The Voice of the Patient: Patient Roles in Antibiotic Management at the Hospital-to-Home Transition

Sima L. Sharara, MD[1], **Alicia I. Arbaje, MD, MPH, PhD**[2,3,4], **Sara E. Cosgrove, MD, MS**[1,2], **Ayse P. Gurses, MS, MPH, PhD**[2,4,5,6,7], **Kathryn Dzintars, PharmD**[8], **Nicholas Ladikos, PharmD**[9,10], **S. Sonia Qasba, MD, MPH**[10,11,12], **Sara C. Keller, MD, MPH, MSPH**[1,2]

[1]Division of Infectious Diseases, Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland

[2]Armstrong Institute for Patient Safety and Quality, Johns Hopkins University School of Medicine, Baltimore, MD

[3]Division of Geriatric Medicine and Gerontology, Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland

[4]Department of Health Policy and Management, Bloomberg School of Public Health, Johns Hopkins University, Baltimore, MD

[5]Department of Anesthesiology and Critical Care Medicine, Johns Hopkins University School of Medicine, Baltimore, Maryland

[6]Whiting School of Engineering, Baltimore, Maryland

[7]Department of Emergency Medicine, Johns Hopkins University School of Medicine, Baltimore, MD

[8]Department of Pharmacy, Johns Hopkins Hospital, Baltimore, MD

[9]Department of Pharmacy, Suburban Hospital, Bethesda, MD

[10]Hospital Epidemiology and Antimicrobial Stewardship, Suburban Hospital, Bethesda, MD

[11]Suburban Hospitalist Group, Johns Hopkins Community Physicians, Bethesda, MD

[12]Pediatric Emergency Department, Bethesda Emergency Associates, Suburban Hospital, Bethesda, MD

Abstract

Objective: Our objective was to characterize tasks required for patient-performed antibiotic medication management (MM) at the hospital-to-home transition, as well as barriers to and strategies for patient-led antibiotic MM. Our overall goal was to understand patients' role in managing antibiotics at the hospital-to-home transition.

Methods: We performed a qualitative study including semi-structured interviews with healthcare workers and contextual inquiry with patients discharged home on oral antibiotics. The setting was

Corresponding Author: Sara Keller, MD MPH MSHP, skeller9@jhmi.edu, 410-952-7572, Fax: 410-583-2654, @SaraKellerMD1.

one academic medical center and one community hospital. Participants included 37 healthcare workers and 16 patients. We coded interview transcripts and notes from contextual inquiry and developed themes.

Results: We identified six themes involving barriers or strategies for antibiotic MM. We identified dissonance between participant descriptions of the ease of antibiotic MM at the hospital-to-home transition and their experience of barriers. Similarly, patients did not always recognize when they were experiencing side effects. Lack of access to follow-up care led to unnecessarily long antibiotic courses. Instructions about completing antibiotics were not routinely provided. However, patients typically did not question the need for the prescribed antibiotic.

Conclusion: There are many opportunities to improve patient-led antibiotic MM at the hospital-to-home transition. Mismatches between patient perceptions and patient experiences around antibiotic MM at the hospital-to-home transition provide opportunities for health system improvement.

Introduction

The goal of antibiotic stewardship (AS) is for patients to receive the right antibiotic at the right time at the right dose for the right duration.[1] For clinicians preparing to discharge a patient from the hospital to the home on an antibiotic, responsibility for the final attainment of these goals[2] falls to the patient and caregiver who must perform medication management (MM) tasks to actually take the antibiotic. MM refers to the ability to obtain, administer, and take medications according to a prescribed regimen[3] and is particularly important during the hospital-to-home transition, a high-risk period for medication errors.[3] Understanding the intersection of AS and antibiotic MM is essential in understanding how patients may play a role in achieving AS. Little research has specifically explored home antibiotic MM in the setting of the need to meet AS requirements.

MM during the hospital-to-home transition involves stakeholders in different work systems. Working in multiple work systems, which may include the hospital, the home, the pharmacy, and the ambulatory clinic, increases the likelihood of error.[4] Meanwhile, changes to medication regimens, especially new medications or short-term medications (such as antibiotics) can increase confusion and complicate patient and caregiver MM tasks.[5] Medication safety interventions often focus on services offered by healthcare workers (HCWs), such as needs assessment, medication reconciliation, patient education, arranging timely follow-up appointments, and telephone follow-up,[6–8] but have not addressed the role of patients in MM, particularly in short-term medications or medications that require rapid titration.[4] Understanding the perspectives of patients and informal caregivers in MM is essential, especially when medications need to be initiated and completed quickly.

