Meeting Date	**26 July 2022**	**Agenda Item**	**5.3**
Report Title	Evaluation of Hospital Electronic Prescribing and Medicines Administration (HEPMA) at Neath Port Talbot and Singleton Hospitals		
Report Author	Marc Thomas, Digital Programme Manager		
Report Sponsor	Matt John, Director of Digital Dougie Russell, Project SRO and Unit Medical Director, Singleton		
Presented by	Rebekah Williams, E-Prescribing Pharmacist Marc Thomas, Digital Programme Manager		
Freedom of Information	Open		
Purpose of the Report	To update the Quality and Safety Committee on the outcomes of expected benefits of the implementation of Hospital Electronic Prescribing and Medicines Administration (HEPMA) at Neath Port Talbot and Singleton Hospitals as described in the original business case.		
Key Issues	The majority of expected benefits have been realised or partially realised when comparing 2019-20 with 2021-22 including a reduction in unintentionally omitted medication doses (7.43% → 0.96%) and improved antimicrobial stewardship (95.67% → 100% appropriateness of antibiotic choice) at Singleton. NPTH saw an increase in the percentage of antibiotic prescriptions over 7 days in 2020-21, however this figure decreased in 2021-22. Time released to care has been identified through the completion of staff questionnaires through no longer rewriting medication charts and a reduction in time taken to access electronic charts; reductions in time taken to undertake medication rounds has also been observed across both sites. An increase in the number of prescribing errors was observed, however data were obtained from Datix which includes incidents which may not have been influenced by HEPMA.		
Specific Action Required ***(please choose one only)***	**Information**	**Discussion**	**Assurance**	**Approval**
	☒	☐	☒	☐
Recommendations	Members are asked to: • Note the implementations of HEPMA at Neath Port Talbot and Singleton Hospitals and its evaluation has concluded; • Note the significant progress and improvements have been enabled by the HEPMA implementation, evidenced by the benefits realisation work undertaken; • Note that some benefits were not realised or only partially realised, and that further work will be undertaken to ensure delivery of the benefits in the future, including discussions on system enhancements with the supplier. This work will be carried out in parallel with the Morriston implementation, overseen by the project board. • Note that work with clinical and financial executive leads is required to release funding which corresponds with time released to care, and to determine priorities for reinvestment with a view that the output of this will be shared with Management Board in September 2022. • Note that the wider implementation of HEPMA at Morriston Hospital commenced on 12 July 2022; the Gorseinon Hospital implementation will take place in October 2022.			

Evaluation of Hospital Electronic Prescribing and Medicines Administration (HEPMA) at Neath Port Talbot and Singleton Hospitals

1. INTRODUCTION

Hospital Electronic Prescribing and Medicines Administration (HEPMA) digitises prescribing and medication administration processes by replacing inpatient medication charts with a digital solution.

Following £945k investment from Welsh Government (WG) and supplemented by funding from the former Abertawe Bro Morgannwg University Health Board and Swansea Bay, HEPMA has replaced the all-Wales inpatient medication paper medication charts, the warfarin and standard insulin charts at Neath Port Talbot and Singleton Hospitals.

The business case outlined a number of efficiency and patient safety and quality benefits expected to be realised through the implementation of HEPMA: to improve medicines management; to increase efficiencies; to improve quality of prescribing processes; and to improve antimicrobial stewardship. This paper summarises the outcomes of the expected benefits, of which almost all have been realised, or have improved against the baseline captured prior to implementation (2019-20).

The implementation across Neath Port Talbot and Singleton Hospital medical wards has concluded. Following a successful bid to the Digital Priorities Investment Fund (DPIF), additional funding of £958k has been secured to implement HEPMA at Morriston and Gorseinon Hospitals as a key digital enabler to support the AMSR programme. The implementation across medical wards at Morriston Hospital commenced on 12 July 2022 and will be followed by Gorseinon Hospital in October 2022. Surgical implementations will commence at Morriston in Q3 2022-23, followed by Singleton and NPTHs.

The evaluation of HEPMA has been approved by the Swansea Bay local project board and assured by Management Board.

2. BACKGROUND

The former ABMUHB submitted a business case to Welsh Government in 2017 seeking investment to implement HEPMA at two acute sites. A key driver for the business case was the *Trusted to Care (2014)* report, and was also predicated on the organisation acting as a pathfinder for the national Welsh Hospital Electronic Prescribing, Pharmacy and Medicines Administration (WHEPPMA) project and would evaluate the integration of a third-party HEPMA solution with the national

architecture, and to share local learning and benefits to inform the national project.

ABMUHB received £945k WG funding during 2018-19 to enable the HEPMA pathfinder in addition to ABMU capital funding to upgrade the local pharmacy and medicines management solution including EPMA functionality. A change control was executed to our local Pharmacy and Medicines Management system contract which enabled EPMA functionality, negating the requirement to run a procurement which would have delayed readiness and integration work. ABMU accepted that this inhibited the ability to maximise benefits across all staff groups given the limitations with our solution.

Throughout 2018 and 2019, the Swansea Bay Digital team worked in partnership with the former NHS Wales Informatics Service (NWIS) to integrate the locally-hosted HEPMA solution with the national architecture. Integration ensures patient demographics are available and up-to-date, live admissions, transfers and discharge statuses update medication charts appropriately, and patient allergy statuses and discharge medications are sent to the discharge advice letter in Welsh Clinical Portal for onward electronic submission to patients' GPs.

In parallel, significant business change activities were undertaken to assess existing ways of working and service transformation enabled by the digital platform.

3. ASSESSMENT

Between February 2020 and March 2022:

- 6,391 individual patients had 7,884 admissions utilising a HEPMA electronic medication chart
- 243,843 medications were prescribed using HEPMA
- 2,491,346 medication doses were charted digitally

Full benefits realisation analyses were undertaken, prior to and following implementation. A summary of the benefits and their respective statuses follows (*note that Singleton was not live until 2021-22 and therefore there are no data for 2020-21):

Prescribing and medicines management

Expected Benefit	Target	Hospital	Baseline (2019-20)	2020-21	2021-22	Status
Reduction in unintentional omitted medication doses	<5%	NPTH	1.06%	0.41%	0.36%	Realised
		Singleton	7.43%	-*	0.96%	
Reduction in unrecorded medication administrations	<5%	NPTH	9.04%	0%	0.05%	Realised
		Singleton	3.2%	-*	0.07%	
Increase in proportion of prescription records with patients' allergy status recorded	100%	NPTH	99.91%	99.78%	100%	Realised
		Singleton	99.59%	-*	99.47%	Partially realised
Increase in proportion of venous thromboembolism (VTE) risk assessments on medication charts	90%	NPTH	96.7%	100%	100%	Realised
		Singleton	86.43%	-*	100%	
Improved prescribing of VTE prophylaxis	90%	NPTH	98.74%	86.27%	92.46%	Realised
		Singleton	82.74%	-*	87.03%	Partially realised

Table 1: Prescribing and medicines management (Baseline data source: All-Wales Medication Safety Audit)

Unrecorded medication administrations ('blank boxes') considerably reduced at both Neath Port Talbot and Singleton Hospitals improving patient quality and safety. There is ongoing work to support improved prescribing of VTE prophylaxis.

The benefits in table 1 are based upon measures included in the All-Wales Medication Safety Audit. The audit investigates a number of measures on a monthly basis. The methodology is used across Wales and baseline measurements were obtained from data collected and already available. However, these audits are conducted once per month and include a snapshot of up to 10 random inpatients per ward. Therefore, the baseline data do not include all patients/prescriptions whereas the measurements in 2020-21 and 2021-22 include all patients and/or prescriptions.

Errors in prescribing and medicines administration

Expected Benefit	Target	Hospital	Baseline (2019-20)	2020-21	2021-22	Status
Reduction in prescribing errors	50% reduction	NPTH	1	+500% (5)	+400% (4)	Not realised
		Singleton	12	-*	+133% (28)	
Reduction in medication administration errors	50% reduction	NPTH	12	No change (12)	-42% (7)	Partially realised
		Singleton	60	-*	-22% (47)	
Reduction in number of medicines prescribed to which patients are allergic	0	NPTH	0	0	0	Realised
		Singleton	2	-*	0	

Table 2: Prescribing and administration errors (Baseline data source: Datix)

The benefits in table 2 rely upon the recording or self-reporting of prescribing and administration errors on Datix and includes medication errors which may or may not have been influenced by HEPMA.

The HEPMA solution alerts prescribers as to conflicts between patients' prescriptions or their allergy statuses including a therapeutic duplicate being prescribed e.g. a second opioid being prescribed, drug-drug interactions and where a prescription contains an allergen to which the patient is hypersensitive. This was not captured in the original benefits register. However, during 2021-22 there were 490 allergy conflicts highlighted by the HEPMA solution following which the prescriber no longer continued with the prescription; 112/490 prescriptions contained penicillin. It can therefore be assumed that had these prescriptions occurred on paper, medications may have been administered to patients leading to avoidable harm.

Antimicrobial Stewardship

Expected Benefit	Target	Hospital	Baseline (2019-20)	2020-21	2021-22	Status
Improved antimicrobial stewardship –	≥95%	NPTH	99%	97.5%	95%	Realised

increased appropriateness of antibiotic choice		Singleton	95.67%	-*	100%	
Reduction in percentage of antibiotic prescriptions lasting over 7 days	≤20%	NPTH	12%	21.82%	15.02%	Realised
		Singleton	3.84%	-*	6.79%	
Reduction in percentage of intravenous prescriptions lasting over 72 hours	<30%	NPTH	100%	45.14%	41.84%	Not realised
		Singleton	33.96%	-*	34.46%	

Table 3: Antimicrobial stewardship benefits (Baseline data source: Bi-monthly Antimicrobial Audit)

While a reduction in the percentage of intravenous prescriptions > 72 hours was not realised during the post implementation period, there were substantial improvements observed at NPTH year on year. Antimicrobial stewardship expected benefits were predicated on key performance indicators at the time the original business case was developed (2016-17) and have since evolved which have been taken into consideration for the Morriston and Gorseinon Hospital implementations and future measurements of Neath Port Talbot and Singleton benefits. The baseline measurement was obtained through the bi-monthly point prevalence antimicrobial audit which has a considerably smaller sample size in comparison with post-implementation data.

Releasing time to care

To ascertain the maximum time that could be released to care, clinical staff worked with the Digital team to:

- indicate (via a survey; 109 responses) the average number of minutes per shift that were spent prescribing and searching for medication charts
- map existing processes including time and motion studies to support medication administration across four daily medication rounds.

A summary of the findings is set out in table 4:

Expected Benefit	Target	Hospital	Baseline (2019-20)	2020-21	2021-22	Status
Prescriber time saved from not	912 hours prescriber	NPTH	2,166 hours	-2,166 hours per year		Realised

Expected Benefit	Target	Hospital	Baseline (2019-20)	2020-21	2021-22	Status
rewriting lost, missing or full medication charts	time saved per year	Singleton	4,842 hours	-*	-3,632 hours (Q2-4)	
Decreased nurse administration round duration	20% reduction	NPTH	59 mins per round	-2.07% 58 mins per round	-17% 49 mins per round	Partially realised
		Singleton	1 hour 14 mins per round	+4% 1 hour 17 mins per round	-8.1% 1 hour 8 mins per round	
Reduction in time taken to access medication charts	75% reduction	NPTH	10,297 hours	-68% 3,297 hours per year		
		Singleton	15,767 hours	-*	-65% 5,600 hours per year	

Table 4: Releasing time to care (Baseline data sources: time and motion studies; staff questionnaires)

The evaluation has demonstrated HEPMA can release prescribers' time by no longer being required to rewrite medication charts.
HEPMA provides access to medication charts regardless of location and clinical team and the evaluation demonstrates a reduction in the time taken to access charts. It is acknowledged however that staff need to spend time logging on to the system to retrieve the electronic medication chart. Therefore, it is estimated that 10,167 hours' time was released to care during 2021-22 at Singleton Hospital (15,767 minus 5,600) and 7,000 hours at Neath Port Talbot Hospital (10,297 minus 3,297). However, it is important to note that 42% of prescriber respondents felt that HEPMA requires a proportion of the released time to undertake prescribing processes electronically e.g. clinical decision support alerts and their subsequent acknowledgement.

In addition, 67% of pharmacists and 44% of pharmacy technicians disagreed that HEPMA saves them time as additional processes are required to ensure discharge prescriptions are reflected accurately on patients' discharge advice letters.

Discussions are now required with clinical executive leads to release the corresponding funding and to determine clinical priorities for reinvestment.

Reduction in drug expenditure

Expected Benefit	Target	Hospital	Baseline (2019-20)	2020-21	2021-22	Status
Reduction in annual drug expenditure	2.5% reduction	NPTH	£366,700 total drug spend	£298,708 total drug spend £67,992 reduction **-18.54%**	£246,128 total drug spend £120,572 reduction **-32.88%**	Realised
		Singleton	£1,161,914 total drug spend	-*	£1,223,537 total drug spend £61,623 increase **+ 5.3%**	
		Total	£1,528,614 total NPTH and Singleton drug spend	-*	£1,469,665 total NPTH and Singleton drug spend £58,949 reduction **-3.9%**	

Table 5: Financial efficiencies – reduction in drug expenditure (Baseline data source: Pharmacy and medicines management system)

When compared with the respective baseline expenditure (2019-20):

- A reduction of £67,992 in drug expenditure in 2020-21 was observed across NPT
- A reduction of £120,572 in drug expenditure in 2021-22 was observed across NPT
- An increase of £61,623 in drug expenditure in 2021-22 was observed across Singleton which may correlate with increased patient activity; work is underway to validate this.

An overall reduction of 3.9% drug expenditure in 2021-22 has been realised in comparison with 2019-20, which has contributed to the ongoing revenue costs required to meet the supplier and resource costs.

Reduction in stationery expenditure

Expected Benefit	Target	Hospital	Baseline (2019-20)	2020-21	2021-22	Status
Reduction in stationery expenditure	100% reduction	NPTH	£852.00	-99.8% (£1.69)	-94.03% (£50.82)	Partially realised
		Singleton	£1,169.97	-*	-55.36% (£647.72)	
		Total	£2,021.97	-*	-65.45% (£698.54)	

Table 6: Financial efficiencies – reduction in stationery expenditure (Baseline data source: Procurement department)

The original target of 100% reduction in purchasing of medication charts was not fully realised given that clinical areas purchased stocks of emergency charts in line with the standard operating procedure for business continuity, and the implementations were conducted in a phased manner i.e. Singleton Hospital wards would have continued to order medication charts until the end of Q1 2021-22 until they were live with HEPMA. It is anticipated that the expenditure observed in table 6 will reduce further in 2022-23.

4. GOVERNANCE AND RISK ISSUES

Governance

The project is overseen by the local HEPMA project board, which has representation from NPT and Singleton clinical and nursing teams, Digital Health Care Wales and System C (supplier). The board reports into the Digital Leadership Group (DLG) which meets quarterly; DLG reports to Management Board. Membership of the project board has been expanded to include senior colleagues from Morriston and Gorseinon Hospitals to reflect the increase in scope of the overall implementation. Clinical governance groups are in place to oversee system configuration and software changes ensuring these support patient safety.

Risks

The implementation of HEPMA has significantly reduced the risk associated with prescribing and medication administration processes, and has also improved patient safety and quality. As with all service transformation projects, a period of time is required to fully embed and adopt new ways of working. Continual business change and support effort is required to mitigate risk e.g. selection error and alert fatigue ensuring we continue to exploit the wider HEPMA solution.

5. FINANCIAL IMPLICATIONS

The ongoing revenue model to support HEPMA operations at Neath Port Talbot and Singleton Hospital requires £318k per annum which includes pay and non-pay (supplier) costs. These costs are covered by the Neath Port Talbot and Singleton Hospitals Service Group in line with expected financial benefits.

Similarly, Morriston revenue costs from 2023-24 onwards will be absorbed by the Morriston SDG.

6. RECOMMENDATION

The Quality and Safety Committee is asked to:

- Note the implementations of HEPMA at Neath Port Talbot and Singleton Hospitals and its evaluation has concluded;
- Note the significant progress and improvements have been enabled by the HEPMA implementation, evidenced by the benefits realisation work undertaken;
- Note that some benefits were not realised or only partially realised, and that further work will be undertaken to ensure delivery of the benefits in the future, including discussions on system enhancements with the supplier. This work will be carried out in parallel with the Morriston implementation, overseen by the project board.
- Note that work with clinical and financial executive leads is required to release funding which corresponds with time released to care, and to determine priorities for reinvestment with a view that the output of this will be shared with Management Board in September 2022.
- Note that the wider implementation of HEPMA at Morriston Hospital commenced on 12 July 2022; the Gorseinon Hospital implementation will take place in October 2022.

Governance and Assurance		
Link to Enabling Objectives *(please choose)*	**Supporting better health and wellbeing by actively promoting and empowering people to live well in resilient communities**	
	Partnerships for Improving Health and Wellbeing	☐
	Co-Production and Health Literacy	☐
	Digitally Enabled Health and Wellbeing	☐
	Deliver better care through excellent health and care services achieving the outcomes that matter most to people	
	Best Value Outcomes and High Quality Care	☒
	Partnerships for Care	☐
	Excellent Staff	☒
	Digitally Enabled Care	☒
	Outstanding Research, Innovation, Education and Learning	☐
Health and Care Standards		
(please choose)	Staying Healthy	☐
	Safe Care	☒
	Effective Care	☒
	Dignified Care	☐
	Timely Care	☒
	Individual Care	☐
	Staff and Resources	☐

Quality, Safety and Patient Experience

HEPMA enables:

- Safer prescribing and medicines administration practices including:
  - Real-time clinical decision-support to highlight interactions between medications and contraindications due to recorded allergies and sensitivities
  - An increase in the legibility of medications prescribed on medication charts
- Reduction in medication errors through mandating documentation of allergy status and completion of venous thromboembolism risk assessments upon admission
- Reduction in the inappropriate prescribing of antimicrobials and/or prolonged use
- Reduction in omitted doses of medications due to medicines being unavailable

Improvements in the documentation of medicines administration

Financial Implications

The ongoing revenue model to support HEPMA operations at Neath Port Talbot and Singleton Hospital requires £318k annum which includes pay and non-pay (supplier) costs. These costs are covered by the Neath Port Talbot and Singleton Hospitals Service Group.

Legal Implications (including equality and diversity assessment)

None.

Staffing Implications

None.

Long Term Implications (including the impact of the Well-being of Future Generations (Wales) Act 2015)

- Long term – acting on climate change by reducing the carbon footprint of using paper
- Prevention – reducing duplication through integrated clinical information systems can reduce the risk of transcription error
- Integration – the Health Board's well-being objectives are in line with 'a healthier Wales'
- Involvement – fair and robust recruitment ensures the highest quality staff resource

• Collaboration – Digital Services at Swansea Bay work in full collaboration with Digital Health and Care Wales to provide a positive contribution to national well-being	
Report History	N/A
Appendices	**APPENDIX 1 –** HEPMA Evaluation – Neath Port Talbot and Singleton Hospitals

GIG CYMRU NHS WALES
Bwrdd Iechyd Prifysgol Bae Abertawe
Swansea Bay University Health Board

Bwrdd Iechyd Prifysgol Bae Abertawe
GWASANAETHAU DIGIDOL
DIGITAL SERVICES
Swansea Bay University Health Board

Hospital E-Prescribing and Medicines Administration (HEPMA) Evaluation

Neath Port Talbot Hospital
February 2020 to March 2022
&
Singleton Hospital
March 2021 to March 2022

Version	1
Date	June 2022
Authors	Nerys James, Senior Project Manager Marc Thomas, Programme Manager Rebekah Williams, E-Prescribing Pharmacist
Owner	HEPMA Project Board

Version Control and Approvals

Version History

Date	Version	Author	Summary of changes
23 Jun 2022	1	Nerys James Marc Thomas Rebekah Williams	Status updated to Final
13 Jun 2022	D08	Rebekah Williams Marc Thomas	Benefits Realisation section updated to include Q3-4 2021-22 data
09 Feb 2022	D07	Marc Thomas Rebekah Williams	Updated following comments from Matt John
04 Jan 2022	D06	Marc Thomas	Updated following comments from Deirdre Roberts
10 Dec 2021	D05	Rebekah Williams	Updated following Pharmacy comments
28 Oct 2021	D04	Marc Thomas Rebekah Williams	Benefits analyses updated
18 Oct 2021	D03	Nerys James Marc Thomas Rebekah Williams	Benefits analyses – Singleton Hospital
07 Oct 2021	D02		Benefits analyses – NPTH
30 Sep 2021	D01	Marc Thomas Rebekah Williams	Initial draft

Approvals

Date	Version	Name/Group
23 Jun 2022	D08	HEPMA Project Board

Circulation

Date	Version	Name/Group
23 Jun 2022	D08	HEPMA Project Board (for approval)
07 Jan 2022	D06	HEPMA Project Board
13 Dec 2021	D05	Judith Vincent, Clinical Director of Pharmacy David Sheard, Assistant Director of Service Transformation, DHCW
29 Oct 2021	D04	Dr Gareth Collier, SRO, WHEPPMA Programme
25 Oct 2021	D03	Martin Bevan, Unit Medical Director, Neath Port Talbot Hospital James Chess, CMIO & Consultant Nephrologist Lesley Jenkins, Nurse Director, Neath Port Talbot & Singleton Hospitals Matt John, Director of Digital Dougie Russell, HEPMA SRO & Unit Medical Director, Singleton Hospital Judith Vincent, Clinical Director of Pharmacy Elizabeth Williams, Chief Nursing Informatics Officer & Senior Matron Roger Williams, Head of Pharmacy Acute Services Jan Worthing, Group Director, Neath Port Talbot & Singleton Hospitals

Document Location

Type	Location
Electronic	\\cymru.nhs.uk\abm_ulhb\group\Informatics\ICT Programmes\Products & Projects\HEPMA\Evaluation\Evaluation - NPTH and Singleton

Contact Details

For further information, please contact one of the following members of the project team:

- Rebekah Williams, E-Prescribing Pharmacist – rebekah.williams@wales.nhs.uk
- Marc Thomas, Digital Programme Manager – marc.thomas@wales.nhs.uk
- Nerys James, Senior Project Manager – nerys.james3@wales.nhs.uk

EXECUTIVE SUMMARY

Medication is the most common intervention made to hospital inpatients, and the digitisation of prescribing and administration practice through hospital electronic prescribing and medicines administration (HEPMA) at Swansea Bay University Health Board has had a profound impact on medical, nursing and pharmacy professionals.

HEPMA replaces paper medication charts with a digital solution and transforms a number of prescribing and medicines administration processes leading to a number of expected benefits being realised including improved quality and safety of prescribing through clinical decision support and guided antimicrobial prescribing, time released to care by no longer rewriting and/or searching for medication charts, and a reduction in expenditure through enabling greater oversight and scrutiny of prescribing practice.

A business case was submitted to Welsh Government in 2017 by the former Abertawe Bro Morgannwg University Health Board which sought investment to enable a HEPMA pathfinder project across two hospital sites. The business case was approved; £0.945m funding was made available which enabled implementations at Neath Port Talbot and Singleton Hospitals.

The implementation of HEPMA required major digital transformation which was enabled through strong clinical leadership, alignment with other digital implementations and processes including the e-whiteboard solution (Signal) and the Welsh Nursing Care Record, end user involvement in the selection and procurement of devices, and significant process mapping and time and motion studies. Communication and engagement across sites was also maintained prior to and throughout implementations.

In addition to digitising prescribing and medicines administration processes, the HEPMA project set out to integrate a third-party EPMA solution with NHS Wales architecture which was achieved over a two-year period. The HEPMA solution at Swansea Bay is integrated with the national patient administration system (WPAS) and the single digital health record (WCP) such that electronic medication charts are generated automatically upon admission, and discharge medications are seamlessly sent to patients' discharge advice letters for transmission to GPs.

Between 11 February 2020 and 31 March 2022, HEPMA was implemented and embedded across Neath Port Talbot and Singleton Hospitals. Just under 1,400 users have been trained and are actively using the solution; over 7,800 admissions have utilised HEPMA leading to almost 244,000 digital prescriptions and just under 2.5 million doses charted digitally.

Key benefits realised and staff experience indicators measured are as follows:

Key benefits

- HEPMA intervened in 490 prescriptions to highlight patient allergy conflicts – 112 prescriptions involved penicillin (2021-22)
- Blank boxes (non-recording of medicines administration or non-administration has reduced from 9% and 3% to below 1% at NPT and Singleton Hospitals respectively
- 5,798 prescriber hours have been released to care through no longer being required to rewrite charts

Staff Experience

- 83% of pharmacists, 75% of nurses and 69% of prescribers agreed/strongly agreed that HEPMA supports safe practice/medication safety
- The most frequent response from prescribers and nurses was "increased legibility"; Pharmacists indicated that remote access (when necessary) to medication charts and no lost charts were the most preferred elements.

The purpose of this evaluation is to present the findings of the implementation measured against the expected benefits in addition to staff feedback gathered through surveys, and to share the wider learning across NHS Wales prior to the implementation of HEPMA in other organisations. Information regarding the approach to the implementation including resource requirements and other lessons learned are also included.

Nurses comprise 78% of the user base and evaluated HEPMA positively with over 50% of nurse respondents indicating agreement or strong agreement with each of the key themes explored in the post implementation questionnaire. HEPMA was received relatively poorly with Pharmacy professionals in relation to the time taken in comparison with paper as it was not possible to replicate all previous processes, which generated a number of workarounds. The HEPMA team continue to work with Pharmacists and Pharmacy Technicians to streamline processes wherever possible.

It is also acknowledged that HEPMA implementations take a considerable period of time to wholly embed the business change required to fully realise expected benefits. In addition, HEPMA data now enables all prescribing and medicines administration data to be interrogated in comparison with significantly limited snapshot audits using paper charts. Therefore, it is anticipated that some benefit domains may appear to worsen following the implementation of HEPMA due to greater visibility of practice.

The HEPMA solution implemented at Swansea Bay was procured as an addition to the Pharmacy and Medicines Management solution. From the user feedback obtained, it is possible a different solution may have been procured through a competitive process where different supplier solutions would have been evaluated and prioritised by a range of local professionals. However, from the benefits data presented within, it has been demonstrated that the solution in place has improved safety and generated efficiencies despite some user dissatisfaction.

CONTENTS

LIST OF TABLES

List of Charts

List of Figures

ACKNOWLEDGEMENTS

The project team would like to acknowledge the significant support, input and advice received from a number of individuals and teams which made the implementation of HEPMA at Swansea Bay UHB possible:

- HEPMA Project Board
- Dr Jonathan Goodfellow, Former Project SRO
- Mr Dougie Russell, Project SRO and Unit Medical Director, Singleton Hospital
- Dr James Chess, Chief Medical Information Officer and Consultant Nephrologist
- Judith Vincent, Clinical Director of Pharmacy, Swansea Bay University Health Board
- Professor Hamish Laing, Former Executive Medical Director and Chief Information Officer, Abertawe Bro Morgannwg University Health Board
- Neath Port Talbot and Singleton Hospital colleagues:
    - Medical Staff
    - Nursing Staff
    - Pharmacy Department
    - Unit/Group Directors
- Members of the Configuration Working Groups and the Clinical Ratification Group
- Swansea Bay University Health Board Digital Operations Department
- Swansea Bay University Health Board Renal Department
- Digital Health and Care Wales (DHCW) teams:
    - Welsh Patient Administration System (WPAS)
    - Welsh Clinical Portal (WCP)
    - National Operational Databases
    - Integration Services

PURPOSE OF DOCUMENT

This evaluation details the findings following the implementation of HEPMA at Neath Port Talbot and Singleton Hospitals between February 2020 and March 2022. The document also includes information regarding resource and system configuration requirements, clinical governance, lessons learned and benefits realisation.

