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# Governing patient safety: lessons learned from a mixed methods evaluation of implementing a ward-level medication safety scorecard in two English NHS hospitals

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## ABSTRACT

**Background** Relatively little is known about how scorecards presenting performance indicators influence medication safety. We evaluated the effects of implementing a ward-level medication safety scorecard piloted in two English NHS hospitals and factors influencing these.

**Methods** We used a mixed methods, controlled before and after design. At baseline, wards were audited on medication safety indicators; during the 'feedback' phase scorecard results were presented to intervention wards on a weekly basis over 7 weeks. We interviewed 49 staff, including clinicians and managers, about scorecard implementation.

**Results** At baseline, 18.7% of patients (total n=630) had incomplete allergy documentation; 53.4% of patients (n=574) experienced a drug omission in the preceding 24 h; 22.5% of omitted doses were classified as 'critical'; 22.1% of patients (n=482) either had ID wristbands not reflecting their allergy status or no ID wristband; and 45.3% of patients (n=237) had drugs that were either unlabelled or labelled for another patient in their drug lockers. The quantitative analysis found no significant improvement in intervention wards following scorecard feedback. Interviews suggested staff were interested in scorecard feedback and described process and culture changes. Factors influencing scorecard implementation included 'normalisation' of errors, study duration, ward leadership, capacity to engage and learning preferences.

**Discussion** Presenting evidence-based performance indicators may potentially influence staff behaviour. Several practical and cultural factors may limit feedback effectiveness and should be considered when developing improvement interventions. Quality scorecards

should be designed with care, attending to evidence of indicators' effectiveness and how indicators and overall scorecard composition fit the intended audience.

## INTRODUCTION

Medication safety is recognised as an important component of patient safety.<sup>1</sup> Medication errors occur frequently, increasing risk of harm to patients and costs to health systems.<sup>2–10</sup> Interventions to improve medication safety take numerous forms,<sup>11–14</sup> with significant efforts in recent years to encourage prioritisation of this safety issue across the English National Health Service (NHS).<sup>3 10 15</sup>

Performance indicators are an established tool of governance applied at macro-level (national), meso-level (organisational) and micro-level (service, ward or individual).<sup>16–20</sup> Indicators have two broad functions in healthcare settings: to support accountability systems and to support front-line quality and safety improvement.<sup>17 20 21</sup> Within hospital organisations, senior leadership may use quality indicators to assess organisational progress against strategic objectives. Research on hospital board governance in the UK, US and Canada reports increasing use of quality indicators in organisational 'dashboards' to support quality assurance and improvement, particularly among 'high-performing' organisations.<sup>22–24</sup> Presenting performance indicators to staff may align staff with organisational priorities and support quality and safety improvement.<sup>17 20 25 26</sup>

Evidence on using performance indicators to support quality and safety improvement suggests that both indicator selection and approach to presentation are important. Evidence suggests that an indicator is more effective when there is strong evidence of association with improved outcomes, when it closely reflects the process it aims to measure and when the measured process is closely related to the desired outcome.<sup>18</sup> Adaptation to local contexts is recognised as important.<sup>16 17</sup> Evidence suggests that indicators are best used formatively to guide discussions of local improvement. This process benefits from involving stakeholders and in harnessing 'soft' data to strengthen the indicators' message.<sup>17</sup>

Reviews of the evidence on audit and feedback in healthcare settings indicate that this technique can positively influence behaviour, but that such effects tend to be small and variable.<sup>27–30</sup> Reviews indicate that factors underlying the varying effects of audit and feedback, and how the technique might be tailored to different settings, require further exploration. In support of this, rigorous mixed methods evaluation is recommended.<sup>27–29</sup> As with audit and feedback, reviews identify a need for greater empirical evidence on the use of performance indicators,<sup>16 17</sup> with a particular focus on issues of implementation.<sup>17</sup> Reviews of quality and safety improvement and spreading innovations suggest it is important to understand the nature of an intervention, how it is implemented and the context into which it is introduced.<sup>31–35</sup>

In this study, we aimed to evaluate the effects of implementing a ward-level medication safety scorecard in two NHS hospitals in a large English city and examine factors influencing these effects. We first present the scorecard's development and implementation. In evaluating its effects, we consider quantitative and qualitative evidence of changes that occurred with the introduction of scorecard feedback. We also analyse the extent to which these effects were influenced by the scorecard contents, feedback approach and organisational setting in which the work took place. We are therefore able to examine factors influencing governance of medication safety. Further, based on the analysis, we identify lessons for using quality and safety indicators at ward level.

