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Learning from electronic prescribing errors: a mixed methods study of junior doctors' perceptions of training and individualised feedback data

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ABSTRACT

Objectives To explore the views of junior doctors towards (1) electronic prescribing (EP) training and feedback, (2) readiness for receiving individualised feedback data about EP errors and (3) preferences for receiving and learning from EP feedback.

Design Explanatory sequential mixed methods study comprising quantitative survey (phase 1), followed by interviews and focus group discussions (phase 2).

Setting Three acute hospitals of a large English National Health Service organisation.

Participants 25 of 89 foundation year 1 and 2 doctors completed the phase 1 survey; 5 participated in semi-structured interviews and 7 in a focus group in phase 2.

Results Foundation doctors in this mixed methods study reported that current feedback provision on EP errors was lacking or informal, and that existing EP training and resources were underused. They believed feedback about prescribing errors to be important and were keen to receive real-time, individualised EP feedback data. Feedback needed to be in manageable amounts, motivational and clearly signposting how to learn or improve. Participants wanted feedback and better training on the EP system to prevent repeating errors. In addition to individualised EP error data, they were positive about learning from general prescribing errors and aggregated EP data. However, there was a lack of consensus about how best to learn from statistical data. Potential limitations identified by participants included concern about how the data would be collected and whether it would be truly reflective of their performance.

Conclusions Junior doctors would value feedback on their prescribing, and are keen to learn from EP errors, develop their clinical prescribing skills and use the EP interface effectively. We identified preferences for EP technology to enable provision of real-time data in combination with feedback to support learning and potentially reduce prescribing errors.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ A key strength is the sequential explanatory mixed methods approach that allowed further exploration of survey responses with in-depth qualitative data from interviews and focus groups.
⇒ All foundation doctors in the organisation were invited to participate; this enabled capture of a range of views and experiences of electronic prescribing (EP) training and feedback that could be used to identify targets for improvement.
⇒ Findings from a single organisation may not be generalisable to other hospital settings, but may be useful for those using similar EP systems and providing similar types of training.

BACKGROUND

Prescribing errors are reported to affect 7% of inpatient medication orders.[1] Worldwide, medication errors comprise a global patient safety issue, costing an estimated £33 billion.[2]

Electronic prescribing (EP) is generally advocated for reducing prescribing errors but studies have typically focused on the technology and not the human factors or educational aspects.[3] A systematic review highlighted that EP systems can introduce other error types, including incomplete computerised displays, selection errors in drop-down menus, reliance on default settings and over-dependence on clinical decision support.[4] Therefore, the transition to EP in the English National Health Service (NHS) introduces an additional component for which staff require training.

Medication safety research based on theories of human error suggests that prescribing errors occur as a result of latent and environmental conditions aligning with, or contributing to, failures in defences.[5] Learning from prescribing errors requires an understanding of the context (both at system and individual level) and that feedback be provided for relevant stakeholders, including prescribers. Past research has generally focused on measuring prescribing errors or root cause analysis[6–10]; more recent publications on feedback

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interventions to improve prescribing are still primarily in the context of paper drug charts.[11–14]

In the UK, newly qualified ('junior') doctors have previously been identified as having one of the highest error rates among prescribers, as well as doing most inpatient prescribing.[6 15] The UK Foundation Programme is a 2-year mandatory training programme for newly qualified medical graduates. The Royal College of Physicians recognises that supporting junior doctors in safe prescribing requires education, practical resources and a culture of patient safety.[16] Numerous studies have identified this novice prescriber group as a focus for educational interventions but to date, most have been in the context of paper-based prescribing.[3 11–14]

A previous questionnaire study of junior doctors and hospital pharmacists identified that receiving structured feedback, including prescribing rates, was well received.[17] However, this work was conducted in the context of paper-based prescribing and required resource-intensive manual audits; this resulted in considerable delay for feedback and was not sustainable for routine implementation. We have therefore identified a literature gap in relation to EP feedback for junior doctors. This study aimed to explore the views of junior doctors towards (1) the EP training and feedback they receive, (2) readiness for receiving individualised EP feedback data and (3) preferences for how they would like to receive and learn from EP feedback.

METHODS

Setting

We conducted a mixed methods study at three large hospitals within an English NHS organisation (trust). The organisation has approximately 10 000 staff serving a population of one million people. EP has been active in most inpatient areas since 2016. This study focused on one organisation so that participants were referring to the same EP system and had equal access to training resources.

Classroom-based training was offered at trust induction for junior doctors. Optional EP training resources include online learning modules (generic and specialty-specific), 'Quick Reference Guides' on the trust's intranet, some postgraduate teaching sessions and EP technical support. EP 'order sentences' with default doses were available for many commonly used medications; clinical decision support tools such as allergy and drug interaction checking were not in routine use at the time of the study.

Participants

All foundation doctors in their first 2 years of practice (Foundation Years 1 (FY1) and 2 (FY2)) at the trust (n=89) were invited to participate. Participant invitations were circulated by the Trust postgraduate education team and blinded to the research team. The year groups were approximately equal in size.

Study design

This was an explanatory sequential mixed methods study comprising two phases: phase 1 was a quantitative questionnaire delivered to all foundation doctors in February/March 2018 and phase 2 was a qualitative interview and focus group study with volunteer participants from the same population in April/May 2018. This study design was chosen to permit analysis of the quantitative data for broad perspectives followed by in-depth exploration of themes that required further explanation.

Patient and public involvement

There was no patient and public involvement in this study.

Data collection

Phase 1 questionnaires were distributed online and on paper. Email circulation via postgraduate education teams ensured that all foundation doctors working in the organisation had an opportunity to participate. The email summarised the purpose of the study and included a weblink to an online version of the questionnaire. In addition, paper questionnaires were distributed at teaching sessions.

In phase 2, the same population of foundation doctors were invited to participate in interviews. In addition, a lunchtime focus group was offered to maximise recruitment. Due to the anonymous nature of the survey, we did not confirm if any of the participants contributed to both phases. However, we decided that maximising recruitment for phase 2 was essential and invited the whole population to participate.

Phase 1—questionnaire study

The questionnaire comprised 65 questions (online supplemental appendix 1). This was based on a questionnaire used in a previous study.[17] There were two major adaptations: (1) questions were adapted to reference EP (rather than paper-based prescribing), and (2) clinical scenarios were added. Most responses required were on 5-point Likert scales ranging from 'strongly disagree' to 'strongly agree'. Where relevant, there were additional options for 'not used' or 'not available'. The questionnaire was not psychometrically tested.

Four clinical scenarios were devised by research pharmacists as examples of prescribing errors with different levels of harm. These were based on categories from a national incident reporting system comprising 'no harm', 'low harm', 'moderate harm' to 'severe harm'.[18] The fifth category of 'death' was not included. Clinical details were devised from clinical experience and knowledge of local prescribing governance committees. The scenarios were prepiloted by four pharmacists and one doctor for face and content validity.

Phase 2—qualitative interview and focus group study

Interviews and a focus group were conducted using a prepiloted topic guide (online supplemental appendix 2). This was formulated after an interim analysis of survey results in phase 1 and identified areas of further

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interest. Six example prescribing error feedback formats were obtained from the published literature and shown to participants. A table of EP error types (eg, allergies, dosing errors) was also used as a prompt for discussion. Handwritten notes were recorded for both the focus group and the interviews, which included some verbatim comments from participants.

