BMJ Open Quality

Twelve-week project to improve medication reconciliation at hospitals in Wellington, New Zealand

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To cite: Dabrowski PM, Lawrie K. Twelve-week project to improve medication reconciliation at hospitals in Wellington, New Zealand. *BMJ Open Quality* 2021;**10**:e000787. doi:10.1136/bmjoq-2019-000787

Received 29 November 2019
Accepted 27 May 2021

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ABSTRACT

Inaccurate prescribing of medications on admission to hospital exposes patients to significant risk, both during the admission and at discharge. Initial data at Capital and Coast District Health Board (CCDHB, Wellington, New Zealand) showed that 0% of medication reconciliations initiated by pharmacy were completed correctly. A widespread lack of awareness of existing processes and communication differences between doctors and pharmacists were identified as root causes of the problem. A 12-week quality improvement project collected baseline data and then three interventions were carried out aiming to improve the rate of completed medication reconciliation. The interventions were education of house surgeons (junior hospital doctors), standardisation of pharmacist practice and a redesigned paper notification system. After three plan, do, study, act cycles our results showed an improvement in the rate of completed medication reconciliations from 0% to 37% and an improvement in pharmacist uptake of text messaging from 30% to 88%. The rate of partially completed reconciliations (where discrepancies were reconciled but documentation was not completed) fell from 82% to 37%. We were not able to show an increase in proportion of discrepancies rectified (in fact a decrease occurred) due to our data collection methodology. The interventions made have improved the quality of medication reconciliations at CCDHB and are likely sustainable in the longer term.

INTRODUCTION

Problem description

It has been shown internationally and in New Zealand that medication errors at transitions of care (for example, on admission to hospital or at discharge) can lead to medication-related harm to patients. This harm can lead to increased length of stay in hospital and possible readmission.[1 2]

Capital and Coast District Health Board (CCDHB) operates several inpatient facilities in the Wellington Region, New Zealand. Patients admitted to CCDHB hospitals usually receive a pharmacy-initiated medication reconciliation to identify medication discrepancies prescribed on admission and those taken in the community. Current CCDHB policy states that all inpatients admitted between 12 noon Sunday and 12 noon Friday are eligible for a medication reconciliation, to be completed as soon as possible.[3] Neonatal intensive care unit patients and patients admitted after 3 pm and discharged before 10:30 am the following day are excluded. In times of high demand, patients over 65 years old or those on more than five medications are prioritised.

Following medication reconciliation junior hospital doctors (house surgeons) are contacted to review and rectify any unintended and/or unexplained discrepancies, as clinically appropriate. The mode of contact varies; in person, via telephone call, by writing in the patient's medical notes or via text message. At CCDHB, all house surgeons and pharmacists carry a work mobile phone provided by the District Health Board (DHB) and set up with a secure messaging service, which maintains patient confidentiality allowing text messaging to be secure. Baseline data collection showed that a significant percentage of identified medication discrepancies were not rectified and that the necessary paperwork to clarify medication changes was not completed. Medication reconciliations were a clear choice for quality improvement efforts; during initial investigation, house surgeons often described a lack of knowledge about the reconciliation process whereas pharmacists expressed their frustration at perceived doctor disengagement, lack of training and difficulties with communicating effectively.

Medication reconciliations are completed by a pharmacist, pharmacy intern or technician who collect and document the list of medications, with most accurate known adverse drug reaction and allergies possible using at least two sources. A ward pharmacist then compares this collected list against the patient's medication chart and clinical notes, indicating which medicines are 'undocumented discrepancies' on a separate dedicated medication reconciliation form. A 'discrepancy' is any medicine that is

Figure 1 Redesigned notification sticker for PDSA 3 (left), original sticker (right). PDSA, plan, do, study, act.

altered, added or substituted on the patient medication chart without a documented explanation in the notes. A house surgeon then is notified to rectify the discrepancy or to document the reason for the medication change on a dedicated medication reconciliation form. Existing CCDHB policy does not specify the preferred communication method between pharmacist and doctor. A paper-based system has developed where, after completing a medication reconciliation, the pharmacist places a green notification label (figure 1) in the patient's paper progress notes and the medication reconciliation form elsewhere in the note folder, awaiting a doctor's input for completion. Currently, CCDHB has 18 pharmacists working on 19 wards, completing between 800 and 1100 medication reconciliations per month. Although some New Zealand hospitals complete medication reconciliations electronically, in 2018, all reconciliations at CCDHB were entirely paper based.