## METHODS

### Design

This was a mixed methods study. The quantitative component was a controlled before and after analysis of performance on a ward-level medication safety scorecard. The qualitative component was based on interviews with hospital staff about governance of medication safety and experiences of scorecard feedback. Drawing these components together permitted understanding of how and why the intervention influenced staff behaviour, whether there were any unintended consequences and what factors were influential.<sup>36 37</sup>

A process of triangulation was applied, where the two research components were analysed separately, with the results drawn together where appropriate.<sup>38</sup> First, we examined qualitative and quantitative data to evaluate how scorecard feedback influenced staff behaviour. Second, the qualitative analysis explored implementation issues as a means of understanding these effects.

### Participants

The scorecard was developed and piloted in two acute NHS hospital organisations situated in a large English city (hereafter referred to as Hospitals A and B).

In each hospital, we recruited three wards: two 'intervention' wards and one 'control'. In Hospital A, all three wards were general medicine wards. In Hospital B, two general medicine wards and an elderly care ward were recruited, with one general medicine ward acting as the control.

We interviewed 25 staff in Hospital A and 24 staff in Hospital B. Interviewees included a range of professionals and managers working at ward level and in governance of quality and patient safety (see online supplementary appendix A).

### Procedure

#### Developing the scorecard

The study was developed and implemented in collaboration with staff in both hospitals. Our approach sought to harness potential benefits of knowledge co-production, such as increased sensitivity to local context and greater relevance of findings to end users.<sup>39 40</sup> A mapping exercise conducted in Hospital A identified a gap in knowledge of how medication safety is governed on wards.<sup>41</sup> A group of senior clinicians and management with responsibilities for governing quality and safety in Hospital A proposed developing and piloting a ward-level medication safety scorecard. This intervention was proposed based on the view that a 'scorecard culture', where staff prioritise safety issues that appear on scorecards, existed in the hospital. A senior pharmacist led selection of indicators, which were chosen for their recognised importance to medication safety.<sup>3 10</sup> Performance was coded red (non-compliant) or green (compliant) and presented relative to the previous week's performance (figure 1A).

While the overall structure of the scorecard was retained for Hospital B, the content was amended. Following suggestions from both Hospital A and B staff, the revised scorecard featured fewer indicators overall; also, following Hospital B pharmacists' recommendation, indicators related to prescribing were added (figure 1B). This process reflects the pragmatic nature of quality improvement, where learning and local intelligence guide adaptation of indicators.<sup>16 17</sup> Performance was coded red (not compliant), amber (partly compliant) or green (compliant) and again presented relative to the previous week's performance.

A

XXX ward — medication safety	Target	Prev	Performance	Change
		DD/MM	DD/MM/YYYY	↑=↓
<b>Allergy documentation</b>				
Patients whose allergy documentation was completed	100%	Z%	X/ Y (Z%)	↑=↓
Patients whose allergy symptoms were documented	100%	Z%	X/ Y (Z%)	↑=↓
Patients whose allergy documentation was signed	100%	Z%	X/ Y (Z%)	↑=↓
Patients whose allergy documentation was dated	100%	Z%	X/ Y (Z%)	↑=↓
<b>Patient identification band</b>				
Patients who had an ID band	100%	Z%	X/ Y (Z%)	↑=↓
Patients who had an appropriately coloured ID band	100%	Z%	X/ Y (Z%)	↑=↓
<b>POD lockers</b>				
Total no. drugs in POD lockers	-	X	Y	
No. drugs labelled for incorrect patient in POD lockers	0%	Z%	X/ Y (Z%)	↑=↓
No. unlabelled drugs in POD lockers	0%	Z%	X/ Y (Z%)	↑=↓
No. patients whose POD locker contained drugs labelled for incorrect patient	0%	Z%	X/ Y (Z%)	↑=↓
No. patients whose POD locker contained unlabelled drugs	0%	Z%	X/ Y (Z%)	↑=↓
<b>Drug omissions</b>				
Total drugs prescribed	-	X	Y	
Drug omissions (percentage of drugs prescribed)	0%	Z%	X/ Y (Z%)	↑=↓
Unexplained omissions (percentage of omissions)	0%	Z%	X/ Y (Z%)	↑=↓
Patients who experienced any drug omission	0%	Z%	X/ Y (Z%)	↑=↓
<b>Trigger drugs</b>				
Patients administered Vitamin K	0%	X	X	
Patients administered Octaplex	0%	X	X	
Patients administered FFP	0%	X	X	
Patients administered Naloxone	0%	X	X	
Patients administered Flumenazil	0%	X	X	
Patients administered Glucagon	0%	X	X	
Patients administered any trigger drugs	0%	X	X	
<b>Secure drug storage</b>				
Badge entry to ward required?	Y	Y/N	Y/N	↑=↓
Clinical room locked?	Y	Y/N	Y/N	↑=↓
Drug cupboards locked?	Y/NA	Y/N/NA	Y/N/NA	↑=↓
ID challenged?	Y/NA	Y/N/NA	Y/N/NA	↑=↓
<b>Access to secure drugs</b>				
Morphine ampoules	N/NA	Y/N/NA	Y/N/NA	↑=↓
Midazolam ampoules	N/NA	Y/N/NA	Y/N/NA	↑=↓
Oral diazepam	N/NA	Y/N/NA	Y/N/NA	↑=↓
Oral codeine	N/NA	Y/N/NA	Y/N/NA	↑=↓
Insulin (from fridge)	N/NA	Y/N/NA	Y/N/NA	↑=↓
<b>Safety notices</b>				
Penicillin traffic light poster present	Y	Y	Y/N	↑=↓
Medication safety bulletin present	Y	N	Y/N	↑=↓
SureMed information present	Y	Y	Y/N	↑=↓

