

CareFlow Medicine Management

Group 12

Sakshi Sunil Dhavale, Chae Hyun Kim, Anita
Bosibori Oseko, Haoyu Wei, Heng Zhong

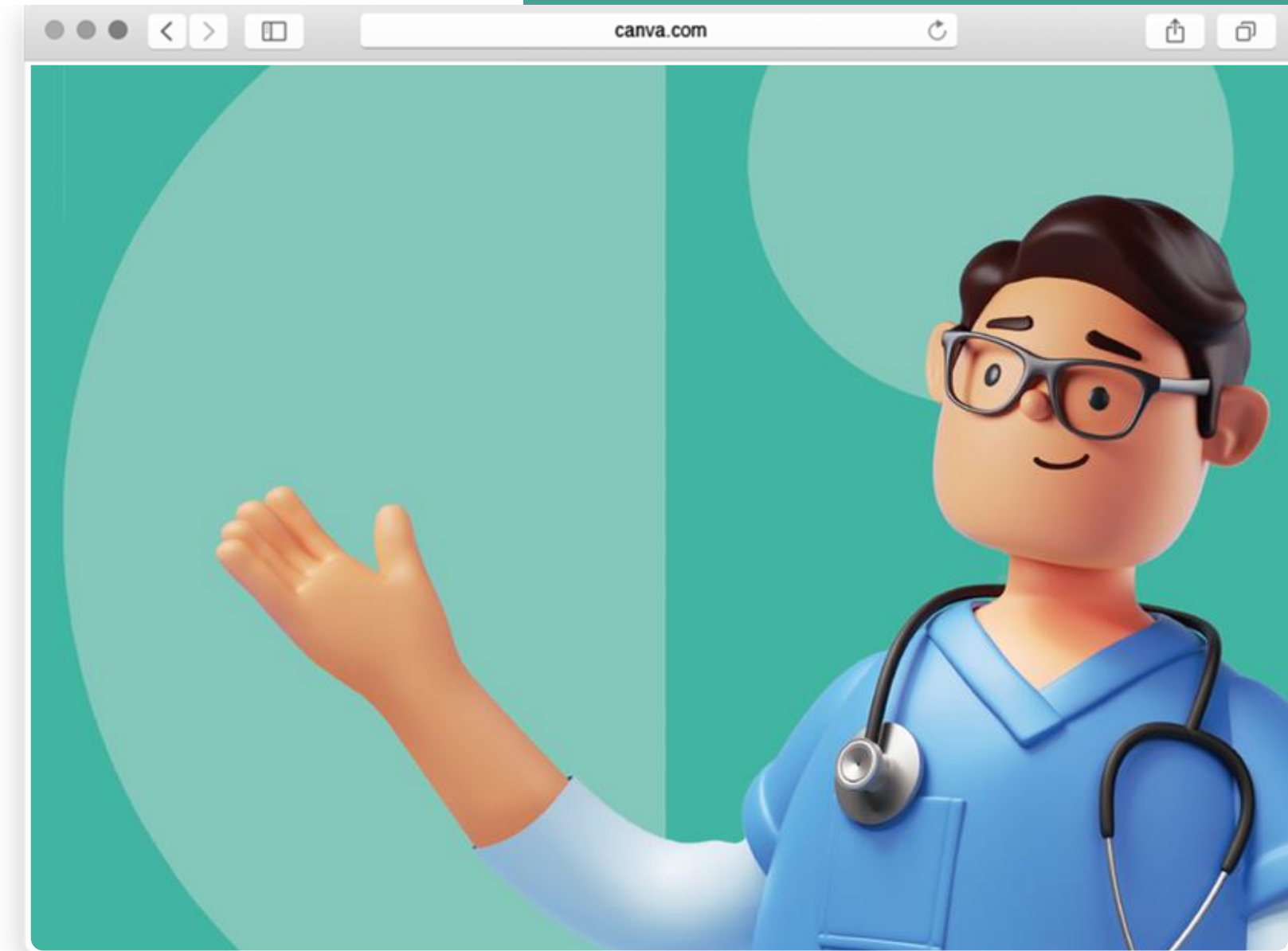


Table of Contents

1. What is System C and Careflow EPR?
2. Development of Careflow's CPOE+CDS
3. Usage of Careflow
4. Scientific Evaluation and Comparison of Careflow

