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Errors in antibiotic transitions between hospital and nursing home: How often do they occur?

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Abstract

We performed systematic review on 40 paired hospital and nursing home charts from a clinical trial to evaluate the fidelity of transitions of care among those discharged on antibiotics. We found that 30% of transitions included an inappropriate change to the patient's antibiotic plan of care.

Introduction

High-fidelity transitions of care (TOCs) between hospitals and nursing homes (NHs) are critical to the continuum of care, and TOCs between hospital and NH have been characterized as susceptible to errors.^{1–3} Successful communication of medication treatment plans between facilities has been suggested to be especially challenging due to hospital and NH factors involving the lack of formal relationships between sending and receiving facilities as well as missing or conflicting documentation.² Failed or incomplete TOCs have been shown to delay NH resident care, to increase the risk of rehospitalization, and to unnecessarily increase NH staff workload.³

Nearly one-quarter of patients discharged from hospitals to NHs are discharged on antibiotics.⁴ Transitions of antibiotic treatment plans require attention to drug, dose, timing, and safety measures. Failed transitions of antibiotics may prevent the resolution of infection and increase the likelihood of adverse events upon transfer.

In this study, we aimed to characterize and quantify the failure of high-fidelity transitions of antibiotics among patients discharged from hospitals to NHs.

Methods

We conducted a descriptive study of patients discharged from hospitals to NHs on antibiotics between January 2011 and June 2014 within the context of the clinical trial “Changing Lives by Eradicating Antibiotic Resistance” that evaluated postdischarge decolonization and education compared to education alone among MRSA carriers discharged from healthcare facilities in Los Angeles County and Orange County, California.⁵

Individuals enrolled in the trial, hospitalized with an infection, and discharged to an NH on antibiotics were included. Few NH visits were reported by trial participants. Charts from participants with sufficiently complete medical records from both the discharging hospital and admitting NH were assessed using a standardized chart review instrument. Information regarding the continuity of the

antibiotic plan of therapy was abstracted using a novel measurement tool deemed the CARDDS tool; it included the choice of antibiotic, route, dose, duration, and safety. The dose element included dose amount, frequency, and appropriate-ness of time between last administration in the hospital and first administration in the NH. Early or late administration was defined as a difference in hours from the scheduled time that exceeded half of the interval between doses. The safety element included the need for antibiotic levels for therapeutic assessment, drug–drug interaction monitoring, and hematologic or chemistry laboratory monitoring for side effects. Mismatches between the hospital’s antibiotic plan of therapy and the NH’s administration of therapy were assessed by a physician reviewer. Inappropriate mismatches without a documented explanation or suspected rationale were classified as transition errors and were reported as a proportion of total transitions. Information regarding the date and time of transfer and availability of the transferring physician’s contact information was collected.

Table 1. Proportion of All Transitions That Experienced an Inappropriate Change in the Antibiotic Plan of Care Upon Transfer From Hospital to Nursing Home

Element	Type of Inappropriate Change	% (No./Total)
C A	Antibiotic choice	0 (0/40)
R	Antibiotic route	0 (0/40)
D	Antibiotic dose	20 (8/40)
	Dose amount	3 (1/40)
	Frequency	3 (1/40)
	Early or late dose timing	20 (8/40)
D	Antibiotic duration	5 (2/40)
S	Antibiotic safety plan	18 (7/40)
	Monitoring antibiotic levels	3 (1/40)
	Monitoring interacting drugs	0 (0/40)
	Missed safety labs	15 (6/40)
Total	Any inappropriate change	30 (12/40)

Results

We evaluated 40 paired hospital and NH charts representing 37 patients discharged from 13 hospitals and transferred to 25 NHs. The NHs had an average of 116 beds, with an average resident age of 78 years and an average acuity index of 14. A description of the antibiotic therapy prescribed upon hospital discharge is available in Supplemental Table 1 online.

We found 21 unique instances of inappropriate changes to any one of the CARDDS elements involving 12 of 40 TOCs (30%) to 9 NHs. Among NHs with transition errors, these facilities had an average of 138 beds, an average resident age of 78 years, and an average acuity index of 13. On average, 1.75 errors occurred per failed antibiotic transition (Table 1). Overall, 8 TOCs included an inappropriate change in one CARDDS element, 3 TOCs included a change in 2 elements, and 1 TOC included a change in 3 elements (Table 2).

The greatest proportion of inappropriate changes occurred in the dose element: 12 errors in any component of the dose element occurred in 8 of 40 TOCs (20%). An early or late first dose upon TOC to an NH was the most common dosing error, with 10 of 12 of dose transition errors (83%) attributed to inappropriate dose timing. Of 10 inappropriate dose timing errors, 7 (70%) were antibiotics that were administered late upon TOC, compared to 3 of 10 (30%) that were administered early. Late doses were administered a mean of 9 hours (range, 4–24 hours) after scheduled dosing, and early doses were administered a mean of 19 hours (range, 9–24 hours) early.

Of 40 TOCs, 2 (5%) included an inappropriate change in duration of therapy upon transfer. Both instances involved shortening of therapy. Also, 7 (18%) included an error in antibiotic safety monitoring upon transfer. A missing safety laboratory report (ie, hematologic or chemistry panels) was the most common error; 6 of 7 safety monitoring errors (86%) involved a missed safety laboratory report. In all instances, safety laboratory tests were performed less frequently than ordered, were not performed before altering antibiotic therapy, or were performed long after antibiotic therapy had been discontinued. Of 7 safety monitoring errors, 1 (14%) involved failure to monitor antibiotic levels. No TOCs included an inappropriate change to antibiotic choice or route.

