

New York State Department of Health Dementia Grants Program
2003-2005 Grant Funded Project

*Improving Continuity of Care and Medication Management
When Nursing Home Residents are Discharged to and
Admitted from the Hospital: an intervention study.*

The Jewish Home and Hospital
120 West 106th Street
New York, NY 10025
Ph. 212-870-5000
Administrator: Margaret Rivers
mrivers@jhha.org

**NEW YORK STATE DEPARTMENT OF HEALTH
2001-2005 DEMENTIA GRANT
FINAL REPORT**

Project Title: Improving continuity of care and medication management when nursing home residents are discharged to and admitted from the hospital: an intervention study

Lead Nursing Home: The Jewish Home & Hospital Lifecare System

Project Director: Kenneth Boockvar, MD, MS

Address: 120 W. 106th St., New York, NY 10029

Phone: 212-870-5726 **Fax:** 212-870-4905

E-mail: Kenneth.Boockvar@mssm.edu

Additional Participating Site: The Mount Sinai Hospital

I. Objectives and Research Hypotheses

Our overall objective was to examine medication management upon transfer of nursing home residents to and from the hospital. We studied adverse drug events (ADEs) and transition drug risk associated with medication changes that occur when residents are transferred between nursing home and hospital in both directions of transfer. We paid particular attention to management of medications commonly used for dementia in nursing home residents, namely antipsychotics and antidepressants, as well as outcomes commonly experienced by demented nursing home residents that adversely affect quality of life, namely delirium and falls. We hypothesized that transfer-related medication prescribing is an aspect of nursing home admission and discharge practice that can be improved to the benefit of nursing home residents with dementia. To this end, we hypothesized that a pharmacist-initiated intervention to improve reconciliation of prescribed medications with previous medication use could increase continuity of care and reduce transition drug risk and ADEs associated with inter-institutional transfer, and thereby improve the quality of life for hospitalized nursing home residents with dementia.

Specifically we planned to:

- Examine the completeness and accuracy of information transferred between nursing home and hospital
- Test the efficacy of an intervention designed to improve continuity of medication prescribing during transfer and reduce the incidence of transition drug risk

II. Background and Rationale

Nursing home residents with dementia have a host of chronic medical conditions and functional disability that predispose them to acute illness and transfer to the hospital. A recent review suggests that nursing home residents are hospitalized nationally at a rate of 25-49% per year ¹, and at least half of nursing home residents have dementia. Although hospitalization is often needed to avert morbidity and mortality from acute illness, the outcomes of hospital care remain poor, with high mortality rates and high rates of iatrogenic complications.

Of iatrogenic complications in the hospital, much national attention has been paid to complications from medication prescribing, or adverse drug events (ADEs). A study of over 4,000 non-obstetrical admissions to 2 tertiary care hospitals found that ADEs occurred in 6.5% of admissions, of which 13% were life-threatening and 28% preventable ². In the hospital, nursing home residents are at particular risk for experiencing ADEs like delirium and falls, for which dementia and the use of psychiatric medications are strong risk factors. Such ADEs adversely affect the quality of life of hospitalized nursing home residents by prolonging their hospital stays and causing injury, permanent disability, and death.

ADEs also occur in the nursing home. A study of long-term care residents in 18 nursing homes demonstrated 1.89 ADEs per 100 resident-months, of which 44% were life threatening or serious³. In the same study, new nursing home residents, residents taking greater numbers of medications, and those taking antibiotics, antipsychotics or antidepressants were shown to have a higher risk of experiencing ADEs⁴. The fact that residents recently admitted to the nursing home have a higher risk of experiencing an ADE than more established residents suggests that suboptimal medication prescribing in the course of transfer from the hospital to the nursing home may precipitate ADEs. Yet errors in medication prescribing upon inter-institutional transfer are rejected as a source of ADEs in typical quality assurance work (which occurs within, but not across, institutions) and have not been studied. In addition, this study suggests that better management of medications commonly prescribed for demented residents, namely antipsychotics and antidepressants, might prevent some transfer-related ADEs and thereby improve resident quality of life.

