HEALTH CARE PROVIDERS FACING PERSISTENT MEDICATION SHORTAGES:
PERSPECTIVES, PROCESSES, AND POLICIES FOR EXPLICIT RATIONING

A dissertation presented

By

Arthur Robert Schleipman

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ABSTRACT OF DISSERTATION

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Abstract

Drug shortages within the U.S. were reported over a decade ago. While the number of medications on the FDA’s shortage list has receded from its peak in 2011, many reappear or remain scarce for long periods of time, adversely impacting patient care and clinical providers’ practices. Legislative actions have only attenuated their impact, thus health care professionals and their associated institutions continue to confront them. This study examines how pharmacists, clinicians, and their respective institutions perceive, understand, communicate, and manage drug shortages.

Methods
An exploratory sequential mixed-methods study using qualitative research techniques (Phase I) and quantitative survey research (Phase II) was designed. For Phase I, semi-structured interviews were conducted with key informants (pharmacists, nurses, and physicians) from leading Boston academic medical centers and surrounding community hospitals. Focused coding techniques and thematic analyses informed by grounded theory were employed to develop a deeper understanding of varied stakeholders’ perspectives and experiences in confronting drug shortages and allocation planning. Individual and institutional drug shortage management responses were evaluated. These data also informed the development of a quantitative survey used in Phase II, where an on-line survey administered through Qualtrics (Qualtrics 2015, Provo, Utah) was administered to a nation-wide convenience sample of pharmacy directors representing community hospitals, teaching hospitals, and small clinics and dispensaries. The survey focused on institutional responses and strategies for managing and communicating drug shortages. Nonparametric and described statistical analyses were conducted with SPSS (IBM Corp. Released 2016. IBM SPSS Statistics for Windows, Version 24.0. Armonk, NY: IBM Corp.).
Results

Throughout this study, identified themes and constructs are counterbalanced by others. The persistence and uncertainty of drug shortages created a siege mentality for respondents, who also displayed great resilience and agency, which served as a buffer to moral distress. Role constraints and expressions of traditional medical hierarchical authority were noted, though in some instances these were eclipsed by genuine collegiality and interprofessional teamwork.

Aggregated drug shortage management responses were analyzed using several developed scales. Conceptually, these aggregate responses were categorized as technical, Pharmacy interventions, or, broad institutional responses, the latter integrating key disciplines, emergency preparedness, and development of drug shortage task forces. Communication strategies were also reviewed and classified as “global” all-user messaging or, targeted, focused communications. Communication of drug shortages and substitutions to patients and their representatives was found to be quite limited.

Conclusion

Ongoing persistent drug shortages present many adverse effects on patients, providers, and health care systems. Government responses have been moderately helpful, though not wholly successful in preventing shortages. Health care professionals and institutions have developed their own responses and strategies to avert or mitigate the effects of drug shortages, though still must make difficult allocation decisions. These decisions are seldom communicated directly to patients, which calls into question the transparency, and possibly the legitimacy of a response or allocation plan.
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Chapter 1

Introduction

"The supply of Metoprolol injection is at a critical level with only about a one-week supply remaining”. This verbatim excerpt from one of many urgent e-mailed notifications from the Pharmacy Department at a well-resourced academic medical center alerts clinical staff to the impending depletion of an essential drug, in this case one used for managing cardiac patients with acute myocardial infarction.

A quick unpacking of this statement is revelatory – Why is there only a week’s supply remaining? For how long will we not have this drug? Why is this drug scarce? What is the Pharmacy going to do about it? What is the FDA doing about it? Is there an alternative drug that’s as effective? As safe? If not, what then? Which remaining patients should receive the drug? Which ones will not? On what basis? Should we tell the patients? Who will tell the patients? Who else has been alerted, and what are they doing about this? What is the hospital doing about it? These are some of the key issues that drug shortages present, which in turn engender additional questions for clinical staff who must figure out how to balance duties to their own patients with their larger, institutional responsibilities. Communications to clinicians should also answer additional questions, notably, how the multi-layered responses to drug shortages and allocation strategies, if developed, will be operationalized across their organization or health system.

Shortages of essential medications in the U.S. have peaked and receded for close to two decades, reaching their apogee in 2011, when over 250 drugs were unavailable. The contributing factors and causes of drug shortages are multifactorial, and range from business decisions of manufacturers to exit the market, quality and sterility issues discovered in drug production facilities leading to their closure, absence of raw substrate materials, and even the vagaries of nature – with Hurricane Sandy being implicated for a plant shutdown.
Many of the drugs in shortage are not elective, easily replaceable agents. They are sterile injectable products used in chemotherapy, anesthesia, and acute settings such as the emergency department. Their absence or substitution with sub-optimal or unfamiliar alternatives have led to medication errors, delays of treatment or surgical procedures, sub-optimal medical outcomes, and significant increased costs and man-hours required to manage them.

Despite many efforts to address and avert drug shortages, they persist and in fact have become a quotidian part of the clinical landscape. As will be demonstrated in the next chapter, reports of drug shortages and their adverse effects on clinical practice and research have surfaced over the last five years in the journals of those specialties hardest hit, e.g., anesthesia and oncology. Reports and calls for policy action have also reached broader medical and health policy audiences in publications such as *Health Affairs* and the *New England Journal of Medicine*. Even broader lay audiences have been informed by drug shortage articles finding their way into the *New York Times and Wall Street Journal*.

While raising awareness of drug shortages, the literature is piecemeal. How scarce medical resources are prioritized between patients – rarely, if ever referred to as rationing – is seldom addressed by pharmacists, though oncologists have more directly confronted this. Predominantly, pharmacy staff have been periodically surveyed, with reports providing useful cross-sectional snapshots of drug shortage prevalence, and to a lesser degree, which remedial or preventive actions are taken up by health care institutions. But many effects and dilemmas created by drug shortages fall on individuals. Certainly, patients are affected, though, as will be demonstrated, they might not be notified of a drug shortages or substitution. Pharmacists, physicians and nurses are forced to operate in an altered landscape where heretofore readily available resources are suddenly non-existent, and must make difficult decisions. The confluence of conflicting duties and limited resources creates a space where moral distress might be easily predicted, yet the published evidence lacks rich detail regarding the beliefs, sensitivities, and perceptions, of clinicians and pharmacists experiencing drug shortages.
Macro-level policy options encompass many strategies: revising Medicare reimbursement rates to incentivize manufacturers to continue to produce sterile drug solutions, release of scarce drugs that are part of the strategic national stockpile (SNS), and increased flexibility and enforcement discretion by the FDA. Moving to the meso- or micro-decision level, few proposals address the hard facts and realities of rationing drug supply and prioritizing access among patients. Yet, persistent drug shortages ensure that these hard facts and difficult decisions are faced by nurses, physicians, and pharmacists on a frequent basis, as are the many choices and strategies they might make to avoid arriving to the point where essential drugs are withheld from their patients.

This research project was not undertaken to develop far-reaching macro policies to confront drug shortages or rationing planning. It is instead designed to inform policy, to describe the perspectives, the discourse, and the management and communication strategies of key informants — the pharmacists and bedside clinicians who grapple with these issues on a daily basis. It provides their own individual experiences, thoughts, and actions, as well as the collective responses and endeavors undertaken within and by their varied institutions and organizations. It provides context to understand the interrelated effects and mechanisms for responding to drug shortages within the hospital setting.

My own experience with these issues starts with the first line. As a licensed clinician at a Boston teaching hospital, I was on the receiving end of these frequent alerts, some cryptic, others more detailed, from the hospital pharmacy. And, while I was personally not a prescriber of any medication, these messages were regularly sent to me as an “all user” message recipient, thus raising my awareness and curiosity. That curiosity led me to review the early papers and reports of drug shortages, and to recognize that the management of drug shortages has great potential as a case study for learning more about the rationing of scarce medical resources, as well as how health care institutions systematically confront these practice dilemmas and problems. The circumstances leading to medical resource rationing,
and the act itself, “owns” a space in bioethics, health policy, and law, for which drug shortages add a new annex.

To further explore these issues, during the Spring semester of 2012 I conducted a modest pilot study as an assignment in an introductory graduate course in Qualitative Methods in Public Health at Northeastern University. For that project, several members of the Pharmacy and Anesthesiology Departments at a large teaching hospital were administered focused semi-structured interviews regarding their perspectives of the drug shortage problem and their respective individual and institutional responses. My a priori uncertainty of how willing and forthcoming the responses would be was unfounded, as participants expressed a keen desire to make known their travails and evolving responses to persistent medication shortages. The respondents’ sense of astonishment that we were now in this “scary” place where they were forced to run across the street to a neighboring institution to borrow tablets that would be crushed and pushed down a patient’s feeding tube, because no injectable solutions were available stuck with me. As members of one of the top academic medical institutions in the nation, and indeed the world, they were astounded that essential medications were no longer accessible. They were also resilient, and confronted the issue head-on, with pragmatic improvised solutions, and a determination to make the correct choices for their patients.

In addition to learning about drug shortages in that course project, I gained familiarity and experience with interviewing techniques, transcription and sorting of texts, identification of codes, memo-writing, and thematic analysis. Coding oversight and valuable project feedback were provided by the professor, an expert in qualitative and mixed methods health research, and a member of this dissertation committee. While the pilot was limited in scope, it delivered useful information. Emergent themes described the profound seriousness of the drug shortage problem, the perceived ineffectualness of the FDA’s and other governmental responses, and the need for explicit and legitimate allocation strategies.
These findings were sufficiently rich to be presented at an annual inter-disciplinary research conference at Brigham and Women’s Hospital, Boston in November of 2012. The dissertation presented here significantly expands the initial pilot study.

A review of the relevant literature is provided in Chapter 2. Case reports, surveys, meta-analyses, and other findings and theories from the pharmacy, medical, bioethics/philosophy, sociology, law, and health policy arenas are presented and analyzed.

For analytical purposes, the interview data are divided into two qualitative studies in Chapters 3 and 4. These build on the original research and pilot interviews. The scope and depth of the participant sample was significantly increased to include multiple key informants from academic medical centers and community hospitals throughout the Boston area. Besides pharmacists, key informants included nurses and physicians who regularly dealt with drug shortages, making practice decisions directly affecting patients in their care. Chapter 3 focuses on perceptions, role conflicts, and the shared language of pharmacists and bedside clinicians as they confront drug shortages. Emerging themes regarding surveillance and awareness of shortages, interactions with patients, and role and setting constraints are reviewed.

Chapter 4 presents the various management and communication strategies developed by pharmacists within their departments, as well as practices undertaken at the bedside or clinic by nurses and physicians as they regularly interact with patients. Systematic, organizational responses to drug shortages within hospitals and their system networks are also examined. Both chapters also discuss communication methods and practices.

This project was conceived as an exploratory sequential mixed-methods research study. Interview data were incorporated into a larger quantitative survey which, after testing and revision, was administered to a nation-wide sample of pharmacy directors. The survey then serves in part as a triangulation device to provide additional checks on the interview findings and generated concepts, i.e., do they hold or persist across a larger, varied sample
distinctly different from the Boston medical community, or, are other management responses employed or favored in those settings?

Overall, response strategies may be Pharmacy-directed, or, developed and disseminated throughout the institution, engaging and activating inter-disciplinary teams of experts. Communication of drug shortages to staff is multi-modal, and may be broadly-focused or specifically targeted on a need to know basis. Flexibility, effectiveness, and transparency all factor into deciding which strategies are appropriate. Communication of drug shortages and substitutions to patients, a critical element of transparency, and to some, a contributor to the legitimacy of a response or allocation plan, is also reviewed. The survey is fully described and presented in Chapter 5.

Chapter 6 summarizes the work in its totality, and integrates findings within a policy context. Here the study’s main points, as well as its limitations are presented. Suggestions for future research are also presented.

I no longer work in a hospital, and therefore no longer receive Pharmacy Department alerts of drug shortages. As a subscriber to the FDA Drug Shortage Alert program, I do receive drug shortage notifications on at least a weekly basis. There seems to be no end of drugs on the shortage list, or rationales for their absence on the market. Subsequent and periodic evaluations of medical resource shortage management and allocation policies are likely to be required in the future for multiple reasons: significant medication shortages have been ongoing over a decade and show no prompt resolution, demographic trends towards an aging populace and associated financial constraints are certain to further erode available medical resource "commons", and with widespread global travel there is an ever present potential for the emergence of new large scale infectious disease outbreaks, as was seen in the SARS and H1N1 outbreaks. This study adds to the literature and, provide a benchmark report of drug shortage responses undertaken by key stakeholders. Drug shortages have forced legislative and regulatory changes, which may yet be revised again. It is hoped that dissemination of
this information will potentially shape policy that responds to ongoing drug shortages as well as future medical resource allocation dilemmas.
Chapter 2

Literature Review and Study Overview

“An exhaustive account of frustrations and problems rang out loud and clear from the 344 pharmacists who returned our survey on national drug shortages. By far, respondents were most frequently alarmed by the lack of suitable alternative drugs, the use of less desirable and unfamiliar substitutes if available, the potential for poor patient outcomes, and the lack of an advanced warning system to alert providers to impending shortages” – these concerns surfaced over 16 years ago, and were brought to light by the Institute for Safe Medication Practices (ISMP, 2001). Two years later Fox and Tyler systematically presented the causal factors and extent of drug shortages affecting their health care system since 1996, presciently forecasting the likely nation-wide persistence or worsening of the problem (Fox and Tyler, 2003). While much of the existing literature is sited within the United States, and is specific to its unique health care and political systems, drug shortages are not limited to the U.S. and are a global problem affecting other nations (Birgli, 2013; EAHP, 2014; Schwartzberg, et al. 2017).