Available knowledge

Medication discrepancies are common on admission to hospitals globally. In one NHS Trust in the UK, Doolub (2017) found that 54% of inpatient medication charts were not reconciled with preadmission medicines at the point of discharge and only 18% were reconciled within 24 hours of admission.[4] This improved to 34% within 24 hours of admission with two interventions: (1) a green sticker placed in the medical notes by the pharmacist when medication charts were incomplete, which required a date and signature from the doctor when the chart had been reconciled and (2) the placing of the loose medicines reconciliation record (a list of preadmission medicines retrieved from a reliable source usually by the pharmacist) to the front of the medication chart. White *et al* developed and introduced a process for electronic, nurse/physician led medication reconciliation at a large tertiary paediatric hospital in the USA, improving the process using the Model for Improvement over 9 months.[5] Initially, 62% of patients had their medications reconciled within 24 hours of hospital admission, but after a 9-month project ≥90% of medication reconciliations were achieved within the same time period. Their results were sustained for a further 27 months.

Other interventions have transferred responsibility for the admission medication history or the entire medication reconciliation process. In a 306-patient randomised controlled trial, Pevnick *et al*[6] compared error reduction achieved when pharmacy staff obtains admission medication histories before admission medications are given. They found that admission medication histories by Pharmacists or Pharmacy Technicians reduced medication errors by over 80%. Kreckman *et al*[7] established a Transition of Care Team, composed of registered nurses, who would oversee the entire reconciliation process from admission to postdischarge outpatient follow-up to provide continuity of care. This intervention reduced admission medication errors from 33.9% to 18.7%, discharge errors from 22.9% to 5.0% and errors at outpatient follow-up from 12.8% to 7%.

Rationale

Inaccurate prescribing of medications on admission to hospital exposes patients to significant risk, both during the admission and at discharge. Errors can arise due to inaccurate medication histories, discrepancies in medication records or previously unrecorded changes to medications. The Institute for Healthcare Improvement describes three steps to medication reconciliation[8]:

- Verification (collection of the patient's medication history),
- Clarification (ensuring that the medications and doses are appropriate),
- Reconciliation (documentation of changes in the prescription).

In New Zealand, all hospitals should be conducting medicines reconciliation for patients at transfers of care, as mandated by the Health Quality and Safety Commission (HQSC) Standards for Medicines Reconciliation. The HQSC believes medicine reconciliation is an evidence-based process, demonstrated to significantly reduce medication errors caused by incomplete or insufficient documentation of medicine-related information.[2]

Specific aims

This project aimed to improve the medication reconciliation process at CCDHB by improving doctors' knowledge of the medication reconciliation process, improve the rate of completed medication reconciliations and improve communication between doctors and pharmacists.

Two specific, measurable, achievable, realistic and timely aims were established, both to be completed by the end of May 2018:

1. To increase the percentage of discrepancies rectified by doctors from 80% to above 90%.
2. To increase the percentage of completed medication reconciliations (defined as all prescription discrepancies rectified and all forms completed) by doctors from 0% to above 35%.

A further aim evaluated how pharmacists communicated with the relevant house surgeon during the medication reconciliation process, and whether the method of communication used was the most effective.

METHODS

Context

This work did not require approval from the local ethics group as there was no expected change to a patient's care as a result of this audit, and no patient identifiable data were collected. This research was designed in consultation with external, public advisors and mentors from Synergia, a leading Australasian analytics, consulting and evaluation group, with two decades' experience in health, social services and the public sector.

The work was carried out as a twelve-week quality improvement project using the Institute for Healthcare Improvement's Model for Improvement. This included baseline data collection and analysis, followed by three different interventions introduced at two weekly intervals with data collection and analysis after each intervention.

Baseline data

Baseline data included quantitative data from real patient interactions and surveys to both house surgeons and pharmacists to gain some qualitative information.

Ward pharmacists collected baseline data over a snapshot period of two days; a continuous period of data collection was ruled out due to concerns over pharmacy service capacity. Thirty-seven medication reconciliations were initiated by pharmacy on day one on five wards at Wellington Hospital; general surgery, orthopaedics, medical sub-specialties, general medicine and obstetrics/gynaecology. Twenty (54%) of these reconciliations had at least one undocumented discrepancy. On day two, the same pharmacist followed up those reconciliations that had discrepancies. None of the 20 reconciliations was completed (defined as doctors both rectifying the discrepancy and completing the relevant documentation) as doctors completed 0% of forms; however, 82% of reconciliations were partially completed (action was taken by the doctors to rectify discrepancies) with 3% of patients lost to follow-up.

