisory Group 2015). These 'early adopter' wards allowed the organisation to provide end to end feedback on data, process, training and general readiness. Selection criteria included live units using HealthRoster and BankStaff being operational so that accurate data could be maintained on staff on rostered units.

**Table 18. Technical and business requirement for implementation of SafeCare**

Technical Requirement:	Business Requirement:
Chrome browser available on desktops to run software efficiently	HealthRoster application well embedded and understood by Roster Creators
Adequate number of desktops to be able to enter census information timely- 3 times per day as agreed.	The Roster Template demand: having the correct staffing compliment/ demand agreed with nurse management critical as a starting point.
	Proactive Operational team and senior nurse management team

Within SafeCare roster, demand templates are used for setting up a ward's shift and skill requirements and to specify how many staff are required on each shift on each day of the week. Demand templates enable duty requirements to be created that are: skill specific, grade specific and team specific according to mandatory or optional skill requirements. These demand templates are critical to rostering safely in each unit.

Analysis of secondary data revealed the following timeline for SafeCare:

- A project launch was undertaken of 'SafeCare Project Kick Off' in September 2015 to prepare for project mobilisation and agree approach to measurement of safe staffing.
- During October 2015, operational day and night managers received training in the use of SafeCare.
- In December 2015, the first on-site training session was delivered to CNMs and front-line staff from the three units. Attendees were introduced to the system, data entry, sunburst views and guided in how to use data operationally.
- In 2016, the project was placed on hold due to significant issues relating to stabilising workforces and the publication of Irish guidance relating to potential issues identified by the SafeCare system.
- In the first quarter of 2017, the introduction of SafeCare to the Gynaecological unit occurred. The aim was to establish and test the operational processes required to use the application prior to any scale up of the implementation – essentially to provide a proof of concept. To facilitate implementation, training was provided to front line staff within this unit on how to complete the Safer Nursing Care Tool and to understand dependency scores. Internal validation of scores were tested by having staff from the same unit to score the same cohort of patients.

## Measurement of Acuity of Patients

Having an agreed acuity and dependency tool to collect patient acuity and dependency was deemed critical to the success of the implementation. The Safer Nursing Care Tool (SNCT) was developed to help measure patient acuity and/or dependency to inform evidence-based decision making for staff (Kirby and Hurst 2014). Originally developed by Fenton and Chapman (Fenton and Casey 2015) and subsequently updated by Hurst (The Shelford Group 2013), it is a NICE (2014) endorsed tool and has been used extensively across the UK within a range of wards/specialties. Kirby and Hurst (2014) reported its general acceptability particularly in acute hospital settings. However, Fanneran et al. (2015) reported criticisms among users regarding its usefulness mental health and learning disabilities units. The procedure for using the tool was:

- Senior staff were trained in the completion of the SafeCare Acuity & Dependency tool (SCADT) prior to assessment.
- Data Collection (census periods) were undertaken at 3 times per day (7.30am, 12.30pm and 7.30pm).
- Data inputted to SafeCare and dependency levels calculated.
- Findings adapted to an Irish Setting (see following section).
- Safety CLUES (Care Left Undone Events/Red Flags) relevant to an Irish context were identified and agreed (see following section).

The tool provides 'multipliers' to translate patient acuity and dependency into staffing requirements. The ward establishment is then set, based on staff required, to meet the average care requirements.

## Configuration to an Irish Setting

It was necessary carry out configuration adaption in order that SafeCare reflected the Irish health care system (see figure 24). Two issues required recalibration:

- (1) Whole Time Equivalent (in the UK, one RN WTE = 37.5 hours per week whilst in Ireland one RN WTE = 39 hours per week)
- (2) Safety CLUES (Care Left Undone Events/Red Flags). (See page 133 for list of specific recalibrations made for the Irish context outlining descriptors of the 'Safety Clues' which are the 'Red Flags' in SafeCare).

These were aligned with Irish Department of Health (2016) Taskforce recommendations and tasks were identified as recognised 'tipping points'. Tipping points reflect workload that is beyond any daily planned activity.

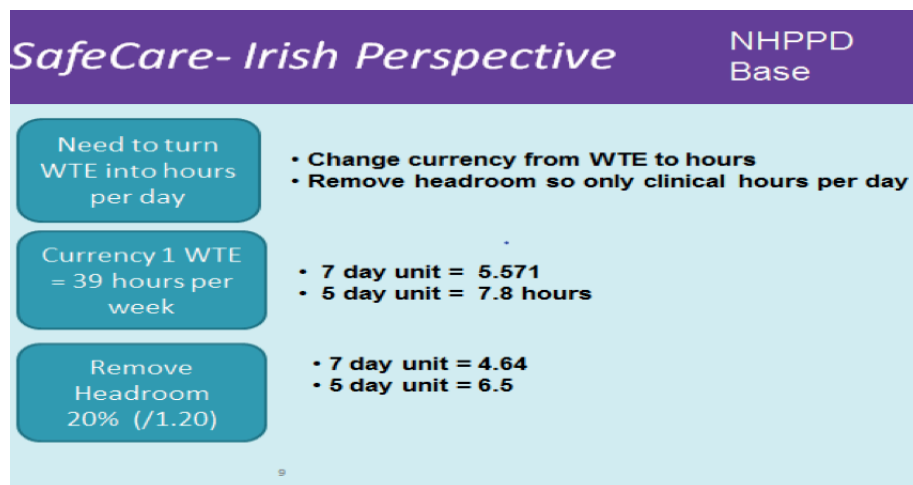


Figure 24. Conversion of WTE to Irish settings

Below is an example of a one-week view of dependency levels in the Gynaecological unit in May 2016, based on the patient measurement protocol. The findings show that most patients had acuity levels of '0', with relatively few patients having 'Level 2' and 'Level 3' (see figure 25).

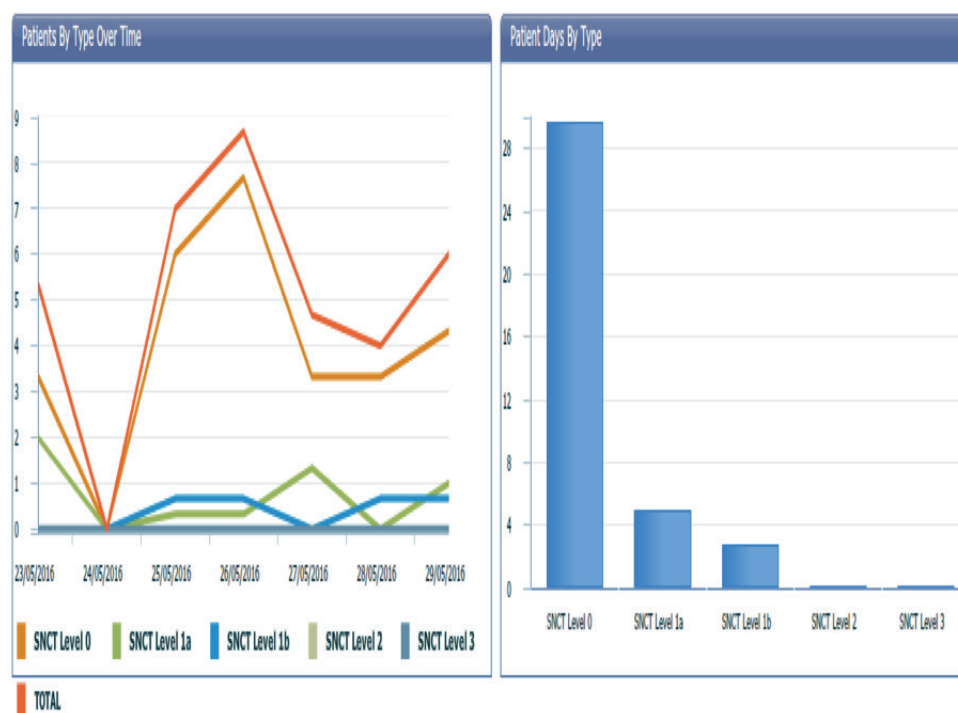


Figure 25. Dependency levels of patient requirement and acuity in Gynaecological unit