In a systems analysis of ADEs more errors occur in physician ordering than in any other stage of medication delivery, and these errors are most commonly because of physicians' lack of drug knowledge and lack of information about the patient⁵. Physicians are prone to make errors in medication prescribing when patients are admitted to the hospital or to the nursing home because of unfamiliarity with patients' medical records and medication use. Discontinuity of care is a particular problem for hospitalized nursing home residents who are infrequently cared for by their primary care physicians in the hospital. This health risk associated with discontinuity of care applies to nursing home residents in both directions of hospital/nursing home transfer.

Case reports and clinician testimony suggest that ADEs occur upon transfer between hospital and nursing home at least in part due to poor communication of medication information. Because hospitals and nursing homes are loosely affiliated and do not share medical records, medication ordering systems, formularies or pharmacies, medication information may be transcribed by hand. Nursing home residents have been observed to incur injury due to the inadvertent omission of a medication, inadvertent change in medication dosing, or prescription of a medication to which a patient has had a past adverse reaction. Transfer documents are also known to be incomplete. In one study of nursing home transfers to a hospital emergency room 24% of transfer documents lacked medication information⁶.

III. Methods

A. Study design

The study was a controlled, pre- and post- intervention trial at The Jewish Home & Hospital Lifecare System (JHH) and The Mount Sinai Hospital in New York City. Eligible subjects were all residents of the JHH Manhattan campus who were admitted to Mount Sinai Medical Center. JHH is a 514-bed academic, not-for-profit nursing home with a long history of clinical and research affiliation with Mount Sinai. It has both subacute and long-term care units. Mount Sinai is a 1,171-bed tertiary care, academic, not-for-profit hospital medical center. On average 20 Jewish Home residents are admitted to Mount Sinai per month.

B. Intervention and rationale

The intervention was designed to improve continuity of medication management for residents transferred to and from the hospital. It is based on interventions shown to decrease the incidence of ADEs. Previous studies have demonstrated that computerized alert systems can reduce serious medication errors by 44-55%^{7, 8}. Other studies have shown that pharmacist retrospective or concurrent review of medication orders in the hospital reduces the incidence of ADEs^{9, 10}. Finally, a geriatrics consultation intervention reduced the incidence of delirium by 36% in patients hospitalized for hip fracture¹¹. One of the most common recommendations made by this consultation team was the elimination of unnecessary medications.

The intervention incorporated aspects of each of these previous types of interventions and was created by a development team that included nursing home pharmacists and physicians. First, for each hospitalized nursing home resident a nursing home pharmacist obtained pre-hospitalization prescribing information. Second, after the resident returned to the nursing home the pharmacist listed the pre- and post- hospital medication regimens in side-by-side columns in a table on the intervention instrument. Using this table, the nursing home pharmacist highlighted all differences, including medication omissions, new medications, and dose changes, between the prescribed regimens. The instrument also included sections for medications not recommended to be used in older adults and formulary changes. The instrument was distributed to the nursing home attending physicians in a timely fashion after nursing home-to-hospital transfer. Nursing home physicians were expected to review the highlighted changes, to contact the physician provider at the hospital in case of questions or concerns about the medication regimen, to acknowledge reviewing the form by signing at the bottom, and to record whether alterations in prescribing were made as a result of reviewing the document.

C. Sample

Potential subjects were identified each day as those residents admitted to the hospital in the last 24 hours according to the nursing home admission/discharge roster. If they stayed in the hospital less than 1 day or were not discharged back

to JHH (e.g., they died in the hospital) they were excluded. Trained research personnel contacted the nursing home primary care physician to identify hospitalized residents that were capable of giving informed consent. Those who were capable were approached in the hospital or nursing home for informed consent. For those who were incapable, legal surrogates were identified from the nursing home medical record and approached for informed consent.