We also recorded the methods by which pharmacists communicated with prescribers and found that writing in the patients' progress notes (including a specific medication reconciliation sticker) was most common form of communication used by pharmacists to contact doctors (n=7), followed by in person (n=6), text message (n=4) and more than one communication method (n=3).

Surveys of both house surgeons and pharmacists were designed using an electronic survey tool and included both qualitative and quantitative questions. The link was provided to 40 house surgeons who attended the teaching session. Of these, 37 house surgeon responses were received; 21 were postgraduate year 1 (PGY1), 11 were second year (PGY2) and 5 were third year or higher. Respondents could select more than one classification. The survey revealed that although 89% knew a formal medication reconciliation process existed at CCDHB, only 3% recalled receiving training on the process. 86% were either 'not so aware' or 'not at all aware' of the criteria for a reconciliation to be performed, with 49% 'somewhat clear' on their responsibilities (45% respondents were either 'not so clear' or 'not at all clear'). 78% had never completed the medication reconciliation form and only 35% knew that a doctors' signature was required on the form. The doctors' survey additionally collected qualitative feedback, which included the following comments on the reconciliation process and areas for improvement. Regarding preferred communication method, 73% of house surgeons preferred to receive a text message (confidentially and securely to their work phone), 46% face-to-face communication and 44% a phone call (respondents could circle more than one communication method).

Seven of the seventeen patient-facing pharmacists at CCDHB responded to our survey. When asked to consider how well the reconciliation process was working, 57% answered 'average'; 14% working 'well' and 29% 'not well'. Commenting on positive aspects of the process, pharmacists noted that the quality of data produced was typically very good and the process used well-designed documentation. Considering areas that could work better, pharmacists were concerned that doctors did not follow-up discrepancies, know what to do or prioritise reconciliations. 85% of pharmacists surveyed thought that doctors did not receive enough training on the medication reconciliation process, and despite confidence in their documentation, 100% of pharmacists were not confident that doctors would know when they had completed a reconciliation. Pharmacists expressed frustration in feeling ignored or being an annoyance to doctors. In contrast with house surgeons, 85% of pharmacists expressed a preference to communicate face-to-face, with 14% preferring to send a text message.

In order to track improvement after interventions, the project was limited to the five wards that underwent baseline data collection.

Interventions

Three interventions were designed in consultation with the CCDHB Professional Lead Pharmacist, considering feedback received from doctors and pharmacists during the baseline data collection phase. The first intervention provided all house surgeons with education on why medication reconciliations were performed, which patients were eligible and what the doctor's responsibilities are. The second set of interventions standardised pharmacist

practice; all pharmacists were asked to communicate with doctors via text messaging in the first instance and to annotate the medication chart directly if the discrepancy involved a dose or frequency issue. The third set of interventions aimed to improve the notification system by moving a pre-existing green sticker previously placed inside the patient's progress notes to the front cover of the national medication chart. This was modified so a doctor could sign to indicate that the reconciliation had been completed. Additionally, the medication reconciliation form would be stapled inside the rear cover of the medication chart until discrepancies were rectified; after which, the doctors were asked to move this form into the patient's notes.

Ward pharmacists would collect data on a Wednesday to better reflect change from baseline data (also collected on Wednesday) and follow-up the following day to see if discrepancies had been actioned. Those patients who were lost to follow-up would have their notes chased by the study author. An identical form was used by pharmacists from all five wards to collect data. Pharmacists performed a similar number of medication reconciliations each plan, do, study, act (PDSA) cycle.

Study of the interventions

The improvement project was conducted in three PDSA cycles over three weeks. Immediately after each intervention, a data collection was undertaken to assess the effectiveness of the intervention on the accuracy of individual medications and medication lists.

PDSA 1: the first PDSA cycle was a series of educational sessions for all current house surgeons, followed by an email to all CCDHB house surgeons summarising the session content. These sessions were conducted during the normal weekly teaching session for PGY1 (a compulsory session) and PGY2 and higher doctors. The CCDHB professional lead for pharmacy delivered a PowerPoint presentation designed for new house surgeons' orientation that focused on the rationale for medication reconciliations, illustrated via a case study and the correct process. Just over 20 first-year doctors attended the first teaching session and 8 second-year or higher doctors attended the second. Since the house surgeons rotate every three months, this intervention would need to be appropriately repeated to each new cohort. The feedback received from house surgeons was generally positive, with many house surgeons commenting that they would have liked to receive the training earlier. An improvement in completed medication reconciliations was afterwards recorded from 0% to 21% with a corresponding decrease in partially completed reconciliations from 82% to 57%. 7% of reconciliations were not completed and 14% were lost to follow-up. 60% of pharmacists communicated with house surgeons via text messages during this cycle.