As shown in figure 26, the number of actual staff hours provided on the ward for each day compared to the number required shows a substantial mismatch. In some cases, more than two and a half times the staff hrs required to deliver safe care was being provided by nursing staff. The surplus margin between hours required and hours provided never fell below 50% access. On one instance, bank nurses were employed on the ward however, data indicates that staff hours exceeded the nursing care required to provide safe care based on patient acuity.



Figure 26. The required vs actual hours for staff on Gynaecological unit

The findings from this example show the potential of the system to clearly identify the parity of staff availability and patient's demands. The yellow shade identified cover the Bank Staff.

The SafeCare application highlighted the need to critically evaluate staffing requirements in this unit. The Gynaecology unit not only provides service to in-patient acute surgical patients, but also facilitates clinic services for patients presenting upon referral from GP's as Ward attenders and ED reviews etc. It became apparent that the staff required to provide care to these clinic services on the Gynaecology unit were to be excluded from the SafeCare calculations to give a true reflection of the actual nursing hours available at ward level to provide care to those patients in the in-patient beds. So, whilst on the same budgeted roster for the service, some staff were to be excluded from this calculation. The SafeCare application was subsequently configured to reflect this in the units.

### Care Left Undine Events (CLUE) Adaption

According to the Irish Department of Health (2016), CLUEs are defined as missed care events referred to as "Safety CLUE's" and include:

- Inability to provide adequate patient surveillance (e.g. post-operative, post procedure, falls risk.
- Inability to carry out vital observations in accordance with parameters set out by National Early Warning Score.
- Delay or unplanned omission in providing patient medications.

- A delay or unplanned omission in supporting patients with necessary physical needs such as washing, toileting, eating and drinking.
- Missed meal breaks by staff.
- Delay or omission in recording clinical practice / developing and updating care plans.

The SafeCare package provides a running total of the Safety CLUE incidents over a 12-week period, as well as classifying the nature of the breaches in safe care, which day of the week they are most likely to occur and time of the day (see figure 27).

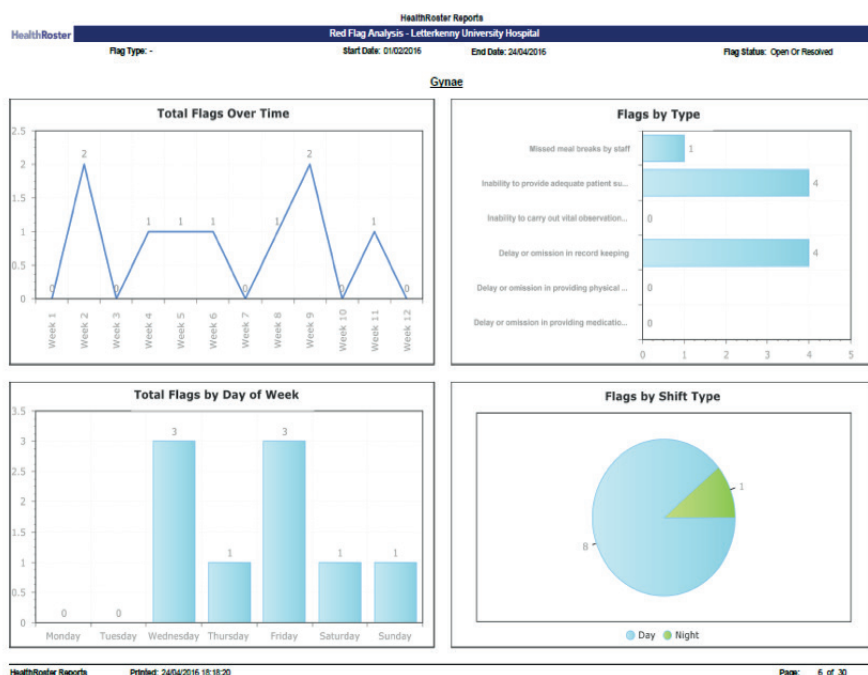


Figure 27. Care Left Undone Events (CLUE) over a 12-week period

Analysis of the data revealed that Wednesday and Fridays were the days when CLUE's were most likely to occur. There were no CLUE's reported on a Monday or Tuesday. The most likely reported CLUE's were 'inability to provide adequate patient surveillance' or 'delay or omission in record keeping'. There were five weeks (out of 12) that no CLUE's were reported. In addition, the majority of CLUE's were reported in daytime hours.

## Establishment of Safety Identification and Response Protocol and Pathway for Escalation

- A HCA or a RN can open an event register regarding a CLUE onto the online system via the staff nurse. The nature and timing of the CLUE event is recorded, and the event can remain live until satisfactorily concluded.
- The CNM's in each area can review CLUE events, and status of same, every Monday morning when worked Rosters are being finalised and action as necessary. A CNM can feedback to the originator of the event (see figure 28).



- A CNM's can print off trends / unit specific reports with metric information to share with staff.
- A CNM3 and/or Line Manager can review trends every 6 weeks (or more frequently if necessary) with all CNM's in that Division.
- Monthly feedback can be provided at Senior Nurse Management Team Meetings of Red Flag events via Divisional Report to the Director of Nursing.
- From this group, information can be escalated to Hospital Executive Board, if necessary.

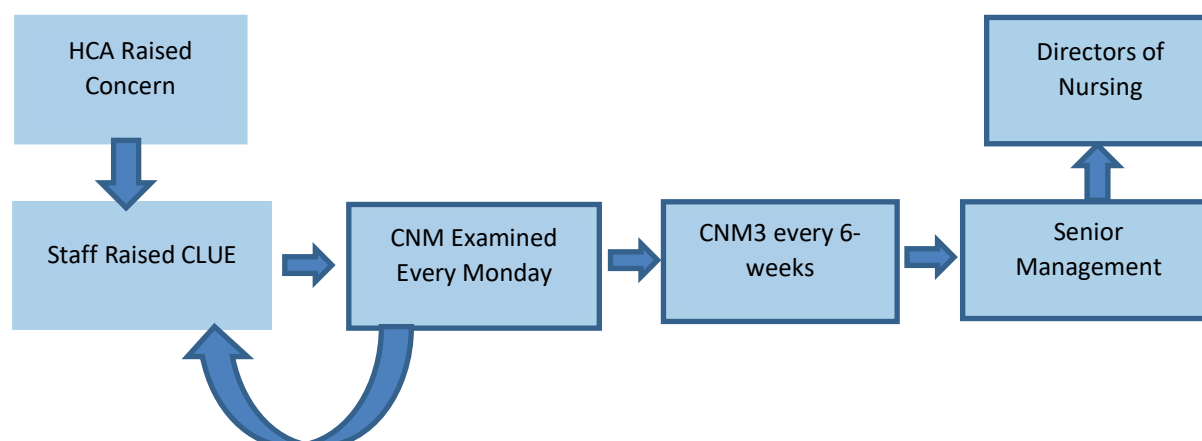


Figure 28. Pathway for identification and escalation of CLUE's

## Conclusion

This was a pilot scheme conducted in a single unit and the findings reported here are useful in presenting an illustration of the SafeCare system and the type of evidence the system produced. As a proof of concept, it is a very positive exercise, but will require project support, commitment and resources to progress with a scaled-up implementation at the hospital. It must be recognised that this is an ongoing project and data continues to be collected on the acuity and staffing levels. LUH is currently in implementation phase of HealthRoster, and hospital wide SafeCare approach is planned to operationalize daily staffing management with SafeCare application. Further examination, therefore, of more up-to-date evidence is required.