D. Data Collection

The trial was a controlled, pre- and post- intervention trial. There was a 12-month pre-intervention phase and a 12-month intervention phase. In the pre-intervention phase all enrolled subjects received usual care, and data was collected on the pre-intervention frequency of medication changes, transition drug risk, and ADEs related to inter-institutional transfer in both directions of transfer (see Measurements section, below). In the intervention phase, the intervention instrument was implemented, during which the same outcomes were measured. This design permitted units to be their own controls, and eliminated the possibility that the intervention instrument was used for a resident meant to be a control (as would be possible if there were concurrent intervention and control groups).

All residents who consented to participate were followed during the course of their hospitalization and for 2 months after readmission to the nursing home. Baseline data was abstracted from hospital and nursing home charts using standardized data abstraction forms. This data consisted of resident demographics (gender, age, ethnicity, residence), clinical condition (chronic conditions, medications, physical and cognitive function), aspects of the acute illness and hospitalization (diagnoses, acuity of transfer, length of stay, disposition), advance directives, quality of transfer documentation (absence, presence, and legibility of information), and medication changes associated with transfer (purposeful and inadvertent). The primary outcomes of transition drug risk and ADEs related to medication changes was ascertained by chart review. Secondary outcomes, namely providers' alterations in prescribing as a result of the intervention, was ascertained through the intervention instrument itself (see Instrument section, below).

E. Variables

Medication changes. Medication changes associated with transfer were classified as medications discontinued, newly prescribed, or changed in dosing or administration. We compared a resident's medication regimen as it was written 1) in the nursing home just before hospital transfer, 2) on the nursing home-to-hospital transfer forms, 3) on admission to the hospital, 4) in the hospital just before discharge, 5) on the hospital-to-nursing home transfer forms, and 6) on re-admission to the nursing home. These comparisons identified medication changes made a) upon transfer from the nursing home to the hospital, b) during the hospital stay, and c) upon transfer back from the hospital to the nursing home.

Transition drug risk. Two research clinicians blinded to group assignment were presented with the table of medication changes and rated each transfer-related prescribing change on a 4-point scale reflecting potential (likelihood and magnitude) for harm (none, small, moderate, great). The ratings were summed and divided by 2 (for the two raters) for an overall transition drug risk score for that transfer. Raters were instructed not to assume that a medication was purposefully altered or that the alteration had a good clinical rationale, but to assume instead that all medication alterations were inadvertent. In tests of reliability, inter-rater reliability between 2 physician raters or a physician and pharmacist for this measure was good (kappa .57-.74). The score also demonstrated good predictive validity: in a multivariate logistic regression model in which transfer-related ADE (yes/no) was the dependent variable, one additional point on the score was associated with a 40% increased likelihood of ADE (OR 1.40; 95%CI 1.1-1.9).

Adverse drug events. We adapted the WHO definition for adverse drug reactions (ADRs) to define adverse drug events (ADEs) in this study, as performed by other investigators. Any noxious, unintended and undesired effect of change in drug administration (including change in dose, change in medication class, and discontinuation of a drug) upon inter-institutional transfer was considered an ADE. Because we were interested in ADEs from medication changes associated with the transfer process we did not consider ADEs that occurred as a result of medications newly prescribed more than 24 hours after inter-institutional transfer. ADEs were considered that occurred during a follow-up period of 2 months after transfer. Two clinicians on the research team reviewed each medical record and separately classified each event according to criteria adapted from Naranjo et al.¹², including the type of event, whether the event could have been caused by something other than a medication change, whether the patient had a known previous reaction to this medication change, whether the adverse event improved after correction of the medication change, and overall certainty that the event was caused by a medication change (using a 6-point Likert scale, 6 representing most certain). Investigator clinicians also rated whether the event resulted in increased hospital length of stay, functional decline, death, or readmission to the hospital, using a 6-point Likert scale for certainty of the cause of each of these outcomes.

Transfer documentation. We evaluated transfer documentation on the basis of completeness. We collected information on approximately 25 items considered to be important for inter-institutional transfer of patient care, based on a list derived from previous studies. These included such items as physician contact information, family contact information, clinical course, advance directives, history of adverse drug reactions, chronic conditions, vital signs, recent laboratory results, assistive devices, sensory function, cognitive function and medications. Completeness was scored based on how many items were present and legible.