Framing the Problem

The working definition of a drug shortage is: a situation in which the total supply of all clinically interchangeable versions of an FDA-regulated drug is inadequate to meet the current or projected demand at the user level (FDA, CDER, 2012). Economic disincentives to produce injectable drugs, pharmaceutical industry consolidation, increased U.S. Food and Drug Administration (FDA) scrutiny of manufacturing practices, and previous limited reporting requirements for manufacturers all exacerbated the problem (Chabner, 2011; Wilson, 2012).

Commercial decisions to manufacture and distribute so-called “orphan drugs” developed specifically for rare diseases do not generally apply to the larger population and problem at hand. In fact, exclusive patent protections and financial incentives to develop and maintain the production of these drugs, introduced by The Orphan Drug Act of 1983 (P.L. 97-
414,96 STAT. 2049; 21U.S.C.§360aa-360ee), have helped keep these on the shelves, at least within developed nations with paying customers (Cheung, *et al.* 2004). Off-patent sterile generics are another story.

In 2011, referred to by many as the peak of the crisis, there were 251 drugs reported in shortage, 183 of which involved sterile injectable drugs (FDA, 2012). Drug manufacturing quality failures were responsible for over half of the shortages in 2011, with perceived low enforcement threats, market disincentives, and aging facilities identified as contributing factors (Woodcock and Wosinka 2013). Drug shortages span medical practice, as the top five drug classes, reported in shortage at a key stakeholders’ meeting in 2014, included antibiotics, chemotherapy, pain/anesthesia medications, and supportive agents such as injectable electrolytes and nutritional products (ISMP, 2014). A quick check of the FDA’s drug shortage reporting webpage provides a recent snapshot, where 56 drugs, including essential items such as atropine, potassium chloride, and sterile saline solutions were in shortage, with several other key medication shortages resolved, *i.e.*, at least one manufacturer reports capacity to “cover the market” (FDA, 2017).

An early survey reporting the impact of drug shortages on pharmacy practice in an acute care hospital setting was published in 2004 (Baumer, *et al.*, 2004). Despite the inherent limitations of self-reporting; approximately 65% of respondents disclosed delayed or canceled procedures attributed to drug shortages, and 10% reported related serious medical errors. With approximately 500 pharmacy directors responding, the authors estimated a national economic impact (from adding staff to manage shortages, purchasing marked up “gray market” drugs, higher costs of alternative drugs, and pharmaceutical compounding expenses) of somewhere between 30 and 90 million dollars for 2002. In this decade Kaakeh, *et al.* surveyed pharmacy directors, asking them to quantify personnel resources required to manage shortages of approximately 30 scarce drugs, and, to assess the impact of the shortages and the quality of information resources available to them (Kaakeh, *et al.* 2011).
The authors estimated that the additional time spent by pharmacy staff in managing drug shortages generated annual additional labor costs of 216 million dollars nation-wide.

**Adverse Effects Related to Drug Shortages**

In response to drug shortages, the subsequent use of alternative drugs with their varied formulations, administration routes, and sometime suboptimal effectiveness has introduced medication errors and unanticipated adverse effects in patients (Gu, *et al.* 2011). Another report detailed significant harms to patients attributed to drug shortages, *e.g.*, delayed treatment, disease progression, and even injuries leading to death (ISMP, 2012).

Recurring shortages of drugs used as first-line therapy have also adversely affected emergency departments’ and first responders’ treatment of life-threatening conditions (Mazer-Amirshahi, *et al.* 2014; Hawley, *et al.* 2016). Important clinical trials and investigational therapies have been placed on hold until the shortages are resolved (De Oliveira, *et al.* 2011; Emmanuel, 2011; Metzger, *et al.* 2012). On a wider level, public health has also been compromised as health agencies responsible for tuberculosis control have reported shortages forcing substitutions for isoniazid, (also known as INH), an effective first-line therapy used to reduce person to person TB transmission, and very recently, inadequate supplies of yellow fever vaccine (CDC, 2013; Gershman, *et al.* 2017).

The impact of drug shortages is acutely felt in oncology practice, where withholding of anti-cancer drugs introduces profound implications beyond inconvenience; or rescheduled elective procedures. A nation-wide survey focused on oncology pharmacy organizations (*N* = 243 respondents) reported delays or changes in chemotherapy administration (93% of respondents), addition of significant resources/man-hours to manage the shortages, near-miss errors attributed to substitutions (16% of respondents), and adverse medical events related to shortages (6% of respondents) (McBride, *et al.* 2013). Examining the impact on oncology patients at a single hospital, Becker, *et al.* followed patient charts and surveyed their oncologists during a peak shortage of chemotherapy drugs in 2011 (Becker, *et al.* 2013). The authors noted that 51% of chemotherapy drugs were in nationwide shortage, for which
63% of their patients were scheduled to receive treatments with these scarce drugs. They also report a single treatment price increase of 1,704% incurred by using a substitute anti-neoplastic drug necessitated by the shortages, as well as the treating physicians’ expressed uncertainty of the substitute’s efficacy and their concerns for increased risks of drug toxicity. Other oncologists have also reported their use of suboptimal therapies owing to the widespread unavailability of cancer drugs and support medications for their patients (Kehl, et al. 2014).

As just described, treatment of cancer patients has been significantly challenged by drug shortages, spurring direct response from oncologists. In early 2013, the Children’s Oncology Group (COG) convened a volunteer expert Working Group (WG) on Chemotherapy Drug Shortages in Pediatric Oncology which developed consensus statements on mitigating and managing the effects of drug shortages (Decamp, et al. 2014). They have continued this work with follow-up recommendations and allocation guidelines which were widely disseminated and later published by the National Cancer Institute (Unguru, et al. 2016). Given the widespread nature of drug shortages which affect not only oncology, but many other critical areas of medicine, as well as the persistence of these shortages across two decades, broader, comprehensive policy responses and government action are necessary.

Federal Government Response

Broad regulations and economic policies potentially deliver “macro” responses to the acute drug shortage problem facing the country. Pharmacist organizations and various medical associations have played a key advocacy role in advancing the issue of medication shortages onto the government agenda. This has included highly publicized meetings at the White House, FDA summits and workshops, participation in Congressional hearings, and position papers from various health care organizations.

What legislative or regulatory actions have resulted from these efforts? Between 2010 and 2012, multiple FDA regulatory updates, a Drug Shortage Summit, and Congressional hearings took place, along with an Executive Order from the Obama administration, though

These various testimonies illuminated the multi-factorial contributing causes and implications of the drug shortage crisis. A more partisan undertaking by House Republican Daniel Issa in 2012 concluded that drug shortages were related to the Medicare Modernization Act or MMA of 2003 (P.L. 108-173) which imposed reimbursement/pricing constraints for sterile injectable drugs. The report also implicated an overzealous inspection and enforcement agenda carried out by the FDA under its director, Dr. Margaret Hamburg (U.S. House of Representatives, 2012).

On July 9, 2012, President Obama signed into law the Food and Drug Administration Safety and Innovation Act, or FDASIA (Public Law 112-144 -July 9, 2012, 126 STAT. 993), a reauthorization of the Prescription Drug User Fee act (PDUFA), and other related user fee acts directed at manufacturers of medical device, biosimilars, and generic drugs. In addition to providing funding for FDA personnel to review the safety and efficacy of new products, PDUFA’s additional key provisions addressing drug shortages were introduced through Title X of the FDAISA. These key provisions included mandates for early (within six months, if practicable) reporting requirements applicable to all manufacturers regarding anticipated shortages of medications used in emergency care or during surgery, in addition to the other previously defined life-supporting categories. The FDA was also charged with the development of a Drug Shortage Task Force to provide a strategic drug shortage mitigation plan, provision of a publicly available up-to-date Drug Shortage list, annual reporting of drug shortage statistics to Congress; and the review and reporting of the agency’s drug shortage mitigation efforts by the Office of the Attorney General. Some repackaging allowances for hospital
pharmacies to prepare their own medications also were instituted. (For a comprehensive section by section overview, see Kracov, et al. 2012).

The FDAISA did not address pharmacy compounding in the context of drug shortages, though Title VII added drug security and risk-based FDA inspections of manufacturing facilities. The regulation of pharmaceutical compounding has mostly been up to the states, though some degree of FDA oversight had been previously appended to the Food and Drug Administration Modernization Act, FDAMA [P.L. 105-115, 111 Stat. 2296 (1997)], which included guidelines from the United States Pharmacopeia (USP). A 2012 U.S. Supreme Court decision in Thompson v. Western States Medical Center invalidated some FDAMA provisions, which at the time led to ongoing legal uncertainty of the FDA’s oversight of compounding pharmacies (Nolan, CRS, 2013).

Numerous emerging reports of a drug-borne fungal meningitis outbreak attributed to contaminated products from the New England Compounding Center changed the landscape, and made it less likely that relaxation of compounding regulations would be considered a viable regulatory response to the medication shortage crisis (CDC, 2012). Following the House, the U.S. Senate passed the Drug Quality and Security Act (H.R. 3204), or DQSA on November 18, 2013, which was signed into law by President Obama on Nov. 27, 2013. Title I, the Drug Compounding Act, placed pharmacies’ compounding of sterile drugs under greater FDA oversight and risk-based inspections in a nod to avoid repeats of the drug-borne illness outbreaks linked to poorly regulated compounding pharmacies (H.R. 3204 -113th Congress). Relevant to “gray market” purchases, Title II, the Drug Supply Chain Security Act, added protections for tracing prescription drug products throughout the pharmacy supply chain. Related FDA guidance documents opened lines of communication between state pharmacy boards and the FDA, as well as updated information regarding prescriptions and re-packaging.

As was required by the FDAISA, the FDA presented its Strategic Plan for Preventing and Mitigating Drug Shortages in 2013. (FDA, 2013) Mitigation efforts for medically necessary drugs permit the Agency to exercise regulatory flexibility and discretion, e.g., allowing end
users to filter particulate matter from sterile solutions in lieu of complete drug recalls, as well as temporary (though still rare) importation of foreign sourced drugs. A sample letter to physician prescribers permitting import of doxorubicin, a critical oncology drug, sourced from India, is included in Appendix A.

In its second annual report on drug shortages to Congress—a requirement of the FDASIA—the FDA reported that its efforts helped prevent close to 80 potential new shortages (FDA, 2014). The U.S. Government Accounting Office (GAO) commended the FDA for its actions in averting some drug shortages, though notes that significant shortages continue to pose a public health problem, and that the structural, economic drivers of the shortages remain beyond the remit of the FDA (GAO, 2014). Additional evaluations point to limited success. Chen and colleagues noted that while reductions of total drugs in national shortage coincided with the legislation’s passage; drugs required for acute, emergency care, e.g., anticonvulsants, sedatives, and cardiovascular agents, frequently appeared on the shortage list, remaining unavailable for prolonged periods of time, with a median duration of 242 days (Chen, et al. 2016). They also noted that administration errors with these types of drugs, or their unfamiliar substitutes, potentially introduce increased safety risks.

In starkest terms, the existing regulations do not greatly offset the root causes of medication shortages, nor prevent them from reoccurring. At best, they modestly attenuate them. This contributes to the current unstable environment which requires pharmacists, clinicians, and their affiliated health care organizations to manage these shortages with various methods and strategies, and when those strategies fall short of securing necessary medications, to consider drug allocation plans.

**Allocation/Prioritization – Context**

In determining which patients will receive appropriate and medically necessary drugs, physicians and pharmacists must make allocation decisions that balance medical efficacy judgments, peer practices, and general principles of distributive justice against the competing requests of patients and their advocate physicians and nurses, and others. Fulfilling the
multiple duties and expectations of providing care for their respective patients, while also serving stewardship and gate-keeping functions for health care institutions or systems, can lead to internal conflicts and potential moral distress which are not easily processed or reconciled amongst clinicians. Long-associated with nurses and house staff, mid- and senior-level health care managers responsible for allocating constrained resources have also experienced these internal conflicts and their ill effects (Epstein and Delgado, 2010; Mitton, et al. 2010; Berger 2013). Adding to the distress and uncertainty, the extent of personal or institutional liability for shifting resources from one patient to another is also unknown, though courts have traditionally paid great deference to medical and health professionals’ judgments and peer-reviewed self-regulation.