The collection of Red flags / Safety CLUEs has been postponed, whilst national guidelines are developed to deal with the identification and escalation of these. In conclusion, SafeCare supports nursing staff to capture actual patient numbers by acuity and dependency, and pair staffing levels against this demand. Fully functioning, this system can provide statistics that inform over- and under-utilisation of staff, facilitate the effective redeployment of staff and supports the proper management of bank staff to maximise impact.

## Interface Project integration with SAP HR: A Case Study

This second case study focuses on the interface of HealthRoster with payroll and salaries system within LUH. Data were extracted from existing documentation and databases relating to the introduction of Payroll in CCU. These included:

- Interfacing Healthsuite pre-engagement documentation.
- Interfacing Healthsuite Specification and Proposal agreed documents January 2017.
- Human Resources/ Payroll Systems Analytics (HPSA) project sign off and disengagement October 2017.
- LUH User acceptance testing and interface activation readiness for formal project sign off Nov 2017.
- Allocate Software (January 2016) Interface Activation Readiness Sign Off.
- Health Business Services (2017) e-Rostering Pilot Project HR/Payroll Systems and Analytics Project 126 report.
- Allocate Software User Acceptance Testing Sign Off (2017).

The full integration of health rostering system and Salary and Payroll in Human Resources aimed to:

1. Provide a seamless process from rostering, time and attendance recording to payroll;
2. Significantly reduce the time spent on manual record keeping; and
3. Provide a system that is fully integrated with SAP HR and Payroll to generate correct payroll payments.

### Timeline of Key Events

Work on the integration of the systems commenced in January 2016. This work involved Allocate Software, the HSE Health Business Services (HBS) and Human Resources and Payroll within the HSE. Early work focused on the identification of the capacity and compatibility of the IT systems to accommodate the Allocate Software systems, digitalising personnel details, skills sets and training and the readjustment of contractual details (data cleansing work, business process mapping).

The establishment of a bidirectional relationship between the 'Black Box' interface provided by Allocate Software required: secure server connections, the development and tailoring of software to support this transfer, and the testing of those processes.

Significant tasks were required in the completion of the payroll system:

- Development of an outbound and inbound interface between HR and Payroll to interlink with the HealthRoster system.
- The installation and set-up of appropriate hardware and software to facilitate the new interface.
- Establishment of secure data transfer link.
- The digitalisation, management and updating of human resource records and the reorganisation of organisational structures (a principle of 1:1 employee/position relationship in the organisational structure was a prerequisite for interfacing with HealthRoster).
- Testing the interface prior to going live.
- Training of relevant personnel to ensure the quality of the information entered and the maintenance of the system.

Significant Dates in the development and rolling out of Payroll system were as follows:

- Proof of Concept: Oct 2016,
- Business test scripts workshop with HR, SAP HR, Finance, HPSA November 2016,
- Business test script development January 2017,
- Business testing Jan – June 2017,
- Parallel runs June – July 2017,
- Evaluation Parallel runs July 2017,
- Go-Live August 2017,
- Go-Live support Aug- Sept 2017.

### **Justification for the integration of the Payroll system**

In the CCU, total avoidable costs fluctuated over the 24-month period (see figures 29 and 30). Negative costs were accrued in the period from May 2016 and December 2016 to May 2017 (apart from March 2017). Avoidable costs quickly rose again before spiking in September 2017 before dropping off again at the close of 2017.

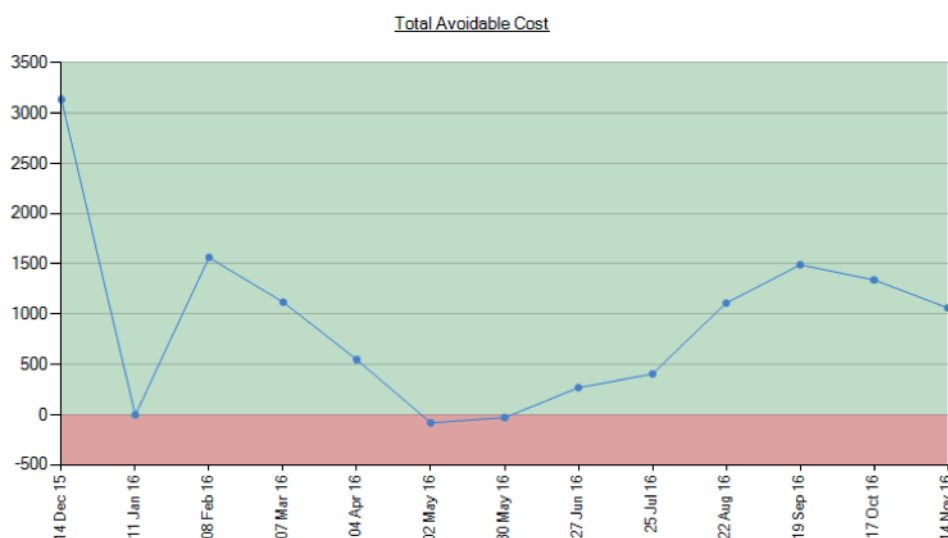


Figure 29. Total avoidable costs for CCU Dec 2014 – Nov 2016

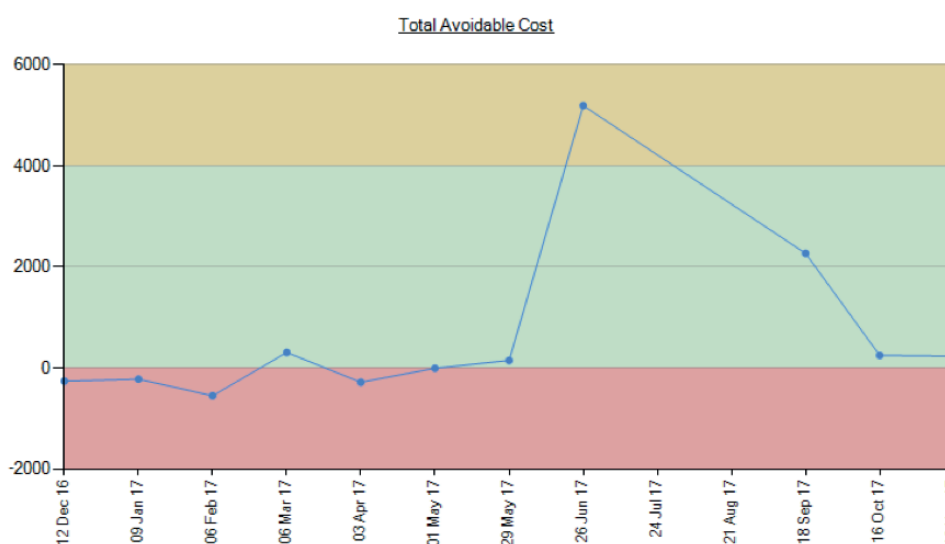


Figure 30. Total avoidable costs (£) for CCU Dec 2016 – Nov 2017

The evidence shows that there was a capacity within CCU to reduce costs. One area of potential savings was the percentage of unused hours (4 weeks). The number of unused hours for four weeks indicates the loss in service attendance or absence hours from staff who are substantive to a unit. Basically, these are paid hours that are not reflected on roster. Efficiency in roster management will minimise any unused hours in any given period and maximise staff available to deliver care to meet demands of service.

