

CareFlow Medicine Management

Group 12

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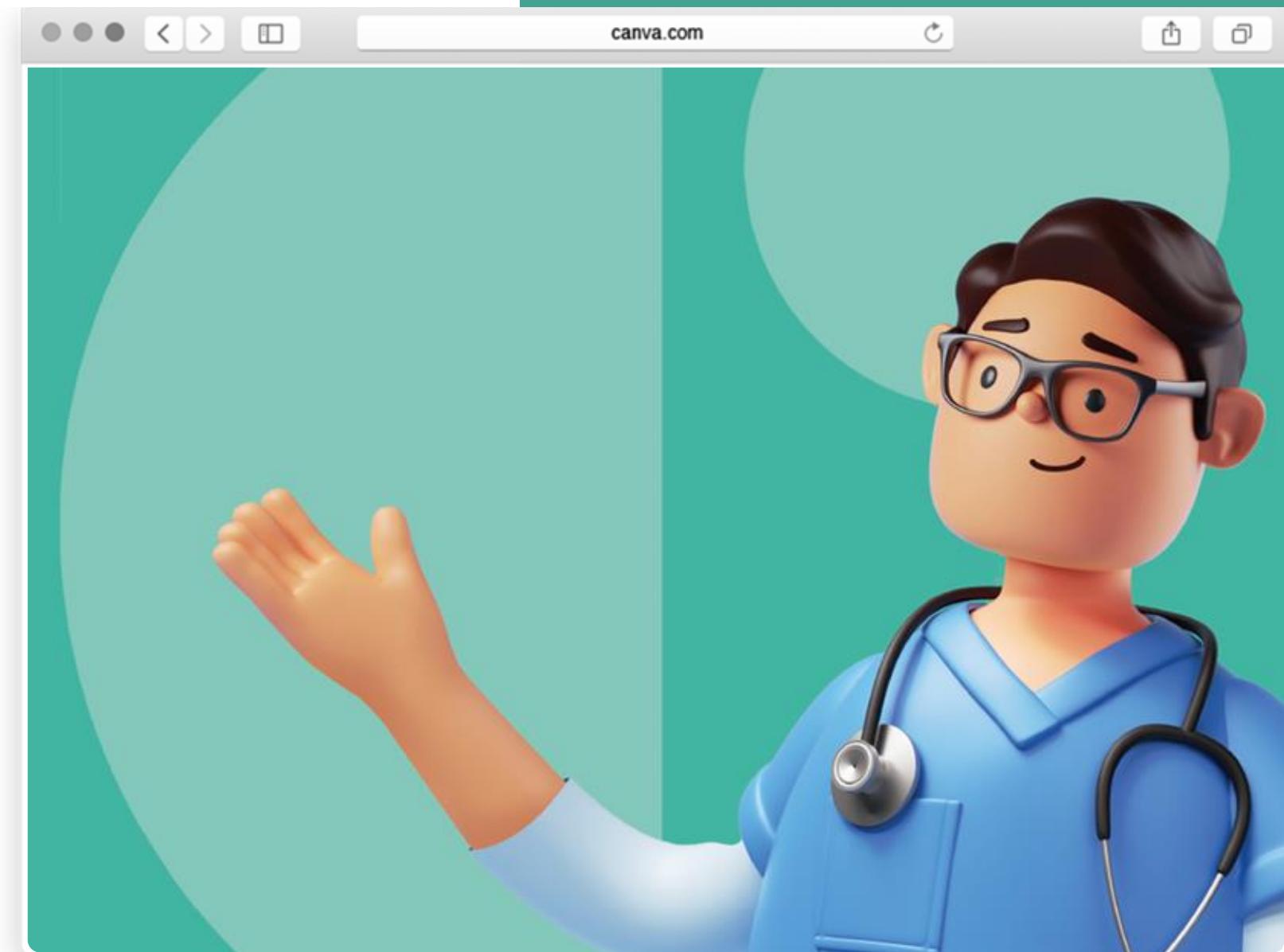
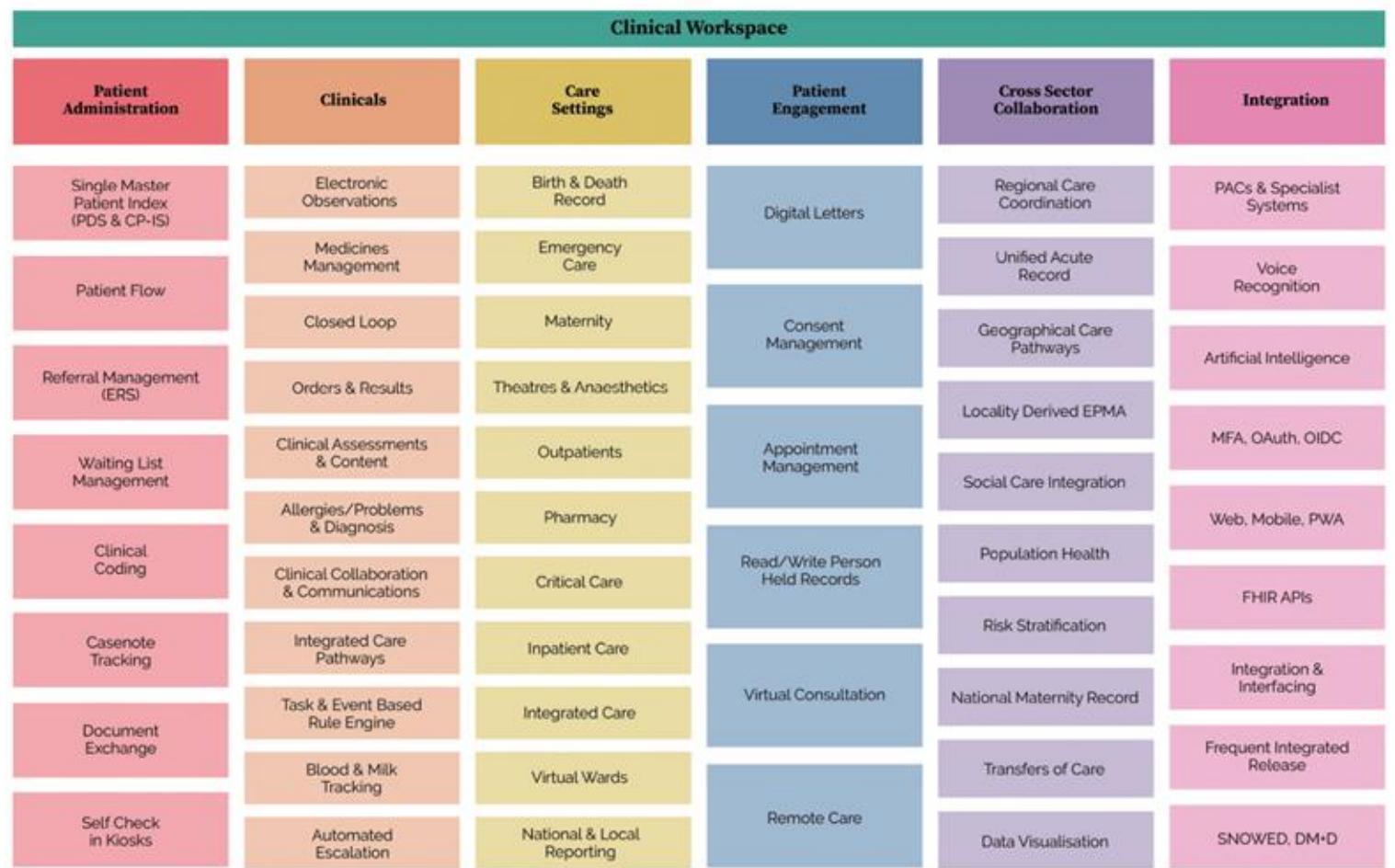


