Faculty of Clinical Informatics
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Abstracts selected by the FCI judging panel for the Annual Scientific Conference.

2022 Prize Winners

The **ePoster Prize** was shared between

- Adam Khimji, Research Associate at the University of Nottingham and Clinical Transformation Lead for Digital Medicines at Birmingham Community Healthcare NHS Foundation Trust, for 'Thematic review of medication-related incidents at a major teaching hospital and the potential mitigation of these incidents with electronic prescribing and medicines administration'

- Alicia Ridout, Director of Involve Me Digital Health Ltd and an Independent Occupational Therapist for 'An evaluation of OT focused digital assessment and deployment for patients establshed it is urgently required but overwhelmed by different competency frameworks'.

The **ePaper Prize** was won by Helen Craggs, Clinical Fellow at Royal Bolton Hospital, for 'Digital transformation of the acute medical take – improving standards of care'.

And the Proxime Accessit went to Caroline Gadd, Director of Healthcare Solutions at Holmusk (an International Company transforming behavioural health research, innovation & care) on 'Evaluation of MaST (Management and Supervision Tool) to support NHS Community mental health teams in identifying Risk of Crisis and Complexity across caseloads'.

PODIUM PRESENTATIONS

Name	**Ben Logan**
Organisation	St. Helens and Knowsley Teaching Hospitals
Title	Free text notes added to a patient's allergy status in electronic prescribing systems digitally analysed for better usability.
Objective	Electronic prescribing systems often provide a drop-down list of medications and pre-specified reactions to record a patient's allergy status. This list is non-exhaustive; less common reaction types require the user to add a free text note. The electronic prescribing system provides decision support preventing a prescriber initiating a drug a patient has a recorded reaction to. Where a free text reaction is recorded this functionality is not provided which results in increased risk to the patient. The aim of this project was to identify recurring free text reactions and incorporate these into the system. Future avoidance of free text documentation will improve data quality and make reaction data available during built-in prescribing decision support.
Methods	Free-text allergy notes added to the electronic prescribing system since implementation (three-years ago) were extracted using structured query language. The data was cleaned and analysed using the Python Pandas package in Jupyter notebook. Python Natural Language Toolkit was then used to further prepare the data. The data was tokenised, stop words were removed and lemmatisation was used to group together inflected words. All punctuation was then removed and a custom word filter was used to remove commonly occurring unnecessary phrases e.g. 'pharmacist', 'adverse reaction' and 'summary care record'. After pre-processing the data was analysed using a basic word counter to find most commonly occurring keywords. Further analysis was carried out using n-gram counters of varying sizes to identify commonly occurring phrases.
Results	A total of 2872 notes were identified for analysis. The most common terms found were already included as part of the electronic prescribing systems allergy documentation system. This included the terms 'rash' and 'penicillin' which were recorded 520 and 480 times respectively. Of the top 20 most frequently appearing terms two were identified as

	not included in the system. These were 'swelling' which was recorded 320 times and 'pain' documented 210. Applying a Bi-gram and trigram filter identified that the term swelling was most often associated with the phrase 'ankle swelling' which appeared 58 times. Variations of ankle swelling were also identified with 'leg swelling' appearing 26 times and 'foot swelling' and 'ankle oedema' appearing. Trigram filters showed that 'ankle swelling' was most commonly preceded by the term 'amlodipine'. Leg swelling is a well-known side effect of amlodipine. Pain was most often associated with the phrases 'chest pain' appearing 38 times and 'abdominal pain' or 'abdo pain' appearing a combined 55 times. Both are reaction types which cannot be documented in the prescribing system.
Conclusion	Natural Language Processing can be applied to large sections of unstructured clinical documentation to quickly analyse themes and trends. With appropriate cleaning and manipulation of the data commonly occurring phrases relevant to clinical practice can be identified. This permitted recurring drug reactions to be identified and added to the electronic prescribing system. It is hoped this will reduce the frequency of free-text notes added in the future and improve reaction documentation. It is anticipated that patient safety will be improved by making more reaction data available for electronic decision support. Packages such as Python NLTK used for natural language processing are freely available and allow users to process data which would be too time consuming to process manually.

Name	**Pei-Fen Lin**
Organisation	Moorfields Eye Hospital
Title	Evaluation of a telemedicine model to deliver cataract care using imaging technology instead of traditional F2F pathways
Objective	To set up and establish a sustainable telemedicine model to deliver cataract care pathway, where the traditional face-to-face cataract assessment clinic is replaced with a telemedicine consult with imaging technology to develop a safe, efficient telemedicine care delivery model in contrast to the current established traditional face-to-face pathways. To study the efficacy, efficiency, safety, patient experience of the new service. To assess usability and review risk of digital exclusion with patients and staff.
Methods	Patients referred for cataract surgery from the community are booked into a video clinic (AttendAnywhere) as per date of referral. Patients were not pre-called or pre-selected for the digital pathway. After video consultation and pt confirmed to have symptomatic cataract affecting quality of life, the patient is preliminary listed for cataract surgery and verbally consented. The patient then attends a cataract imaging hub where anterior segment and fundus high resolution photography and optical coherence scans were performed. In addition, patient blood pressure and blood sugar are obtained. The results of the assessments are reviewed by the surgeon remotely to confirm the stratification of the cataract and plan for surgery. Any patient with unexpected findings or abnormal vitals were brought back for face to face review. Post-op patients are follow-up in the community. All patient consultation and imaging were recorded in an electronic patient records (Medisfot) Prospective data collected on patient demographics, access to video consult, referral date, review date, stratification, and outcome of surgery. Patient experience assessed via a post video clinic survey.
Results	403 patients were assessed, 42 excluded from the final data analysis due to erroneous bookings into the clinic. Total 361 patients correctly booked for new cataract assessment were included. 9 patients were brought back for further assessment in a face-to-face clinic as additional abnormalities were found on imaging. 299 listed for surgery (conversion to surgery rate of 82%). Average age of the patient is 74 yrs old. 31% >75 and 17% > 80 years old. 24% patients were the presumed digitally excluded group e.g. elderly, language barrier, care home resident, patient with partial or lack capacity, and lack of technology. To date, 166 patients have completed their surgery and 6 week

	post-op follow up. 96% reported improvement of vision post surgery. 7% had post-op complications and 3 patients had intraoperative complications. Cases were stratified and operated appropriately by all levels of surgeons, 52% by trainees and 48% by consultants or consultant grade surgeons. No attendance to the emergency eye care service within 1 month post-operation. Patient survey showed 95% satisfied with care, 57% preferred the video clinic method. 82% would have come to a face to face clinic via a carbon emitting mode of transport, 60% by car.
Conclusion	Digital cataract service (DCS) has demonstrated it is safe; patients with abnormal findings on imaging clinics were correctly stopped from proceeding with surgery. 96% of patients reported improvement of vision post surgery, this is better than the national audit standard of 95%. 4% patients had post-op complications which is lower than the 14% audit standard. DCS is effective as it has a high conversion to surgery rate at 82% compared to the national average of 74%. The stratification of patients and their cataracts enabled surgery to be carried out safely by all levels of surgeons. For patient experience it shortened the overall assessment time to 1.5 hours compared to a 3-4 hour wait in a face-to-face clinic. It also maximises the efficient use of staff, equipment and space; patients are consulted / assessed at time of arrival with no idle staff in the process. 24% patients with demographics traditionally included in the digitally excluded group were able to access the service by proxy, it also enabled clinicians to bring care to patients' home environment. Overall DCS provides a safe, effective, efficient way of delivering cataract care with reduced carbon footprint by minimising patient and staff travelling.

Name	Daniel Chan
Organisation	North York General Hospital (Toronto, Ontario, Canada)
Title	Reduction of Order Alerts through Filters: Impact on Pharmacists' Override Rate and Perceptions of Alert Fatigue
Objective	Clinical decision supports (CDS) in electronic medication order systems identify alerts for clinicians. However, CDS may cause alert fatigue, which is the tendency for clinicians to ignore prompts presented by CDS due to excessive numbers and/or their perceived limited clinical significance. Alert fatigue may increase the risk of missing clinically relevant alerts. At North York General Hospital, pharmacists managed over 50% of all medication CDS alerts amounting to approximately 60 alerts per day per pharmacist with an override rate of over 90% indicating a high likelihood of alert fatigue. Thus, we attempted to reduce pharmacists' alert fatigue utilizing customizable filters.
Methods	Optimizing medication CDS has traditionally centered around turning on or off alerts, changing alert severity levels or clinician role tailoring. These strategies can be labor and time-intensive requiring several clinicians from different specialties to review hundreds of individual alerts. As such, this study pursued the use of customizable filters that consider the context around the medication order to determine whether an alert should be displayed to a clinician. Utilizing data from the EHR vendor's visual analytics dashboard and guided by pharmacists' feedback, three customizable filters were applied or changed. First, a filter to suppress alerts for medications that are ordered by the same prescriber during one session was implemented. Second, a filter to reduce alerts for medications that are commonly ordered both as scheduled and as needed frequencies was applied. Finally, customization was done on how long discontinued medications are eligible for alert checking by the medication CDS system. Data was collected 1 month prior to and 3 months after implementation for a duration of one month each. Alerts data was taken from the analytics dashboard. Pharmacists' perceptions of alert fatigue were collected using a voluntary online survey. Adverse medication events data was obtained from the hospital's incident reporting tool.