While many reports have focused on patient performance of MM tasks after hospital discharge, most of these reports have focused on chronic medications.[3,4,9–11] Chronic

MM may differ from the management of medications taken on a short-term basis (such as antibiotics, steroids, opioids, anxiolytics, corticosteroids, or certain anticoagulants). For example, patient-led antibiotic MM may differ from other MM tasks as patients must start taking these antibiotics immediately on discharge, and stop taking these medications on course completion.[3,12–16] An understanding of patient-managed oral antibiotic MM at the hospital-to-home transition is necessary to reduce the likelihood of adverse drug events, improve AS, and provide insights to management of other short-term medications. We performed semi-structured interviews of HCWs and direct observations of and semi-structured interviews with patients to characterize tasks required for, barriers to, and strategies for patient-led oral antibiotic MM at the hospital-to-home transition.[3,4,9]

Methods

HCWs and patients were recruited from a tertiary care hospital in Baltimore, MD and a community hospital in suburban Bethesda, MD. At the tertiary care hospital, many patients are provided with medications from the on-site pharmacy prior to discharge. At the community hospital, there is no on-site pharmacy, but informational cards targeted to the individual patient's medications are provided to patients on discharge. We used two approaches to evaluate antibiotic MM at the hospital-to-home transition: in-person semi-structured interviews with HCWs and contextual inquiries followed by semi-structured interviews of patients performing antibiotic MM tasks after discharge. Contextual inquiry involves observing individuals--in this case, patients--in their work system (managing antibiotics), and asking clarifying questions.[17–19]

Our semi-structured interview guide was based on the Four Moments of Antibiotic Decision-Making -- a framework that emphasizes healthcare teams pausing to reflect on antibiotic indication, choice, and duration[2]--and the Transition Model of MM, which describes processes required for MM at the hospital-to-home transition (Appendix).[3] Interviews were recorded and transcribed.

HCW semi-structured interviews were conducted by two investigators individually (SLS and SCK) January 2019-August 2019. HCW interviews lasted 20–40 minutes and focused on antibiotic-decision making, antibiotic MM, and challenges in antibiotic prescribing.[2] Eligible HCW participants included inpatient physicians, pharmacists, nurses, discharge coordinators, nurse practitioners, and physician assistants, as well as clinicians from a hospital follow-up clinic. HCWs were recruited through e-mail outreach to relevant clinical groups. HCWs were excluded if they were not involved in discharging patients on antibiotics or following patients after discharge. We performed purposive sampling to ensure capture of experiences from different HCW roles.[20]

Patients eligible for contextual inquiries were on antibiotic courses for at least two days after hospital discharge to home, and were contacted just prior to or within a day of discharge. Patients were excluded if they did not speak or read English, were <18 years of age, enrolled in hospice services, or unable to provide consent. Patients who lived within an hour of either of the two hospitals were prioritized. Contextual inquiries occurred between July 2019-February 2020 while the patient was still receiving the antibiotic and were followed

by recorded interviews. One or two investigators (SLS, SCK) visited patients' homes to ask about the transition home, antibiotic MM, and follow-up. Notes were taken on the home environment.

All interviews were audio-recorded and transcribed. Two investigators (SCK and SLS) created a preliminary coding template after independently reviewing and comparing the same three randomly selected transcripts. A third investigator (AIA) independently reviewed eight transcripts to further refine the coding template. AIA, SCK, and SLS discussed and revised the coding template, with changes applied retroactively. Two investigators (SCK and SS) reviewed all transcripts to ensure that consensus was reached.

Directed content analysis of the transcripts was performed, focusing on barriers to, strategies for, and processes and outcomes of antibiotic MM at the hospital-to-home transition. Interviews were conducted and coded until thematic saturation was reached.[21] Triangulation between HCW and patients as well as across individual patients with antibiotic indication, contextual inquiry notes, and interview was applied to further contextualize the data.[22] Analysis was facilitated with NVivo 12 Pro (QSR International, Australia). Themes presented included recurrent unifying concepts or statements.[23] To aid in development of themes, we considered frequency, novelty, and relevance. The Johns Hopkins University School of Medicine Institutional Review Board approved this study.