In considering allocations of scarce medical resources, published empirical surveys of physicians, and the theoretical models related to implicit rationing of bedside care are somewhat instructive. Hurst and colleagues surveyed European physicians regarding their rationing decisions (Hurst, et al. 2006). The most frequently withheld interventions being: time spent with patients, MRI exams, screening tests, labs, and prescription drugs. The most commonly cited justification was the small expected benefit or chance of success from the intervention. They found that bedside rationing is more likely to be reported when clinicians are personally aware of existing scarcities, though less so when allocations are formally organized within public health systems, i.e., when physicians do not bear the brunt of independently making the allocation decision.

Johannes van Delden interviewed physicians, as well as health care administrators and policy makers in the Netherlands (van Delden, et al. 2004). While all groups agreed in the majority that age would be a reasonable criterion for transplantation of scarce organs, policy makers and physicians rejected the notion of prima facie conservation of other treatments in support of younger patients. Interestingly, while U.S. physicians often complain of payer or government intrusion on clinical practice, 91% of Dutch physicians stated that government, rather than physicians should make allocation decisions, and that “the main virtue of doctors
is compassion, and not justice.”

Excepting disaster medicine triage protocols and non-binding practice guidelines based on clinical effectiveness, few health care organizations, networks, or researchers have addressed the larger issue of explicit rationing. The political milieu and backlash in the U.S. against so-called “death panels”, end-of-life care, and universal health care access portend that a frank discussion, and serious proposals for medical rationing from political leaders is improbable, and allocation policy, like many health care issues, will likely be driven by medical professionals themselves, and their health care organizations. There is also an existing argument that implicit rationing is less susceptible to political manipulation, and may be preferred by physicians as it offers the discretion and flexibility that they typically employ in changing clinical scenarios; though some situations, e.g., organ allocation policies, still require open communication and review (Mechanic, 1991).

A systematic review of physician surveys and interviews within the medical rationing literature was conducted by Strech and colleagues (Strech, et al. 2008a; 2008b, 2009). Meta-analyses were carried out, and agreement data were pooled into dichotomous responses, with physicians quite willing to consider cost consciousness and effectiveness, though much more reluctant to withhold therapy from patients where there may be a reasonable treatment benefit. There were clearly mixed preferences for accepting implicit versus explicit rationing. Strech concludes there is "remarkable ambivalence concerning rationing amongst physicians"; which impacts policy solutions to scarce medical resources, and their coordinated implementation. Thus, persistent medication shortages provide a test case for examining not only the institutional responses to prevent shortages, but also the explicit rationing of scarce medical resources and associated allocation strategies.

For managing drug scarcities, responses may include the following: (i) shifting internal resources to develop in-house compounding and other technical manipulations within the Pharmacy (as permitted by state laws, infrastructure, and expertise); (ii) substitution of prescribed medications with alternative drugs that approximate compatibility, safety, and
efficacy; (iii) postponement of elective surgeries and other procedures until medication shortages are resolved; (iv) suspension of clinical research trials so that scarce medicines are conserved for immediate clinical needs, and finally; (v) rationing, i.e., restricting access to scarce drugs based on determinative classifications of patients, disease acuity, and/or drug class categories. These are not uncomplicated options, and those requiring the prioritization of individual patients or classes of patients over others seemingly require well-reasoned justifications and robust communication and transparency of the allocation plan.

**Rationing - Background and Context**

Historical precedents of drug rationing include the preferential allocation of newly developed insulin in the 1920s to certain powerful and politically connected patients, as well as the “soldiers first” distribution of penicillin in the 1940s. Both instances were problematic once discovered by others, underscoring the need for thoughtful examination of equitable distribution strategies, as well as public deliberation and transparency (McGough, et al. 2005). In developing nations, drug rationing is not an historic artifact but an ongoing reality, where for example, patient age, propensity to adhere to dosing protocols, and other considerations often outline who receives anti-retroviral treatment for HIV. (McGough, et al. 2005).

The broader moral issues, potential legal constraints, and regulatory options related to large scale, “macro-allocations” of medical resources, such as universal health care access for the uninsured have been publicly discussed at length, notably during the Clinton and Obama administrations’ pushes for health care reform, and in response to prioritization and coverage decisions of the U.K.’s National Health Service. (Daniels, 1985; Callahan, 2011; Cookson and Dolan, 2000; Singer, 2009). In 1990, following the death of a seven-year old Medicaid patient denied some bone marrow transplant three years earlier, the state of Oregon unveiled a “priorities list” of covered services under its public health insurance plan, thus introducing transparent, public awareness on which services should or would be available or not (Perry and Hotze, 2011). Its early focus on cost effectiveness calculations at the perceived
expense of critical medical interventions was socially and politically problematic, leading to several revisions (Hadorn, 1991). With its many controversies and frequent and politically necessary permutations, the plan ultimately did not introduce significant rationing. Instead it was co-opted by policy actors who used those discussions and controversies to ultimately improve overall access to basic medical care by its poorer citizens (Jacobs, et al. 1999). With Oregon as the sole exception, legislators and policy-makers within the U.S. have been quite uncomfortable in proposing or advocating for any explicit rationing scheme. This was abundantly reinforced by the "death panel" clamors surrounding the abandoned end-of-life care options that President Obama had originally proposed during the debates around his ACA health care reforms (Pear, 2010).

Health care rationing as a discrete policy is well developed for the distribution of transplantable solid organs, where there have always been more potential recipients than available organs. Organ-specific (kidney, liver, etc.) wait-list scoring systems rank patient prognoses and medical necessity as key factors in allocation decisions. However, transplantable organs in general are "lumpy resources", meaning not divisible amongst many. Thus, while organ sharing strategies encompass many similar and entwined issues of compassion, justice, and legitimacy, they cannot quite compare or apply to the necessary distribution of volumes of medications allotted to multiple needy patients.

More a propos to scarce medicines, hierarchical decisions regarding allocation of ventilator machines, operating room assignments, and preventive vaccines are quite transparent within the protocols of military medicine and disaster triage. (Hick, et al. 2012; Lin, et al. 2009). Following recent national shortages of normal saline – an essential preparation used in hospitals everywhere – Hick and colleagues advocated that hospitals should implement incident command procedures similar to those used in disaster response to manage saline and other drug shortages (Hick, et al. 2014). Following the 2001 anthrax attacks in the U.S., Gostin, et al. co-developed a Model State Emergency Health Powers Act for the U.S. CDC for addressing similar public health emergencies. This covered public health
authorities’ oversight of quarantines, responder credentialing, and, rationing and distribution of scarce vaccines, medicines, and other resources (Center for Law and Public Health, 2001; Gostin, 2002). Infectious disease emergencies and pandemics such as the first reported avian flu outbreak featured “extra-medical” prioritization, with health care workers moved up the inoculation waiting list as more vaccine-worthy than others. This consideration of vaccine recipients’ instrumentality was introduced as a practical means of maintaining the health care infrastructure in crisis situations. Some have gone further, and advocated broadening priorities to provide first line vaccines to transportation workers and others vital to the larger societal infrastructure (Derpmann S, 2011; Kass, et al. 2008). In reviewing the allocation schema of several mass casualty/emergency plans, Hensel and Wolf caution that some prioritizations potentially disfavor those with disabilities and could run afoul of federal antidiscrimination laws (Hensel and Wolf, 2011). In fact, several municipalities have been sued for their failure to provide or account for persons with disabilities in their emergency preparedness plans (Rudow, et al. 2015). Standards of care often change during the fluctuating conditions of a disaster, though ethical allocation of scarce resources still requires fairness, consistency, and transparency, i.e. legitimacy (Gostin and Berkman, 2007; IOM, 2012). These thornier considerations enlarge the debate and suggest a priori ethical considerations be undertaken.

**Ethical Perspectives on Allocation**

**Theoretical Considerations**

The bioethics literature offers normative perspectives using, chief among others, the four “common morality” principles of biomedical ethics (Beauchamp and Childress, 2001), from which two, beneficence and justice, can be further subdivided. Duties and roles of caregivers, such as those exercised during the implicit implementation of bedside rationing (Hurst and Danis, 2007) are related to beneficence. Several older seminal texts examine the importance of medical virtues, where the telos of the healing relationship underscores
clinicians’ actions and justice considerations for their immediate patient, and not necessarily those of the larger good (Pellegrino, 1995, 2001).

Rights-based, fair opportunities and contractual approaches to health care access as espoused by Norman Daniels’ extension of John Rawls’s justice theories to health care, also inform justice discussions (Daniels, 1985, 2008; Rawls, 1999). Distributive justice considerations include several models and may take several forms. Egalitarianism would grant each patient the same opportunity to receive the resource (as by example in a lottery). Moral desert rewards and entitles those who have somehow contributed, and earned the right to the resource, e.g., deserving of a scarce resource because they have volunteered in a clinical trial. Utilitarian prioritization schemes would offer drugs, ICU beds, or other scarce resources to the largest number of needy recipients. Rescue rules prioritize those in need of essential life-sustaining care. Evaluating the theoretical application of various justice principles to potential distribution strategies, Persad and colleagues found most of them insufficient. In their “complete lives” proposal, they called for a combination of various elements such as lottery, prioritizing younger patients, and saving the most lives (Persad, Wertheimer, and Emmanuel, 2009).

The tension between respecting a duty to one’s patient, while implicitly adhering to budget constraints or other distributive limitations engenders multiple undesirable processes and outcomes such as internal conflicts, so-called “work arounds” which game the system, evasion and deflection of patient requests, personal denial that rationing exists, and likely, imperfect or poorly maneuvered allocations (Garbutt and Davies, 2012; Hurst, et al. 2005; Doyal, 1997). With various players, histories, and traditions, there are difficulties in reaching ethical consensus, much less procedural agreement in a secular, pluralistic society, particularly amongst what have been called “moral strangers”. Kevin Wildes and later, Stephen Hanson, pointed out that “moral acquaintances”, not unlike politics’ strange bedfellows, could find common ground and reference points such as informed consent, some
overlapping values, and the rule of law to work through ethical dilemmas (Wildes, 2000; Hanson, 2009).

**Conceptual Frameworks**

Scheunemann and White express that "a substantial barrier to moving from implicit to explicit approaches to rationing health care is the failure to specify what principles(s) should guide allocation" (Scheunemann and White, 2011). The broad moral theories underlying ethical models for formulating resource allocation decisions traditionally have been divided as: (a) deontological, duty-based requirements; (b) utilitarian or consequentialist decisions; and (c) principlism, using the four “common morality” principles of bioethics, namely autonomy, beneficence, nonmaleficence, and justice (Beauchamp and Childress, 2001; Petrini, 2010).

The simplest interpretation of a duty-based model relies on clinicians’ traditional ethos, that their primary responsibilities are to their immediate patients, rather than overall stewardship of medical resources. As applied to drug shortages; a clinician’s individual duty would be to secure the needed medications for those patients immediately under his or her care, then gain access for those on the wards, within the hospital, health care network, etc. within an ever-expanding circle of patients. Even here, one can easily envision conflicting needs amongst various medical and surgical services and patients themselves. Furthermore, the traditional physician-patient dyad has long been replaced by networks of significant interactions with payers, insurance plan administrators, and other allied health care practitioners. While “individual” duties may exist, clinicians are hard-pressed to solely exercise any duties as individuals within the complex organizational environments in which they practice, and as members of those organizations, their patients’ priorities may be subsumed within a larger pool of patients’ needs.

Public health delivery chiefly operates under utilitarian principles, prioritizing interventions that result in the greatest number of lives saved, as for example in managing influenza outbreaks. Utilitarian allocations might set aside certain amounts of anesthetics,
oncology drugs, anti-fungals, etc. to accommodate treating the largest number of patients. These allocations could proceed with or without individual patient prognoses, or, they might weigh overall anticipated benefits or summary quality of life considerations. However, this type of allocation strategy is not easily applied outside of a public health care delivery setting.

Sole reliance on the four common morality principles of Beauchamp and Childress has been criticized over the years for several reasons. Some argue that these “thin” principles are incomplete moral systems (Gert and Clouser, 1990; Englehardt, 2012). A more recent empirical study also questioned the “commonality” of the four principles (Christen, et al. 2014). In complex multi-faceted cases, the four principles may yield conflicting guidance, e.g., preference of patient autonomy over physician beneficence. Henry Richardson presents the specification and balancing of moral precepts or competing principles, which permits a pragmatic way of incorporating seemingly opposite models to resolve the particular case at hand (Richardson; 1990, 1995).