<b>SUMMARY</b>	Indicators that improved	↑	X
	Indicators that stayed the same	=	X
	Indicators that got worse	↓	X

**Figure 1** (A) Scorecard used in Hospital A. (B) Scorecard used in Hospital B. Note: FFP stands for 'fresh frozen plasma'.

#### Scorecard data collection

In both hospitals, scorecard data were collected on unannounced ward visits. In Hospital A, in the baseline phase (July 2009–February 2010), data were collected by

AR and pharmacists. During the feedback phase, data were collected weekly by AR and a member of audit staff. In Hospital B, ST and pharmacists collected scorecard data over the period September–November 2011.

B

XXX ward	Target	Previous	Performance	Change
		DD/MM	DD/MM	↑=↓
<b>Allergy and ID bands</b>				
Patients whose allergy status was completed, symptoms documented, signed and dated	100%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
Patients with ID band	100%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
Appropriate ID band (if allergy)	100%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
ID bands on same wrist (if allergy)	100%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
<b>POD lockers</b>				
Drugs for correct patient in POD locker	100%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
<b>Drug omissions</b>				
Doses omitted over the last 24 hours (except code 6)	0%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
Unexplained omissions (% of omissions)	0%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
'Drug not available' (code 7) for two consecutive omissions (% of omissions)	0%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
<b>Prescribing</b>				
Prescriptions without prescriber's signature	0%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
Doses administered without prescriber's signature	0%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
Once-only prescriptions without drug start time	0%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
Unacceptable abbreviation of units	0%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
Brand prescribing (excluding exceptions)	0%	X/ Y (Z%)	X/ Y (Z%)	↑=↓
<b>SUMMARY</b>	<b>Indicators that improved</b>		↑	X
	<b>Indicators that stayed the same</b>		=	X
	<b>Indicators that got worse</b>		↓	X

Figure 1 Continued.

#### Feedback to ward staff

In Hospital A, scorecard data were sent to ward leaders in intervention wards on a weekly basis over 7 weeks (February–April 2010). It was agreed that ward managers would present the scorecard to nurses at ward handover meetings and that consultants would present the data at junior doctors' educational meetings.

In Hospital B, data were fed back on a weekly basis to intervention wards over 7 weeks (October–November 2011). Feedback took place at established staff meetings (some uniprofessional, some multiprofessional) attended by ST and a Hospital B pharmacist. In these meetings, staff discussed the scorecard data, identifying possible causes of and potential solutions to the issues identified. Using established meetings in both hospitals permitted examination of existing approaches to governing medication safety in the participating organisations.

#### Interviews

In each hospital, interviews were conducted once the intervention phases were complete. Interviews lasted

between 15 and 60 min in locations agreed with interviewees. Interviewees discussed aspects of medication safety and their experiences of providing and receiving scorecard feedback. Interviews were digitally recorded and professionally transcribed. Transcripts were stored for analysis on QSR NVivo software.

#### Analysis

To analyse the effects of scorecard feedback, we applied a standard 'difference in difference' technique.<sup>42</sup> Difference in difference is a quasi-experimental technique that measures the effect induced by a treatment, policy or intervention. It combines within-subject estimates of the effect (pretreatment and post-treatment) with between-subject estimates of the effect (intervention vs control groups). Using only between-subject estimates produces biased results if there are omitted variables that confound the difference between the two groups. Similarly, using only the within-group estimate produces biased results if there is a time trend present (eg, wards are always improving). The difference in



**Table 1** Summary of medication safety risks analysed

Indicator	Medication safety risks	Collection method
Allergy documentation	The proportion of patients whose allergy documentation was incomplete (including symptoms documented, signed and dated)	Inspecting patient drug chart
Drug omissions	The proportion of patients who experienced a drug omission in the 24 h prior to data collection (excluding appropriate omissions, eg, patients refusing the dose)	Inspecting patient drug chart
ID wristbands	The proportion of patients who either had an ID wristband that did not reflect their allergy status or who had no ID wristband at all	Comparing allergy documentation on drug chart with colour of patient wristband
Patient's own drugs (POD) locker contents	The proportion of patients whose POD lockers contained either unlabelled drugs or drugs labelled for another patient (in Hospital B drugs that were not <i>currently</i> prescribed for patient were categorised as inappropriate)	Comparing patient name on drug chart with name appearing on drugs in POD locker; in Hospital B, also comparing with current patient drug chart

difference estimate combines the estimates and produces a more robust measure of the effect of an intervention.