Data analysis

Phase 1 quantitative data were summarised using descriptive statistics, using Microsoft Excel. Positive responses ('agree and strongly agree') and negative responses ('disagree and strongly disagree') were combined when reporting the data. Neutral responses were included in the figures.

Phase 2 interview and focus group notes were transcribed and then analysed thematically using an inductive approach. This involved systematic coding of the transcripts, organising codes into categories followed by grouping into broader themes (Appendix 3). Two researchers conducted this independently, with quality assurance by a third, more experienced researcher. Comparison between the interview and focus group data sets suggested that themes were similar and could be integrated. Themes were discussed to consensus. Member checking was not used.

The quantitative and qualitative data were then further integrated at the discussion phase. This included reflection on whether the data was complimentary or if there were areas of divergence. This was discussed to consensus by the wider research team.[19 20]

RESULTS

In the phase 1 quantitative study, 25 of 89 (28%) foundation doctors submitted responses. Respondents comprised 14 women (56%), 8 men (32%) and 3 whom did not disclose their gender. The majority were FY1 (n=16), six were FY2 (n=6) and three did not indicate their grade. Respondents were from 14 different medical schools.

In the phase 2 qualitative study, 12 participants took part in either a focus group (n=7) or an individual interview (n=5). Eight were FY1 and four were FY2.

Phase 1: quantitative survey data

Current level of EP training and feedback

Foundation doctors reported varied experiences of EP and associated training resources (figure 1). They were equivocal as to whether EP reduced the number of prescribing errors that led to patient harm (12/25 agreed). Similarly, about half of them were satisfied with the training that had been provided at induction (13/25). More than half of them were satisfied with the availability of resources to enable them to prescribe safely (18/25). However, there was a lack of awareness and/or use of specifically tailored training resources. Some reported not having received EP classroom training (7/25) and 13/25 reported not using the specialty-specific training modules. The majority reported not receiving the training provided as part of the postgraduate education sessions (14/25) or not having used the 'Quick Reference Guides' and crib sheets available on the intranet (17/25). However, in free-text responses, respondents perceived that training on the EP interface

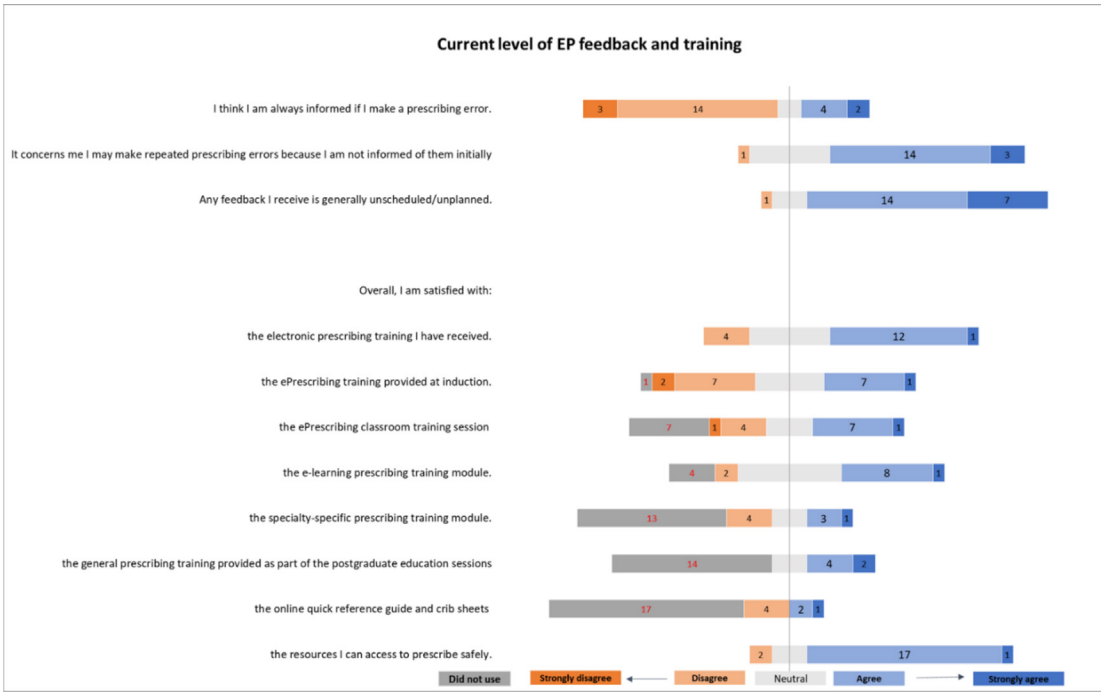

Figure 1 Survey results: current level of electronic prescribing (EP) feedback and training reported by Foundation doctors (numbers correspond with number of respondents, total 25 participants).

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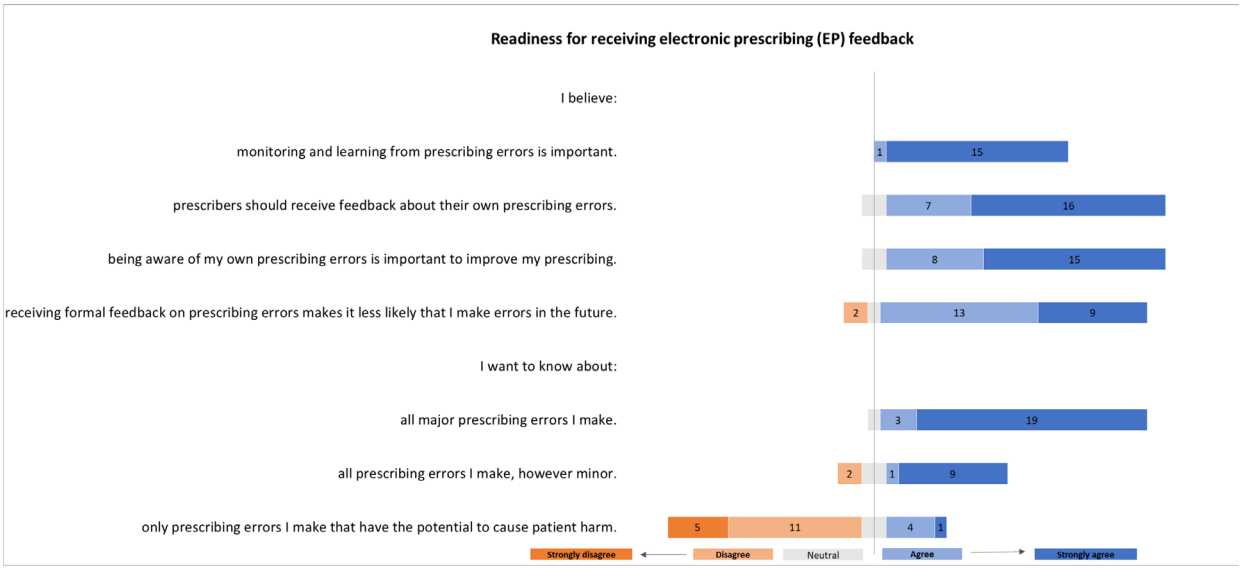

Figure 2 Survey results: readiness for receiving EP feedback reported by Foundation doctors (numbers correspond with number of respondents, total 25 participants).

would be useful, and that better understanding of the EP system might help prevent errors.

The majority of the respondents said they were not always informed of their own prescribing errors (17/25) and that this was of concern. If they did receive feedback, this was generally in an unplanned or unscheduled way (21/25). Free-text responses reconfirmed that 'little' or 'rare' feedback was received. Junior doctors stated they would seek EP help from their peers (23/25), pharmacists (22/25) or more senior doctors (12/25). However, they said they generally did not ask nurses (6/25) or consultants (2/25).