Results	Comparing before and after implementation, total alerts decreased by 48.4% for pharmacists. This was driven primarily by a reduction in drug-drug interaction and duplicate therapy alerts by 33% and 61%, respectively. In practice, this represented a reduction from 59.7 to 27.1 medication CDS alerts per day per pharmacist. However, pharmacists' alert override rate was minimally changed from 98.1% to 97.3%. Fourteen (78%) of the 18 pharmacists surveyed felt there was an overall decrease in unnecessary alerts while 67% perceived they were able to spend more time on reviewing meaningful alerts post-implementation. Compared to pre-implementation, pharmacists reported a minor reduction in the percentage of alerts they deemed unnecessary or inappropriate from 66.8% to 59.3% and a decrease in time spent on non-clinically significant alerts by about 5 min per day. However, 78% still remarked that there was room for improvement in the mCDS alerting system. The number of adverse medication incidents were similar between the periods before and after implementation. Incidents classified as "extra dose/duplicate" or "adverse drug reaction" were reviewed in further detail. None were found to be a result of the new customized contextual filters.
Conclusion	The use of customizable filters may be a viable alternate approach to reducing alert volume without needing to completely turn off specific alerts or changing alert severity. Pharmacists' perceptions of alert fatigue appeared to improve modestly post implementation. Comparison of medication incidents before and after implementation did not show an increase in medication errors. However, override rates remain elevated and pharmacists felt that further improvements could still be made to the medication CDS system. Further review and re-assessment of alert settings and filters is recommended to continually manage pharmacists' alert fatigue.

Name	**Jack Bennett and Madeleine Salter**
Organisation	University of Leeds
Title	The Documentation of Allergy across Electronic Systems for patients presenting to Emergency Departments in Leeds
Objective	How consistent is the recording of allergy documentation across multiple electronic systems in patients presenting to the emergency departments of a large UK tertiary trust? Over 20% of the UK population are affected by one or more allergic disorders (1) and there has been shown to be a 615% increase in the rate of hospital admissions for anaphylaxis in the UK, between 1992 and 2012 (2). Correct documentation of patient allergies is essential to protect patients and prevent avoidable drug errors, estimated to cause around 1080 deaths annually in secondary care across England (3). Our objective was to determine how consistently allergies were recorded across multiple patient electronic record systems, in patients presenting to the emergency departments (ED) of Leeds Teaching Hospitals Trust.
Methods	50 patients were randomly selected from those presenting to the ED between 25th and 27th October 2021 with an allergy recorded on at least one electronic system. A further 51 patients were randomly selected from the those who had presented with anaphylaxis between 1st April 2020 and 31st March 2021. Their allergy status was then analysed retrospectively from the following five electronic records: Yorkshire Ambulance Service patient report form, Symphony (ED patient information system), the medical assessment record, Leeds Care Record (primary care summary) and eMEDS (electronic prescribing system). The patients' records were then compared for accuracy relative to each other and if they were not identical, compared against part 1.2.1 of NICE guideline CG183 (5). This states that their medical record must include one of the following: "drug allergy", "unable to ascertain" or "none known". Patients who did not have identical records, but "unable to ascertain" listed instead, were recorded in a separate group as meeting this guideline due to the nature of ED presentations. We excluded the following allergies: hay fever, dust mites and pollen. The group presenting with anaphylaxis had to have previously been diagnosed with the allergy before that attendance
Results	413 individual electronic allergy records were analysed, of which 214 records were part of the anaphylaxis group and

	199 were part of the non-anaphylaxis group. Only 17% of patients had synonymous records across the 5 possible electronic systems. Overall, 33% of patients had at least one record that stated they did not have an allergy when at least two others stated they did have an allergy. Concerningly in the anaphylaxis group, 20 individual records (9%) across 15 patients (27%) had records that stated they did not have an allergy, despite their attendance for an anaphylaxis reaction. 27% of all patients had either synonymous records or records that met the NICE guideline. Every patient who had three or more allergies did not have synonymous records.
Conclusion	The inconsistency of recording allergy status in a patient's health record demonstrates the importance of improved interoperability between electronic systems, to reduce the risk of administration errors and patient harm due to multiple versions of the "truth". To mitigate the limitations of the current systems, it is important clinicians review the patient's allergy status every time a medication is prescribed. This can be especially challenging in emergency and urgent health care environments, when due to a patient's clinical status, they may be unable to provide an accurate allergy history. Our findings are consistent with those of other studies, including a 2008 study which compared two key forms of patient allergy documentation, 36.5% of these records were not synonymous (4). This further suggests the need for additional research, not just across the trust but nationally. Depending on the results it is likely further safety measures may need to be introduced, especially in areas where multiple patient information systems are used or in patients who cannot accurately recall their own allergies. Further audits should also be carried out against the second part of the NICE guideline CG183, part 1.2.2, which sets criteria for how the allergy should be recorded (5).

Name	**Caroline Gadd**
Organisation	Holmusk
Title	Evaluation of MaST (Management and Supervision Tool) to support NHS Community mental health teams in identifying Risk of Crisis and Complexity across caseloads
Objective	The Management and Supervision Tool (MaST) helps NHS mental health care professionals identify patients who are most likely to need psychiatric hospital admission or home treatment, due to severe mental illness, through a Risk of Crisis (RoC) algorithm driven by electronic health record (EHR) data analytics. MaST improves the efficiency of caseload management of Mental Health Professionals. We describe the derivation and validation of the MaST RoC algorithm, and its implementation to support preventative mental healthcare in the NHS.
Methods	The RoC algorithm was developed and evaluated with EHR data from six UK NHS trusts using Ordered Predictor List propensity scores informed by a priori weightings from pre-existing literature, as well as real-world evidence evaluating the associations of clinical risk factors with mental health crisis using NHS EHR data. Mental health crisis was defined as admission to a psychiatric hospital or acceptance to a community crisis service within a 28-day period. Predictor variables included age, gender, accommodation status, employment status, Mental Health Act (MHA) status (under section or Community Treatment Order), and previous mental health service contacts (including hospital admissions and crisis services). Data were analysed using Ordered Predictor List propensity scores. The algorithm was derived using structured EHR data from 2,620 patients in a single NHS trust and externally validated using data from 107,879 patients in five other NHS trusts. Qualitative and quantitative data on feasibility, acceptability and system efficiency impacts of MaST implementation were obtained through staff surveys and local audits.
Results	The factors associated with greatest propensity for mental health crisis included recent previous crisis, multiple previous crises, higher number of mental health service contacts in recent weeks, MHA section, accommodation status and employment status. The RoC algorithm identified 64% and 80% crises in its top quintile. Sentiment analysis of staff surveys suggested that the use of MaST improved productivity by reducing time taken to access patient information to support caseload management that was previously difficult to obtain through manual review of EHRs. The systems efficiency audit revealed a reduction in

	duration of crisis and inpatient admissions following MaST implementation.
Conclusion	The MaST RoC algorithm supports the identification of people more likely to use crisis services in NHS mental health trusts, is feasible to implement, and improves systems efficiency. The visualisation of these insights enables improved caseload management within community mental health teams. EHR-derived algorithms can support real-world clinical practice to improve outcomes in people receiving NHS mental healthcare.

Name	**Helen Craggs**
Organisation	Royal Bolton Hospital
Title	A Quality Improvement Project to assess the functionality and safety of the current medical referral process and to develop a safer and more usable referral and patient tracking system
Objective	With over 50 acute medical referrals per day at Royal Bolton Hospital, an efficient and safe acute medical take process is crucial to maintain high standards of clinical care. The existing process involved multiple non-communicating patient lists to track referrals. It also relied on manual data entry - resulting in patients being missed for clerking or not being identified for senior review - thereby missing national targets. A quality improvement project was designed to i). assess the functionality and safety of the current medical referral process and ii). develop a safer and more usable referral and patient tracking system.
Methods	A new automated electronic Acute Medicine Referral List (AMRL) was outlined by the trust's IT team and clinicians. It was designed to integrate into the existing Electronic Patient Record (Allscripts). The new AMRL system integrates into existing clinical practices of A&E and AMU clinicians. Clinical performance data from the pre-existing process and the new AMRL were benchmarked against Society of Acute Medicine Quality indicators, and analysed to assess the impact on the medical on-call team's working patterns, patient flow and patient outcomes. A pre-intervention benchmark audit cycle (7 days of admission data) was carried in February 2020. The AMRL and referral process was subsequently implemented in November 2020. Following an interim spot audit and user survey, minor refinements were made to the AMRL. Two post-intervention audit cycles (7 days admission data) were then performed in January (6 weeks post intervention) and April 2021 (5 months post intervention).
Results	Since introducing the electronic AMRL, patients waited less time for medical clerking ($\bar{x}$ 00:13 hours) and senior review ($\bar{x}$ 04:58 hours). There was also a 6.4% increase in the proportion of patients clerked within the 4 hour target window. When looking at weekend data, the impact of AMRL is more marked. The waiting times for medical clerking and consultant reviews at the weekend have improved by 25.1% and 26.1% respectively. There was a significant increase in the proportion of patients being reviewed by a consultant within 14 hours. This improvement was sustained through multiple audit cycles.