The intended audience for the document is:

Swansea Bay UHB

- HEPMA Project Board
- Neath Port Talbot and Singleton Service Delivery Group Directors
- Digital Leadership Group
- Welsh Clinical Portal Implementation Programme Board
- Digitisation of Nursing Documentation Project Board
- Nursing and Midwifery Board
- Medicines Management Board
- Medication Safety Group
- Antimicrobial Stewardship Group

Wider NHS Wales

- Welsh Hospital E-Prescribing, Pharmacy and Medicines Administration (WHEPPMA) Project Board
- Welsh Clinical Informatics Council
- All-Wales Nursing Group

Welsh Government

- Technology, Digital and Transformation (Department of Health and Social Services)

ACRONYMS

Acronym	Full description
ADT	Admissions, discharges and transfers – patient location on Welsh Clinical Portal as defined by their inpatient episode recorded in WelshPAS
CMM	CareFlow Medicines Management (SBUHB HEPMA supplier) formerly WellSky International and JAC Computer Services
DAL	Discharge advice letter; composed within patients' digital health records in WCP and transmitted electronically to their GP practice via the Welsh Clinical Communications Gateway
DHCW	Digital Health and Care Wales, formerly NHS Wales Informatics Service (NWIS)
EPMA	Electronic Prescribing and Medicines Administration
HEPMA	Hospital Electronic Prescribing and Medicines Administration
MTeD	Medicines Transcription and E-Discharge
PRN	When required medication
STAT	Once only medication
VTE	Venous thromboembolism
WCP	Welsh Clinical Portal
WCRS	Welsh Care Records Service (Patient documents in WCP)
WHEPPMA	Welsh Hospitals Electronic Prescribing, Pharmacy and Medicines Administration
WPAS	Welsh Patient Administration System

Table 1: Acronyms

INTRODUCTION

Hospital Electronic Prescribing and Medicines Administration (HEPMA) digitises prescribing and medication administration processes by replacing multiple inpatient medication charts with a digital solution.

HEPMA is expected to enable, support and/or enhance:

- Safer prescribing practices and patient safety through embedded clinical decision support tools e.g. highlighting therapeutic duplicates, drug interactions, contraindications due to patient allergies and guided antimicrobial prescribing;
- Increased time to care through the elimination of time previously taken to transcribe lost or full medication administration charts, and decreased medication round times through immediate oversight of patients who are due medications;
- A reduction in expenditure by no longer purchasing paper medication charts, and through enabling greater scrutiny of prescribing practice.

Following the publication of *Trusted to Care* (2014), Welsh Government's (2014) *Prudent Healthcare Principles* and *Informed Health and Care – A digital health and social care strategy for Wales* (2015), the former Abertawe Bro Morgannwg University Health Board submitted a business case to Welsh Government seeking investment to implement hospital e-prescribing and medicines administration (HEPMA) at two acute sites within the Health Board. The business case was predicated on the Health Board acting as a pathfinder in advance of the national Welsh Hospital Electronic Prescribing, Pharmacy and Medicines Administration (WHEPPMA) project: to integrate a third party HEPMA solution with the national architecture, and to share local learning for the benefit of the national project. The former Abertawe Bro Morgannwg University Health Board were supported by Welsh Government to enable the HEPMA pathfinder.

Objectives

The HEPMA project set out to:

- Integrate CareFlow Medicines Management Electronic Prescribing and Medicines Administration with the Swansea Bay instance of Welsh Clinical Portal to allow users to prescribe electronically from within WCP and to populate discharge advice letters with discharge medications.
- Undertake full end-to-end testing of the HEPMA solution integrated with WCP.
- Implement HEPMA across two acute hospital sites at Swansea Bay UHB.
- Document the support model required for HEPMA.
- Evaluate the implementation including efficiencies and benefits to inform the national project.

HEPMA – Product Overview

CareFlow Medicines Management and Electronic Prescribing and Medicines Administration (EPMA)

CareFlow Medicines Management (CMM) is the Swansea Bay UHB pharmacy stock control and medicines management solution. CMM was formerly known as JAC Computer Services Limited and later WellSky International. CMM is underpinned by a prescribing formulary which enables stock management for drugs purchased by the organisation, and for the recording of medications dispensed to patients.

CMM electronic prescribing and medicines administration (EPMA) builds upon the local formulary and stock management solution with a web application which enables electronic prescribing of medication usually stocked by the Health Board and electronic recording of medicines administration.

CMM EPMA provides:

- The ability to electronically prescribe medications and chart medications given/not given.
- Clinical decision support at the point of prescribing – providing alerts where there are conflicts between an item already prescribed and another to be prescribed (drug-drug interactions), and those which contain an allergen which causes a reaction in a patient or to which the patient is sensitive.
- Clinical decision support at the point of prescribing providing formulary information with the option to prescribe formulary alternatives where a non-formulary medication is selected.
- Electronic recording of venous thromboembolism risk assessments which are mandated before prescribing can commence.
- Electronic recording of allergy status which is mandated before prescribing can commence and retained on the patient's record for future admissions.
- The ability to produce electronic medication orders which is automatic for medicines not kept as ward stock and immediately available to administer to patients.

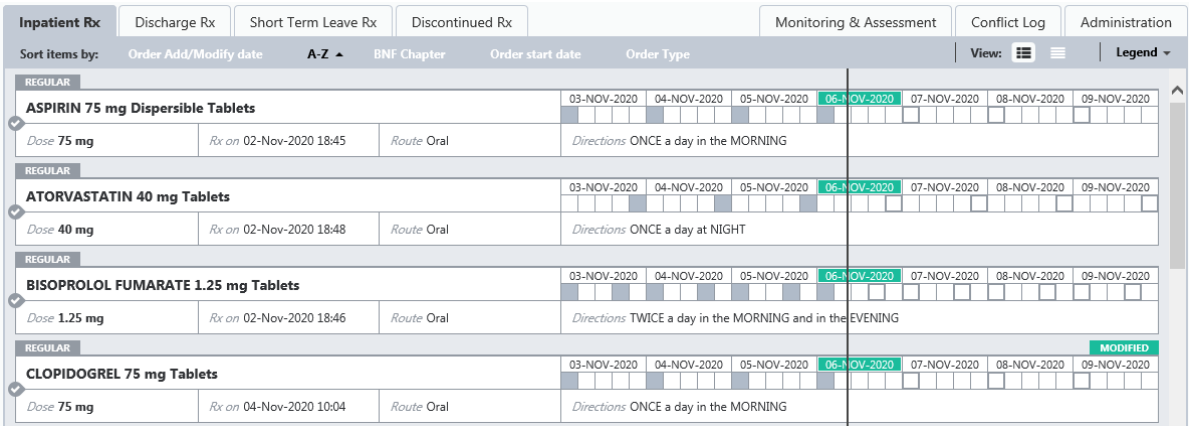


Figure 1: Example inpatient administration chart.

Migration from Paper to HEPMA

Prior to HEPMA, all patients requiring medication intervention during hospital admission had medication prescribed on the all-Wales inpatient medication administration record where the vast majority of medication is prescribed. There are a number of additional supplementary medication charts e.g. adult diabetic ketoacidosis treatment and monitoring chart which are used alongside the all-Wales chart when required for specific treatment with more complex prescribing and administration processes.

All supplementary paper medication charts were reviewed prior to implementation to ascertain whether their associated processes could be safely replicated using HEPMA. In addition to the all-Wales inpatient medication administration record, the adult inpatient Warfarin chart and adult insulin administration record have been digitised via HEPMA.

Replacement of ABMU Clinical Portal with Welsh Clinical Portal

Swansea Bay UHB has been replacing the local clinical portal with the Welsh Clinical Portal (WCP) on non-HEPMA wards since May 2019. The implementation of HEPMA requires a parallel implementation of WCP such that discharge prescriptions generated and allergies recorded within the HEPMA solution populate patients' discharge advice letters (DALs) in their digital health record accessed via WCP.

Processes to Enable Implementation

During the days leading up to ward implementations, a number of key activities were undertaken:

- Confirmation to proceed from Matron and Ward Manager
- Wider ward engagement including the hospital medical team and pharmacy
- Hardware check including charging bays, trolleys, carts and emergency chart production PCs
- Transcription of paper charts onto CMM and suspension of medications until ward go live

Transcription of paper medication charts onto CMM and suspension of medications

To enable HEPMA go live on each ward, paper medication charts must be transcribed into CMM as close to implementations as possible, to reduce the requirement for amendments to be made to electronic medication charts immediately prior to implementation wherever possible (where changes occurred on paper charts), and to minimise the risk of a patient being discharged prior to go live. Immediately following transcription, medications were suspended on HEPMA with the reason "For EPMA Go Live". Transcribing medications indicates that the HEPMA "prescriber" is the transcriber, therefore, a note was added in HEPMA to each patient's record indicating that a paper chart had been transcribed with the name and role of the person who transcribed the chart.

The following processes occurred for each patient admitted at the time of go live per ward:

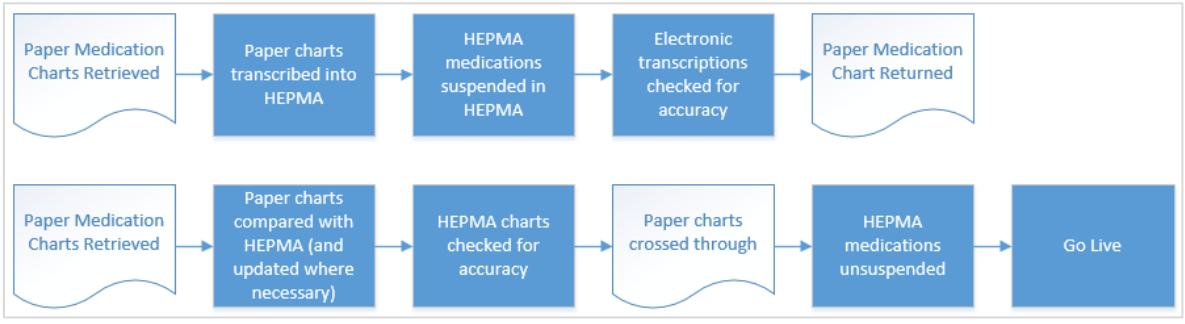


Figure 2: Processes to transcribe paper charts on HEPMA for go live

On average, it took a member of the HEPMA team or supporting Pharmacy staff 27 minutes per patient to transcribe medication chart(s) onto the HEPMA solution.

Each electronic medication chart was compared with the paper chart from a clinical perspective by a Pharmacist or Pharmacy Technician – for completeness and accuracy – to mitigate the risk to patients through inaccurate transcription. This process took a further 15 minutes per patient on average, however this happened in parallel while additional charts were being transcribed.

HEPMA medications were unsuspended immediately prior to the go live medication round (usually lunchtime where fewer medications are administered than during the morning round) to enable HEPMA medicines administration.

Generating Discharge Advice Letters in WCP

In parallel with each HEPMA ward implementation, the Swansea Bay WCP team liaised with Digital Health and Care Wales (DHCW). DHCW were required to update national reference data such that the new HEPMA ward was activated as a medicines transcription and e-discharge (MTeD) ward to enable discharge advice letters to be generated upon admission for new patients. In addition, DHCW also replayed admit messages from the Welsh Patient Administration System (WPAS) into the national messaging architecture to automatically create DALs for patients admitted to HEPMA wards, to enable HEPMA discharge prescribing.

Pre-Pilot

Prior to the implementation of HEPMA on the pilot ward at Neath Port Talbot Hospital, classroom-style training sessions were provided over a two-week period in advance of go live to nurses, prescribers, pharmacists and pharmacy technicians.

All training sessions were tailored to each role with training packages designed to target the most likely usage scenarios. All attendees were provided with the opportunity for questions and answers following each session as well as access to a training instance of HEPMA and an in-house e-learning training package to further familiarise themselves with the system ahead of go-live.

Implementation Support

The support rota was designed to ensure that HEPMA implementation staff were physically on the ward from the morning administration round until the completion of the bedtime round:

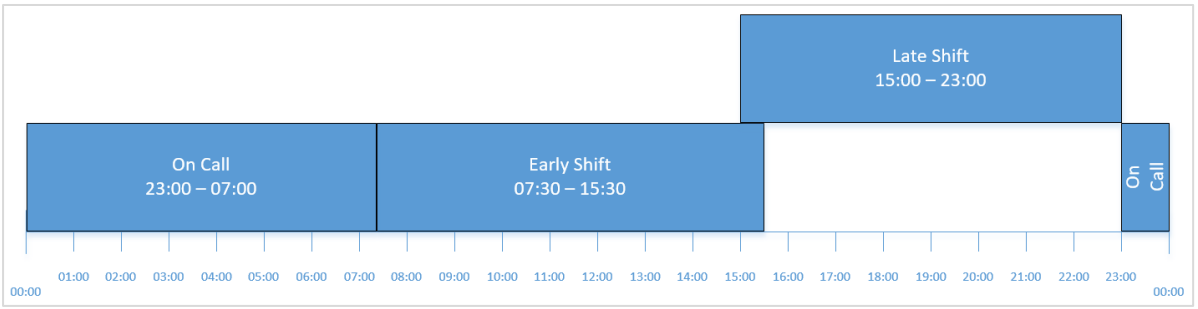


Figure 3: Support Rota Configuration

Implementation Pace

Due to the potential for patients to be transferred between wards within hospitals, it was identified from the outset that it would be necessary to implement HEPMA on each ward as quickly as possible following the previous ward. Therefore, each ward was provided with one week of full

HEPMA team presence including additional, dedicated training support followed by a second week of reduced HEPMA team support. Ongoing ad hoc HEPMA team support was provided as required.

Neath Port Talbot Hospital Implementation

Following testing, configuration and project board approval, HEPMA was taken live on the Neuro Rehabilitation Unit at Neath Port Talbot Hospital on 11 February 2020. The Neuro Rehabilitation Unit was selected as the first location to go live due to its size (up to 14 beds) and level of patient flow which were both lower than the rest of the hospital.

The Neath Port Talbot implementation team comprised:

- 1 E-Prescribing Pharmacist
- 1 HEPMA Facilitator (Pharmacy Technician)
- 5 non-clinical Digital staff (in addition to substantive roles)

All ward implementations were heavily supported by Pharmacy colleagues for the transcription of medication charts to HEPMA including clinical checks of the newly digital prescriptions.

During summer 2020, surgical services were suspended at the hospital, therefore HEPMA did not go live in theatres and on the surgical ward until surgical services resumed in September 2020. HEPMA was piloted in the two theatres in operation at Neath Port Talbot Hospital between September and December 2020; however, during this period the HEPMA solution did not have the ability to prescribe STAT medication retrospectively i.e. those given peri-operatively and recorded later. Also, restrictions on the movement of HEPMA staff between sterile theatres and non-sterile wards during the pandemic was prohibited. Therefore, following feedback from anaesthetists and surgeons and in agreement with the Unit, the surgical ward and theatres reverted to paper.

Implementations took place as follows:

	Ward	Date
Neath Port Talbot Hospital	Neuro Rehabilitation Unit	11 February 2020
	Ward D	15 June 2020
	Ward C	29 June 2020
	Ward B	06 July 2020
	Ward E	13 July 2020
	Theatres x 2	07 September 2020

Table 2: Neath Port Talbot Implementations

Learning from Neath Port Talbot Hospital

Integration Defect – Discontinued Medications Not Included on Discharge Advice Letter

An issue was identified during the first ward of the full implementation at Neath Port Talbot Hospital: admitted on medication that was discontinued during admission did not appear on the discharge advice letter, which would not alert the GP as to the secondary care prescriber's intention to stop the medication which may have continued to be prescribed on an ongoing basis in primary care. The implementation was paused while the issue was resolved by DHCW and the HEPMA system supplier. This resulted in a one-week delay before progressing to the second ward. All patients affected were easily identified through access to HEPMA data. The E-Prescribing Pharmacist wrote to patients' GPs to provide them with accurate medication statuses where patients had already been discharged prior to issue resolution.

HEPMA Supporting the Covid-19 Response

The HEPMA team were asked to leave the hospital site and provide off-site support only from late March 2020 due to the Covid-19 pandemic. During this period, non-HEPMA wards experienced challenges in the administration of medications to patients. These challenges included difficulty in sharing or accessing patients' medication charts, the requirement to reduce the ward footfall to minimise the risk of infection transmission, as well as an increased risk of error where patients' medication charts were stored away from the patient and the medication to be administered needed to be relayed verbally to the nurse with a patient.

In May 2020, the HEPMA team were approached by Neath Port Talbot Hospital Directors to resume the implementation of HEPMA across medical wards given that the HEPMA device could be decontaminated between patients and that a number of pharmacy and prescribing duties could be performed remotely through digital access to medication charts.

Incident – Missed Doses due to Medication Chart Transcription

To enable the implementation of HEPMA at Neath Port Talbot Hospital, 2,882 prescriptions for 108 patients were transcribed from paper to electronic charts. As a result of the transcription to HEPMA, one out of 108 (0.92%) patients resulted in two medication doses being unintentionally omitted.

Root cause analysis was undertaken which established the following:

1. The patient's paper medication chart was transcribed to HEPMA accurately.
2. The patient's paper medication chart was returned to enable medicines administration on paper until go live.
3. A number of patients' paper medication charts were removed from the ward by pharmacy to undertake regular, ongoing review of all medications prescribed, including that of the affected patient.
4. The affected patient's paper medication chart was given to the pharmacist responsible for accuracy checking the transcription of paper medication charts to HEPMA alongside charts which had already had medications unsuspended on HEPMA.
5. The pharmacist (in 4) crossed through the patient's chart and filed it in their notes in line with agreed processes. However, medications had not been resumed in HEPMA.
6. The affected patient's medications remained suspended on HEPMA and two doses were omitted during the evening and bedtime medication rounds following go live.

The unintentionally omitted medications included Adcal D3 (calcium and vitamin D3) and Senna (a stimulant laxative).

The HEPMA team immediately logged an incident using Datix and an investigation was undertaken by the ward manager; the investigation concluded that no harm was caused to the patient.

The process to support the transcription of medications to go live was subsequently strengthened to mandate an additional check to ensure that HEPMA medication charts are reviewed ensuring relevant medications are unsuspended prior to the paper chart being crossed through and filed.

No such incidents occurred at Singleton Hospital (233 patients' medication charts transcribed; 5,917 prescriptions).

Software Limitations

A supplier upgrade to the HEPMA solution was required to resolve a number of limitations present in the live environment which were not acceptable for the Singleton implementation including:

- Medications which patients were admitted on and were withheld during admissions were not appearing on discharge advice letters. Neath Port Talbot Hospital pharmacy colleagues were required to manually edit discharge advice letters for affected patients which was not deemed sustainable in the longer term.
- The start date for medications commenced in hospital, which were to be continued following discharge were appearing on discharge advice letters with an incorrect date (the date of the discharge prescription instead of the actual start date). Where start dates were clinically significant, Neath Port Talbot Hospital pharmacy colleagues were required to manually edit discharge advice letters to include an appropriate narrative to communicate the correct date to primary care colleagues.

A further issue was unable to be resolved prior to the planned Singleton implementation:

- Discharge prescriptions containing Warfarin did not include the pharmacist verification status. Therefore, discharge advice letters displayed "Medications not clinically verified by Pharmacist in EPMA system" despite all prescriptions being verified in the HEPMA solution. Neath Port Talbot Pharmacists also annotated DALs to indicate that relevant medications *had* been clinically verified.

The HEPMA project board was briefed and accepted in partnership with Pharmacy management that the Warfarin verification issue was not a significant dependency that should stop the Singleton implementation. This issue was resolved in Q4 2021-22.

Training Approach

Upon go live, additional staff training was required and given the level of change to medication processes, extensive training during the implementation was also required. Due to shift patterns, a number of nurses who had attended a classroom training session did not see the system for up to three weeks prior to go live; prescribers also described a lack of confidence in using the system without additional training and pharmacy staff also requested further training. It was therefore agreed that limited training to nurses would be provided in advance of the next ward go live, and that additional staff would provide support to the previous ward following movement to the next.

The HEPMA implementation and training and support model allowed for 1:1 training for each member of staff from all professions. The trainer's role evolved into:

- accompanying nurses on medication administration rounds, often more than once
- supporting prescribers during ward rounds, or as required throughout the day
- supporting pharmacy colleagues particularly due to the changes to the discharge advice letter (which superseded the local Electronic Transfer of Care solution in ABMU Clinical Portal)

On call support was provided overnight between 23:00 and 07:00 (see On Call).

Singleton Hospital

Following project board acceptance of the unresolved Warfarin discharge medication issue, HEPMA was taken live on ward 4 at Singleton Hospital on 23 March 2021. Ward 4 was selected given its relatively lower level of patient flow in comparison with other Singleton wards.

The Singleton implementation (11 wards) team comprised:

- 1 E-Prescribing Pharmacist
- 2 HEPMA Facilitators (Pharmacy Technicians)

- 13 non-clinical Digital staff (in addition to substantive roles)
- 1 Ward Pharmacist
- 2 Ward Pharmacy Technicians

All ward implementations at Singleton Hospital were also heavily supported by Pharmacy colleagues for the transcription of medication charts to HEPMA including clinical checks of the newly digital prescriptions.

The implementation team was expanded to include additional resource from the wider digital department and Singleton Pharmacy, which allowed for a model of continuous core HEPMA clinical support and sufficient trainers to support medication administration rounds. Weekend support was reduced in line with the reduced number of clinical and pharmacy colleagues working on site.

The implementations at Singleton were as follows:

	Ward	Date
Singleton Hospital	Ward 4	23 March 2021
	Ward 3	06 April 2021
	Ward 6	13 April 2021
	Ward 9	20 April 2021
	Ward 8	27 April 2021
	Singleton Assessment Unit	04 May 2021
	Ward 1	11 May 2021
	Ward 7	18 May 2021
	Ward 12	18 May 2021
	Ward 11	24 May 2021
	Enhanced Medical Unit	26 May 2021

Table 3: Singleton Implementations

Learning from Singleton Hospital

In advance of the implementations at Singleton Hospital, it was made clear that the HEPMA project would need to be able to respond appropriately to ward moves due to estates work which was addressing the building's cladding. The HEPMA project team responded in an agile manner by developing a number of project plans to enable implementations to continue regardless of the physical location of the subsequent ward.

This approach posed additional problems where more than one ward combined, or a ward was split into two locations. At each decision point prior to the next ward's implementation, the HEPMA Senior Project Manager liaised with hospital operations management, matrons and ward managers to confirm implementations. There was no impact to the overall delivery of HEPMA against the timescales set out in the project plan.

Processes – Pre and Post HEPMA

Table 3 details processes associated with prescribing and charting medications pre and post implementation of HEPMA:

Process		Paper – Pre-HEPMA	HEPMA
Prescribing	Documenting allergy status	Handwrite on front of each paper medication chart for every admission to hospital.	Document allergies and associated reactions digitally against patient record. Previously documented allergies are presented for validation or amendment upon subsequent admission(s).
	Venous thromboembolism (VTE) risk assessments	Multiple different iterations of a paper risk assessment form. Record on paper medication chart whether VTE prophylaxis is indicated or not.	Completion of risk assessment digitally.
	Prescribing medications	Handwrite medication prescribed. External resources used e.g. BNF / COIN, pharmacists etc. to inform clinical decision making.	Prescribe medications digitally, supported by clinical decision support at the point of prescribing to identify allergy conflicts, interactions, duplication of therapy, unlicensed and non-formulary prescriptions.
	Prescribing oxygen	Circle target oxygen saturation on the front of each paper medication chart and sign.	Prescribe oxygen as a PRN medication with a note to indicate target O_2 saturation.
	Additional prescribing where there is no longer space available to chart the administration of PRN (as required) medications	Prescribe the same medication again on the paper chart or transcribe the whole medication chart where there is no space available to prescribe a single item required.	No limit to the number of doses that can be administered (unless the prescriber chooses to limit intentionally).
	Rewriting lost or full medication charts	Where paper medication charts are full with no space for additional prescribing, new charts including all currently prescribed medications must be re-written.	Medications charts are available to all authorised users via any Health Board device, from any hospital site for the entirety of patient admissions.
	Withholding medications	Prescribers must strike through paper medication charts for prescriptions or the dates on which medications are to be withheld.	Prescribers are able to suspend medications causing them to be unavailable for administration by nursing colleagues. Prescribers can restart prescriptions with ease when clinically appropriate/indicated.
	Antimicrobial prescribing	Prescribe antimicrobials in specific section of the chart with space to include indication, whether probable or possible and rationale for choice. Initial prescriptions have a hard stop after 72 hours and have to be re-prescribed if to continue for a maximum of 5 more days. If needed for longer prescriptions have to be re-written again.	Prescribe antimicrobials by indication, configured based upon guidelines including dose, frequency and duration of treatment. Business intelligence deployed to support highlighting when antibiotic prescriptions need to be reviewed. When reviewed, prescriptions continue without the need to re-write. If not reviewed, prescriptions suspend after 72 hours.
	Warfarin dosing	Manage warfarin dosing on a paper inpatient warfarin chart including the documentation of patients' INR results and dose of warfarin to be administered – requires updating on a regular, often daily basis.	Business intelligence solution deployed to support warfarin prescribing. Prescribers can view all Warfarin patients' dosing statuses via Swansea Bay's e-whiteboard solution – Signal.

Process		Paper – Pre-HEPMA	HEPMA
Administering	Medication rounds	Nurses review each item on every patients' paper inpatient medication charts to identify whether any medications are due to be administered now.	HEPMA visually indicates which patients currently have medications due to be administered, however all nurses are encouraged to review patients' electronic medication charts regardless. 'Quick chart' functionality provides nurses with the ability to see at a glance which medications, the form, dose and route are due to be given at that time.
	Charting medications given	Nurses record medications given by signing/initialling each item administered under the correct date, item and medication round.	When preparing medications to be administered, nurses can utilise checkboxes to indicate medications given. When medications are administered, nurses chart all doses together. A clear audit trail records the nurse's full name.
	Documenting non-administrations	A numeric code is written for medications not administered instead of the nurses' initials for which there is no record of who charted the non-administration code. This is also not enforced resulting in the ability to leave a dose box blank, resulting in an unknown administration.	A dropdown list is available for each dose to record any non-administration reason (which corresponds with the numeric reasons used on the all-Wales inpatient medication chart) and there is an audit trail of who entered the non-administration reason.
Medicines Management	Drug History	Compile drug history list from sources of medicine information: patient, patient's own medication, GP record, any previous discharges, other sources of prescriptions. Use of Pharmaceutical Care Plans in some areas including additional information.	Compile drug history list from sources of medicine information: patient, patient's own medication, GP record, any previous discharges, other sources of prescriptions. Add a note to the patient's record with the drug history list.
	Medicines Reconciliation	Annotate drug chart if medicines prescribed are new, continued from pre-admission or where doses have changed. Communicate any queries with the medical team verbally, by writing in medical notes or annotating the front of the drug chart.	Select checkboxes on prescriptions to indicate where medication was taken prior to admission. Notes can be added to indicate where doses have changed. Communicate any queries with the medical team verbally, by writing in medical notes or adding a 'doctor to action' note on the HEPMA system.
	Ordering Medication	Orders are transcribed by hand on to ordering sheet for dispensing. Drug chart annotated with date supply of medication made.	Medications are ordered electronically via HEPMA and are automatically generated for medications prescribed that are not kept on the wards. Medication locker checks are documented electronically via Swansea Bay's e-whiteboard solution – Signal.
	Rewritten lost or full medication charts	Where paper medication charts have been rewritten due to being lost or full, Pharmacists undertake a transcription check to ensure all prescription information has been transcribed correctly.	Medication charts continue for the entirety of a patient's admission.

Process		Paper – Pre-HEPMA	HEPMA
Discharge comms to Primary Care	Allergies	No allergy information communicated as standard on discharge using local Electronic Transfer of Care solution.	Allergy information automatically populates the Discharge Advice Letter from the HEPMA system when discharge prescription completed.
	Medicines Transcription	Prescriptions are manually transcribed from paper medication charts onto e-discharge solution, mainly by Pharmacy staff.	Prescriptions are imported electronically from the drug chart onto the discharge prescription by prescribers.
	Clinical Summary Narrative	Completed electronically in ABMU Clinical Portal's Electronic Transfer of Care (EToC) solution or WCP Medicines Transcription and E-Discharge (MTeD).	Completed electronically in WCP.

Table 4: Medication Processes pre and post HEPMA

Safer Prescribing

EPMA provides increased prescription legibility, reducing the potential incidence of medication and dispensing errors caused by illegible prescriptions.

A number of options relating to safer prescribing practices were considered during the configuration phase of the project. Clinical working groups agreed to enforce the completion of a patient's allergy status and initial VTE risk assessment before any prescribing can take place, resulting in improved compliance and increased assurance on prescribing practice.

CMM provides the ability to customise the VTE risk assessment with up to an additional three thrombotic and three bleeding risks according to local policy. These risk factors were agreed prior to go live. When updated guidelines were published in September 2020, the risk factors were amended to include the new thrombosis-related risk factor of 'confirmed or suspected COVID-19'.