Readiness for receiving individualised EP feedback data

Most respondents (23/25) believed receiving feedback about prescribing errors was important and that being aware of their own errors would help improve their prescribing (figure 2). They believed receiving formal feedback on prescribing errors would reduce future errors (22/25). Foundation doctors wanted to know about all prescribing errors they made (22/25), including minor errors (19/25) and confirmed this when presented with example clinical scenarios covering 'no harm' (18/25) and 'low harm' (22/25).

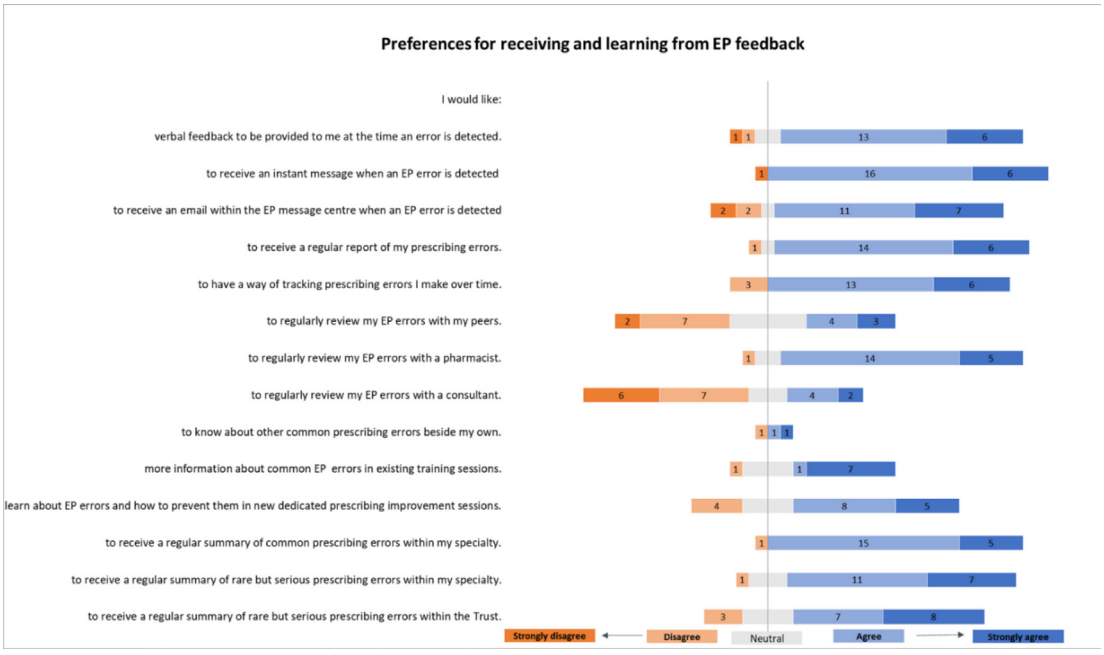

Figure 3 Survey results: preferences for receiving and learning from electronic prescribing (EP) feedback reported by Foundation doctors (numbers correspond with number of respondents, total 25 participants).

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Preferences for receiving and learning from individualised EP feedback

Participants were keen for individualised feedback data to be timely; they supported a variety of methods including verbal (19/25), instant messaging (22/25) and/or EP system emails (18/25) (figure 3).

Respondents were receptive to the idea of receiving a regular report (20/25) and the ability to track errors made over time (19/25). They were keen to review personal EP errors with a pharmacist (19/25). However, there was a lack of consensus about doing this with their peers (7/25 agreed and 9/25 disagreed) and opposition to reviewing EP errors with a consultant (6/25 agreed and 13/25 disagreed).

Participants were also keen to learn from others' prescribing errors that were relevant to their practice (20/25). This information could be received in several ways, including on the ward (14/25), in existing training sessions (17/25) or new dedicated sessions (13/25). They were also receptive to receiving a regular summary of common prescribing errors within their specialty (20/25), rare but serious errors in their specialty (18/25), and in the organisation (15/25).

Phase 2: qualitative interview and focus group data

Preferences for receiving and learning from EP feedback

Participants discussed both general prescribing feedback and their perceptions of EP-specific feedback. Participants' preferences for receiving and learning from prescribing feedback were grouped into four themes: (1) nature of individualised feedback data, (2) context of feedback, (3) learning from feedback and (4) EP-specific feedback.

Nature of individualised feedback data

The most consistent theme among participants was the need for timely feedback when specific errors were detected. This was especially important for significant clinical errors. Due to working patterns, the original prescriber might not be aware of their prescribing error at all. Feedback on a specific error within a week or two was required to optimise recall of the patient's clinical situation and the doctor's working context. More timely feedback using the EP system was a perceived advantage expressed by participants, compared with feedback based on paper drug charts and manual audit.

Participants wanted individualised feedback data to be specific, tailored and concise. They also focused on the learning aspect rather than the error itself and wanted feedback to be non-judgemental, balanced and motivational, especially if delivered by email.

> It would be nice to have a headline that says something like 'congratulations, you only made two errors this past month'—give some positive feedback as well as information about prescribing error (FY2, interview 2).

> Error rate sounds a bit judgey [sic] and feels like an attack, feels like you've been watched (FY1, focus group).

In terms of format and content, there was no consensus on preferences around the example reports shared. Instead, a combination of text, illustrations, graphs and case studies were generally considered to be useful.

Context of feedback

Although participants were generally positive about receiving feedback on EP errors, this depended on the context in which it was given and received. An important factor was the feedback provider. EP feedback in a report from an anonymised source was perceived to be potentially problematic due to workload pressures and limited time to focus on emails. Most participants had received verbal feedback from their ward pharmacist who had corrected an error and were comfortable with this if they had worked with them before. There was a degree of trust and confidence in particular with specialist clinical pharmacists (eg, renal, paediatrics) as they were perceived to understand the nuances of prescribing for their patient cohort and were able to better highlight clinically relevant errors. However, participants raised concern about the potential workload for their ward pharmacist if more regular formal feedback was to be delivered due to the time required for data collection and also being able to reciprocate with time to receive feedback.

> Sometimes pharmacists will say "oh you do know that you got this wrong" but it's done casually (FY2, interview 1).

There was consensus from participants that feedback on more significant prescribing errors (ie, those associated with potential or actual 'major harm') was very important. The value of feedback for less serious errors was less convincing as participants perceived that they would not have time to focus on all errors. When given a list of example error types, participants ranked prescribing a drug to which a patient has an allergy as the most important error to receive feedback on. Clinical contraindications, omissions and unnecessary prescribing were also prioritised for feedback. However, dosing errors and formulation errors were not.

Learning from feedback

Participants acknowledged that learning from prescribing feedback could take place at an individual level, in a group setting or even at organisational level.

There were mixed feelings about learning from data such as baseline error rates; some participants perceived this to be helpful for context, while others felt that statistics (especially in isolation) would not be as helpful for learning in comparison to narrative feedback. Similarly, benchmarking statistics with peers had a mixed response; some participants valued the quantitative aspect while others were unclear about how this would advance their learning and were afraid of being judged.

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> Error rates is like a per cent on your exams…It doesn't say anything, and you can't learn from it (FY1, focus group).

However, there was general agreement that learning about prescribing errors in the form of case studies was a helpful educational tool. Learning about errors made by peers in a group setting was useful, especially as foundation doctors rotated specialties. However, it was noted that reporting on real EP errors publicly needed to be done carefully and anonymously, as there was concern about having a negative impact:

> …it might break the team spirit (FY1, focus group).