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System C



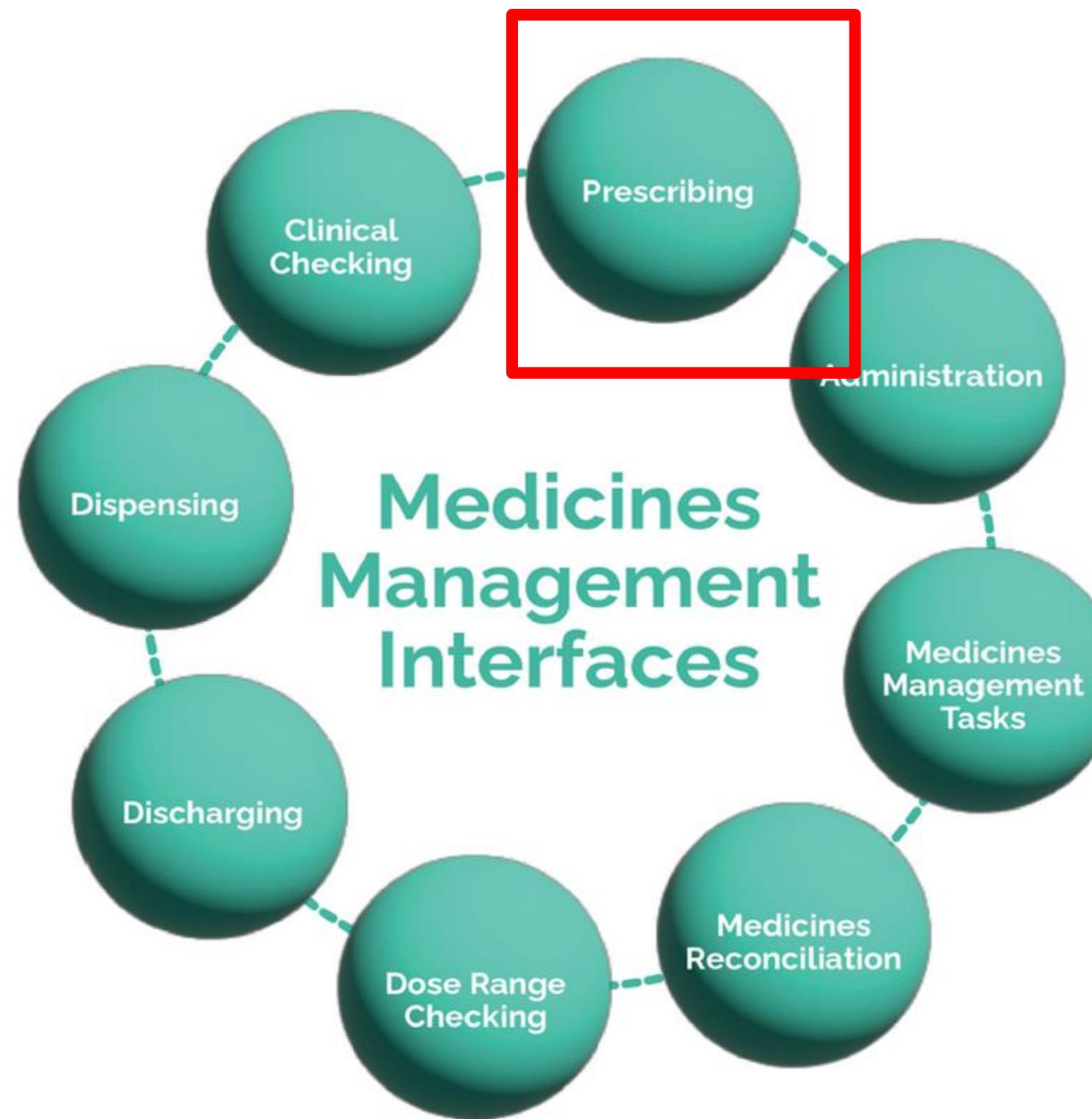
- **System C Healthcare Limited** is a British supplier of health information technology systems and services
- Develops suite of digital healthcare solutions to support clinical workflows, improve patient safety, and enhance the efficiency.
- Mainly used in acute care and children's hospital. Currently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

