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Estimating the impact of enabling NHS information systems to share patients' medicines information digitally

SCIENTIFIC SUMMARY

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ABBREVIATIONS

A&E	Accident and Emergency
ADE	Adverse drug event
ADR	Adverse drug reaction
API	Application programming interface
BPMH	Best possible medication history
CCG	Clinical Commissioning Group
DHSC	Department of Health and Social Care
dm+d	dictionary of medicines and devices
EHR	Electronic health records
eMedsRec	Digitally-enabled medicines reconciliation
ePMA	Electronic Prescribing and Medicines Administration
EPS	Electronic Prescription Service
FAE	Finished admission episode
FCE	Finished consultant episode
FHIR	Fast Healthcare Interoperability Resources
IFT	Inter-facility transfer
ISN	Information standards notice
LYG	Life-years gained
MedsRec	Medicines reconciliation
NHS	National Health Service
NHSE	NHS England
pADE	Preventable adverse drug event
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-analyses
QALY	Quality-adjusted life-years
RR	Relative risk
SCR	Shared care record
WHO	World Health Organization

SCIENTIFIC SUMMARY

1 INTRODUCTION

Access to accurate medicines information is key to the management of patients, especially when they transfer from one care setting to another, such as on admission to or discharge from hospital. However, there are often discrepancies or deficiencies in medicines information provision leading to clinically important medicines being omitted or being prescribed and administered inappropriately ('medication errors'). Harm caused by medication is referred to as an adverse drug event (ADE). ADEs can occur even when the medicine is prescribed appropriately, (e.g. due to overdose, adverse drug reactions (ADRs) or allergies), but in the presence of a medication error, any resultant harm can be considered an 'avoidable' or 'preventable adverse drug event' (pADE). Medication errors at transfer between care settings is a WHO priority area in their 3rd global patient safety challenge in 2017 focused on medication safety. Health systems have a range of processes in place to mitigate against medication errors, including medicines reconciliation, which have been shown to reduce transition medication errors. In 2022, NHS Digital estimates per year in England that 167 million hospital prescription items are transcribed, consuming 1.2million hours hospital staff time and 9000 weeks general practice (GP) clinical and administrative time. Across many sectors, there have been huge leaps in technology development to enable information systems to share their information digitally, often referred to as system interoperability. Making patient and medicines information systems interoperable across care transitions and across electronic systems within individual health care organisations could reduce time taken by healthcare staff to reconcile medication discrepancies, improve patient experience, facilitate quicker discharge, support better healthcare planning and reduce risk of avoidable harm to patients. A nationwide initiative by NHS England to introduce interoperability into all NHS health and social care settings is the national roll-out of information standard notification 'ISN DAPB4013: Medicine and Allergy/Intolerance Data Transfer'. There is a lack of evidence from systematic or other reviews supporting benefits of interoperability solutions to guide decisions on their implementation and use. This report estimates impact of ISN DAPB4013 on transition medication error rates, patient harm and associated NHS costs in England.

2 AIMS AND OBJECTIVES

The research study aimed to estimate the medication safety benefits that are expected to be evident following the implementation of information standard notification 'ISN DAPB4013: Medicine and Allergy/Intolerance Data Transfer' to patients and the NHS in England by answering the following questions:

1. What is the prevalence of medication errors at key transitions between care settings?
2. What is the estimated patient harm and NHS cost of transition medication errors?
3. How will improved information transfer affect transition medication errors, patient harm and NHS cost?

We focused on four transfer settings: Primary to secondary care; secondary to primary care; intra-hospital transition where there is transfer from one electronic prescribing system to another; inter-hospital transfer.

3 METHODS

This study used published evidence and stakeholder/expert input to estimate prevalence, patient harm and cost of transition medication errors, and the expected effect of the new information standards on these parameters using the following methods:

1. Rapid literature review to identify: a) transition medication error prevalence at interfaces between care locations in the UK; b) costs and health burden associated with transition medication errors in the UK; benefits and costs of interoperability systems designed to reduce transition medication errors.

2. Modelling to provide estimates of annual transition medication error prevalence and burden in the NHS in England before and after the implementation of the ISN DAPB4013.
3. Liaison and engagement with stakeholders was carried out to understand the composition, costs and expected benefits of the key components of ISN DAPB4013:
 - Fast Healthcare Interoperability Resources (FHIR)
 - Application programming interface (API) for exchanging electronic health records (EHR)
 - Dictionary of medicines and devices (dm+d) adoption
 - Enhanced electronic prescription service.