Cognitive and physical function. Pre- and post- hospitalization cognitive and physical function was measured using validated MDS-based scales. Pre-hospitalization information was collected from MDS assessments up to, but not exceeding, 3 months prior to the hospitalization. For cognitive function we used the MDS Cognitive Performance Scale (CPS). It consists of 5 MDS items assessing consciousness, short-term memory, decision-making skills, communication ability, and ability to feed oneself. These items are counted hierarchically and yield a score from 0 (cognitively intact) to 6 (very severe impairment). The CPS has excellent reliability with estimates in the range of 0.66 - 0.88, and high sensitivity (>90%) and specificity (>85%) using the Mini-mental state exam as the gold standard. For physical function, we used the MDS ADL-Long Form scale. This scale employs 7 MDS items assessing ability to perform the tasks self-hygiene, dressing, toileting, transfer, locomotion, bed mobility and eating. Each item is scored from independent to totally dependent (0-4) and the scores are summed for a total scale range of 0-28. This scale was shown to predict average daily minutes of care provided by nursing assistants.

E. Data analysis

1) Determinants of transfer document completion (pre-intervention). We calculated summary statistics for scores of completeness of transfer documentation. We compared transfer documentation in each direction of transfer (nursing home-to-hospital vs. hospital-to-nursing home) using t-tests or and chi-square tests as appropriate. We compared transfer documentation pre- and post- HIPAA regulations implemented 4/15/04 to determine if HIPAA influenced document completion.

2) Efficacy of the intervention (post-intervention). We created a variable for whether the intervention instrument was employed or not and examined transition drug risk and provider drug prescribing related to instrument use. We tracked timing of provider interface with the instrument relative to the day of patient transfer, and recorded provider actions that were plausibly responsive to the instrument. We considered orders that followed the instrument that rectified or addressed drug discrepancies contained in the instrument as being influenced by the tool.

IV. Results

1) Determinants of transfer document completion (pre-intervention). For this analysis we included 61 nursing home residents who were hospitalized once and 17 more than once for a total of 100 hospitalizations and 200 inter-facility transfers (100 NH-to-H and 100 H-to-NH). On average patients were 85 years old, 82% were female, 60% were white, and 69% had dementia. The most common causes of hospitalization were urinary tract infection (23%), pneumonia (19%), congestive heart failure (17%), and dehydration (12%). Eighty-four percent of NH-to-H transfers were considered urgent and 58% occurred during

off-hours. Outcomes of the illness episode were poor, with 23% and 13% patients experiencing hospital readmission and death, respectively, within 2 months of return to the nursing home. Transfer documents were not identified in the medical record for 2 NH-to-H transfers (2%) and 1 H-to-NH transfer (1%). Overall transfer document completion was greater for NH-to-H transfers than for H-to-NH transfers (86.7% vs. 69.0%; $p = 0.002$). Items more likely to be present in NH-to-H transfer documents than in H-to-NH transfer documents were proxy name, nurse name, vital signs, cognition, mobility, and continence. Laboratory results were less likely to be present in NH-to-H transfer documents than in H-to-NH transfer documents. There were no significant differences in transfer document completion, overall or for any individual item, between transfers that occurred after HIPAA compliance date and in the pre-HIPAA interval (all $p > 0.05$). In multiple logistic regression models in which transfer document completeness dichotomized into 2 levels was the dependent variable, timing of transfer relative to HIPAA compliance was not associated with either NH-to-H or H-to-NH transfer document completeness. Older age, female gender, dementia diagnosis, shorter duration of nursing home residence, and off-hours hospital transfer were associated with less complete NH-to-H transfer documents. Shorter hospital length of stay was associated with less complete H-to-NH transfer documents.