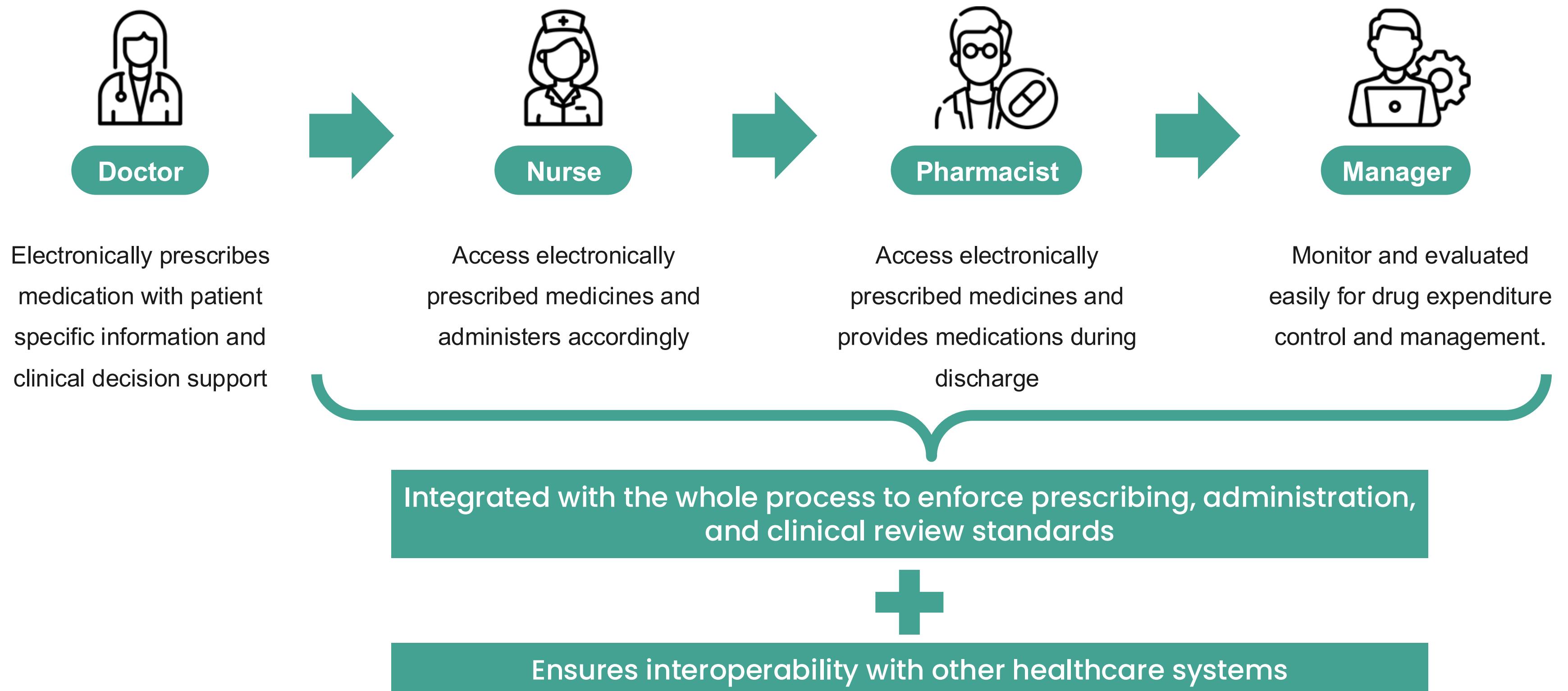
Drug-disease interaction

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)

The screenshot shows a web-based clinical information system. At the top, there is a navigation bar with links for Home, Inpatient Finder, PHM V2018SP7, MR A USER, My Account, and Logout. Below the navigation bar, patient information is displayed for "DA VINCI, Leonardo". The patient's details include: Born 26-Jan-2000 (21 y), Gender Male, National No. (not visible), Address Yellow Brick Road, Hospital No. DUMMY5, Allergy Status Recorded allergies, Consultant Z, Z, Ward ZZTESTWARD, Body Surface Area, Weight 50 kg, and Height. A success message at the bottom of the screen states "You have successfully saved the VTE assessment." Below the patient info, there are tabs for ADD ASSESSMENT, DRUG CLINICAL INFORMATION, PATIENT NOTES, and HELP. The DRUG CLINICAL INFORMATION tab is selected. Under this tab, there are buttons for Inpatient Rx, Discharge Rx, Short Term Leave Rx, Discontinued Rx, Monitoring & Assessment (which is highlighted in blue), Conflict Log, and Administration. A table titled "Pending Actions" lists several tasks: Review patient's allergies, Assess and record patient's height, Complete discharge letter, Send discharge prescription to pharmacy, and VTE Assessment within 24h from admission. To the right of the table, a red box highlights the "Recorded Allergies" section, which lists: PENICILLINS [Rash], ranitidine [Anaphylaxis], and ibuprofen [Bleeding]. A yellow callout bubble with a cursor arrow points to the "Recorded Allergies" section.

