

## TEACHING CASE REPORT

### Can you prevent adverse drug events after hospital discharge?

**Case 1:** An 80-year-old woman was admitted to the clinical teaching unit of the local university hospital because of congestive heart failure, which had been precipitated by new-onset rapid atrial fibrillation. She was prescribed warfarin for stroke prophylaxis and received 5 mg on days 2 and 3 of her stay. On the morning of day 3, her international normalized ratio (INR) was 1.5.

When discharged on day 3, she was prescribed warfarin (7.5 mg/d) and asked to follow up with her family doctor. When she saw her doctor a week later, her INR was 8.0.

**Case 2:** A 75-year-old man with type 2 diabetes mellitus was admitted to hospital for management of upper gastrointestinal bleeding. His chart was marked NPO (nothing by mouth) at admission; his dosage of glyburide, 5 mg twice a day, was continued. During his 6-day stay in hospital, despite having resumed his diet and not taking any hypoglycemic agents, his serum glucose measurements never exceeded 6.0 mmol/L. At discharge, he was advised to resume his medications at his pre-hospital doses.

The next day, the patient was brought back to the hospital. His level of consciousness was decreased and his blood sugar concentration had dropped to 1.5 mmol/L. Upon review, the physicians involved determined that before his initial hospital admission, the patient had not been taking as much of his glyburide as had been prescribed.

Both of these cases involve medication-related complications, also termed adverse drug events (ADEs).

Recent research has found that about 10% of hospital patients will experience ADEs after discharge.<sup>1,2</sup> Many ADEs, such as those in these illustrative cases, are particularly troubling because they could have been prevented or their severity minimized if simple strategies had been implemented by the physicians caring for the patient.

The woman in case 1 experienced a dangerous hematologic abnormality after being sent home with a prescription for too much warfarin. No one monitored her condition adequately after discharge. Warfarin-related ADEs can be prevented by applying algorithms developed for initiating warfarin therapy.<sup>3</sup>

The man in case 2 experienced life-threatening symptoms from excessive doses of glyburide. He resumed his medications at pre-hospital dosages without an adequate assessment of adherence before his hospital admission and without consideration of whether those medication dosages were still needed. Since his blood sugar levels were normal while he was in hospital, it is unlikely that he needed the glyburide.

These cases illustrate the types of ADEs that can occur after hospital discharge. Although most ADEs lead to temporary problems that are easily reversed, these cases also demonstrate that the line between a transient abnormality in a laboratory measurement (e.g., hypoglycemia or an increased INR) and a permanent disability (e.g., brain damage from hypoglycemia or a hemorrhagic stroke) is often very slender.

Thankfully, most ADEs are side effects caused by the pharmacologic activity of a medication and can therefore be predicted and mitigated. Nevertheless, some one-third to one-half of ADEs are caused by human error or flawed procedures (system design flaws) that either intensify the side effect or cause the adverse event outright. Factors that contribute to such

ameliorable or preventable ADEs are described in Table 1.

Clearly, hospital-based physicians must do all they can to minimize the risk that their patients face after leaving the hospital. The factors in Table 1 can be used to direct health system planners on how to spend resources to improve patient safety; meanwhile, the 8 actions listed below can help physicians to reduce postdischarge ADEs among patients.

1. Communicate explicitly as to which of the pre-hospital medications need to be changed or stopped.
2. Provide an accurate, legible medication profile to the patient and his or her pharmacist, physician and other community care providers. Included on this list should be the indications for the medications and the reason for any changes in dosage. Include the prescribing physician's contact information as well, so that questions can be easily directed.
3. Advise patients to bring all existing medications from home along with their new prescriptions when they go to the pharmacy, so any discrepancies can be quickly resolved.
4. Educate patients on the side effects of medications, especially new or high-risk medications (Table 1). Patients need to recognize a side effect when they experience one, as well as to know what to do and whom to call.
5. Ensure that the patient is aware of any medications that require laboratory monitoring, when tests should be performed and who is responsible to respond to the results.
6. If multidisciplinary sources of information on drug use exist (e.g., nurses or clinical pharmacists who teach inhaler or injection techniques), ensure that they are engaged before patient discharge. Enlist the aid of community pharmacists and nurses to provide ongoing education and support for the discharged patient.
7. Provide timely communication to community-based physicians. An

**Table 1:** Factors contributing to adverse drug events (ADEs) that develop after a patient's discharge from hospital

Factor	Description	Implications for discharge planning
Changing medications	All medications have an inherent risk of side effects. Most ADEs become apparent shortly after initiating treatment. Errors in administration occur, likely because of unfamiliarity.	Put or keep a system in place to monitor patients for new symptoms or errors during the first few days after discharge
Changing metabolic requirements	Dietary modifications, changes in hepatic or renal function, or co-administration of specific drugs often necessitate dose adjustments or even stopping a medication.	Pay special attention to patients: <ul style="list-style-type: none"> <li>• with altered renal or hepatic function</li> <li>• whose medication habits must change</li> </ul>
Multiple prescriptions	Because each medication is associated with risk of an ADE, such events become more likely as the number of concurrent medications increases.	Ensure that patients taking 8 or more medications are adequately educated and monitored
Inadequate preparations for discharge	Many patients do not recall being taught about the side effects of their medications. They often feel inadequately prepared by hospital staff to manage their care at home.	Educate patients about their medications, the side effects they may expect and the monitoring required, beginning in the hospital and continuing afterward
High-risk medications	High-risk drugs that are commonly prescribed include warfarin, glucocorticoids, antibiotics, narcotic analgesics and hypoglycemic medications.	Pay special attention to patients receiving high-risk medications Plan for monitoring (e.g., INR tests)
Poor integration and coordination of care	Discharge summaries are often not received. Systems of care for monitoring patients in the days after their discharge from hospital are inadequate.	Prepare a structured discharge summary Provide and distribute it promptly Routinely check on patients out of hospital

Note: INR = international normalized ratio.

interim discharge summary should be faxed to the primary care physician and a copy given to the patient. The discharge summary needs to be dictated (and, one hopes, transcribed) on the day of discharge and copies must be sent to all relevant caregivers.

8. Whenever possible (and assuming the patient consents), enlist family members or other supportive people to help monitor patients, arrange follow-up and ensure that medications are accurately administered at home.

Preventing ADEs after discharge from

hospital requires an organized, multi-disciplinary approach. Although individual clinicians can make a difference, hospital investment is also needed to ensure that the infrastructure is in place to support the suggestions I have described.

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#### REFERENCES

1. Forster AJ, Murff HJ, Peterson JF, et al. Adverse drug events occurring following hospital discharge. *J Gen Intern Med* 2005; 20:317-23.
2. Forster AJ, Clark HD, Menard A, et al. Adverse events affecting medical patients following discharge from hospital [published erratum in *CMAJ* 2004;170(5):771]. *CMAJ* 2004;170(3):345-9.
3. Kovacs MJ, Rodger M, Anderson DR, et al. Comparison of 10-mg and 5-mg warfarin initiation nomograms together with low-molecular-weight heparin for outpatient treatment of acute venous thromboembolism: a randomized, double-blind, controlled trial. *Ann Intern Med* 2003;138:714-9.



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