The independent variables were 'ward type', 'study phase' and 'effect':

- ▶ 'Ward type' measured the difference between intervention wards, where scorecard data were presented to staff, and control wards, where no data were presented.
- ▶ 'Study phase' measured the difference between the baseline phase, during which data were collected but not fed back, and the feedback phase, during which data continued to be collected and were fed back to intervention wards.
- ▶ 'Effect' was the interaction (multiplication) of the 'ward type' and 'study phase' variables and isolated 'effect' of the intervention on the intervention wards. This was the so-called 'difference in difference' estimator.

Dependent variables were wards' performance on four indicators featured on the medication safety scorecard: we measured the proportion of patients experiencing a risk on these indicators (table 1). These were selected because they were identified by both the participating hospitals and in guidance as important factors in medication safety.<sup>3</sup> Standard ordinary least squares regression was used to estimate the four difference in difference models.

#### Qualitative analysis

Interviews were analysed using data-driven thematic analysis.<sup>43</sup> In part, the quantitative analysis guided our focus. Analysing staff response to scorecard feedback permitted examination of effects not captured by the scorecard, and factors influencing the process and effects of feedback. Based on this, lessons for future implementation of scorecards of this kind were identified.

## RESULTS

### Quantitative analysis

Table 2 presents performance on medication safety indicators at baseline in terms of the percentage of instances in which patients experienced a medication safety risk (see column '% error'). It indicates that while performance varied across indicators, a

significant proportion of patients were exposed to medication safety risks in all cases (see online supplementary appendix B for further breakdown of patients).

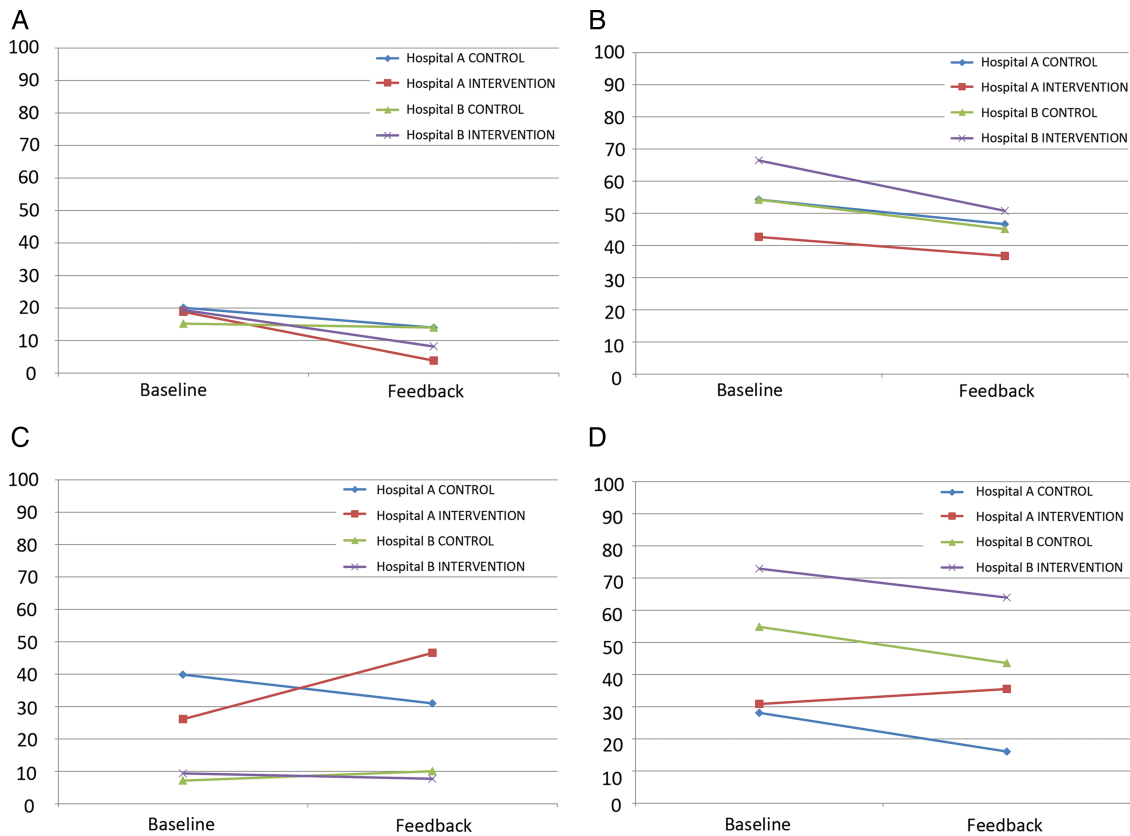
Each drug omission (ie, each dose) was categorised using a list of 'critical drugs not to omit'<sup>15</sup> developed by Hospital B. We found that, at baseline, 22.5% of omitted doses (N=865) could be classified as 'critical omissions', for example, heparin, oxycodone and levotiracetam, where omission or delay in doses increases the likelihood of outcomes such as mortality, haemorrhage and infection (see online supplementary appendix C).

