Reducing hospital admissions for adverse drug events through coordinated pharmacist care: learning from Hawai'i without a field trip

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Accepted 13 November 2018
Published Online First 24 November 2018

Linked

► http://doi.org/10.1136/bmjqs-2018-008418

Check for updates

To cite: Steinman MA. *BMJ Qual Saf* 2019;**28**:91–93.

Adverse drug events among older adults are common and serious. Approximately 9% of all hospital admissions for older adults are attributable to adverse drug reactions.[1] Moreover, up to one in five adults experience an adverse drug reaction during hospitalisation,[2 3] and approximately 15%–50% of hospitalised older adults will suffer an adverse drug event within 30 days of returning home (with most of these events resulting from medications that were started in the hospital).[4–6] If our goal is primum non nocere ('first, do no harm'), we have substantial opportunities for improvement.

A variety of interventions have been attempted to stem this tide of medication-induced harm, with variable success, and no clear path for hitting the sweet spot of meaningfully improving clinical outcomes related to medication use in a manner than is clinically scalable and cost-effective.[7–12] Into this breach step Pellegrin *et al* with the Pharm2Pharm intervention, outcomes of which are reported in this issue of *BMJ Quality and Safety*.[13] In the Pharm2Pharm programme, hospital-based pharmacists identified inpatients at high risk of medication misadventures, using criteria such as use of multiple medications, presence of high-risk medications such as warfarin or glucose-lowering drugs and history of previous acute care use resulting from medication-related problems.[14] The hospital pharmacist then met with the patient to reconcile medications, offer education and facilitate a coordinated hand off to a community pharmacist, selected with patient input. This community pharmacist met with the patient on an as-needed basis for up to a year postdischarge to reconcile medications, assess medication appropriateness, resolve drug therapy problems and notify prescribers of updates to the medication list, all supported by a health information exchange system. This programme was implemented sequentially in 6 of 11 non-federal general hospitals with 50 or more beds in the US state of Hawai'i, which were mostly non-urban, relatively small facilities. The remaining five hospitals served as a control group. Effectiveness was tested at a population level: International Classification of Diseases, Ninth Revision codes were used to assess the presence of adverse drug events present at the time of admission or that developed during the hospital stay, and the primary outcome of interest was the rate of adverse drug events per 1000 admissions, evaluated using an interrupted time series design.

The results are impressive. In an earlier publication stemming from this work, the authors reported a 36% reduction in the rate of medication-related hospitalisations among intervention hospitals compared with control hospitals, a benefit consistent with results from selected other pharmacist-led transitional care programmes.[15 16] The intervention generated an estimated savings of $6.6 million per year in avoided hospitalisations compared with $1.8 million in annualised costs to deliver the intervention. With the study reported in this issue of *BMJ Quality and Safety*, the authors extend these results by delving more

deeply into the findings, evaluating in what settings adverse drug events were reduced and which medications accounted for the greatest reduction.[13] Overall, 70% of medication harms were present on admission (ie, presumably developed in the community), with the remaining 30% being hospital-acquired (ie, identified during the hospital stay but not recorded as present at the time of admission). Moreover, the intervention's beneficial effects on the rate of medication-related problems was solely attributable to a reduction in problems present on admission, with no change in the rate of hospital-acquired problems. Nearly all of the harms observed were due to medications used therapeutically—that is, the correct drug used at a therapeutic dose—with only 8% due to issues such as overdose or use of the wrong drug given or taken in error. The most common culprits were anticoagulant, antineoplastic, immunosuppressive and corticosteroid medications, and reductions in harms related to anticoagulants comprised about half of the total decrease in medication-related harms.