2) Efficacy of the intervention (post-intervention). For this analysis we included 102 nursing home residents who experienced 147 hospitalizations. The majority of patients were white, female, and had dementia. The most common causes of hospitalization were dehydration, urinary tract infection, and pneumonia. All patients survived the initial hospital stay (an inclusion criterion), but 37% died or were readmitted to the hospital within 60 days of initial hospital discharge. Of 147 eligible hospitalization episodes, the pharmacist completed the instrument form in 140 (95%) (Table). Among 140 cases in whom the form was completed, the mean number of drug discrepancies entered on the communication form was 6.6 (s.d. 3.9). Physicians signed and returned the form in 106 (76%), and recorded a response to 86% of these discrepancies. In 71% of responses the physician indicated they were aware of the discrepancy, in 7% they indicated they would review the drug regimen, in 8% they indicated they would adjust the drug regimen, and in 4% they indicated they would initiate additional monitoring. We identified plausibly related drug prescribing changes in the medication orders corresponding to 10% of the pharmacist's recorded discrepancies. Finally, in cases in which prescribing orders occurred that were plausibly related to the intervention, these orders had the potential to reduce the transition drug risk score for the episode of care by 2.1 (s.d. 3.2) points on average. The clinical meaning of a score reduction of 2 points is provider adjustment of 1 additional drug rated as having a "small" potential to cause ADE. In a multivariate logistic regression model in which transfer-related ADE (yes/no) was the dependent variable, transition drug risk score was one of 2 variables associated with ADE. One additional point on the score was associated with a 40% increased likelihood of ADE (OR 1.40; 95%CI 1.1-1.9), and weekend or non-business hours

transfer was associated with a decreased likelihood of ADE (OR 0.05; 95%CI 0-0.53).

Table. Evaluation of instrument to improve continuity of medication prescribing at the time of nursing home resident return from the hospital.

<u>Category</u>	<u>Measure</u>	
Instrument completion	Completed in an eligible patient (N/N (%))	140/147 (95%)
	Time from hospital discharge to completion (median days (range))	15 (0-39)
Drug discrepancies	At least one documented on form (%)	93
	Average number documented (mean (s.d.))	6.6 (3.9)
Contraindicated drugs	At least one documented (%)	55
	Average number documented (mean (s.d.))	1.9 (2.0)
	At least one interaction documented (%)	52
Formulary suggestions	At least one documented (%)	3
	Average number documented (mean (s.d.))	.04 (.24)
Physician response	Review returned and signed by physician (N/N (%))	106/140 (76%)
	Time from pharmacy review to physician return (median days (range))	3.5 (0-48)
Drug discrepancies	Any physician response on form* (N/N (%))	598/696 (86%)
	Plausibly related physician order** (N/N (%))	73/696 (10%)
Contraindicated drugs	Any physician response on form * (N/N (%))	65/190 (34%)
	Plausibly related physician order** (N/N (%))	13/190 (7%)
Formulary suggestions	Any physician response on form* (N/N (%))	3/5 (60%)
	Plausibly related physician order** (N/N (%))	0/5 (0%)

*Physician documented any one of: noted or aware, will review, will adjust drugs, will monitor, or drug already adjusted

**Order occurred after pharmacy review was faxed to physician

V. Strengths and Limitations

This study's strengths are its systematic recording of the content of transfer documents, medication prescribing and transition drug risk, its sample of consecutive patients transferred between nursing home and hospital, and its measurement of other predictor variables. Although it is an improvement over

anecdotal reports regarding transfer risk, this study is limited to the experience of transfers between one hospital and one nursing home in which transfer document completion was high compared to previous reports⁶, and an experience which may not be generalized to other settings. The study needs to be replicated at other sites and in other transfer circumstances. Results may vary by facility because of variation in structure and census of facilities and by state because of variation in state laws and regulations. Another study limitation is that it did not look at all forms of communication (e.g., oral, fax, and electronic) between the study facilities. Nevertheless, oral, fax, and electronic communication likely constituted a small fraction of the communications between providers at these facilities, which is also likely true in general for communication between nursing home and hospital providers in the U.S.