System C

Clinical Workspace					
Patient Administration	Clinicals	Care Settings	Patient Engagement	Cross Sector Collaboration	Integration
Single Master Patient Index (PDS & CP-IS)	Electronic Observations	Birth & Death Record	Digital Letters	Regional Care Coordination	PACs & Specialist Systems
Patient Flow	Medicines Management	Emergency Care		Unified Acute Record	Voice Recognition
Referral Management (ERS)	Closed Loop	Maternity	Consent Management	Geographical Care Pathways	Artificial Intelligence
Waiting List Management	Orders & Results	Theatres & Anaesthetics	Appointment Management	Locality Derived EPMA	MFA, OAuth, OIDC
Clinical Coding	Clinical Assessments & Content	Outpatients		Social Care Integration	Web, Mobile, PWA
Casnote Tracking	Allergies/Problems & Diagnosis	Pharmacy	Read/Write Person Held Records	Population Health	FHIR APIs
Document Exchange	Clinical Collaboration & Communications	Critical Care		Risk Stratification	Integration & Interfacing
Self Check in Kiosks	Integrated Care Pathways	Inpatient Care	Virtual Consultation	National Maternity Record	Frequent Integrated Release
	Task & Event Based Rule Engine	Integrated Care		Transfers of Care	SNOWED, DM+D
	Blood & Milk Tracking	Virtual Wards	Remote Care	Data Visualisation	
	Automated Escalation	National & Local Reporting			

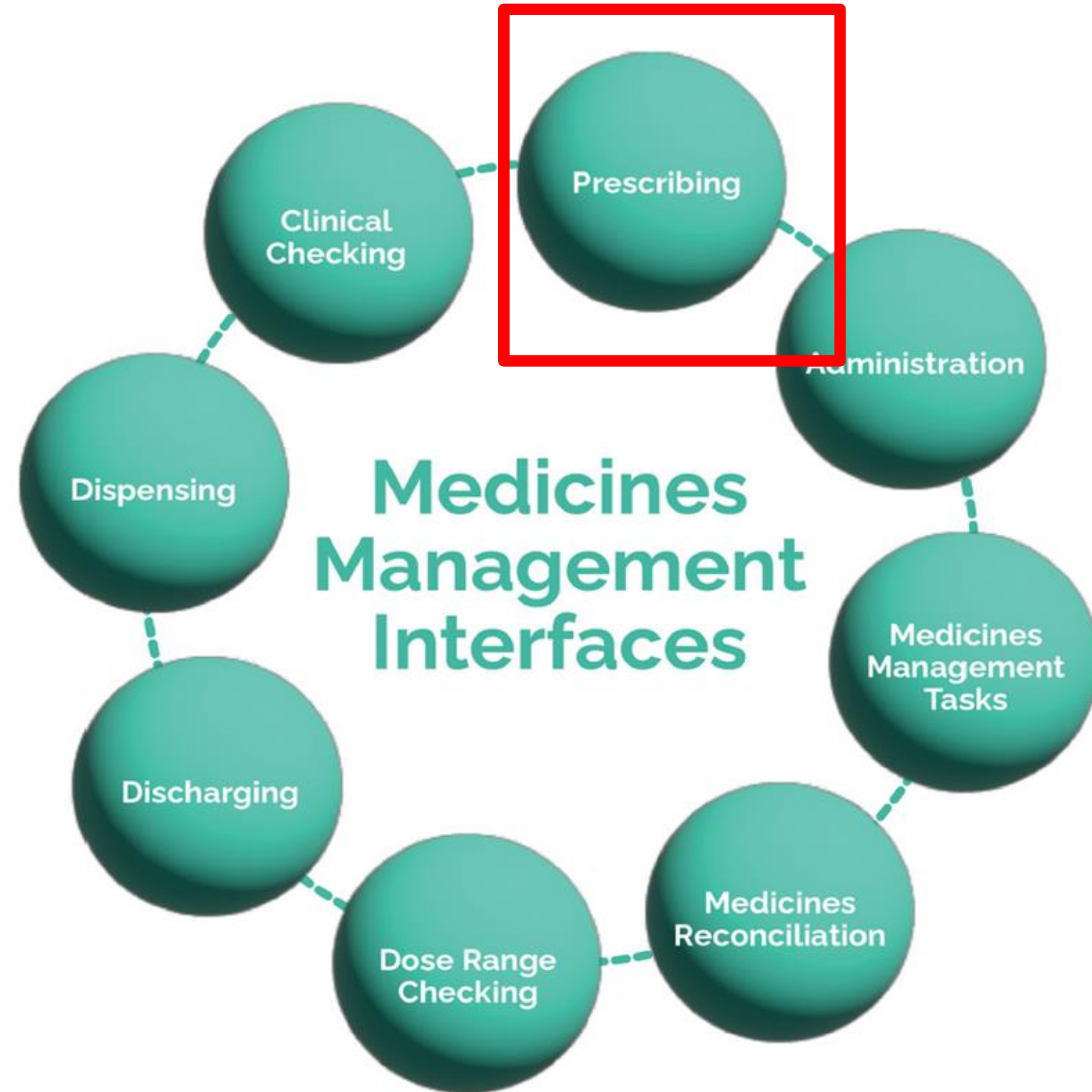
- **System C Healthcare Limited** is a British supplier of health information technology systems and services
- Develops suite of digital healthcare solutions to support clinical workflows, improve patient safety, and enhance the efficiency.
- Mainly used in acute care and children's hospital. Currently deployed widely in NHS Trusts. (System C, 2024)

