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Frequency of Outpatient Antibiotic Prescription on Discharge to Hospice Care

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The use of antibiotics is common in hospice care despite limited evidence that it improves symptoms or quality of life. Patients receiving antibiotics upon discharge from a hospital may be more likely to continue use following transition to hospice care despite a shift in the goals of care. We quantified the frequency and characteristics for receiving a prescription for antibiotics on discharge from acute care to hospice care. This was a cross-sectional study among adult inpatients (≥18 years old) discharged to hospice care from Oregon Health & Science University (OHSU) from 1 January 2010 to 31 December 2012. Data were collected from an electronic data repository and from the Department of Care Management. Among 62,792 discharges, 845 (1.3%) patients were discharged directly to hospice care (60.0% home and 40.0% inpatient). Most patients discharged to hospice were >65 years old (50.9%) and male (54.6%) and had stayed in the hospital for ≤7 days (56.6%). The prevalence of antibiotic prescription upon discharge to hospice was 21.1%. Among patients discharged with an antibiotic prescription, 70.8% had a documented infection during their index admission. Among documented infections, 40.3% were bloodstream infections, septicemia, or endocarditis, and 38.9% were pneumonia. Independent risk factors for receiving an antibiotic prescription were documented infection during the index admission (adjusted odds ratio [AOR] = 7.00; 95% confidence interval [95% CI] = 4.68 to 10.46), discharge to home hospice care (AOR = 2.86; 95% CI = 1.92 to 4.28), and having a cancer diagnosis (AOR = 2.19; 95% CI = 1.48 to 3.23). These data suggest that a high proportion of patients discharged from acute care to hospice care receive an antibiotic prescription upon discharge.

Hospice care is a growing health care sector designed to provide compassionate end-of-life care for patients with a terminal illness and life expectancy of 6 months or less (1). Due to decreasing host resistance and frequent health care exposures, infection is prevalent and often the ultimate cause of death among hospice patients (2–4). The use of antibiotics is also common in hospice care with a national study suggesting that approximately 27% of U.S. hospice patients received antibiotics in the final week of life (5). However, there is limited evidence that antibiotic use benefits hospice patients by reducing symptom burden, prolonging survival, or improving quality of life (6, 7). Additional concerns with antibiotic use in hospice care include potential medication side effects and adverse events, increased risk of subsequent opportunistic infections, and prolonging the dying process (6, 8). Furthermore, antimicrobial therapy increases selective pressure for antimicrobial-resistant organisms. Given these risks, there is increasing attention toward reducing potentially unnecessary or inappropriate antibiotic use in hospice care.

In this study, we quantified the prevalence and identified characteristics of receiving an outpatient antibiotic prescription on discharge to hospice care. These patients may be at increased risk of continued antibiotic use in hospice care and may represent a target population to reduce unnecessary or inappropriate antibiotic use in this setting. This is also important given the increased emphasis on antimicrobial stewardship across the continuum of care (9).

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MATERIALS AND METHODS

This was a cross-sectional study of adult patients (aged ≥18 years) discharged directly to hospice care from Oregon Health & Science University (OHSU) between 1 January 2010 and 31 December 2012. During the study period, OHSU was a 544-bed academic, tertiary-care facility in Portland, Oregon. Patients may have had multiple discharges to hospice care; however, we included only the first discharge to hospice care for each patient during the study period. We excluded patients if they died prior to hospital discharge or their discharge disposition was unknown. We also excluded patients who were admitted to the hospital for less than 24 h or for observation purposes only (e.g., outpatient surgery). Prior to study commencement, the OHSU Institutional Review Board approved this study.

Study data were collected from two primary sources. We collected patient data on demographics, diagnoses, medications, and microbiology and laboratory results from the Oregon Clinical & Translational Research Institute (OCTRI) Research Data Warehouse (RDW). The RDW is a data repository that houses all patient electronic health record data and associated laboratory and administrative data. In addition, we collected discharge disposition data from the OHSU Department of Care Management, including vital status and discharge location (e.g., hospice care). We

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validated data from both sources by performing chart review on a subset of patients for all variables.