We encountered several barriers during implementation of the intervention. First, although the pharmacist completed intervention instruments in the vast majority of eligible patients (95%), because of competing responsibilities there was often a significant delay between patient return to the nursing home and pharmacist instrument completion (average 15 days). We might have missed an opportunity to prevent ADEs during this period. To overcome this we attempted to facilitate the intervention tasks that the pharmacist was responsible for, including maintaining electronic access with the JHH pharmacy databases (the pharmacist was working off site), providing her with a personal digital assistant (PDA) to test drug interactions, providing research staff support to facilitate distribution of completed intervention forms to providers, and providing a financial incentive to complete the forms (\$40 per patient). These interventions had only a partial effect. A better arrangement would be to integrate the intervention into pharmacy routine tasks and to provide adequate staffing to perform this task in a more timely fashion. It might be cost-effective to do this if it reduces ADEs and reduces costly health service use.

A second barrier we encountered was incomplete physician reply to the forms (76%) and low rates of physician orders plausibly related to the information on the forms (10%). The first of these was largely due to 1) changes in patient assignment so that the form was delivered to a provider who was no longer caring for the patient, and 2) delays in form delivery, making the information on the form obsolete (e.g., the patient had died or had been readmitted to the hospital before the form was delivered). We believe that lack of physician reply was not due to lack of motivation because we kept motivation high by presenting quarterly at medical department meetings and by maintaining a good relationship with physician staff. Issues of patient assignment were complicated by greater than usual physician staff turnover, so we concluded that 76% reply was as good as we could achieve at this time. With regard to physician ordering in response to the instrument, although it was low, other types of responses (“noted or aware,” “will review,” “will monitor,” or “drug already adjusted”) were high, and we expected that only a small fraction of pharmacist items to trigger orders. Nevertheless, an effective way to increase the impact of the instrument would be

to speed up its delivery and make the included data more relevant to the physician.

VI. Conclusions

This study demonstrated the beneficial effect of implementing a medication reconciliation intervention at the time that a patient returns to the nursing home from the hospital on reducing drug risk during transfer and on changing provider prescribing. We hypothesized that medication reconciliation implemented at the time of nursing home readmission would be efficient, and would prevent the majority of ADEs. These results are concordant with the few studies that examine the efficacy of medication reconciliation. In one such study, a multicomponent intervention that featured drug regimen reconciliation successfully decreased the rate of medication errors by 70% and reduced ADEs by 15%¹³. The utilization of pharmacy technicians to initiate drug regimen reconciliation by obtaining medication histories for surgical patients reduced potential ADEs by 80% over 3 months¹⁴. A randomized trial of a hospital pharmacist transition coordinator who created a medication transfer summary and met with the receiving care team after discharge prevented inappropriate prescribing, pain, and hospital utilization, but did not affect ADEs¹⁵.

In addition, with regard to completeness of transfer documents, there was no change in written health information communicated during inter-facility patient transfer before and after HIPAA privacy protection measures were implemented, suggesting that the rule's intent to not restrict disclosure of health information for treatment purposes is being followed by providers at the study sites in the situation of inter-facility patient transfer. This finding is in contrast to recent case reports of health care entities invoking HIPAA standards while withholding information needed for patient treatment and public health initiatives. Results of this study also suggested that nursing home providers describe frailer and more communicatively impaired nursing home residents less completely in transfer documents than other residents at the time of inter-facility transfer. In addition, shorter duration of nursing home residence and shorter hospital length of stay were each associated with less complete NH-to-H and H-to-NH transfer documents, respectively. This may reflect the fact that providers are less familiar with the case histories of patients whom they have known for shorter periods of time, or, alternatively, that patients with shorter lengths of stay have less clinical complexity. Finally, off-hours hospital transfer was associated with less complete NH-to-H transfer documents. Providers who complete transfer documents off-hours are often cross covering for other providers and may be unfamiliar with residents' case histories. Off-hours staff may also have less time to complete transfer documents because of lower staff-to-patient ratios at those times.