Figure 2 presents performance across the four selected medication safety indicators disaggregated by Hospital (A or B), ward type (control or treatment) and phase (baseline or feedback). Where the gradients of the lines in figure 2 differ for pairs of wards (control and intervention) within hospitals, the feedback intervention is having an effect and the larger this divergence, the stronger the effect. The significance of these effects was addressed using difference in difference regression. The data were fitted using standard ordinary least squares regression, and the

**Table 2** Performance on medication safety indicators at baseline

Indicator	Hospital	Total patients	Mean patients* (SD)	% error (SD)
Allergy documentation	Hospital A	390	20.53 (3.79)	19.3 (9.3)
	Hospital B	240	16.00 (3.93)	18.0 (11.5)
	Total	630	18.53 (4.43)	18.7 (10.2)
Drug omissions	Hospital A	336	16.80 (3.86)	46.7 (15.6)
	Hospital B	238	15.87 (3.72)	62.4 (13.9)
	Total	574	16.40 (3.78)	53.4 (16.6)
ID wristbands	Hospital A	264	12.57 (3.63)	30.9 (20.9)
	Hospital B	218	14.53 (3.66)	8.5 (8.0)
	Total	482	13.39 (3.72)	22.1 (20.2)
POD locker contents	Hospital A	397	18.90 (5.43)	29.9 (14.2)
	Hospital B	237	15.80 (3.78)	66.9 (18.2)
	Total	634	17.61 (5.00)	45.3 (24.3)

\*Mean number of patients per ward, per data collection visit.  
POD, patient's own drugs.



**Figure 2** (A) Percentage of patients with incomplete allergy documentation. (B) Percentage of patients who experienced a drug omission in the preceding 24 h. (C) Percentage of patients who did not have an appropriately coloured ID wristband (D) Percentage of patients with inappropriate patient's own drugs locker contents.

effect on the intervention wards is captured by the difference in the difference. That is the difference between the control and treatment wards over the pretreatment and post-treatment periods. This difference in difference effect is reported as unstandardised  $\beta$  coefficient for each of the performance measures in table 3 alongside the R-squared ( $R^2$ ), which represents the proportion of variance in the performance measure that is explained by the regression model. The statistical significance of the intervention effect is also indicated.

These models explain only a modest proportion of the variation in the data. This suggests other factors might have been influential or that patterns observed may represent random variation. Two significant effects were found: in Hospital A, performance on the ID wristbands and patient's own drugs (PODs) lockers indicators improved in the control ward while deteriorating in intervention wards (illustrated in figure 2C, and 2D, respectively). No statistically significant improvements were associated with presenting scorecard data to staff.

These data offer two messages: first, on all selected indicators, many patients were exposed to medication safety risks at baseline, and second, scorecard feedback did not significantly improve this situation in either hospital.

### Qualitative analysis

In this section, we examine factors that might explain these results. First, we cover some practical issues that may have limited the effect of scorecard feedback. Second, we examine how staff perceived the content of the scorecard and approach to feedback.

#### Feedback challenges

Scorecard data were not always presented to staff. In both hospitals, meetings were sometimes cancelled due to competing priorities or practical issues. The most pronounced example occurred in a Hospital A intervention ward:

...there was a weekly juniors' meeting specifically for the [Hospital A ward] team. It seems to have gone into

**Table 3** Summary of difference in differences analyses

Measure	Hospital A		Hospital B	
	$R^2$	$\beta$	$R^2$	$\beta$
Allergy documentation	0.480	-8.908	0.179	-10.013
Drug omissions	0.184	1.739	0.162	-6.574
ID wristbands	0.201	29.304*	0.025	-4.555
POD lockers	0.240	16.694*	0.167	2.318

$\beta$  represents the difference in difference effect.

\*Signifies  $p < 0.05$ .

POD, patient's own drugs.

abeyance [...] largely because of lack of space (Consultant, Hospital A)

Ward managers and consultants were identified as key to sharing information with nurses and junior doctors, respectively. However, interviewees suggested the degree to which clinical leaders engage in such processes might vary:

...you would just hope that the ward manager would cascade information. But one couldn't guarantee that (Pharmacist, Hospital A)

I was engaged in the conversation, and found it quite enjoyable, but I looked over at [consultant] and I know s/he was keen to get back out there (Consultant, Hospital B)

Some staff also suggested that translating messages into practice might take more time than the study period permitted.