CareFlow Medicine Management

- **CareFlow EPR** is a mobile, cloud-based, interoperable electronic patient record (EPR) platform which is a part of System C's G-cloud service.
- Features of CareFlow EPR includes **CPOE (Computerized Physician Order Entry)** and **CDS (Clinical Decision Support)**, which aims to support safe medicine prescription.
- Connected with Careflow EPMA for inpatient and outpatient drug prescription.

(System C, 2025)

Our Focus



- From the broad healthcare services provided by System C, we will focus on Medicine Management Interface.
- Furthermore focusing on the **Prescribing Medicines** by the Clinicians using the features of CDS imbedded in CPOE
- **CPOE** : Digital System allowing healthcare providers to electronically enter medication orders.
- **CDS** : Systems flag potential adverse drug interactions, inappropriate dosages based on patient-specific data

Development of CareFlow Medicine Management

- CareFlow Medicine Management is a **Knowledge-based CDSS**
- Data embedded in the system: **First Databank's Multilex**, a drug knowledge base and CDSS with largest, up-to-date information about medications.
 - This includes **NICE guideline** for drug prescription and multiple sources checked by expert clinicians of FDB. (FDB (First Databank))
- **Element of AI** – Used Natural Language Processing to analyse free-text allergy notes to identify recurring reactions and incorporate them into the system, improving data quality and patient safety (Logan, 2022)