Demo of Careflow's CPOE+CDS

2

Select drug to prescribe from dropdown list with doses

The screenshot shows the Careflow software interface. At the top, patient information is displayed: Address (Yellow Brick Road), Consultant (Z, Z), Ward (ZZTESTWARD), Hospital No. (DUMMY5), Allergy Status (Recorded allergies), Body Surface Area, Weight (50 kg), and Height. Below this is a 'Communication zone' with links for ADD DRUG, ALL ORDERS, PREVIOUS CARE EPISODE, DRUG CLINICAL INFORMATION, PATIENT NOTES, and HELP. A navigation bar includes Inpatient Rx, Discharge Rx, Short Term Leave Rx, Discontinued Rx, Monitoring & Assessment, Conflict Log, and Administration.

A 'Treatment Search' dialog is open, titled 'Treatment Search'. It displays a message: 'There were 8 drugs found.' A search bar contains 'DALTEPARIN'. The results table has columns: Drug Name, Route, Formulary Status, Drug Notes, and Comments. The first seven results are for DALTEPARIN in various unit/size combinations, all listed as 'Subcutaneous injection'. The eighth result is for DALTEPARIN 10000 units in 1ml Injection, also listed as 'Subcutaneous injection'. The 'Formulary Status' column for the first seven results shows a dropdown menu with options: Formulary, Subcutaneous injection (which is highlighted with a yellow box and a cursor arrow pointing to it), and another option that is partially visible. The 'Comments' column for all results shows a 'View notes' link.

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
DALTEPARIN 10000 units in 1ml Injection	Subcutaneous injection	Formulary		View notes

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 shows a medical software interface for drug order entry. At the top, there are patient details: Address (Yellow Brick Road), Consultant (Z, Z), Ward (ZZTESTWARD), Hospital No. (DUMMY5), Allergy Status (Recorded allergies), Body Surface Area, Weight (50 kg), and Height. Below this is a 'Communication zone' section with links for ADD DRUG, ALL ORDERS, PREVIOUS CARE EPISODE, DRUG CLINICAL INFORMATION, PATIENT NOTES, and HELP.

The main window displays a drug order for 'DALTEPARIN 5000 units in 0.2ml Injection'. It includes a 'Communication zone' and tabs for DRUG SEARCH, CLINICAL DRUG INFORMATION, and HELP. The 'Drug Notes' tab is active, showing a 'WARNING: LATEX ALLERGY' message for 'All Routes'. This message is highlighted with a yellow circle and a cursor icon.

The 'Formulary' tab is also visible. On the right side of the order entry screen, there are fields for Title (WARNING: LATEX ALLERGY), Modified (02-Nov-2020), Route (All Routes), Status (Active), and Author (STUART SETCHELL).

A prominent red 'WARNING:' message box contains the 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 order entry screen, there is a note: '* required order information.' and buttons for 'Cancel' and 'Next'.

Demo of Careflow's CPOE+CDS

4

Make any changes if needed, and confirm order

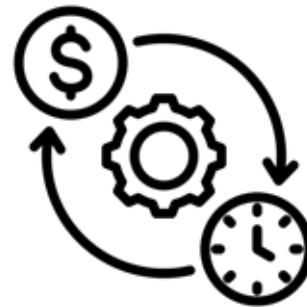
The screenshot shows the Careflow CPOE+CDS software interface. At the top, there is a header with patient information: Address (Yellow Brick Road), Hospital No. (DUMMY5), Allergy Status (Recorded allergies), Consultant (Z, Z), Ward (ZZTESTWARD), Body Surface Area, Weight (50 kg), and Height. Below the header is a 'Communication zone' and a navigation bar with links for ADD DRUG, ALL ORDERS, PREVIOUS CARE EPISODE, DRUG CLINICAL INFORMATION, PATIENT NOTES, and HELP.

The main window displays a drug order for DALTEPARIN 5000 units in 0.2ml Injection. The order form includes the following details:

- Regular Order**
- Dose:** 5000 unit
- Frequency:** OD (18:00) - Once a day (18:00)
- Route:** Subcutaneous injection
- Administration times:** 18:00
- Start on:** 15-Sep-2021 at 16:19
- Days of treatment:** (dropdown menu)
- Doses of treatment:** (dropdown menu)
- Last Administration:** (dropdown menu)
- Medicine Management:** (dropdown menu)

At the bottom of the order form, there is a note: "* required order information." and buttons for **Cancel** and **Next**. A yellow circle with a cursor icon is positioned over the 'Order Entry' tab in the navigation bar.