One participant was clear that all prescribing errors were significant for patient safety and that accepting minor errors was suggestive of professional 'laziness'. Instead, they felt that the organisation should be learning from all types of errors and cultivating good prescribing practice:

> 'We as a hospital are lazy… for example, in giving the indication for medications (FY2, interview 4).

The team prescribing culture was felt to be important, as junior doctors were influenced by senior decision-makers, particularly in terms of bad habits or prescribing outside the protocol. Moreover, prescribing decisions were often made by the consultant but enacted by the junior doctors. Therefore, one participant suggested providing feedback to the team in general as well as individuals.

> The junior doctors are a lot influenced by the senior doctors and there is a hierarchy, sometimes I want to say something… but it's in some way difficult to correct them. But anyway, I just say it… because patient safety is the priority… It's the job of the entire team to look at the drug chart and review it (FY1, interview 4).

In addition, error rates on its own might not be helpful for comparing between specialties with different prescribing cultures, therefore reducing the validity of the data.

> Graphs are a nice idea in some ways… but if you are in a specialty and you are not making many errors, it's weird to be like "oh well, I do way better than the other specialties" … how serious are these errors on the graphs? If you do badly it's embarrassing for the team, but it can be a good thing for some… maybe they are going to do more to do their best (FY2, interview 5)

EP-specific feedback

Participants perceived that the EP system architecture was capable of providing greater prescribing support than paper prescribing and there was a potential for EP data to be used for feedback. Participants wanted to have a better understanding of the EP system to avoid repeating errors and queried how EP error data would be accurately collected and judged. There was anxiety about being monitored and that automated EP data might not accurately reflect their abilities.

There were some examples of participants who had difficulties transitioning from paper-based prescribing. Specifically, participants found that the default settings for standard drug administration times made it more difficult to prescribe complex scheduling times, reschedule drug administration times and suspend medication doses. These EP-specific challenges exposed them to risks of making EP errors. Participants were keen to know how to use the EP system better in these situations and how the system could be adapted to be more intuitive.

Some participants also suggested that the national student prescribing safety assessment was not a good marker for preparedness and was not helpful for EP skills:

> it's very different from actually using the system (FY2, interview 5).

DISCUSSION

Key findings

Foundation doctors in this mixed methods study reported that current feedback provision on EP errors was lacking or informal, and that existing EP training and resources were underused. This feedback gap has been previously identified[17] and persists despite quality improvement initiatives at the study organisation. However, these have been difficult to sustain due to the use of manual audit and human resources, including individual ward pharmacists[21 22] Other studies have also identified that provision of safe prescribing training and induction is variable (including e-learning) due to the lack of a standardised prescribing curriculum for postgraduate doctors.[23 24]

Survey participants believed feedback about prescribing errors to be important and indicated readiness to receive real-time, individualised EP feedback data. Participants in the interviews and focus group expanded that feedback also needed to be in manageable amounts, motivational and clearly signposting how to learn or improve. Survey participants wanted feedback and better EP training to prevent repeating errors. In addition to individualised EP error data, they were receptive to learning from general prescribing errors and aggregated EP data. However, focus group and interview participants revealed that despite this surface acknowledgement, there was a lack of consensus about how best to learn from statistical data. Potential limitations included concern about how the data would be collected, whether it reflected clinical ability and time to reflect. Concerns about being performance managed have also been highlighted in other patient safety research with junior doctors.[25]

Participants in the survey, interviews and focus group all identified ward pharmacists as a trusted source and provider of feedback. This is consistent with other studies evaluating pharmacist-led feedback interventions.[11 12 14 26]

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Interpretation

This study supports the findings of previous research that foundation doctors want feedback on prescribing errors.[17] There is hope that EP technology could facilitate feedback data in a timely, individualised and digitised format to optimise learning. However, recent initiatives to extract EP data for this purpose is still challenging.[27] In addition, provision of EP error data in isolation would not be adequate to promote reflective practice and prevent further EP errors. This is consistent with other research suggesting that email feedback alone is less effective than group discussions or directly observed prescribing encounters.[28] In our study, participants described contextualising EP errors using illustrative case studies and having the opportunity to debrief with a pharmacist as potential learning opportunities. Enabling novice prescribers to have enough time and cognitive space to both consider the feedback and formulate an action plan were identified as potential challenges. An electronic feedback tool involving individualised learning plans has been described by others.[29]

Participants did not agree on the use of statistical data as a feedback mechanism. However, a Cochrane review suggests that audit and feedback interventions in healthcare are an effective method of stimulating behaviour change.[30] Perceptual control theory also recognises the role of 'benchmarking' against a 'reference standard' as a key motivator for behaviour change.[28] This might be due to the study exploring doctors' perceptions rather than a direct evaluation of experience.

In addition, interview participants discussed 'feedback', but it was not always clear whether they were distinguishing between general prescribing feedback and provision of EP data. It is therefore possible that participants and researchers were discussing different aspects of 'feedback' but using the term interchangeably to mean different things. This has also been found in the educational literature, where there is well-recognised incongruence between learners and teachers as to the definition, quantity and quality of feedback given and received.[31]

Strengths and limitations

The main strength of this study came from combining quantitative and qualitative data collection methods. This gave us the opportunity to explore the research question from different perspectives. The survey was completed by more participants and captured a broader range of respondents, while the interviews and focus group gave us an opportunity to probe responses in more depth. Eliciting the challenges perceived by foundation doctors was a strength of the qualitative data, as there were some underlying anxieties that were not readily captured by the survey data. The multidisciplinary nature of the research team (doctor and pharmacists, with medical education and medication safety expertise) was also a strength as we were able to contribute different perspectives to the data analysis from the context of our professional experience.

Limitations of this study include the low response rate and small sample size from a single organisation, which limits generalisability. It was not feasible to expand recruitment to other institutions or extend the timeline of the study. However, themes were being repeated, suggesting that the data was approaching saturation. There are differences between FY1 (newly qualified) and FY2 (independently registered) doctors, so including both cohorts in this study population may make it more difficult to design tailored interventions. The questionnaire was not psychometrically tested. There may be participation bias, particularly with the interviews and focus group, as respondents may be more likely to be interested in the study concept. They may also have provided socially desirable responses rather than their true viewpoints. We explored participants' perceptions rather than conducting a direct evaluation in practice. Participants therefore made hypothetical assumptions about the capability of the EP system and provision of EP data. The examples that participants were shown in the interviews were based on the existing literature at the time, and thus were mainly paper-based.

Implications for practice

This data informs future work for developing individualised, digital EP feedback data for prescribers. Feedback needs to be timely, concise and relevant, with a blended educational approach in terms of providing data and example case studies, both verbally and electronically. Situational factors should be acknowledged, and feedback should be supportive and non-judgemental. Consideration should be given to the role of pharmacists in providing feedback, allocating sufficient time for prescribers to focus on feedback, prioritising the relative importance of EP errors and support formulation of action plans. Other learning points include improving awareness and engagement of EP training opportunities, changing the focus to prescribing accuracy (rather than on errors), maximising opportunity for reflective practice (not just providing information) and enabling individuals to contribute to organisational learning and improvements (eg, reporting EP system defaults). A challenge to achieving this in practice includes staffing and time resource, as well as digital capability.