Maybe it just takes longer time than the intervention period to actually get that message through (Consultant, Hospital B)

Other changes took place over the course of the study. These included a reorganisation of the Hospital A ward structure during the baseline phase. Broader issues, such as staffing and financial pressures, were frequently cited by interviewees. Taken together, these data indicate that competing priorities, wider resource issues and variable engagement of ward leadership may have limited the effect of scorecard feedback. Such factors are likely to represent more widely felt obstacles to leading quality and safety improvement initiatives.<sup>44</sup>

#### Staff experiences of scorecard feedback

Nurses were receptive to scorecard feedback, finding it relevant to their practice:

...some of the things that the scorecard was talking about, it was like a reinforcement (Nurse, Hospital A)

It brought things forward that we already know as best practice [...], 'Oh yes, I should get on top of that!' (Nurse, Hospital B)

In both hospitals, nurses paid particular attention to feedback on POD locker contents and reported use of new routines to address the issue:

When you're cleaning the bed, make sure you tell them to open the POD locker. Once the POD locker is opened then you know there's medicine, take it out and leave it open, at least there is nothing in there when the next patient comes in (Nurse, Hospital A)

Now, when a patient gets discharged I always open up the cabinet and make sure everything is cleared out (Senior staff nurse, Hospital B)

These data suggest that nurses found scorecard feedback useful and sought to translate it into practice. This reflects scorecards' potential to support

quality improvement when a measure is perceived as relevant and performance is seen as suboptimal. However, given the levels of error presented, it is interesting to note that the overall response demonstrated relatively little urgency. This was also a common theme in doctors' responses to scorecard feedback:

So... just useful information to know but I'm not sure if it necessarily altered how we did things. (Junior Doctor, Hospital A)

In Hospital B, doctors frequently referred to prescribing measures as useful, reflecting staff prioritisation of issues perceived as relevant to their own practice:

The prescribing stuff is useful, particularly for the junior staff—reiterating the need to prescribe differently (Doctor, Hospital B)

Well, it has made me more mindful of not prescribing trade names (Consultant, Hospital B)

Junior doctors frequently referred to learning about medication safety directly from ward pharmacists, while medical consultants emphasised uniprofessional approaches to learning typified by the 'apprenticeship' model, where doctors reflect on individual practice under the guidance of more experienced peers.<sup>45–50</sup>

Scorecards and traffic lights are very familiar now [...] actually it doesn't really fit that well in terms of [the] medical model of working. (Consultant, Hospital A)

I think that using the clinical supervisor or the education supervisor would be a more effective way of getting that kind of targeted feedback to me as an individual (Consultant, Hospital A)

Our data suggest nurses engaged more with scorecard feedback than doctors. These differences may reflect a contrast in how well the scorecard approach fitted with doctors' and nurses' established approaches to improvement. This 'lack of fit' may have reduced the extent to which doctors engaged with the scorecard intervention. However, another potential factor is the relative likelihood of sanction:

If a nurse commits a serious medicines error, they're removed from their responsibilities. If a doctor commits a serious medicines error, it doesn't happen: there's no censure at all (Consultant, Hospital B)

Considering the overall composition of the scorecard revealed a potential source of tension. While staff engaged with 'their' indicators, some stated that indicators associated with other professions were not relevant. However, the potential for a joint scorecard to encourage staff to take a wider view of their role in medication safety was noted:

in retrospect we would have been better to do that jointly with the nursing staff because [...] for the nurses

to hear the doctors say, 'Well, that's not my job,' might have been quite useful, because they could have said, 'Well, actually, it would be really helpful if you would look at that aspect' (Consultant, Hospital A)

I think it's helped nurses [...] to go up to the doctors and say, "You've written the brand name," [...] or if their writing's not clear: I think it's making us look more enabled (Deputy ward manager, Hospital B)

Thus, the relationship between the content of feedback and the forum in which it is to be presented is important. Where feedback is presented to a multiprofessional group, a mixed scorecard may prompt valuable discussion and negotiation of roles; where feedback is presented to a single profession, a mixed scorecard may include indicators perceived as irrelevant to their practice, and its effect diluted. Further, joint feedback sessions should be led with care to ensure discussions do not become an outlet for blame rather than learning.