FDB Multilex®

Role of CPOE+CDS in the Workflow of Drug Prescription and Administration



Doctor

Provide comprehensive prescribing functionality to support all medicines

Drug-drug
interaction

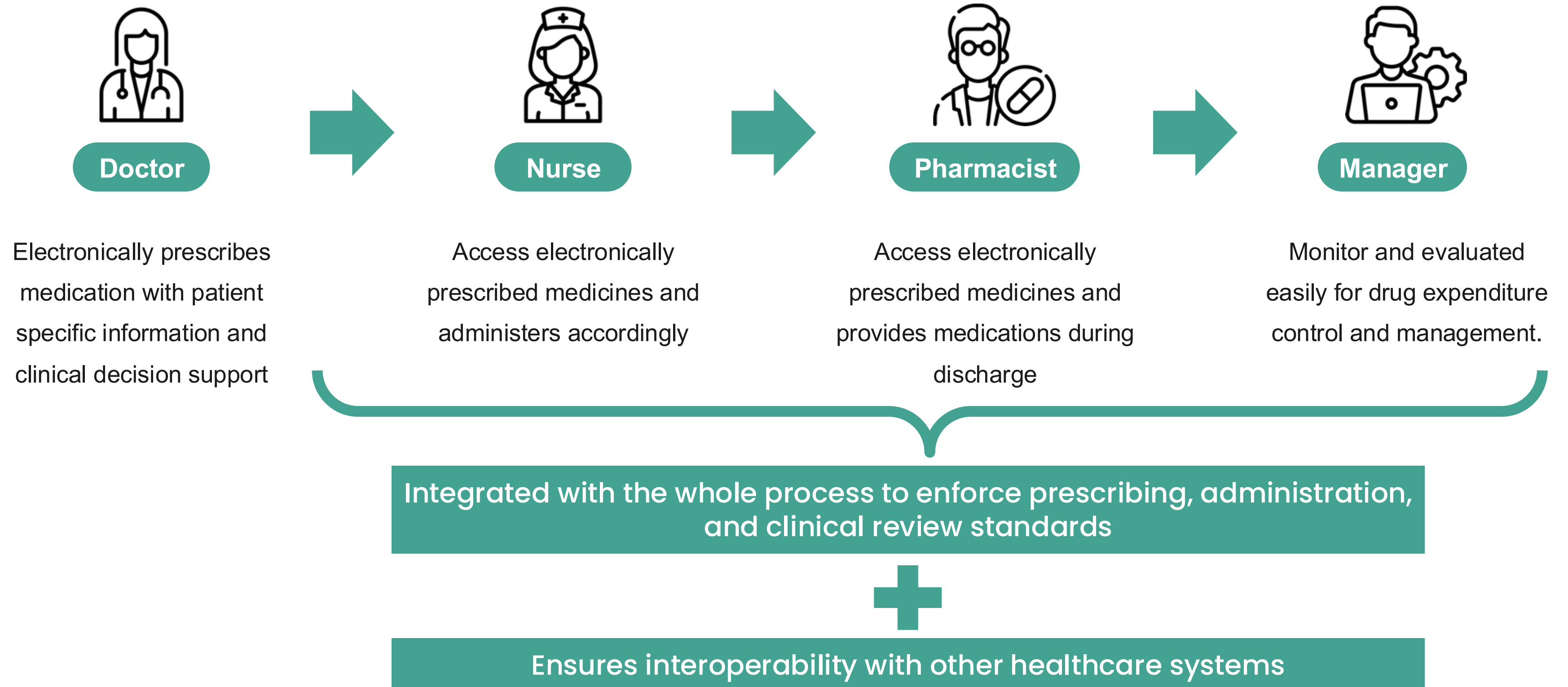
Drug-
disease
interaction

Allergy

Duplicate
therapies

Dosing
support

Role of CPOE+CDS in the Workflow of Drug Prescription and Administration



Demo of Careflow's CPOE+CDS

- 1
- Presented with patient information (Age, Gender, Body surface area, Allergies, Assessments)

HomeInpatient Finder

PHM V2018SP7

MR A USERMy AccountLogout

DA VINCI, Leonardo

Born 26-Jan-2000 (21 y)

Gender Male

National No.

Address Yellow Brick Road

Hospital No. DUMMYS

Allergy Status Recorded allergies

Consultant Z, Z

Ward ZZTESTWARD

Body Surface Area

Weight 50 kg

Height

You have successfully saved the VTE assessment.