	Overall, there was a measurable improvement in clinical performance against the national clinical quality indicators. The average hospital length of stay reduced by 1.3 days, equating to a reduction of approximately 15600 total occupied bed stays per annum.
Conclusion	The introduction of the Acute Medicine Referral List, a single consolidated electronic patient list and referral process, has improved standards of care and patient flow within the organisation. Timely senior decision making has prompted earlier discharges and a reduction in overall inpatient length of stay - resulting in an estimated cost saving of £3.1 million. The AMRL demonstrates how the unification of both patient referral listing and workflow systems can improve standards of patient care and experience. The primary reasons for success of the AMRL include: 1) the ability to integrate within established clinical and workflow systems and 2) stakeholders were responsive to feedback from end users, addressing pitfalls promptly to continuously improve on the systems usability and functionality.

Name	**Olivia Curtis**
Organisation	Royal Marsden Hospital
Title	The limitations of using commercial wearable activity trackers, such as FitBits, for the clinical monitoring of patient activity levels
Objective	There is increasing interest in remote monitoring of patents within the comfort and safety of their homes or care homes and became more pertinent during the COVID-19 pandemic to reduce hospital footfall and staff risk. While specifically designed medical devices exist, commercial wearable activity trackers (WAT), such as FitBits, are cheap, easy to use, and patients may already use them for lifestyle advice so their value in clinical intervention is of interest. The feasibility of using commercial WAT for daily monitoring within a tertiary oncology centre was investigated, including limitations of non-medical devices, such as data collection and synchronisation errors.
Methods	Participants were recruited for a study that investigated if remote monitoring of step counts was feasible and acceptable. Patients with advanced lung, upper and lower gastrointestinal cancer, or mesothelioma who were starting a new line of systemic anti-cancer treatment were recruited between December 2020 and December 2021. Once recruited, participants were provided with a FitBit Inspire HR or Inspire 2 and asked to wear it every day for a 16-week monitoring period. Pseudo-anonymous accounts were created to register the FitBits without sharing patient identifiable data and the devices were set up to automatically synchronise data to the cloud-based platform, Fitabase, via their smartphone. Steps were monitored on every workday and the ability to record heart rate was used as a proxy marker for compliance as it confirmed that the device was being worn. A day was considered complaint if the device was worn for >70% of waking hours, assumed for purpose of trial to be 7am to 10pm. The manufacturer or age of the participant's smartphone was not recorded. Previous discussions with FitBit regarding synchronisation issues had highlighted potential clashes with other Bluetooth devices preventing automatic synchronisation so use of other such devices was documented.

Results	Forty-seven patients were recruited and 43 were eligible for ongoing monitoring. Average age was 66 (SD 9) and majority were men (72%). Twenty-four patients completed the maximum 112 days of monitoring and six remain under active monitoring. Patients were eligible for monitoring on 3577 days. Of these, synchronisation errors occurred on 469 days (13%) and all data from the previous 24 hours was missing on 270 days (8%) due to synchronisation not occurring on the day on monitoring. Only 6 (13%) of participants did not have synchronisation errors during their monitoring period. The median number of synchronisation errors per patient was 8 and maximum of 49, which accounted for 64% of that participant's monitored days. One participant was withdrawn due to 100% synchronisation error over the first seven monitored days. Twenty-two participants (47%) used other Bluetooth devices but there was no correlation between their use and synchronisation errors (r=-0.27). 517 days (14%) were considered non-compliant as heart rate was documented for less than 70% of the waking hour period. When synchronisation errors were removed, however, only 183 days (6%) were truly non-compliant due to the patient not wearing the device, rather than not having access to the data.
Conclusion	This study has revealed a potential limitation of using commercial wearable activity trackers, such as FitBits, for clinical monitoring. While compliance with monitoring was good and matched previous reports on compliance at over 80%, the loss of data due to synchronisation errors reduced perceived compliance and, importantly for clinical interventions, reduced data available for immediate action. Correcting these issues and restarting the automatic synchronisation was not a complex procedure but did necessitate a telephone call with the participant to manually synchronise the device, restart their smartphone or occasionally reinstall the app, which added to the participant burden of the investigation and overwhelmed the technological abilities of some participants. Currently, it is not clear what causes these synchronisation errors and, therefore, it is not possible to select patients who would be more suitable for this intervention. The frequency of synchronisation errors mean that it is not feasible to use commercially available WAT for remote

	monitoring of patients and caution is needed if the results are used to guide clinical intervention, rather than simply offer lifestyle advice.

Name	**Sarah Wilson**
Organisation	Newcastle University
Title	Usability and acceptability of wearable technology in the early detection of dementia.
Objective	Digital technology is transforming health and social care. Digital technologies, which includes smartphones and wearables, can be used to predict, diagnose, monitor, and/or develop treatments for different diseases. These technologies also have the potential to detect markers of neurodegenerative diseases at a much early stage than is currently possible. The Early Detection of Neurodegeneration (EDoN) initiative aims to use digital technologies to detect preclinical dementia, with aspirations to validate a digital toolkit for clinical practice. To enhance its development, we aimed to assess the usability and acceptability of the EDoN toolkit in people with cognitive impairments and their carers.
Methods	Various UK-based networks such as Join dementia research were used to recruit participants. The EDoN toolkit, which includes a smartwatch (Fitbit Charge 4), EEG headband (Dreem 3), and two smartphone applications (Longevity and Mezurio), was sent to each participant. University ethical approval was obtained (2135/12893/2020). Written and video guides were provided to support participants' when using the toolkit. Participants' initial perspectives of the toolkit and experiences of the setup process were explored through an initial interview, conducted approximately three days after receiving the devices. Follow-up interviews were conducted two weeks later to explore the acceptability and usability of the toolkit. NVivo enabled the thematic analysis of the interview transcripts. Emerging themes were discussed and refined by the research group.
Results	Sixteen semi-structured interviews were conducted with nine participants, at two-time points. Four participants had mild cognitive impairment, two had frontotemporal dementia, one had Alzheimer's disease and two were carers. Key themes were identified and centre around usability, acceptability, and inequity. Sub-themes within usability included the utility of the toolkit, experiences of setting up the devices, comfort of the wearables, and preference towards the written guides over the video guides, especially amongst those "who don't like technology" (P3) and

	"prefer instruction booklets rather than go backward and forwards online"(P1). In terms of acceptability, participants appeared to show a greater acceptance for familiar devices (e.g., previously worn a fitbit) and an initial hesitancy for the EEG Headband as it looked "cumbersome"(P3). They described the importance of understanding how the device worked and obtaining feedback for "personal interest" (P4), and raised fears around the implications of a high score in practice, with their "driving license being taken"(P3) . Various inequities of the toolkit were uncovered such as a lack of accessibility to compatible phones and Wi-Fi connection, "sore patches" (P6) caused by the wearables amongst individuals with dermatological issues, and digital exclusion regarding poor digital literacy and the view that technology is "alien"(P6).
Conclusion	These results highlight that the EDoN toolkit was usable amongst only some individuals with cognitive impairments and their carers. Feedback on product acceptability and usability will be fed back to developers to help improve the different devices. Future work is needed to increase the inclusivity of the EDoN toolkit to support health equity and to reduce the stigma surrounding dementia.

Name	**Nehal Hassan, Robert Slight, Sarah Slight**
Organisation	School of Pharmacy, Newcastle University
Title	Healthcare staff perceptions on using artificial intelligence predictive tools: A qualitative study.
Objective	Artificial intelligence (AI) predictive tools can help inform the clinical decision-making process by, for example, detecting early signs of patient deterioration or predicting the likelihood of a patient developing a particular disease or complications post-surgery. However, it is unclear how acceptable or useful clinicians find these tools in practice. This project aims to explore healthcare staff' perceptions on the benefits and challenges of using AI tools to inform clinical decision-making in practice.
Methods	Healthcare staff (physicians, pharmacists and nurses) working in different departments at one large teaching hospital in the North East were invited to participate in semi-structured interviews. Interviews were conducted between August and November 2021 by zoom videoconferencing, with questions focused on what AI predictive tools they currently use, how they guide daily tasks around diagnosis, management, prevention, prognosis and screening, and what challenges they face with their use. All transcribed files were checked for accuracy. Thematic saturation guided the volume of qualitative data collection. Qualitative data analysis and development of themes was performed for each interview using Nvivo 12 software. Ethical approval was obtained (20/EM/0183, IRAS 280077).
Results	Ten healthcare staff were interviewed (physicians (n=7), pharmacists (n=1), surgeons (n=2)) from different medical specialities (e.g., Oncology, Endocrinology, Cardiology, Head and Neck, and transplant surgery). Five themes emerged, including the meaning of the term AI, the usefulness of AI predictive tools in informing clinical decision-making, features that healthcare staff found helpful, and challenges around their use. Healthcare staff recognised the benefits of AI predictive tools in being able to "detect deterioration quicker than you would currently do"(05-ID), which informed decisions around patient discharge: "can you safely send them home (...) or do you want to keep them, in case they do deteriorate" (05-ID). They found AI predictive tools useful when explaining the potential risk of cardiovascular events to patients and encouraging medication adherence "it does help so much convincing the patient to actually adhere to the medication" (07-Endo).