Our primary outcome of interest was receiving an outpatient prescription for antibiotics upon discharge to hospice care. We further categorized antibiotic data into individual therapeutic classes by manually grouping generic drug names within the medication table.

Our two primary exposures of interest were (i) having a documented infection and (ii) receiving a palliative care consultation on the index admission. We defined a documented infection as receiving antibiotics for more than 3 consecutive days and having either a diagnosis of an infection in the medical record or laboratory confirmation of a positive clinical culture on the index admission. Infectious diagnoses were identified using International Classification of Diseases ninth revision (ICD-9) codes associated with the index hospitalization and included bloodstream infection (790.7), septicemia (038.xx [where x is a number]), endocarditis (421.x and 424.9), pneumonia (480.x to 483.x, 484.x, 486.x, 487.x, 507.x, and 997.3), urinary tract infections (590.x, 595.x, 590.0, 996.62, and 996.64), sepsis (995.91 and 995.92), gastrointestinal tract infections (001.x to 009.x and 567.x), pressure ulcers (707.0x, 707.1x, and 707.9), skin and soft tissue infections (035 and 680.x to 686.x), respiratory tract infections (381.x, 382.x, 460, 461.x, 464.x, 465.x, 466.x, 472.0, 473.x, 473.9, 485.x, 490.x, and 491.x), and other (030.x to 040.x, 513, 090.x to 099.x, 462.x, 463.x, and 010.x to 018.x). Last, an infectious disease pharmacist (D.T.B.) reviewed positive clinical culture results and culture source data to confirm that they were clinically plausible as infectious agents.

Our other primary exposure of interest, receiving a palliative care consultation, was defined as the presence of a consultation note from a member of the Palliative Care Service at OHSU in the medical record for the index admission. The OHSU Palliative Care Service consults adult patients and families with any diagnosis, many of whom are at or near the end of life (10). The most common reasons for consults are to clarify prognosis and goals of care and to assist with discharge planning. Additional exposures of interest included demographic variables (e.g., age, sex), primary and comorbid diagnoses (also defined using ICD-9 codes), length of hospital stay, and completion of a physician orders for life-sustaining treatment (POLST) form.

POLST forms are medical orders regarding patient preferences for treatments under emergency circumstances, which are inserted into patient medical records and also on file with the Oregon POLST registry (http://www.oregonpolst.org/oregon-polst-registry) (11). The current Oregon POLST form includes preferences for cardiopulmonary resuscitation, medical interventions, and enteral/parenteral nutrition. From June 2009 through May 2011, the POLST form also included three possible out-of-hospital orders for antibiotic use: (i) "No antibiotics. Use other measures to relieve symptoms"; (ii) "Determine use or limitation of antibiotics when infection occurs"; or (iii) "Use antibiotics if medically indicated."

Descriptive statistics were calculated using means, standard deviations, frequencies, and percentages. We performed chi-square tests and *t* tests to evaluate bivariable associations and multivariable logistic regression to examine the adjusted associations between patient and hospitalization characteristics and receiving an outpatient prescription for antibiotics upon discharge to hospice care. We used manual forward stepwise selection to determine the final model. The *P* value for entry into the model was 0.20, selecting the variable with the smallest *P* value at each step. Only our exposures of interest, variables found to have a confounding effect, and variables that significantly contributed ($P < 0.05$) to the model were retained in the final model. Variables were considered confounders if their inclusion in the final model changed the measure of association between our exposures of interest and outcome by at least 10%. Results from the multivariable model are presented with adjusted odds ratios (OR) and 95% confidence intervals (95% CI). All analyses were performed using SAS statistical software, version 9.2 (SAS Institute, Cary, NC).