Results

A total of 37 semi-structured interviews were conducted with HCWs, and 16 contextual inquiries were conducted with patients (Table 1). Descriptions of the tasks required for patient-led antibiotic MM at the hospital-to-home transition are presented in the Appendix and barriers to and strategies for tasks in patient-led antibiotic MM as presented by patients and HCWs are described in Table 2. Themes arose (Figure 1) in the synthesis of the data. We highlight tasks associated with patient-led antibiotic MM and barriers to and strategies for these tasks.

Procuring the Antibiotic

The first task was for the patient or caregiver to procure the antibiotic. Procuring the antibiotic was sometimes a time-consuming process for clinicians and patients, especially if the pharmacy did not have the antibiotic, as clinicians did not know in advance which antibiotics the pharmacy stocked. Strategies included changing the antibiotic to one carried by the pharmacy or sending the prescription to a hospital-based pharmacy considered more likely to carry the antibiotic. Other barriers included the pharmacy being closed, not having transportation, lack of insurance coverage, uncertainty about antibiotic cost, and competing priorities, as one medicine housestaff at the academic hospital explained:

> "I think a lot of our patients have difficulty with transportation, finances, like competing priorities, where they have to … get their rent and pick up their kids and going to the pharmacy is much lower on their list."

Transition guides (nurses who aid patients with the hospital-to-home transition through pre-discharge preparation and post-discharge contact), post-discharge phone calls, and home

care nurses aided in ensuring antibiotic acquisition. A particularly helpful strategy was medication delivery from an on-site pharmacy to the patient's room.

While many patients noted that taking the antibiotics was relatively straightforward, many noted difficulties procuring medications post-discharge, particularly acquiring medications from the pharmacy. For example, one patient who said taking antibiotics was easy had to go to three pharmacies over two days to procure all of her medications. This highlighted a theme: <u>There may be dissonance between patient-reported perceptions of MM at the hospital-to-home transition as being easy despite patients experiencing many MM challenges.</u>

Managing the Infection

Patients also had to manage the infection: monitoring for and managing side effects; attending follow-up appointments, tests, and procedures; and preventing infection spread. One surgical housestaff at the academic medical center explained that clinicians did not always sufficiently describe side effects:

> "I think some of the side effects of antibiotics we don't really prepare patients for as well as we could. So, as a person who's personally gotten doxycycline esophagitis … There are lots of … random complications that people might experience and we just prescribe them an antibiotic and most people just think like, antibiotics can make me better. They don't think about all the ways it might not."

Some patients did not recognize side effects as being due to an antibiotic, particularly milder side effects such as diarrhea or nausea. A patient discharged from the academic medical center on antibiotics for asymptomatic bacteriuria saw her vulvovaginal candidiasis as a sign of the infection being treated:

> "I recognized all the signs of what happens after you start taking [an] antibiotic for [a urinary tract infection], all the little itchiness and whatnot, I said, okay, you little buggers are leaving, we're good….It's sort of like itchiness down below and feeling that, once I took the antibiotics … the bacteria is trying to escape."

A theme arose. <u>Patients who experience side effects may not recognize them as such, so may require additional education around antibiotic side effects.</u>

Infection management also meant ensuring infection resolution, with tasks such as dressing changes or drain management, as well as scheduling and attending follow-up appointments. Many noted an inability to schedule tests or appointments due to busy outpatient schedules, insurance authorizations, or need for referrals. This became a source of frustration for patients, as one woman discharged from the academic medical center stated:

> "I'm trying to have my drain removed. They told me to call when it gets 10 cc's or less, which it is. I called to schedule the appointment to have it removed. And it's looking like it's not going to be removed no time soon. …[The scheduler] said because of my insurance [she couldn't schedule it]."

These delays are significant as many patients were told to continue their antibiotics until a test or follow-up appointment occurred. Thus, the delay in scheduling tests or appointments extended the antibiotic duration. This data led to another theme: Optimizing AS requires access to follow-up care and procedures for post-discharge infection management.