PDSA 2: the second PDSA cycle introduced initial system changes to standardise pharmacy practice 2 weeks after PDSA 1. As the initial survey showed that house surgeons prefer text messaging as the primary form of communication, pharmacists were asked to send a text message to house surgeons every time a doctors' input was needed. All pharmacists were asked to annotate medication charts directly if the discrepancy was a dose or frequency issue; something that some, but not all, pharmacists were doing prior to the project. The results showed a decrease in completed medication reconciliations to 7% from 21%; 7% of reconciliations were partially completed and 38% were not completed. 46% of patients were lost to follow-up, with the vast majority of these coming from one ward (7 North) where there was intermittent pharmacy staff coverage. This cycle showed a significant increase in pharmacists using text messages, with 100% of pharmacists communicating with house surgeons via text message.

PDSA 3: changes to the green medication reconciliation notification sticker occurred during the final two weeks; this was redesigned and all pharmacists were asked to place it on the front of the patient's national medication chart (figure 1). The lower section, for doctor sign off, was introduced so that medical, nursing and pharmacy staff would know when a doctor had reconciled medications. Pharmacists were asked to staple the reconciliation form directly inside the medication chart until completed by doctors, who were then instructed via the green sticker to place the completed form in the patient notes. This PDSA cycle demonstrated an increase in the rate of completed reconciliations from 7% to 37%, with another 37% partially completed. 13% of reconciliations were not completed and 13% were lost to follow-up.

Measures

The outcome measures for all three cycles were defined as:

1. Percentage of medication reconciliations completed (all discrepancies were rectified and all were documentation completed).
2. Percentage of medication reconciliations partially completed (all discrepancies rectified but not all documentation completed).
3. Percentage of medication reconciliations not completed (no discrepancies or documentation completed).
4. Percentage of patients lost to follow-up.
5. Percentage of total messages from pharmacist to doctor that were sent via text message.

Analysis

Data for each PDSA cycle were collated after collection by ward pharmacists and plotted on a run chart to assess the impact of each PDSA cycle over time.

RESULTS

The goal to increase the percentage of completed medication reconciliations (defined as all prescription discrepancies rectified and all forms completed) by doctors from 0% to above 35% was met by PDSA 3 (37%, figure 2). Initially, there was an encouraging response to our education session, with completed medication reconciliations

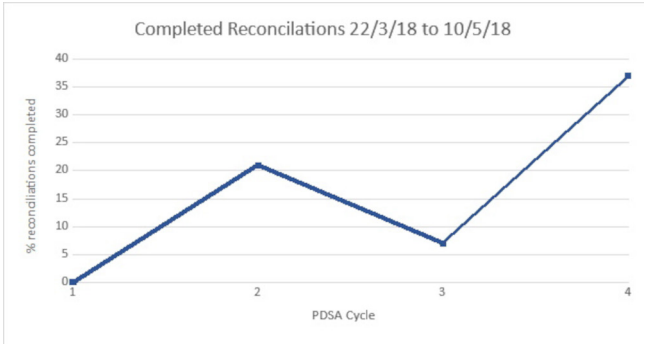

Figure 2 Percentage of completed medication reconciliations by doctors. PDSA, plan, do, study, act.

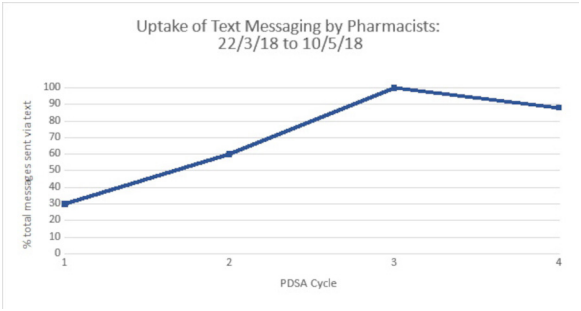

Figure 4 Uptake of text messaging by pharmacists to doctors. PDSA, plan, do, study, act.

rising from 0% to 20%. This rate dropped during PDSA 2 to approximately 7.5% before rising again to 35% in PDSA 3.

Figure 3 demonstrates that the goal to increase the percentage of discrepancies rectified by doctors from 80% to above 90% was not met; the percentage of discrepancies rectified decreased across all PDSA cycles compared with baseline, reaching a peak at PDSA 2 (57%). Possible reasons for this data trend are discussed below.