RESULTS

Among 62,792 live adult discharges from OHSU during the study period, 845 (1.3%) were directly to hospice care during the study period and included in this study. Characteristics of patients discharged directly to hospice care and bivariable analyses comparing patient characteristics by receipt of an outpatient prescription for antibiotics are displayed in Table 1. Among patients discharged to hospice care, 50.9% were aged 65 years or older, and 54.6% were male. Additionally, 57.6% of patients had a diagnosis of cancer, and 64.5% had a diagnosis of heart failure or cardiovascular disease. The mean (standard deviation [SD]) Charlson comorbidity index score was 6.9 (3.9), and a POLST form, indicating preferences for life-sustaining therapy, was on file for 60.3% of patients discharged to hospice care. A consultation with the palliative care service was performed in 84.0% of patients.

Prevalence of an outpatient antibiotic prescription on discharge to hospice care was 21.1% (178/845). Patients discharged to hospice care with an antibiotic prescription were significantly younger ($P = 0.02$), and 65.7% of these patients had a diagnosis of cancer compared to 55.5% of patients discharged without a prescription ($P = 0.01$) (Table 1). Furthermore, patients with an antibiotic prescription on discharge had a significantly higher Charlson comorbidity index score (7.6 [4.1] versus 6.7 [3.8] [SD shown in brackets]; $P = 0.006$) and longer hospital length of stay (>7 days) (50.0% versus 41.7%; $P = 0.047$) and were more likely to be discharged to home hospice care compared to those without an antibiotic prescription (73.6% versus 56.4%; $P < 0.001$).

Among the 178 patients with antibiotic prescription on discharge to hospice care, 126 patients (71.8%) patients had documented infection during their index admission compared to 34.3% of patients discharged to hospice care without an antibiotic prescription ($P < 0.001$). The distribution of documented infections during the index hospitalization is displayed in Table 2. The most prevalent documented infections were bloodstream infections, septicemia, or endocarditis (40.3%), pneumonia (38.9%), and urinary tract infections (36.3%). Despite the fact that many of these infections are considered complicated, only 11.8% of patients received a prescription for intravenous antibiotics on discharge (data not shown).

Among the 52 patients who received a prescription for antibiotics on discharge but did not have a documented infection on the index admission, more than half of these patients received either a fluoroquinolone (18/52 [34.6%]) or a penicillin (9/52 [17.3%]) (data not shown). In addition, 37/52 (71.2%) of these patients did not meet our definition of a documented infection because they did not receive antibiotics for more than 3 days during the index admission; 36/52 (69.2%) of these patients did not have a positive clinical culture, and 25/52 (48.1%) of these patients did not have an infectious diagnosis code.

The frequencies of specific antibiotic classes on discharge to hospice care are displayed in Table 3. The most frequent antibiotic classes were fluoroquinolones (36.0%), penicillins (21.9%), metronidazole (12.4%), cephalosporins (10.7%), and sulfonamides (9.0%). Approximately 17.4% of patients received a prescription for more than one antibiotic on discharge.

Patients discharged to hospice care at home were more likely to receive an outpatient antibiotic prescription at discharge than those discharged to an inpatient facility (adjusted OR = 2.86; 95% CI = 1.92 to 4.28) (Table 4). Additionally, patients discharged

TABLE 1 Characteristics of patients discharged from the hospital directly to hospice care and bivariable analysis of receiving an outpatient antibiotic order on discharge