## DISCUSSION

Our data confirm previous research suggesting medication safety risks occur frequently.<sup>2-9</sup> It also indicates that a notable proportion of these errors had the potential to cause harm. In relation to the impact of scorecard feedback, the quantitative analysis found no significant improvements. However, our qualitative data suggested staff were highly receptive to the data presented and importantly that staff reported that feedback prompted both process and culture changes. These findings support previous research that suggests presenting quality indicators may encourage engagement with patient safety issues, but with limited effect on actual performance.<sup>28 29</sup> Our results also reflect a wider evidence base indicating that improvement initiatives may often have limited or no demonstrable effect on quality, and that this may often be associated with contextual factors.<sup>33 51</sup>

Our qualitative analysis revealed a number of contextual factors, practical and cultural, that may mediate the effect of scorecard feedback. Practical factors identified by staff included the capacity for staff to engage with feedback and the capacity to translate feedback into practice, for example, having time to design and embed new processes: these are established obstacles to quality improvement work.<sup>16 31 33 44</sup> Significant cultural factors included how staff respond to data indicating poor performance, and professions' different styles of engaging with quality improvement activity. The lack of urgency in staff response to the feedback was notable. This may reflect a wider cultural issue of 'normalised deviance', where frequent errors are perceived as unsurprising or even acceptable. Such normalisation has been identified as a potentially significant risk to patient safety.<sup>51-53</sup> This may relate to what Francis described as 'a culture of habituation and passivity' in

his report into poor quality care at Mid Staffordshire NHS Foundation Trust.<sup>54</sup> Our data support previous research indicating that different professions engage differently with quality and safety improvement activity.<sup>35 45-48 55-57</sup> Doctors' and nurses' responses also support previous research indicating that staff engage with performance indicators that are seen as relevant to practice and associated with quality and safety outcomes.<sup>16</sup> However, a corollary of this is that 'irrelevant' indicators may dilute a scorecard's credibility, unless an objective of scorecard feedback is to encourage shared understanding of medication safety across professions, facilitated through feedback to multiprofessional meetings.

This study has some limitations. First, that our intervention fitted poorly with doctors' approach to quality and safety improvement suggests a key assumption of the study—existence of a 'scorecard culture'—was not borne out. Widening our collaborative process to include a wider range of front-line staff may have highlighted this and encouraged reflection on how best to communicate with different professions. Second, the interventions did not take place concurrently in Hospitals A and B. The intervening 18-month period may have seen changes in local and national contexts. However, interviewees indicated that the contextual issues faced by the participating hospitals were quite consistent. Third, the scorecards used in Hospitals A and B differed and this may have had an effect on the results. For example, the difference between Hospital A's and Hospital B's performance on POD locker contents at baseline may reflect the additional criteria applied for 'appropriate labelling' in Hospital B. Given the potential influence of scorecard composition, the fact that the scorecards used in Hospitals A and B differed in terms of number and nature of indicators selected may be important. The presence of other indicators on scorecards may have influenced staff response, that is, a higher number of indicators may reduce the effect of specific indicators. However, the differences in timing and indicators used reflect this study's sequential approach. This approach permitted learning across the two interventions, reflecting recommendations for developing effective quality and safety improvement interventions.<sup>16 17</sup> Fourth, as intervention and control wards experienced the same data collection process, the potential effects of being audited should also be acknowledged. Control ward staff may have changed behaviour because of an awareness that they were being measured; they may even have become aware of specific indicators being measured (eg, the visibility of POD locker and ID wristband inspections) and adjusted their behaviour accordingly.<sup>58</sup> Fifth, in terms of capturing the effect of the scorecard, research indicates that the intervention and associated data collection period was too short.<sup>16</sup> This may have limited the extent to which staff had time to make and embed



changes, and for these to translate into improved medication safety. Finally, while interviews commenced after completion of the feedback phase, the quantitative analysis had not been completed. There may be value in incorporating quantitative findings, that is, whether the intervention had a significant effect into evaluation interviews.

Turning to future work, we found the mixed methods approach valuable in understanding the effect of scorecard feedback. However, we propose amending this approach to build on the learning and limitations identified above. Future research might address feedback approach and duration, scorecard design and evaluation methods. First, parallel implementation in two or more hospitals, using consistent wards, would allow clearer understanding of how similar wards in different organisational settings engage with quality and safety indicators. Second, using the same scorecard across all participating wards (developed in collaboration with all participating hospitals) would permit a stronger focus on how tool composition interacts with varying organisational settings. Testing the relationship between indicators and audience at other organisational levels, for example, hospital boards' interactions with quality dashboards, may provide valuable insights on how best to support leadership for quality improvement.<sup>22–24</sup> Third, greater use of observational methods would allow a clearer understanding of processes at work in improvement work of this kind, including the extent to which control ward staff are influenced by factors such as the act of measurement and 'contamination' from wards that receive feedback.<sup>59 60</sup> Key foci would include feedback sessions and the embedding of any changes identified in response to feedback. Finally, a longer follow-up period would be valuable. This would allow staff sufficient time to incorporate findings into process redesign, and for these changes to be adopted by staff. It would permit exploration of staff's initial responses to interventions and their views on the nature and sustainability of changes brought about in the longer term.