Documented allergy statuses enable clinical decision support to be utilised, and ensures that prescribers are alerted when a prescription conflicts with a patient's allergy status.

The EPMA system allows for the ability to prevent prescribing of medication where certain allergy reactions are selected e.g. anaphylaxis. For other reactions, users are alerted to a conflict and have the ability to override to continue to prescribe e.g. stomach upset. The clinical working groups approved the decision to prevent prescribing of medication where an allergy reaction of anaphylaxis is recorded to mitigate the risk of serious patient harm.

Protocols

Doctors and non-medical prescribers are supported during the prescribing process by HEPMA where standard medications or sets of instructions should/could be followed in the form of a 'protocol'. There are a number of protocols that have been configured to be available to prescribers which can facilitate more efficient, guided prescribing. For example:

- Prescribing antimicrobials for particular clinical indications and optimum durations to support antimicrobial stewardship e.g. Amoxicillin for hospital-acquired pneumonia for five days.
- Automatically reducing medication dosages at tailorable, defined intervals as per guidelines e.g. Prednisolone – commencing a dose of 20mg per day, reducing by 5mg each week, completing the course after four weeks.
- Prescribing medications given once per week e.g. Methotrexate. Prescribers can select a protocol based on the day of week the medication should be administered, without requiring the prescriber to select the start date, frequency, and day of week for administration.
- Prescribing as required medication for last days of life e.g. medication to relieve pain, breathlessness, nausea and respiratory secretions at doses, routes and frequencies as per Palliative Care guidelines.

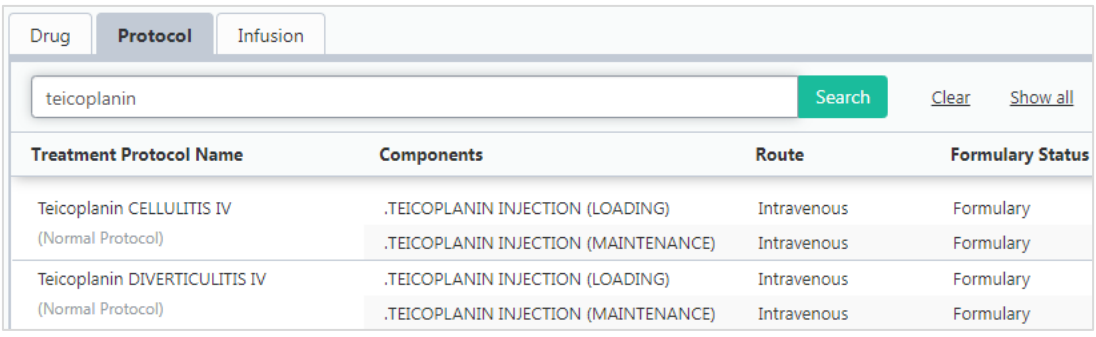


Figure 4: Example treatment protocol search within CMM

A full list of treatment protocols configured by the HEPMA team following approval by the relevant professional working group(s) can be found at appendix 5.

Product Testing

Comprehensive testing was undertaken throughout 2019 and early 2020 to ensure the application functioned as required, and that all end-to-end processes were tested including:

- Admissions, discharges and transfers generate an electronic medication chart, transfer the electronic chart to the correct ward, or archive the chart following discharge.
- Prescribe medications including amendments, suspensions and discontinuations for inpatients, home leave patients and discharge prescriptions.
- Medicines administration, including the charting of unintentionally omitted doses.
- Medicines management ensuring that medications' statuses e.g. new, continued are recorded correctly and are accurately reflected on patients' discharge advice letters (DALs) in Welsh Clinical Portal.
- Clinical narratives and drug notes stored within the HEPMA solution also populate DALs.

Integration between CMM and other products

Integration	Functionality	In Place?
WelshPAS (WPAS)	• Patient demographics – CMM maintains patient records within its own database, mirroring WelshPAS (WPAS) i.e. when a patient's record is updated in WPAS it is updated in CMM, enabling pharmacy operations to continue during periods of WPAS downtime.	✓
	• Admissions, discharges and transfers (ADTs) – CMM maintains a live patient location to enable electronic prescribing based on the patient's location, dependent on this being updated in real-time using WCP.	✓
Welsh Care Records Service (WCRS)	• Populates discharge advice letters (DALs) (viewable in WCP) with discharge prescriptions completed in CMM.	✓
Welsh Clinical Portal (WCP)	• Viewing patients' electronic medication charts from within their digital health records in WCP. This functionality was enabled by DHCW, however remains disabled due to the ability to navigate between multiple patients' EPMA medication charts within a single patient's record in WCP. This was resolved by the supplier mid-implementation and will be activated in readiness for future implementations across Swansea Bay UHB.	✗
Active Directory	• CMM supports single sign on – the ability to launch the HEPMA solution without being required to enter a username or password, providing the user logged into the computer is an authorised user of CMM.	Partially

Table 5: Integration between CMM and other products

The following simplified diagram explains how the HEPMA solution (CMM) is integrated with WelshPAS and WCP:

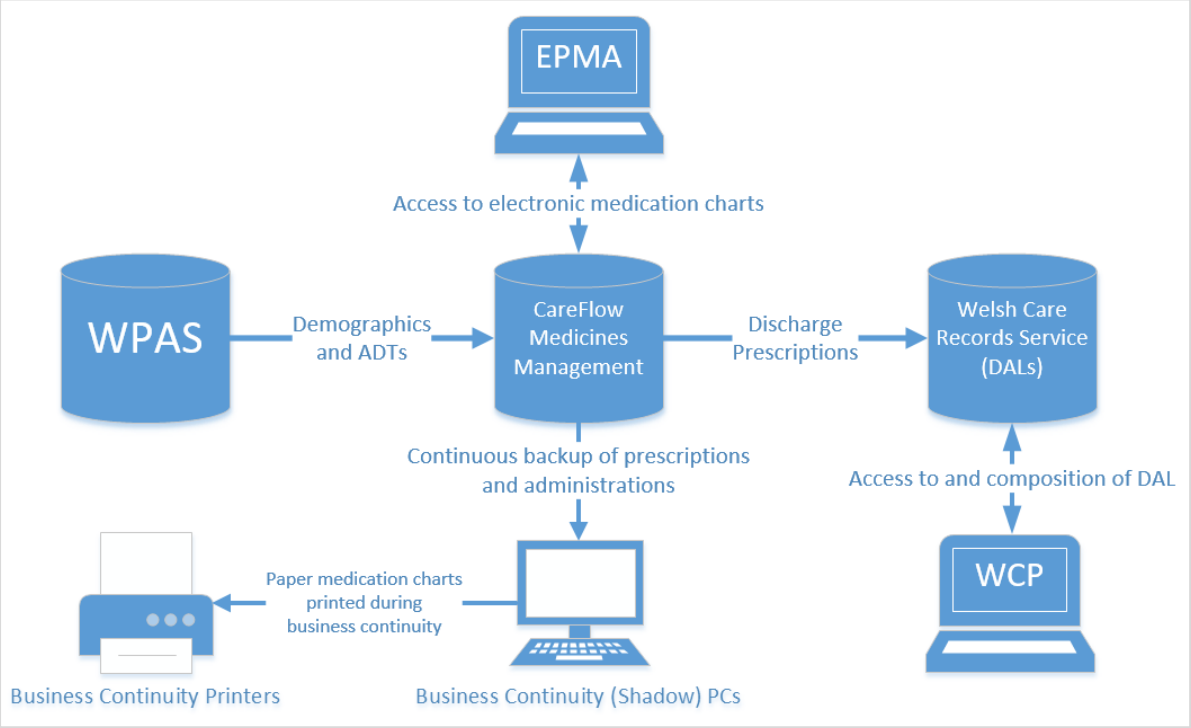


Figure 5: Integration between CMM EPMA, WPAS and WCP

Development by the supplier and DHCW to enable discharge prescriptions to populate patients' discharge advice letters lasted between Summer 2017 to late 2019. A number of upgrades to the CMM EPMA solution was required including interface development which prompted additional development by DHCW to ensure the accurate population of DALs.

DIGITAL TRANSFORMATION

In order to enable digital prescribing and medicines administration processes, a number of activities were undertaken in readiness to plan the order of implementations, to ensure the system was safe and fit for purpose and to procure and deploy suitable hardware to enable the implementation of EPMA.

Clinical Leadership

The HEPMA project board comprises senior, clinical roles including Unit Medical Director, Chief Clinical Information Officer, Clinical Director of Pharmacy, Head of Corporate Nursing and Chief Nursing Informatics Officer. Board members have remained fully engaged throughout the life of the project and have also provided significant advice and guidance outside of the remit of the project board.

The HEPMA project was also governed clinically by a number of configuration working groups such that configurable functionality was appropriately directed and assured. See Appendix 6 – Clinical Governance – Working Groups and Configuration Ratification Group.

Alignment with the Implementation of Welsh Clinical Portal – the wider Digital Ward

Digital implementations at Swansea Bay are not undertaken in isolation of other digital solutions available. HEPMA was implemented in parallel with Welsh Clinical Portal (WCP) such that WCP became the ward's main clinical portal alongside HEPMA given that discharge advice letters in WCP are populated seamlessly by HEPMA. In addition, twice daily warfarin alerts and a number of business intelligence reports populate Signal, the Swansea Bay digital whiteboard solution.

The Welsh Nursing Care Record was also implemented at Neath Port Talbot and Singleton Hospitals following HEPMA such that the user base was familiar with the devices available and the concept of the digital health record. The evaluation of WNCR also indicated that users had increased confidence in using devices following the implementation of HEPMA.

Device appropriateness

Prior to the implementation of HEPMA, hardware audits were conducted on all wards where HEPMA would be implemented, and all user professions were consulted in relation to the choice of devices which could be made available to enable the implementation. This included hands-on demonstrations of devices and equipment. Learning from the original devices selected has informed future implementations to support the digital ward. See Appendix 2 – Devices.

Business Continuity

The implementation of HEPMA required a robust business continuity solution given that a swift return to paper is not possible following implementation as no current record of all medications prescribed and the administration histories for those prescriptions is available. A number of emergency chart production PCs are deployed across both hospitals in locations agreed with clinical site managers and are utilised for both HEPMA and WNCR. See Business Continuity in Appendix 2 – Devices.

Baselining and Process Mapping

Prior to implementation, it was important to fully understand the impact of the digital transformation to be undertaken. Pre and post implementation questionnaires were completed by all staff groups; clinical audits were completed to ascertain the appropriateness of prescribing and administrations prior to implementation; 100+ time and motion studies were conducted observing existing processes to identify opportunities to improve patient safety, quality and time efficiencies.

Training

Bespoke training packages were developed for all staff groups including classroom training, 1:1 training during implementation, and e-learning.

Communication and Engagement

Meetings were held with all cohorts of staff across each hospital both prior to and during the implementations thus ensuring all staff were ready for the significant changes ahead and therefore would embrace it. A culture of continuous learning was maintained, with regular review of what worked well and what did not work well. The level of support and training provided to each ward before, during and since their implementation was tailored in response to their own requirements.

HEPMA Utilisation

The following data relate to the period 11 February 2020 to 31 March 2022.

Users

Table 6 details the number of users by HEPMA role as at 31 March 2022. Each user received 1:1 training during the implementation, or undertook e-learning and was granted access when e-learning completion was verified:

Role	n Users
Prescribers	262
Nursing	1,086
Pharmacy	50
Total	**1,398**

Table 6: Number of HEPMA users by role as at 31 March 2022

Admissions to HEPMA wards

Between 11 February 2020 and 31 March 2022, 6,391 unique patients had 7,884 admissions which included stays on HEPMA wards, and therefore had electronic medication charts and discharge advice letters populated with discharge prescriptions and allergies by the HEPMA product and integration with the national architecture.

Prescribing

243,843 individual medications were prescribed electronically using HEPMA. This includes inpatient, home leave and discharge medication prescriptions:

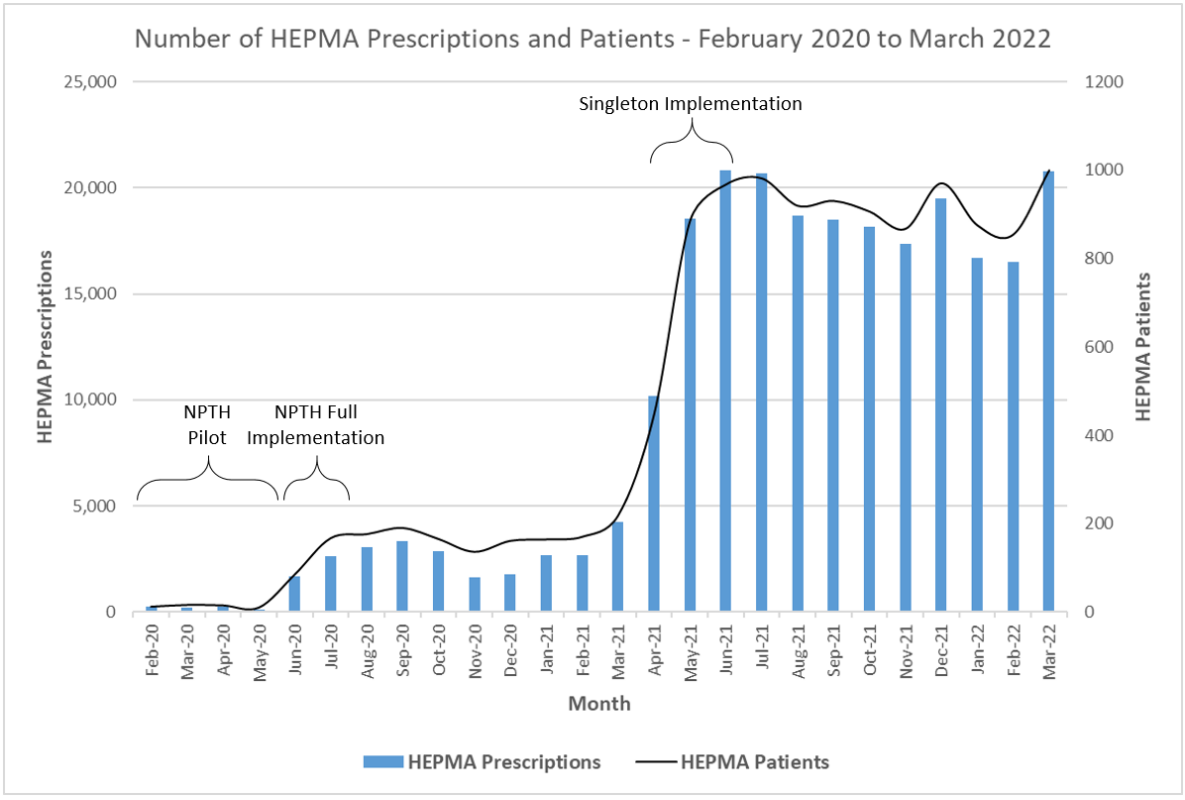


Chart 1: Number of HEPMA prescriptions and patients by month Feb 2020 – Mar 2022

The rise and decline in number of prescriptions observed in chart 1 correlates with the number of patients admitted to HEPMA wards during respective months.

Pharmacist Verification

242,022 prescriptions have been verified by a Pharmacist between February 2020 and March 2022:

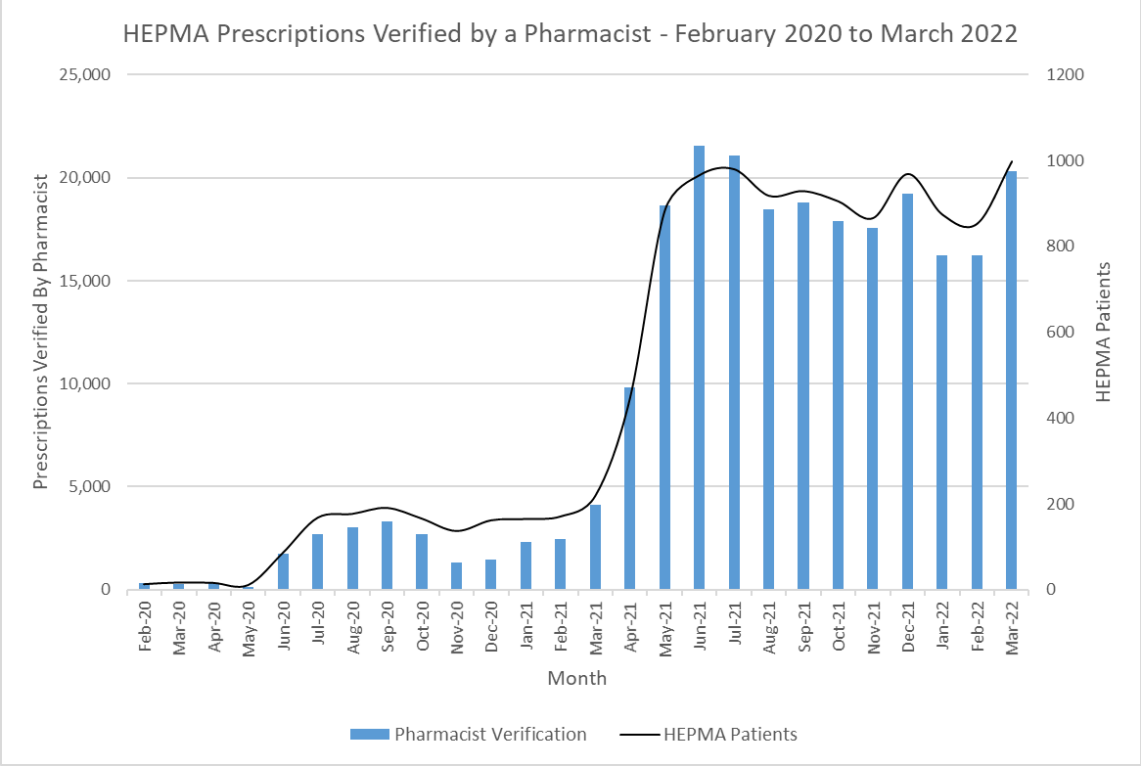


Chart 2: HEPMA Prescriptions verified by Pharmacists Feb 2020 – Mar 2022

Not all HEPMA prescriptions require pharmacist verification e.g. dietary supplements, oxygen and 'dummy drug files' e.g. Milk. Therefore, the number of digital prescriptions verified by pharmacists will always be lower than the total number of digital prescriptions.

Nursing

2,491,346 medication doses have been charted digitally since February 2020:

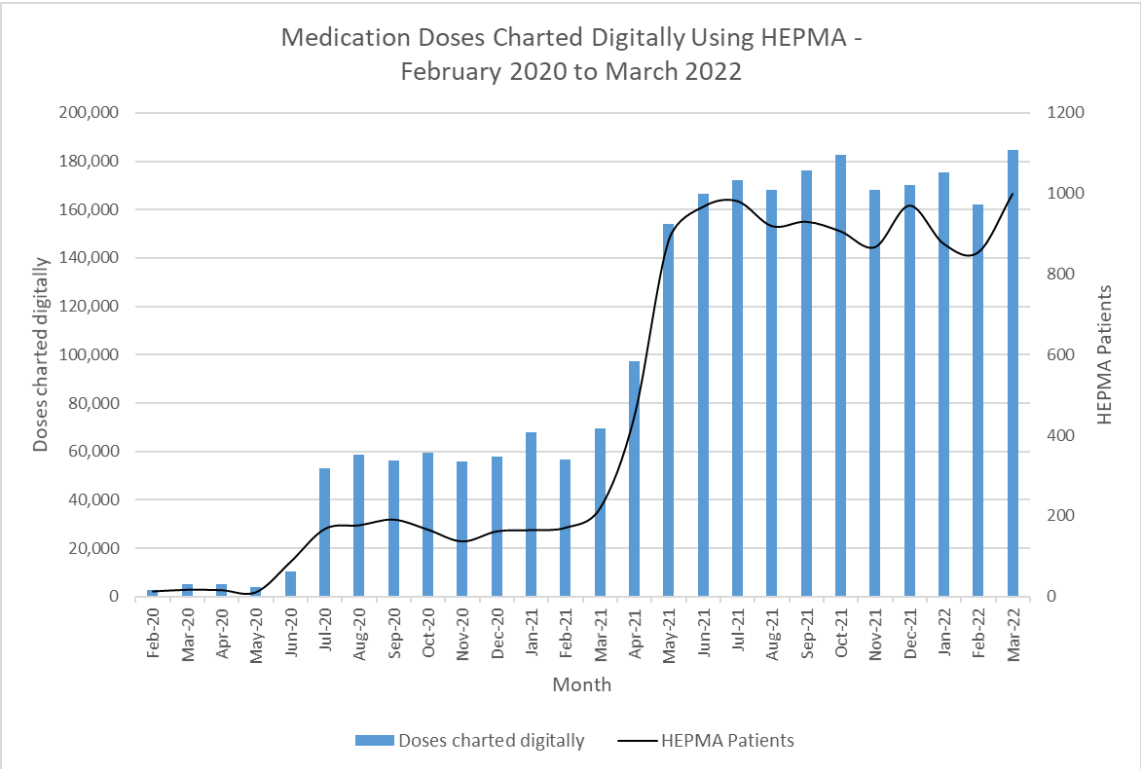


Chart 3: Doses Charted using HEPMA Feb 2020 – Mar 2022

Following implementations, a staff survey was undertaken which asked respondents to either rate their agreement with a statement and to give free text responses. 109 responses were received.

Prescribers (Medical and non-medical prescribers)

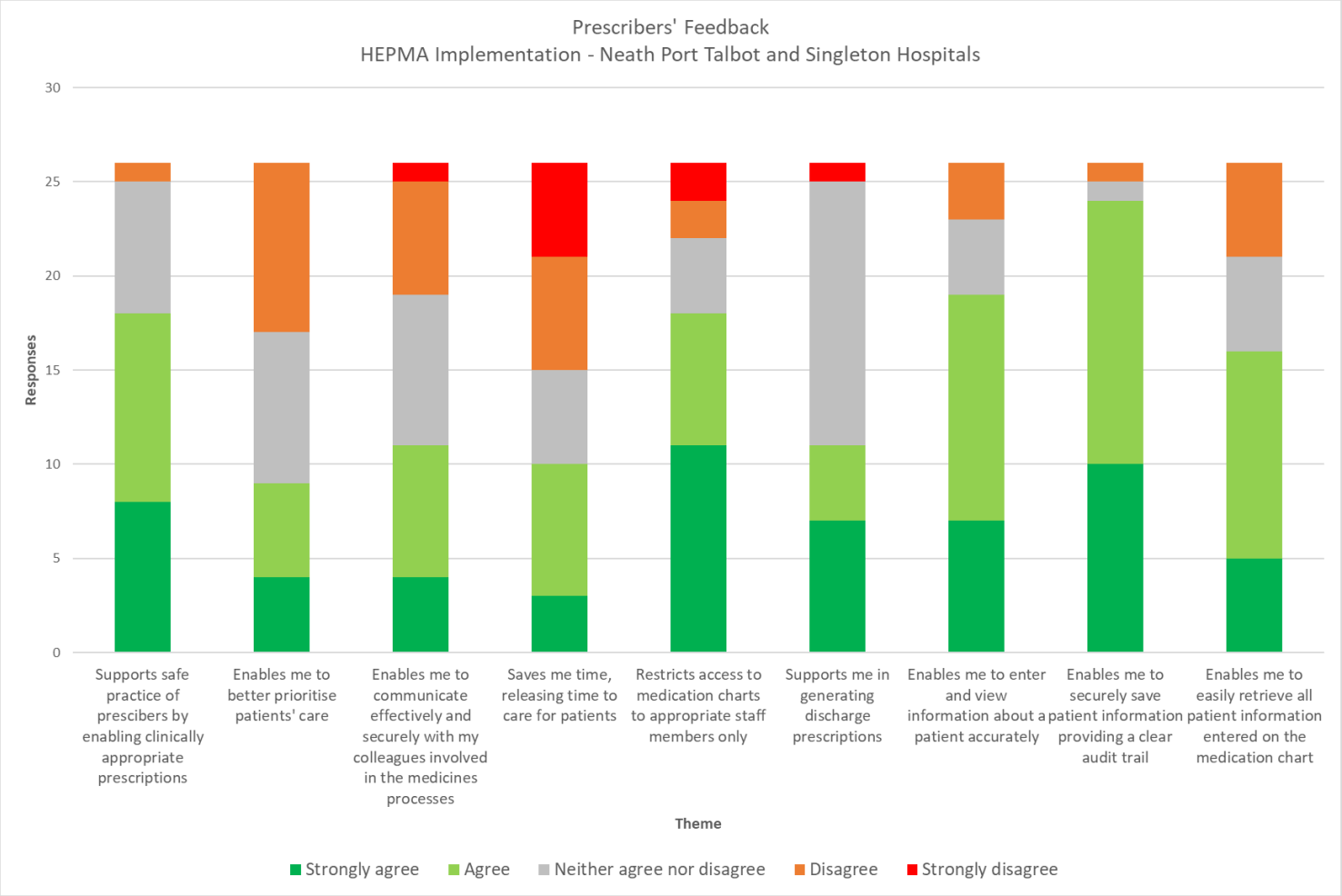


Chart 4: Prescribers' Feedback

Theme	% Strongly Agree / Agree	% Neither Agree nor Disagree	% Disagree / Strongly Disagree
Enables me to securely save patient information providing a clear audit trail	92%	4%	4%
Enables me to enter and view information about a patient accurately	73%	15%	12%
Supports safe practice of prescribers by enabling clinically appropriate prescriptions	69%	27%	4%
Restricts access to medication charts to appropriate staff members only	69%	15%	15%
Enables me to easily retrieve all patient information entered on the medication chart	62%	19%	19%
Enables me to communicate effectively and securely with my colleagues involved in the medicines processes	42%	31%	27%
Supports me in generating discharge prescriptions	42%	54%	4%
Saves me time, releasing time to care for patients	38%	19%	42%
Enables me to better prioritise patients' care	35%	31%	35%

Table 7: Prescribers' Feedback

Over 50% of prescribers agreed or strongly agreed with five of the nine key themes with the changes to workflow processes following the implementation of HEPMA. Two of the key themes with less than 50% agreement had a greater % of agreement than disagreement, one theme had equal responses and there was only one area where prescribers indicated a more negative response in relation to releasing time to care.

The lack of time saving is not an uncommon finding in the early stages of new clinical information system implementations, however this finding is almost on par with the % of staff that agreed it does release time to care.

The highest rated area across all staff groups was the ability to securely save patient information providing a clear audit trail. All prescribing and medication administration activities are date and time stamped enabling clinicians to review medication with information not previously provided on paper medication charts. Prescribers also highly agreed that HEPMA supports appropriate prescribing with the provision of clinical decision support now available at the point of prescribing.

Another theme which is common across professions is the consensus that the HEPMA solution restricts access to medication charts to appropriate staff members only; anyone without an account can no longer view a medication chart.