ADD ASSESSMENT

DRUG CLINICAL INFORMATION

PATIENT NOTES

HELP

Inpatient Rx

Discharge Rx

Short Term Leave Rx

Discontinued Rx

Monitoring & Assessment

Conflict Log

Administration

Pending Actions

Complete Actions

Active Monitoring

Concluded Monitoring

Action	Category	Status	Date & Time D
Review patient's allergies	Patient Information	Overdue	15-Sep-2021 ⌚
Assess and record patient's height	Patient Information	Overdue	15-Sep-2021 ⌚
Complete discharge letter	Discharge	Pending	
Send discharge prescription to pharmacy	Discharge	Pending	
VTE Assessment within 24h from admission	Clinical Assessment	Pending	16-Sep-2021 ⌚ 16:13

Recorded Allergies

- PENICILLINS [Rash]
- ranitidine [Anaphylaxis]
- ibuprofen [Bleeding]

Demo of Careflow's CPOE+CDS

- 2
- Select drug to prescribe from dropdown list with doses

Address Yellow Brick Road

Hospital No. DUMMYS

Allergy Status Recorded allergies

Consultant Z, Z

Ward ZZTESTWARD

Body Surface Area

Weight 50 kg

Height

Communication zone

ADD DRUG ALL ORDERS PREVIOUS CARE EPISODE DRUG CLINICAL INFORMATION PATIENT NOTES HELP

Inpatient Rx Discharge Rx Short Term Leave Rx Discontinued Rx

Monitoring & Assessment Conflict Log Administration

Treatment Search

There were 8 drugs found.

Drug Protocol Infusion

DALTEPARIN

Search

Clear

Show all

Help

More search options

Drug Name	Route	Formulary Status	Drug Notes	Comments
DALTEPARIN 2500 units in 0.2ml Injection	Subcutaneous injection	Formulary	View notes	
DALTEPARIN 5000 units in 0.2ml Injection	Subcutaneous injection	Subcutaneous injection	View notes	
DALTEPARIN 7500 units in 0.3ml Injection	Subcutaneous injection	Formulary	View notes	
DALTEPARIN 10000 units in 0.4ml Injection	Subcutaneous injection	Formulary	View notes	
DALTEPARIN 12500 units in 0.5ml Injection	Subcutaneous injection	Formulary	View notes	
DALTEPARIN 15000 units in 0.6ml Injection	Subcutaneous injection	Formulary	View notes	
DALTEPARIN 18000 units in 0.72ml Injection	Subcutaneous injection	Formulary	View notes	
PRIORITY DRUGS				
NON-PRIORITY DRUGS				
DALTEPARIN 10000 units in 1ml Injection	Subcutaneous injection	Formulary	View notes	
NON-PRIORITY DRUGS				
HIGH ALERT DRUGS				

Demo of Careflow's CPOE+CDS

3

CDS provides Automatic drug notes, Formulary, Predifined doses, Frequency, Route, and Drug conflict checks in **red** which has to be acted upon

The screenshot displays the Careflow CPOE+CDS interface. At the top, a patient information header includes fields for Address (Yellow Brick Road), Hospital No. (DUMMYS), Allergy Status (Recorded allergies), Consultant (Z, Z), Ward (ZZTESTWARD), Body Surface Area, Weight (50 kg), and Height. Below this is a 'Communication zone' and a navigation bar with links: ADD DRUG, ALL ORDERS, PREVIOUS CARE EPISODE, DRUG CLINICAL INFORMATION, PATIENT NOTES, and HELP.

The main content area is titled 'DALTEPARIN 5000 units in 0.2ml Injection'. It features a 'Communication zone' and a navigation bar with links: DRUG SEARCH, CLINICAL DRUG INFORMATION, and HELP. A progress bar at the top of the main area shows the following steps: Drug Notes (checked), Formulary (checked), Drug Conflicts (checked), Order Entry (checked), and Confirmation (indicated by a red circle with an exclamation mark).

Under the 'Drug Notes' tab, there is a 'WARNING: LATEX ALLERGY' section with the text 'All Routes'. A yellow circle with a mouse cursor is positioned over this warning. To the right of the warning, there are input fields for Title (WARNING: LATEX ALLERGY), Modified (02-Nov-2020), Route (All Routes), Status (Active), and Author (STUART SETCHELL).

Below the input fields, a large red 'WARNING:' box contains the following text: 'The needle shield may contain latex (natural rubber) which may cause severe allergic reactions in individuals with hypersensitivity to latex (natural rubber). Please check Patient's Allergies.'