Figure 4 demonstrates that the percentage of all pharmacist to doctor communication sent via text message climbed to 100% when mandatory text messaging was introduced, falling back to 87% on PDSA cycle 3. The target percentage was over 80% of total communicates.

DISCUSSION

The aims of this project were that by the end of May 2018 we would show; an increase in the percentage of discrepancies rectified by doctors from 80% to above 90% and an increase in the percentage of completed medication reconciliations (defined as all prescription discrepancies rectified and all forms completed) by doctors from 0% to above 35%.

This project demonstrated a significant improvement in completed reconciliations—up to 37% so our second aim was met. We did not achieve a sustained increase in discrepancies being rectified, in fact this percentage decreased. This could have been due to a number of reasons which we had not measured for—such as increased house surgeon understanding of medicines reconciliation could have increased the proportion of medicine changes, which were adequately documented which would have led to a greater number of changes being intentional (better quality of prescribing but this was not measured by our audit), to truly investigate the reason for the decrease in proportion of identified discrepancies rectified by the house surgeons we would have had to kept record of what each one was and investigated if the doctors could give reasons for not rectifying them and examined this data for trends.

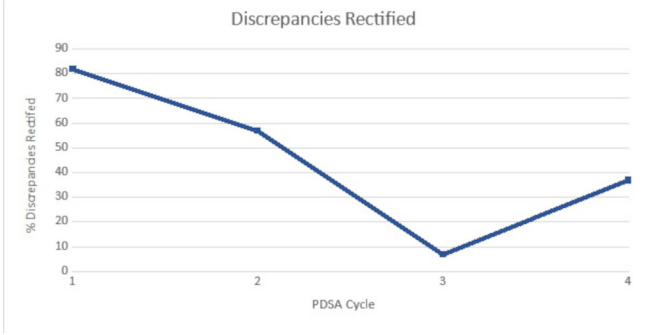

Figure 3 Percentage of discrepancies rectified by doctors. PDSA, plan, do, study, act.

Successes of the project include achieving target percentage for completed reconciliations and standardising communication between pharmacists and doctors, this project also demonstrated a successful partnership across professional lines; with pharmacists collecting data and providing education and doctors championing the quality improvement.

While some interventions, such as the modified notification sticker (PDSA 3), are likely sustainable in the long term, the transient house surgeon population, changing every 3 months (often moving to different hospitals), means that education sessions (PDSA 1) must be on-going. One possibility could be to invite pharmacists to the regular teaching sessions for new house surgeons every quarter to present interesting reconciliation forms, which contained discrepancies and have them explain their rationale and the background about recommended medications. Making more widespread change, such as introducing dedicated Transition of Care Teams, would require a significant increase in resources.

Limitations

There were significant limitations to the project. Data collection across the project was problematic; though pharmacists were asked to collect data as part of their routine work, data were collected as a snapshot rather than continuously. Although this was done on the same day each week (in order to avoid wide variability in practice), this approach provided only a few data points. There were numerous wards within CCDHB that were not captured by baseline data or subject to the quality improvement cycles. As discussed above, we were not able to fully explain the decrease in the proportion of discrepancies that were rectified, in hindsight we would have

needed to examine the types of discrepancies and ask the house surgeons about each one to identify why this decrease occurred. This could be the subject of future audit work.

CONCLUSIONS

Education, standardisation of practice and improved notification systems have improved the quality of medication reconciliations at CCDHB. Although regular education sessions would need to be on-going for new house surgeons, other interventions are simple and inexpensive to implement within this DHB and others. On-going auditing of the medication reconciliation process will reveal if these changes continue to produce sustainable change in the longer term.

Acknowledgements The author wishes to thank the pharmacy staff of CCDHB for their enthusiasm and collaborative work throughout the project. Special thanks also to all CCDHB doctors who participated, CCDHB Quality Improvement Advisor Anne Stewart and the staff of the New Zealand Resident Doctors Association Quality Improvement Project/Synergia.

Contributors Both listed authors contributed to the concept, design, data acquisition for this project. The lead author (PMD) was responsible for data analysis and interpretation. The lead author (PMD) drafted the manuscript with editing and review by the second author (KL). The final version was approved by the lead author (PMD). All authors stand by their work and findings.

Funding The project received funding from the New Zealand Resident Doctors Association Trust as part of a pilot scheme for junior doctor-initiated projects in quality and safety.

Competing interests None declared.

Patient and public involvement Patients and/or the public were involved in the design, or conduct, or reporting, or dissemination plans of this research. Refer to the Methods section for further details.

Patient consent for publication Not required.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article.

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