Taking the Antibiotic

Barriers to taking the antibiotic included frequent dosing, uncertainty about who to contact with questions, and competing priorities. Community health services, home health workers, and case management helped patients manage their antibiotics, as a nurse practitioner in a post-discharge clinic described:

> "I love partnering with patients. I love the role [of] a community health worker. I love the role of the case manager. And I wish it would be a bigger role, actually, and we would involve even more hands-on care, especially with we take care of a pretty darn vulnerable patient population… I think that… folks …struggle with access, finances, health literacy. If we can partner with them, we give them the best foot forward to be able to follow through with the regimens that we think are appropriate for their care."

Patients used several strategies to remember to take their antibiotics. Medication cards provided at discharge by the community hospital could be tailored to the individual patient. Pill boxes were also commonly employed, but many patients did not incorporate antibiotics into their pill boxes. Sometimes this was because their antibiotics had to be taken with food where other medications were not, but other times it was because they felt they did not need cues to remember their antibiotics. This led to an additional theme: Patients often do not integrate their antibiotics into other chronic MM tasks.

Stopping the Antibiotic

Stopping the antibiotic is an essential part of managing antibiotics at the hospital-to-home transition. Patients sometimes inadvertently prolonged the antibiotic course by taking all the antibiotic pills they were given. For example, one woman discharged from the academic hospital who was told to take four days of an antibiotic (after taking six days of an antibiotic as an inpatient) was given 10 days of antibiotics after discharge: "Yes, they did give me ten days' worth, but they told me I only had to take it for … four more days after I got home, but I'm going to finish the whole bottle." Strategies to ensure antibiotics were not extended included prescribing the exact number of pills on the day of discharge and providing clear instructions about antibiotic disposal. A theme arose: Providing patients with clear instructions about completing antibiotics is an essential part of AS.

Managing Information

Managing information was another important task. Ambulatory clinicians may not have the same access to institutional treatment guidelines as the inpatient team. If the ambulatory team was unaware of infection management guidelines, they may inappropriately extend or change antibiotics, as a nurse practitioner in an ambulatory clinic described:

> "[I had to change antibiotics for] a patient who had questionable Lyme disease at the time of his discharge … and so we felt compelled to extend his course to a 21-day course as opposed to a 14-day course because he … seemingly had the infection for quite some time [based on lab tests]."

Possible strategies include providing AS support, including institutional guidelines, to ambulatory clinics.

Understanding the Purpose of their Antibiotics

Patients had to understand the purpose of the antibiotics they were taking. This was problematic if patients who were inappropriately prescribed antibiotics were also provided with rationales for the inappropriate prescription. One woman who was prescribed antibiotics on discharge from the academic medical center was told she did not have an infection but was at risk of developing one:

> "My kidneys seemed like it was trying to start … a urinary tract infection, but the infection hadn't started and they said that the direction that the kidneys were looking in numbers, it's like it's heading towards an infection, so that's when they started antibiotics in the hospital."

On the other hand, empathetic communication with patients was a strategy to ensure patients understood the reason they were not receiving an antibiotic, as a medicine housestaff at the academic hospital explained:

> "I find it helpful to just kind of realign myself on the side of the patient, so it's not me versus them and they feel like I'm withholding something. It's me looking out for them by not giving them something that could harm them."

This led to a theme: <u>Patients typically assume the clinician has a good reason for prescribing antibiotics, even if they are unclear of the reason.</u>

Discussion

We characterized tasks required for patient-led antibiotic MM at the hospital-to-home transition,[3,9] and in doing so reported barriers to and strategies for patient-led antibiotic MM at the hospital-to-home transition. Addressing these barriers is essential to ensuring that AS goals are met.

We found that there were patients who did not believe they struggled with antibiotic MM, but had in fact experienced significant challenges, particularly with procurement.[3] This cognitive dissonance has been noted in prior studies of patient hospital-to-home transitions: patients are often satisfied with their care, even if they have experienced barriers.[3,9] This is significant—patient experience scores are included in quality measures used for ranking and reimbursements,[24] but a disconnect between perceived ease with antibiotic MM and struggles with antibiotic MM may indicate a mismatch between patient experience scores and patient MM. Clinicians seeking to mitigate barriers to MM at the hospital-to-home transition should probe patient MM tasks to identify barriers. Strategies to mitigate these barriers could include providing medications to the patient prior to leaving the hospital.