Regarding TOC documentation, 8 of 40 hospital records (20%) had missing information related to the frequency or duration of discharge antibiotics. Of 40 hospital discharge summaries, 20 (50%) contained missing or conflicting information with final progress notes in relation to discharge antibiotics. Within hospital information contained in the NH chart, 31 of 40 charts (78%) did not contain physician contact information in the event the NH had questions regarding the TOC. Lastly, for 29 charts where a time of transfer was recorded, 17 (59%) arrived after business hours and pharmacy support was no longer available.

Discussion

Nearly 1 in 3 antibiotic transitions from hospital to NH experienced an inappropriate change to, or lack of follow through on, the antibiotic plan of therapy. The most common changes were among dose and safety elements.

These data suggest the need for improvements in TOCs between facilities. A multitude of factors, including lapses in communication between the discharging hospital and receiving NH, have been implicated in contributing to errors during a TOC.^{2,3,6} These barriers can be remedied. The American Medical Directors Association encourages medication reconciliation at all points of TOC between facilities, calling for a dedicated process involving providers in both facilities, family members, and patients themselves.⁷ Multicomponent medication reconciliation upon hospital discharge and NH admission may be used in conjunction with stewardship to ensure safe and appropriate use of

antibiotics upon transfer.^{8,9} Nevertheless, this process may be difficult because physicians and pharmacists are rarely on site in NHs during over-night TOCs. Furthermore, family members of patients may not be present, and patients are often unaware of their medication list and dosing schedule. Additionally, many physicians prepopulate tentative discharge plans that may not be corrected prior to transfer. Therefore, fixed templates for antibiotics, similar to fixed templates for infection prevention, should be considered.¹⁰ For example, interfacility transfer forms should be expanded to include CARDDS elements.

Our study has several limitations. First, we reviewed paired charts from a limited number of TOCs. Second, the retrospective nature of this study introduced the possibility of missing data, such as missing laboratory reports not otherwise mentioned in notes. Lastly, we did not assess the impact of transition errors on infection resolution or adverse events.

In conclusion, nearly one-third of antibiotic transitions from hospital to NH involved a failed transition of at least 1 antibiotic care-plan element. Hospitals and NHs need structured processes and interfacility transfer forms to ensure cohesive and safe TOCs for patients discharged on antibiotics.

Table 2. Description of All Inappropriate Antibiotic Changes

Transition	Type of Inappropriate Change					Prescription Upon Hospital Discharge	Discrepancy in Nursing Home
	Choice	Route	Dose	Duration	Safety		
1			X		X	IV vancomycin 750 mg q12h for 3 more days for urosepsis and MRSA positive wound	Dose increased to 1500 mg and frequency decreased to q36h on arrival without laboratory check of drug levels; first dose in nursing home received 9 h late.
2			X		X	IV piperacillin/tazobactam 3.375 g q8 hours for 7 more days for bloodstream infection	Chemistry labs drawn upon nursing home admission but not drawn until 15 d later; first dose in nursing home received 8 h late
3					X	PO ethambutol 900 mg q24h unknown duration; PO isoniazid 300 mg q24h unknown duration; PO levofloxacin 750 mg q24h unknown duration (all 3 for empiric <i>Mycobacterium tuberculosis</i> bone/joint infection); patient prescribed twice-weekly liver function tests on discharge because of initial drug-induced transaminitis	Single liver function test check performed 2.5 weeks into therapy
4			X	X	X	IV piperacillin/tazobactam 3.375 g q8h for 9 more days for pneumonia; PO vancomycin 250 mg q6 h unknown duration for gastrointestinal infection; patient prescribed weekly labs	First dose of piperacillin/tazobactam in nursing home received 4 h late; first dose of vancomycin in nursing home received 6 h late; duration of piperacillin/tazobactam decreased from 9 more days to 1 more day without documentation; first complete blood count and basic metabolic panel in nursing home ordered 3 weeks after nursing home admission after antibiotic therapy had been stopped
5			X			IV vancomycin 1 g q24h for 7 more days for pneumonia	First dose in nursing home received 24 h early
6			X			PO vancomycin 250 mg q6h unknown duration for sepsis and <i>Clostridioides difficile</i> infection	First dose in nursing home received 3.25 h late
7			X	X		IV vancomycin 1 g q12h for 39 more days for bone/joint infection	Duration decreased from 39 more days to 14 more days without documentation; first dose in nursing home received 9 h early
8			X			IV daptomycin 750 mg q48h for 18 more days for bone/joint infection; IV imipenem/cilastatin 250 mg q6h for 14 more days for bone/joint infection	First dose of daptomycin in nursing home received 24 h early; first dose of imipenem/cilastatin in nursing home received 6 h late
9			X			IV daptomycin 330 mg q24h for 5 more days for VRE positive urinary tract infection	First dose in nursing home received 24 h late
10					X	IV daptomycin 700 mg q24h; IV piperacillin/tazobactam 4.5 gm q8h for 7 more days for cellulitis with weekly complete blood count, complete metabolic panel, creatinine kinase, and erythrocyte sedimentation rate	No documentation of labs performed in nursing home
11					X	IV cefepime 1 g q12h; IV daptomycin 500 mg q24h for 35 more days for surgical site infection	Complete blood count and complete metabolic panel performed upon nursing home admission; lab tests not performed again during nursing home therapy
12					X	IV amikacin 350 mg q24h for 7 more days for urinary tract infection	Creatinine check not performed while on antibiotic therapy in nursing home

Note. IV, intravenous administration; q12h, given every 12 hours; MRSA, methicillin-resistant *Staphylococcus aureus*; PO, oral administration; VRE, vancomycin-resistant enterococci.

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Conflicts of interest. All authors report no conflicts of interest relevant to this article.

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