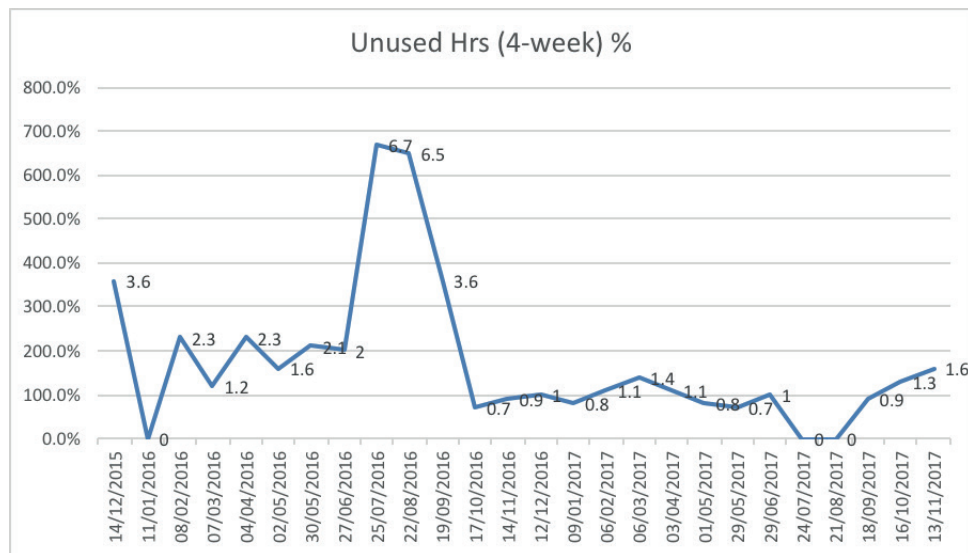


Figure 31. Percentage unused hours per 4-week period in CCU

In the CCU, the overall percentage of unused hours was relatively low (see figure 31) however, there was still capacity for improvement. The highest score was 6.7% (July 2016) but there after the percentage does not exceed 2% for the remainder of the period.

Further examination of data derived from a standard 4-week period shows that all additional duty hours were in relation to HCAs and occurred on night shifts between Saturday to Monday:

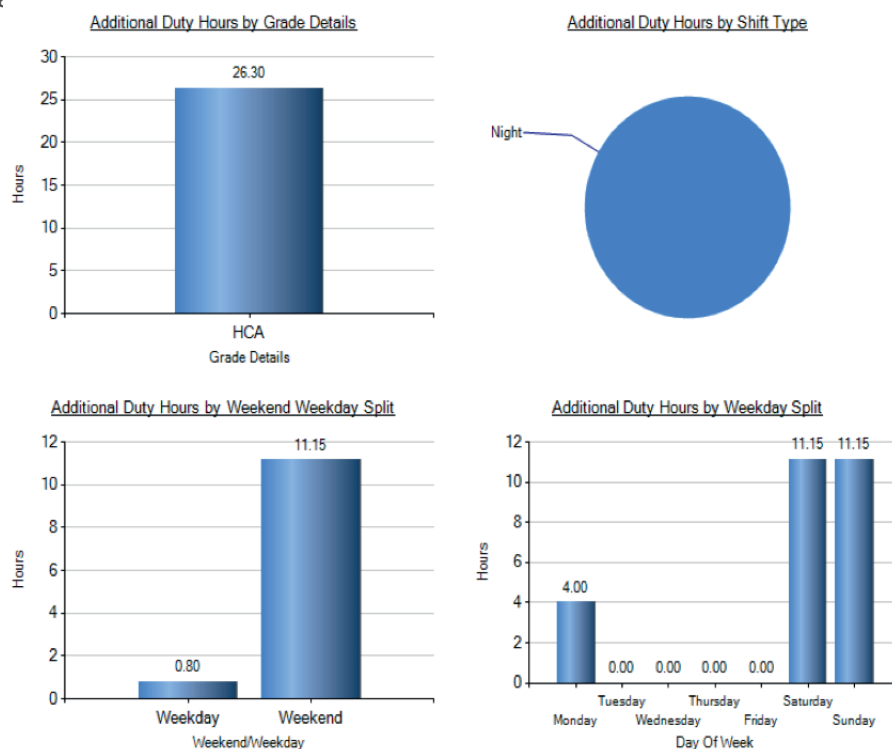


Figure 32. Breakdown chart of additional duty hours for CCU by grade and weekday split

Reason for the additional duty hours amounted to 26.3 hours (see figure 33). The data extracted only presents the patterns of reasons, not a description of why additional duty hours occurred. Additional duty hour's reason logged in the system as 'unknown' reason. This has prompted staff to be more specific about reasons additional hours are created in a roster. Nevertheless, an avoidable cost has been identified. HealthRoster's avoidable / legitimate split' report in additional duty hours can also support future service requirements as legitimate additional hours can map trends in service demands and support development of business cases.

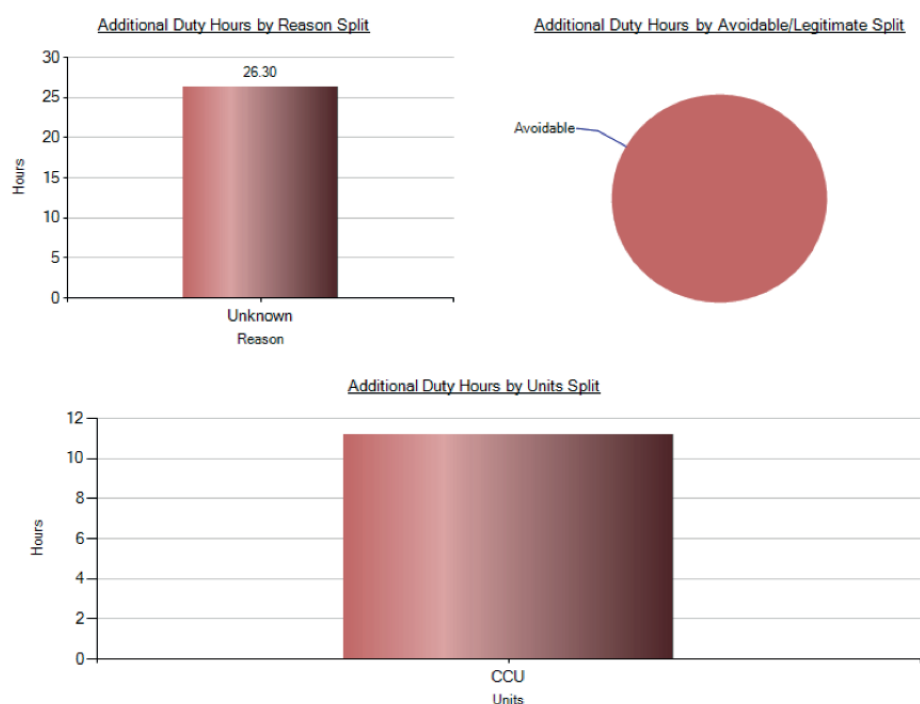


Figure 33. Breakdown chart of additional duty hours for CCU by reason and unit

The integration of the SAP/HR Payroll system permits the production of a strong evidence-base to identify the extent of avoidable costs. In addition, it also facilitates examination of where potential savings may be made, such as in the maximisation of unused hours for staff and/or the reduction in additional duty hours.