We have already taken steps to disseminate these findings. First, we have prepared manuscripts for scientific publication for physician and pharmacist

researchers and clinicians, and have already had one published in Journal of the American Medical Directors Association¹⁶. Second, we held a “Dissemination Symposium” on 6/3/05 at JHH entitled “Improving Continuity of Care and Medication Management for Nursing Home Residents.” Presenters included Dementia Grant research staff and local experts, and topics included adverse drug reactions in geriatrics patients, continuity of drug prescribing, impact of the pharmacist intervention, and recognition and treatment of delirium. Approximately 50 individuals attended from facilities around the New York metropolitan area and we generated constructive discussion. Third, Dr. Boockvar has presented the results in other settings, including at the inaugural “Transitional Care Retreat” sponsored by Columbia-Presbyterian Medical Center in 9/05.

Next steps planned include using the research results to support additional grant proposals studying the impact of medication reconciliation on improving quality of care during transfer. Dr. Boockvar has developed a proposal that is in review at the Department of Veterans Affairs for this purpose. Study results have been used to improve quality of care during transfer between the study sites (JHH and Mount Sinai). Ideally the results could be used to support policy changes that would require formal medication reconciliation at the time of patient transfer. In fact, drug regimen reconciliation at the time of patient transfer is a new national hospital patient safety goal of the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and a key component of the effort to re-engineer VA Pharmacy Benefits Management data operations.

VII. References

1. Castle NG, Mor V. Hospitalization of nursing home residents: a review of the literature, 1980-1995. *Med Care Res Rev* 1996; 53:123-48.
2. Bates DW, Cullen DJ, Laird N, et al. Incidence of adverse drug events and potential adverse drug events. Implications for prevention. ADE Prevention Study Group. *Jama* 1995; 274:29-34.
3. Gurwitz JH, Field TS, Avorn J, et al. Incidence and preventability of adverse drug events in nursing homes. *Am J Med* 2000; 109:87-94.
4. Field TS, Gurwitz JH, Avorn J, et al. Risk factors for adverse drug events among nursing home residents. *Arch Intern Med* 2001; 161:1629-34.
5. Leape LL, Bates DW, Cullen DJ, et al. Systems analysis of adverse drug events. ADE Prevention Study Group. *Jama* 1995; 274:35-43.
6. Jones JS, Dwyer PR, White LJ, Firman R. Patient transfer from nursing home to emergency department: outcomes and policy implications. *Acad Emerg Med* 1997; 4:908-15.
7. Bates DW, Leape LL, Cullen DJ, et al. Effect of computerized physician order entry and a team intervention on prevention of serious medication errors. *Jama* 1998; 280:1311-6.
8. Raschke RA, Gollihare B, Wunderlich TA, et al. A computer alert system to prevent injury from adverse drug events: development and evaluation in a community teaching hospital. *Jama* 1998; 280:1317-20.

9. Leape LL, Cullen DJ, Clapp MD, et al. Pharmacist participation on physician rounds and adverse drug events in the intensive care unit. *Jama* 1999; 282:267-70.
10. Folli HL, Poole RL, Benitz WE, Russo JC. Medication error prevention by clinical pharmacists in two children's hospitals. *Pediatrics* 1987; 79:718-22.
11. Marcantonio ER, Flacker JM, Wright RJ, Resnick NM. Reducing delirium after hip fracture: a randomized trial. *J Am Geriatr Soc* 2001; 49:516-22.
12. Naranjo CA, Busto U, Sellers EM, et al. A method for estimating the probability of adverse drug reactions. *Clin Pharmacol Ther* 1981; 30:239-45.
13. Whittington J, Cohen H. OSF healthcare's journey in patient safety. *Qual Manag Health Care* 2004; 13:53-9.
14. Michels RD, Meisel SB. Program using pharmacy technicians to obtain medication histories. *Am J Health Syst Pharm* 2003; 60:1982-6.
15. Crotty M, Rowett D, Spurling L, Giles LC, Phillips PA. Does the addition of a pharmacist transition coordinator improve evidence-based medication management and health outcomes in older adults moving from the hospital to a long-term care facility? Results of a randomized, controlled trial. *Am J Geriatr Pharmacother* 2004; 2:257-64.
16. Boockvar KS, Fridman B. Inter-Facility Transfer of Patient Information Before and After HIPAA Privacy Measures. *J Am Med Dir Assoc* 2005; 6:310-5.