	During COVID-19, AI prediction tools helped identify patients that might potentially need mechanical ventilation and ICU admission. Healthcare staff also felt it was important that AI predictive tools provided reliable information, that was easy to understand, and integrated with the current systems. A concern raised around the use of AI predictive tools was whether they might "mislead junior doctors or doctors who would not have that much of a clinical sense and would totally depend on it" (07-Endo).
Conclusion	This study demonstrated opportunities for the application of AI predictive tools in clinical practice. Concerns raised around the use of these tools should be considered by developers. We recognise that the perceptions of only a small number of clinicians were included mainly due to the increased time pressures on staff during the COVID-19 pandemic. Healthcare staff described essential features that will guide the future development of AI predictive tools with higher potential for application in real practice.

Name	**Presenter: Nishita Gadi** All authors : Gadi N, Utukuri M, Osei-Boadu B, Aung Y, Le E, Deighton A, Dibblin C, Ferry M, D'Souza F, Hirniak J, Agboola B, Abedi M, Axiaq A, Chand C, Patel C, Pitt M, Harris B, Byrne M, Sethi R
Organisation	Faculty of Digital Health; Nuffield Department of Surgical Sciences, University of Oxford
Title	A national survey to investigate the current provisions, perceptions and challenges regarding digital health education in the United Kingdom medical undergraduate curriculum
Objective	Digital health (DH) is the integration of technologies to tackle challenges in healthcare. Its applications include mobile health, remote & wireless healthcare, artificial intelligence, and robotics. Digital technologies are increasingly being used to deliver routine care, whilst simultaneously patients are increasing their uptake of DH solutions (e.g. wearables). With the adoption of DH increasing across the NHS, there is a growing need for a digitally literate workforce. However, there are no national standards on DH education for UK medical students. Consequently, this study sought to assess the current provisions, perceptions and challenges regarding DH education in the undergraduate medical curriculum.
Methods	An anonymous cross-sectional online survey was developed following a literature search and by collecting iterative feedback from both researchers and external collaborators. The survey consisted of questions in 6 areas: (a) understanding of DH; (b) existing provision of DH education; (c) interest in DH education; (d) preferred means of delivering and assessing DH education; (e) impact of the COVID-19 pandemic on DH; and (f) demographic information. The survey was administered via Qualtrics from March to October 2021, and disseminated to UK medical students via university mailing lists, social media and student representatives. Quantitative and qualitative data were collected pertaining to demographics, attitudes, preferences, and current provisions regarding DH education. Qualitative responses underwent thematic analysis. For quantitative analysis, R (version 3.5.0) and R Studio (version 1.1a) were used.

Results	514 complete responses were received from 39 UK medical schools in 2021. 57.2% of respondents were female, with a mean age of 22.9 ± 3.2. 65.8% of students considered DH 'extremely important' to future clinical practice, particularly the domains of electronic patient records, telehealth and smartphone applications. However, only 18.1% felt aware of the DH competencies required in clinical medicine. 70.2% of students reported receiving some DH education, with the highest proportion being in the form of lectures or seminars (30.5%, n=157), e-learning modules (28.6%, n=147) and ad hoc teaching during clinical placements (22.8%, n=117). However, only 25.7% felt satisfied with these provisions. Themes for student satisfaction related to a practical teaching approach, delivery of content appropriate for their training stage and coverage of topics in student interest. Conversely, student dissatisfaction originated from inadequate teaching, and subsequent fears of falling behind. 56.1% preferred DH education to be mandatory rather than elective, ideally through hands-on workshops (75.8%) and lectures and seminars (60.4%). 65.4% thought DH proficiency should be assessed in some capacity, of which 75.6% preferred formative assessment.
Conclusion	This study represents the first national survey of UK medical students on DH education. Overwhelmingly, the results indicate that medical students recognise the significance of DH and would appreciate better formal integration into their curriculum; which is supported by previous similar studies in the literature. This study also identified how students would prefer to be taught and assessed on DH, in particular that they would prefer it be mandatory yet remain formative at present. Given the increasing ubiquity of DH in clinical practice, it is therefore crucial that universities and wider medical education organisations work to improve and standardise DH education, to better prepare medical students to adapt to the continuously developing digital landscape. This rings especially true in light of the recent COVID-19 pandemic which has highlighted the quintessential nature of DH to medical practice. Our intended future research from this study includes undergraduate focus groups for greater qualitative depth of information, and Delphi panels from wider medical education stakeholders into what should be included in DH education, with the eventual goal of developing a comprehensive and standardised national DH curriculum.

Name	**Elaine Taylor-Whilde**
Organisation	Nine Health Global Ltd
Title	Woubot and TRUST4Health : predictive personalised A.I. tools for front line clinicians
Objective	Integrating technological innovation in clinical big data from Nine Health Global (NHG) and data science Woubot is a prototype precognitive system for community & wound clinics. Focusing on leg ulcers, Woubot will produce recommendations from several thousand possible treatment combinations. Working with suppliers to the National Wound Care Strategy Programme, the project will create a suite of automated software tools with a user-friendly mobile application designed by doctors and nurses for their own use within the NHS. This will generate a personalised care pathway for each patient via a series of recommendations. TRUST4Health will apply the technology to other diseases.
Methods	We undertook a feasibility study to test artificially intelligent software on data from Cegedim Thin and the NHS Community Data set. We combined know how from our A.I. diagnostic system Diagbot co-produced with a Chinese partner for grass roots doctors in China and applied data science techniques creating a new AI prototype system. With a consortium led by the Royal College of Surgeons in Ireland (RCSI) we have applied for Horizon 2022 EU government funding to build on the work in wounds and to apply the methods to 3 other vascular clinical diseases stroke, heart failure and dementia . Woubot will use artificial intelligence (AI) to identify people likely to develop chronic leg wounds and manage their preventative care. In those that already have leg wounds, such as diabetic foot ulcers, the software will help to ensure that evidence of effective treatment is turned into simple steps which are available quickly and easily to front-line staff. Our AI software will rapidly sift through millions of data items in secure NHS facilities. This will enable recommendations to be generated via a mobile app. A suite of software tools will generate a personalised care pathway with a series of recommendations for use in the NHS. Most of this care will be delivered by nurses and other healthcare professionals in clinics and the community. Prescriptions, whether for exercise, other lifestyle changes, medication or dressings, will be individualised for each patient based on their history and biological makeup and linked to the latest clinical evidence. We will also use image software to monitor progress easily and accurately.

Results	We built a secure platform hosted by UK Cloud (Nine Health Community Interest Company is an NHS research data organisation)using wound data sourced from Cegedim Thin and the NHS Community Data set (NHS Humber Foundation Teaching Trust) using patient pseudonymised data sources (which have gone through the double de-identification process). Data was reviewed by a statistical expert to exclude bias and included a national sample from primary care and a local sample from Hull and East Riding where the demographic includes both inner city, city and rural and a diverse range of nationalities including black, ethnic and minority groups aged 19-80. We collated and analysed around 2000 comprehensive patient records of those with hard to heal wounds (diabetic foot ulcer and venous leg ulcer) across a 2 year period. A raft of modifiable predictive factors such as Vitamin B12 levels, the impact of BMI on healing were identified and analysed. Isolating the key measures enabled the prediction of time from developing diabetes to developing a foot ulcer and then the ability to predict time to an amputation. These results if validated by further research such as the Horizon 2022 EU Trustworthy A.I. project referred to above would enable targeted management to prevent these sequelae. We have developed clinical algorithms based on the national wound guidelines produced by the NWCSP for some parts of the patient pathway e.g. initial assessment including red flags. We now need to validate via clinical trials and automate processes, combining existing data collected by the National Minimum Wound Assessment Data Set, our data sets and others @ NHS digital https://digital.nhs.uk/ HES, CSDS and other international data .
Conclusion	Woubot https://fundingawards.nihr.ac.uk/award/AI_AWARD01723 has started to identify people likely to develop chronic leg wounds and suggested predictive factors which may prevent amputation and death. The automated identification of these factors will in the next phase enable management of their preventative care. In those that already have leg wounds, such as diabetic foot ulcers, the software will help to ensure that evidence of effective treatment is turned into simple steps which are available quickly to front-line staff. Dressing analysis (size and type over time) suggests a good proxy measure for wound healing. In the next phase recommendations for personalised care will be generated via a mobile app. The software will generate a personalised care pathway with a series of recommendations for use in the NHS. Most of this care will be delivered by nurses and other healthcare

	professionals in clinics and the community. Prescriptions, whether for exercise, other lifestyle changes, medication or dressings, will be individualised for each patient based on their history and biological makeup and linked to the latest clinical evidence. The clinician chooses whether or not to accept the recommendations and records their decision. Following the above results in the area of hard to heal wounds we shared these with the Royal College of Surgeons in Northern Ireland and an expert consortium of data scientists and clinicians which has led to our submission to develop trustworthy clinical A.I. tools for front line clinicians in stroke, heart failure and vascular dementia. For the first time if successful we intend to explore the common causal factors across all 4 disease areas and create a unique synthetic /augmented data resource for the UK and Europe.