### Current Position of Payroll system

As of September 2017, from the 25 units in LUH pilot, 18 are live on the HealthRoster system and two are fully integrated in the SAP HR/Payroll system. The initial testing of the two units commenced in Sept 2017. The initial testing of both occasions was closely monitored by the HPSA, HBS and e-Rostering team to ensure satisfactorily roll out of the project.

## Conclusion

The rolling out of the payroll system was a complex task that involved significant contribution from National ICT, Network and Server Management, HR, HPSA, and other organisations. It has proven challenging at times and there have been significant issues such as data cleansing work in HR and business process mapping work. Evidence from the HealthRoster show a need to reduce avoidable costs and maximise output. Further monitoring of the Payroll system is required to examine its impact on helping reduce unused and avoidable costs.

### Summary of key findings

- There is a clear lack of Irish national standards upon which to measure current performance indicators.
- Examination of annual leave, study leave, sickness and other show that total unavailability exceeds 20%. Further investigation into variability across units on the contributors to total unavailability (sick leave, parenting leave etc.) may provide insight into reasons for this.
- Generally, as the e-Rostering system has become more embedded, staff have requested less changes since approval.
- There was considerable variability in the percentage of unused hours within units over time. Further investigation to the reasons for the variability is required.
- CNMs and HCAs make up a major part of staff overtime, however the reliance on overtime has decreased over time.
- Paediatrics being a specialist skills unit with a stable workforce were supported with their self-rostering model of practice which is attributed to the 0% of auto roster use.
- Bank staff use was generally low and in response to high patient acuity and/or staff sickness. The need for HCAs made up the main bulk of requests for bank staff.
- As a proof of concept, SafeCare provides strong empirical evidence to match staffing levels with patient acuity levels. However, to be effective it must be responsive to acuity and/or staffing changes and supported by a structured system for addressing Care left undone events (CLUE).
- Interfacing Healthsuite project that provided the bi-directional interface between the SAP HR system and HealthRoster has highlighted the quantitative information available to CNM's at ward level to maximise efficient use of resources available for their services.

## SECTION 6

# Conclusion & Recommendations

This is the first study in Ireland that has evaluated the implementation of e-Rostering for a healthcare workforce. Implementation consisted of five work packages, broken down into the following deliverables: HealthRoster (with Employee Online), BankStaff Module, Roster Perform, SafeCare Module and Interface Project. This work programme has been a substantial undertaking, in terms of the scale and capacity to manage the change. The implementation experience has been a collective learning process which has been influenced by several inter-related factors including organisational and technical factors, human skills, organisational structure, technical infrastructure, leadership, financial resources and change management process.

Overall, the vision of introducing e-Rostering was primarily driven by the promise of an effective solution for organising the health care workforce, streamlining systems and thereby improving quality, and efficiency of care. However, shifting from a manual 'staff-oriented' roster, to an advanced computerised system based, on algorithms and patterns, is a phenomenon that is still unfolding for LUH. Overall, it was found that e-Rostering implementation did not occur in discrete phases, rather it is an ongoing process with overlapping stages that occur simultaneously and involve a wide variety of activities and stakeholders. To achieve the potential benefits, it is likely to be an incremental and interactive process that unfolds over time. This report, therefore, represents an evaluation of the initial learning phases of the implementation process. It highlights the organisational environment and conditions under which e-Rostering was adopted, beginning with the enablers which influenced the decision to invest in the technology, through to engagement, early implementation experience and ending with reference to preliminary use.



The results suggest that this process has resulted in a significant amount of change within the organisation. In addition, to the technical learning requirements, employees, managers and the organisation, have had to learn how to approach rostering in dramatically new ways. This has impacted not only on the existing system structures but also the nature of the relationships between staff.

This report offers an insight into how front-line staff perceived and interacted with the new technology. From the data sets (staff survey and focus groups) a range of benefits and challenges were discovered with a strong emphasis on impeding and facilitating determinants on a user level. Factors related to successful implementation include, ease of use, sufficient training and support available for front-line staff, access to technical support, positive staff attitudes and beliefs, leadership support, staff champions and evidence of the advantages of the new system. In addition, most front-line staff reported they felt confident interacting with the online rostering system and praised its usability. Perceived barriers included: limited engagement and consultation, lack of assessment of prior skills and recourses, unstandardised training and a lack of communication regarding e-Rostering benefits and consequences on work practice.

Organisational change was viewed as being imposed via a top down management approach and led many stakeholders to question the efficiency and economic effectiveness of the e-Rostering system. Negative perceptions were linked to those occupying more junior roles, indicating a negative climate for implementation in those groups. Interaction with the technology was reported to be straightforward to use and convenient and this enhanced the uptake. However, criticism of the technology centred on the operational setup relating to the number of requests by each staff member and an inability to see colleagues' requests which influenced how participants interacted with the technology. All front-line staff identified several adjustments or additions to e-Rostering technology or the implementation process that they felt would enhance engagement, for example, the provision of information days throughout the project's lifespan.

Findings from key stakeholders suggest that there were many different translations for the overall vision of e-Rostering. Whilst a national scoping study was undertaken prior to the implementation, no internal scoping, economic evaluation or consultation exercise was undertaken prior to the implementation within the LUH. Many believed this had repercussions for the development, implementation and engagement process. The provision of adequate human, financial and technical support was acknowledged as integral to the success of the implementation and the continuing maintenance of the system. However, inadequate resources were recognised as diminishing the process of implementation and questioned future roll out.

Overall, a lack of consultation, transparency in how and why decisions were made and role clarity among stakeholders resulted in misunderstandings and gradual disengagement from certain business functions that required further senior management facilitating and navigating communications to progress project through challenging processes. This had consequences on the delivery of the work packages and was perceived as a barrier to

implementation; for example, the interface project was considered a complex programme of work. Whilst it was recognised from the outset that successful implementation relies heavily on integration with other existing systems, there was a lack of engagement and appreciation of the time and resources needed to undertake this. Despite this, valuable learning has occurred and has resulted in LUH providing a blueprint for the integration of HealthRoster to SAP HR payroll in Ireland and has demonstrated the importance of engaging and harnessing the energy and knowledge of experts from the outset. External factors have also compromised the implementation process, for example, a lack of specific national policy to guide the measures and actions of the SafeCare work programme was reported. Unsurprisingly, the importance of e-Rostering aligning with Irish government policies to guide health care delivery was particularly highlighted.