## CONCLUSIONS

Medication errors occur frequently at ward level. Presenting evidence of this in the form of a scorecard has limited effect on staff performance. Established factors, including organisational processes and professional cultures, remain influential mediators of change. The persistence of these meso-level issues, relatively unchanged from past research in this area, suggests that efforts to prioritise and improve medication safety across the English NHS are yet to gain traction.<sup>3 10 15</sup>

Our findings indicate that presenting evidence-based performance indicators has the potential to influence staff behaviour. However, when applying such interventions it is important to allow sufficient time for

such changes to translate into overall performance improvements. Further, there exist several practical and cultural contextual factors that may limit the effectiveness of feedback, and which should be considered when developing the improvement strategy. When selecting performance indicators, the extent to which they fit the task and the setting should be assessed, and the feedback approach should be considered carefully. Further research on scorecard composition and implementation, drawing on the lessons above, may contribute to clearer understanding of how performance indicators might be used effectively in a range of healthcare settings.

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## Appendix A. Profile of interviewees

Interviewees	Trust A	Trust B	Total
Pharmacists	Senior pharmacist Clinical pharmacist x 3 Managerial pharmacist <b>Total = 5</b>	Senior pharmacist x2, Clinical pharmacist x2, Clinical governance pharmacist Policy pharmacist <b>Total = 7</b>	<b>12</b>
Doctors	Clinical Director Medication safety lead Medical consultant x2 Registrar Junior doctor <b>Total = 6</b>	Medical consultant x4 Patient safety manager Registrar Junior doctor <b>Total = 7</b>	<b>13</b>
Nurses	Senior nurse manager Matron Ward sister Ward manager Ward nurse x4 <b>Total = 8</b>	Senior nurse manager Matron Senior staff nurse x2 Deputy Ward manager Staff nurse <b>Total = 6</b>	<b>14</b>
Managers	Divisional manager Risk manager Governance manager <b>Total = 3</b>	Risk manager Clinical governance manager <b>Total = 2</b>	<b>5</b>
Senior management	Board members x3 <b>Total = 3</b>	Board members x2 <b>Total = 2</b>	<b>5</b>
<b>Total</b>	<b>25</b>	<b>24</b>	<b>49</b>



**Appendix B. Summary of patients whose data was collected for each medication safety measure, by Hospital and Phase (total number, and mean per weekly data collection)**

Hospital	Measure	Phase	Total patients	Mean patients (s.d.)
<b>Hospital A</b>	Allergy documentation	Baseline	390	20.53 (3.79)
		Feedback	533	25.38 (4.14)
		Total	923	23.07 (4.63)
	Omissions	Baseline	336	16.80 (3.86)
		Feedback	434	20.67 (4.47)
		Total	770	18.78 (4.57)
	ID bands	Baseline	264	12.57 (3.63)
		Feedback	329	15.67 (4.92)
		Total	593	14.12 (4.55)
	POD lockers	Baseline	397	18.90 (5.43)
		Feedback	499	23.76 (4.43)
		Total	896	21.33 (5.48)
<b>Hospital B</b>	Allergy documentation	Baseline	240	16.00 (3.93)
		Feedback	266	14.78 (2.67)
		Total	506	15.33 (3.30)
	Omissions	Baseline	238	15.87 (3.72)
		Feedback	265	14.72 (2.72)
		Total	503	15.24 (3.21)
	ID bands	Baseline	218	14.53 (3.66)
		Feedback	229	12.72 (2.54)
		Total	447	13.55 (3.18)
	POD lockers	Baseline	237	15.80 (3.78)
		Feedback	262	14.56 (2.64)
		Total	499	15.12 (3.22)
<b>Overall</b>	Allergy documentation	Baseline	630	18.53 (4.43)
		Feedback	799	20.49 (6.39)
		Total	1429	19.58 (5.62)
	Omissions	Baseline	574	16.40 (3.78)
		Feedback	699	17.92 (4.78)
		Total	1273	17.20 (4.37)
	ID bands	Baseline	482	13.39 (3.72)
		Feedback	558	14.31 (4.23)
		Total	1040	13.87 (3.99)
	POD lockers	Baseline	634	17.61 (5.00)
		Feedback	761	19.51 (5.92)
		Total	1395	18.60 (5.54)

### Appendix C. Proportion of drug omissions that could be classified as 'critical omissions'

Measure	Baseline	Feedback	OVERALL
Total no. omitted drugs	421	444	865
Omitted drugs not on 'critical list'	294	292	586
Omitted drugs on 'critical list'	95	118	213
Uncategorised omitted drugs	32	32	64
Excluded (transcription unclear)	0	2	2
<b>% omitted drugs on 'critical list'</b>	<b>22.57</b>	<b>26.58</b>	<b>24.62</b>