We also observed that patients experiencing side effects may not have recognized them as such. The impact of side effects on stopping medications in risk-adverse patients has been reported.[25,26] However, few have reported the impact of patient perception of side effects and possible implications on continuing antibiotics. Strategies to improve patient understanding of side effects could include patient-centric educational materials with the ability to target individual patients and to go over these with the patient using teach-back. The instructions provided should include how to monitor for side effects, what side effects may occur, and who to contact if side effects occur.

We also learned that to improve AS, a focus needs to be placed on overall infection management. Frequently, patients who did not have appropriate follow-up testing or appointments had potentially unnecessary extensions in their antibiotic courses if test results were required to stop antibiotics. While close follow-up has been described as necessary to improve outcomes for patients on parenteral antibiotics on hospital discharge,[27,28] it has not been described as an important factor in improving outcomes for patients on discharged on oral antibiotics. Strategies to ensure MM included ensuring close follow-up including scheduling of tests and outpatient appointments.[1]

Patients seldom integrated antibiotics into their normal MM tasks. Patients may make a distinction between medications that they need for a temporary basis, such as antibiotics, and medications they take on a more chronic basis. Alternatively, as antibiotics may be linked in patients' minds with the reason for their hospital admission (an acute infection), they may consider antibiotics as more important than their other medications. Those assisting patients with MM at the hospital-to-home transition may need to consider how to aid patients with incorporating antibiotics and other temporary medications into their routine, by providing patients with specific strategies (e.g., how to include these temporary medications in a pill box).

An important portion of the Transition Model of MM includes stopping medications.[3] Every additional day of antibiotics is associated with an increased risk of adverse drug events.[29] However, patients in our study who were given additional doses of antibiotics took them, even if the healthcare team told patients the extra doses weren't needed. Strategies to improve stopping medications includes only prescribing the desired number of antibiotic doses, and providing clear instructions to patients about the duration of antibiotic therapy. Patients should receive instruction in the potential harm from excessive days of antibiotics, and only be prescribed the number of doses of antibiotics required.

In addition, as has been reported in other studies in ambulatory settings, patients did not seek out antibiotics.[30,31] Instead, patients trusted that if their clinicians wanted them to take antibiotics, there was a good reason and they should take the antibiotic. Engaging patients in their care and communicating with patients about antibiotic use has been used as strategies to reduce unnecessary antibiotic use in ambulatory settings,[30,32–34] but should be a part of a strategy to improve antibiotic use at the hospital-to-home transition.

Several themes related to struggles procuring antibiotics or arranging follow-up due to insurance coverage can be connected to larger health system barriers. Determining whether

these concerns may also be present in government-run universal healthcare systems (e.g., the Veterans Affairs health system, national health systems, etc.) would be an important focus of future research.

This is one of the first studies to focus specifically on the role of patients in AS at the hospital-to-home transition, and provides novel findings that may impact AS at the hospital-to-home transition by highlighting the role of patients. We interviewed inpatient and outpatient HCWs in different roles in the discharge process as well as patients, thus allowing a broad range of views. We also had two reviewers review all transcripts to increase consensus.

There were limitations to the study. Non-English speakers were excluded, and the research took place in one geographic area, so the study may not apply to other settings or populations. Each hospital had interventions in place to improve MM (e.g., providing patients with their medications prior to discharge, providing cards with information about medications, providing follow-up phone calls with transition guides, etc.) that could have impacted our findings. Despite these existing improvement efforts, we found opportunities for further improvement. Our study does not reflect the work systems of those going to facilities or home with home care services, or those going home on parenteral antibiotics. Interviewers and coders did overlap, which may have impacted the findings as well.

Conclusion

We have identified the important role of patients in AS at the hospital-to-home transition, particularly as they perform MM tasks. We recommend that hospitals and AS programs focus on AS at the hospital-to-home transition and the importance of patients in carrying forward AS goals. In addition, we recommend that patients should be aware of the rationale for antibiotics and the duration, and told not to continue antibiotics past the intended stop date. We suggest that discharge coordinators and hospitals aid AS programs in ensuring patients have the appropriate follow-up appointments and tests in a timely fashion, including appropriate insurance authorizations, to ensure that antibiotics are not ended prematurely or extended without clear indication. Patients should understand what adverse drug events to watch for and what to do if these are experienced. We recommend that health systems should assist patients with antibiotic MM at the hospital-to-home transition, and that researchers and policy makers focus on ways to improve antibiotic use through patient engagement at the hospital-to-home transition.