Analysis of secondary data from HealthRoster datasets demonstrate that it can provide an overwhelming amount of 'live', easily accessible management level information. The e-Rostering system provided a very strong evidence base of metrics at unit, directorate and hospital level: thereby enhancing visibility, efficiency, accuracy and accountability. The provision of such organisational intelligence has the potential to provide managers with the knowledge base upon which to strategically evaluate strengths, and, more importantly weaknesses. The findings reported from the analysis of datasets indicate that HealthRoster is still in the process of being embedded among staff members, policy and systems within LUH. The lack of evidenced Irish national standards upon which to measure current performance indicators requires attention. At present, the extraction of the data helps to ensure proof of concept, demonstrating the capabilities of e-Rostering software within selected units in LUH. Implementation of e-Rostering does not, by itself, guarantee that it will be used in a manner that leverages its full potential. The need to move beyond the technical aspects to a more strategic and analytical model of usage which is embedded in practice, processes and culture is required. At a strategic level, therefore, LUH must carefully consider how best to make use of the knowledge captured.

In conclusion, the implementation of e-Rostering requires technical, social, organisational and economic support, underpinned by a clear implementation and communication strategy to ensure success. e-Rostering, therefore, is not a function undertaken in isolation, rather it is only as good as infrastructure that supports it; the organisations wider systems, the leadership, staff engagement and investment in technology. To be successful, it must sit at the heart of the organisation to ensure its effective and appropriate utilisation.

## Limitations

Whilst this study provides an insight into the implementation process and experience, it was conducted in a single, largescale hospital, therefore, the findings may not be generalisable to all settings. In addition, frontline staff and key stakeholder participants were purposively selected by representatives from the implementation team and Research Advisory Group. This sampling strategy may have biased the results. Finally, findings are derived from participants' perceptions rather than actual data on effective implementation; mitigating this, saturation of themes was reached via a large sample of participants.

## Recommendations

Based on a consideration of the information gained in this study and implementation literature (Cresswell et al. 2013) the following recommendations are outlined. Collectively, they are relevant for future organisations implementing e-Rostering.

- 1 **Assessment:** To ensure (or help) early re-alignment with the implementation strategy, a structured assessment prior to implementation is recommended. Such efforts should include a detailed preliminary assessment of implementation requirements, a review of organisational capacity, economic implications, and relevant external factors.
- 2 **Shared vision:** It follows that implementation may be more effective when the aim, requirements and benefits are conceptually unified between all key stakeholders.
- 3 **Engagement:** Overall, staff buy-in and standardisation of training are essential to engaging staff, ensuring their ongoing participation and support, while giving them the tools and information they need to use the technology effectively. Involving stakeholders from the beginning, sharing information and building trust is vital to facilitate the partnership required for the implementation process and the avoidance of silos occurring.
- 4 **User-centered design:** Ensure the intended users are included in the design stage. Involving front line staff in analysing specific determinants that play a role in their interaction with e-Rostering could have a profound influence on the acceptance and success of the software.
- 5 **Resource planning:** Implementing health information technology is a complex, resource heavy, process that requires appropriate allocation of human, material and financial resources at all stages of the implementation process (conception, adoption, implementation, maintenance and evaluation).
- 6 **Embedment:** Time to harmonise, evolve and mature the e-Rostering system with existing processes and practices is required. The need to move beyond the technical aspects to a more strategic and analytical model of embedded usage is also recommended. At a strategic level, therefore, the hospital must carefully consider how best to make use of the knowledge captured.

**7 Organisational intelligence:** The evidence presented here show that the e-Rostering system provides a very strong evidence base for hospital performance at multiple levels within the hospital. The e-Rostering system is a new and key decisions in its effective management are required. These include:

- Clear Irish national standards need to be identified and adapted to help measure performance against, rather than across data collection time points. This would help identify areas of concern.
- A protocol for extracting, monitoring and highlighting findings, and comparing them against national standards would help the identification of areas that may benefit from strategic and informed interventions, as well as, providing a method of monitoring change over time.
- The potential of the e-Rostering system to provide in-depth KPI information requires its effective management to prioritise what information is required, how often this information is extracted and who best to receive the information.
- A clear procedure for the extraction and reporting of KPI findings from the database may help to maximise hospital wide performance and potential, whilst also helping to significantly reduce costs.

**8 Further evaluation:** The implementation of e-Rostering is a phenomenon that is still unfolding, and consideration for a prospective, longitudinal design should allow for discrimination between transitory and more sustained consequences of implementation and a full adoption and integration of the new system.

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# Appendices

## APPENDIX 1

# Search strategy

## E-rostering Search

The following databases were utilised to search for literature pertaining to the e-Rostering: CINAHL, Embase, Medline and Google. The reference and citation list of the review papers were also searched for additional sources and we also contacted experts within the field of e-Rostering to provide any reports and literature they were aware of which was not publicly available.

The search strategy was restricted to studies undertaken and published within the last 16 years as the issue of e-Rostering is a relatively contemporary phenomenon. Studies (published i.e. peer reviewed journal articles and unpublished studies (i.e. theses, editorials, letters) were included in the review if they were published in English. The term roster is a multi-factorial concept (O'Keeffe & Gander 2012) therefore key words searches were roster, electronic roster, e-Rostering, shift work, staff scheduling, and personnel scheduling.

## Implementation search

The following databases were utilised to search for literature pertaining to the implementation of digital healthcare technologies: CINAHL, Embase, Medline and Google.

The search strategy involved combining the following key words and entering each into the electronic databases: Digital **OR** electronic **OR** computer **AND** Technology **AND** Implement\* **AND** Acute care. A hand search of relevant papers was also completed to identify papers pertinent to the topic under review.

Papers were included in this review if written in the English language, full-text availability and published between January 2012 and November 2017. Papers were excluded if the focus was solely on patients, health care staff other than nurses and healthcare assistants (e.g. physicians) and occurred in other settings (e.g. primary care). Papers that focused on medical technology (e.g. sensors) or compared different software technology were also excluded.

## APPENDIX 2

# Key Stakeholders telephone interview schedule

## Phase 2: Allocate Software Interview schedule

### Opening Statements

The participants will be reminded of the aim of this study and the researcher will clarify the terms of confidentiality regarding this study as follows:

*“The aim of this study is to evaluate the implementation of the e-Rostering system in the Letterkenny University Hospital across nursing and patient, staff and organisational outcomes. All disclosed information will be treated confidentially unless required by law i.e. there is a risk to yourself or others”.*

- The researcher will explain that the interview will take between 30-60 minutes and seek verbal consent to continue and the usage of a digital recorder, if the participants do not agree only notes will be taken. The researcher will countersign participant consent forms and disseminate as appropriate.
- The researcher will start with an opening statement as follows:

*‘ Thank you for taking your time for this interview today, I want to remind you that there are no wrong answers and the interview can be stopped at any time. ’*

### Questions

1. Please describe Allocate HealthRoster role in the implementation process? (Prompt: Who was involved in the initial development and implementation? How was the project managed and implemented? I.e. what management structures and processes were put in place from Allocate perspective?)
2. What initial concerns and challenges did you experience, why you experienced them and what steps you took to overcome them?
3. Please outline the implementation plan and its progress to date. (Prompt what factors (positive and negative), if any, have influenced the progress?)