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

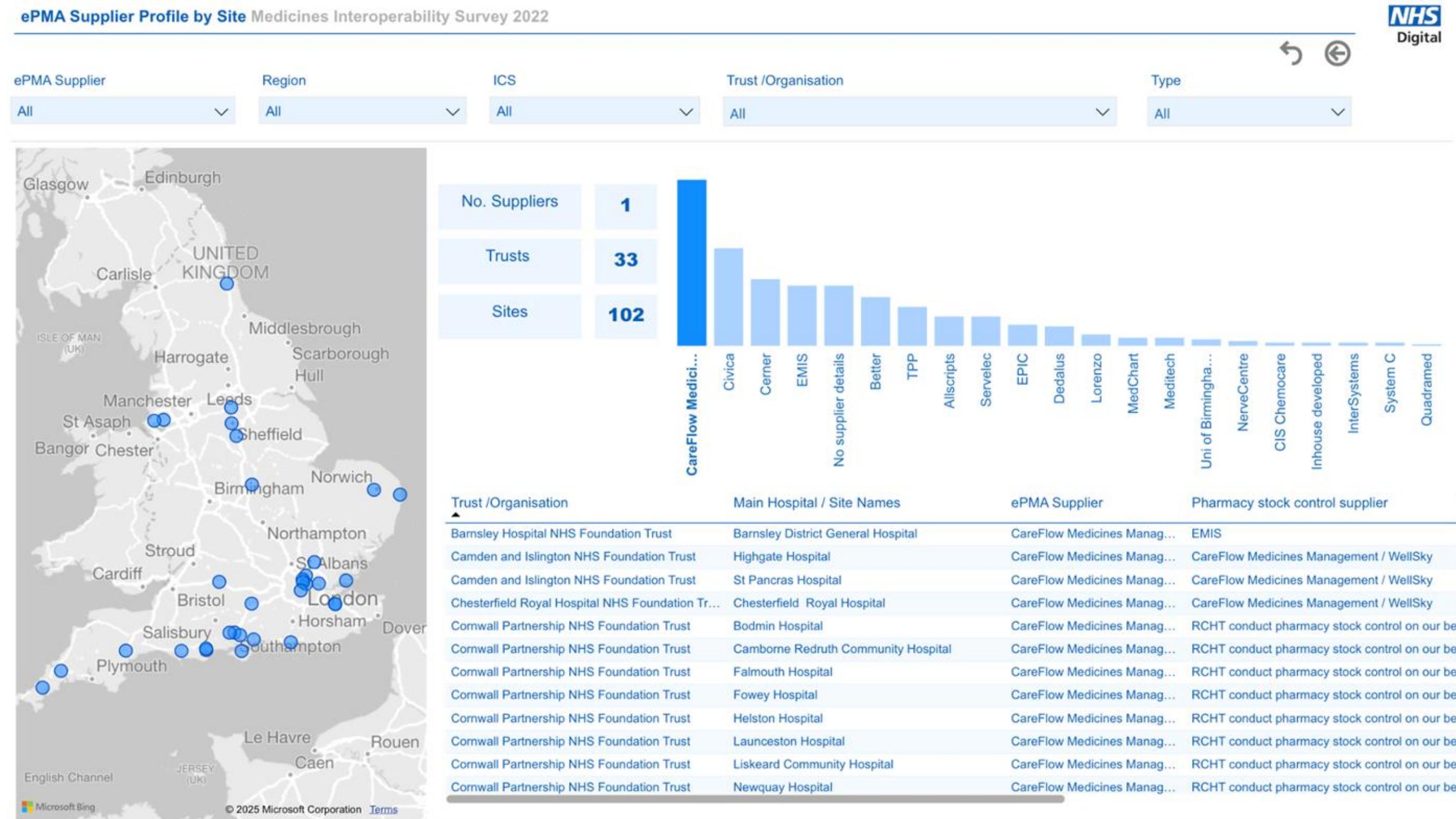


- 1. Over 3,200 (50%) High/Significant drug-drug interactions were acted upon**
- 2. 35% (over 3,000) Duplicate prescriptions prevented**



- 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. Papoutsi, 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=eyJrljoiMjU5YjI3OGUtOGMxNy00YWMzLThkZTctZjVjMTBkJNjZhYzUzliwidCI6IjM3YzM1NGlyLTg1YjAtNDdmNS1iMjlyLTA3YjQ4ZDc3NGVIMyJ9>
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!