Prescribers were also given the opportunity to define, in their opinions, the most and least preferred elements of HEPMA. The content of these were analysed, categorised, and reviewed independently by two members of staff for validation. Categories with a frequency ≥ 2 are included on the chart. Individual comments are listed below charts:

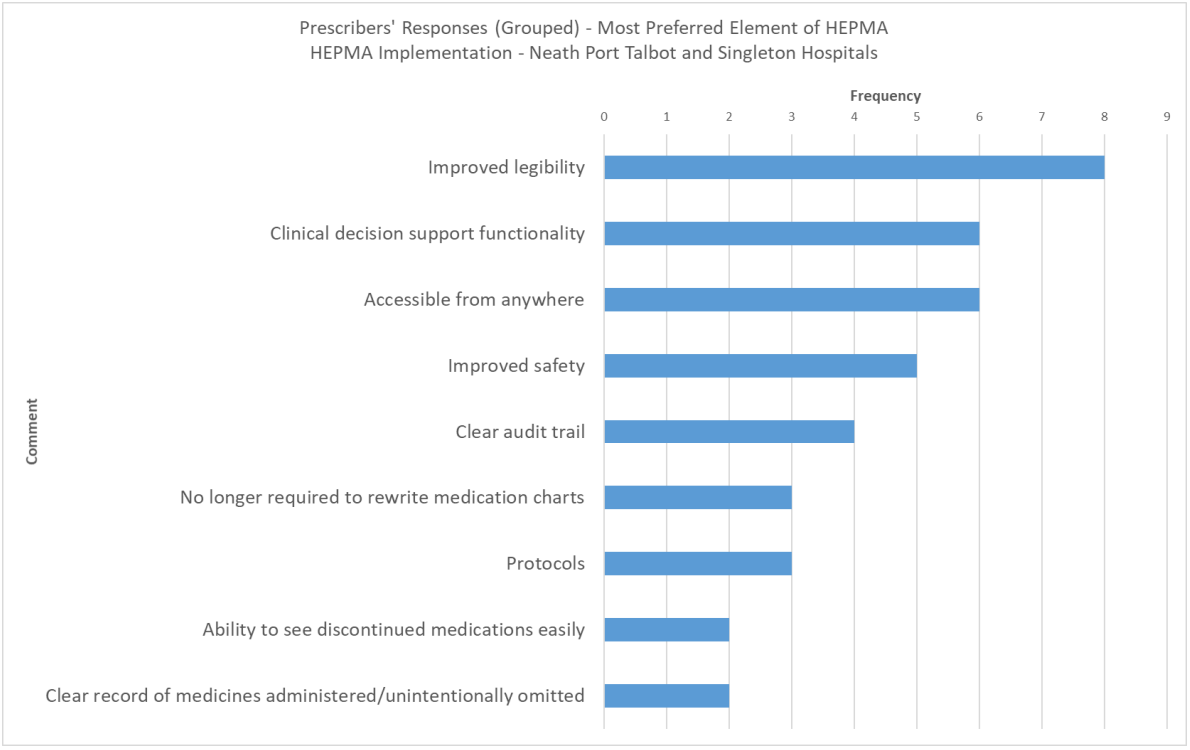


Chart 5: Prescribers' Grouped comments – Most preferred Element of HEPMA

Comments from individual prescribers – most preferred element:

- Access to clinical drug information via HEPMA solution
- Ease of use / Easier to prescribe medications with definite end date
- Saves time / releases time to care for patients
- Simplicity
- Prefer HEPMA over paper medication charts

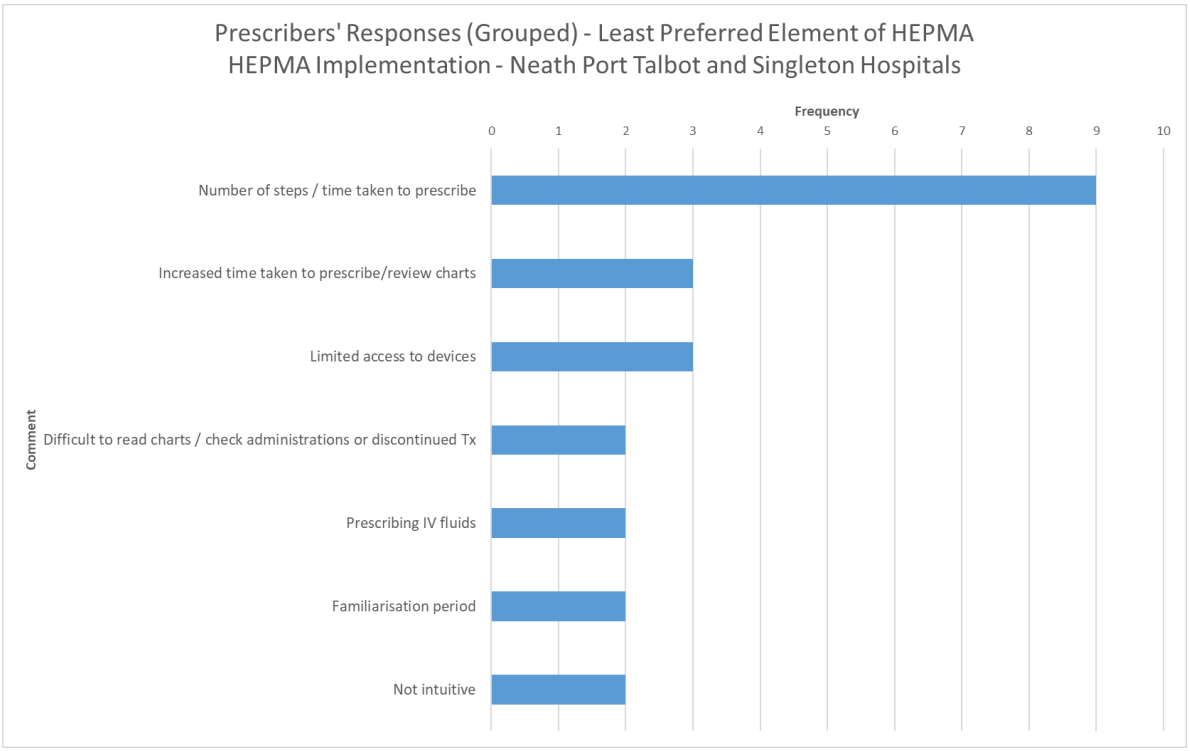


Chart 6: Prescribers' Grouped comments – Least preferred element of HEPMA

Comments from individual prescribers – least preferred element:

- Unable to see trends of warfarin and historic INR results easily
- Takes longer to review charts in urgent situations
- Unable to amend route once medication prescribed
- Required to log in
- System time out
- Access to prescribing different regimens
- Selecting time at which changed dose begins
- Unable to record retrospective administrations
- Lack of integration with Chemocare
- Difficult to access at the bedside
- Unable to see all PRN prescriptions together including past 24h administrations
- Not implemented 10 years ago!
- Required to search for generic drug names
- Unable to change a regular medication to PRN or vice versa
- Devices slow
- Poorer visibility of prescriptions
- Alert fatigue
- Chart not printed on transfer to non-HEPMA ward
- Unable to prescribe by brand

Other comments from prescribers (verbatim):

- Minor adjustments needed
- I would not go back to paper medication charts
- Initially felt HEPMA wasted time, but now prefer it over paper as it is safer and always available
- Keen to see HEPMA rolled out across the Health Board
- Not intuitive - by default, stat prescriptions later appear in discontinued medications tab once administered
- Does not replace pen and paper for ease of use
- Do not like the 'note' functionality - not easy to action e.g. It is difficult to make notes that are clear for all to see (i.e. held while CrCl <30) that actually get seen
- Unable to prescribe by brand e.g. creams and inhalers. Would like to be able to search by brand to prescribe the generic drug.
- The team has been excellent - very responsive and knowledgeable
- Felt really supported during implementation
- HEPMA telephone support is very helpful when having specific prescribing issues
- The training and support was good
- Larger team will be required to implement and support on a bigger site such as Morriston

Nursing

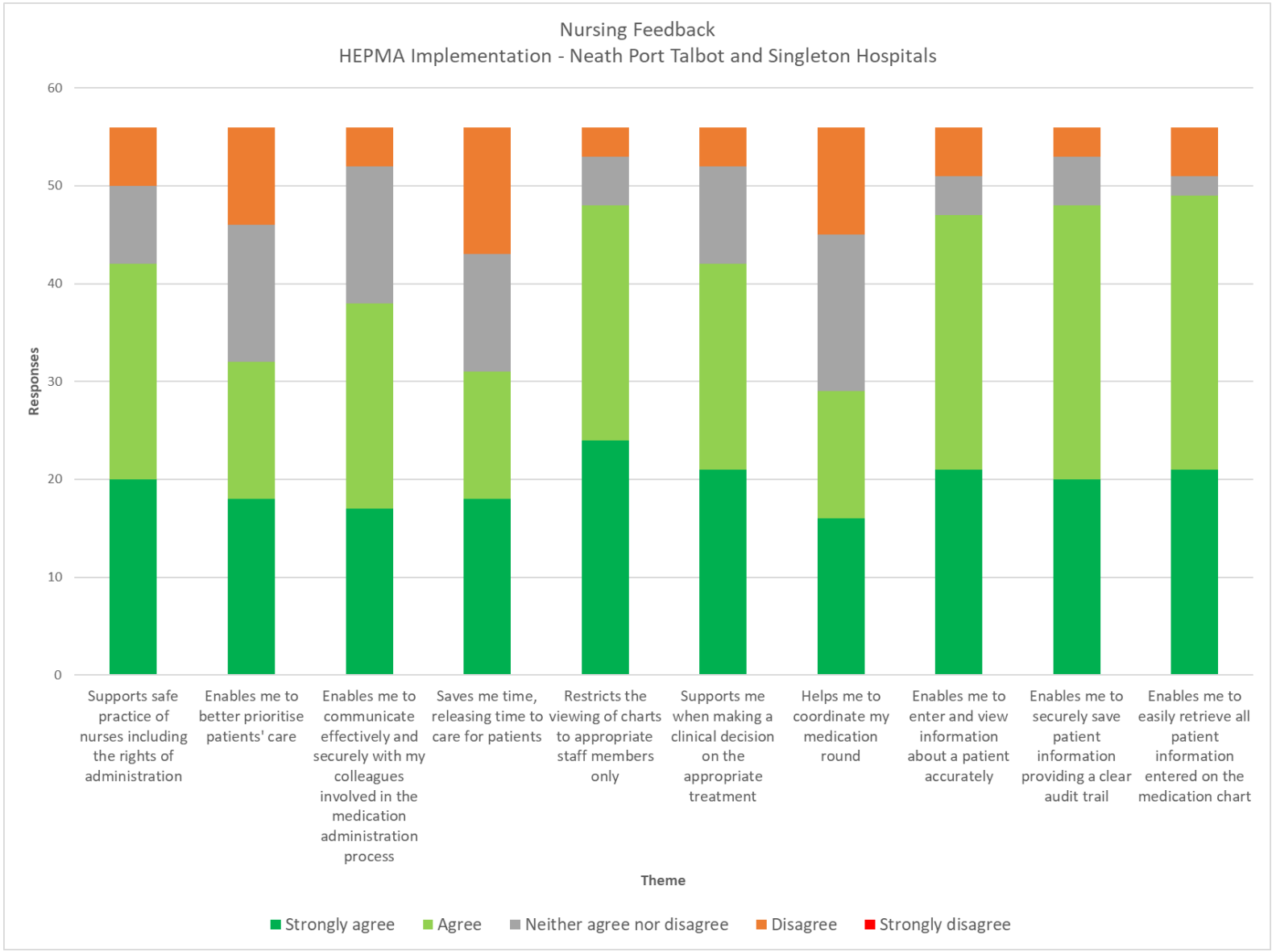


Chart 7: Nurses' Feedback

Theme	% Strongly Agree / Agree	% Neither Agree nor Disagree	% Disagree / Strongly Disagree
Restricts the viewing of charts to appropriate staff members only	86%	9%	5%
Enables me to securely save patient information providing a clear audit trail	86%	9%	5%
Enables me to enter and view information about a patient accurately	84%	7%	9%
Supports safe practice of nurses including the rights of administration	75%	14%	11%
Supports me when making a clinical decision on the appropriate treatment	75%	18%	7%
Enables me to communicate effectively and securely with my colleagues involved in the medication administration process	68%	25%	7%
Enables me to better prioritise patients' care	57%	25%	18%
Saves me time, releasing time to care for patients	55%	21%	23%
Helps me to coordinate my medication round	52%	29%	20%

Table 8: Nurses' Feedback

It is positive to observe that more than half of nursing staff agreed/strongly agreed with all of the key themes above when asked, given that nurses comprise 77% of the HEPMA user base.

The most negative area was in keeping with the Prescriber opinions on time saving and releasing time to care, however, this is to be expected given the implementation of HEPMA has not only changed the way medications are administered, but has also mandated that nursing staff work more digitally.

A great deal of informal verbal feedback received related to confidence and competence in using computers, where some nursing staff had previously not used a computer at work. The Welsh Nursing Care Record implementation at Neath Port Talbot Hospital in 2021 followed the implementation of HEPMA where Nurses cited a greater confidence in using Digital solutions and that the implementation of WNCR was supported having already transitioned to HEPMA.

The HEPMA solution supports medication policy compliance with medications e.g. controlled drugs, and mandates dual administration signatures.

Nurses were also given the opportunity to define, in their opinions, the most and least preferred elements of HEPMA. The content of these were analysed, categorised, and reviewed independently by two members of staff for validation. Categories with a frequency ≥ 2 are included on the chart. Individual comments are listed below charts:

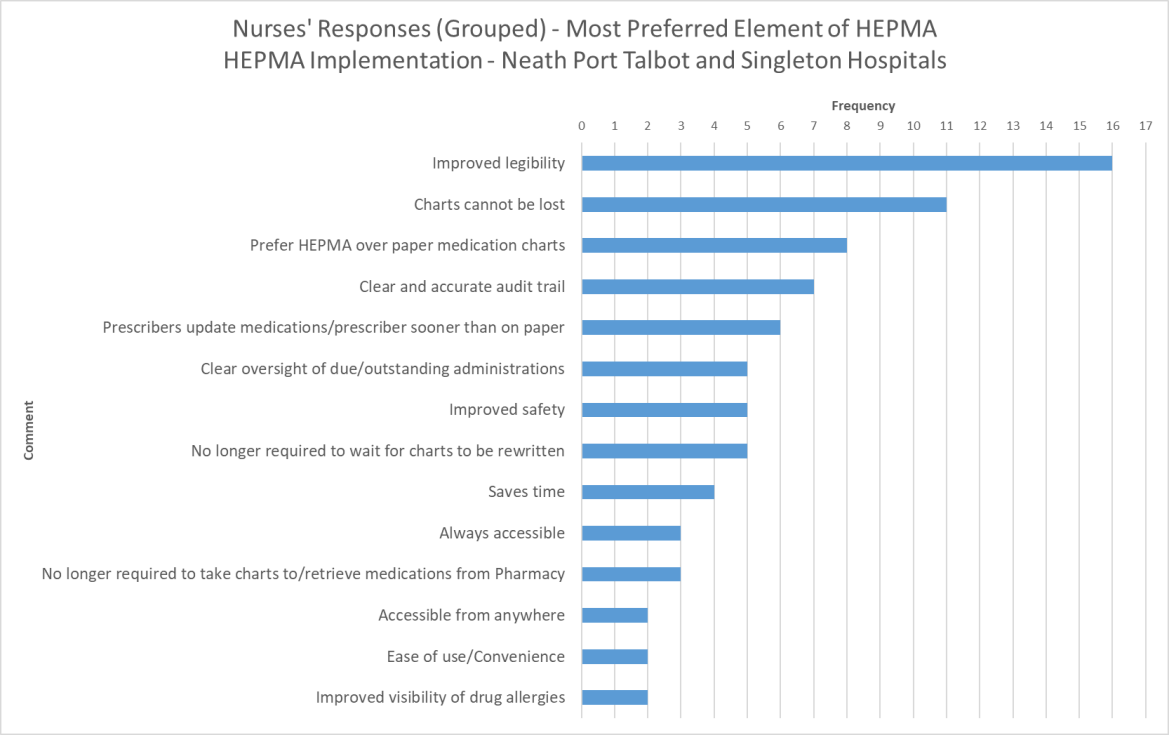


Chart 8: Nurses' Responses – Most preferred element of HEPMA

Comments from individual Nurses – most preferred element:

- Access to clinical drug information via HEPMA
- Cannot miss regular medications
- Drug name easy to read
- Greater supports the investigation of medication errors
- Improved safety due to alphabetical patient list
- Medication charts can be accessed by multiple people concurrently

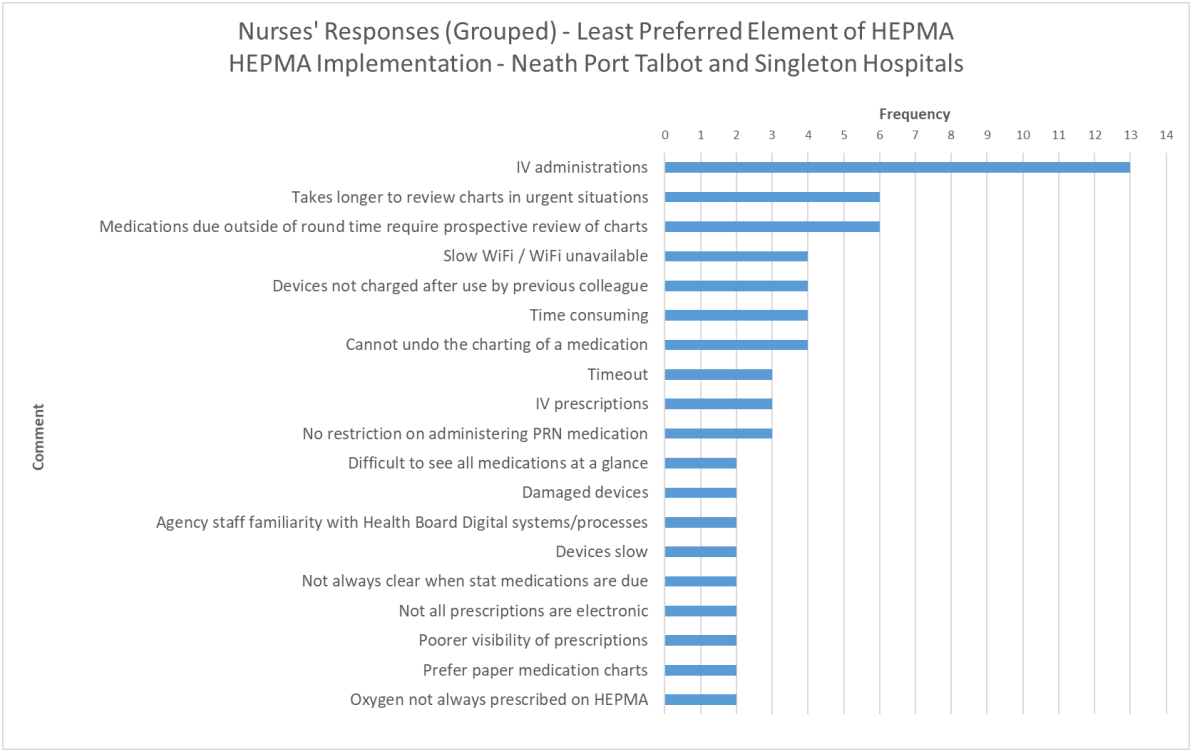


Chart 9: Nurses' Feedback – Least preferred element of HEPMA

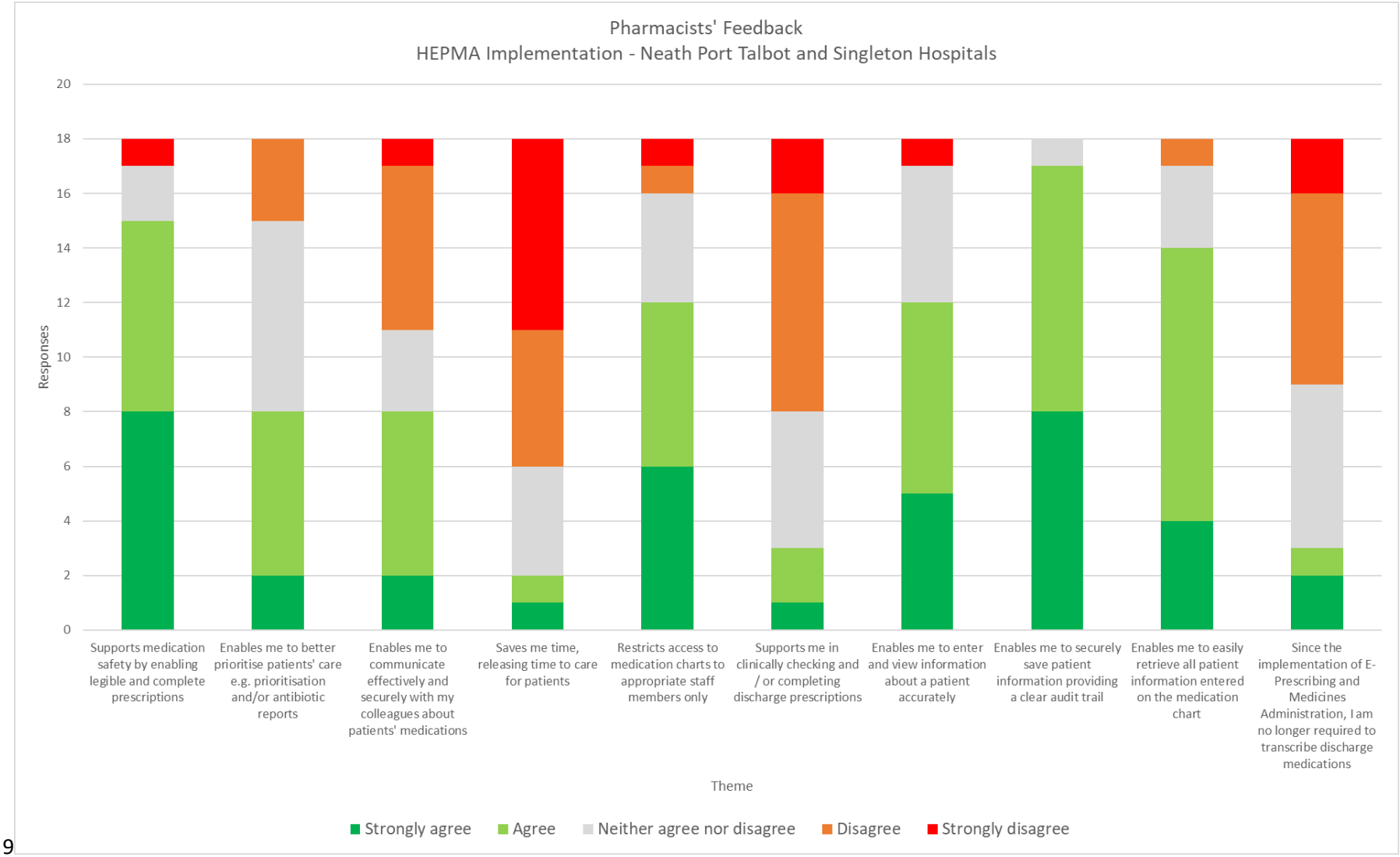
Comments from individual Nurses – least preferred element:

- Anaesthetic charts not on same system
- Difficult to navigate if not used every day (e.g. by nurse practitioners)
- Practicalities of taking laptop on trolley for witnessing of controlled drugs
- Computer on wheels has very little storage for supplies
- Difficult to see at a glance when PRN meds were administered
- Difficult to access HEPMA when other system in use on device
- Access to devices
- Medications available to chart 90 minutes before time due to be given
- Process for administering PGDs needs to be improved
- Printing charts upon transfer to non-HEPMA ward
- The same medication can be prescribed at different doses and are do not appear together on the chart
- Imprivata has not improved log on time
- Quality of screen enables relatives to see medication chart
- HEPMA does not exactly replicate order of prescriptions on all-Wales medication chart
- System does not support self-administration
- Required to learn how to use a new system
- HEPMA defaults to the most historic date an administration is outstanding for any patient
- The same medication can be prescribed at different doses and do not appear together on the chart

Other comments from Nurses:

- Single sign on e.g. Imprivata required
- Patient medication summary printout required
- Medication appears to not be restocked as often since HEPMA implemented
- More training options required e.g. access to training system in addition to e-learning
- E-learning overwhelming
- Nurses no longer aware when medication ordered
- Greater visibility of change requests required
- Keen to see HEPMA rolled out across the Health Board
- Administration time defaults to current date and time
- Implementation of HEPMA at wrong time during Covid (summer 2020)
- E-Prescribing team support fantastic

Pharmacists



9

Chart 10: Pharmacists' Feedback

Theme	% Strongly Agree / Agree	% Neither Agree nor Disagree	% Disagree / Strongly Disagree
Enables me to securely save patient information providing a clear audit trail	94%	6%	0%
Supports medication safety by enabling legible and complete prescriptions	83%	11%	6%
Enables me to easily retrieve all patient information entered on the medication chart	78%	17%	6%
Restricts access to medication charts to appropriate staff members only	67%	22%	11%
Enables me to enter and view information about a patient accurately	67%	28%	6%
Enables me to better prioritise patients' care e.g. prioritisation and/or antibiotic reports	44%	39%	17%
Enables me to communicate effectively and securely with my colleagues about patients' medications	44%	17%	39%
Supports me in clinically checking and / or completing discharge prescriptions	17%	28%	56%
Since the implementation of E-Prescribing and Medicines Administration, I am no longer required to transcribe discharge medications	17%	33%	50%
Saves me time, releasing time to care for patients	11%	22%	67%

Table 9: Pharmacists' Feedback

Pharmacists agreed with half of the key themes with the changes to workflow processes following the implementation of HEPMA. The HEPMA system does not replicate Swansea Bay Pharmacy ways of working on paper medication charts which has had an impact on workflow processes and role based activities.

There is commonality between Prescriber and Nurse opinions on there being a clear audit trail and supporting clinically appropriate prescribing.

More Pharmacists agreed than disagreed that they are able to better prioritise patients' care and communicate effectively about medication with the provision of business intelligence reports and the ability to document notes on patient records.

The results indicate Pharmacists disagree that they are no longer required to transcribe discharge medications, however this is now a prescriber role. Pharmacy staff now need to wait for prescribers to complete discharge prescriptions without the ability to prepopulate these as previously undertaken in the Electronic Transfer of Care (EToC) solution. The discharge process in its entirety is taking longer for Pharmacists since the implementation of HEPMA, due to ensuring medication information is accurately reflected on the DAL and current staffing pressures. This is compounding the current inability to release time to care. It is anticipated that as changes to processes are embedded it will become more streamlined.

Pharmacists were also given the opportunity to define, in their opinions, the most and least preferred elements of HEPMA. The content of these were analysed, categorised, and reviewed independently by two members of staff for validation. Categories with a frequency ≥ 2 are included on the chart. Individual comments are listed below charts:

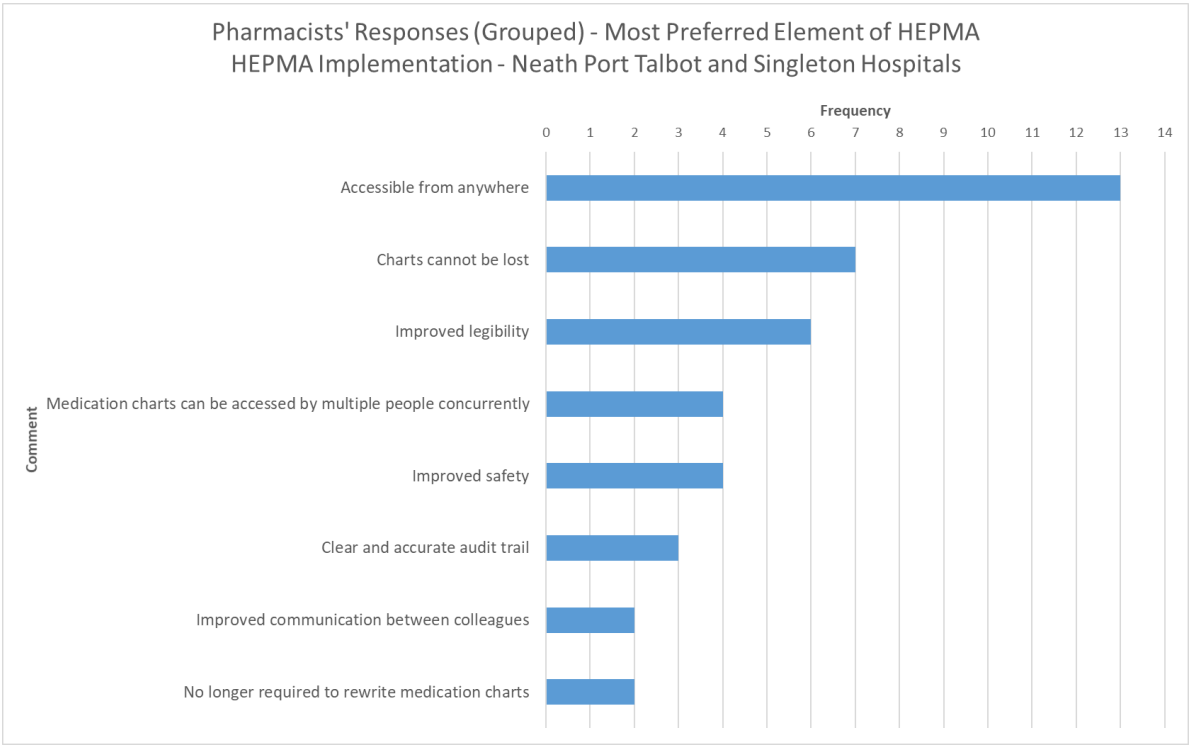


Chart 11: Pharmacists' Responses – Most preferred element of HEPMA

Comments from individual Pharmacists – most preferred element:

- Improved patient confidentiality

Further feedback from Pharmacy staff indicates the rationale for the best element of HEPMA, being that it is accessible from anywhere, is due to ability for pharmacy staff to screen medication charts without competition for devices or interruptions on the ward. This then allows Pharmacy staff to focus required interventions when they arrive on the ward to enable delivery of a ward based clinical service. It is recognised the importance of Pharmacy staff reviewing patients on the ward and to be able to access information not available on HEPMA. The additional benefit of accessibility during the pandemic has been that footfall on the ward could be reduced.