These findings confirm the benefits that can accrue from using several high-value strategies for improving pharmaceutical care. First among these is the use a pharmacist-led approach, which have been among the most successful types of interventions for reducing medication misadventures in both inpatient and outpatient settings.[15 17 18] This should not be surprising, since pharmacists are experts in medications, and have expertise in evaluating, diagnosing and addressing medication-related problems, and in eliciting and understanding patient perspectives on medications. This latter skill set is critical for recognising how medications are actually used (or not used) in daily life, and for identifying and resolving barriers to safe, effective and goal-directed use. Second, the intervention focused on the highest-risk patients during a high-risk period, maximising opportunities for impact. Third, it accounted for the unique challenges of transitions of care, and its flexible approach seems attuned to providing the right care for the right patient at the right time.[19] Finally, the intervention was designed not to be a boutique initiative but one that could be widely scaled and implemented, with a business case that could justify widespread use.

Another important strength of this report is the authors' attempt to assess not only whether the intervention worked, but how and why it worked. For example, the finding that half of the intervention's impact on medication-related admissions was due to anticoagulants—despite being the target of only 9% of pharmacist recommendations—suggests that more robust services in this area, such as a stronger presence of anticoagulation clinics in the community, may be beneficial. While these are valuable contributions, further digging will be helpful to further unpack the study's findings. One finding that would especially benefit from further exploration is the surprisingly robust population-level effects of an intervention that was targeted to only a small proportion of older adults.

This effect was quite dramatic. Rough, back-of-the-envelope calculations based on the numbers reported suggest that there were roughly 12 000 admissions of older adults per year among the six intervention hospitals, and that approximately 1300 unique older adults received the intervention (with some individuals being hospitalised several times per year).[13 16] Thus, only a fraction of hospitalised older adults received the intervention, yet the population-level rate of medication-related admissions fell by a third—and this population presumably included many older adults who had not been recently hospitalised and thus had no opportunity to receive the intervention. There are several potential explanations for this surprising finding. A relatively small number of older adults may have had recurring admissions for medication-related problems and thus may have accounted for a large proportion of the total rate. This may have allowed this targeted intervention to be so successful at lowering the overall population rate of hospitalisations for adverse drug reactions. Alternatively, there may have been spillover effects in both the hospital and community, whereby even people who did not receive the intervention benefited from the increased attention and resources being directed to medication safety. And, as with any unblinded study there is the opportunity for ascertainment bias. Exploring these issues could provide fertile ground for better understanding the intervention and planning the next phase of its evolution and dissemination.

Finally, in interpreting the results it is important to recognise that the types of medication-related problems measured in this study likely represent only the tip of the iceberg of the total burden of such problems. If a person taking warfarin suffers a major gastrointestinal bleed, or someone taking insulin develops severe hypoglycaemia, these are easily recognised by clinicians as adverse drug events and are likely to be coded as such. If contrast, consider the case of an older adult taking a benzodiazepine who has an injurious fall, or an older adult taking over-the-counter diphenhydramine who suffers a motor vehicle accident, or a person with heart failure who starts taking ibuprofen for joint pain and is later admitted for heart failure exacerbation. How often are these recognised by clinicians as potential drug-related harms, much less identified as such in research databases? While attention to 'obvious' adverse drug reactions is important, it is imperative that we also direct our attention to less immediately obvious ones as well.

Reducing the burden of serious adverse drug events is hard. The Pharm2Pharm intervention seems highly promising. Careful, iterative evaluation will be critical for understanding the how and why of its success and guiding future development and implementation. In the meantime, clinicians and designers of improvement

interventions may want to keep in mind that reducing the burden of medication-related harms will require a focus beyond medications that are often inappropriate in older adults, such as sedative-hypnotic and strongly anticholinergic medications. As shown in this study and others, a high proportion of serious medication harms are due to agents such as anticoagulants which are often appropriate in older adults yet carry high risks of harm if used improperly.[20] Careful attention to judicious prescribing and to coordinated patient-centred counselling, monitoring and follow-up will be essential, both for individual clinicians and as a focus of systems-level interventions to support these tasks.

Funding National Institutes of Health (K24AG049057).

Competing interests MAS previously served as a consultant for iodine.com, an internet start-up focused on soliciting and sharing patient-reported effectiveness and harms of medications.

Patient consent Not required.

Provenance and peer review Commissioned; internally peer reviewed.

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