Additional approaches incorporate solidarity and communitarian principles in bioethical decision-making (Callahan, 2003; Etzioni, 2012; Prainsack and Buyx, 2012). As Jennings and Dawson have stated, the moral imagination of solidarity allows us “to shift from seeing health as an achievement or as a matter of the biological lottery to seeing health (and illness) as something mutual, something that creates responsibilities of care and concern incumbent on us all” (Jennings and Dawson, 2015 p. 37). These approaches are not primarily focused on patient autonomy and individual rights, which are sacrosanct in the U.S., and are more widely considered in societies which recognize the need for communal inputs, as well as medical rationing and prioritization policies. For example, in the U.K., the National Health Service introduced the National Institute of Clinical Excellence (NICE), now known as the National Institute of Health and Clinical Effectiveness. NICE adopted a familiar set of moral principles: respect for autonomy, non-maleficence, beneficence, and distributive justice, though also added elements of transparency, public discussions and reappraisals (NICE, 2008). Using quality of adjusted life years (QALY), cost effectiveness analyses, and systematic reviews,
NICE provides a scientific foundation for medical allocation decisions (Walker, et al. 2007). These widely dispersed and public evidence-based clinical guidelines have also provided the British courts with a yardstick for evaluating coverage decisions, lending legitimacy to judicial review of cases where procedures or medicines have been withheld (Syrett, 2013).

The public input functions of NICE correspond with the Accountability for Reasonableness (AfR) framework of Daniels and Sabin who have long advocated for accountability, revisability, and openness in any medical allocation framework (Daniels and Sabin; 1997, 1998, 2000). They propose that medical rationing policies used within either private or public systems must fully account for legitimacy and fairness considerations. Explicitly communicated policies also may facilitate discussions between patients and caregivers, reflecting greater shared decision making, and possibly less distrust around denied resources.

There are four necessary conditions for AfR (p. 45, Daniels and Sabin, 2002):

1) Publicity Condition: Decisions regarding both direct and indirect limits to care and their rationales must be publicly accessible.

2) Relevance Condition: The rationales for limit-setting decisions should aim to provide a reasonable explanation of how the organization seeks to provide “value for money” on meeting the varied health needs of a defined population under reasonable resource constraints. Specifically, a rationale will be reasonable if it appeals to evidence, reasons, and principles that are accepted as relevant by fair-minded people who are disposed to finding mutually justifiable terms of cooperation.

3) Revision and Appeals Condition: There must be a mechanism for challenge and dispute resolution regarding limit-setting decisions, and more broadly, opportunities for revision and improvement of policies in the light of new evidence or arguments.

4) Regulative Condition: There is either voluntary or public regulation of the process to ensure that conditions 1-3 are met.
While Daniels and Sabin’s framework has been adapted and used in varied settings and countries, it is not without its detractors, who question the operationality of the relevance condition, as well as its premise of delivering fair allocation decisions (Rid, 2008; Ford, 2015).

**Application of Frameworks**

How does one apply principles underscoring procedural and other justice considerations at the bedside? Samia Hurst examined U.S. physicians’ bioethical decision-making in a series of guided interviews with internists, oncologists and critical care specialists (Hurst, et al. 2005). Access to treatment, including chemotherapy, was most commonly reported as the constrained resource, even without drug shortages. Physicians’ strategies involved negotiating with or manipulating the health care system; which included bargaining with department heads and discussions with hospital legal counsel. When resource requests were deflected or deferred, disclosures and direct discussions with patients and families were held. Negotiation was preferred over outright denial, and alternatives were often sought out. The authors point out the disconnection between the typical discussions of distributive justice that are widespread within the normative, philosophy-based literature and the actual, nuanced clinical practice at bedside, suggesting a knowledge gap yet to be bridged.

Building on this and other studies, Hurst has proposed a rationing framework based on physicians’ clinical judgment in which allocation decisions take place. These could surface in several circumstances, such as in triage during acute resource shortages, when comparing benefits and needs between patient recipients, or when deciding that population-based, evidence-based guidelines proscribing or restricting costly procedures or resources are warranted (Hurst, 2007).

Her framework requires six minimal considerations:

1. a closed system that offers reciprocity (of sacrifice and benefit);
2. awareness of, and attention to general concerns of justice;
3. respect for individual variations (of medical need, intervention efficacy, and probable outcomes);
(4) a consistently applied process;
(5) clearly communicated, explicitness; and
(6) iterative review of decisions.

By their training and professional experience, physicians, as compared to ethicists or health care administrators, would be considered the most informed arbiters of their patients’ medical needs and probable intervention outcomes. They are generally less familiar with formal justice deliberations or in explicitly communicating rationing schemes.

As with Beauchamp’s and Childress’s four principles of the “common morality”, one can easily encounter conflicting principles in applying Hurst’s six requisites to rationing decisions. For example, reciprocity may not be the first consideration for an emergent life-saving need. And as described earlier, distributive justice principles widely vary, and are heavily influenced by the “rule of rescue” where oft heroic life-saving actions for one or a few patients are given priority over the mundane, routine medical care of multitudes of patients in less dire straits (Jonsen, 1986; McKie and Richardson, 2003). Nevertheless, Hurst’s framework offers a thoughtful baseline for clinicians, administrators, and health policy makers to either incorporate into, or compare to their allocation strategies.

In a modest study attempting to illuminate the practical application of ethical problem-solving amongst several clinical disciplines within a hospital setting, McGrath and Henderson compared emergency room nurses’ and physicians’ ethical reflections on difficult emergency care cases, where the principal mode was “finding the best possible care for patients” (McGrath and Henderson, 2009). Though participants mentioned common bioethical principles (autonomy, beneficence, etc.) and interestingly, consideration of community norms, they placed most emphasis on their own professional codes of conduct.
Social Contexts of Allocation Decisions

As members of professions, health care institutions, and organizations, clinicians do not operate in a vacuum. Theories of how those within organizations respond to changing environments and implausible or difficult events, include those of “sense-making” as developed by Weick (Weick, 1995; Weick and Sutcliffe, 2005; Weber and Glynn, 2006). The ambiguity and uncertainty of perceiving and responding to shortages of heretofore available medical resources in the absence of an explicit plan, would occasion or trigger sense-making within an organization, leading to actions and responses not solely chosen or undertaken by an individual clinician. Historically, research into bioethical decision-making has focused on the physician-patient relationship, and, most often within a hospital setting. Not only critical care physicians, but also intensive care unit nurses and other clinicians must make daily allocation decisions. These may include how to shuffle patients into and out of a crowded ICU, how much consulting or face time is allotted at bedside, and the assignment of critical care nurse coverage (Truog, et al. 2006).

Individual belief systems and conceptual frameworks for making these decisions would expectedly differ amongst varied professionals’ roles and constructed identities. The pervasive and unavoidable “micro-allocation decisions” which essentially restrict or limit potential health benefits to some patients while favoring others has become a reality for other clinical “gatekeepers”. Notably and with relevance to the drug shortage problem, this also includes pharmacists. Referencing Weick’s sense-making theories, Elizabeth Chiarello describes the contextual, setting-specific decisions and practices carried out by pharmacists working within both hospital and community pharmacy environments (Chiarello, 2012).

By nature of their expertise and expanded professional scope of practice, pharmacists often perform medical, legal, and fiscal gate-keeping. For example, medical gate-keeping includes warning prescribing physicians of drug interactions, suggesting alternative therapies, and monitoring prescribing practices. Legal gate-keeping involves identifying fraudulent prescriptions, uncovering diversions of drugs for illegal use, etc.
Fiscal gate-keeping may involve advocating for destitute patients, locating less costly and/or alternative drug preparations, or monitoring overall pharmacy budgets. In Chiarello’s study, so-called moral gate-keeping, e.g., the refusal to distribute syringes to substance abusers, provide end-of-life sedatives, or distribute “morning after” emergency contraceptive pills to minors due to personal beliefs, was seldom performed. These were generally subsumed by codes of practice which place the patient first, as well as by prevailing statutes within their respective jurisdictions.

In several survey and interview projects Chiarello determined that the pharmacy setting itself contributed to significant differences; where community pharmacists interacted much more closely with patients, exercised greater autonomy and decision-making. Chiarello’s work is of interest for three reasons. First, it looks beyond the traditional physician-patient nexus and reflects contemporary concepts of pharmacy practice. Secondly, it recognizes that differences in organizational milieu generate varied sociological underpinnings and responses. Lastly, Chiarello’s findings challenge the idea that medical and allied health practitioners’ bioethical decision-making is closely allied to the purely normative methods discussed within the academic literature. Her work opens the door to exploring the different perspectives of, and approaches to medication shortages between community, commercial, and medical, hospital-based pharmacies.

A shift to examining larger social structures and organizational ethical arrangements was called for by Kevin Wildes, who presents as exemplar, the Roman Catholic health care system as one with a developed institutional conscience (Wildes, 1997). The concept of institutional duties and the practical application of organizations exercising their ethical responsibilities relies on the degree and classification of clinical versus organizational needs and contexts, the varying degrees of deference to professional expertise and self-regulation, and consideration of stakeholder theory, which touches on issues of fidelity and public trust (Ozar, et al. 2000; Goold SD, 2001; Bean S, 2009).
Berkman and colleagues collected ethics statements and policies from medical associations, group practices, and health plans, systematically evaluating their various bioethical taxonomies and policies (Berkman, et al. 2004). As distinct from medical specialty societies, group practice and health plan documents paid scant attention to beneficence, justice, allocation of resources, or even stewardship of resources. None used “the R-word” - rationing. While the authors clarify that documents alone do not constitute actual practice, a health care organization’s ethical standards do reflect its social compact with the public. Furthermore, integrating, rather than compartmentalizing, caregivers’ ethos with that of the organization may be helpful when responding to new challenges and ethical dilemmas.

The extent and manner by which clinicians and others in their organization respond to medication shortages could well be underscored by their respective institutional organizational cultures, which may interest policy makers and stakeholders. It is also conceivable that resource allocation strategies developed in public clinics and hospitals, those developed within church-based healthcare systems, or created by for-profit entities, might differ from each other based on their respective missions of those organizations, as well as their institutional cultures, case mixes, served populations, and other environs.

In summary, conceptual frameworks and “ethical lenses” offer competing and complimentary theories which permeate the consideration and application of scarce resource responses and allocations within medical settings, each with their proponents and detractors. These range from individuals balancing principles and duties while implicitly applying them on a regular basis, to more formally articulated, explicit institutional policies. Agreement likely requires a fusion of basic “common moral precepts”, specification of principles, and some overlapping of “moral communities”, i.e., groups allied for or against specific causes and beliefs. Given the diverse roles and responsibilities of various clinicians and health care institutions themselves, ethical or policy consensus will not be casually achieved. The expectations of patients, professional peers, and others all contribute to shaping the development of policies for managing drug shortages and allocating scarce supplies. These
policies must be evaluated within the boundaries of our legal system, as defined by state and federal regulations, pertinent case law, and quasi-legal restrictions of accreditation organizations’ requirements such as those of the Joint Commission (formerly the Joint Committee on Accreditation of Health Care Organizations).

There are several domains that are affected by drug shortages, that in turn, influence or control decision-making and responses. These realms include the larger, environmental context, the institution or organization itself, and individual health care professionals. These influencing factors can be catalogued and thought of as belonging to separate, though interrelated realms – the personal, individual ethos, duties, and roles; the institutional values, resources, governance and regulation; as well as the ever-changing drug availability environment, and are summarized in Figure 2-1. Patients’ expectations and relationships with their providers are important and included. Being intimately affected by drug shortages, patients and their families and other representatives, as well as clinical research subjects, would comprise a whole separate domain. That many of them are unaware, or are kept unaware, of drug shortages and substitutions, their role as informants is limited, and was not explored in this study.
### Figure 2-1. Realms and context

#### Environment

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<thead>
<tr>
<th>Recurring drug shortages</th>
<th>Societal Context</th>
<th>Legal landscape</th>
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<td></td>
<td>Norms, expectations</td>
<td>Controlling/evolving statutes</td>
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<td>Public awareness</td>
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<td>State Boards of</td>
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<td>Pharmacy, Medicine, Nursing</td>
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#### Institution/Organization

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<tr>
<th>Mission statement</th>
<th>Networks</th>
<th>Legal and quasi-legal constraints</th>
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<tr>
<td>Values/Corporate culture</td>
<td>Drug-sharing arrangements</td>
<td>TJC</td>
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<td>Case mix</td>
<td>Group purchasing</td>
<td>CMS</td>
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<td>CLIA</td>
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<td>Resources</td>
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<td>Facilities</td>
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<td>(Clean Rooms, compounding)</td>
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<td>Communications/IT structures</td>
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<td>Drug supply storage capacity</td>
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<td>FTEs/Budget</td>
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<tr>
<td>Committees/teams/expertise</td>
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<td>Pharmacy &amp; Therapeutics (P &amp; T)</td>
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<td>Office of the General Counsel (Legal)</td>
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<td>Chief Medical Officer/Chief Nursing Officer (CMO/CNO)</td>
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<td>Risk Management/Quality</td>
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<td>Emergency Preparedness</td>
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<td>Bioethics</td>
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#### Individual

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<th>Personal moral understanding and precepts</th>
<th>Professional roles</th>
<th>Patient relationships/expectations</th>
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<td>Ethical principles</td>
<td>Norms/codes</td>
<td>Peer relationships</td>
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<td>Duties</td>
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Organizational Efforts to Address Allocation

Specific Case Reports – Rationing of Therapy

The hypothetical case studies and surveys we have reviewed are instructive, though as was also described above, in the actual, real-time oncology setting, there is no allowable room for clinician ambivalence. Care plans and allocation decisions must be made and discussed with patients. The following case reports offer three examples of how organizations have recognized essential medical resource scarcities, balanced potential solutions, and then organized and applied comprehensive institutional responses.