4. What level and types of support have you provided from development to implementation of the software? On reflection, has this been sufficient is there anything you would change?
5. How would you describe your working relationship with Letterkenny Hospital in the implementation process? (Prompt: On reflection what factors do you think inhibited and/or strengthened the relationship?)
6. To date, what outcomes do you think the project delivered for staff, patients, and management? What benefits have yet to be realised?
7. If you were to undertake a similar project, what overall resources (financial/ human other) would be required to implement the project?
8. What have been the greatest achievements and why? (What have been the critical success factors for enabling these achievements?)
9. If you were to undertake a similar project, would you do anything differently?
10. What recommendations can you provide to other hospitals who may want to adopt your project? Please think about the critical 'enablers' that need to be in place to ensure the success of the project.

#### **Final question:**

Is there anything else you would like to add?

#### **End of interview:**

Thank the participant

## APPENDIX 3

# Key stakeholders face to face interview schedule

## Interview schedule: Software Implementation

### Opening Statements

The participants will be reminded of the aim of this study and the researcher will clarify the terms of confidentiality regarding this study as follows:

*“The aim of this study is to evaluate the implementation of the e-Rostering system in the Letterkenny University Hospital across nursing and patient, staff and organisational outcomes. All disclosed information will be treated confidentially unless required by law i.e. there is a risk to yourself or others”.*

- The researcher will explain that the interview will take between 30-60 minutes and seek verbal consent to continue and the usage of a digital recorder, if the participants do not agree only notes will be taken. The researcher will countersign participant consent forms and disseminate as appropriate.
- The researcher will start with an opening statement as follows:

*‘ Thank you for taking your time for this interview today, I want to remind you that there are no wrong answers and the interview can be stopped at any time. ’*

### Questions

1. What was the rationale (local drivers/ contextual factors) for choosing e-Rostering? (Prompt: what issues, if any, were you trying to solve by implementing the software?)
2. How was the project developed? (Prompt: Who was involved? Was an assessment of skills and capabilities undertaken prior to implementation?)
3. How would you describe your working relationship with Allocate HealthRoster in the implementation process? (Prompt: On reflection what factors do you think inhibited and/or strengthened the relationship?)



4. Please describe the implementation process. (Prompt: Who was involved (all layers of staff)? Was a formal case for change made? Did you consider ownership issues, if so how? Did you access and address the cultural landscape for implementation, if so how? What factors did you consider when implementing the software? How was the project managed and implemented? I.e. what management structures, processes, new roles, new skills, were put in place? How did you communicate the message? What policies (if any) were developed to aid the implementation? Did you prepare for the unexpected, if so how?)
5. Reflecting on the implementation process to date, what concerns, and challenges did you experience, why you experienced them and what steps you took to overcome them?
6. What levels and types of engagement/ communication strategies were adopted? (Prompt: What factors (positive and negative), have influenced engagement? On reflection, has this been sufficient is there anything you would change?)
7. What level and types of organizational support has been provided in the implementation and engagement process? On reflection, has this been sufficient is there anything you would change?
8. To date, what outcomes do you think the project delivered for staff, patients, management and service? What benefits do you think have yet to be realised?
9. What implementation plans/ issued for the future need to be considered and why?
10. If you were to undertake a similar project, would you do anything differently with regards implementation and engagement strategies?
11. What recommendations can you provide to other hospitals who may want to adopt your project? Please think about the critical 'enablers' that need to be in place to ensure the success of the project and the key lessons learned.

### **Final question:**

Is there anything else you would like to add?

## APPENDIX 4

# Front line staff focus group schedule

## Focus groups with front line staff

### Opening Statements

The participants will be reminded of the aim of this study and the researcher will clarify the terms of confidentiality regarding this study as follows:

*“The aim of this study is to evaluate the implementation of the e-Rostering system in the Letterkenny University Hospital across nursing and patient, staff and organisational outcomes. As per the PIS/Consent form all disclosed information will be treated confidentially unless required by law i.e. there is a risk to yourself or others”.*

- The researcher will explain that the interview will take between 30-60 minutes and seek verbal consent to continue and the usage of a digital recorder, if the participants do not agree only notes will be taken. The researcher will countersign participant consent forms and disseminate as appropriate.
- The researcher will remind the participants to respect the privacy of fellow participants.
- The researcher will start with an opening statement as follows:

*‘ Thank you for taking your time for this focus group today, I want to remind you that there are no wrong answers and the focus group can be stopped at any time. ’*

### Senior Nursing Staff Questions

1. Why do you think your organisation implemented e-Rostering?
2. What do you think are your organisations goals and expectations for e-rRostering? - (Prompt - in relation to quality of care, patient outcomes, efficiency or other issues)
3. How was the e-Rostering system presented to senior nurses? (Probe: Any discussions held? / Were any policies shared/disseminated, if so please state? Was an assessment of skills and capabilities undertaken prior to implementation?)

4. What level and types of organizational support has been provided to senior nurses in the implementation and engagement process? (Probe: How have senior nurses been prepared for the a) change over b) implementation process and c) engagement process? On reflection, has this been sufficient is there anything you would change?)
5. Have senior nurses had a role in the development of the e-Rostering system? If so, please explain the role.
6. Have senior nurses had a role in preparing frontline staff in the implementation? If so what has this been? (Probe: How did you communicate the message? What has been their reaction? On reflection, has this been sufficient is there anything you would change?)
7. Have senior nurses had a role in preparing frontline staff to engage with e-Rostering? If so what has this been? (Probe: How did you communicate the message? What has been their reaction? On reflection, has this been sufficient is there anything you would change?)
8. Reflecting on the implementation process what daily challenges/ enables did you experience (Prompt: why you experienced them and what steps you took to overcome the challenges them?)
9. Reflecting on the e-Rostering are there any areas you have any difficulty? (Probe: making amendments, accessing support)
10. Has e-Rostering system impacted on your role? (If yes, to what, and in what way has your role changed?)
11. Overall, do you feel the project management of the implementation/engagement could be improved, if so how?
12. What three recommendations can you provide to other senior nurses in hospitals who may want to adopt e-Rostering? Please think about the critical 'enablers' that need to be in place to ensure the success of the project and the key lessons learned.

### Frontline staff (RN, RM & HCA) Questions

1. Why do you think your organisation implemented e-Rostering?
2. What do you think are your organisations goals and expectations for e-Rostering? (Prompt - in relation to quality of care, patient outcomes, efficiency or other issues)
3. How was the e-Rostering system presented to RNS/HCAs? (Probe: Any discussions held? / Were any policies shared/disseminated, if so state? Was an assessment of skills and capabilities undertaken prior to implementation?)
4. What level and types of organizational support has been provided to RN/HCAs nurses in the implementation? (How well do you think staff was prepared? How did they react? On reflection, has this been sufficient, is there anything you would change?)

5. What level and types of organizational support has been provided to help RN/HCA engage with the e-Rostering system? (How well do you think staffs were engaged? How did they react? On reflection, has this been sufficient, is there anything you would change?)
6. Do you know if RNS/HCAs had a role in the development of the e-Rostering system? If so please explain the role.
7. Reflecting on the implementation process were there any daily challenges / enablers you experienced (Prompt: Why you experienced them and what steps you took to overcome challenges them?)
8. Reflecting on the e-Rostering are there any areas you have any difficulty? (Probe: making amendments, accessing support)
9. Has e-Rostering system impacted on your role? (If yes, to what, and in what way has your role changed?)
10. Overall, do you feel the project management of the implementation/ engagement could be improved, if so how?
11. Do you think the e-Rostering system is a success or a failure or some combination? Describe where you think it has been a success and where it is deemed a failure
12. What three recommendations can you provide to other RNs/HCAs in hospitals who may want to adopt e-Rostering? Please think about the critical 'enablers' that need to be in place to ensure the success of the project and the key lessons learned.