Future research

Future research should focus on the evaluation of EP feedback mechanisms and integrating this into clinical practice for novice prescribers. The feasibility, acceptability and use of these tools should be considered and appropriate mechanisms for providing context and promoting learning put into place. Challenges, unintended consequences and resource implications of introducing a novel EP feedback interface should also be captured. Our study focused on junior doctors as the main prescribers in hospitals, but in the UK, independent nurses and pharmacist prescribers also have an important role, thus provision of prescribing feedback to multiprofessional prescribers should be explored. Future educational interventions

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could consider combining individualised EP feedback data with modern initiatives including simulation and video-stimulated feedback.[13 32]

CONCLUSION

The digital transformation of hospital inpatient prescribing presents a timely opportunity to develop, implement and evaluate an individualised prescribing feedback and learning initiative to reduce prescribing errors. Foundation doctors in this study are receptive to receiving value feedback on their prescribing, keen to learn from errors to develop their clinical prescribing skills and want to use the electronic interface effectively.

Our findings suggest a range of educational options would be a positive strategy to enhance the value of individualised EP feedback data for novice prescribers. We found a demand for EP technology to enable provision of real-time feedback to support learning, thus potentially reducing prescribing errors. The next steps are to develop a feasible approach for extracting EP data, providing individualised EP feedback data and evaluating its use and effectiveness in practice.

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Contributors MM and BDF conceived the study and study design. Methods were developed by MM, BDF, GD and AK. Data were collected by AK, GD and MM and initial data analyses were conducted by GD, AK, AC and MM. Interpretation of the data was discussed to consensus by AC, BDF and MM. The manuscript was prepared and revised by AC and MM. All authors reviewed and finalised the manuscript. AC is the author acting as guarantor.

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Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study met the Health Research Authority criteria for service evaluation; National Health Service ethics approval was not required. It was registered as a service evaluation within the trust (reference 266). The study was conducted in line with ethical research practice: ensuring voluntary participation, obtaining written consent for interviews and focus groups and anonymising data in line with data protection regulations. There was no patient and public involvement in this research. Participants gave informed consent to participate in the study before taking part.

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Data availability statement Data are available upon reasonable request.

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Appendix 1 Questionnaire template

Appendix 1:

Junior doctors' prescribing safety survey

Improving safety and effectiveness of electronic prescribing – how can training and learning from errors be improved?

Invitation: **All foundation year 1 and 2 doctors** at Imperial College Healthcare NHS Trust.

This questionnaire forms part of a study that aims to improve prescribing safety in hospitals with electronic prescribing systems. It centres on how the Trust can help make it easier to prescribe safely and effectively, particularly in the way in which electronic prescribing training and feedback about errors are currently provided. It also asks about your preferred methods for receiving feedback on your prescribing errors and learning from prescribing errors. Participation is voluntary, and all information will be treated confidentially. **If you have any questions, please contact monsey.mcleod@nhs.net on behalf of the Imperial Prescribing Feedback team.**

In the following questions, please select the answer that best represents your opinion by circling it.
(**SD**= Strongly Disagree, **D**= Disagree, **N**= Neutral, **A**= Agree, **SA**= Strongly Agree)

A. YOUR PRESCRIBING AND FEEDBACK EXPERIENCE

I am confident in prescribing the correct and appropriate **non-intravenous** medications for patients via Cerner.		SD D N A SA
I am confident in prescribing the correct and appropriate **intravenous** medications for patients via Cerner.		SD D N A SA
I would prefer to use a paper drug chart.	Never used	SD D N A SA
I think I am always informed if I make a prescribing error.		SD D N A SA
It concerns me I may make repeated prescribing errors because I am not informed of them initially.		SD D N A SA
I think receiving formal feedback on prescribing errors makes it less likely that I make errors in the future.		SD D N A SA
Any feedback I receive is generally unscheduled/unplanned.		SD D N A SA

B. QUALITY IMPROVEMENT

I believe electronic prescribing has reduced the number of prescribing errors that result in actual patient harm.	Don't know	SD D N A SA
I believe monitoring and learning from prescribing errors is important.		SD D N A SA
I believe prescribers should receive feedback about their own prescribing errors.		SD D N A SA
I believe being aware of my own prescribing errors is important to improve my prescribing.		SD D N A SA

C. TRAINING

Overall, I am satisfied with electronic prescribing training I receive.		SD D N A SA
I am satisfied with the following: ePrescribing training provided at induction.	Not received	SD D N A SA
I am satisfied with the ePrescribing classroom training session provided by the Trust Information Communications and Technology (ICT) team.	Not received	SD D N A SA
I am satisfied with the e-learning prescribing training module.	Not received	SD D N A SA
I am satisfied with the specialty-specific prescribing training I receive.	Not received	SD D N A SA

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Appendix 1 Questionnaire template

I am satisfied with the prescribing training provided as part of the postgraduate education sessions for F2/CMT (covers general prescribing safety including electronic prescribing tips).	Not received	SD	D	N	A	SA
D. RESOURCES						
Overall, I am satisfied with the resources I can access to prescribe safely.		SD	D	N	A	SA
When relevant, I like to use the 'EPA quick reference guide' and crib sheets on the Source to help me prescribe.	Not used	SD	D	N	A	SA
In general, I mostly contact the pharmacy EPA team for technical prescribing queries relating to the Cerner system.	Not used	SD	D	N	A	SA
In general, I mostly ask **nurses** for help whilst prescribing (for technical Cerner-specific queries or medication-related queries).	Not used	SD	D	N	A	SA
In general, I mostly ask the **ward pharmacist** for help whilst prescribing (for technical Cerner-specific queries or medication-related queries).	Not used	SD	D	N	A	SA
In general, I mostly ask **my peers** for help whilst prescribing (for technical Cerner-specific queries or medication-related queries).	Not used	SD	D	N	A	SA
In general, I mostly ask a **CMT** for help whilst prescribing (for technical Cerner-specific queries or medication-related queries).	Not used	SD	D	N	A	SA
In general, I mostly ask the **consultant** for help whilst prescribing (for technical Cerner-specific queries or medication-related queries).	Not used	SD	D	N	A	SA
In general, I mostly ask nurses for help whilst prescribing **out-of-hours**	Not used	SD	D	N	A	SA
In general, I mostly ask the on-call pharmacist for help whilst prescribing **out-of-hours**	Not used	SD	D	N	A	SA
In general, I mostly ask my peers for help whilst prescribing **out-of-hours**	Not used	SD	D	N	A	SA
In general, I mostly ask a CMT for help whilst prescribing **out-of-hours**	Not used	SD	D	N	A	SA
E. PROSPECTIVE FEEDBACK (specific error) INCLUDING EXAMPLE SCENARIOS						
I want to know about all **major** prescribing errors I make.		SD	D	N	A	SA
I want to know about **all** prescribing errors I make, however minor.		SD	D	N	A	SA
I **ONLY** want to know about prescribing errors I make that have the potential to cause patient harm.		SD	D	N	A	SA
I would like verbal feedback to be provided to me at the time the error is detected.		SD	D	N	A	SA
I would like to be able to receive an instant message when a prescribing error I've made has been detected.		SD	D	N	A	SA
I would like to be able to receive an email within the Cerner message centre when a prescribing error I've made has been detected.		SD	D	N	A	SA
I would like to receive feedback if I made this type of prescribing error:						
An 82-year-old male patient with hospital acquired pneumonia was prescribed temocillin 2g IV BD and amoxicillin IV 1g TDS. He had a penicillin allergy with known anaphylaxis but his allergy status had not been completed on the electronic prescribing system. The error was detected and corrected before it reached the patient.		SD	D	N	A	SA
A 67-year-old female admitted for elective right hip replacement was started on prophylactic antibiotics at induction. Cefuroxime 1.5g IV TDS was prescribed post-op, intended for 24 hours but no stop date was prescribed. The patient received cefuroxime 1.5g IV TDS for two extra days before it was stopped. The patient has not reported any side effects from the prolonged course.		SD	D	N	A	SA
A 55-year-old male with type 2 diabetes and hypertension was admitted. One of their medications, ramipril 10mg OD, was not prescribed and the patient missed their dose for 3 days over the weekend. Their blood pressure had increased gradually and is now 190/110 mmHg.		SD	D	N	A	SA