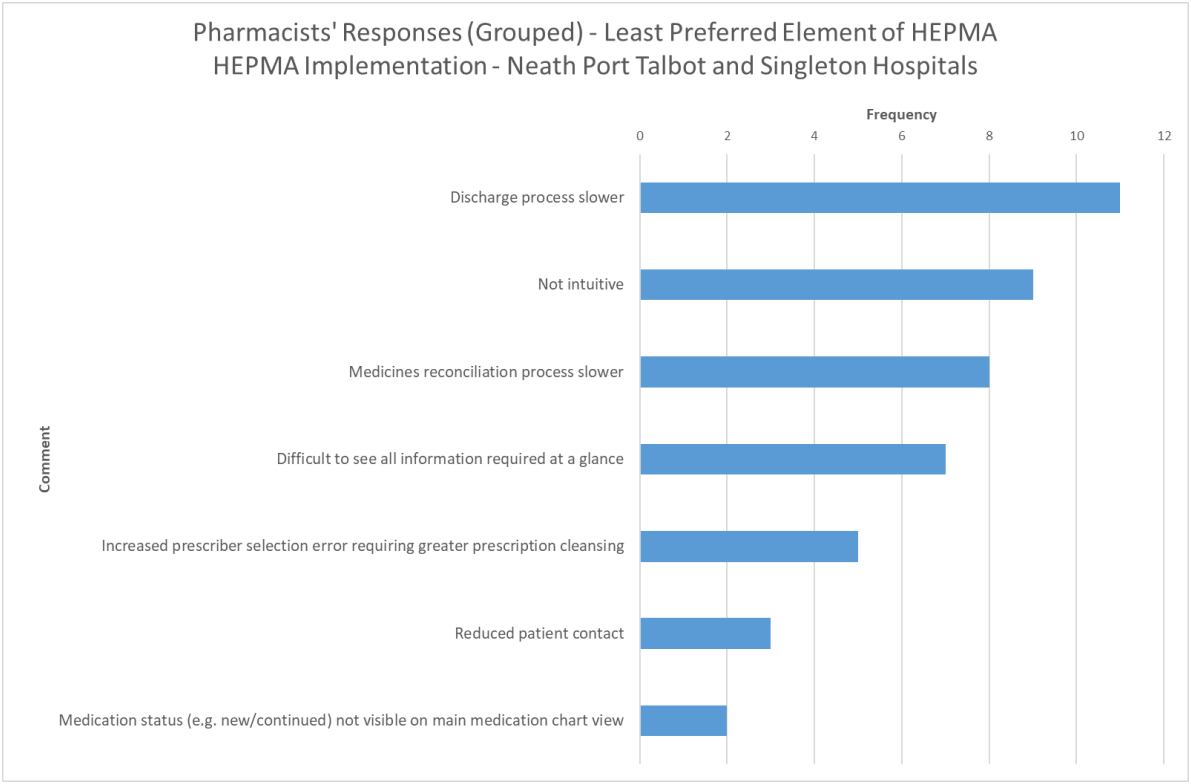


Chart 12: Pharmacists' Responses – Least preferred element of HEPMA

Comments from individual Pharmacists – least preferred element:

- Changing practice to fit the system rather than the system being changed to reflect practice
- Inaccurate discharge advice letter when warfarin prescribed on discharge
- System errors/crashes
- Where medications are cleansed, Pharmacists appear as the named prescriber
- Doctors approaching Pharmacy for E-Prescribing support
- Process for reviewing suspended medication prior to discharge required
- Pharmacists have absorbed Technicians' duties on discharge prescriptions due to system limitations
- Too many workarounds for Pharmacy staff
- Process for prescribers to review notes is required

Other comments from Pharmacists (verbatim):

- HEPMA is the way forward for all professions to improve medicines optimisation.
- Fully support its rollout.
- I think EPMA should replicate a paper chart as much as possible, it should be annotatable.
- Make Edge the default browser as the HEPMA system seems to run a lot smoother.
- Whilst there are many advantages of the system, several areas need to be reviewed to make the system easier to use and less cumbersome.
- Pharmacy processes seem to have been neglected in the development of the software.
- System has many flaws that often make life difficult.
- When producing an electronic version, it should simplify processes not make them take longer.
- I do not believe that the system as it stands will work in Morriston
- The team have been so amazing, so knowledgeable and so supportive - thank you!!
- Even though there are issues with the system I still wouldn't want to go back to paper medication charts

- Software lags behind pharmacy processes
- HEPMA team excellent in supporting Pharmacy colleagues during transition
- More members of HEPMA staff required to provide a greater level of ward support
- I would however like to thank the EPMA team who have been extremely helpful and always present and professional at all times. They have made the entire process much easier.

Pharmacy Technicians

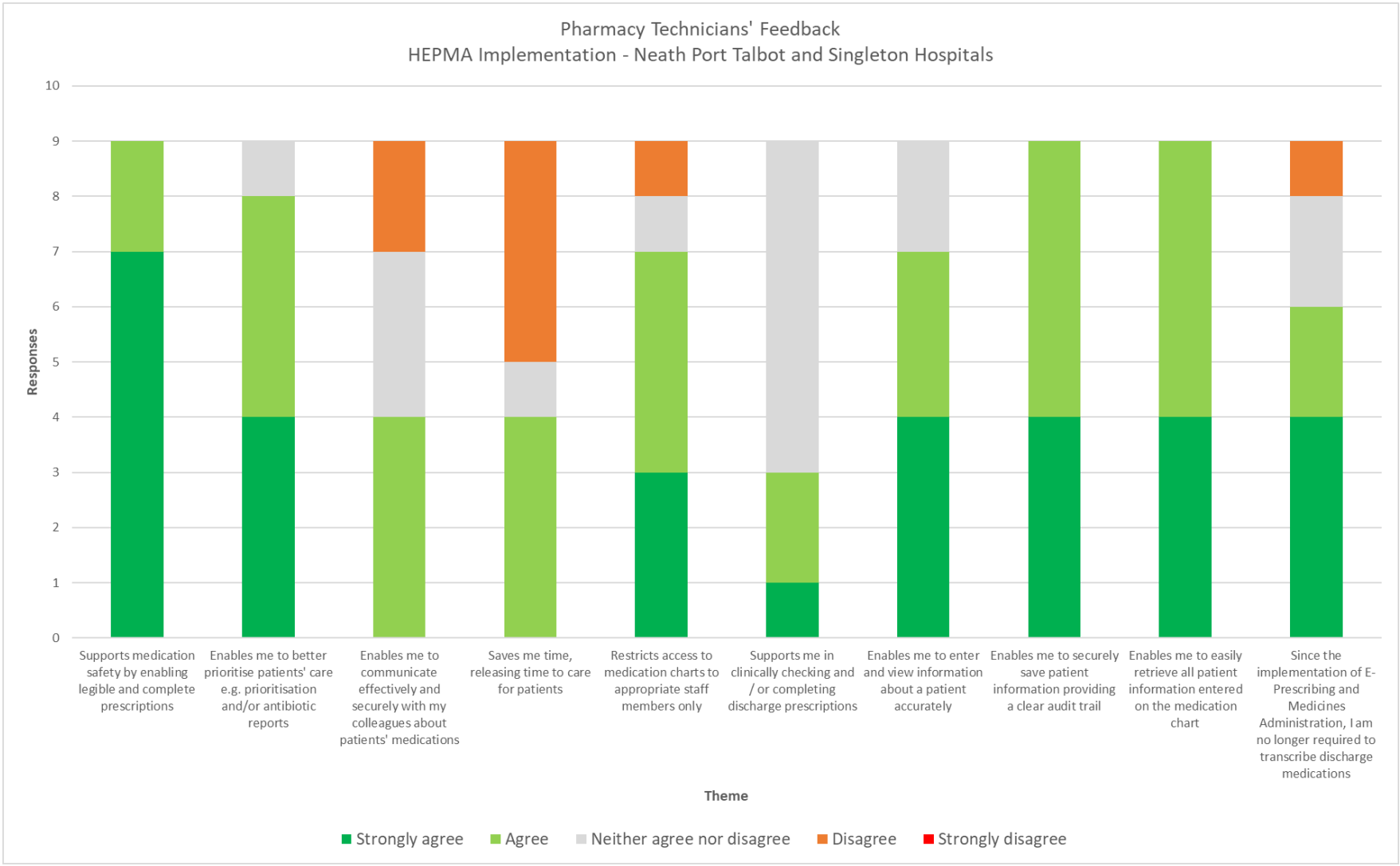


Chart 13: Pharmacy Technicians' Feedback

Theme	% Strongly Agree / Agree	% Neither Agree nor Disagree	% Disagree / Strongly Disagree
Supports medication safety by enabling legible and complete prescriptions	100%	0%	0%
Enables me to securely save patient information providing a clear audit trail	100%	0%	0%
Enables me to easily retrieve all patient information entered on the medication chart	100%	0%	0%
Enables me to better prioritise patients' care e.g. prioritisation and/or antibiotic reports	89%	11%	0%
Restricts access to medication charts to appropriate staff members only	78%	11%	11%
Enables me to enter and view information about a patient accurately	78%	22%	0%
Since the implementation of E-Prescribing and Medicines Administration, I am no longer required to transcribe discharge medications	67%	22%	11%
Enables me to communicate effectively and securely with my colleagues about patients' medications	44%	33%	22%
Saves me time, releasing time to care for patients	44%	11%	44%
Supports me in clinically checking and / or completing discharge prescriptions	33%	67%	0%

Table 10: Pharmacy Technicians' Feedback

Pharmacy Technicians largely agreed with the majority of the key themes with the changes to workflow processes following the implementation of HEPMA.

The most negative area for Pharmacy Technicians was the perception of time efficiencies not being generated, however an equal number of responses indicated that HEPMA has saved time. Technicians have largely not been affected or may feel that HEPMA has had a positive impact on completing discharge prescriptions.

Pharmacy Technicians were also given the opportunity to define, in their opinions, the most and least preferred elements of HEPMA. The content of these were analysed, categorised, and reviewed independently by two members of staff for validation. Categories with a frequency ≥ 2 are included on the chart. Individual comments are listed below charts:

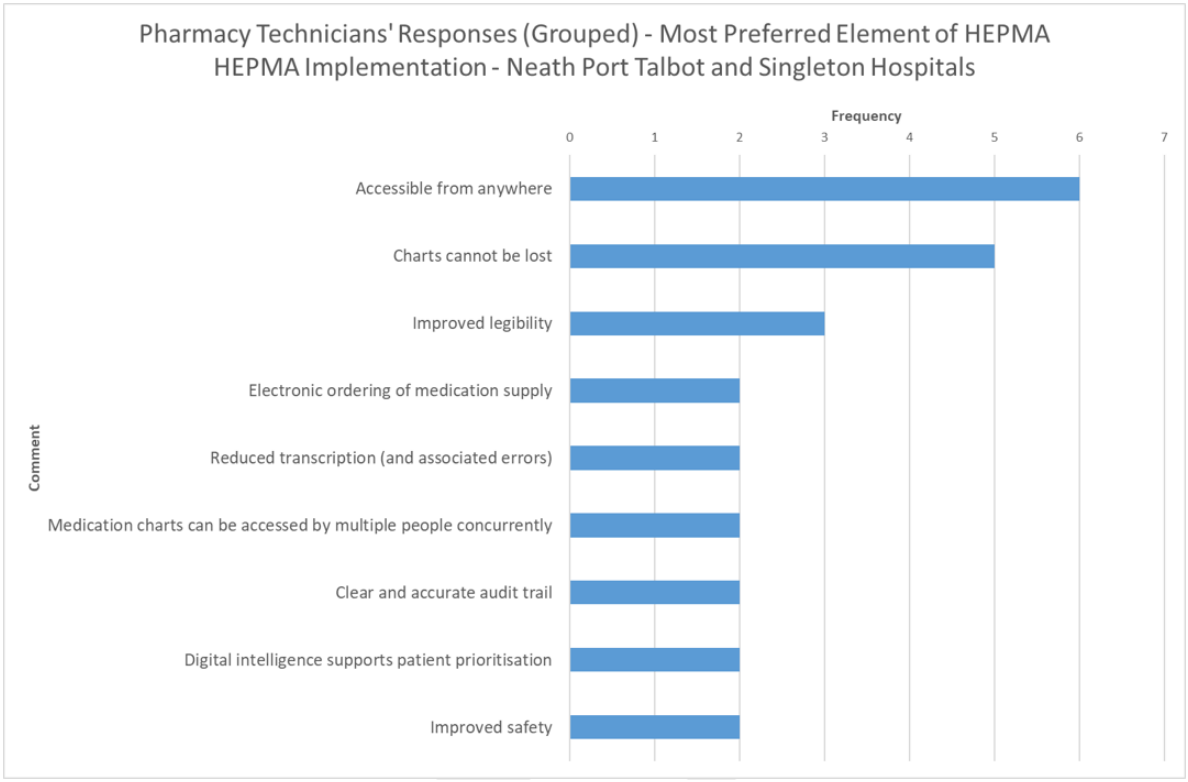


Chart 14: Pharmacy Technicians' Responses – Most preferred element of HEPMA

Comments from individual Pharmacy Technicians – most preferred element:

- Easy to access HEPMA team for support
- Improved efficiency

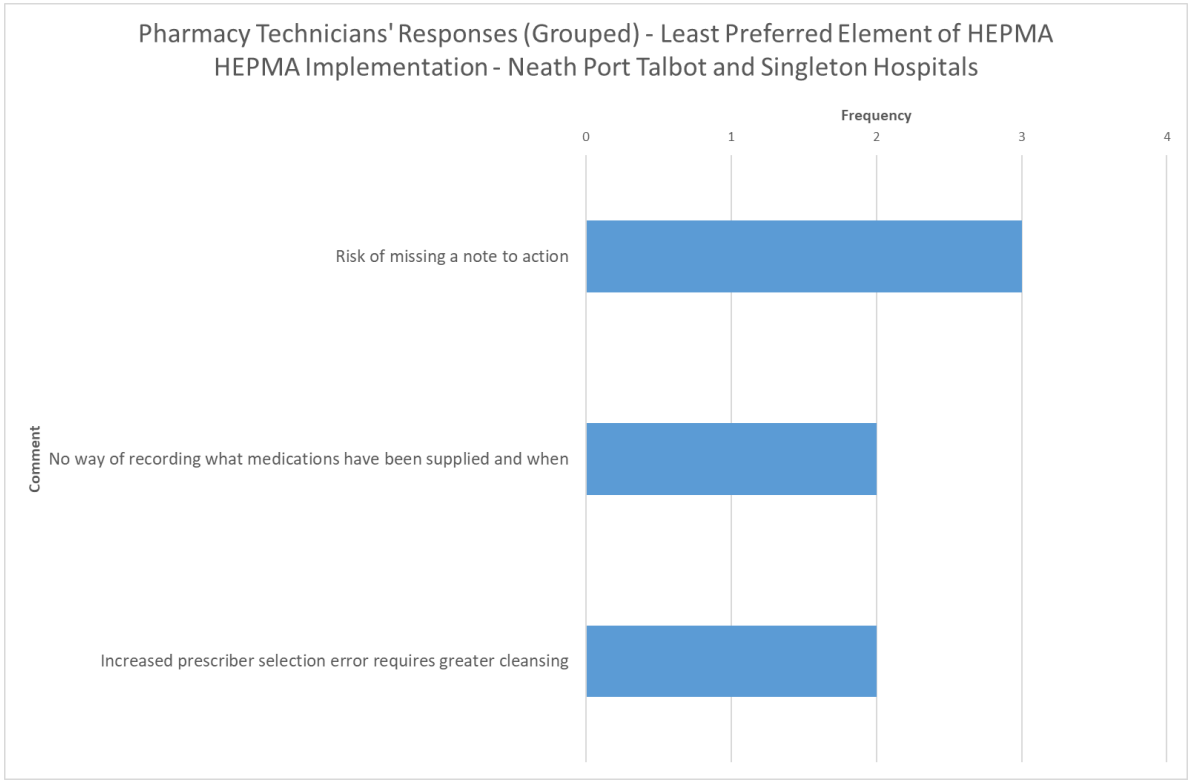


Chart 15: Pharmacy Technicians' Responses – Least preferred element of HEPMA

Comments from individual Pharmacy Technicians – least preferred element:

- Not able to enter INR results
- Not able to record patients' weights
- Unable to change formulation of medication once prescribed
- Medications are incorrectly selected by prescribers e.g. requiring patients to take multiple tablets when higher dosages are available
- Medication status (e.g. new/continued) not visible on main medication chart view
- Not intuitive
- Increase in number of steps / time taken to review patients / complete discharges

Other comment from a Pharmacy Technician:

- HEPMA is a great tool for what it was designed to do, and that is prescribing and administrating medication safely and efficiently. However, using it daily to review all the patients on the wards and to process discharges it is not a one step process, there is a lot of processes to go through to get the information you need, unfortunately this can lead to more time needed to perform the pharmacy ward duties.

Conclusion – Staff Experience

It was clearly felt by survey respondents that the HEPMA system improves prescription safety, auditability and information governance. However, a number of respondents indicated that they feel that HEPMA does not generate time efficiencies when prescribing medications or undertaking pharmacy processes. Conversely, significant time released to care has been identified through the availability of medication charts through HEPMA and through no longer being required to rewrite medication charts when a chart is full or lost (see Benefits Realisation).

The implementation of HEPMA at both hospital sites was undertaken in an atypical manner due to the challenges of the COVID-19 pandemic and this evaluation comprises responses of staff that may not have utilised the HEPMA system for very long and had the opportunity to embed the business change.