Characteristic	No. of patients (%) unless specified otherwise			
	All patients ($n = 845$)	Patients with antibiotic prescription on discharge ($n = 178$)	Patients with no antibiotic prescription on discharge ($n = 667$)	*P* value[a]
Age > 65 yrs	430 (50.9)	77 (43.3)	353 (52.9)	0.02
Male	461 (54.6)	95 (53.4)	366 (54.9)	0.72
Race				
White	758 (89.7)	157 (88.2)	601 (90.1)	0.29
Black	26 (3.1)	5 (2.8)	21 (3.1)	
Asian	29 (3.4)	10 (5.6)	19 (2.8)	
American Indian/Alaska native	9 (1.1)	3 (1.7)	6 (0.9)	
Other	23 (2.7)	3 (1.7)	20 (3.0)	
Marital status, single	429 (50.8)	97 (54.5)	332 (49.8)	0.26
Inpatient encounter diagnosis[b]				
Cancer	487 (57.6)	117 (65.7)	370 (55.5)	0.01
COPD[c]	148 (17.5)	37 (20.8)	111 (16.6)	0.20
Dementia	127 (15.0)	25 (14.0)	102 (15.3)	0.68
Heart failure or cardiovascular disease	545 (64.5)	117 (65.7)	428 (64.2)	0.70
Cerebrovascular disease	186 (22.0)	24 (13.5)	162 (24.2)	0.002
Renal or liver disease	381 (45.1)	87 (48.9)	294 (44.1)	0.25
Charlson comorbidity index score [mean (SD)]	6.9 (3.9)	7.6 (4.1)	6.7 (3.8)	0.006
Length of hospital stay of >7 days	367 (43.4)	89 (50.0)	278 (41.7)	0.047
POLST[d] form on file prior to discharge	510 (60.3)	108 (60.7)	402 (60.3)	0.92
New POLST form completed during index admission	389 (46.0)	78 (43.8)	311 (46.6)	0.50
Palliative Care Service consultation during index admission	710 (84.0)	151 (84.8)	559 (83.8)	0.74
Documented infection during index admission	355 (42.0)	126 (70.8)	229 (34.3)	<0.001
Discharged to home hospice care (vs. inpatient hospice facility)	507 (60.0)	131 (73.6)	376 (56.4)	<0.001

[a] The *P* values are comparing the values for patients with an antibiotic prescription to the values for the patients with no antibiotic prescription upon discharge.
[b] Patients could have more than one of these diagnoses associated with their encounter.
[c] COPD, chronic obstructive pulmonary disorder.
[d] POLST, physician orders for life-sustaining treatment.

with an outpatient prescription for antibiotics were more likely to have had a documented infection during the index admission (adjusted OR = 7.00; 95% CI = 4.68 to 10.46) or a cancer diagnosis (adjusted OR = 2.19; 95% CI = 1.48 to 3.23). Palliative care consultation was not significantly associated with an antibiotic prescription on discharge (adjusted OR = 0.81; 95% CI = 0.49 to 1.34).

Last, to assess whether antibiotics prescribed at discharge may have been a continuation from the inpatient admission, we performed a subgroup analysis of patients who received antibiotics on the final day of their inpatient admission. Of the 845 patients discharged directly to hospice care, 314 (37.2%) received antibi-

TABLE 2 Infectious diagnoses during index admission for all patients with a documented infection ($n = 355$)

Infection	No. of patients (%)
Bloodstream infection, septicemia, or endocarditis	143 (40.3)
Pneumonia	138 (38.9)
Urinary tract infections	129 (36.3)
Sepsis	96 (27.0)
Gastrointestinal tract infections[a]	62 (17.5)
Pressure ulcers	50 (14.1)
Skin and soft tissue infections	28 (7.9)
Respiratory tract infections	19 (5.4)
Other	10 (2.8)

[a] This includes 35 *Clostridium difficile* infections.

TABLE 3 Frequencies of antibiotic classes prescribed for patients discharged from the hospital directly to hospice ($n = 178$)

Antibiotic class	No. of patients (%)[a]
Fluoroquinolones	64 (36.0)
Penicillins	39 (21.9)
Metronidazole	22 (12.4)
Cephalosporins	19 (10.7)
Sulfonamides	16 (9.0)
Glycopeptides	13 (7.3)
Topical	11 (6.2)
Lincosamides	10 (5.6)
Macrolides	6 (3.4)
Nitrofurantoin	3 (1.7)
Tetracyclines	3 (1.7)
Carbapenems	3 (1.7)
Linezolid	2 (1.1)
Lipopeptides	1 (0.6)

[a] Percentages do not add to 100 because 31 patients were discharged with an order for more than one antibiotic.