Appendix 1 Questionnaire template

A 11-month old girl was prescribed amoxicillin 125mg/5ml suspension twice. One was for 2.5ml TDS for one week, and the other for 5ml TDS for one week. The error was corrected before it reached the patient.	SD	D	N	A	SA

F. RETROSPECTIVE FEEDBACK (error trends specific to my own prescribing)

I would like to receive a regular summary of my prescribing errors.	SD	D	N	A	SA
I would like to have a way of tracking prescribing errors I make over time.	SD	D	N	A	SA
I would like the opportunity to regularly review my prescribing errors with **my peers**.	SD	D	N	A	SA
I would like the opportunity to regularly review my prescribing errors with a **pharmacist**.	SD	D	N	A	SA
I would like the opportunity to regularly review my prescribing errors with a **consultant**.	SD	D	N	A	SA
Feedback (review) sessions about prescribing errors of relevance to my specialty would be most valuable on the **ward**, (e.g. at handover, as part of ward round).	SD	D	N	A	SA

G. AGGREGATED RETROSPECTIVE FEEDBACK (of prescribing errors within Imperial)

I would like to know about other common prescribing errors besides my own.	SD	D	N	A	SA
I would like more information about common prescribing errors in existing training sessions.	SD	D	N	A	SA
I would like to learn about prescribing errors and how to prevent them in new dedicated prescribing improvement sessions.	SD	D	N	A	SA
I would like to receive a regular summary of **common** prescribing errors within my specialty.	SD	D	N	A	SA
I would like to receive a regular summary of **rare but serious** prescribing errors within my **specialty**.	SD	D	N	A	SA
I would like to receive a regular summary of **rare but serious** prescribing errors within the **trust**.	SD	D	N	A	SA

Please answer the following questions.
If you had enough time, what three things would make it easier for you to prescribe safely and efficiently?

_____

_____

_____

What are the main concerns regarding the current feedback you receive, if any, on prescribing errors?

_____

_____

Sex: F / M	Grade:	Medical school qualified from:

Please email monsey.mcleod@nhs.net on behalf of the Imperial Prescribing Feedback team for any of the following:

☐ I would like to receive a copy of the survey results
☐ I am happy to be contacted to clarify my answers above
☐ I am happy to be contacted about future improvement projects

Thank you for completing this questionnaire.
Please return to this to the Postgraduate Medical Education team at your site (directly or internal mail).

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Appendix 2 Interview Topic Guide

Prescribing Safety Feedback Interview

Thank you for taking the time to participate this study. My name is XX and I am currently doing some research into feedback on prescribing errors within this trust.

Have you had a chance to look at the participant information sheet? Do you still have any questions? Are you happy for us to take notes? Are you happy to sign this consent form? No identifiable information is being recorded.

This interview is part of a larger study to explore the views of junior doctors and other stakeholders about providing feedback concerning prescribing errors. The interview focuses on how best to provide feedback to foundation year doctors to help make it easier to prescribe safely on the electronic system. This includes receiving feedback on prescribing errors as well as tips for how to prevent them. Participation is voluntary, and these interviews are completely anonymous.

Selection of prescribing error related feedback strategies

We know from a recent survey at this trust that FY1 and FY2 doctors do want to receive feedback about their own prescribing errors and also learn from errors elsewhere. In response to this, we are now looking to get your views on a range of different methods for receiving prescribing feedback.

PART 1

I will show you a few ways of providing feedback to support learning from prescribing errors and would like your feedback on each strategy. [ACTION: give out documents – see below].

Questions to ask while they are looking at the documents:

1. Which of these feedback reports do you prefer? Please rank in order of preference.

- *[Wait until they have put them in order of preference, indicating which they think is best to worst (or if the same)]*

2. Can you tell me the reasons for your answer?

3. What changes to this feedback document would make this more useful to you?

a. Prompts: What would you like to see changed about the feedback concerning prescribing errors?

b. Prompts: Do you identify any problems with this feedback report? If you do, which problems?

c. Prompts: What do you like about the presentation style?

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d. Prompts: Is the information presented clear to you? Is the text big enough?

Appendix 2 Interview Topic Guide

Do you like the length of the feedback document or do you think we need to

add/remove some information?

4. If you want to receive feedback, how often do you want to receive a document like

these?

a. Prompts: Would you prefer to receive a feedback document weekly or

monthly or other?

PART 2

Thank you, now I would like you to look at the lists below.

1. 1ST column - please tick the top 5 types of data you would like to receive feedback on

and why.

2. 2nd column – please rank in order the denominators you would like to be used to

determine the error rate. Why?

NUMERATOR – **please tick top 5** Types of prescribing error (irrespective of actual or potential patient harm)	DENOMINATOR – **please rank (1 = most preferred info, 7 = least preferred info)**
□ Allergy □ Omission of medication □ Unnecessary prescribing □ Clinical contraindications □ Dosing errors □ Formulation errors □ Wrong route errors □ Lack of clear directions for administration □ Technical errors (e.g. no max dose) □ Duration of treatment errors □ Miscellaneous □ Other (please state):	□ No. of NEW medications prescribed (any time) □ No. of NEW medications prescribed 9am – 5pm □ No. of NEW medications prescribed out of hours □ No. of NEW medications prescribed (by day of week) □ No. of patients under the doctor's care (by consultant) □ No. of patients in which the doctor had prescribed at least one drug (irrespective of consultant/specialty/ward) □ Other (please state):

Did you receive feedback in the past via a different way than the methods discussed in this

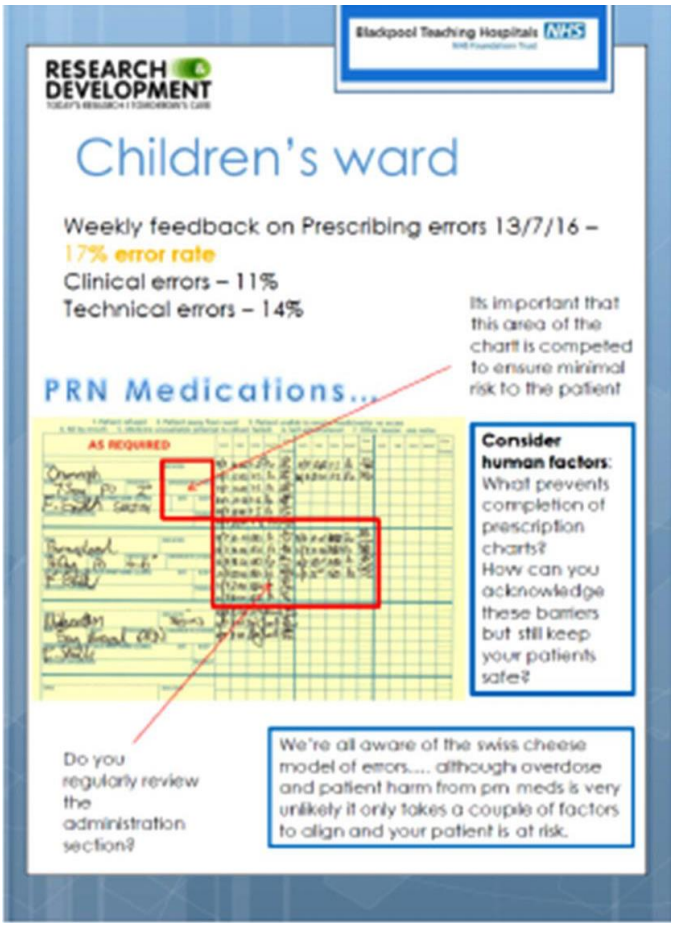
interview?