Key reviews served as the starting point for observational studies reporting prevalence and impact of medication error in the UK at transitions and studies of interoperability solutions to support medicines safety. Nine databases were searched for studies from 2000-June 2022 and five journals were hand-searched. Search strategies covered all specified information transfer transitions, preferentially included UK data, using data from other settings if necessary. Data extracted was combined in a narrative synthesis. We included all comparative study designs where the intervention was carried out at an information transfer transition, incorporated one or more elements included in ISN DAPB4013 and measured one of: medication errors, costs, or patient outcomes.

We used error rates reported in the studies above to estimate prevalence of transition medication errors in England per year. We found very little data indicating direct links between errors and patient harm. Therefore, we developed estimates of burden of transition medication errors using published work around adverse drug events (ADEs), where a retrospective judgement had been made that harm/burden was due to an ADE. The primary approach was to identify available UK-based case studies of estimates of burden on healthcare resources (inpatient admissions, inpatient length of stay, accident and emergency (A&E) visits and deaths) associated with transition medication errors and to extrapolate to estimate impact for England per annum.

We assumed the estimates of number of transition medication errors and burden from those transition medication errors for the 'current practice' scenario. We derived estimates of the anticipated effectiveness of ISN DAPB4013 implementation. We combined these data to allow derivation of indicative estimates of changes in patient harm, and costs from NHS England's perspective (£, cost year 2020/21). The population was people at risk of experiencing medication transition errors at defined transitions. The intervention was digitally-enabled interoperable medicines information transfer. The comparator was manual medicines information transfer. The outcomes assessed were transition medication errors, hospitalisations, adverse drug events, length of hospital stay, readmissions, deaths. It was assumed that, prior to ISN DAPB4013 introduction, all acute hospitals have electronic inpatient prescribing (therefore no discrepancies caused by manual chart re-writes are included in our estimates) and carry out standard (non-digitally-enabled) medicines reconciliation during an inpatient stay.

4 RESULTS: RAPID REVIEW

4.1 Transition medication error prevalence: From the 12 studies found reporting the prevalence of transition medication errors, it was not possible to pool estimates of prevalence due to study heterogeneity, so one UK study was used. No studies reported intra- or inter-hospital transfers, so the prevalence of transition medication errors during intra-hospital transfers was assumed to equal the prevalence of transition medication errors during drug chart rewrites. Prevalence of inter-hospital transition medication errors was assumed to be the same as at hospital admission.

4.2 Transition medication error harm and costs: Three studies relating to harm from transition medication errors in the context of the UK NHS were identified, specifically harm from transition medication errors relating to

discharge prescriptions, hospital admissions due to ADEs, and harm from ADEs that occur during hospitalisation.

4.3 Effect of interoperability: Five reviews of reviews, 31 reviews and 53 primary studies were retrieved to derive estimates of costs and benefits of ISN DAPB4013 implementation. One Spanish and one US study provided estimates of effectiveness for standard medicines reconciliation versus digitally-enabled medicines reconciliation on hospital admission and discharge, respectively. The impact of interoperability on transition medication errors during intra-hospital transfer, or inter-hospital transfer was not available. It was assumed that impact of interoperability on transition medication errors at both of these transitions would be the same as during a process of admission. This in turn assumed that standard medicines reconciliation was already in place at these transitions.

5 RESULTS: MODELLING

5.1 Transition medication error prevalence and burden

The total number of transition medication errors (in the presence of standard medicines reconciliation) was estimated to be 1,779,368 in England per year, with 369,195 patient episodes experiencing at least one transition medication error. The estimated burden of transition medication errors is characterised by number of people experiencing harm, excess bed days, cost to the NHS and deaths. Over a year, the total number of people estimated to experience harm from a transition medication error is 31,236, with the majority (52%) resulting from admission errors. The errors are estimated to result in 36,099 additional bed days of inpatient care, costing around £17.43 million per year. The total number of people estimated to die from these errors is 44 (Table 1).

Table 1: Summary of annual transition medication error rates, harm and costs, by transition and total

Parameters	Admission	Intrahospital transfer	Interhospital transfer	Discharge	TOTAL
Number of transition medication errors	924,551	48,596	21,146	785,075	1,779,368
Number of patient episodes with ≥ 1 transition medication error	193,593	10,176	4,428	160,998	369,195
Number of patients with harm from transition medication error	16,379	861	375	13,621	31,235
Excess bed days due to harm	17,558	923	402	17,216	36,098
Cost of excess bed days (20/21 prices)	£6,531,557	£343,312	£149,385	£10,404,549	£17,428,802
Deaths due to harm	30	2	1	12	44

5.2 Impact of ISN implementation on error rates and burden

Figure 1 summarises transition medication error rates at hospital admission and discharge, and intra- and inter-hospital transfer in the absence of any medicines reconciliation, presence of standard medicines reconciliation and addition of interoperability standards to standard medicines reconciliation.