Name	**Farah E Shamout, Zaki Almallah, Nasir Hayat, Terrence Lee St John, Phillip Wang, Vee Nis Ling, Lelan Orquiola, Vansh Gadhia**
Organisation	New York University, Abu Dhabi
Title	Development and evaluation of a machine learning model to predict urinary tract infections in the outpatient setting and minimize the use of antibiotics
Objective	Excessive prescription of antibiotics is amongst the principal drivers of antibiotic resistance, which is considered a surging threat to global health. The most frequent resistant pathogens are usually linked with urinary tract infections (UTI). Studies have shown that clinicians may prescribe antibiotics based on presenting symptoms due to the prolonged time required to obtain the final results of urine bacterial cultures. While many of the current approaches to ameliorate prescribing behavior are educational or regulatory, here we develop and evaluate a logistic regression model that detects the risk of UTI based on the patient's history and presenting physiological data extracted from the electronic health records.
Methods	We used an anonymized dataset collected between 2015 and 2021 in a multi-specialty large hospital with primary, secondary and tertiary care facilities. The retrospective study received approval by the Institutional Review Board (IRB) from both the research institution and hospital (IRB references: HRPP-2020-173 & A-2019-054, respectively). We included adult outpatient encounters associated with at least one urine culture test. For the input features, we extracted and pre-processed each patient's vital signs (heart rate, respiratory rate, oxygen level, and temperature) collected prior to the acquisition of the urine culture, as well as diagnosis codes (ICD-10 codes) and treatment codes (HCPCS and hospital-specific codes) from the patient's previous hospital encounter. We defined the output as a binary label indicating a positive or negative urine culture result by processing textual data within laboratory test results. We assume a positive UTI if the concentration of urine pathogen is mild or moderate, i.e. higher than 10,000 colony forming units per milliliter (CFU/ml). We split the dataset randomly into a training (70%), validation (10%), and test set (20%). We optimized a logistic regression model using the training set, and evaluated it on the test set with 95% confidence intervals computed using bootstrapping with 1000 iterations.
Results	After applying the inclusion criteria, the overall dataset consisted of 9,352 unique patients (55.6% females; mean

	age 47.6 standard deviation 17.4 years). Amongst all encounters, 1,312 (14.1%) were associated with a positive label. We evaluated the models on the held-out test set consisting of 1,870 encounters (18.8% of encounters had positive UTI). The logistic regression model achieved a 0.714 (0.691, 0.738 95% CI) Area Under the Receiver Operating characteristic Curve (AUROC) and 0.305 (0.275, 0.337 95% CI) Area Under the Precision Recall Curve (AUPRC). Amongst the female population, the logistic regression model achieved a 0.692 AUROC compared to a 0.716 AUROC amongst males. When investigating different patient age groups, the model achieved a 0.706 AUROC amongst patients younger than 40 years, compared to 0.692 AUROC amongst patients older than 40 years. We binarized the predictions by adjusting the threshold to achieve approximately 80% sensitivity on the test set, which is a clinically acceptable level of sensitivity. Amongst the 1,518 encounters associated with a negative urine culture in the test set, 29 were prescribed with a UTI-related antibiotic during their respective encounters. With the fixed threshold, our model was able to correctly classify 41.4% (12/29) as negative amongst those who indeed did not require an antibiotic.
Conclusion	In this study, we develop and evaluate a machine learning model for the detection of UTI amongst outpatients using a real-world dataset. Our results demonstrate that the optimized model has the potential to decrease false positives and as a result minimize unnecessary antibiotic prescription. In future work, we are interested in further improving the model by leveraging temporal sequences of the input features, extensively fine-tuning hyperparameters of the network, and decreasing the performance gap across different patient subgroups. While our study uses a dataset collected in a single cohort, the results can be translated into other settings via external validation or by simply fine-tuning the model. Overall, our novel application is of high relevance to the clinical informatics community considering the global threat of antibiotic resistance, especially in the context of managing urinary tract infections.

EPOSTER PRESENTATION

Name	**Rory Dykes**
Organisation	Lewisham & Greenwich Trust
Title	Assessment of a digital consent process identified a reduction in errors and the omission of core risks whilst increasing the quality of Shared Decision Making
Objective	The importance of shared decision making (SDM) for informed consent has been emphasised in the updated regulatory guidelines. Errors of completion, legibility and omission have been associated with paper-based consent forms. We introduced a digital consent process and compared it against a paper-based process for quality and patient reported involvement in shared decision making.
Methods	223 patients were included in this multi-site, single centre study. Patient consent documentation was by either a paper consent form or the Concentric digital consent platform. Consent forms were assessed for errors of legibility, completion and accuracy of content. Core risks for 20 orthopaedic operations were pre-defined by a Delphi round of experts and forms analysed for omission of these risks. SDM was determined via the 'collaboRATE Top Score', a validated measure for gold-standard SDM.
Results	72% of paper consent forms contained ≥1 error compared to 0% of digital forms ($P<0.0001$). Core risks were unintentionally omitted in 63% of paper-forms compared to less than 2% of digital consent forms ($P<0.0001$). 72% of patients giving consent digitally reported gold-standard SDM compared to 28% with paper consent ($P<0.001$).
Conclusion	Implementation of a digital consent process has been shown to reduce both error rate and the omission of core risks on consent forms whilst increasing the quality of SDM. This novel finding suggests that using digital consent can improve both the quality of informed consent and the patient experience of SDM.

Name	**Keith Reid**
Organisation	CNTW NHS Foundation Trust
Title	A friendly accessible description of The "L-test" – measuring (dis)information in incomplete incident reporting
Objective	Incomplete incident reporting is concerning. England's Mental Health Units Use of Force Act 2018 (Seni's Law), responding to deaths and incomplete reporting, will mandate central restraint reporting per-person including ethnicity. "L" is a proposed test for disinformation, i.e. "false surprise" regarding true reports. Information, or "surprise", is measurable as H = –log(p) "bits", as defined by Shannon (1948). The author explains his conjectured "L-test", in a friendly accessible way. It is generalisable from incomplete restraint reports to other incomplete centralised safety reports. L is increased if complete reports seem falsely surprising consequent to noise from incomplete reports.
Methods	Incident registers and minimum data sets are ubiquitous. Each hospital reports diverse incidents alongside measures of size or need. Notionally then data may include a) restraints; b) detentions … m) bed days n) injuries. L postulates that each hospitals' report of {a, b, ... m, n}, implies signals of ratios (log a/log b), (log a/ log m)… which each can be received from the set of reports and combined to estimate e.g. a typical ratio of safety events per-patient per-month. Omissions are noise. Procedure: 1. Split the ordered list of complete report estimates into alternate halves E "even" and O "odd". 2. Derive a probability p(E~O) that E and O are similar using Mann-Whitney U test, approaching p(E~O) =1.0 for large similar E and O. The test tolerates non-normally distributed estimates. 3. Calculate h(E~O) information as –log(p(E~O)), approaching zero as O and E seem unsurprisingly similar. 4. Construct a noisy odd group "NO" made of O mixed with estimates from incomplete reporters. 5. Calculate h(E~NO) information, approaching high values as incomplete reporters make E seem falsely surprising. L is the proportional increase in h(E~O) due to noise: h(E~NO) - h(E~O)

	$L = \frac{}{h(E \sim O)}$
Results	Estimate signals support funnel plotting, scatter plotting, and coefficients of determination (R^2) as a measure of correlation. The author will show that omissions (allowing for size and Poisson distribution) can be obvious on visual inspection of funnel and scatter plots and aid categorisation. Where the estimates follow a normal distribution among reasonably complete reporters, this can be used to plot a typical ratio and infer incidents, with confidence intervals, even in null reporters, from measures of size and need. Funnel plots from safety reports may have interesting properties such as innate asymmetry; they may reflect institutional-social processes such as regulation and closure as much as academic processes such as purported "publication" bias. H varies with the effect of incomplete reports and has other desirable features such as being zero when there are no omissions.
Conclusion	Omitted reports have a measurable effect upon the standing of complete reports. The author responds to this observation quantitatively, showing the roots and reasoning behind their conjectured "L-test", in a friendly accessible way, with reference to papers under submission, other public data, and toy data sets. In summary, L can tell investigators which incomplete reports skew the overall picture most. In a context of restricted resource, regulatory efforts could concentrate on the omissions which have the most distorting effect - the biggest L score.

Name	**Alicia Ridout**
Organisation	Involve Me Digital Health Ltd
Title	Prioritising competencies to support novice occupational therapists digital practice development: Helping or hindering?
Objective	The core objective was to prioritise competencies to underpin novice digital, clinical practice development using a digital tool and wrap around support programme. A Clinical Onboarding Guide for Occupational Therapists (COG-OT) had been successfully deployed as a proof-of-concept webapp and insights from that work informed this funded evaluation study. The phase one aim was to align the updated COG-OT content to competencies which would enable novice therapist involved in the support programme, to demonstrate increased confidence and skills development in relation to digital clinical practice and safety. A collaborative approach was used, ensuring content of the programme met user requirements.
Methods	The Health and Care Professions Council (HCPC), Faculty of Clinical Informatics (FCI) and Health Education England (HEE) Allied Health Professions frameworks were reviewed against a set of core requirements and assumptions for novice practitioners, taken from the Royal College of Occupational Therapists (RCOT) frameworks and prioritised in a MoSCoW (Must do, Should do, Could do, Wont do) grid. An initial appraisal of the lists was conducted by two of the project's occupational therapists. This initial set was then subject to a light touch, three stage Delphi process with students in a co-design workshop, a national advisory group, practice educators in clinical settings and higher education lecturers. The final round prioritised the most frequently selected competencies with the strongest alignment to existing/new topics in COG-OT, previously validated by over 1000 users. The wrap-around support sessions were aligned to the topics and novice practice development requirements/competencies and validated by educators, in readiness for the deployment of the programme. Out of scope for prioritisation were the extensive, repetitive array of competencies focused on legally required aspects of governance applicable to any role, except where they interfaced usefully with digital safety/inclusion. This enabled