Is there anything else you would like to add?

Thank you for participating on this interview. Your contribution is very much appreciated

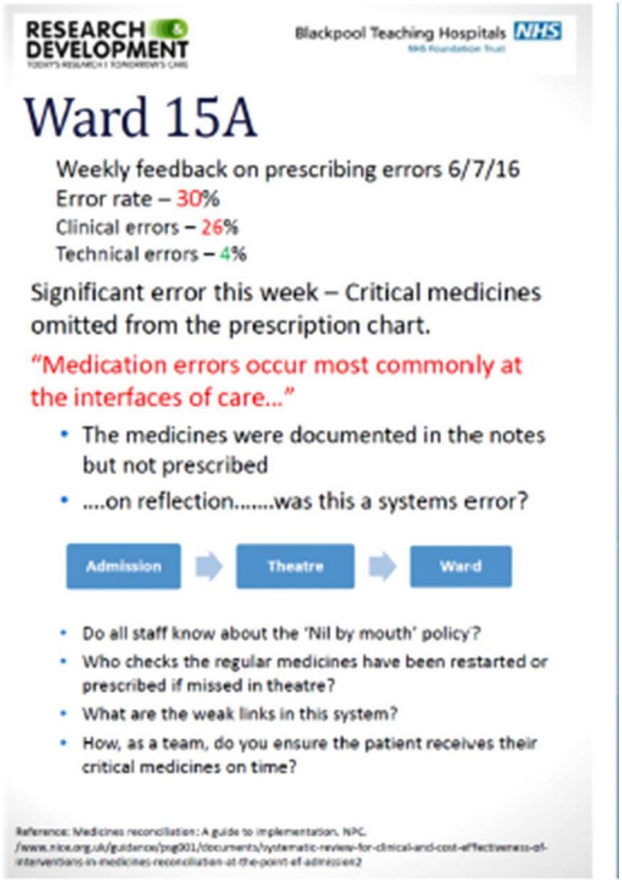
Appendix 2 Interview Topic Guide

Example 1



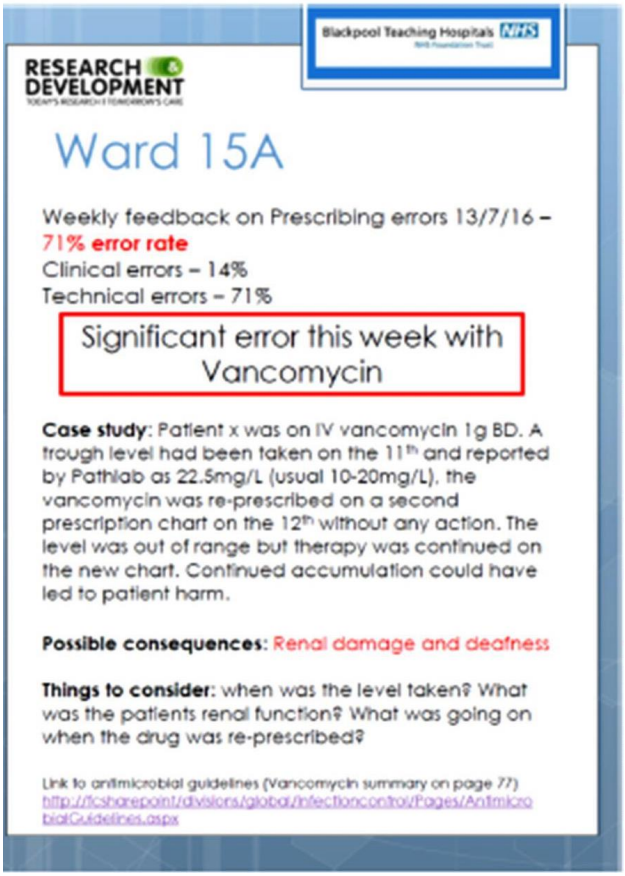
Appendix 2 Interview Topic Guide

Example 2



Appendix 2 Interview Topic Guide

Example 3



Appendix 2 Interview Topic Guide

Example 4

Western Sussex Hospitals Standard Process for Routine Ward Round
Considerative Checklist for Complete Patient Review

The purpose of this process is to ensure that the team "does it all" for all the patients during the round
Make one member of the team the "Safety Checker" who uses this checklist before leaving each patient.
The checker must highlight anything omitted, speak up and get it done!
Key = ☐ **these sections must be checked in all patients**, tick white boxes only when indicated

Date	Checker's Name	Checker's Status	Signed	Clinical Team	Type of Round
…/…./2015					**Routine**
Start time	Finish time	Number of Doctors	**Total number of patients**		
			New	**Review**	**No of wards**

Aspect of Care										
Patient Initials										
Bed number										
Preparatory Discussions	**Preparation Before Going to the Bedside**									
Review Diagnoses										
Checked New Results										
Clinical Thinking										
Clinical Frailty?										
Report from Nurse?										
Consultation	**Bedside Patient Consultation**									
Nurse present?										
Hand hygiene?										
Introductions?										
Wristband check?										
Ask and Listen?										
Charts	**Check All Relevant Bedside Charts**									
Write the NEWS Score										
Drugs Chart checked?										
On iv Fluid? Review chart										
Diabetic? Glucose levels										
Planning	**Decide on blood tests, radiology, Discuss Discharge Date, Ceiling of Care**									
Agree future tests?										
EDD discussed?										
MRFD?										
7 Point Safety Check	**7 Point Safety Check to Reduce Avoidable Harm**									
Pain or discomfort										
Eating and Drinking										
Bowel Function										
Urine / catheter?										
Cannula and iv lines										
Pressure area care										
Change VTE Rx?										
All 7 points checked?										
Documentation	**Consultant Inspects and Counter Signs Today's Notes**									
Notes signed by Consultant?										
Summed Up to Patient?										
Reported Plan to Nurse?										