Specific case 1. In response to more requests than treatment slots, a formal, explicit allocation system for proton beam therapy at the Northeast Proton Beam Therapy Center based at Massachusetts General Hospital in Boston was developed. The treatment slots were prioritized, “based on principles of public deliberation, but embracing the flexibility that professional discretion allows” (Jagsi, et al. 2004). This system was developed by a committee of physicians, nurses, physicists, and hospital administrators, which prioritized the number of treatment slots by disease categories where there was known benefit, and, in keeping with its research mission and funding, for clinical trials evaluating proton beam therapy efficacy and outcomes. Notably, “public deliberation” is mentioned, though patients or clinical trial participants did not sit on committee. The authors’ discussion of their institution’s cancer therapy rationing system concludes with an admonition to all health care professionals to proactively reflect on and debate the ethical merits of allocation as soon as is possible, before a crisis atmosphere overwhelms them as caregivers. This is an important caution applicable to other scarce medical resources that institutions facing drug shortages neglect at their own peril.
Specific case 2. Able only to accommodate 3-4 patients/month undergoing a complex biologic cancer therapy (Sipuleucil-t), the authors described their institution’s allocation task force and prospective rationing plan drawn up by a multi-disciplinary committee of oncologists, nurse practitioners, a transplant surgeon, an ethicist, and a patient advocate (Peppercorn, et al. 2013). Once patients met pre-specified medical criteria, they were placed on a first come-first served wait list. In addition to this complex therapy, the authors also mention ongoing shortages of more commonly used drugs, and apply elements from their specialized plan into a template for managing all oncology drug shortages. Notable parameters of the plan include educating clinicians regarding shortages and access criteria; eliminating (i.e., withholding from patients) any non-evidence-based utilizations; establishing communication lines around supply, demand, access, and distribution; and conducting periodic reviews and quality assessments of existing allocation and patient prioritization procedures.

Specific case 3. The formulation of a multi-disciplinary committee to develop a prospective allocation policy for all applicable drug shortages was reported within the medical literature by Rosoff and colleagues at Duke University Medical Center (Rosoff, et al. 2012). The committee drew on existing Pharmacy and Therapeutics (P&T) committee members, Ethics Committee members, administrative leaders from Pharmacy, Medicine, and Nursing, and representatives from Risk Management and the Office of Legal Counsel. The committee followed Daniel’s and Sabin’s Accountability for Reasonableness framework, incorporating four ethical benchmarks: transparency and open review by all, of the policy, clinical relevance that is rationally accepted by affected parties, an appeals method, and equal enforcement and implementation of the rules. An additional “fairness” consideration that all clinically similar patients would be treated the same way was added. Once approved and ratified by ethics and executive medical staff committees, the policy was communicated to all staff and patients.
Specific attributes of the plan as applied to several chemotherapeutic agents include: dosing as many patients as feasible on the same day to maximize use of vial contents, not commencing a new patient’s treatment unless a complete course could be administered, restricting new referrals to the medical center’s proximate geographical area, prioritizing scarce drugs for curative over palliative indications, and conserving drugs used in research trials to those with proven clinical efficacy. If two identical patients met the same medical criteria under a period of absolute drug scarcity, regardless of age, a coin flip would determine the recipient. With one year’s reported experience, the authors reported that no patient had yet had to rely on the vagaries of a coin toss. The medical center also maintains a compounding pharmacy for preparing methotrexate suspensions, and other needed drugs. The authors noted that not all hospitals have this option. They also describe as “unexplored” how an outpatient, commercial, stand-alone pharmacy would respond to and allocate scarce drugs.

In a related paper presented to the bioethics community, Rosoff mentions the shortcomings and “bruising of moral intuition” which might take place when forced to decide between distributing drugs to the elderly versus pediatric patients, from “drug shopping” by desperate and/or well-heeled patients, and the potential stockpiling of scarce drugs by pharmacies anticipating imminent shortages (Rosoff, 2012). He also asks if hospitals and physicians will continue to conserve and carefully prescribe medicines once particular shortages are abated. Rosoff notes that no matter how open and transparent an allocation plan may be; some disappointed patients may resort to the legal system to question their place in the prioritization queue.
Legal Aspects

Traditionally, great deference has been paid to physicians’ professional expertise in making clinical decisions. In the U.K., the case of Regina v. Cambridge Health Authority [1995] also referred to as “the Child B case” presents both sides of the debate. There the court found that the health authority, in refusing a pediatric chemotherapy treatment used in the U.S. but not readily available in England at the time, could not make generalized constrained resource arguments, and that when the life of a child is at risk, health authorities “must do more than toll the bell of tight resources” and “must explain the priorities that have led them to decline to fund the treatment” (Laws J, 25 BMLR 5, pp:10-18). However, final judicial review of the case acknowledged that health authorities often must make difficult decisions about how to allocate limited resources to maximize benefits to the maximum number of patients, and that the Court would defer to health authorities’ rationing decisions unless they were made irrationally or outside of defined powers.

In his in-depth analysis of judicial review of health care rationing, Daniel Wei Liang Wang posits that despite plaintiff’s loss on appeal; the Child B case ushered in a sea change in both the allocation practices of health authorities, and the British courts, as health authorities’ justifications for rationing decisions would be henceforth held under greater scrutiny than as in years past (Wang, 2013). In another review of legal challenges to NHS rationing decisions, Christopher Stone concludes, “lawful adherence to NICE guidance appears to be the most persuasive defense to current rationing strategies adopted by NHS funding authorities” (Stone, 2010, p. 12). Thus, at least in Britain, legal theories for questioning fairness of a treatment decision reside less in challenging utilitarian principles of conserving medical resource commons at the expense of individual patients, than it does in examining adherence to procedural rigor, as is routine in administrative law.
In the U.S., one must keep in mind additional factors governing the legal and policy environment:

- Physicians are to a large extent self-regulated
- Legislators are typically averse to proposing explicit medical rationing statutes
- Regulations and coverage decisions within the Centers for Medicare and Medicaid Services (CMS) influence health care organizations’ policies and procedures as do quasi-legal organizations such as the Joint Commission (formerly, the JCAHO) and other accrediting bodies, and
- State boards of medicine and pharmacy are also often engaged in the controlling regulations or questions arising from licensees’ actions.

Several key cases have addressed providers withholding treatment or failing to provide care when a patient is unable to pay, using legal theories of contract law, torts, and fiduciary law (Mehlman and Massey, 1994). In U.S. jurisprudence, negligence claims are usually the primary legal recourse for aggrieved patients, rather than lawsuits claiming vague lapses of questionable fiduciary duties (Tauber, 2002). To date, there are no precedent U.S. legal cases brought by a patient aggrieved by their clinician’s preferential redirection of a scarce medication to another patient that better fit existing allocation criteria. Additionally, product liability/medical malpractice cases against pharmaceutical manufacturers for either rationing supplies, or halting manufacture of drugs, have not resulted in awards or advantageous findings for patient plaintiffs.

In *Lacognata v. Hospira*, where Hospira, Inc. ceased production of its injectable vitamin preparation Aquasol A®, plaintiff Lacognata contended that the manufacturer owed a duty to provide her with sufficient quantities of their product to protect her from adverse effects (essentially worsening visual acuity) of Vitamin A deficiency. In July 2012, the Florida District Court found,
The Court agrees that Plaintiff’s negligence claim fails as a matter of law. There is no authority that supports Plaintiff’s argument that a drug manufacturer, like Hospira, has a duty to continue supplying a patient with a drug that it knows the patient relies upon for his or her medical health. It is not this Court’s role to dramatically expand Florida law as Plaintiff seeks (p. 8).

A Florida Appeals Court affirmed the decision in June of 2013. Not long after, the U.S. Supreme Court also denied a writ of certiorari in the case.

In *Shubert v. Genzyme*, the widow of a deceased patient who had received only a portion of the full prescription of orphan drug Fabrazyme® following Genzyme’s rationing of scarce supplies to its patients after a plant shutdown, claimed Genzyme had an affirmative duty to provide sufficient quantities of the drug, as Genzyme was the sole manufacturer. However, the Utah Court found,

In light of the unavoidable nature of manufacturing and supply issues, a rule requiring manufacturers to forever supply a therapeutic or preventative treatment to everyone who is or may be prescribed it, regardless of the cost or reasonability of doing so, would create a significant disincentive to manufacturers that is against the public interest (Slip Op. 12).

In another case brought by multiple plaintiffs against Genzyme for its limiting of supply of Fabrazyme, *Hochendoner v. Genzyme Corp* [F.Supp.3d 15 (2015)], *Lacognata* and *Shubert* were both cited in the decision.

Plaintiffs fail to cite a single case establishing that Genzyme has a duty to manufacture sufficient medication to meet market demand. “I can find no such case under the law of any state implicated in these actions. In addition to citing no cases in which a court has found such a duty, Plaintiffs fail to identify indicia that the highest court of any of
the relevant states would expand the state's tort law in such a way as to include the proposed new duty of care (p. 12).

The inventive basis for claims against manufacturers (Common Law duty to initiate a rescue, due process, contract and warranty law, etc.) that similarly aggrieved patients have attempted to use, or might further consider using are described in a thoughtful paper examining several of these and other cases involving limited access to non-marketed, investigational drugs (Janssen, 2014).

Physicians sometimes refuse to offer life-sustaining therapies where there is a dismal prognosis with minimal or no expected benefit resulting from those therapies. This introduces conflicts and potential legal difficulties. However, adversarial conflicts between caregivers and family members can sometimes be diffused through family meetings and bioethics consults in the ICU. Without those meetings and communications, withholding futile or minimally beneficial treatments may be perceived by family members as an act of physician abandonment – an established legal claim to medical malpractice.

It is unclear how the case of withholding a scarce medication from one patient to treat a needier patient would play out in either family meetings in the ICU, or later in a court of law. How indeed would a physician parse his or her duties to multiple patients in competition for the same resource? Hensel has claimed that lack of transparency in decision-making regarding drug allocations may conflict with the standards of patient-centered informed consent (Hensel, 2016). This is somewhat questionable as patients aren’t usually formally consented prior to taking prescription medications, though changes to anesthesia protocols might be reasonably expected to be mentioned in the consent process. Young and colleagues claim that the duty to disclose information material to a patient’s treatment or probable outcome is an existing ethical requirement of physicians, and, parallel to medical error disclosures, rationing policies and allocation justifications, when openly communicated with patients, might lead to fewer litigated cases (Young, et al. 2012).
It is therefore possible that an existing explicit allocation protocol and a priori disclosures, as in the Accountability for Reasonableness framework of Daniels and Sabin, may be beneficial in avoiding adversarial, legal battles over drug prioritization decisions.

**Literature Consensus Areas**

Three content areas were examined: an academic base of philosophy, bioethics, and medical sociology; the medical literature, which includes clinical reports, surveys, and practice guidelines; and a policy/law base covering health and public policy, legislation, and legal cases. From these reports, the following statements can be considered as areas of consensus:

(i) medication shortages significantly and negatively impact care, and will persist for a variety of reasons, though flexible regulatory oversight may attenuate their effects;

(ii) pharmacists and their respective institutions confront drug shortages with a number of strategies – some are purely technical, pharmacy department initiatives, where others involve multiple disciplines, actors, and stakeholders within affected organizations;

(iii) the requirement to prioritize patients’ access to scarce drugs may exacerbate role conflicts and potential moral distress encountered in the balancing of clinicians’ duties to their patients, institutional hierarchies, and organizational responsibilities;

(iv) there is a lack of training directed to developing resource allocation strategies and consequentially, clinicians rarely voice normative moral theories regarding their actions, and instead rely on the traditional virtues and roles of the healing professions;

(v) in the U.S., there is scant published evidence of systematic rationing plans by health care institutions, resulting in only a few institutions’ reported allocation plans in response to drug shortages or other medical resource scarcities;

(vi) transparency of the allocation decision-making plan and apparatus is generally viewed as an important element for fairness and procedural justice, is considered an
optimal practice within ethical frameworks, and may potentially offset litigation resulting from prioritization decisions;

(vii) given the aging of the population, and the potential for future pandemics or other medical crises, the need for explicit allocation planning for scarce medical resources is unambiguous.