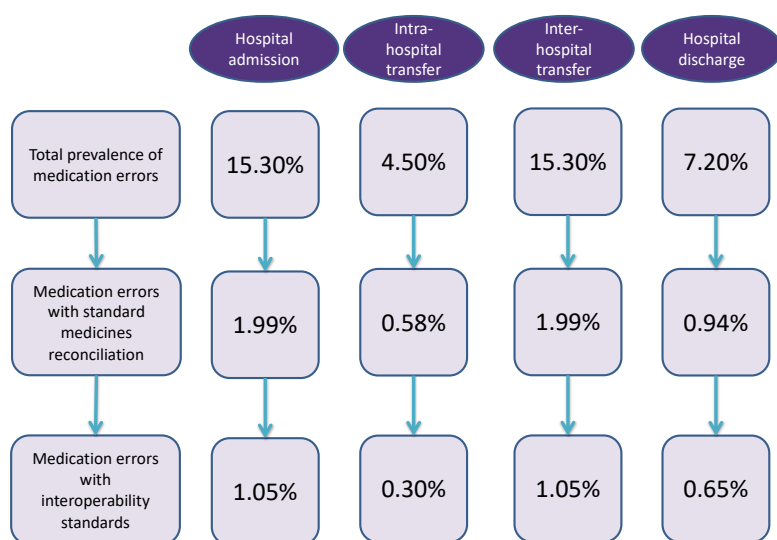


Figure 1 Prevalence of transition medication errors at key care-setting transfers in the absence of medicines reconciliation, with standard, and with digitally-enabled medicines reconciliation

Applying the estimated impact of ISN DAPB4013 implementation on the burden of medication errors at care transitions reduced the number of errors and number of patient episodes with an error by 40% from 1,779,368 to 1,065,541, and from 369,195 to 220,782, respectively. The ISN DAPB4013 implementation is estimated to result in 12,556 fewer people estimated to experience harm from a transition medication error, 14,275 fewer bed days of inpatient care, saving around £6.59 million per year and preventing 20 people dying from these errors. (See Table 2)

Table 2: Summary of impact of ISN implementation on annual transition medication error rates, harm and costs for each transition, and total

Reduction in parameters by ISN implementation	Admission	Intrahospital transfer	Interhospital transfer	Discharge	TOTAL
Number of transition medication errors	436,065	22,920	9,973	244,868	713,827
Number of patient episodes with ≥ 1 transition medication error	91,308	4,799	2,088	50,216	148,412
Number of patients with harm from transition medication error	7,725	406	177	4,248	12,556
Excess bed days due to harm	8,281	435	189	5,370	14,276
Cost of excess bed days	£3,080,613	£161,923	£70,457	£3,245,216	£6,558,210
Deaths due to harm	14	1	1	4	20

6 DISCUSSION

Medication transition errors persist despite standard medicines reconciliation, and the improved interoperability from planned ISN DAPB4013 implementation will substantially reduce transition medication error prevalence, and associated harm and cost.

We have assumed that hospitals in England have medicines reconciliation in place during a patient's admission, such that our 'before interoperability' baseline transition medication error rates are what would be seen with these systems in place. This reduces the baseline transition medication error rates substantially, which reduces

the scope of ISN DAPB4013 to further reduce transition medication errors, and thus provides what is probably a conservative estimate of effectiveness of ISN DAPB4013.

The suggested benefits of ISN DAPB4013 implementation from this report focus on patient safety and associated costs. The overall benefits of ISN DAPB4013 implementation incorporate other benefits, in terms of healthcare professional time saved, improved patient experience and quality of care, facilitating quicker discharge, enhanced capacity for cross organisational medicine optimisation, and supporting better healthcare planning.

7 RECOMMENDATIONS

Our key recommendations are:

- The ability of interoperability solutions to support more responsive and timely medicines reconciliation during admission or transfers requires service expansion and reconfiguration.
- We need UK data on the proportion of patients undergoing medicines reconciliation, how long after care transfer this occurs, and patient risk factors for transition medication errors allowing targeting of high-risk patients, such as polypharmacy.
- We need to measure transition medication error prevalence, including at inter- and intra- hospital transfer, both prior to, and after, ISN DAPB4013 implementation to assess the impact on transition medication errors, medicines reconciliation capacity, and health care professional confidence in decision-making.

We also recommend a more explicit role for patients, carers and families in these developments to improve medication safety in transitions of care.