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Lessons learned: using adverse incident reports to investigate the characteristics and causes of prescribing errors

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ABSTRACT

Introduction Prescribing errors are a principal cause of preventable harm in healthcare. This study aims to establish a systematic approach to analysing prescribing-related adverse incident reports, in order to elucidate the characteristics and contributing factors of common prescribing errors and target multifaceted quality improvement initiatives.

Methods All prescribing-related adverse incident reports submitted across one NHS board over 12 months were selected. Incidents involving commonly implicated drugs (involved in ≥10 incidents) underwent analysis to establish likely underlying causes using Reason's Model of Accident Causation.

Results 330 prescribing-related adverse incident reports were identified. Commonly implicated drugs were insulin (10% of incidents), gentamicin (7%), co-amoxiclav (5%) and amoxicillin (5%). The most prevalent error types were prescribing amoxicillin when contraindicated due to allergy (5%); prescribing co-amoxiclav when contraindicated due to allergy (5%); prescribing the incorrect type of insulin (3%); and omitting to prescribe insulin (3%). Error-producing factors were identified in 86% of incidents involving commonly implicated drugs. 53% of incidents involved error-producing factors related to the working environment; 38% involved factors related to the healthcare team; and 37% involved factors related to the prescriber.

Discussion This study establishes that systematic analysis of adverse incident reports can efficiently identify the characteristics and contributing factors of common prescribing errors, in a manner useful for targeting quality improvement. Furthermore, this study produced a number of salient findings. First, a narrow range of drugs were implicated in the majority of incidents. Second, a small number of error types were highly recurrent. Lastly, a range of contributing factors were evident, with those related to the working environment contributing to the majority of prescribing errors analysed.

INTRODUCTION

Prescribing errors are a principal cause of preventable harm in healthcare.[1] Recent guidelines advocate utilising readily accessible information present within prescribing-related adverse incident reports to identify factors contributing to errors.[2 3] This study aims to establish a systematic approach to analysing prescribing-related adverse incident reports within one NHS board, in order to elucidate the characteristics and contributing factors of common prescribing errors, and subsequently target multifaceted quality improvement initiatives.

METHODS

According to local policy, this work met criteria for improvement activities exempt from ethics review.

All adverse incident reports submitted via the Datix system in one NHS board over 12 months (February 2017 to February 2018) were identified. Those categorised as 'medication prescribing incidents' by the reporter were selected. Furthermore, all incidents reported by doctors were screened, and those regarding prescribing were also selected. The drug(s) involved in each prescribing-related incident were identified. A list of commonly implicated drugs (involved in ≥10 incidents) was collated.

Incidents involving commonly implicated drugs underwent analysis to establish contributing factors. The reporter's free-text description of the incident was evaluated using Reason's Model of Accident Causation. This framework categorises conditions that increase the probability of an error occurring into those inherent to the prescriber (eg, lack of knowledge); the working environment (eg, heavy workload); the healthcare team (eg, poor handover); the prescribing task (eg, difficulty accessing electronic records); and the patient (eg, complex comorbidities).[4 5]

RESULTS

In total, 330 prescribing-related incident reports were identified. Of these, 41% were submitted by pharmacists; 24% by nurses; and 10% by doctors. Of note, 84% resulted in no obvious harm; 9% caused minor, non-permanent harm; and 7% caused moderate, semipermanent harm.

A total of 167 named drugs were involved in the 330 incidents. Commonly implicated drugs were insulin (10% of incidents), gentamicin (7%), co-amoxiclav (5%), amoxicillin (5%), enoxaparin (4%), warfarin (4%), aspirin (3%), paracetamol (3%), vancomycin (3%), morphine (3%) and tinzaparin (3%). Errors involving these 11 drugs accounted for 51% of incident reports.

The most common error types were prescribing amoxicillin when contraindicated due to allergy (4.8% of incidents); prescribing co-amoxiclav when contraindicated due to allergy (4.5%); prescribing the incorrect insulin type (3.3%); inappropriately omitting to prescribe insulin (3.0%); prescribing the incorrect gentamicin dose (2.1%); incorrect gentamicin level monitoring (2.1%); and prescribing gentamicin in the incorrect dosage frequency (1.8%, table 1).

Error-producing conditions were identified in 86% of incidents involving commonly implicated drugs. In 53% of incidents, error-producing factors related to the working environment were evident. The most prevalent environmental factors were workload and time pressure in medical receiving (27%); workload and time pressure in accident and emergency (5%); prescribing for unfamiliar patients (4%, eg, ward junior doctors prescribing insulin for patients boarding from other specialties); and workload and time pressure while on-call (4%).

In addition, error-producing factors related to the healthcare team were found in 38% of incidents. The most commonly implicated team factors were different teams looking after one patient (eg, duplication of antibiotic prescription by Accident & Emergency and Medical teams, 16%); poor communication between medical and nursing staff (11%); and poor communication between medical staff (10%).

Furthermore, error-producing factors related to the individual prescriber were identifiable in 37% of incidents. The most prevalent prescriber factors were lack of knowledge of insulin types (6%); lack of knowledge of gentamicin level monitoring (4%); lack of knowledge regarding coprescribing of anticoagulants (2%); and lack of knowledge regarding omitting insulin (2%).

Lastly, error-producing factors related to the patient and the prescribing task were less commonly identified (13% and 11% of incidents, respectively). Patient factors included inaccurate knowledge of their own medications (contributing to errors in medicines reconciliation, 6%); and complexity due to anticoagulation (invalidating generic thromboprophylaxis guidelines, 3%). The most common task factor was unavailability of medication information on admission (eg, inability to access electronic patient records, 4%).