At the bottom of the interface, there is a footer with the text '* required order information.' and two buttons: 'Cancel' and 'Next'.

Demo of Careflow's CPOE+CDS

4 Make any changes if needed, and confirm order

Address Yellow Brick Road

Hospital No. DUMMY5

Allergy Status Recorded allergies

Consultant Z, Z

Ward ZZTESTWARD

Body Surface Area

Weight 50 kg

Height

Communication zone

ADD DRUG

ALL ORDERS

PREVIOUS CARE EPISODE

DRUG CLINICAL INFORMATION

PATIENT NOTES

HELP

DALTEPARIN 5000 units in 0.2ml Injection

Communication zone

DRUG SEARCH

ADD ORDER NOTE

CLINICAL DRUG INFORMATION

HELP

Drug Notes

Formulary

Drug Conflicts

Order Entry

Confirmation

Regular Order

Dose * 5000 unit

1 x 0.2 mL syringe

Frequency * OD (18:00) - Once a day (18:00)

Administration times: 18:00

Route * Subcutaneous injection

Start on * 15-Sep-2021 16:19

First Administration 15-Sep-2021 18:00

Days of treatment

Doses of treatment

Stop on dd-MMM-yyyy

Last Administration

Medication Management

* required order information.

Cancel

Next

Benefits of Careflow's CPOE+CDS



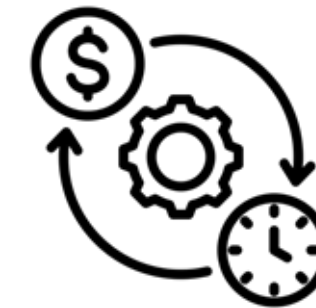
Improve patient safety

Active clinical checking against patient's medication record (allergy, drug-drug interaction, drug-disease interaction, duplicate) by the CDS allow safer and appropriate medication prescription



Reduce dosing errors

Predefined, patient-specific automatic dose order using age, weight, body surface area minimise over- and under-dosing



Enhance clinical efficacy

Reduction in time to prescribe, check, supply, and administer medicines
Access to fully qualified, evidence-based, up-to-date medicine information continuously updated to the system