	a focus on day-to-day skills to underpin occupational therapy practice development.
Results	Over 240 competencies were reviewed and filtered down to just over forty, to underpin COG-OT content for the novice practitioners and wrap-around support sessions. The HCPC competencies were adopted as 'must do's' largely due to their regulatory status, despite only a handful of them being explicitly applicable. The FCI framework was deemed a 'should do' due to the evidence-based and focused articulations relating to digital practice. Not all the detail in the prioritised competencies was applicable, but it was decided to take a broad-brush approach to inclusion to maintain choice for practitioners. The HEE framework was placed in the 'could do' section in part due to its size and overlapping competencies. The RCOT frameworks were used to develop COG-OT integrated support tools, appropriate to novice practice (levels 5 and 6). Previous insights from COG-OT indicated that e-safety and the technical topic areas were the least used, possibly due to perceptions of their specialised nature. However, risk management competencies were aligned by reviewers across the topic areas in COG-OT, embedding it across the programme and, the occupationally focused areas of practice. There was strong cohesion across the web app topic areas and repeated alignment of a core set of priority competencies.
Conclusion	This project demonstrated that there are an unwieldy range of competency frameworks being deployed which risk overwhelming practitioners of all levels of expertise. The outputs highlighted the need for effective occupationally focused digital assessment and deployment. Digital clinical safety was also highlighted as a priority for novice practice development. Perceptions remain that digital competencies are the domain of specialists or senior staff despite the changes brought about during the pandemic. Safe and effective digital practice is a prerequisite for HCPC registered staff of all levels. The focused nature of this work enabled honing of these large lists of competencies to a manageable and meaningful level for evaluation of the intervention in 2022-23. The evaluation will follow final year students across their first year of practice to ascertain the effectiveness of COG-OT, with a wrap-around support programme, driven by competencies prioritised by their peers.

	As the profession faces significant challenges to workforce deployment nationally, it is vital that novice practitioners are supported and optimise their use of digital skills and knowledge for patient benefit and, reduce attrition rates. This small-scale, proof-of-concept project presents potential for wider discussion/exploration of applicability of these frameworks that enhances practice, and users of services outcomes.

Name	**Alicia Ridout & Professor Susan Grant-Muller**
Organisation	Involve Me Digital Health Ltd & University of Leeds
Title	Use of the NASSS-CAT to support effective deployment of a smart wristband in response to the COVID-19 pandemic: surfacing risks and challenges
Objective	The Non-adoption, Abandonment, Scale-up, Spread and Sustainability (NASSS*) tool was used with a newly convened, diverse project consortium exploring additional risk management activities for the success of a complex COVID-19 technology innovation project. The Innovate UK funded project, aimed to develop and deploy a smart wristband at scale. Technologists, analysts, transport specialists were involved. The wristband was to detect any instances of close proximity between individuals, thereby potential COVID-19 exposure. Movement data/insights gathered should improve future preparedness for another variant/viral pandemic. The goal was to improve mitigation policy, protect large-scale loss of life and relieve system pressures. [*https://www.researchprotocols.org/2020/5/e16861]
Methods	The short NASS-CAT (NASSS Complexity Assessment Tool) was selected to screen in and surface this new teams view of the future risks of non-adoption. It was circulated to the extended consortium team members, to complete individually. This was chosen due to the ongoing pandemic pressures and need to adopt a light touch quick review of the planned programme of work. The survey responses were collated into a summary report and used as a focus for a team review meeting held in the preliminary stages of project initiation. Some terminology was adapted to suit the project (citizens not patients, as the focus was on the public). This aimed to make the findings more relatable to the new consortium team who were from diverse fields of practice. The recommendations and insights provided opportunities for focused discussions and exploration regarding potential mitigations for new or wider risks that had not been discovered up to that point. Team members based within and external to the UK and from technical, manufacturing, marketing, deployment, academic and data analysis expertise were involved. The actions from this review were adopted into project

	planning, risk management and deployment planning with a view to repeating the review pre-deployment.
Results	Citizen condition: there were disparate views of future citizen needs. Scores reflected significant uncertainty in the team about citizen needs, and fewer responses to these questions were made. The technology: The team were unanimous that it would not require adopting organisations to make business process changes, with a more dispersed response to the likelihood that the service model for deploying it may need to change in future. Value proposition: There was a prominent level of cohesion in this field although uncertainty surfaced regarding the future business model. Intended adopters: Responses to this section were dispersed. The team accepted the risks of complexity in adoption, in the context of changing views of the technology in future (it could delay/speed adoption or impact on duration of adoption). Organisations implementing the technology: responses indicated a universal view that the complexity relating to organisations involved in the project was not significant. External context for innovation: responses identified external factors impacting on the organisations deploying/adopting it, but not from political/policy, citizen related, or the commercial context. The opportunities for learning from (similar) organisations was seen positively, potentially mitigating economic pressures post pandemic. A high number of responses indicated ambivalence, adding risk to the project.
Conclusion	The team scores demonstrated a strong technical understanding of the product, application of the technology and its strengths/limitations but less of the citizens, their context, and the challenges brewing in the deploying environment. The adoption context is more complex and risk laden than was reflected in the scores at the early stage of the project. There was an increased recognition of the need to positively engage stakeholders who would not usually be able to influence a scaled adoption. By sharing these insights throughout the project as a routine conversation and adding to a weekly meeting agenda, team members were able to re-balance this element of the whole development roadmap.

	In addition, more targeted work was undertaken with the team to define and focus on communities considered the most vulnerable consumers, using recent work by the European Parliament There was increased recognition of team wellbeing and resilience requirements due to the pandemic. The team were directly impacted by Covid19 and were unable to meet in person, with variations in regulatory requirements adding further risks to team resilience and maintaining communications. Holding a 'whole deployment and adoption' roadmap view, and understanding the complexities faced by end users were key learning points.

Name	**Rebekah Davies**
Organisation	NHS England and NHS Improvement
Title	Discovering an accessible YOUniverse ; Achieving autonomy & breaking barriers through codesign
Objective	The Long Term Plan (LTP) set-out that individuals will be equipped to independently manage their healthcare using digital tools, but many with communication barriers are unable to access existing tools due to limited accessibility. Self-management can be overwhelming to navigate, negatively impacting on healthcare engagement and outcomes. It may escalate to avoidance and withdrawal with the potential to lead to health inequalities as vulnerable patients become further disengaged or disadvantaged from vital services that support their health and wellbeing. What is missing from current offers and what can codesigning new solutions bring to addressing the lack of people first technology?
Methods	A focus group of 6 young adults 16- 22 supported by communication professionals engaged between July 2021 and Jan 2022. The focus groups were recruited from participants across two specialist education settings having advertised the opportunity through professional social media networks. The participants were recruited via ethics approved processes, signing digital consent/equality and diversity forms after having the project aims presented and explained. The focus group participated in 3 workshops (July, September, November,) constructed to; 1. Understand the group's main challenges in managing their own health currently. 2. Begin to co-design the features and content by sharing experiences and ideas 3. Feedback on the wireframe developments to date Bespoke coding began using C# to build the App in a test environment followed by agile sprints to review and make amends to layout, flow and process in order to maximise the UX. Revisiting and comparing research questions and activities against assumptions and outcomes ensured momentum and clear objectives. With the focus being to create an accessible tool to support independent healthcare self-management for those with communication barriers, much of the development has been on aligning with WCAG (Web Content Accessibility Guidelines 2.1) the Royal College of

	Speech & Language Therapists plus other accessibility guidelines including the British Dyslexia Association.
Results	Whilst results may not be epidemiological (yet) the outcomes to date have provided an opportunity for participants to explore their experiences and use these to develop a concept in codesigning as they shared their ideas and suggestions. As a speech therapist it was paramount that everyone felt able to engage using their preferred communication which ranged from verbal to symbols. Whilst integral to the practice of professionals in the group, we were aware inclusion and accessibility is not yet ingrained in healthcare design, reflected in the consideration without inclusive design throughout the entire process some individuals would have been prevented from fully participating. These workshops allowed real depth of insight into challenges faced by neurodiverse individuals and those with learning disabilities managing their health needs. Discussions highlighted that not only was the aim of increasing autonomy in self-management of appointments significant but, recording and easy, secure sharing of health information with approved healthcare professionals was also needed. The project is far from over despite being at a stage where able to launch out of test environment and make available to download. The challenges of navigating multiple operating systems as a new product developer has been full of hurdles and delays.
Conclusion	Whilst a new 'YOUuniverse' may be in final development, it requires more specialist resource and knowledge to develop a fully rounded clinical product meaning rather than concluding, I am at the precipice of another journey. I am delighted to be an NHS Clinical Entrepreneur on the forthcoming 6th cohort where my hope is in ensuring a high quality secure, clinically safe and assured product with a good ORCHA rating that, above all makes a difference to peoples independence. Testing the MVP based on the research questions and co-design plans is necessary so development and testing of the app will continue with lived experience experts and communication specialist clinicians, initially utilising the focus group participants. Planned testing more widely in 3 proposed test beds are underway; • Surrey Heartlands ICS (CDO Katherine Church) • North East and North Cumbria ICS (Professor G Evans and Health Inequalities Co-Clinical Director NUTTH) • Blackpool Teaching Hospitals. I have secured two very highly respected mentors; Hassan Chaudhary and Clive Flashman both specialist in digital health

	internationally and UK with enthusiasm for the app's potential to reduce health inequalities for those with communication barriers. I'm excited and eager to explore what the new YOUniverse holds.