DISCUSSION

This study illustrates that analysis of prescribing-related incident reports provides a simple and efficient method of identifying the characteristics and contributing factors of common prescribing errors.

Furthermore, a number of salient findings were produced. First, a narrow range of 11 drugs were involved in over 50% of incidents. Second, a small number of error types were highly recurrent, namely: prescribing of penicillins in allergy; omission of insulin; and prescription of the incorrect insulin type.

In addition, analysis using Reason's framework revealed a range of contributing factors. Most significantly, factors related to the working environment were deemed contributory to 53% of analysed incidents. Factors related to the healthcare team, and those related to the prescriber, were considered relevant to a significant minority of incidents (38% and 37%, respectively). These findings emphasise the multifactorial nature of prescribing errors, as previously established.[4 6]

This study has a number of limitations. First, it includes only one NHS board. Thus, findings are not necessarily generalisable. However, the methodology is transferable, given the ubiquity of incident reporting systems. Second, analysis of the presence and contribution of error-producing factors depended on both the level of detail in the reporter's description of the incident (which varied), and subjective evaluation by the researcher, risking interpersonal variation and bias. Third, evidence suggests that incident-reporting systems significantly under-report the frequency of prescribing errors.[7] Furthermore, bias may exist in the type and severity of patient safety incidents reported.[8] Thus, the analysed incidents are unlikely to represent the rates or characteristics of all prescribing errors locally.

Given these limitations, the study findings are likely most effectively utilised in providing an impetus and evidence base for targeting local quality improvement interventions towards addressing the commonly implicated drugs, error types and error-producing factors identified. This could involve continuous quality improvement, consisting of 'plan–do–study–act' cycles of iterative change, at a departmental/ward level, as successfully trialled elsewhere.[9] Of note, electronic prescribing has been introduced more broadly across the NHS board since the data collection period. Evidence suggests that this may also reduce the frequency of medication errors, however local evaluation is required.[10]

Our initial intervention is the delivery of teaching sessions to final year medical undergraduates prior to commencing Foundation Training, which generate learning from anonymised prescribing-related adverse incidents, involving the commonly implicated drugs and recurrent error types identified. These sessions intend to promote safe prescribing by making learning increasingly relevant (as reflected in learner feedback); raising awareness of contextual factors contributing to errors; and fostering a safety culture and familiarity with incident reporting systems from early in training. However, the evidence linking teaching in isolation with reduction in error rates is lacking.[11] Therefore, it is imperative that moving forward this educational approach proceeds in

Table 1 Most commonly reported prescribing error types

Drug involved	Overview of incident	Frequency N (%)	Specific error type	Frequency N (%)
Amoxicillin	Prescribed when contraindicated due to allergy	16 (4.8)	Prescribed in penicillin allergy	15 (4.5)
			Prescribed in cephalosporin allergy	1 (0.3)
Co-amoxiclav	Prescribed when contraindicated due to allergy	15 (4.5)	Prescribed in penicillin allergy	15 (4.5)
Insulin	Prescribed incorrect type	11 (3.3)	Prescribed incorrect type of long acting insulin	3 (0.9)
			Prescribed short/rapid acting insulin instead of mixed insulin	3 (0.9)
			Unknown	2 (0.6)
			Prescribed short/rapid acting insulin instead of long acting insulin	1 (0.3)
			Prescribed incorrect type of mixed insulin	1 (0.3)
			Prescribed two long-acting insulins simultaneously	1 (0.3)
	Prescription omitted	10 (3.0)	Unknown	3 (0.9)
			Insulin not documented in medicines reconciliation	2 (0.6)
			Insulin not prescribed on transfer to rehabilitation unit	2 (0.6)
			Insulin prescribed once daily instead of twice daily	1 (0.3)
			No subcutaneous insulin prescribed on discontinuation of intravenous insulin	1 (0.3)
			Insulin inappropriately withheld due to concerns re hypoglycaemia	1 (0.3)
Gentamicin	Prescribed incorrect dose	7 (2.1)	Dose calculated using incorrect weight	2 (0.6)
			Dose too high	2 (0.6)
			Dose calculated using outdated blood results	1 (0.3)
			Dose calculated using eGFR instead of creatinine	1 (0.3)
			Dose prescribed in excess of maximum daily dose	1 (0.3)
	Incorrect drug monitoring	7 (2.1)	Level not taken post administration	6 (1.8)
			Level taken too early post administration	1 (0.3)
	Prescribed incorrect dosage frequency	6 (1.8)	Prescribed 24 hourly instead of 48 hourly	2 (0.6)
			Prescribed without checking level <1 in patient with renal impairment	2 (0.6)
			Prescribed 48 hourly instead of 24 hourly	1 (0.3)
			Prescribed 12 hourly instead of 24 hourly	1 (0.3)
Vancomycin	Prescribed incorrect dose	5 (1.5)	Loading dose prescribed instead of maintenance dose	2 (0.6)
			Dose too high	2 (0.6)
			Dose too low	1 (0.3)
Paracetamol	Duplication of therapy	5 (1.5)	Prescribed regularly and as required	2 (0.6)
			Prescribed alongside co-codamol	2 (0.6)
			Prescribed alongside co-dydramol	1 (0.3)
Enoxaparin	Prescribed without indication	5 (1.5)	Prescribed when patient already anticoagulated	3 (0.9)
			Prescribed for incorrect patient	1 (0.3)
			Prescribed in line with outdated guidelines	1 (0.3)
Warfarin	Prescription omitted	5 (1.5)	Unknown	4 (1.2)
			Not prescribed on transfer to rehabilitation unit	1 (0.3)

tandem with targeted, on the ground quality improvement initiatives, to optimise efforts to promote safe prescribing.

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