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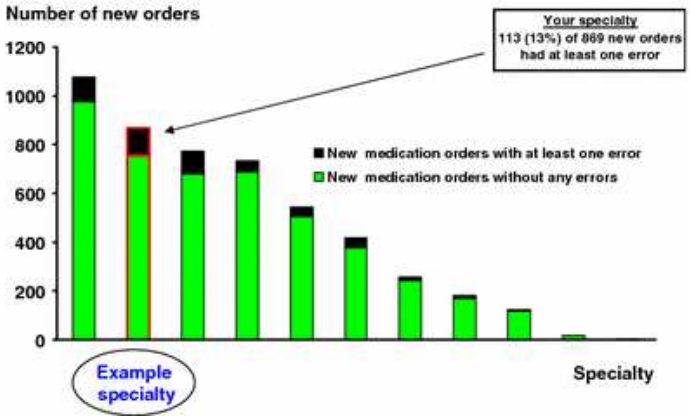
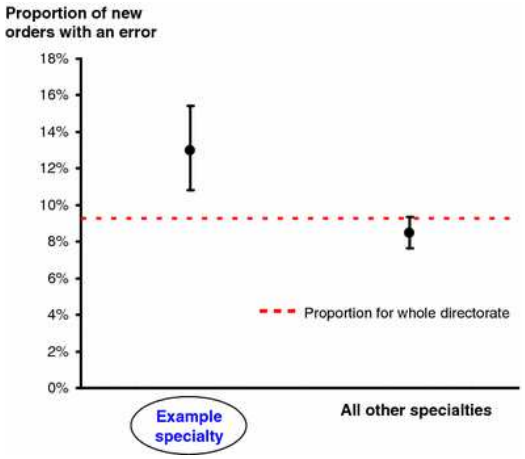
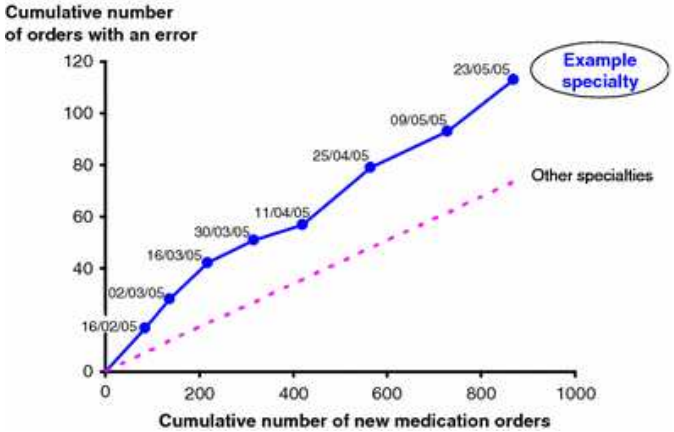
H:_1_Gordon_Assessment_and_Feedback_1Ward Round Pack_SOP Routine Ward Round 21150217.docx

Appendix 2 Interview Topic Guide

Example 5

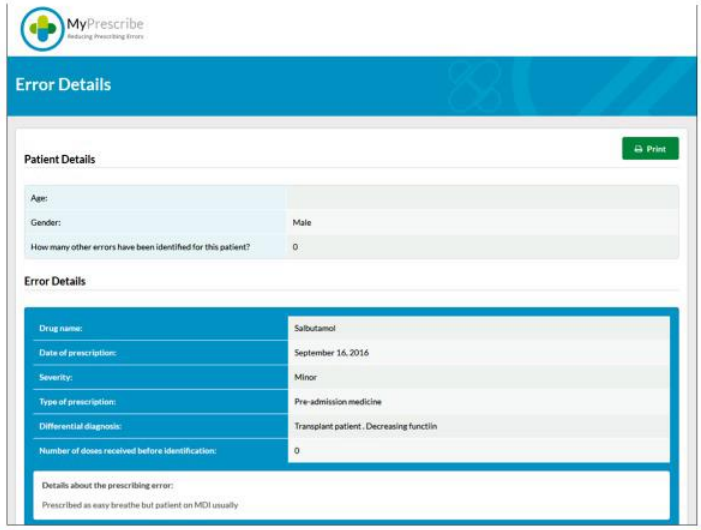


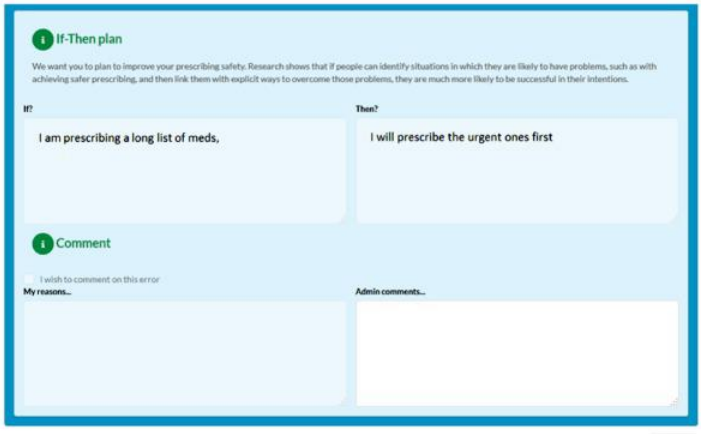




Appendix 2 Interview Topic Guide

Example 6





Appendix 3 Thematic Framework

Theme	Sub-theme	Codes
Nature of individualised feedback data	*Timing of feedback*	Timely feedback especially for significant errors
		Weekly feedback appropriate for minor or general errors
		Timely feedback really important
		Timely feedback to optimise recall and context – weekly or fortnightly
		Weekly feedback
		Timely personal feedback e.g. weekly
		Team every 2 weeks
		Timely feedback – weekly or fortnightly
	Characteristics of feedback	Feedback not helpful if too generic
		Tailoring the feedback e.g. selecting the most common error or significant error in that report
		Positive as well as negative feedback
		Keep feedback brief
		Short and personalised report
		Feedback needs to be specific
		Non-judgemental
		Qualitative feedback better than quantitative
		Needs to be motivational
	Content format	Combination of graphs and text
		Combination of content:
		Text poster - weekly feedback error rate + picture of example drug chart
		Text poster – weekly error rate + tips/questions for improvement
		Overview of prescribing error rate but less frequently
		Mixed feelings about error rates
		Poster with weekly error rate and example drug chart highlighting mistake
		Useful formats:
		Text poster – weekly error rate + tips/questions for improvement

Appendix 3 Thematic Framework

		Text poster – significant error highlighted with case study
		Basic qualitative info would be helpful for context
Context of feedback	*Relationship with feedback provider*	Feedback in person from the person correcting the mistake is more helpful
		Not received formal feedback before
		Mistakes corrected by pharmacist and feedback usually casual
		Specialised pharmacist can provide context
		From anonymised source
	Importance of error	Feedback on significant errors – actual or potential harm to patients
		Prescribing tips sometimes helpful but not always significant
		Recognised importance of major and minor errors for safe patient care
		Minor errors indicate 'laziness'
		Feedback focussed on serious errors
		Especially for significant error
		Significant errors by others would be useful for learning
	Time to focus on feedback	Workload pressure – doctors not good at focussing on emails
		Implementing change is difficult – better to start at the beginning of a cohort
		Not always time to read emails
		Workload pressures
Learning from feedback	*Data validity*	Participant unclear about how data will be captured
		How to collect the data
		Equivocal about graphs – comparisons between teams and specialties may not be valid, minor and serious errors may not be separated
		Error rate on its own is not helpful
	Benchmarking with peers	Benchmarking against peers could be helpful but numbers might be too small

Appendix 3 Thematic Framework

		The person who made the error might feel bad though
	Generic case studies/examples	Learning from others' mistakes especially as Foundation doctors rotate specialties
		Learning from case study helpful
		Case studies helpful
		Learning from case study
	Teamworking culture	Personalised feedback but also in context of team prescribing culture
		Role modelling or bad habits from senior doctors
		Team hierarchy
		Feedback to team
		Team feedback and culture very important
		Personal relationships help with feedback e.g. ward or team pharmacist
		But if there is little existing relationship, better to receive a document
EP-specific feedback	*EP errors*	Electronic prescribing hard to adjust to from paper system
		There are some advantages to the paper charts not easily transferred to EP system e.g. suspending a drug, alternate day dosing, stopping medicines, holding a medication pending review
		EP errors e.g. meds being administered 'now' rather than pre-set times
	Other	Preparedness – national prescribing exam too easy