Acknowledgements

Appendix

Appendix

Appendix Table:

Tasks Required for Patient Antibiotic Management in the Hospital-to-Home Transition

Process	Sub-Task	Outcome
Procuring the Antibiotic	• Ensuring pharmacy can be accessed (is open and patient can travel there). • Ensuring pharmacy has antibiotic. • Clinician is aware the pharmacy has the antibiotic. • Ensuring patient is able to pay for antibiotic including insurance coverage. • Communicate about errors (clinician-pharmacist-patient). • Clinician is aware the patient has acquired the antibiotic.	• Patient acquires antibiotic. • Patient pays too much for antibiotic. • Time taken by clinician. • Time taken by patient. • Patient frustration.
Managing the Infection	• Patient understands which adverse drug events to monitor. • Patient monitors for possibility of adverse drug events. • Patient manages adverse drug events. • Patient monitors for infection relapse including contacting clinician. • Patient manages infection (e.g., drain, wound dressings, etc.). • Patient schedules appointments and procedures. • Patient attends appointments and procedures. • Patient protects family from infection.	• Infection relapse managed in a timely fashion. • Infection relapse unrecognized. • Prevention of adverse drug events. • Early recognition and mitigation of adverse drug events. • Worsening adverse drug event. • Continues antibiotic despite adverse drug events. • Stop antibiotics early due to adverse drug events. • Infection cured. • Return to normal activities.
Taking the Antibiotic	• Patient decides to take antibiotic. • Patient discusses antibiotic with clinician. • Patient takes antibiotic at appropriate intervals. • Patient incorporates antibiotic into routine. • Patient develops strategies to take antibiotics. • Patient integrates antibiotic with other medications. • Patient swallows antibiotic.	• Patient doesn't take antibiotic. • Patient remembers to take antibiotic. • Patient takes antibiotic at appropriate frequency. • Patient takes the wrong antibiotic.
Stopping the Antibiotic	• Patient aware of when to stop antibiotic. • Patient understands how to stop antibiotic. • Patient disposes of antibiotic. • Clinician provides right amount of antibiotic.	• Patient completes antibiotics. • Patient prolongs antibiotic. • Patient keeps antibiotic for later use. • Patient takes a prior antibiotic from prior prescription. • Patient experiences side effects from prior antibiotic.
Managing Information	• Patient provided information. • Patient or inpatient care team passes information to outpatient clinicians. • Ambulatory team understands plan. • Ambulatory team aware of updated guidelines.	• Patient receives follow-up care. • Appropriate changes made to care plan. • Inappropriate change made to care plan.
Understanding the Purpose of their Antibiotics	• Patient understands why they are taking the antibiotic. • Patient understands plan. • Patient trusts clinician. • Clinician comes up with diagnosis and plan.	• Patient understands why they are on antibiotic. • Patient changes beliefs and attitudes about antibiotic stewardship. • Increasing antibiotic resistance.

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1. There may be dissonance between patient-reported perceptions of MM at the hospital-to-home transition as being easy despite patients experiencing many MM challenges.

2. Patients who experience side effects may not recognize them as such, so may require additional education around antibiotic side effects.

3. Optimizing AS requires access to follow-up care and procedures for post-discharge infection management.

4. Patients often do not integrate their antibiotics in with their other chronic MM tasks.

5. Providing patients with clear instructions about completing antibiotics is an essential part of AS.

6. Patients typically assume the clinician has a good reason for prescribing antibiotics, even if they are unclear of the reason.

Figure:
Themes in Patient-Led Antibiotic Management at the Hospital-to-Home Transition

Table 1.

Characteristics of Participants in Semi-Structured Interviews and Contextual Inquiry