**Final question:**

Is there anything else you would like to add?

## Front line cross-sectional online survey

### E-Rostering Project

#### Study title:

Evaluation of the implementation process of the e-Rostering system/  
employee online and Health Roster in Letterkenny University Hospital (LUH)

#### Instructions

- Please read each question carefully and tick a box to indicate your answer.
- Once you have finished, please take a minute to check you have answered all the items required.
- The questionnaire consists of 26 items and should take no longer than 5-10 minutes to complete.
- Once you have completed the questionnaire please submit it.

Remember, completion of the questionnaire is voluntary, and a completed questionnaire implies your consent to take part.

Q1 Are you?

Male ☐ Female ☐

Q2 Age: What is your age Group?

18-24 years old ☐ 25-34 years old ☐ 35-44 years old ☐  
45-54 years old ☐ 55-65 years old ☐ 66+ years old ☐

Q3 Are you a ...

Health Care Assistant ☐ Registered Staff Nurse/Midwife ☐ CNM/ CMM ☐

Q4 How long (in months) have you been using the e-Rostering system?

.....

**Q5** How many colleagues of your profession (HCA's, staff nurses or CNM's) do you work with on the ward?

.....

.....

**Q6** How big is the unit you work on?

20 Staff ☐      21 - 60 Staff ☐      > 60 Staff ☐

Please tick your level of agreement to the following statements

	Strongly Agree	Somewhat Agree	Neither Agree or Disagree	Somewhat Disagree	Strongly Disagree
Q7 My ability to use e-Rostering was assessed prior to implementation?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q8 I was asked about my access to computer facilities to use e-Rostering?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q9 I received sufficient training to use the e-Rostering system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q10 I have sufficient internet access to use the e-Rostering system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q11 There was support available to help me deal with any difficulties I had with the e-Rostering system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q12 The e-Rostering system fits into existing hospital rules, regulations and legislation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q13 I was given sufficient time to learn the e-Rostering system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q14 I find the e-Rostering system easy to use?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q15 Rostering management policy for nurses and midwives at LUH was presented at a ward level?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q16 The hospital policy relating to e-Rostering was clear?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

	Strongly Agree	Somewhat Agree	Neither Agree or Disagree	Somewhat Disagree	Strongly Disagree
Q17 I feel confident using the e-Rostering system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q18 There was support for colleagues in implementing the e-Rostering system?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q19 There was support from higher management in the organisation as to the implementation of e-Rostering?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q20 The e-Rostering system supports sufficient staff numbers are on the ward each day?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q21 The e-Rostering system helps provide a consistent skill mix on the ward to provide efficient care?	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q22 The e-Rostering system supports effective use of staff to ensure patient safety.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q23 The e-Rostering system works well in the hospital.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q24 I am satisfied with the e-Rostering system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Q25 The best aspect about e-rostering for me has been:**

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.....

**Q26 The worst aspect about e-rostering for me has been:**

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**Thank you for completing this survey, please submit your questionnaire.**

## APPENDIX 5

# Front line cross-sectional online survey

UNIVERSITY OF ULSTER

RESEARCH GOVERNANCE

## RG3 Filter Committee Report Form

PROJECT TITLE	Evaluation of the implementation process of e-Rostering system in Letterkenny university hospital (Saolta University Health Care Group)
CHIEF INVESTIGATOR	Dr Felicity Hassan
FILTER COMMITTEE	Nursing and Health Research

This form should be completed by Filter Committees for all research project applications in categories A to D (\*for categories A, B, and D the University's own application form – RG1a and RG1b – will have been submitted; for category C, the national, or ORECNI, application form will have been submitted).

Where substantial changes are required the Filter Committee should return an application to the Chief Investigator for clarification/amendment; the Filter Committee can reject an application if it is thought to be unethical, inappropriate, incomplete or not valid/viable.

Only when satisfied that its requirements have been met in full and any amendments are complete, the Filter Committee should make one of the following recommendations:

The research proposal is complete, of an appropriate standard and is in

- category A and the study may proceed \*
- category B and the study must be submitted to the University's Research Ethics Committee \*\* Please indicate briefly the reason(s) for this categorisation
- category C and the study must be submitted to ORECNI along with the necessary supporting materials from the Research Governance Section \*\*\*
- category D and the study must be submitted to the University's Research Ethics Committee \*\*

SIGNED:

*George Kernohanm*

DATE:

25<sup>th</sup> May 2017



**\*The application form and this assessment should now be returned to the Chief Investigator. The Filter Committee should retain a copy of the complete set of forms.**

**\*\* The application form and this assessment should now be returned to the Chief Investigator so that he/she can submit the application to the UUREC via the Research Governance section. The Filter Committee should retain a copy of the complete set of forms for their own records.**

**For all categories, details of the application and review outcome should be minuted using the agreed format and forwarded to the Research Governance section**

**Please complete the following**

The application should be accompanied by an appropriate and favourable Peer Review Report Form (if not, the Filter Committee should be prepared to address this as part of its review). Please comment on the peer review (include whether or not there is evidence that the comments of the peer reviewers have been addressed).

Peer review is complete and there are no outstanding issues of serious ethical concern. This proposal has been reviewed and approved under arrangements for "Chair's action"

Please provide an assessment of all component parts of the application, including questionnaires, interview schedules or outline areas for group discussion/unstructured interviews.

This is a low-risk study using interviews focus groups & questionnaires to explore implementation of an e-roster service from provider and user perspectives. All component parts have been reviewed and deemed to be acceptable to address the study objectives.

Please comment on the consent form and information sheet, in particular the level of language and accessibility.

Arrangements for consent are deemed to be acceptable and there are no serious issues in this regard.

Please comment on the qualifications of the Chief and other Investigators.

Well qualified investigators for the proposed study.

Please comment on the risks present in conducting the study and whether or not they have been addressed.

All ethical issues have been addressed. The benefit in predictable new knowledge outweighs any risks associated with the study. Any identified issues will be reported to the Director of Nursing.

Please indicate whether or not the ethical issues have been identified and addressed.

Yes, the sources of data are clear: key informants have been identified (phases 2 & 3). Given the likely response rate to questionnaire research in such settings, it is deemed acceptable to adopt a sample of the whole population for phase 4. The samples of documents for review in phases 1 & 5 are acceptable.

Please comment on whether or not the subjects are appropriate to the study and the inclusion/exclusion criteria have been identified and listed

General Manager's Office,  
Letterkenny University Hospital, Letterkenny Co. Donegal. F92 AE81  
**Tel:** (074) 912 3501      **Fax:** (074) 910 4651

7<sup>th</sup> June 2017

**Dr. Randal Parlour**  
**Assistant Director (NMPD HSE-West) CNME**  
**St. Conals**

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**Re: Evaluation of the implementation process of e-rostering system in Letterkenny University Hospital**

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Dear Dr. Parlour,

With reference to application listed above, your application has been considered by members of LUH Ethics Committee and I am happy on behalf of Letterkenny University Hospital Research Ethics Committee to grant Chairman's approval.

Please do not hesitate to contact me if you require any further information.

Yours sincerely



**Mr Sean Murphy**  
General Manager

Health Service Executive

Dr. Steevens' Hospital

Dublin 8

Ireland

[www.hse.ie](http://www.hse.ie)