**The Present Study: Research Questions and Plan**

The questions asked in this dissertation commence with a series of semi-structured in-depth interviews conducted with a pool of key informants from hospital pharmacy departments, operating rooms, intensive care units, and clinics, all within the greater Boston area. These were purposively sampled, a commonly used approach in qualitative research (Morse, 2003). These informants present their own personal experiences, and the concerted actions undertaken within their institutions in Chapters 3 and 4, which for analysis, are presented as qualitative studies one and two. Their responses inform the questions administered to a nation-wide survey of pharmacy directors, which complete the data collection phases of this exploratory, sequential mixed-methods study,

**Research Questions of Interest**

1. How do pharmacists and bedside clinicians perceive, understand, and discuss drug shortages?
2. What adverse effects on practice, including potential moral distress of caregivers, and, patient outcomes have resulted from drug shortages?

In Chapter 3, the first of the two qualitative studies, interviews focus on the evolving personal experiences and perceptions of participants, how they talk about drug shortages, drug substitutions, and drug allocations with each other, and with their patients. The adverse effects of drug shortages on care, practice, and their own instances of moral distress are reviewed, as well as the actions they take to mediate and mitigate these effects.
3. How are institutions confronting, managing, and operationalizing organizational responses to drug shortages?

As the second qualitative study, Chapter 4 examines the breadth of hospitals’ institutional responses to, and preparedness for medication shortages; including in-house compounding, drug-sharing and substitution arrangements, preferential allocation to clinical vs. research needs, development of explicit allocation schema and emergency planning. Responses from participants fulfilling various roles (physicians, nurses, pharmacists, etc.) are also analyzed in this chapter. However, many of the strategies are pharmacy-based, and there is a larger contribution from pharmacist respondents. Drug shortage management strategies are also presented in Chapter 5, which provides insights from a separate group of key informants - a quantitative web-based survey of ~100 pharmacy directors distributed throughout the country, representing a variety of practice settings.

4. How are shortages, drug substitutions, and patient prioritization/allocation plans systematically communicated and coordinated amongst staff, to prescribing physicians, and to patients and families?

Chapters 3-5 cover these important communications, and analyze the varying degrees of transparency of allocation planning.

5. How do those approaches differ between settings?

Chapters 4 and 5 explore if and how those approaches, and allocation plans differ between settings, i.e., academic vs. community hospitals.

Policy opportunities and implications, comparisons to norms and practices cited in the literature, and quasi-legal boundaries surrounding existing or potential responses are discussed and summarized in Chapter 6, as are the study limitations, and suggestions for future research.
Chapter 3

Qualitative Interviews with Key Informants: Perspectives and Discourse

How are drug shortages perceived, discussed, and constructed as a legitimate social problem? Given the varied professional roles within hospitals, how is responsibility to manage them apportioned, or assumed? Which institutional policies, personal moral codes, or other resources do clinicians rely on for making drug substitutions or allocation decisions? By whom and how are patients informed, if at all, that their prescribed medications are not available?

These questions may be fit into quantitative surveys, but they can never be fully answered with a multiple-choice checkbox. Indeed, these issues lend themselves to exploration through qualitative methods which present opportunities to uncover the deeply felt experiences and complexities faced by front-line clinicians and pharmacy staff.

Approach

The study was first reviewed by the Northeastern University Institutional Review Board, and approved under expedited review on August 20, 2014. Over the course of twenty months (September 2014-May 2016) semi-structured interviews were conducted across the Boston metropolitan area with key informants at leading academic medical centers and teaching hospitals. Informants were also recruited from several community hospitals, as these types of facilities generally operate under different charters, with fewer specialized staff, or other resources. These participants were recruited by e-mail, word of mouth, and telephone inquiries. Following written consent of participants, interviews took place at their preferred locale, ranged from 30-60 minutes, and were digitally recorded and transcribed.

1IRB#14-07-05
Sample/Participants

The sample is comprised of pharmacist leaders (directors and assistant directors), a hospital manager and attending physicians from Anesthesia, Internal Medicine, and Cardiology Departments. Early memo-writing and other preliminary analyses indicated a gap in understanding the process of communicating drug shortages and alternative substitutions to patients, a task rarely directly taken on by pharmacy staff. To address this gap, registered nurses were added to the interview sample with IRB approval. All interviewed nurses were Master’s- or doctoral-trained, and worked at the bedside and/or in clinical, unit-based management positions, i.e., regularly had direct patient contact. A nurse practitioner working in Occupational Health was also added to the sample to learn how shortages of Tuberculosis testing solutions and vaccines were managed.

The practice settings ranged from smaller (<300 bed) suburban community hospitals to large (~1000 bed) urban academic medical centers, as well as an inner city “safety net” hospital, and an academic oncology specialty site. To ascertain environmental effects of the professional setting, community and commercial pharmacies had been included in the original study design. These sites were later dropped when willing candidate participants replied that they would not be permitted by their senior leadership to discuss their organizations’ (potentially proprietary) drug shortage management practices. Thus, the qualitative portion of this project is centered solely within hospitals. These boundaries are not a bad thing, as community pharmacy issues and responses may have confounded the analyses. Hospitals themselves provide a rich research environment with ample variability of settings and roles.; and afforded an opportunity to explore Pharmacy perspectives, bedside clinician “in the trenches” viewpoints, and additional clinical and administrative views, as well as the systems approaches undertaken by informants’ organizations. The sample population is categorized in Table 3-1.
Table 3-1. Interviewee attributes

<table>
<thead>
<tr>
<th>Interview sample</th>
<th>Urban Academic Medical Center</th>
<th>Community Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Setting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban Academic Medical Center</td>
<td></td>
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<tr>
<td>Community Hospital</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Professional Role</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Pharmacist Director/Asst. Director of Pharmacy</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Hospital Manager</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>MD</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>RN</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>NP</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

To preserve confidentiality, no names, initials or other personal identifiers are used; and participants are referred to by professional role and workplace setting, *i.e.* teaching hospital nurses 1-5, community hospital pharmacists 1-4, teaching hospital physicians 1-3, etc. (Table 3-2)

Table 3-2. Participant/interview key

<table>
<thead>
<tr>
<th>Code</th>
<th>Role/setting</th>
</tr>
</thead>
<tbody>
<tr>
<td>AHPH</td>
<td>Academic/teaching hospital pharmacist</td>
</tr>
<tr>
<td>CPHH</td>
<td>Community hospital pharmacist</td>
</tr>
<tr>
<td>AHMD</td>
<td>Academic/teaching hospital physician</td>
</tr>
<tr>
<td>AHRN</td>
<td>Academic/teaching hospital nurse</td>
</tr>
<tr>
<td>AHNP</td>
<td>Academic/teaching hospital nurse practitioner</td>
</tr>
<tr>
<td>AHIO</td>
<td>Academic/teaching hospital manager/leader</td>
</tr>
</tbody>
</table>
Analytic Methods

In accord with grounded theory methods, the interview questions evolved during these twenty months, as various dimensions of codes and thematic categories were uncovered over the course of interviews and ongoing analyses. (See appendix B, Interview guide)

The author was the sole interviewer and coder. Focused coding techniques and thematic analyses were performed by visual inspection, line by line and axial coding, and the use of qualitative data analysis software (QSR. NVivo qualitative data analysis Software; QSR International Pty Ltd. Version 11, 2015). Modifications of grounded theory were used in evaluating participants’ constructed meanings around resource scarcities and discussion of adverse events, with iterative revisions to interview questions posed in subsequent interviews, to develop a deeper understanding of varied stakeholders’ perspectives and experiences theory (Corbin and Strauss, 1990, 2008; Charmaz, 2006). The use of memos for individual participants, categories, and grouped role responses was used to identify emerging themes. Reflexivity, attention to divergent/negative cases, and to the extent possible, ongoing participant validation was assessed in the study, as suggested in the literature (Mays and Pope, 2000; Maxwell, 2009; Reynolds, et al. 2011).

Many if the codes were identified relatively early in terms of the number of interviews. As more participants were interviewed, additional dimensions of these codes were revealed, leading to their revision and the introduction of additional new codes and the development of thematic categories. Saturation was achieved once similar responses were collected in the latter interviews with few variations or additions to previously identified elements. This pattern is consistent with, and satisfies the construct of “meaning saturation” described by Hennink, and the model of “information power” developed by Malterud, et al. (Hennink, et al. 2016; Malterud, et al. 2016).
The interplay between respondents’ own personal responsibility and institutional support frameworks surfaced, as did a larger picture of how participants (individually, and collectively within their organizations and professional networks) comprehended and confronted overall resource scarcities. Administering the interviews several years after the nation-wide peak onset of medication shortages was fortuitous, in that sampling during this period yielded insights into respondents’ established planning options and ongoing preventive methods [as discussed in Chapter 4], rather than simply cataloguing emergent reactionary responses. This also enabled inquiries regarding participants’ evolving perceptions of the impact of nation-wide drug shortages, as well as the mutable sense of “control” – both personal and institutional – over these scarcities.

The initial guiding research objective was to specifically determine how rationing of scarce resources is developed and executed. Respondents uniformly resisted the appellation “rationing”, and shifted the conversation towards “prioritization” and “being on allocation”. This was much more than a semantic quibble, as their responses to drug scarcities involve a host of apercus and actions which commence long before making any formal rationing decisions. While inescapably intertwined with their framing of drug shortages, pharmacists’ and clinicians’ actual working strategies for managing dwindling inventories, as well as other institution-wide practices, are more fully described in Chapter 4. Here, the understandings, the conversations, and felt implications of medical resource scarcities are reviewed and presented under identified thematic categories.

**Findings**

**Experience and Personal History with Shortages**

The diversity of participants’ clinical tenure, leadership roles, and their organizational settings accounted for varied experiences with confronting drug and other medical resource shortages. To distinguish and appreciate those different experiences, a key preliminary of each interview was to ask each respondent to describe their own discoveries of, and
experiences with drug shortages. Several of these informants compared their experiences while working at several hospitals, whereas the majority provided responses and context based solely at their current site. All respondents, regardless of role, had experienced drug shortages within their respective institutions, some as far back as 2002.

An intensive care unit nurse shared an urgent e-mail notice received the night preceding our interview. This notice alerted staff that only ten vials of a critical drug remained within the entire hospital, and suggested that the affected clinicians should meet to figure out who would have priority use of those last vials. Seemingly unfazed by now, having received these for over a decade, she mentioned, “Ten years ago, everyone was, ‘how can we not have this?’” [AHRN05]

While most clinicians were appreciative of Pharmacy notifications, those practitioners outside of the targeted teams often discovered incidentally that medications were unavailable, perhaps finding a sticky note left in the Omnicell (unit-based drug cache), or, noting from a colleague’s referral note that the patient’s prescribed drug was no longer available. “It happens quickly without really a lot of advance notice.” [AHRN03] In an outpatient-focused practice one internist only became aware of her patients’ inability to locate tamsulosin (Flomax) when they would return from Walgreens empty-handed.

What you hear—the patient comes back and says, ‘Hey, the pharmacist said we’re out of x’, and you really don’t get that same type of formal communication the way you would about the hospital’s supply of i.v. medications. [AHMD02]

To bedside nurses at the large teaching hospitals, the disconnect between their established patterns of reviewing physicians’ orders to administer a routinely used medication and, while going to prepare it, finding suddenly that none was available, was remarkable in its dissonance. A nurse spoke of the extreme awkwardness she felt when she found herself unable to prepare a standby emergency syringe during a Code Blue (cardiac arrest), as was the usual practice in her hospital in these highly-charged events. It was no longer on the code
cart because the pharmacists now maintained control and storage over certain medications. The new, shortage-driven practice required the pharmacist to deliver this scarce drug from the Central Pharmacy to the code site, retain it in his own hands, and only release it when and if the directing physician ultimately voiced the go ahead. Essentially, this had become a formal and orderly sequestration of a life-saving drug, which previously could be grabbed off the code cart at a moment’s notice—in a heartbeat as it were—in the absence of a patient’s heartbeat.