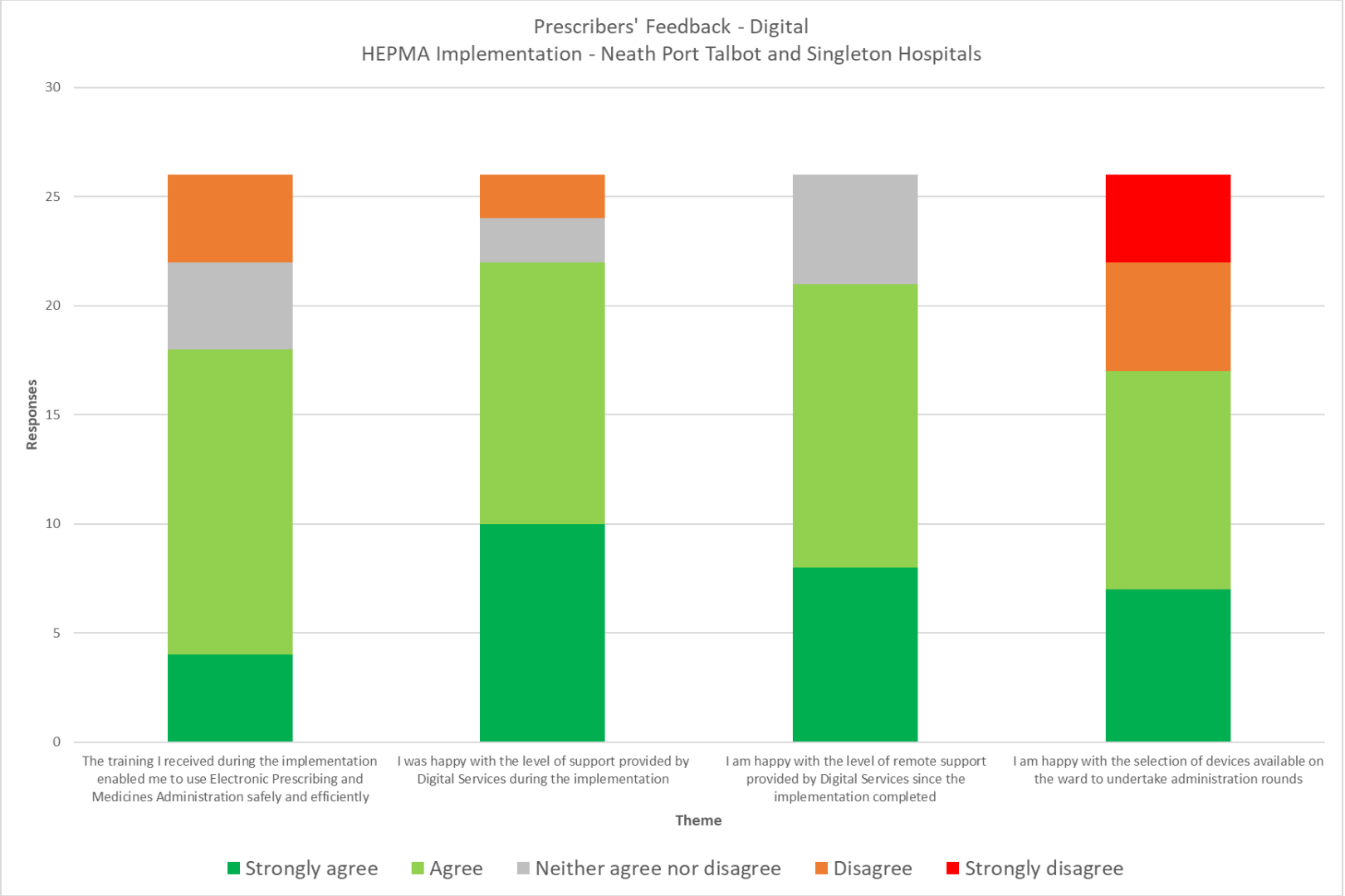


Chart 16: Prescribers' Feedback – Digital

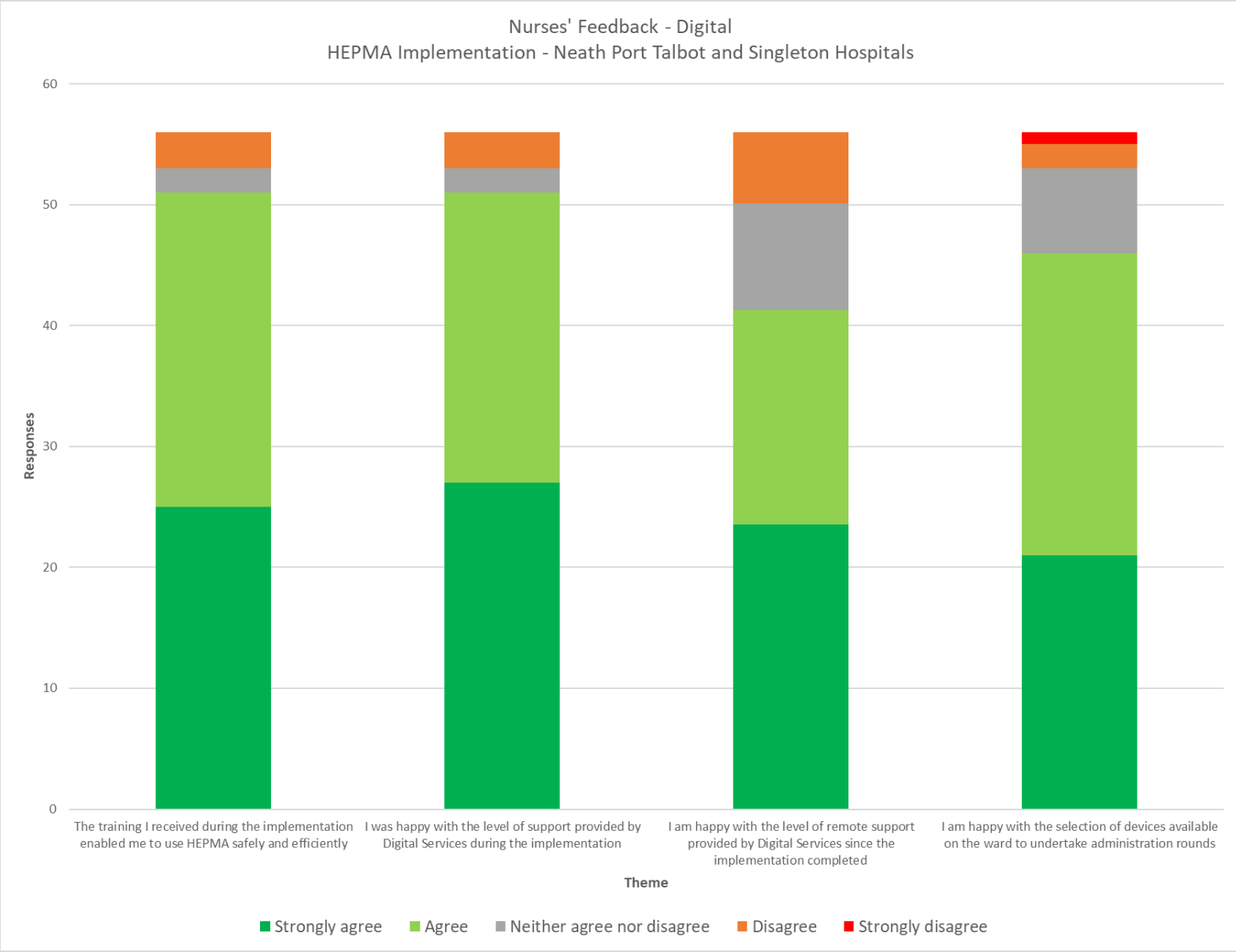


Chart 17: Nurses' Feedback – Digital

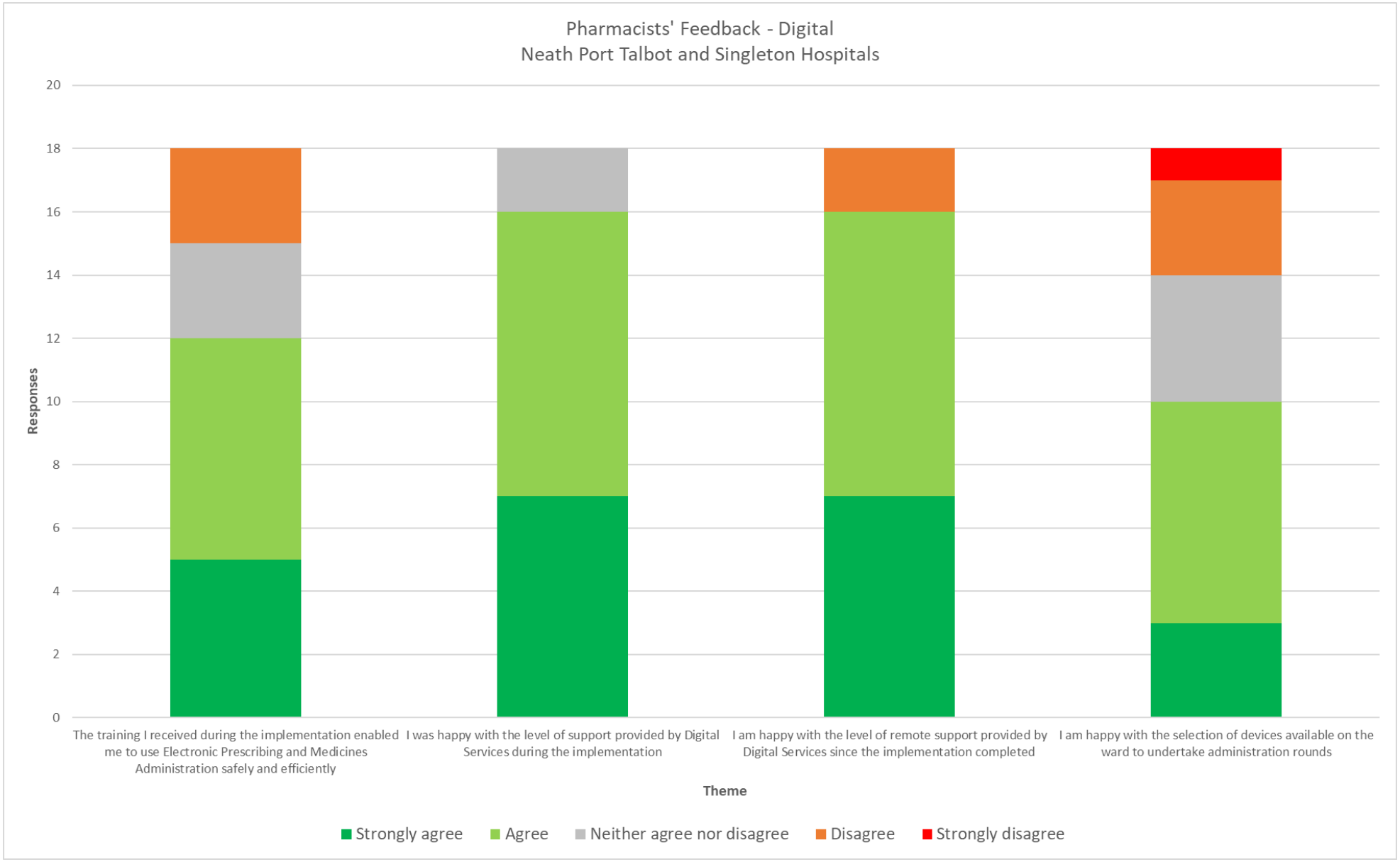


Chart 18: Pharmacists' Feedback – Digital

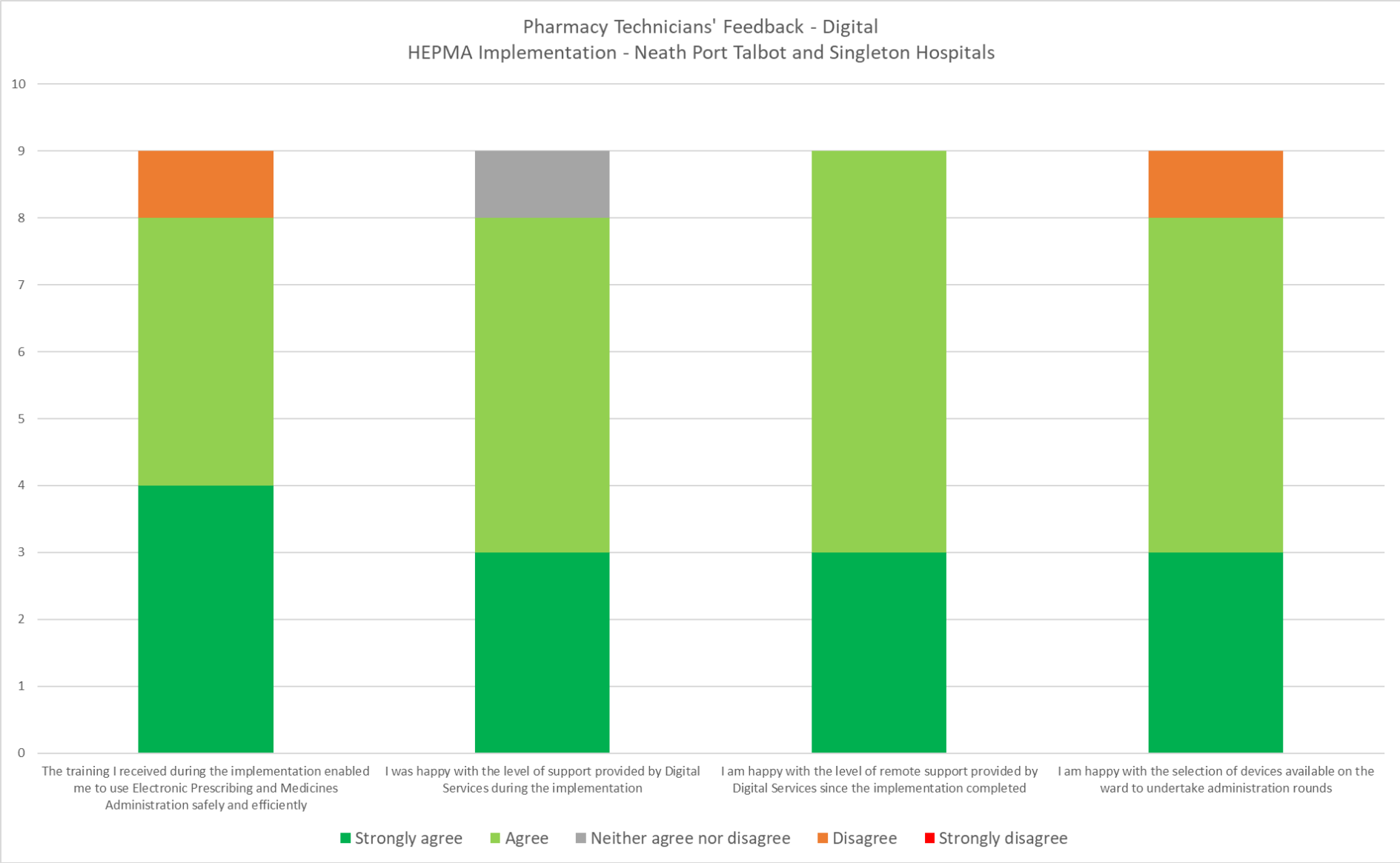


Chart 19: Pharmacy Technicians' Feedback -Digital

Expected benefits used in the initial business case were further refined through a number of benefits workshops with medical, nursing and pharmacy representatives. Tables 11 to 27 detail the expected benefits and their post-HEPMA implementation status at Neath Port Talbot and Singleton Hospitals.

Neath Port Talbot Hospital was live with HEPMA as of February 2020 on the pilot ward, with the remaining medical wards all live from Q2 2020-21. All Singleton Hospital medical wards were live with HEPMA from the end of Q1 2021-22.

Reduction in unintentional omitted medication doses

Measure	Target	Hospital	Baseline 2019-20	Measurement 2020-21	Measurement 2021-22	Status
Audit missed doses recorded as "medicine unavailable" pre and post implementation	**<5%**	NPT	1.06%	**0.41%**	**0.36%**	**Realised**
		Singleton	7.43%		**0.96%**	

Table 11: Benefits realisation status – reduction in unintentional omitted medication doses

On paper medication administration charts nursing staff either sign to record a medication administration or write a numbered code for a non-administration reason. These codes have been replicated in the HEPMA system to enable continuity of practice.

Baseline data were taken from the Fundamentals of Care audit which is a snapshot sample of up to 10 patients per ward once per month. The audit includes doses missed due to 'medicine unavailable' (code 5) in the previous 24 hours. Data from the HEPMA system includes all patients and all administration and non-administration data, enabling a more accurate rate of non-administrations for all reason types to be determined. There is business intelligence available in the form of a dashboard utilised as a 'prioritisation' tool for Pharmacy staff. The dashboard highlights patients with a documented code 5 non-administration reason in the previous 24 hours such that these medications can be ordered / located in a timely manner.

During 2021-22 0.36% of non-administrations at Neath Port Talbot Hospital and 0.96% at Singleton Hospital were categorised as 'medicine unavailable'.

Reduction in prescribing errors

Measure	Target	Hospital	Baseline 2019-20	Measurement 2020-21	Measurement 2021-22	Status
% reduction in number of prescribing errors on inpatient medication charts (Datix)	**50% reduction**	NPT	1	**+500%** (5)	**+400%** (4)	**Not realised**
		Singleton	12		**+133%** (28)	

Table 12: Benefits realisation status – reduction in prescribing errors

Neath Port Talbot Hospital

The single prescribing error recorded as baseline during 2019-20 could have been prevented with HEPMA in place. During 2020-21, there were five prescribing errors reported, one of which was attributed to the incorrect route being documented on HEPMA and one where a transcribing error took place from a paper drug chart on to the HEPMA system. During 2021-22, there were four prescribing errors reported; one was due to a prescription being prescribed as a 'dummy drug' to circumvent the HEPMA system's allergy clinical decision support and two were due to Warfarin mismanagement.

Singleton Hospital

Of the 12 prescribing errors during 2019-20 as baseline, three could have potentially been avoided with HEPMA in place. During 2021-22 there were 28 prescribing errors recorded. Of the 13 in Q1-Q2, 3 were attributed to the HEPMA system; an antibiotic prescription was prematurely stopped, an untrained prescriber used a paper chart, and one case where the wrong patient was prescribed and administered medication. In Q3-Q4 there were 15 prescribing errors, of which 11 of them were due to Warfarin not being prescribed for patients and resulted in unintentional missed doses. There was also another incident with an antibiotic prescription being stopped prematurely. In Q4 2021-22, prescribers were no longer prompted daily by the HEPMA team to prescribe Warfarin and advised to utilise the dosing reports available on the patient handover system, Signal. Due to the potential for missed doses, measures have been implemented to further support antibiotic and Warfarin prescribing.

Reduction in medicines administration errors

Measure	Target	Hospital	Baseline 2019-20	Measurement 2020-21	Measurement 2021-22	Status
% reduction in number of incident reports on administration errors (Datix)	**50% reduction**	NPT	12	**No change** (12)	**-42%** (7)	**Partially realised**
		Singleton	60		**-22%** (47)	

Table 13: Benefits realisation status – reduction in medicines administration errors

Neath Port Talbot Hospital

Of the 12 medicines administration errors reported during 2019-20 used as baseline, six could have potentially been avoided with HEPMA. HEPMA was implemented across the medical wards during 2020-21. Pre-implementation there were four administration incidents reported, three of which could have potentially been avoided with HEPMA in place. Of the eight administration errors post HEPMA implementation, six could have occurred regardless of HEPMA. Of the other two, one error involved nursing staff not recording administration on HEPMA resulting in a subsequent dose of medication given to a patient, and one was a near-miss where the nurse had selected the wrong patient on the HEPMA ward list that was corrected when checking the patient's demographic wristband. During 2021-22 there were eight administration errors recorded though one was a duplicate entry. Five errors could have occurred regardless of HEPMA. Of the remaining two, one was due to a paracetamol dose being given too early despite the last administration time being available, and the other involved a failure to record administration of Warfarin as no dose had been prescribed.

Singleton Hospital

Of the 60 medicines administration errors reported during 2019-20 used as baseline, only 18 could have potentially been avoided with HEPMA in place. During 2021-22 there were 33 errors in Q1-Q2 and 14 in Q3-Q4. Three errors involved the HEPMA system during Q1-Q2, however none were a direct result of the HEPMA system and could have similarly occurred on a paper drug chart. One was due to a paracetamol dose being given too early despite the last administration time being available, one where a dose of 0mg Warfarin was not charted/signed for, and one where the wrong dose of medication was administered. None of the incidents reported in Q3-Q4 were attributed to the HEPMA system.

Due to the incidents involving Paracetamol administration, measures have been implemented to further highlight date and time of last administration to nursing staff. A significant proportion of the prescribing and medicines administration Datix incidents reported as baseline would not have likely been impacted by HEPMA (50% in NPTH, 70% in Singleton Hospital). One of the lessons learned from the evaluation of benefits realisation is that Datix incident numbers alone may not be a sufficient enough measure to ascertain the impact on implementing HEPMA on prescribing and medicines administration errors, due to the low volume of incidents reported in smaller hospital sites and the inclusivity of all types of medication errors not just those that could be potentially avoided with HEPMA in place. Consideration should be given to adopting a different measure of impact such as a drug chart prescribing and medicines administration audit of documentation.

Improved recording of medicines administration

Measure	Target	Hospital	Baseline 2019-20	Measurement FY 2020-21	Measurement FY 2021-22 (Q4 only)	Expected benefits status
Audit medicines administration documentation for blank boxes pre and post implementation	<5%	NPT	9.04%	0%*	0.05%	Realised
		Singleton	3.20%		0.07%	

Table 14: Benefits realisation status – improved recording of medicines administration

On paper medication administration charts there is no mandate to enforce an administration or non-administration is recorded and therefore the ability to leave doses unaccounted for. The baseline figures are based on the Fundamentals of Care audit where up to 10 patients are audited once per month and assess as to whether there were any blank boxes in the previous 24 hours. At Neath Port Talbot Hospital, the baseline rate is predicated on 65 blank boxes recorded on 719 patient medication charts. In Singleton, the baseline rate is predicated on 53 blank boxes recorded on 1,655 patient medication charts.

Prior to the HEPMA go live at Neath Port Talbot Hospital, it was agreed by the clinical working groups to only include the standard non-administration codes as per the paper medication charts with the intention of eliminating the possibility of 'blank boxes' and to improve recording of medication administration. Since go live, it was noted that there were still occurrences where an administration was unknown to have taken place. Where this had been the case, nursing staff were encouraged to ascertain whether an outstanding dose had or had not been given and to update the HEPMA system accordingly. Where it was not feasible, in order to be able to chart subsequent doses, nursing staff entered the non-administration reason of 'Code 6 – Other' and were asked to additionally record a note on the patient's record stating the administration is unknown to distinguish these from true Code 6 non-administration reasons.

*This figure is 0% due to the inability to leave a 'blank box' and an unaccounted dose in the HEPMA system. There was limited evidence that non-administration notes were being added alongside a Code 6 recording where administration was unknown and reporting on notes on patient records could not easily be automated without additional, continuous scrutiny. The scale of unknown administrations, therefore, was unable to be determined. During Q4 2021-22 it was agreed by the Medication Safety Group to create a new non-administration reason named 'unknown administration'. The figures for Q4 2021-22 represent a truer reflection of the rate of 'blank boxes' as it is based on the number of unknown administrations out of the total number of administrations and non-administrations which includes all patients on all HEPMA wards. These data will enable greater oversight of administration practice such that greater targeted support can be provided.

Increased allergy documentation

Measure	Target	Hospital	Baseline 2019-20	Measurement FY 2020-21	Measurement FY 2021-22	Status
% of prescription records with allergy information recorded	**100%**	NPT	99.91%	**99.78%**	**100%**	**Realised**
		Singleton	99.59%		**99.47%**	**Partially Realised**

Table 15: Benefits realisation status – increased allergy documentation

Baseline data were taken from Fundamentals of Care audit, a snapshot sample of up to 10 patients per ward once a month, whereas data from the HEPMA system includes all patient admissions.

The HEPMA system is configured such that a patient's allergy status must be recorded prior to any prescribing taking place. There is the option to record 'No Known Drug Allergies', a drug allergy or 'Allergy Status Undetermined'. The latter is a system reserved reason for use in emergency situations where there is a need to prescribe without being able to confirm a patient's allergy status. In Singleton, the figure for FY 2021-22 represents 36 patients out of 6,752 that were admitted during the year that did not have an allergy status recorded, where the allergy status undetermined option was selected. As there is no clinical decision support provided where allergy status undetermined is recorded there is an automatic alert to the HEPMA team such that patients can have their allergy status reconciled at the earliest opportunity.

Reduced prescribing of medicines to which patients are allergic

Measure	Target	Hospital	Baseline 2019-20	Measurement FY 2020-21	Measurement FY 2021-22	Status
Number of Datix incidents recorded where patients are prescribed medicines where there is a known allergy	0	NPT	0	0	0	**Realised**
		Singleton	2		0	

Table 16: Benefits realisation status – reduction in prescribing of medicines to which patients are allergic

There have been no incidents reported where patients were prescribed medication to which they are allergic. The HEPMA system includes clinical decision support, and as the system is configured to mandate the recording of a patient's allergy status with associated reaction information, the decision support for allergies is provided at the point of prescribing. During 2021-22 there were 490 instances where allergy conflicts were displayed in the HEPMA system, following which the prescriber no longer continued with that particular prescription; 112 of the 490 instances involved penicillin.

Improved documentation of VTE risk assessment

Measure	Target	Hospital	Baseline 2019-20	Measurement FY 2020-21	Measurement FY 2021-22	Status
Audit documentation of VTE risk assessments on medication charts	**90%**	NPT	96.70%	**100%**	**100%**	**Realised**
		Singleton	86.43%		**99.99%***	

Table 17: Benefits realisation status – improved documentation of VTE risk assessment

The HEPMA system is configured such that a patient's initial venous thromboembolic (VTE) risk assessment must be completed prior to any prescribing taking place. **This figure is not 100% due to a system bug on a single patient's record whereby the VTE risk assessment was not mandated and prompted out of a total of 6,752 VTE risk assessments analysed.*

Improved prescribing of VTE prophylaxis

Measure	Target	Hospital	Baseline 2019-20	Measurement FY 2020-21	Measurement FY 2021-22	Status
Audit VTE prophylaxis prescriptions on medication charts and assess if matches VTE risk assessment	**90%**	NPT	98.74%	**86.27%**	**92.46%**	**Realised**
		Singleton	82.74%		**87.03%**	**Partially Realised**

Table 18: Benefits realisation status – improved prescribing of VTE prophylaxis

Although the benefit was realised at Neath Port Talbot Hospital as the 2021-22 measurement was greater than the target, the post-implementation measurement demonstrates a reduction against the baseline. The baseline data, however, may not be representative of the true rate of VTE prophylaxis prescribing – the total number of patients in the baseline measurement was 317 compared with all HEPMA data readily available (6,752 patients). Singleton Hospital's prescribing practice in relation to VTE prophylaxis has improved and the benefit is therefore partially realised, however the target of 90% was not met.

It is important to note that this measure assumes that all VTE risk assessments are updated and are always correct. It is possible, however, that medication charts are correct and VTE prophylaxis is compatible with the patient's clinical status, where the VTE risk assessment has not been updated.

Reduction in number of C.Difficile cases

Measure	Target	Hospital	Baseline 2019-20	Measurement FY 2020-21	Measurement FY 2021-22	Status
Audit number of inpatient C.Difficile cases pre and post go live	**25% reduction**	NPT	6	**+50%** (9)	**No change** (6)	**Not Realised**
		Singleton	22		**+18.18%** (26)	

Table 19: Benefits realisation status – reduction in number of C.Difficile cases

It is unclear as to why the number of C.Difficile cases have risen across the hospital sites. The Health Board saw a significant reduction in secondary care cases after restrictive guidelines were introduced in 2018 which was sustained for two years. Half of the cases were then attributable to primary care, which remains the case however the hospital cases started to rise again despite no obvious change in antibiotic prescribing. During Q2 2021-22 new functionality was introduced in the HEPMA solution requiring antimicrobial prescriptions to be reviewed within 72 hours of prescribing, in line with the Antibiotic Review Kit (ARK) paper prescription charts. This may have contributed to the lower number of C.Difficile cases in the latter half of 2021-22 at Singleton Hospital (9 in Q3-Q4, compared with 17 in Q1-Q2).

Improved antimicrobial stewardship – increased appropriateness of antibiotic prescription choice

Measure	Target	Hospital	Baseline 2019-20	Measurement 2020-21	Measurement Q1 2021-22	Measurement Q2 2021-22	Measurement Q3 2021-22	Measurement Q4 2021-22	Status
Bimonthly antimicrobial prescribing audit	**≥95%**	NPT	99.00%	97.50%	**98%**	**95%**	**96%**	**95%**	**Realised**
		Singleton	95.67%		**89%**	**94%**	**94%**	**100%**	

Table 20: Benefits realisation status – improved antimicrobial stewardship – increased appropriateness of antibiotic prescription choice

Neath Port Talbot Hospital has consistently stayed above the target for appropriate of antibiotic prescription choice prior to and throughout the implementation of HEPMA. Singleton Hospital had a marked decrease in appropriateness of antimicrobial choice in Q1 FY 2021-22, however continued to improve throughout the year. The HEPMA system is configured such that all antibiotics are prescribed as a 'protocol' to enable the indication for the antibiotic to be captured. Prescribers are subsequently able to confirm the appropriateness of the antibiotic choice at the point of prescribing.

The Health Board's bimonthly antimicrobial prescribing audit reports percentages by quarter and therefore it was not possible to present the data by financial year in the above table.

Reduction in percentage of antibiotic prescriptions over 7 days

Measure	Target	Hospital	Baseline 2019-20	Measurement FY 2020-21	Measurement FY 2021-22	Status
Number of antibiotic prescriptions over seven days as a proportion of all antibiotic prescriptions administered non-intravenously	**≤20%**	NPT	12.0%	**21.82%**	**15.02%**	**Realised**
		Singleton	3.84%		**6.79%**	

Table 21: Benefits realisation status – reduction in % of antibiotic prescriptions over 7 days

There was an increase in the number of antibiotic prescriptions with a duration of greater than seven days at both Neath Port Talbot and Singleton Hospitals in both financial years. However, the baseline may not be representative of all antimicrobial prescribing practice. All antimicrobial prescriptions were evaluated in post-implementation measurements (2020-21 and 2021-22) and it is positive to see a reduction in the percentage of prescriptions over seven days at Neath Port Talbot in 2021-22 compared with 2020-21, and that Singleton Hospital remains significantly lower than the target.

Reduction in percentage of intravenous antibiotic prescriptions over 72 hours

Measure	Target	Hospital	Baseline 2019-20	Measurement 2020-21	Measurement 2021-22	Status
Number of intravenous antibiotic prescriptions as a proportion of all intravenous antibiotic prescriptions	**<30%**	NPT	100%	**45.14%**	**41.84%**	**Not Realised**
		Singleton	33.96%		**34.46%**	

Table 22: Benefits realisation status – reduction in percentage of intravenous antibiotic prescriptions over 72 hours

The number of intravenous antibiotic prescriptions reduced at Neath Port Talbot Hospital between 2019 and 2022, however the baseline only included two patients who both had IV antibiotics prescribed for a duration of greater than 72 hours. There was a slight increase observed at Singleton Hospital in 2021-22 against its baseline which again was taken from a snapshot audit which may have over reported the true rate of antimicrobial prescribing practice. It will therefore be important to repeat all post-implementation measurements for 2022-23.

Prescriber time saved from not rewriting lost, missing or full medication charts

Measure	Target	Hospital	Baseline 2019-20	Post-Implementation Measurement	Status
Audit time spent writing medication charts pre go live	912 hours prescriber time saved per year	NPT	2,166 hours prescriber time per year	-2,166 hours prescriber time saved per year	**Realised**
		Singleton	4,842 hours Prescriber time per year	-3,632 hours prescriber time saved July 2021 to March 2022	

Table 23: Benefits realisation status – prescriber time saved from not rewriting charts

Prior to the implementation of HEPMA, inpatient medication charts were required to be rewritten when there was no additional prescribing space available for new medications, or where medication charts were not able to be retrieved at which point a decision is made to rewrite one or more medication charts. As HEPMA medication charts can always be accessed electronically (except for potential system outages whereby business continuity including printed charts is available across all sites) and not filled to the point where no further medications can be prescribed – a HEPMA patient is technically able to have up to 100,000 prescriptions per admission – all time previously spent by HEPMA prescribers rewriting medication charts can therefore be released to care.

Decreased nurse administration round duration

Measure	Target	Hospital	Baseline 2019-20	Measurement Mar 2021	Measurement Sep 2021	Measurement Mar 2022	Status
Audit administration round times pre and post go live	**20% reduction**	NPT	59 minutes per round	**-2.07%** 58 minutes per round	**-3.7%** 57 minutes per round	**-17%** 49 minutes per round	**Partially Realised**
		Singleton	1 hour 14 minutes per round		**+4%** 1 hour 17 minutes per round	**-8.1%** 1 hour 8 minutes per round	

Table 24: Benefits realisation status – decreased nurse administration round duration

The pre-implementation baseline measurement captured medication round durations through samples of both time and motion studies and completion of data capture forms by nurses recording the start and end time of their administration round. Post-implementation measurements are taken from administration data available and therefore reflects all medications administered during the morning, lunchtime, teatime and bedtime rounds.

The 20% reduction in medication administration rounds target was proposed based on evidence from other UK organisations who have implemented electronic prescribing and medicines administration. Given that the target has not been wholly met two years following implementation at Neath Port Talbot Hospital it may be appropriate to set a lower target for future implementations such that results can be realistically achieved.

Time saved from searching for medication charts

Measure	Target	Hospital	Baseline 2019-20	Post-implementation Measurement	Status
Time spent looking for medication charts (pre-implementation) compared with time spent waiting for access to a computer (post-implementation)	**75% reduction in time taken to access medication charts**	NPT	10,297 hours per year	**-68%** 3,297 hours per year	**Partially Realised**
		Singleton	15,767 hours per year	**-65%** 5,600 hours per year	

Table 25: Benefits realisation status – time saved searching for medication charts

Prior to implementation, prescribers reported spending an average of 5.33 minutes per shift searching for paper medication charts, nurses 16.78 minutes and pharmacists 9.58 minutes. The average number of shifts worked per year was captured through the post-implementation questionnaire to identify the maximum potential time efficiencies generated by no longer searching for paper charts (the baseline). In addition, the average time taken by professional group to access a computer e.g. walking to the nurses' station or doctors' office, or retrieving a computer from a charging bay was captured and deducted from the time taken to search for paper charts to ascertain a more accurate representation of the time taken to access medication charts (post-implementation measurement).

In comparison, prescribers reported spending an average of 4.83 minutes per shift waiting to access a computer, nurses 2.74 minutes and pharmacists 1.35 minutes. The potential time efficiencies are likely to increase with further implementations by reducing the number of staff searching for paper medication charts.

Reduction in annual drug expenditure

Measure	Target	Hospital	Baseline 2019-20	Measurement 2020-21	Measurement 2021-22	Status
Comparison between HEPMA location drug expenditure pre and post implementation	**2.5% reduction**	NPT	£366,700	**-18.54%** (£298,708)	**-32.88%** (£246,128)	**Realised**
		Singleton	£1,161,914		**+5.3%** (£1,223,537)	
		Total	£1,528,614		**-3.9%** (£1,469,665)	

Table 26: Benefits realisation status – reduction in annual drug expenditure

The benefit of reduced annual drug expenditure is predicated on an improvement to the quality of prescribing through clinical decision support and formulary management provided by the HEPMA system. To date there have been no restrictions made to the ability to prescribe non-formulary medication within the HEPMA system to enable a greater understanding of the prevalence of such prescriptions as these data are difficult to ascertain through paper-based prescribing. The drug expenditure significantly decreased in both financial years at Neath Port Talbot Hospital and increased at Singleton Hospital, however HEPMA was being implemented throughout Q1 2021-22 at Singleton Hospital and was not live for a full financial year, therefore a reduction in drug expenditure was not be expected to be realised during 2021-22. It is also unclear as to the impact COVID-19 has had on patient flow and prescribing practice.

It is important to note that while drug expenditure increased by 5.3% at Singleton Hospital during 2021-22, the savings at Neath Port Talbot Hospital contributed to an overall reduction in drug spend for HEPMA wards at Swansea Bay UHB. It is anticipated that future measurements of drug expenditure at Singleton will be lower than that observed during the implementation year (2021-22).

Reduction in stationery costs

Measure	Target	Hospital	Baseline 2019-20	Measurement FY 2020-21	Measurement FY 2021-22	Status
Cost of paper medication charts purchased	**100% reduction in expenditure**	NPT	£852.00	**-99.8%** (£1.69)	**-94.03%** (£50.82)	**Partially Realised**
		Singleton	£1,169.97		**-55.36%** (£647.72)	
		Total	£2,021.97		**-65.45%** (£698.54)	

Table 27: Benefits realisation status – reduction in stationery costs

All paper prescription charts were assessed as to their appropriateness to be replicated on the HEPMA system. To date, the scope of the project includes the digitisation of the All Wales Inpatient Medication Administration Record, along with a number of supplementary paper charts such as Warfarin and Insulin. There are multiple other supplementary paper charts used for more complex prescribing and medicines administration regimes which have remained on paper at this time. The target reduction of 100% on medication chart spend will not be achievable until all prescribing and administration recording can be undertaken digitally. In addition, a stock of paper medication charts must be kept as per the business continuity standard operating procedure.

ANTIMICROBIAL STEWARDSHIP

Since the implementation of HEPMA the majority of prescribing and medication administration is now digitised, and as such business intelligence reporting has enabled greater oversight of prescribing and medication administration practice. An area of high interest is antimicrobial stewardship due to increasing rates of antimicrobial resistance, and it is now possible to understand antimicrobial prescribing practice to a much greater degree.

Prior to HEPMA, the Health Board was in the process of implementing a new paper drug chart incorporating specific sections for antimicrobial prescriptions and 'ARK' (Antibiotic Review Kit) functionality, to act as a behavioural intervention and to support a reduction in the total antibiotic burden in hospital inpatients. These medication charts were in operation at Singleton Hospital but not Neath Port Talbot.

Following an upgrade of the HEPMA system prior to the Singleton Hospital implementation new functionality was made available in the form of 'task management'. A task can be added to a prescription to highlight an action needed to be taken e.g. to monitor biochemistry results or to review in x days, in addition to being added to the patient's record for more general tasks e.g. to weigh the patient.

The task functionality was utilised to support antimicrobial prescribing by mandating that antimicrobial prescriptions were to be reviewed within 72 hours, in line with the Antibiotic Review Kit (ARK) methodology. At the point antimicrobial medication is prescribed, a task is automatically added to the patient's record stating the prescription will need to be reviewed.