Characteristic	Healthcare Worker Semi-Structured Interview Participants (Percentage of N=37)	Patient Contextual Inquiry Participants (Percentage of N=16)
Location		
Academic Hospital	27 (73%)	11 (69%)
Community Hospital	10 (27%)	5 (31%)
Gender		
Female	30 (81%)	9 (56%)
Male	7 (19%)	7 (44%)
Median Age (Range)	Not Recorded	59 (20–85)
Median Length of Stay (Range)	N/A	4.5 (3–18)
Race		
White	Not Recorded	7 (44%)
African American	Not Recorded	9 (56%)
Role		
Housestaff	10 (27%)	N/A
Hospitalist	3 (8%)	N/A
Nurse Practitioner or Physician Assistant	9 (24%)	N/A
Nurse	9 (24%)	N/A
Inpatient Pharmacists	6 (16%)	N/A
Years of Experience		
1–3 Years	21 (57%)	N/A
4–7 Years	5 (14%)	N/A
8–12 Years	5 (14%)	N/A
More than 12 Years	6 (16%)	N/A
Indication for Antibiotics		
Pneumonia	N/A	4 (25%)
Urinary Tract Infection	N/A	4 (25%)
Skin and Soft Tissue Infection	N/A	4 (25%)
Intra-abdominal Infection	N/A	2 (13%)
Bronchitis	N/A	1 (6%)
COPD Exacerbation	N/A	1 (6%)
Median Duration of Antibiotic Therapy at Discharge (Range)	N/A	6.5 (3–25)

Table 2:

Barriers to and Strategies for Antibiotic Management at the Hospital-to-Home Transition

Task	Barrier	Strategy
Procuring the Antibiotic	• The pharmacy is closed. • Patient cannot get transportation to pharmacy. • Competing priorities make it difficult for the patient to get to the pharmacy. • The pharmacy doesn't have the antibiotic. • The healthcare team does not know in advance if the pharmacy has the antibiotic. • The healthcare team does not receive feedback if the patient does not receive the antibiotic. • The healthcare team cannot reach the pharmacist. • Insurance does not cover antibiotic. • Healthcare team is unaware of expensive copays. • Prior authorization causes delays.	• The patient can learn pharmacy hours. • The healthcare team changes the antibiotic to one carried by the pharmacy. • The healthcare team sends the prescription to hospital pharmacy. • The healthcare team discharges patient with antibiotics in hand. • Clinicians review cost of antibiotic prior to prescribing. • Clinicians change antibiotic to an affordable option. • Healthcare team provides patient with voucher to cover antibiotic. • Case managers, home care nurses, and transition guides or post-discharge phone calls assist patients.
Managing the Infection	• Patient socioeconomic status or health literacy may impact infection management. • Patient does not take antibiotic due to fear of adverse drug event. • Patient does not know when adverse drug events require stopping the antibiotic. • Patient misinterprets unrelated symptoms as adverse drug events. • Patient misinterprets of adverse drug events as sign of efficacy. • Patient unclear who to contact with questions. • Patient unable to get tests due to insurance or scheduling constraints.	• Healthcare team calls patients after discharge to assess for problems. • Caregiver advocates for patient. • Patient performs self-advocacy. • Healthcare team collaborates closely with outpatient clinician. • Family members support patient in medication management.
Taking the Antibiotic	• Patients struggle to take frequently-dosed antibiotics. • Patients are unsure who to contact about how to take antibiotics. • Patient's competing priorities make it difficult to take medications. • Health literacy, education, access to healthcare, financial or insurance concerns make it difficult to take medications. • Patients struggle to remember to take antibiotic. • Patients don't wish to take antibiotics. • Different appearance of antibiotic may cause confusion for patient. • Patients can't take the antibiotic with other medications.	• Clinicians prescribe less frequently-dosed medications. • Post-discharge phone calls, home care nurse, or transition guide assist patient with troubleshooting. • Patients travel with antibiotics. • Patients use phone alarms or apps to remember to take antibiotics. • Patients use the placement of medication as a cognitive aid. • Patients use medication cards, highlighted discharge summary, or other notes to remember how to take the antibiotic. • The patient writes down instructions or maps out instructions. • The healthcare team helps the patient understand what the antibiotic looks like.
Stopping the Antibiotic	• The patient has excess doses of antibiotics from pre-admission or hospital discharge. • Errors on medication list lead patient and healthcare workers to believe patient should still be on antibiotic. • Electronic health record system leads to automated refills of antibiotics.	• Healthcare workers only prescribe a limited number of pills. • Healthcare workers provide instructions to patients about disposing of antibiotics. • Ambulatory clinicians provide close post-discharge follow-up.
Managing Information	• Ambulatory clinicians understand updated antibiotic guidelines.	
Understanding of Antibiotics	• Patients lack understanding of antibiotics. • Patients trust clinicians' decision making.	• Healthcare team communicates with the patient. • Patient performs self-advocacy.