**Unpredictability of Shortages**

The seemingly surprise nature of some shortages further contributed to a destabilized environment. Despite the keen vigilance of pharmacists and hospital purchasing agents (hence forward referred to as “buyers”), and, regular postings of shortage alert notices; the vicissitudes of medication availability contributed to clinicians’ unease. Nurses often received shortage notification e-mails from Pharmacy, though these were not always accompanied by a full explanation. Some felt these were cyclical, while others remarked that the e-mails constantly flowed in, “not knowing the rhyme or reason behind them.” [AHRN01] Vague information from drug distributors often left pharmacists unprepared to judge the criticality of a shortage event, nor how to predict a resolution or return to the status quo—“the thing that makes these so complicated – we don’t know when they are going to get better.” [AHPH04]

Acute shortages of tuberculosis (TB) testing solutions were attributed to a “Tubersol plant being wiped out by Hurricane Sandy” [AHNP01], as were propofol supply lines that were closed in the hurricane’s wake. The caprices of fate were also invoked by one pharmacist director, “We were lucky, a couple of good luck scenarios helped us stave off the saline shortages”. [AHPH04]
There were mixed responses as to whether the urgency of drug shortages had peaked or otherwise abated. 2010-2011 was described as “a difficult and brutal time” [CHPH02], and the current period as “not as severe as a few years ago.” [APH03]

All participants were aware that drug shortages were still an ongoing issue, and acknowledged this in several ways. “There are still shortages. The drugs that are short are changing all the time…One of my colleagues keeps track of these.” [AHMD01]

I would have a difficult time saying shortages have gotten better...So I think it would be difficult for me to say that we’re spending any less time on it, or that it’s any net on par better, it’s just different – that’s my perception [APH04]

These episodes’ discrepant flow of events and cues, an unstable environment requiring constant decision-making, and the uncertainties underlying those decisions all correlate with the early stages of sense making, the “processing” phenomenon described by Karl Weick (Weick, 1995).

**Siege Mentality**

The daily realities and persistence of drug shortages also contributed to participants’ feelings of being under siege. Pharmacy managers at academic medical centers described their drug shortage task force meetings as “war rooms” of experts convened to direct allocation plans. In several instances pharmacy staff called in the hospital disaster response committees for additional back-up and support. At the smaller community hospitals, several pharmacy directors felt the odds were stacked against them, noting there was seldom much drug product available to them once drug distributors had taken care of the teaching hospitals with their large-volume group contracts. On the other hand, despite their capacious supply rooms and significant purchasing power with drug distributors (as compared to the smaller community hospitals and clinics); large hospitals with their complex case mixes and encyclopedic formularies felt that they were equally “up against it”. Faced with their institutions’ multiple user groups each clamoring for their share of scarce drugs, and, unlike
a small hospital or commercial pharmacies such as Walgreen’s or CVS, these behemoths were unable to selectively choose product lines, or to filter resource needs.

“We’re ‘X hospital’ – bring us your tired, your hungry, man!” [AHI01]

A Darwinian “survival of the fittest” ethos was voiced, “It’s like you know, the evolution thing, everyone has to fight for his hospital to make sure he has enough.” [CHPH02]

From a variety of settings and professional roles, their comments speak to the constant stressors experienced by these participants, seemingly just keeping their head above turbulent waters. Your guard is up, if you hear anything you still are ready to go crazy trying to get the product. [CHPH02] I would say we barely have control of the situation. [AHMD03]

“But I say that the key point from this is – ongoing or active shortages still plague us. And it’s these that are likely what keeps me more awake at night, the ongoing shortages that don’t seem to resolve.” [AHPH06]

The sheer magnitude and constant eruption of drug scarcities were not the only causes of concern. There was also the foreboding knowledge that the many pre-emptive actions and management processes their organizations had developed still might not preclude the requirement to make difficult rationing decisions. “You know you might have incremental shipments of drug or something, but not enough to take off whatever stop-gap measures that you’ve put in place.” [AHPH06]

With their persistent presence, and potential cascading effects and events which could easily be interpreted as a threatening condition, drug shortages constitute not only disrupt health care delivery, but also meet Spector and Kitsuse’s definition of a social problem (Spector and Kitsuse, 1987). It follows then that the claiming of drug shortages as a bona fide social problem by clinicians and others has implications for policy proposals and advocacy in both societal and organizational realms. But first, to the immediate problems.

2 Redacted for confidentiality
Adverse Effects of Drug Shortages

Respondents corroborated the clinical, operational, and financial challenges described in Chapter 2, and bore witness to events that particularly affected them and their care of patients. Just the operational constraints alone were significant. Pharmacists unanimously spoke of the added time required to manage shortages. “It takes a piece out of everyone’s day.” [AHPH03] “Talk about changed practice- what I’ve had to do is drop everything else. My whole job becomes obtaining that drug.” [CHPH02]

This constant attention to managing resource scarcities competed with, and potentially usurped their routine and necessary focus on quality and patient safety. “It shifts your attention from other things you should be doing.” [AHPH02]

Many “downstream dependencies”, e.g., the re-stocking of code carts and Omnicells, new refrigeration requirements, and multiple revisions of drug preparation and administration routines also required additional time and personnel assignments. While many pharmacy managers had requested additional staff to mitigate drug shortages, only a single respondent affirmed that their institution’s leadership had granted an additional FTE (full-time equivalent) to Materials Management buyer staff.

A minority of participants confirmed that surgeries and imaging exams had been “absolutely” cancelled due to drug or contrast agent shortages. Postponements or cancellations of medical procedures were not limited to community hospitals; and in the larger teaching hospitals these few instances were referred to as rare occurrences.

Not never, but rare. Um, we’ve come close, and I’d say probably with the anti-infectives. When we had Pentamidine in shortage, we had to, we used the Task Force, we developed an algorithm, and we had to call people scheduled for appointments, but not unknown.” [AHPH06]

For TB testing and flu prevention conducted by Occupational Health Services, nation-wide shortages of related drugs and testing solutions were paradigm-shifting.
These shortages led to significant practice changes, eventually resulting in the routine testing and vaccination of fewer thousands of hospital staff members. Many physicians and nurses, skeptical that they were no longer on the “A-list” to receive influenza vaccines, required additional communication measures and reassurance that the new practice patterns were safe for them, as well as for their patients.

The necessity to select drug substitutions, and especially, which patients would receive them, also affected clinical practice. There was an undercurrent of a loss of control. “These [shortages] force clinicians to make decisions they would rather not make.” [AHPH01]

Um, some other medication we were at the – some level for example we were down to two years ago, no a year ago we were without Succinylcholine. I mean an anesthesiologist without succinylcholine is, is really severely limited because succinylcholine is an irreplaceable drug for rapid sequence – there’s no other drug for intubation. [AHMD01]

Universally, participants voiced concerns with drug substitutions, of switching from, “an ideal agent to one that is just okay.” [AHPH01] “Because you’re changing standards, right? I mean you’ve changed what the norm is.” [AHRN04] They mentioned the prolonged intubation times and additional required medical supervision of patients receiving less optimal anesthetics and sedatives, and, of their patients no longer having access to the only previously-effective prescription medication. One nurse chose a path of deliberately slowing down to take extra time to carefully read and scrutinize the directions for safely preparing and administering any substituted medication, a difficult task in her fast-moving trauma unit. A pharmacist and nurse respectively spoke of unacceptable side effects or injuries caused by using alternative drugs or replacement devices, which were quickly pulled out of service for safety reasons.

Despite pharmacists’ provision of carefully crafted messaging and instructions, the ever-present potential for dosage miscalculations on the wards accompanied drug substitutions. “We worry about concentration errors, dosing errors, because it’s a different
product line, a different dosing form...And so, as a pharmacist I worry about that a lot.” [AHPH05]

Another pharmacist obliquely mentioned a drug substitution-related medical error currently under investigation at his hospital. Pharmacists guardedly spoke, *sotto voce*, of Risk Management staff “sniffing around” or being “disquieted” by the changing standards of care wrought by drug shortages. One intensive care nurse, who as a key member of a drug quality and safety team in her hospital was uniquely tuned into these issues, succinctly summed up her safety concerns with using unfamiliar drug substitutions. “So then, it becomes a safety issue downstream, right? Now they’ve got a product that’s no longer programmed – you’ve no longer got any guardrails in it” [AHRN04]

Extending well beyond operational and staffing challenges, participants’ emerging questioning of care quality, patient safety, and potential legal problems suffuse these conversations. No matter how stoically they are presented or hinted at, these “lowered guardrails” possess a power and capability to challenge hospital staff members’ sense of their own personal and professional integrity.

**Uncertainty/Distress**

How did these concerns personally affect those responsible for delivering care? Simply not having the preferred medication was difficult for some clinicians. A nation-wide shortage of i.v. acetaminophen “deeply resonated” with a physician who routinely prescribed it in her palliative care practice for patients in end of life care. A concerned pharmacist echoing others’ resigned acquiescence that essential medicines were unavailable, voiced the following,

> And I can’t give you Methotrexate because I can’t get your rescue agent, Leucovorin. You know, it just feels professionally like we’re not doing our job for the patient...It’s hard to say to a patient in 2015, ‘we just don’t have the drug to treat you’ – I never would think I would have to say that. It doesn’t feel very good. [AHPH05]
This perceived affront to personal responsibility, and potentially compromised duty to patients also surfaced when circumstances required the administration of sub-optimal drug substitutes.

There’s a reason that drug was not selected first. You feel like you’re compromising the best care you want to give. [AHRN03]

You don’t have that drug—it might force you to make some adjustments, and with a little, we should say, anxiety on the results? Yes. [AHMD01]

The classic literature on moral distress in the health care setting typically speaks of caregivers’ internal conflicts related to institutional or role constraints—of not having the authority to effect a change or carry out the best practice for one’s patients in the setting of an ethical dilemma. (Jameton, 1984; Corley, 1995) Organizational impediments and circumstances not supportive of clinicians’ values can variously impact clinicians. One model of moral distress describes these circumstances as moving through a spectrum; first progressively challenging, then threatening, and finally progressing to violating caregivers’ sense of professional or individual moral integrity (Thomas and McCullough, 2015).

Importantly, the participants interviewed for this study do not single out or blame their organizations’ ethical climate; yet they are clearly expressing unease with their inability to deliver the care they identify as the most appropriate and consistent with their practice. While they steadfastly refrained from expressing or using the term, “moral distress”, their discomfort matches evolving concepts and broader definitions of moral distress more recently described in the literature (Pauly, et al. 2012; Campbell, et al. 2016).

Owing to power and rank differences among health care professionals within hospitals, moral distress is frequently described and researched as a nursing phenomenon (Jameton, 1984; Corley, 2002; Oh and Gastmans, 2014). Yet, moral distress may also be experienced by other health care professionals facing legal or other constraints on their moral decisions (Kälvemark, et al. 2004; Sporrong, et al. 2006; Austin, et al. 2008; Mitton, et al. 2010).
The interview excerpts demonstrate that the conflicts and distress spurred by persistent drug shortages span professional roles, and may equally and adversely affect pharmacists, physicians, and nurses, regardless of the extent of their power, autonomous decision-making privileges, or station within the health care setting. Given that the “residue” of persistent unresolved moral distress is associated with professional burn-out and exit of clinicians from the workforce, there is an organizational imperative for institutions to recognize and address these concerns via staff counseling and employee assistance programs, bioethics training, or other means. Several of these “processing” options included discussions amongst peers, and other venues.

So, we have, um, you know, pharmacists have the ability, obviously, we can talk about it through our Task Force. And then we also have Employee Assistance. As part of our regular walks, we do Safety Rounds-walk rounds, so staff pharmacists as well can bring up this type of concerns. [AHPH05]

**Deflection of Rationing**

Deciding which patients are allocated the remaining drug creates an additional layer of conflict. One physician whose outpatient-focused clinic, fairly removed from critical care medicine, confided, “you know I feel very lucky in some ways that I don’t run across it that much because I’m not usually giving that last drug that’s going to cure people or something like that.” [AHMD02]

Pharmacists were routinely loath to make patient-based allocation decisions, and deferred this responsibility to physicians. “How can you pull from one patient for another? That’s weighing the scales of justice.” [CHPH01] When asked how they would prioritize patients with equally compelling medical needs, they responded, “We shouldn’t have to make that decision” [AHPH01], “And that’s something that I don’t think I could bear. In other words, I’d, you know, I’d do anything to prevent that from occurring.” [CHPH02]
After a tough, confrontational meeting with oncology physician leaders that ultimately determined which services’ patients would be allocated the hospital’s dwindling stocks of chemotherapy agents, a pharmacist ruefully remarked, “I never want to have that conversation again.” [AHPH04]

Rejecting the assignment to consider or even mention the act of “rationing” drugs persists throughout the interview data. “We don’t call it the rationing of scarce drugs—it’s prioritization guided by public health agency guidance.” [AHNP01] “I don’t like the word rationing - it’s allocation of scarce resources.” [AHPH05] “We’re redistributing drugs; it’s not really rationing.” [CHPH03]

This silenced uttering of “rationing”, of not explicitly claiming to make difficult, value-laden selections affecting patients’ care is somewhat problematic, at least from a transparency perspective. Where does it come from? This evasion is likely to be at least partially related to staff reluctance to engage in normative evaluation or considerations of distributive justice as cited above, or, perhaps due, relatedly, to a perceived or real deficit of comprehensive bioethical training (see Chapter 4).

Their reluctance may also be attributed to the varied meanings and histories participants associate with the term, that is, how and what they conceptualize as the act of “rationing”. Recalling Weick’s sense-making mantra, “How can I know what I think until I see what I say?” (Weick, 1995), the framing of this process; and its actual naming, influences the management of scarce resources, and also underpins how these decisions are communicated.