Name	**David Chalkley**
Organisation	Somerset NHS Foundation Trust
Title	A Journey Towards a Consolidated Medicines Record
Objective	Delivery and evolution of a system wide consolidated medication record, in a scalable repeatable model for others to blueprint, aligned to 2 primary objectives. Firstly, the integration and reuse of medicines information from across Somerset care providers, via the implementation of national standards, including dm+d & FHIR structured dose syntax. Enabling the creation/modification of patient medication records within provider systems with minimal manual intervention, eliminating transcription and optimising care continuity Secondly, the creation of a consolidated patient medication record view, connecting and presenting medications information and transactions from across providers, creating a foundation for a single source of truth.
Methods	This has been enabled through the aggregation of medication data from multiple data repositories into a single point, achieved by using medication statements through vendor developed FHIR services. When the clinical user accesses the information via an electronic prescribing medicines reconciliation module all data is returned and translated via dm+d mappings and structured dose syntax into a reusable prescription. The integration developed for the first stage has allowed the creation of a virtual medication record for reconciliation, but does not attempt to de-duplicate this data into a single record. The focus for the second stage is to bring the data into an independent clinical data repository in order to provide a more precise record for consumption by other systems. The expectation is to continue the use and development of the Medication Statement, with the introduction of an event mechanism to allow the Medication platform CDR to be actively updated. Through user design research and an iterative UI/UX approach a visualisation of a consolidated medication record from across providers will be produced. The integration utilises national standards such as dm+d, FHIR and structured dose syntax, therefore the outputs are intended to be scalable, vendor independent and 'blueprintable' by other care systems.
Results	As of January 2022 the first objective has been technically delivered by supplier partners and is undergoing clinical validation and a DCB0160 aligned clinical safety review. The aim is to have the solution in Live pilots by the second quarter of the year. The solution can currently be fully

	demonstrated in a test environment. The development of the second objective has commenced and is scheduled to run throughout 2022, design concepts are anticipated to be available in the first half of the year following the completion of user design research.
Conclusion	A collaborative system wide approach to data sharing, enabled by innovative partnerships, open engagement and user-design research has proven effective in delivering a first of type solution, which has the potential to deliver significant benefits to direct patient care. The quality and efficiency gains that can be enabled through the adoption of core national interoperability standards and structured medications data can be demonstrated through their practical application to existing systems, via visualisation in user interfaces that are already embedded in key to care pathways. The foundations have been established for a next phase of consolidated medicines record views, these will build on existing capabilities with a view to further unlocking benefits in patient safety, quality and service efficiency. This journey will continue explore several undefined areas of digital solution development and application, whilst simultaneously expanding the underlying capabilities needed to move towards a learning health system.

Name	**Suzy England**
Organisation	Royal College of Occupational Therapists
Title	The data literacy learning and development needs of occupational therapists.
Objective	There is a lack of national occupational therapy impact data and occupational therapists report challenges collecting, using, and sharing information as part of professional practice. All occupational therapists need a firm grasp of data, but little is known about how confident occupational therapists feel working with data at different points in their career and in different roles and contexts. The objective of this research is to better understand the challenges facing occupational therapists and to consider what activities will support the development of the professions data literacy skills as part of a two-year programme of activity led by the Royal College of Occupational Therapists.
Methods	The research method is a UK survey open to every occupational therapist working in the UK (open throughout the duration of January). The survey is being shared through the monthly professional magazine (OT News), email networks, health and care digital forums as well as social media. This is a descriptive study that will help the researcher to understand the confidence of occupational therapists to use, collect and share professional data alongside any barriers to improving data practices. The survey captures demographic and personal characteristics information which enables the researcher to identify differences between occupational therapists employed in different contexts in different geographical locations e.g. NHS and Local Authority as well clinical specialism e.g. physical and mental health. Occupational therapists are asked about their access to data literacy CPD opportunities and what they think they need from a professional body to improve their data literacy. The data will be analysed through descriptive statistics and the content analysis of open comments.
Results	There was over 300 responses to the survey with good representation from every region of the UK. As expected a significantly high number of the responses were from occupational therapists employed in NHS roles, of them the responses covered a wide range of clinical areas from acute care to primary care. 85% of those surveyed report

	using an electronic system to document occupational therapy information and 40% of those report using more than 2 systems to access information to provide safe care. Despite a high number of electronic record keeping usage, 49 % of respondents report that the only formal training they received was system specific. When it came to using data to improve individual and service outcomes only 15% of respondents felt confident. The survey findings overall provide a useful insight into the experiences of occupational therapists in different contexts and at different points in their career.
Conclusion	There were over 300 responses to the survey with good representation from every region of the UK. As expected, a significantly high number of the responses were from occupational therapists employed in NHS roles, of them the responses covered a wide range of clinical areas including acute, in patient, community and primary care. 85% of those surveyed report using an electronic system to document occupational therapy information and 40% of those report using more than 2 systems to access information to provide safe care. Despite a high number of electronic record keeping system usage, 49 % of respondents report that the only formal training they received was system specific. When it came to using data to improve individual and service outcomes only 15% of respondents felt confident. The survey findings overall provide a useful insight into the experiences of occupational therapists in different contexts and at different points in their career. A wide range of different data literacy CPD activities were identified by occupational therapists at different points in their carer. These recommendations could be useful insights for pre and post registration providers of occupational therapy education, system developers, professional bodies and organisations who employ occupational therapists.

Name	**Melissa Andison**
Organisation	Surrey and Borders Partnership NHS Foundation Trust
Title	Digital Health Safety Matters: Early insights from a promising practice study in Australia.
Objective	Rapid deployments of digital technologies do not often assess and understand patient safety risk; resulting in harm, which have ethical and legal considerations (HEE, 2019). It has been recognised that the Covid -19 Pandemic accelerated digital adoption (Greenway et al., 2021; Hutchings, 2020; Issa, 2020). The NHS has received caution of the potential risks of the use of digital technologies during the pandemic (Hutchings, 2020). To nurture emerging digital health safety culture, safety assessment practice is worthy of study. Further, identifying factors that support the promising adoption and implementation of safety practices will promote maturity across digital health professionals.
Methods	Conducted for a Master's Dissertation in Digital Health Leadership with The Institute of Global Health Innovation Imperial College, this study uses a promising practice model to identify assets of the Australian healthcare system to achieve patient safety when deploying digital health technologies. The question guiding the study is: what are the factors that need to be evaluated to support the scaled adoption and implementation of e-safety guidelines as a professional practice in Australia? Taking into consideration the socio-technological factors of digital health safety the research strategy uses a mixed method to generate a creative and innovative study. Qualitative data will be collected from stakeholders from the Australasia Institute of Digital Health (AIDH) members and Certified Health Informatician Australasia (CHIA) Alumni via surveys, interviews and focus group. This will be analysed alongside data mined from existing documents and artefacts to understand trends, implications and what is grounded in national policy. It is expected mining of the AIDH resources will provide further insights into adoption and scaling of e-safety practices by the digital health community. The presentation will share reflections of the experience conducting international research and how networks like the UK FCI and AIDH can knowledge.
Results	The promising practice investigation is related to the larger problem of the adoption of safety standards to ensure innovative new ways of working do not compromise patient safety. The presentation will share results the international literature review and early insights of the first phase of data analysis. Evidence from the literature has exposed the

	current healthcare information technology safety practice challenges. There were few studies that focused on the factors influencing the adoption of digital health safety standards, however the review surfaced seven key areas that need to be understood and require attention to improve safety practice and culture, which will be summarised in the presentation. A comparison of safety frameworks from the UK, USA and Australia will be presented to the audience to help spark discussion of strengths and limitations of current approaches. In addition, a review of the unique assets of the Australian E-Health Safety Guidelines and resources will be provided. Finally, a maturity model to guide the professional practice to assist organisations determining their status in adopting e-safety into governance, policy, process, culture, and other facets of operations will be shared (Rowlands, Zelcer & Williams, 2017).
Conclusion	As a science, measuring digital health and patient safety remains basic (Singh & Sittig, 2016). The health science community recognises digital health safety is challenging and international efforts are being made to understand the socio-technical dynamics to ensure patient safety (Sittig et al., 2020). Given the the national focus 'to embed digital clinical safety across health and care' (NHS X, 2021, p. 25), it is timely to look beyond to source exemplar organisations and best practice to participate in research. In contrast to the approach taken by the NHS Digital to mandate digital health safety standards, in Australia the Patient Safety Electronic Health (E-Health) Professional Practice Guidelines empowers organisations to establish 'best fit' with their strategic and operating context. This study is framed alongside the national NHS Digital Clinical Safety Strategy and searches for evidence of a promising practice related to the Australian E-Health Professional Practice Guidelines. This presentation will be beneficial for Clinical Safety Officers looking to further skills and knowledge, Chief Clinical Information Officers tasked with developing their clinical safety risk management process and Trust and Integrated Care Services investing in team building, recourses, and capability.