Specific Use Cases



**1. Over 3,200 (50%)
High/Significant drug-drug
interactions were acted upon**

**2. 35% (over 3,000) Duplicate
prescriptions prevented**



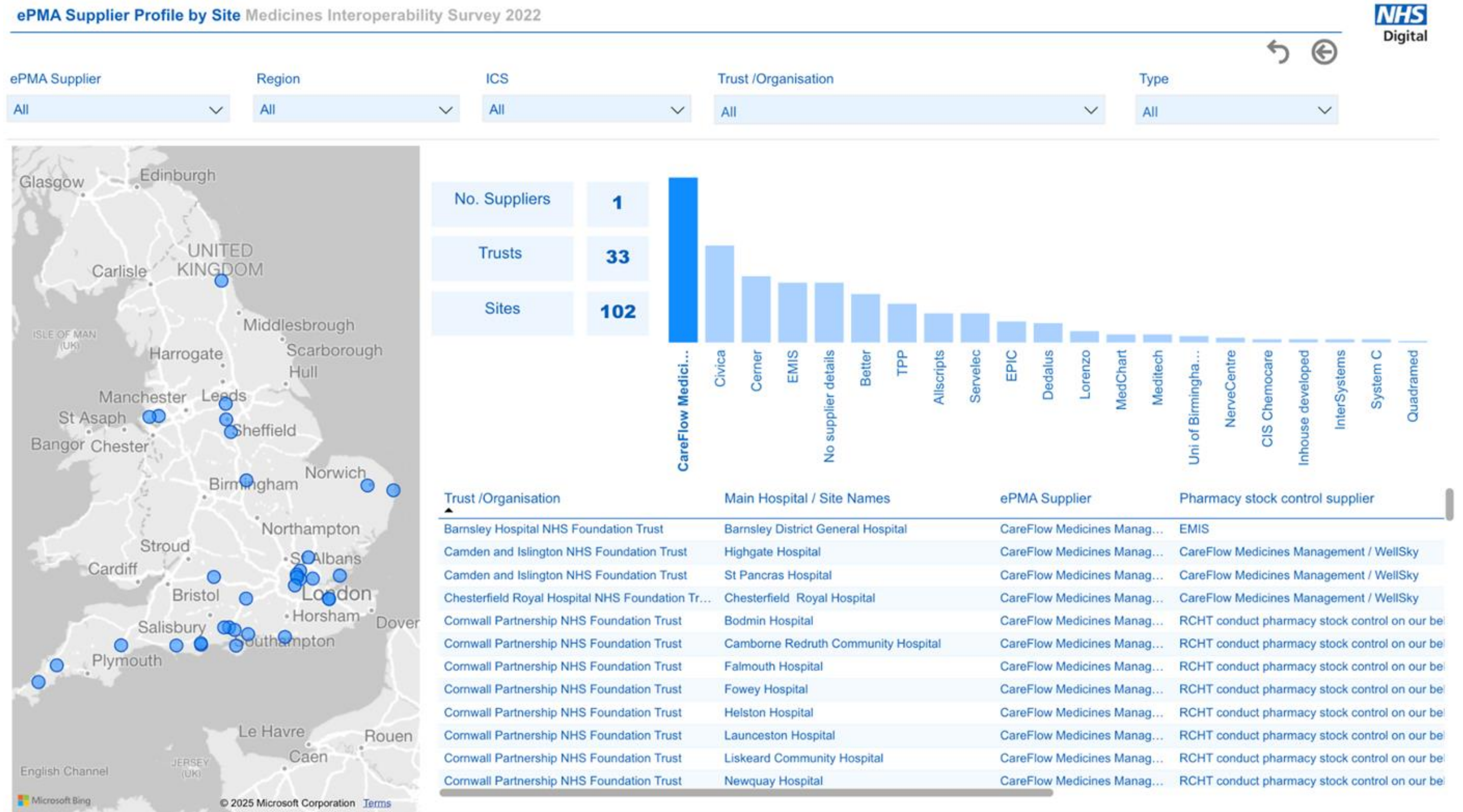
**1. 43% Reduction in prescription
error**

**(42% Overall medication error, Fewer under or
over-dosing and standardised prescribing &
allergy alerts)**

**2. 90% Time reduction in writing
prescriptions**

**3. Total estimated savings of
£54,000 per year**

Usage Status in the NHS



The Scientific Evaluation



Different directions

More than 5,200 inpatient records.

The overall medication error rate decreased by 55%.

Details:

Dosage errors decreased by 60.5%.
Allergy-related errors decreased by 81.3%.

01

Reduce Prescription Errors

Dosage recommendation :

Automatically calculate the recommended dosage based on the patient's weight, age

Real-time decision support :

Real-time alerts help HCP identify drug allergies and interactions.

02

User experience and workflow

Initial user resistance gradually decreased over time.

89% of doctors reported that the system improved their prescription efficiency.

Risks and Challenges

01

System downtime:

Occasional system failures require the use of backup processes.

02

Training:

Doctors with varying levels of technical proficiency require different levels of support.

Limitation of Scientific Evaluation

- There is no scientific evaluation of the accuracy or effectiveness of the system, only qualitative studies.
- Load: Some complex prescribing processes require multiple steps.
- Overreliance: Doctors' dependence on the system sometimes reduces critical thinking.
- The results of the current study may not be fully applicable to all healthcare settings.