To support the ability to identify prescriptions needing review, a dashboard was developed by the Swansea Bay UHB Digital Intelligence team and made available via Signal for clinicians to review. The dashboard displays all patients prescribed antimicrobials and the date by which the prescription needs to be reviewed. To indicate a prescription had been reviewed, the tasks are 'completed' in the HEPMA solution. Where tasks are completed within 72 hours, prescriptions can continue as per the prescribed duration; on the paper medication charts, prescriptions would have to be re-written to be able to continue past the third day.

Since the functionality went live in July 2021 across Neath Port Talbot and Singleton Hospitals, there have been:

- 4,159 antibiotic prescriptions
- >47,000 doses administered
- 725 prescriptions suspended due to task non completion (not being reviewed in time)
- 1,276 missed doses due to suspended prescriptions (2.71% of all doses due)
- 95% of prescriptions were reviewed within 72 hours where patients were admitted >72 hours

BUSINESS INTELLIGENCE

Business intelligence capabilities have enabled the development of a number of dashboards and reports which are available to support professionals in the clinical prioritisation of patients. Below are examples of the available reports.

Pharmacy Prioritisation Report

The Pharmacy Prioritisation Report displays admitted inpatients by ward, medicines reconciliation status, number of high risk and time critical medications prescribed and number of prescriptions not yet clinically checked by a pharmacist:

[redacted]	High Risk	Time Critical	Admitted Date	Forename(s)	Surname	Consultant	Ward	Unverified	Med Unavailable	Med Rec Status	Pharmacy Tasks
[redacted]	1		[redacted]	[redacted]	[redacted]	DR ANGELIKA PLAKANTONAKI	N WARD E	0	0	PCP-For pharmacy use only*-Completed	0
[redacted]	4		[redacted]	[redacted]	[redacted]	DR ANGELIKA PLAKANTONAKI	N WARD E	4	0	PCP - Started	0
		High Risk	Drug Description	Route	Verify Status						
			OXYCODONE HCl (SHORTEC) 5 mg Capsules Immediate Release	Oral	U						
			ENOXAPARIN SODIUM (INHIXA) 40 mg in 0.4mL Injection	Subcutaneous	V						
			OXYCODONE HYDROCHLORIDE (LONGTEC) 10 mg MR Tablets	Oral	V						
			OXYCODONE HYDROCHLORIDE (LONGTEC) 5 mg MR Tablets	Oral	V						
		Time Critical	Drug Description								
[redacted]	1		[redacted]	[redacted]	[redacted]	DR JULIAN HALCOX	S WARD 9	0	0	meds rec complete - nrmoa	0
[redacted]	2		[redacted]	[redacted]	[redacted]	DR RHODRI EDWARDS	S WARD 3	3	0	Meds rec complete	2

Figure 6: Pharmacy Prioritisation Report

This report enables patients to be prioritised based on the need for their medications to be reviewed e.g. a patient with high risk and/or critical medications can be identified and reviewed promptly to improve the quality and safety of patient care. The Pharmacy Prioritisation Report was developed in partnership between the HEPMA team and Swansea Bay Pharmacy colleagues based requirements specified by Pharmacy colleagues.

Antibiotic Prescriptions

The Antibiotic Prescriptions Report displays all inpatients prescribed antimicrobials by ward, the indication where a specific protocol has been selected, whether an indication note has been added where a generic protocol has been selected, and the start and stop date:

	Note Attached	Admitted Date	Forename(s)	Surname	Consultant	Ward
					DR	S WARD 3
	⊞No	Drug	Protocol	Start Date	Stop Date	
		.CIPROFLOXACIN 400 mg in 200mL Intravenous Infusion	Ciprofloxacin HAP IV	18/10/2021 18:00	23/10/2021 07:31	
					DR	S WARD 12
					DR	N WARD D
					DR	S SAU
					DR	S SAU
					DR	S WARD 3
					DR	S WARD 6

Figure 7: Antibiotic Report

This report enables all patients prescribed antimicrobials in the hospitals to be located, allowing for more efficient and targeted antimicrobial reviews.

Antibiotic Review Report

The Antibiotic Review Report displays all inpatients by ward who are prescribed antimicrobials where a review of the prescription and patient is upcoming/outstanding:

Prescriptions **must** be reviewed by the specified day and the **task completed** in the HEPMA system in order for administration to continue. Prescriptions not reviewed within 72 hours will be suspended.

Ward	Patient	Consultant	Drug	Indication Note	Review Action	Start Date	Stop Date	Duration
SAU			Amoxicillin CAP Oral		Review by tomorrow	17/10/2021 13:00	22/10/2021	5 Days
			Clarithromycin CAP Oral		**Prescription suspended – please review**	16/10/2021 07:30	20/10/2021	4 Days

Figure 8: Antibiotic Review Report

HEPMA system functionality is configured to replicate the Antimicrobial Review Kit (ARK) methodology whereby all antibiotic prescriptions must be reviewed within 72 hours of initiation. Where an antibiotic is not reviewed within the required period, the prescription is withheld thus reducing the risk of unintentional, longer courses of antibiotics. The ARK paper medication charts mirror these processes i.e. nurses are unable to administer doses until such time the prescription is reviewed and discontinued or extended.

Diabetic Report

The Diabetic Report displays all inpatients by ward prescribed medication to manage diabetes e.g. insulin to enable more targeted reviews of patients prescribed anti-diabetic medication:

	Admitted Date	Forename(s)	Surname	Consultant	Ward
				DR	S WARD 3
	Drug	**Dose**	**Frequency**		
	HUMULIN I (INSULIN) KWIK PEN 100 units in 1mL Injection	8 unit	ONCE a day in the MORNING		
				DR	N WARD D
	Drug	**Dose**	**Frequency**		
	HUMALOG MIX 25 (INSULIN) KWIK PEN 100 units Injection	6 unit	ONCE a day in the MORNING		
	Drug	**Dose**	**Frequency**		
	NOVORAPID (INSULIN) FLEXPEN 100 units in 1mL Injection	2 unit	Every FOUR hours		

Figure 9: Diabetic Report

Penicillamine allergy

When adding drug allergies, the search defaults to individual drugs with the option to select to search for a drug group if necessary. As Penicillins are a drug group, when searched for as a drug allergen it is possible to select Penicillamine in error. A report identifies where patients have had a drug allergy to Penicillamine recorded and the HEPMA team ensure this has been recorded correctly:

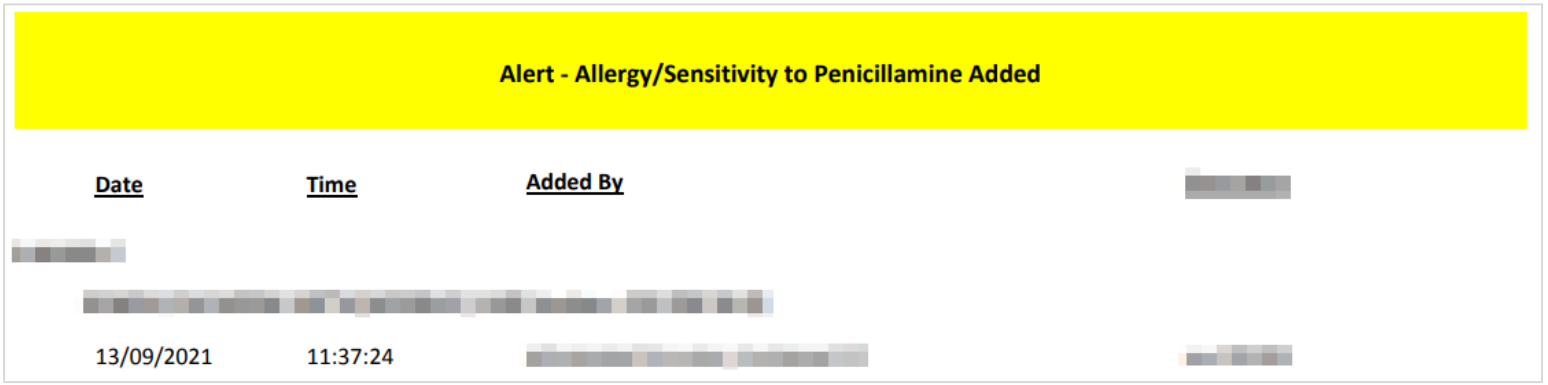
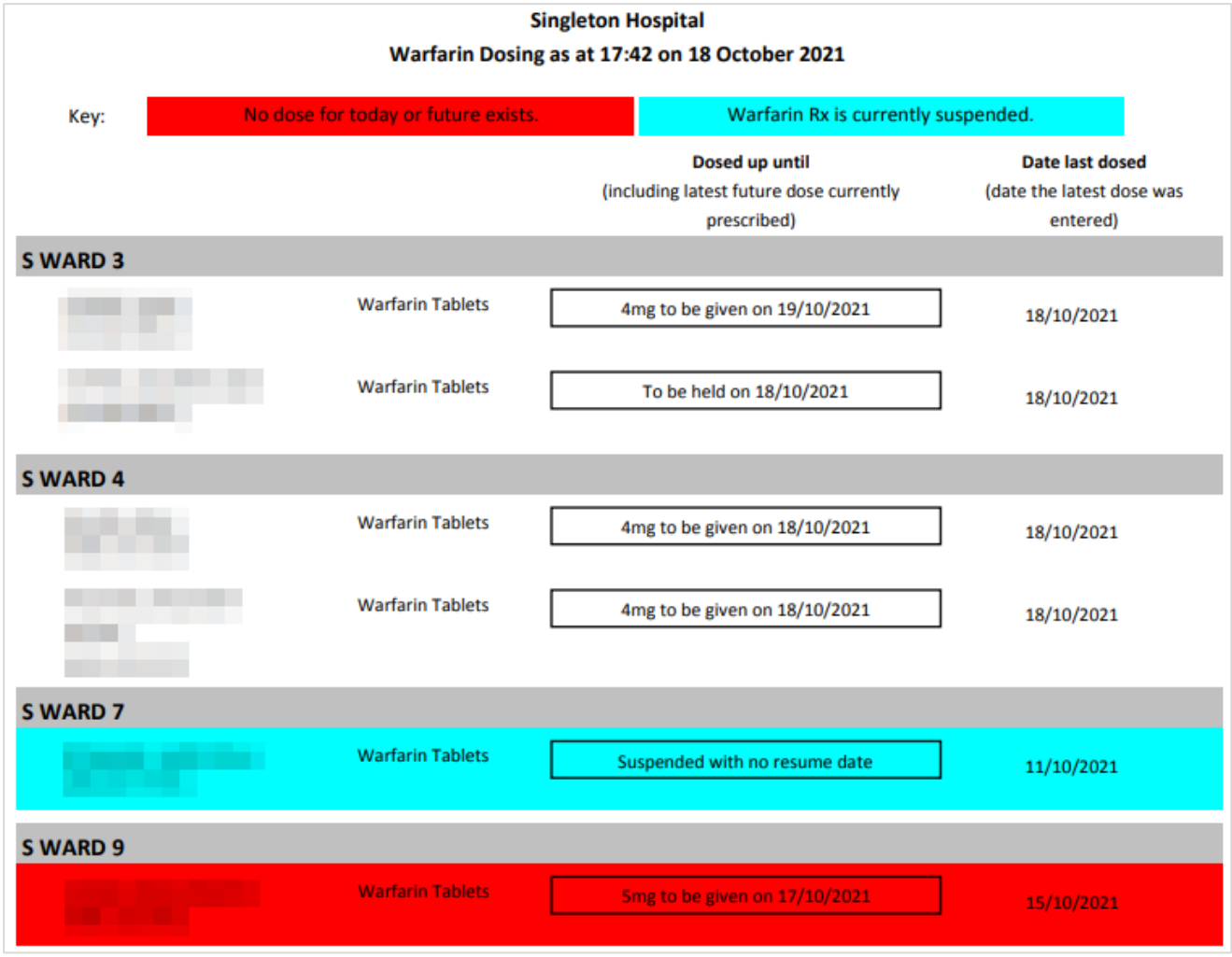


Figure 10: Allergy/sensitivity to Penicillamine added

Warfarin

This report is published to Signal twice daily displaying all inpatients by ward prescribed Warfarin and the details of the greatest future dated prescription, whether a dose is required to be prescribed, or whether a patient's prescription is currently suspended:



Singleton Hospital

Warfarin Dosing as at 17:42 on 18 October 2021

Key: No dose for today or future exists. | Warfarin Rx is currently suspended.

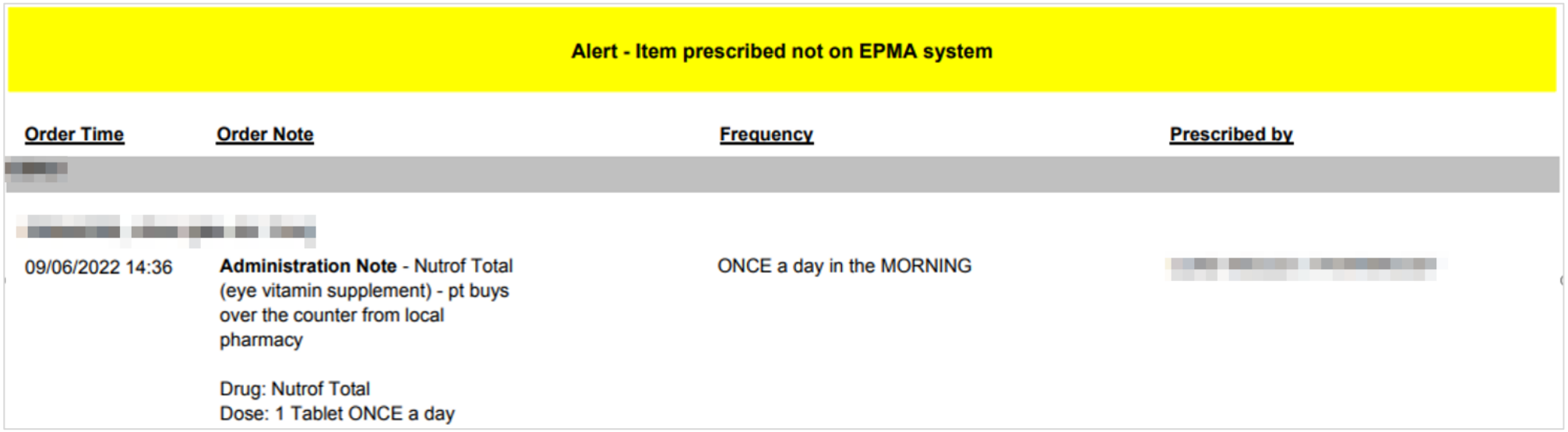
		Dosed up until (including latest future dose currently prescribed)	Date last dosed (date the latest dose was entered)
S WARD 3			
[redacted]	Warfarin Tablets	4mg to be given on 19/10/2021	18/10/2021
[redacted]	Warfarin Tablets	To be held on 18/10/2021	18/10/2021
S WARD 4			
[redacted]	Warfarin Tablets	4mg to be given on 18/10/2021	18/10/2021
[redacted]	Warfarin Tablets	4mg to be given on 18/10/2021	18/10/2021
S WARD 7			
[redacted]	Warfarin Tablets	Suspended with no resume date	11/10/2021
S WARD 9			
[redacted]	Warfarin Tablets	5mg to be given on 17/10/2021	15/10/2021

Figure 11: Twice daily Warfarin report

In addition, there are a number of safety alerts sent directly to the HEPMA team to flag patients/prescriptions that may require additional intervention/support.

Drug not on EPMA System

Where a medication is not available to prescribe on the HEPMA system there is the option to prescribe a 'dummy drug file' requiring the dose, route and frequency to be specified including a note detailing what the medication is to enable administration. A report identifies where patients have had this dummy drug file prescribed to review whether the medication needs to be made available to prescribe in the HEPMA system:



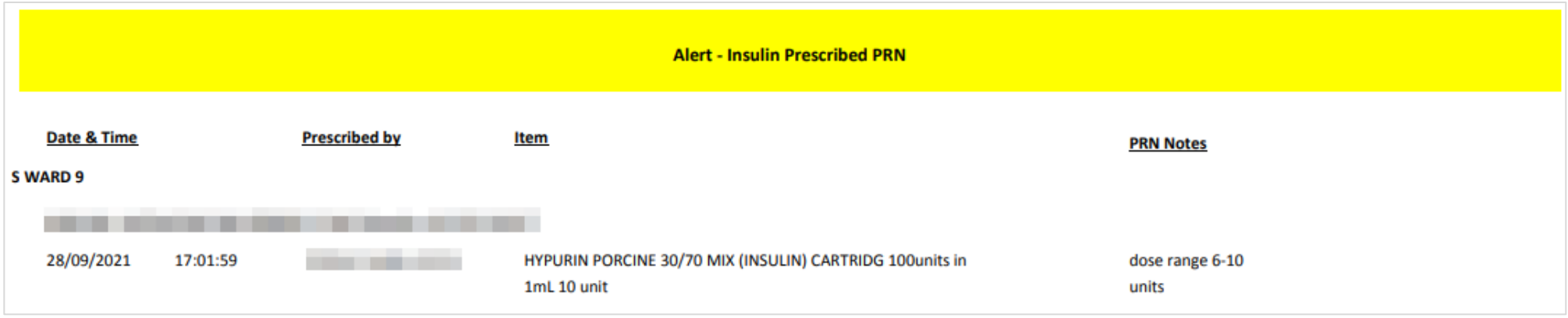
Alert - Item prescribed not on EPMA system

Order Time	Order Note	Frequency	Prescribed by
[redacted]			
[redacted]			
09/06/2022 14:36	**Administration Note** - Nutrof Total (eye vitamin supplement) - pt buys over the counter from local pharmacy Drug: Nutrof Total Dose: 1 Tablet ONCE a day	ONCE a day in the MORNING	[redacted]

Figure 12: Item prescribed not on EPMA system

Insulin PRN

The HEPMA system does not support dose range prescribing, and as such dose range insulin prescriptions have to be prescribed as a when required (PRN) medication with the dose range included in the PRN notes field. A HEPMA PRN prescription enables the nursing staff to edit the dose/units given up to the maximum prescribed amount. This is covered at length during user training and the following report highlights to the HEPMA team where patients are prescribed insulin products as a PRN prescription to be able to support the ward staff prescribing and documenting administration correctly:



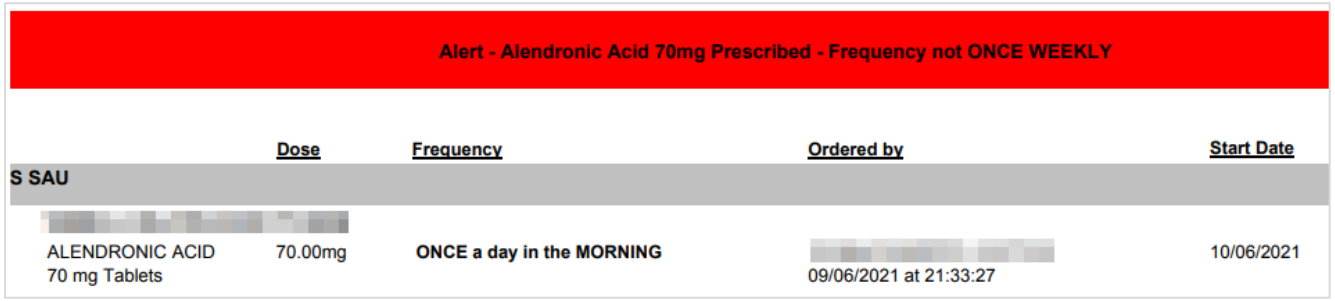
Alert - Insulin Prescribed PRN

Date & Time	Prescribed by	Item	PRN Notes
S WARD 9			
28/09/2021 17:01:59		HYPURIN PORCINE 30/70 MIX (INSULIN) CARTRIDG 100units in 1mL 10 unit	dose range 6-10 units

Figure 13: Insulin dose range prescription

Alendronic Acid

The HEPMA system flags where Alendronic acid, a once weekly medication, is prescribed to be administered other than weekly:



Alert - Alendronic Acid 70mg Prescribed - Frequency not ONCE WEEKLY

	Dose	Frequency	Ordered by	Start Date
S SAU				
ALENDRONIC ACID 70 mg Tablets	70.00mg	**ONCE a day in the MORNING**	09/06/2021 at 21:33:27	10/06/2021

Figure 14: Alendronic acid prescribed daily

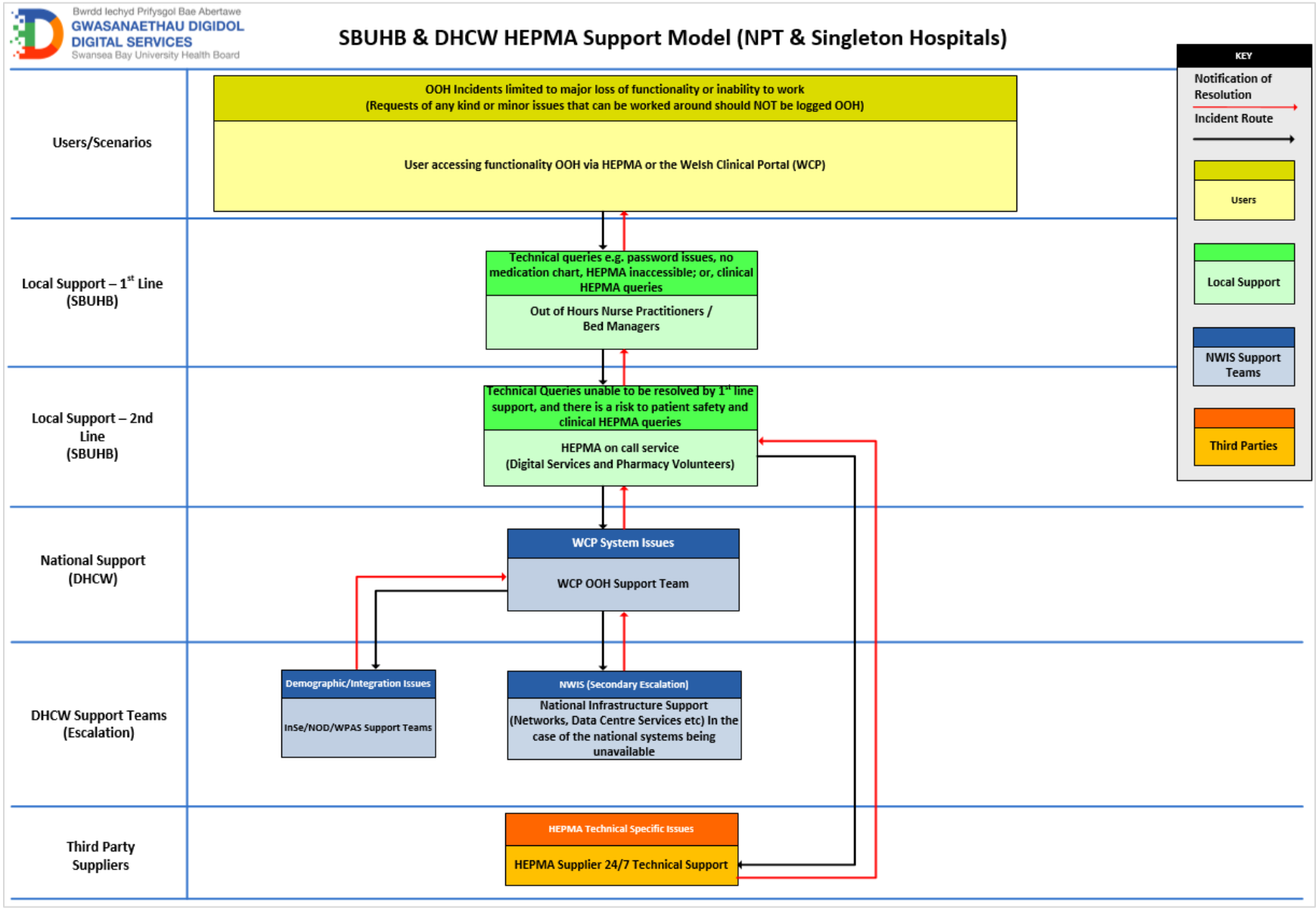


Figure 15: HEPMA Service Management Model

On Call Support

During the pilot ward implementation at Neath Port Talbot Hospital overnight on call support was provided by members of the project team and a number of Neath Port Talbot Pharmacy colleagues on a trial basis. Upon commencement of the wider implementation at Neath Port Talbot three members of the HEPMA project team provided an on call service overnight on a rotational basis during implementations.

When wards moved to the HEPMA business as usual model, first line calls were taken by the Out of Hours Nurse Practitioners for non-clinical support e.g. password resets and issuing new accounts, supported by the HEPMA team and additional Health Board colleagues as second line support for clinical and technical queries.

Chart 20 reflects the number of calls received by the on call service per month between March 2020 and March 2022:

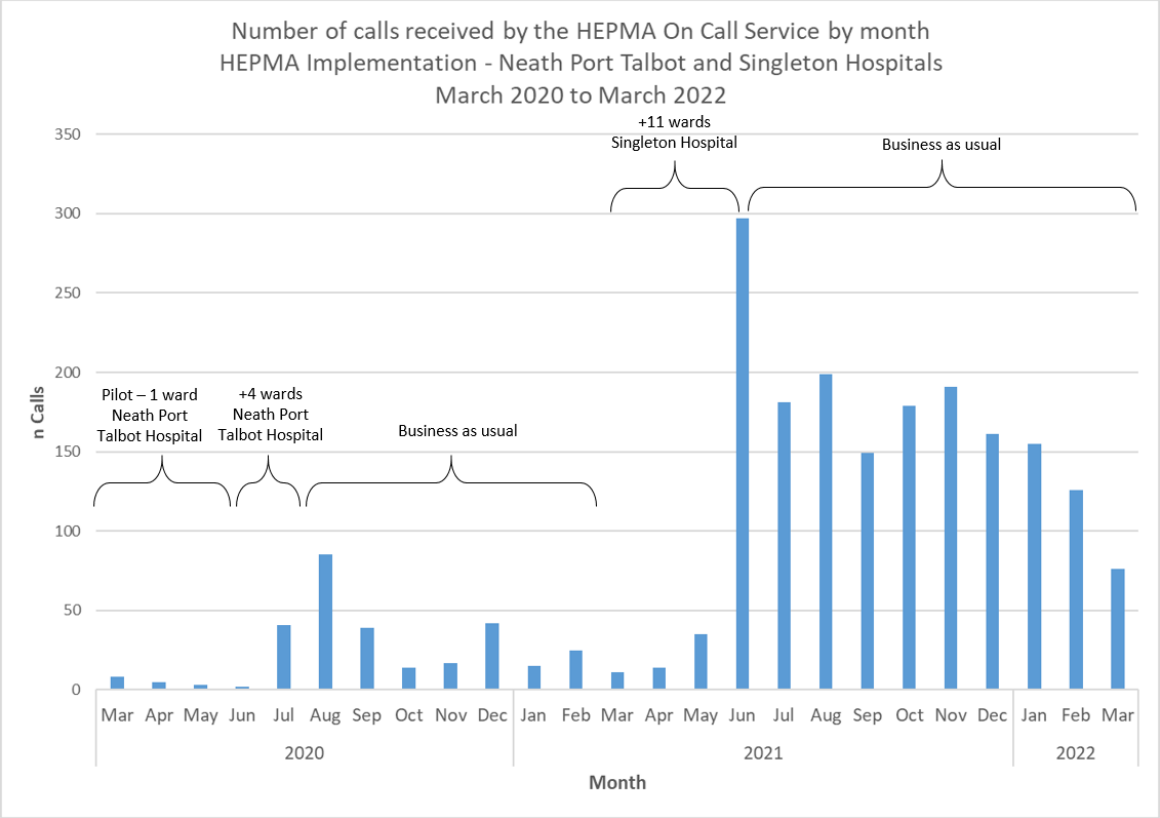


Chart 20: Number of calls received by the on call service per month Feb 2020 – Mar 2022

As expected, the chart demonstrates that the number of calls received by the on call service increases when further wards transition to HEPMA, and also that the implementation at Singleton, as a more acute site, generated more calls.

It is positive to see that the number of calls received out of hours has reduced month-on-month between November 2021 and March 22, however it will be important to continue to monitor the number of calls received until it can be assumed that a lower call volume will be maintained.