Name	**John Williams**
Organisation	Nuffield Department of Primary Care Health Sciences
Title	Implementing SNOMED CT in the Oxford-Royal College of General Practitioners Research and Surveillance Centre, which uses patient level coded general practice data, to replace dependency on Read version 2 and Clinical Terms Version 3: Problems encountered and solutions adopted
Objective	Identification of significant problems encountered and solutions adopted while implementing SNOMED CT to replace legacy coding schemes in a busy research and surveillance unit using patient level coded General Practice data held in a database populated by extraction from a subset of English General Practices: • Setting up a full SNOMED CT database from scratch • Changing data extraction / search processes throughout the unit away from the use of legacy Read version 2 and Clinical Terms Version 3 codelists to reusable SNOMED CT 'variables' held in a library • Establishing a robust process for curating, storing and maintaining SNOMED CT 'variables'

Methods	Retrospective review of an implementation project.
	• Setting up full SNOMED CT database. Research required to find clear instructions as to how the release files available from TRUD should be processed to build a fully functional database and to avoid pitfalls. Further research to develop understanding of SNOMED CT concept inactivation and how to mitigate effects
	• Collation of legacy codelists into consistent format to pass through cross mapping tables
	• Design and implementation of infrastructure to hold reusable SNOMED CT 'variables' taking into account naming, provenance, metadata to be included, handling of inactive concepts
	• Development of robust and time efficient SNOMED CT variable curation process
	  o Development of supporting tools
	  o Training of clinicians to curate
	• Explaining to researchers the concept of reusable 'variables' and the need for them to modify practices in order to match research and surveillance data needs to an existing library of 'variables' and to seek curation of new variables to fill gaps
	  o Consideration of problems with defining research / surveillance data requirements
	  o Providing the means to search the library

	o Explanation of the implications of inactivations o Version controls o Consideration of how best to convey the coverage and definition of 'variables' to others
Results	• SNOMED CT database successfully set up: Combination of experimentation, outdated advice found in grey literature, informal help from terminology expert colleague • Legacy codelists: Found 350 in multiple formats, little or no provenance or definition, idiosyncratic naming. All translated in batch via cross mapping tables. Resulting outputs used as substrate for full curation. Only 154 of these taken forward. Full curation typically added many extra active and inactive concepts • Infrastructure developed: Supporting: o Unique naming and numbering of 'variables' o Agreed editorial principles for naming o Recording of dates and names of curator and checker o Agreed metadata including output type, option for free text comment o Storage of 'variables' in supertype / subtype format o Generation of concept flatlists for searches on demand • Agreed curation process, making best use of supertypes that can be added or subtracted. 'SNOMED CT helper tool' developed. Curating team trained in its use. All 'variables' checked by second team member • Interaction with researchers. o Difficulties with: ▪ Shifting thinking away from fixed code lists ▪ Obtaining plain English definitions of requirements ▪ Matching requirements to existing 'variables' / to identify gaps; help needed from curation team ▪ Explaining implications of inactivations o Scepticism about re-usability
Conclusion	• SNOMED CT database implementation hampered by poor quality, inaccessible, guidance • Cross mapping legacy codelists of limited value. Significant time wasted in inferring definition / purpose. Curation against full SNOMED CT led to richer more complete concept lists, and rejection of

	some original concepts as erroneous. Less than half of legacy codelists were fully processed into the library. Better to start afresh and apply clear definition direct to SNOMED CT
	• Infrastructure
	  o 'Variables' stored in supertype / subtype formulation easily exportable as Expression Constraint Language (ECL) statement which is human readable and computable. Built-in mitigation for inactivations occurring over time
	  o Easy to overlook resources required to design and implement fit for purpose supporting infrastructure
	  o No agreed standards for:
	  ▪ Naming 'variables'
	  ▪ Associated metadata
	• Curation process:
	  o Good support tooling essential to achieving major savings in time and increased efficacy.
	  o Curators should
	  ▪ Have clinical knowledge
	  ▪ Work as a team
	  ▪ Check each other's work
	• Interaction with researchers
	  o Reproducibility of 'variables' still dependent on code lists whereas SNOMED CT version plus ECL formulation might be more robust and meaningful
	  o Data requirements evolve as projects develop, leading to variable mapping changes. Version control of documentation essential

Name	**Michelle Sykes and Samuel Smales**
Organisation	Leeds Teaching Hospitals Trust
Title	Introduction of electronic recording of Observations with bespoke safety functionality in the Electronic Health Record (EHR) for the Children's Hospital at Leeds Teaching Hospitals Trust (LTHT).
Objective	Electronic observations incorporating ePAWS (Paediatric Advanced Warning Score) was developed as a bespoke functionality within the EHR for implementation across the Children's Hospital. ePAWS supports the identification of patients at risk of deterioration using a graded response strategy. To promote effective working, the functionality enables observations to be recorded via mobile device or ward computers and has enhanced safety features to support early identification of the deteriorating child. This work followed the successful development and implementation of eObservations incorporating NEWS2 for adult patients with a recognised improvement in the detection of deteriorating adults.
Methods	ePAWS was developed from the existing paper based graded strategy. Logic within the functionality calculated the score and presents the relevant strategy advice to the user on observation submission removing the risk of calculation errors and ensuring appropriate actions are taken. Additional safety features including wristband scanning to support patient identification, requirement for a Registered Nurse countersignature for higher risk scores recorded by a clinical support worker, tasks generated for observation due time and for an intervention to be recorded for higher risk scores. To promote visibility, the ePAWS scores and related strategy colour present on the desktop, mobile and electronic white board. There is also the ability to set bespoke parameters for children with different physiological norms. The functionality displays the results in chart and table views with the ability to tailor this to view different trends. Recognising the importance of the change in practice required for using the new functionality, an enhanced training and support plan was implemented utilising mandatory e-learning supported by a dedicated training team to provide group, one to one and go-live floor walking.
Results	User engagement in the move to digital recording of electronic observations and ePAWS was seen across the Children's Hospital. Linking ePAWS to the electronic ward view was recognised to promote visibility of deteriorating

	patients and supporting staff to ensure observations are recorded and actioned in accordance with the strategy, promoting patient safety. Clinicians acknowledged the benefit of observations being recorded on a central digital system enabling all health professionals involved in the patients care to review the observations from anywhere in LTHT and externally. Clinician feedback recognised that a chart view which can be tailored to enable easy identification of trends e.g. looking at a patient's Blood Pressure over a period of time is valuable. Supporting implementation with mandatory elearning to be completed prior to go-live and a dedicated support and training team ensured the functionality was quickly, effectively and safely embedded in practice. Staff highlighted the benefits of no missing paper documents, clear awareness of the actions to take and the additional patient safety from Registered Nurse countersigning for patients with higher scores.
Conclusion	The implementation of electronic observations and ePAWS has been highly successful, with improvement in the escalation of care for deteriorating patients. The enhanced visibility and additional safety features within the system promote patient safety through clear, standardised strategy adherence. The utilisation of e-learning and on the ward training and support during go-live was recognised to have supported the safe, timely transition to digital working. The e-learning is now part of the induction programme for all new trust clinical staff. It is clear that functionality requires user training and support for it to achieve its potential for patient care and safety.

Name	**Nav Paul**
Organisation	Whittington Health NHS Trust
Title	Dermatology and the metaverse: what's on the horizon?
Objective	To explore how the metaverse, a computer-generated reality and next-generation infrastructure of the internet, could impact dermatology in the future.
Methods	A literature review was conducted to determine the considerations relevant to dermatology.
Results	The metaverse has rapidly become a part of life for the digital native population and includes virtual reality (VR), augmented reality (AR) and mixed reality (MR) technologies (1). VR is a fully immersive digital environment whereas AR overlays digital information onto real-world elements. MR combines real-world objects with digitally generated ones, allowing them to interact in real time (2). The vast majority of research in the health metaverse has encompassed AR/VR/MR through medical education, surgical procedure training, patient information and engagement thus far (3,4,5). Despite dermatology being a visual specialty, limited progress has been made in real-world clinical practice (6). Artificial intelligence (AI) has been central to diagnostics through convolutional neural networks (CNNs), consistently achieving dermatologist-level classification of two-dimensional images of skin lesions (7). However, future technology will be capable of creating three-dimensional (3D) reconstructions of the body skin surface using human haptic tactile perception information amalgamated with a digital image, providing addition clinical diagnostic information. Developments in 3D visualisation and haptic feedback systems are also expected to revolutionise Moh's micrographic and dermatological surgery in the future (8). Similar immersive technologies could enhance the provision of dermatology training through VR clinics whilst educational resources may incorporate synthetically created skin images using Generative Adversarial Networks (GAN) to demonstrate dermatological presentations (6). This process could enable the development of cross-border educational resources and maintain training through any future pandemics. New approaches to education in the metaverse also include gamification, such as a skin cancer awareness programme exemplified in Australia (9). The health metaverse is also expected to incorporate the development of virtual teams (VT), geographically

	dispersed individuals collectively serving a person (10), potentially centralising the provision of care.
Conclusion	The health metaverse has many potential benefits for the healthcare ecosystem to interact in a three-dimensional immersive way, altering the traditional medical model during consultation and education. Dermatology is a visual speciality ripe for research in this field, as the skin is an accessible organ amenable to an array of digital technologies. Clinicians, trainees and patients are key stakeholders in the development of the health metaverse and should be encouraged to be engaged and advocate for the needs of the population for the future. References and further information can be provided on request.