TABLE 4 Adjusted and unadjusted associations between patient characteristics and receipt of an outpatient prescription for antibiotics upon discharge to hospice care

Characteristic	Unadjusted odds ratio (95% CI)	Adjusted odds ratio (95% CI)[a]
Age > 65 yrs	0.68 (0.49–0.95)	
Male	0.94 (0.68–1.31)	
Race		
White	ref[c]	
Black	0.91 (0.34–2.46)	
Asian	2.02 (0.92–4.42)	
American Indian/Alaska native	1.91 (0.47–7.74)	
Other	0.57 (0.17–1.96)	
Marital status		
Single	ref	
Married	0.83 (0.59–1.15)	
Inpatient encounter diagnosis[b]		
Cancer	1.54 (1.09–2.17)	2.19 (1.48–3.23)
COPD	1.31 (0.87–1.99)	
Dementia	0.91 (0.56–1.45)	
Heart failure or cardiovascular disease	1.07 (0.76–1.52)	
Cerebrovascular disease	0.49 (0.31–0.77)	
Renal or liver disease	1.21 (0.87–1.69)	
Charlson comorbidity index score [mean (SD)]	1.06 (1.02–1.11)	
Length of hospital stay of >7 days	1.40 (1.01–1.95)	
POLST form on file prior to discharge	1.02 (0.73–1.43)	
POLST form updated/completed during index admission	0.89 (0.64–1.25)	
Palliative Care Service consultation during index admission	1.08 (0.68–1.71)	0.81 (0.49–1.34)
Documented infection during index admission	4.63 (3.23–6.65)	7.00 (4.68–10.46)
Discharged to home hospice care (vs. inpatient hospice facility)	2.16 (1.50–3.11)	2.86 (1.92–4.28)

[a] Adjusted analysis was performed using multivariable logistic regression.
[b] Patients could have more than one of these diagnoses associated with their encounter. COPD, chronic obstructive pulmonary disorder; POLST, physician orders for life-sustaining treatment.
[c] ref, reference group for the odds ratios.

otics on the final day of their index admission of which 49.7% also received an outpatient prescription for antibiotics. Among patients who received antibiotics on the final day of their admission, patients with an outpatient prescription for antibiotics were younger (age ≤64 years; 57.1 versus 43.7%; $P = 0.02$), more likely to have a cancer diagnosis (64.7 versus 51.3%; $P = 0.02$), be discharged to home hospice care (76.3 versus 53.8%; $P < 0.001$), and have a documented infection during their index admission (73.1 versus 62.0%; $P = 0.04$) compared to patients who did not receive an outpatient antibiotic prescription. Additionally, patients who received an outpatient antibiotic prescription more frequently received fluoroquinolones (28.2 versus 16.6%; $P = 0.01$) on the last day of their index admission compared to patients who did not receive an outpatient antibiotic prescription. Conversely, patients who did not receive an outpatient order more frequently received cephalosporins (29.3 versus 15.4%; $P = 0.003$) on the final day of their index admission compared to those who did receive an outpatient prescription for antibiotics on discharge to hospice care.

DISCUSSION

We observed that approximately 21% of patients discharged directly from acute care to hospice care had an outpatient prescription for antibiotics. Among patients who had an antibiotic prescription on discharge, 28.2% did not meet our criteria for a documented infection during the index admission. Patients with a cancer diagnosis and patients discharged to home hospice care had significantly greater odds of receiving an outpatient antibiotic order. To our knowledge, this is the first study to quantify the frequency and characteristics of patients with an antibiotic prescription upon discharge to hospice care. These data may have important implications for efforts to reduce unnecessary or inappropriate antibiotic use in hospice care.