Calls to the on call service are categorised by the member of staff taking the call. A breakdown of these calls in order of frequency follows in table 28:

Call Category	n Calls	Average Resolution Time (mins)
Access Issue - HEPMA - New Account Request	531	4.21
Access Issue - HEPMA - Password Reset	386	4.14
General Issue - Other	223	5.17
Guidance Required - HEPMA - Prescribing	219	4.19
Technical Error - HEPMA	200	4.63
Guidance Required - HEPMA - Administering Meds	166	5.95
Guidance Required - WCP	139	4.70
Proactive Call - Warfarin dosing prompt	85	4.18
Guidance Required - HEPMA - General	50	4.10
Technical Error - WCP	37	4.59
Network Down	10	13.10
Inappropriate Call	9	2.56
Hardware Issue	5	6.60
Technical Error - Admission / Discharge / Transfer failure	4	9.50
Guidance Required - Process Issue	3	6.33
Access Issue - WCP - Permissions Required	2	5.50
Access Issue - WPAS - No ADT permissions	1	5.00
Grand Total	**2070**	**4.57**

Table 28: Categorised calls received by the HEPMA on call service

The two most frequent reasons for telephoning the on call service are:

- To request access to HEPMA out of hours e.g. an agency nurse undertakes the e-learning at the start of their shift at 19:30. Following completion of the e-learning, the user is presented with a code. To verify completion of e-learning, the on call person confirms against the e-learning database prior to issuing a pre-set username and password to the user.
- Password reset – aside from two pilot wards at Neath Port Talbot Hospital where a single sign on solution is in place, HEPMA accounts are separate from all-Wales Cymru accounts. Therefore, the data suggests that an additional, distinct username and password for HEPMA has caused a high frequency of login issues.

Calls to the on call service take 4.57 minutes on average to resolve (range = 1-220 minutes between 08 March 2020 and 31 March 2022).

SINGLE SIGN ON

Single sign on refers to functionality that enables a user to use their login credentials i.e. username and password to access multiple applications without being required to re-enter them.

Clinical information systems accessed at Swansea Bay UHB including Welsh Clinical Portal require users to utilise their NHS Wales digital identity i.e. Cymru username and password (NADEx). The HEPMA solution at Swansea Bay, CMM, fully supports integration with organisational credentials where these are used on all devices, however this was not implemented at the outset as historically, ward PCs utilised a generic username and password to access the desktop to enable access to applications with local usernames and passwords. Such PCs are usually continuously logged in and permit no access to clinical information systems without further authentication. Accessing the HEPMA solution from a computer logged into a generic user account which is not associated with a HEPMA account results in an error.

Given that ward PCs often remain continuously logged in to a desktop, access to applications such as Welsh Clinical Portal require users to enter their Cymru username and password which are now familiar to a large proportion of staff.

Swansea Bay UHB has invested in third-party Single Sign On functionality to support full transition away from generic usernames and passwords such that all users are required to login to a PC to further access all applications.

Single Sign On – Benefits to HEPMA

A key benefit of Single Sign On to HEPMA is a reduction in the time taken to witness medication administrations. Controlled drugs require a second user to confirm that they have witnessed the preparation and/or administration of such a medication to a patient. Without Single Sign On, the witnessing user is required to type their username and password.

On average, it takes a user 12 seconds to type their username and password to witness a medication being administered; Single Sign On takes three seconds. Between 11 February 2020 and 30 September 2021, 94,436 medication doses administered were witnessed in HEPMA suggesting that over 236 hours nursing time to care would have been released were Single Sign On in operation from the beginning of the HEPMA implementation.

Single Sign On HEPMA Pilot

A successful pilot of Single Sign On has completed on two wards at Neath Port Talbot Hospital with full HEPMA integration. The solution enables access to PCs using a radio frequency identification (RFID) card to tap to access the PC. Access to clinical systems including HEPMA is then enabled without the requirement to enter a username and password. Users are occasionally required to enter a PIN associated with their designated card to confirm ownership.

Further implementations across all HEPMA wards are planned during 2022-23.

Patient Safety and Quality

Following the implementation of HEPMA, reductions in unintentional omitted medication doses was observed at Neath Port Talbot and Singleton Hospitals (baseline 1.06% and 7.43%; 2021-22 0.36% and 0.96% respectively). A reduction in medication administration errors was also observed at both hospitals (7 at Neath Port Talbot, 47 at Singleton compared with 12 at NPTH and 60 at Singleton) however these post-implementation measurements fell short of the 50% reduction target. Recording of medicines administration improved and met the expected benefit target across both sites, (0.05% and 0.07% compared with 9.04% and 3.20% at Neath Port Talbot and Singleton Hospital respectively). Both hospitals also met the target of 0 patients being prescribed a medicine to which they were allergic during 2021-22. Documentation of venous thromboembolism risk assessments increased to 100% at both sites post-implementation.

In line with antimicrobial stewardship post-HEPMA implementation, at the end of Q4 2021-22 95% and 100% of antibiotic prescriptions at Neath Port Talbot and Singleton Hospitals were clinically appropriate. In addition, both sites met the target of ≤20% of antibiotic prescriptions greater than seven days in duration. Neither site met the target of less than 30% of intravenous prescriptions for a maximum of 72 hours.

Releasing Time to Care

Following the implementation of HEPMA, 5,798 hours (2.97 WTE) was released to care through prescribers, nurses and pharmacists no longer required to search for patients' medication charts. In addition, in March 2021, 614 hours nursing time was released to care through a reduction of medication round duration when compared with the 2019-20 baseline.

Cost Efficiencies

A 32.88% reduction in drug expenditure at Neath Port Talbot Hospital was observed in 2021-22 compared with the previous financial year; this contrasts with the Singleton Hospital expenditure in Q1-2 2021-22 which demonstrated a 5.3% increase in the same period. Calculating the total drug expenditure of Neath Port Talbot and Singleton Hospitals and comparing with the total baseline (2019-20), a 3.9% reduction was achieved against a -2.5% target.

Staff (User) Experience

The staff user experience demonstrated that respondents feel that HEPMA improves prescription safety, auditability and information governance. However, responses show that users do not feel that HEPMA saves them time when prescribing or undertaking pharmacy processes. In relation to prescribers, the perception of gross time saved may not be noticeable given that a large proportion of prescribers feel that prescribing takes longer; the net effect of time saved from no longer searching for medication charts or not rewriting charts post-implementation of HEPMA may not be immediately recognisable.

Infection Prevention and Control

Following the implementation of HEPMA on the pilot ward at Neath Port Talbot Hospital, Unit Directors requested that HEPMA be implemented across the remaining medical wards on site. HEPMA devices and trolleys can be decontaminated with disinfectant wipes which supported the wider implementation across Neath Port Talbot during 2020.

Prior to the HEPMA implementation at Singleton Hospital, all HEPMA implementation staff were offered the Covid vaccination as frontline staff and were present on wards where Covid-positive patients were admitted. No implementation staff contracted Covid during the implementation.

Final Recommendations

HEPMA has demonstrated improvements in patient safety and quality, and time released to care at Swansea Bay UHB. A significant proportion of nursing and prescriber time released to care has been observed, however Pharmacy processes are not directly replicated in HEPMA which has increased the time taken to undertake their clinical duties.

Prior to this evaluation, the Morriston Hospital Directors requested that HEPMA be implemented across Morriston and Gorseinon Hospitals, based upon interim benefits data and wider Health Board feedback on the implementations at that point. As such, a bid to the Welsh Government's Digital Priorities Investment Fund was submitted in February 2021 which was approved in August 2021. Implementations at Morriston Hospital commenced with the Ty Olwen palliative care hospice in March 2022, and wider implementations are currently planned to commence in Q2 2022-23.

The Mental Health and Learning Disabilities Group has also indicated their intention to implement HEPMA across their inpatient sites in the future, pending further analyses of the relevant expected benefits and a relevant business case/funding bid.

It is therefore proposed that HEPMA be implemented across all inpatient locations at Swansea Bay University Health Board such that benefits can be realised on a larger scale for the benefit of all patients cared for.

APPENDIX 1 – MEDICATION CHARTS TRANSITIONED TO HEPMA

Table 29 details paper medication charts in operation prior to the HEPMA implementation, and those which have transitioned to HEPMA:

Medication Chart	Migrated to HEPMA	Comments
All-Wales Inpatient Medication Administration Record	✓ (with the exception of intravenous infusions)	All STAT, regular, PRN prescriptions except intravenous infusions are prescribed using HEPMA
Adult Inpatient Warfarin Chart	✓	Warfarin is prescribed using HEPMA
Adult Insulin Administration Record	✓ (with the exception of recording blood glucose measurements)	Insulin is prescribed using HEPMA
Continuous Subcutaneous Infusion Administration Record (Syringe Driver Chart)	✗	Not in initial scope; for later implementation
Adult Diabetic Ketoacidosis Treatment and Monitoring Chart	✗	Complex paper chart that could not be included as part of the HEPMA prescribing process
Adult Hyperosmolar Hyperglycaemia State Chart	✗	
Continuous Subcutaneous Insulin Infusion Chart	✗	
Variable Rate Insulin Infusion Chart	✗	
Heparin Infusion Chart	✗	
Epidural Chart	✗	
Patient-Controlled Analgesia Chart	✗	
Blood Transfusion Chart	✗	Not in scope

Table 29: Medication Chart Migration to HEPMA Status

APPENDIX 2 – DEVICES

IT Desktop Support

2 x WTE Desktop Support Engineers were recruited to support the IT requirements of both hospital sites. Both roles are permanent and were essential for the pre-implementation scoping, hospital implementations and ongoing desktop support.

Pre-Implementation

Prior to the implementation, IT hardware audits were undertaken by the Desktop Support Engineers to scope wards and identify requirements to support the implementation of HEPMA across Neath Port Talbot and Singleton Hospitals.

Following the scoping exercise, it was agreed with the configuration working groups that each medical ward should be provided with a selection of devices to include:

- touch screen laptops on slim carts
- computers on wheels
- handheld tablets

Device Type

Swansea Bay UHB were advised by the HEPMA supplier that support for both Apple and Android devices had been withdrawn for JAC (CMM) v2018 and v2019 in April 2019, and that should iPads or Android tablets be utilised to access HEPMA, this would not be supported. In addition to this, any issues or bugs relating to an Apple/Android device would not be supported as the 'Quick Chart' functionality (used by most, if not all, medication administration users of the system) would not work correctly, and clinical information accessible via hover-text would not work i.e. using a PC browser, users can move the mouse over an administration marker to activate hover-text which includes important clinical information such as the date and time of the last administration.

Both Apple and Android devices were therefore descoped from both hospital implementations.

Equipment Procured

The following equipment was procured to support both rollouts:

Item	Qty
Charging Cabinets	17
Surface Go with Keyboard and Cover	50
DELL 5490 Touchscreen	100
DELL All-in-One PCs	62
Ergotron Carefit Slim Carts	54
UPS APC units (Battery power for business continuity PCs)	8
Business Continuity Printers	8

Table 30: HEPMA devices procured

In addition to the above, each ward already had access to a number of desktop PCs in situ.

Procurement Issues

There were two key issues during the IT hardware procurement process, these were:

- Delivery timescales were impacted following Brexit and a change to processes for receipt of UK goods

- Touchscreen laptops are not as widely available as standard laptops
- During 2021-22, there was a global shortage of silicon chips which delayed receipt of hardware procured.

Deployment of IT Hardware

All hardware was distributed to each ward in scope and ahead of their implementation:

- to allow staff the opportunity to familiarise themselves with each device
- to support training on wards
- to enable Wi-Fi connectivity testing prior to rollout
- to enable business continuity tests ahead of rollout

Business Continuity

Based on the size of each site, the supplier advised that we would require eight emergency chart production PCs to support the wards in the event of a system outage. A separate scoping exercise was undertaken to identify appropriate, accessible locations for placement. Proposed locations were agreed with configuration working groups. Business continuity is supported by an SOP (see Appendix 7).

Following implementation, business continuity tests are undertaken weekly for each emergency chart production PC by an IT Desktop Support Engineer.

Damage to devices

To date a number of damages have been recorded at both sites:

Damage	Reason(s) for damage	Total
Laptop screen	• Closing screen lids when fixed to carts • Dropping laptop in transit • Knocking laptops off carts	10
ECP screen	• Cracks to screen following force	2
Laptop keyboard	• Liquid spillages • Cleaning incorrectly	25
Laptop motherboard beyond repair	• Cleaning incorrectly	3
Snapped hinges	• Breakages due to force	4
Charging cables	• Missing • Broken	10

Table 31: Hardware damage

Infection Prevention and Control

When administering medication to patients, there is a requirement for a mobile device, such as a laptop on a cart to be transported to the patient's bed side or as near to the patient as possible. The e-prescribing platform replaces the All Wales Paper Medication Chart, as the information is made available electronically. Despite the risk of cross contamination using a paper medication chart being removed, the use of mobile devices in patient areas will introduce additional infection prevention control measures. Training was provided to all wards by the IPC teams onsite.

Lessons Learnt

Following both implementations, the following lessons learnt were recorded for IT hardware:

- Alternative methods to holding laptop screens open on carts is required to avoid breakages to screens
- Laptops need to be attached securely to carts using alternative holders on carts of Velcro
- Additional IPC training is required to ensure users are cleaning the devices using the correct technique - previously cleaning wipes have not been wrung appropriately resulting in the liquid causing damage
- Curly cord cables have been ordered to offer more flexibility for charging
- Baskets to fit on the carts have been purchased to increase storage space for items such as medication pots

APPENDIX 3 – STAFF RESOURCES REQUIRED

Drug File Configuration – 226 hours

In order to prescribe medication using CMM EPMA, each combination of drug, form and strength was required to be configured. Within each drug file configuration, additional information can be specified, or to mandate individual prescription specification to support safer prescribing.

As at September 2021, there were 3,978 prescribable items within the HEPMA solution. A number of these files were already configured to enable outpatient e-prescribing at the Princess of Wales Hospital in 2015. However, full validation of all drug files, including amending and creating these was required to be undertaken by the E-Prescribing Pharmacists and an E-Prescribing Facilitator (Pharmacy Technician). This process resulted in the creation or modification of almost 4,000 drug files taking approximately 226 hours between July 2019 and February 2020.

Between September 2020 and March 2022 there were 213 requests for change to the configuration of the HEPMA system. These requests included making new drug files available to prescribe, new frequencies where patients take medications at specific times on specific days, and new protocols. Over 60% of requests came from Pharmacy staff and 23% from prescribers. A change request log is kept of all the requests, the action taken and to quality assure details to ensure the configuration integrity.

Transcribing Charts for Go Live – 27 minutes per patient including 15 minutes per patient for a Pharmacy Accuracy Check

Immediately prior to a ward go live, all admitted patients' medication charts must be transcribed into the HEPMA solution.

On average, the transcription of paper medication charts took 27 minutes per patient, followed by 15 minutes of checking by a Pharmacist/Pharmacy Technician for accuracy.

Implementation

At Neath Port Talbot Hospital, the team comprised:

- 1 E-Prescribing Pharmacist
- 1 HEPMA Facilitator (Pharmacy Technician)
- 1 Desktop Support Engineer
- 5 non-clinical Digital staff members

The implementation effort amounted to 1,555 person hours for five wards over seven weeks in total (5.92 WTE).

At Singleton Hospital, the team comprised:

- 1 E-Prescribing Pharmacist
- 2 HEPMA Facilitators (Prescribing Technicians)
- 1 Desktop Support Engineer
- 13 non-clinical Digital staff members
- 1 Ward Pharmacist
- 2 Ward Pharmacy Technicians

The implementation effort amounted to 2,622 hours for 10 wards over 12 weeks (5.83 WTE).

Business as usual

Following the implementation, HEPMA was supported across two hospital sites Monday to Friday 08:00 – 17:00 by:

- 1 WTE E-Prescribing Pharmacist
- 2 WTE HEPMA Facilitators (Pharmacy Technicians)
- 2 WTE Desktop Support Engineers
- 0.2 WTE Data Analyst

Feedback from Pharmacy staff indicates that they provide support and guidance to clinical staff using the HEPMA system on a regular, ongoing basis when present on the wards.

An on call service is provided by six members of staff on a rota: the HEPMA team, a pharmacist, a pharmacy technician and a Digital Trainer.

APPENDIX 4 – ISSUES

A number of issues were identified throughout the implementation:

Issue	Description	Status
A maximum of 12 allergies and 12 sensitivities can be recorded in HEPMA	CMM EPMA only has the ability to store up to a maximum of 12 allergies and 12 sensitivities. This was discussed at a patient safety workshop where it was concluded that where possible, drug groups should be recorded with an allergy note added e.g. add 'Penicillins' as a drug group rather than Amoxicillin and Flucloxacillin separately. A future version of CMM EPMA will enable the storage of a greater number of allergies and sensitivities however no timescales have been provided.	Open
HEPMA account lockouts	Users can become locked out of their accounts when attempting to witness the administration of controlled drugs. This requires the HEPMA team or out-of-hours nurse practitioners to reset passwords. This has been acknowledged by the supplier however timescales have not been provided.	Open
ADT interface failure	Admission, discharge and transfer messages intermittently fail resulting in no HEPMA medication chart created for new admissions, impeding prescribing. The HEPMA team have the ability to manually create a medication chart. This is restricted to the HEPMA team as the manual admission on HEPMA requires patients' WPAS spell numbers to be obtained from the WPAS audit table to enable future discharge medications to populate the DAL. This was reported to DHCW upon each occurrence. Changes to the national architecture appear to have eliminated these issues.	Resolved
Discharging patients via WCP prior to completion of discharge prescriptions	When patients are discharged using WCP the medication chart is archived. Where patients are discharged before the discharge prescription has been completed, HEPMA team intervention is required by 'cancelling' the discharge in the HEPMA solution to reinstate the medication chart.	Open

Issue	Description	Status
Discontinued medication not appearing on patients' DALs	Regular medications taken by patients at the point of their admission must be prescribed on HEPMA, flagged as an 'Admitted on' medication and then discontinued with a relevant reason. It was identified during the Neath Port Talbot Implementation that these medications were not appearing on patients' discharge advice letters as a medication with a status of "Stopped" and the relevant reason. The Deputy Medical Director was informed and it was agreed that the E-Prescribing Pharmacist would write to affected patients' GPs to advise them of the errors.	Resolved
Inability to modify a prescription where the dose contains a decimal point	A system bug was identified by the HEPMA team whereby prescriptions cannot be modified if the dose contains a decimal point. An error message is presented to the user. Swansea Bay HEPMA users are trained to discontinue and prescribe the new dose separately.	Open
Inability to prescribe multiple administration routes per prescription without unique protocol	It is possible to enable medications to be prescribed with the option of more than one route of administration. However, it was agreed by the Medical Working Group that the process for adding the option to give medication via enteral routes would be to add notes to nursing staff that appear at the point of administration to advise this.	Partially resolved
Incorrect medication start dates appearing on DAL	New medications prescribed in hospital were appearing on DALs with a start date of the date of the discharge prescription which was incorrect. It was assessed that this could pose significant risk to patients who require medications for a short period of time where the prescriber indicates that the medication should be given for a finite period. GPs would therefore continue the prescription for a period not intended by the discharging doctor. During the Neath Port Talbot implementation, Pharmacy colleagues annotated each discharge advice letter where erroneous dates were presented to indicate the correct date. This was resolved in advance of the Singleton implementation.	Resolved

Issue	Description	Status
Intravenous infusions caused a high frequency of issues for prescribers and nurses	Technical limitations in the CMM EPMA solution inhibited the safe utilisation of HEPMA to support the administration of intravenous infusions: • It is not possible to stop an infusion on EPMA unless it was within 90 minutes of the prescribed infusion end time • The rate of an infusion could not be amended by the prescriber once the infusion had commenced. • Unclear how many infusion bags were prescribed. Intravenous infusions returned to paper charts due to the technical limitations of CMM EPMA and the significant level of user concern.	Resolved
No dose accumulation limits in EPMA	PRN medications can be charted once per minute even though prescribers can indicate the maximum number of doses per day. The supplier has not provided timescales that will limit medicines administration for 'as required' medications.	Open
Prescriptions with different doses in the same day cannot be prescribed in a single order	Each strength must be prescribed separately. The supplier has indicated that this is on their development roadmap.	Open
Printed medication charts are unclear	It is necessary to print medication charts when transferring patients to non-HEPMA wards. The following issues remain: • Unclear information on medications stopped or withheld • Incomplete information for prescription frequencies, administration times and 'either/or' administration protocols • The absence of non-administration reasons for prescriptions where administrations did not occur • The absence of allergy reaction information • Incorrect presentation of the number of bags of fluids prescribed for infusions e.g. one bag prescribed when three are to be administered to the patient	Open
Warfarin discharge prescriptions prevent the clinical verification status from appearing correctly on the DAL	Where discharge prescriptions do not include Warfarin and each item prescribed is clinically verified by a Pharmacist in HEPMA, the DAL states "Medications clinically verified by Pharmacist in EPMA system". However, due to an issue in CMM EPMA, Warfarin prescriptions included in the overall discharge prescription prevent the Pharmacists' verification statuses from updating the DAL correctly. Pharmacists are required to manually annotate the DAL to indicate that the discharge prescription is clinically verified. This issue has now been resolved.	Resolved

Table 32: Process and technical issues

APPENDIX 5 – PROTOCOLS

A list of treatment protocols developed by Swansea Bay UHB to support HEPMA can be downloaded here: Swansea Bay UHB HEPMA Treatment Protocols (June 2022) – should the link become inaccessible, please e-mail sbu.hepma@wales.nhs.uk.

Protocol types are as follows:

Protocol Type	Function	Examples
Either / or	Prescribes multiple medication which enables the nurse to select the most appropriate at the point of administration (replicates the prescriber indicating multiple routes on paper medication charts e.g. PO/IV)	Dexamethasone PO/IV/SC/IM Omeprazole PO/IV Cyclizine PO/IV/SC/IM Metoclopramide PO/IV/SC/IM Naloxone IV/IM
Normal	Prescribes one or more medications for a specified indication	All Antibiotics Last Days of Life Care Post-op Surgery
Variable Dose	Prescribes courses of medication with varying doses	Prednisolone reducing regime Dexamethasone reducing regime Chlordiazepoxide reducing regime
Single Selection	Presents options at the point of prescribing for selection of a single prescription	Methotrexate once weekly Alendronic acid once weekly

Table 33: HEPMA protocol types

APPENDIX 6 – CLINICAL GOVERNANCE – WORKING GROUPS AND CONFIGURATION RATIFICATION GROUP

The configuration of the HEPMA solution was overseen by a number of professional groups:

Group	Membership	Group Objectives
Medical Working Group	• Chief Medical Information Officer and Consultant Nephrologist • Consultant Clinical Oncologist • Consultant Physician • Consultant Physician and Clinical Director	1. Act as subject matter experts, providing crucial input to the HEPMA system configuration process 2. Ratify the final, proposed system configuration prior to submission to the HEPMA configuration Ratification Group that will approve before Medicines Management Board (MMB) 3. Ensure that HEPMA and its functions are fit for purpose and will support frontline staff in their delivery of excellent patient care. 4. Act as communication conduits, engaging with their peers, keeping them updated with project/implementation progress 5. Understand and review HEPMA risks and issues where escalated by the HEPMA project implementation team, prior to consideration by the HEPMA project board. 6. Consider and advise on standards for information sent from secondary to primary care. 7. Promote the importance of patient safety through use of the system 8. Ratify proposed changes to the prescribing process and their rationale
Nursing Working Group	• Advanced Nurse practitioner • Matron • Nurse Practitioners • Senior Ward Sister • Ward Sisters	As Medical Working Group objectives 1-7, including: 8. Be satisfied with the changes to processes of administration and reasons for undertaking these changes.
Pharmacy Working Group	• Clinical Effectiveness & Formulary Pharmacist • Clinical Pharmacists • Head of pharmacy • Lead Clinical Pharmacists • Medicines Safety Officer • Patient Services Manager	As Medical and Nursing Working Group Objectives

Group	Membership	Group Objectives
Surgery & Anaesthetics Working Group	• Surgical doctor • Anaesthetist • Consultant Anaesthetists • Ward Sister • Theatre Sister • Pharmacists	As Medical and Nursing Working Group Objectives
Configuration Ratification Group	• Chief Medical Information Officer and Consultant Nephrologist • Clinical Effectiveness & Formulary Pharmacist • Head of Corporate Nursing • Head of Pharmacy • Head of Pharmacy Acute Services • Medication Safety Officer	• Ensure that HEPMA and its functions are fit for purpose and support frontline staff to deliver excellent patient care • Provide quality assurance for the work undertaken in the respective working groups • Final system configuration proposals prior to submission to Medicines Management Board (MMB) • Standard of information to support transfer of care • Changes to administration and prescribing processes

Table 34: HEPMA Configuration and Ratification Groups

APPENDIX 7 – STANDARD OPERATING PROCEDURES

To support the safe and correct utilisation of the HEPMA solution, the following standard operating procedures (SOPs) are published on the Swansea Bay UHB intranet site in the same location of local clinical policies and procedures.

- CID3202 SOP 01 HEPMA Obtaining an EPMA User Account
- CID3204 SOP 03 HEPMA User Account Password Reset
- CID3206 SOP 04 HEPMA Printing Medication Charts during System Downtime (V1.2)
- CID3208 SOP 05 HEPMA Prescribing and Administering Medication during System Downtime
- CID3214 SOP 08 HEPMA Recording and Maintaining Allergies and Sensitivities in the EPMA System
- CID3216 SOP 09 HEPMA Completing a VTE Assessment in the EPMA System
- CID3218 SOP 10 HEPMA Drug, Route or Frequency not available for Prescribing on the EPMA System
- CID3220 SOP 11 HEPMA Antibiotic Prescribing
- CID3222 SOP 12 HEPMA Prescribing Teicoplanin
- CID3224 SOP 13 HEPMA Prescribing Vancomycin
- CID3226 SOP 14 HEPMA Prescribing Gentamicin
- CID3228 SOP 15 HEPMA Managing Medicines on Supplementary Charts
- CID3230 SOP 16 HEPMA Prescribing PRN Medications
- CID3234 SOP 18 HEPMA Prescribing and Administering Oral Anticoagulants
- CID3236 SOP 19 HEPMA Prescribing and Administering Methotrexate for non-Cancer Treatment
- CID3246 SOP 24 HEPMA Prescribing Protocols
- CID3248 SOP 25 HEPMA Viewing Prescriptions and Charting Medications
- CID3252 SOP 27 HEPMA The Medicine Administration Chart (MAC) and Medicine Administration Profile (MAP)
- CID3254 SOP 28 HEPMA Transferring Medication Information from EPMA Wards to non-EPMA Wards
- CID3256 SOP 29 HEPMA Transferring Medication Information from non-EPMA Wards to EPMA Wards
- CID3258 SOP 30 HEPMA Discharge Processes on and WCP (Prescriber)
- CID3260 SOP 31 HEPMA Discharge Processes on and WCP (Pharmacist)
- CID3262 SOP 32 HEPMA Medicines Reconciliation
- CID3264 SOP 33 HEPMA Ordering and Dispensing Medication

Should any of the links become inaccessible, please e-mail sbu.hepma@wales.nhs.uk.

APPENDIX 8 – BENEFITS REALISATION STATUSES

For full details on the status of individual benefits realisation statuses, please see Benefits Realisation.

Key:

Benefit Realised/Target Met	Benefit Partially Realised/ Post-Implementation Measurement Improved	Benefit Not Realised/ Target Not Met

Benefit	Target	NPTH	Singleton
Reduced unintentional omitted doses of medicines	<5%		
Reduced prescribing errors	50% reduction		
Reduced medicines administration errors	50% reduction		
Improved recording of medicines administration	<5%		
Increased allergy documentation	100%		
Reduced prescribing of medicines to which patients are allergic	0		
Improved documentation of VTE risk assessment	90%		
Improved prescribing of VTE prophylaxis	90%		
Reduced number of C.Difficile cases by 25%	25%		
Improved antimicrobial stewardship – increased appropriateness of Abx Rx choice	>95%		

Benefit	Target	NPTH	Singleton
Reduce % of antibiotic prescriptions over 7 days	≤20%		
Reduce % of IV antibiotic prescriptions over 72 hours	<30%		
Prescriber time saved from not rewriting lost, missing or full prescription charts	912 hours doctor time saved per year		
Decreased nurse drug round time by 20%	20% reduction		
Time saved from searching for drug charts	75% reduction in time taken to access drug charts		
Reduced annual drug expenditure by 2.5%	2.5% reduction		
Reduced stationery costs	£0		

Table 35: Benefits Realisation Statuses