Comparison in Evaluations

Comparison with similar systems

- **Epic Systems**
- **Cerner Millennium**

Epic Systems

- A widely implemented EPR system with comprehensive CDSS functionalities
- A study has shown that contextualised CDSS
 - not significantly improve **patient** outcomes
 - increase the contextualisation of care

Cerner Millennium

- Cerner's EPR system, Millennium, with advanced CDSS features
- A study highlighted that
 - CDSS can improve **clinician** performance,
 - the impact on **patient** outcomes varies, needing effective integration and user engagement

Contributions

- Sakshi Sunil Dhavale - System description, Development
- Chae Hyun Kim - System description, Usage of system
- Anita Bosibori Oseko - System description, Usage of system
- Haoyu Wei - Scientific evaluation
- Heng Zhong - Comparison with other systems

References

1. CareFlow Electronic Prescribing and Medicines Administration (EPMA) - Digital Marketplace. (2019). Service.gov.uk. <https://www.applytosupply.digitalmarketplace.service.gov.uk/g-cloud/services/562657533718258>
2. C. Papoutsis, J. E. Reed, C. Marston, R. Lewis, A. Majeed, and D. Bell, "Patient and public views about the security and privacy of Electronic Health Records (EHRs) in the UK: results from a mixed methods study," BMC Medical Informatics and Decision Making, vol. 15, no. 1, Oct. 2015, doi: <https://doi.org/10.1186/s12911-015-0202-2>.
3. EPMA Team NNUH. EPMA Prescribing Sessions for UEA Medical Students - YouTube. Available at: https://www.youtube.com/watch?v=V3_U5CQ_8Wo&ntb=1&msockid=26c39869064311f0ac5e4b08d9e27f11
4. FDB (First Databank). Drug Database & Clinical Decision Support Software | Multilex. Available at: <https://www.fdbhealth.co.uk/solutions/multilex-clinical-decision-support>
5. Logan, B. (2022). 9 Free text notes added to a patient's allergy status in electronic prescribing systems digitally analysed for better usability. In: Part I: ePapers. November 2022. BMJ Publishing Group Ltd. p.A5.2-A6. [Online]. Available at: doi:10.1136/bmjhci-2022-FCIASC.9
6. NHS ePrescribing Toolkit. ePMA Implementation - Experiences from East London Foundation NHS Trust. ePrescribing Toolkit | Welcome to the ePrescribing and Medicines Administration Toolkit for NHS Hospitals. Available at: <https://www.eprescribingtoolkit.com/case-study/case-study-example-b/>
7. The Pharmaceutical Journal. (2022). *Electronic prescribing system cuts dispensing errors by almost half in one trust*. Available at: <https://pharmaceutical-journal.com/article/news/electronic-prescribing-system-cuts-dispensing-errors-by-almost-half-in-one-trust>
8. Power BI report. Available at: <https://app.powerbi.com/view?r=eyJrIjoimjU5YjI3OGUtOGMxNy00YWMzLTlkZTctZjVjMTBkNjZhYzUzliwidCI6ImM3YzM1NGlyLTg1YjAtNDdmNS1iMjlyLTA3YjQ4ZDc3NGVIMyJ9>
9. System C. (2025). CareFlow EPR | Electronic Patient Record. Available at: <https://www.systemc.com/healthcare/careflow-electronic-patient-record/>
10. System C. (2024). CareFlow Medicines Management | Healthcare. Available at: <https://www.systemc.com/healthcare/careflow-medicines-management/>
11. Uslu, A. and Stausberg, J. (2021) 'Value of the Electronic Medical Record for Hospital Care: Update from the literature,' *Journal of Medical Internet Research*, 23(12), p. e26323. <https://doi.org/10.2196/26323>.
12. Weiner, S.J. *et al.* (2022) 'Effect of electronic health Record Clinical decision support on contextualization of care,' *JAMA Network Open*, 5(10), p. e2238231. <https://doi.org/10.1001/jamanetworkopen.2022.38231>.
13. Wickware, C. (2022). Electronic prescribing system cuts dispensing errors by almost half in one trust. The Pharmaceutical Journal. Available at: <https://pharmaceutical-journal.com/article/news/electronic-prescribing-system-cuts-dispensing-errors-by-almost-half-in-one-trust>
14. Wilson, R. (2020). How we designed and delivered NHS Nightingale Jersey. The Architects' Journal. Available at: <https://www.architectsjournal.co.uk/buildings/how-we-designed-and-delivered-nhs-nightingale-jersey>

Thanks!