Although having a documented infection during the index admission was a significant predictor of receiving an outpatient antibiotic prescription, 28.2% of patients in our study had an outpatient prescription for antibiotics but did not have a documented infection. One explanation is that our infection criteria may not have captured all infections, and manual chart review was not performed to verify infection diagnosis. In our previous analysis of National Home and Hospice Care data, 85% of hospice patients who received antibiotics in the final week of life lacked a diagnosis of an infection (5). As we discussed in that article (5), there may be less incentive for diagnostic coding beyond the primary diagnosis in hospice care because therapy is directed at symptoms, and reimbursement is fixed at a per diem rate. Furthermore, in a study of hospitalized patients with advanced cancer who ultimately died in the hospital, only approximately 70% of patients who received antimicrobial therapy met clinical criteria for an infection (12).

In addition to having a documented infection on the index admission, we observed that having a diagnosis of cancer and being discharged to home hospice care rather than an inpatient facility for hospice care were independently associated with receiving an antibiotic prescription on discharge to hospice care. Cancer and associated chemotherapy are well-described risk factors for infection that may favor antibiotic use for infection or prophylaxis. Cancer patients face many difficult decisions as they transition to hospice care, including to no longer aggressively treat their disease with chemotherapy. Thus, we hypothesize that antibiotics may be offered more frequently to cancer patients because they recently renounced other forms of aggressive care or because clinicians may feel obligated to treat infections potentially associated with cancer chemotherapy. With respect to the increased risk of receiving antibiotics among patients discharged to home hospice care, the primary receiving inpatient hospice for most OHSU patients discourages antibiotic use unless a strong case can be made that they are necessary for symptom control. Because transfer from OHSU to inpatient hospice requires a physician-to-physician sign out, the accepting hospice physicians often counsel the discharging physician to discontinue antibiotics unless absolutely necessary.

Neither stating preferences for life-sustaining therapy (i.e., POLST) nor receiving a palliative care consultation on the index admission were significantly associated with having an outpatient antibiotic prescription. We hypothesized that both variables would be associated with a lower likelihood of antibiotic orders because in their absence, the default is aggressive life-sustaining

therapy. However, a previous study reported that antibiotic preferences on patients' POLST forms were not associated with antibiotic treatment decisions (13). In contrast, several previous studies have reported an association between palliative care consultation and a decrease in health care costs and utilization (14–16). However, none of these studies observed significant differences in pharmacy costs. Thus, palliative care consultation may have less of an effect on medication utilization compared to laboratory expenditures and costs associated with admission to an intensive care unit. Furthermore, at OHSU, the Palliative Care Service makes recommendations for symptom management medications after discharge and the primary care team is responsible for writing outpatient medication prescriptions even for patients discharging to hospice care.

The primary limitation of this study was that our retrospective design did not allow for better understanding of the intention of the outpatient antibiotic prescription. Specifically, it was not clear whether antibiotics were intended to treat an active infection, serve as prophylaxis against future infections, or some other function. In addition, our retrospective design enabled us only to identify patients discharged directly to hospice care, and thus, patients who were initially discharged to nonhospice locations but subsequently enrolled in hospice care shortly thereafter were not identified. It is not clear how inclusion of these patients would have influenced our data. We hypothesized that these patients would be even more likely to receive an antibiotic order on discharge because they had yet to enroll in a hospice and thereby forgo life-sustaining therapy. As a result, our estimate of the prevalence of outpatient antibiotic prescriptions likely underestimates the true proportion of patients who enroll in a hospice either directly at discharge or shortly following discharge from the hospital. Finally, although we had data on whether patients indicated or updated their preferences for life-sustaining therapy on the POLST, we lacked data on specific preferences, including those for antibiotics.

Despite these limitations, this study provides the first data to our knowledge on antibiotic use upon discharge to hospice care. Given the uncertainty regarding the benefits and harms of antibiotic use in hospice care, these data are important as an initial step toward understanding which patients receive antibiotics and why. Further research should build on these data to clarify the role of antibiotic use in hospice care.

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