**Communication with Patients/Patients’ Awareness**

Regardless of the terms that are used, there is a general presumption, flowing from a professional’s’ fiduciary duty, that patients would be informed that a required drug is unavailable to them. My presumption of that responsibility was decidedly not backed up by the interview data. “Patients were for the most part unaware of drug shortages” [AHPH01]
So I definitely remember having to explain to patients, ‘here’s why we can’t do your PPD, this is why you need to do this’...so I remember explaining those sorts of things, but I have to say in general medicine I don’t think I’ve had to explain, you know, there’s a nation-wide shortage of this drug and therefore I can’t treat your hypertension or something because, almost, there are very few things I do where there is only one, absolutely, one drug, I would say. [AHMD02]

“With most patients, it doesn’t always come up... we haven’t had to explain national shortages.” [AHMD02] “I don’t think the patient ever got to know there is not enough Propofol, there’s little propofol.” [AHMD01]

On the other hand, in several instances patients were themselves acutely aware that their preferred medication was unavailable, and took active steps of their own. A cardiologist spoke of her frustrated patients writing angry letters to a pharmaceutical manufacturers’ chief executive officer after production of a favored prescription drug was halted. A pharmacist relayed the story of an intrepid patient who had brought his own scarce chemotherapy agent to the cancer clinic. This had been purchased overseas by the patient through some murky parallel market – though to no avail, as its questionable provenance utterly disqualified it from being deemed sufficiently safe to be administered by the treatment team here.

In addition to medications being unavailable, substitutions of scarce drugs with sometimes sub-optimal alternative medications were also not uniformly communicated to patients. This was primarily to avoid causing additional anxiety, particularly in the peri-operative setting. “Disclosure is not a bad thing, but typically does not happen.” [AHRN03] “I would not communicate it, unless there is a significant risk to the patient.” [AHMD01]

This reluctance to announce each, and every drug shortage or substitution, cannot be construed *prima facie* as ambivalence, as negligence, or, avoidance of the issue; as the patient’s overall well-being was regularly referenced as a contributing factor. However, red flags are raised. They are raised in the name of transparency, in the name of accountability, and they signal potential incursions and breaches of patient autonomy. These will be discussed
in subsequent chapters, but are noted here as important clues to the overall strategies employed for communicating the scarcity of medical resources.

Not just if, and when, but also the manner which drug substitutions are communicated to patients is important. One nurse did regularly notify her patients if there was a drug substitution, and found, not surprisingly, that patients were more likely to trust the switch to an alternative medication if she had first established an open relationship with them. Another noted better acceptance of the alternative, no matter how hastily improvised, when it was not presented haphazardly, but rather as a well thought out choice, a "workable plan", by the care team.

Several teaching hospitals formalized these communications to patients, proscribing that the patient’s physician was foremost responsible for informing cancer patients of any oncology drug allocations. At another medical center, all formal drug shortage communications to patients, regardless of medical indication, are first required to be reviewed and vetted by a Health Care Quality Committee. This level of external scrutiny was not mentioned by any other respondents.

The “whos” of communicating drug shortages and substitutions to patients were important. In one Oncology setting, pharmacists themselves assisted in communicating drug shortages to patients and families with concerns about treatment course interruptions, or were afraid that there were not enough drugs on hand to even commence their anti-tumor therapy in a timely manner. This site’s hospital pharmacy also set up an emergency telephone line specifically for concerned patients.

These open lines of communication were undertaken directly by pharmacy staff. In most cases however, nurses or physicians took on the sometime onerous role of telling patients there was a shortage-related change of plans, though this assignment was often fluid. “Um, that’s a good one. Who does tell? It depends on the situation.” [AHRN03]

Several nurses voiced their personal discomfort in talking to patients or to a pediatric patients’ parents about a drug substitution; and emphatically felt that under the prevailing institutional
practice models, this was "100 percent”, the physician’s job. The division of duties and related responsibilities was not only defined by professional roles, but in some cases, also limited by them.

**Role constraints**

Interviewed pharmacists spoke of the inter-professional difficulties they encountered when drug shortages first became a regular standing issue. One was brusquely challenged by physicians, who asked him if he knew how to run a pharmacy. “Frankly five years ago, it was taboo to tell the MDs we were out of this.” [AHPH04] On rare occasions, physicians demanded access to unreliable substitutes, attempting to override the pharmacist’s decision. “I nixed it and told the surgeon we wouldn’t use it- but there was a lot of pressure to go ahead.” [CHPH02]

Chief Medical Officer and/or Pharmacy and Therapeutics Committee (P&T) back-up was sometimes relied upon to bolster and reinforce the pharmacy’s choice of alternative medications or allocation plans. “When it came down to a physician stamping his feet, it was like, ‘Here’s the chairman of the P&T- you call him’.” [CHPH04]

These behaviors, for the most part outliers in this sample, reflect the continued expression of physicians’ authority over other clinicians. While medical dominance has been steadily eroded by the advanced education and evolving clinical privileging of other health professionals, oversight of payers, and emphasis on evidence-based medicine, it still manifests itself, affecting communication and relations between health care practitioners working in what’s been termed a negotiated, collaborative order. (Light and Levine, 1988; Nugus, et al. 2010) Describing competing control of antibiotic stewardship programs within hospitals, Broom and colleagues refer to the “evolving professional asymmetries” between pharmacy and medicine, which requires subtle discretion by pharmacists to exercise their delimited power over physicians in drug dispensing decisions. (Broom, et al. 2015)
Persistent drug shortages present an additional milieu where this asymmetry of power and responsibilities may be either contested or collaboratively managed. Alternative drug substitutions were not presented to physicians as inflexible pharmacy mandates, but were instead offered as suggestions for physicians to consider and hopefully “bless” with a medical stamp of approval. Pharmacists emphasized and reiterated that physicians are ultimately responsible for the patient’s care, and that the pharmacist’s role related to drug shortages are as follows: securing inventory, identifying alternative drugs, communicating impending shortages and remaining supply inventories to physicians. Their professed duties preclude the responsibility for solely making decisions to allocate scarce drugs to specific medical services, or, especially, to individual patients. “It’s our duty to tell MDs there’s no more drug. If they use the remaining supplies injudiciously, it’s on them, not me.” [CHPH04]

Several community hospital pharmacists expressed difficulty in exercising control of physician use patterns in their milieu, and felt that pharmacists at the larger teaching hospitals were likely to have more resources and authority to “rein in” profligate prescribers of scarce items. This variation in organizational climate was also noted by several nurse managers at large teaching hospitals, who preferred the more collegial and collaborative experience they currently enjoyed as compared to their previous tenure in smaller community hospitals where physicians operated in a more authoritative manner.

Nurses also felt unprepared to administer certain drug substitutions to their patients, particularly when off-label administration routes strayed from their scope of practice, e.g., infusing a drug through a peritoneal dialysis bag (which in this case, the pharmacist and physician were required to verify as acceptable technique), or when the substitute drug was prescribed to be administered as a non-routine dosage.

I literally had the physician and the pharmacist come into the room. We were able to verify it was the right med.” “…there was a lot of concern about how high this dose was, and I felt a little, uh ‘naked’ as a nurse, because I wasn’t protected by my EMAR (Electronic Medication Administration Record).” [AHRN01]
This same participant spoke of each nurse having his or her own “personal safety index”, admittedly variable amongst them, which might compel some to carefully review, and others to quickly accept the substituted medications. Another nurse “struggled to understand” a new heparin protocol which required dilutions of higher strength concentrations, which if performed incorrectly, posed a dangerous potential bleeding risk to her patients. This struggle to understand illuminates the incomplete knowledge inventories of clinicians facing medical resource scarcities. [see Chapter 4]

Resilience

Pharmacists’ long familiarity with persistent drug shortages attenuated some of the associated pressures and uncertainties. As each new drug found itself on the shortage list, it was no longer fearfully perceived or managed as the “crisis du jour”. One pharmacy manager noted, “we cannot control shortages, but we have better control of our processes now” [AHPH01], and others, “it’s been so long, it’s just part of my job.” [CHPH03] “People have learned to tolerate this.” [AHPH04]

With fewer medical resources, pharmacists learned to “manage around things”, and physicians to “practice medicine without them”. Overall, participants demonstrated an admirable sense of resilience and determination. These were not novices or new graduates. One nurse manager reflected on her colleagues’ past medical missions to under-resourced countries and voluntary assignments to disaster relief operations, “...it’s a pretty seasoned group I work with...they take it in stride.” [AHRN03] Another described her team’s flexibility and ingenuity when her unit was forced to work with a substitute blood collecting device her nurses had deemed unsuitably safe, despite its FDA- and hospital committee-approved status. “We were prepared to do something else - we had ‘a little MacGyver’ alternative.” [AHRN05] This accountability and willingness to act, without the figurative umbrella of formal permission or “empowerment”, is an example of the agency, described by Traudt, et al., used as “the
first antidote for moral distress of nurses.” (Traudt, et al. 2016, p. 209) This confidence and self-awareness also extended to drug allocation decisions. “The prioritization decisions were sound, making these decisions is what we do.” [AHPH06]

Notably, this pharmacy manager did not say, “This is what I do.” In addition to learning how to constantly juggle many variables, of redirecting drugs to their most efficacious uses, and honing their project management skills, the “silver lining” that was most mentioned by pharmacists was the teamwork and mutual respect that grew out of their institutions’ collective responses to drug shortages. “One positive result from shortages is the heightened collegiality and consultation.” [AHIO01]

**Teamwork**

To the relief of pharmacy directors previously going it alone in the early years of drug shortages, a burgeoning group management approach was becoming the new norm within their departments. “Over the years, the issue became so disruptive we had to move it off only a few shoulders.” [AHPH04]. Pharmacists spoke of “pulling together to make this work” [CHPH01], that “we are all finding our niche along the way.” [CHPH01] “Everybody takes a piece of it.” [AHPH01]

Relationships between pharmacy and bedside clinicians were also critical to developing an extramural team approach. “We have sort of trained the clinicians to trust our judgment, they ask us ‘what do we need to do to mitigate this’?” [AHIO1/AHPH02] Pharmacy managers regularly reached out to medical directors, asking them to “help us steward this.” [AHPH04] When successfully implemented, these models are a corrective to the authoritative medical dominance previously discussed.

On the wards, nurses and physicians repeatedly commended pharmacy staff’s helpful direction and responsiveness. They acknowledged that pharmacy took the brunt of the work in managing drug shortages, and, expressed gratitude that their hospital pharmacists routinely and thoughtfully responded to their concerns, be it in person, during ICU rounds, or
in promptly answering pager calls at 03:00 AM regarding questionable drug substitutions. This collaboration between practitioners is consistent with trends in medical and allied health education and practice to break down barriers between clinicians, to embed continuous interaction and knowledge sharing, and the development of trust amongst health care teams – core competencies and values of the Interprofessional Collaborative Practice (IPEC) initiatives endorsed by varied professional associations representing medicine, nursing, pharmacy, and other allied health professions. (Interprofessional Education Collaborative Expert Panel, 2011, 2016).

The collaborative management of drug shortages heretofore noted between pharmacists, physicians, and nurses could potentially be extended and enriched by the participation of other stakeholders and members of health care organizations. These may include representatives from risk management, legal counsel, emergency response teams, bioethicists and other staff, as well as patients and patient advocates, as evaluated in the subsequent chapters.

**Discussion**

This chapter has presented the perspectives of various health care professionals as they develop an understanding of persistent drug shortages, of how to talk about them, and to confront them, both personally and with others. Despite the specificity of the locale, namely hospitals both within and outside the Boston metropolitan area, these participants have reiterated and confirmed the operational difficulties and potential adverse medical events attributed to drug shortages as presented throughout the literature.

Their sheer incredulity that essential medications were unavailable in their highly resourced medical centers in this day and age was remarked several times, though most participants had experienced drug shortages at their respective institutions for years. Despite those years of making necessary adjustments, they have not become blasé and indifferent to them, but instead respond to drug shortages as one more challenge in their busy, daily
routines. The persistence of drug shortages has not diminished their resilience, their so-called “personal safety indices” or collective professional sense of duty to their patients and colleagues. In fact, new collaborations between pharmacists, physicians, and nurses have led to a heightened sense of collegiality, an *esprit de corps* which is deemed essential to a successful institutional response. In the early days, pharmacists were solely responsible, and sometimes blamed, for drug shortages. For better or worse, the steady encroachment of drug shortages across different medical specialties has steadily raised awareness on the part of other clinicians, who are working together with pharmacists and their specialty counterparts to identify optimal substitute medications, as well as in developing prioritization schema and a priori allocation plans.

Prioritizing which patients will receive limited medical resources is a sticky issue, fraught with difficult decisions and conversations. In fact, most participants demurred from mentioning the word rationing. Language is important here, both to the framing of these issues, and in the development of an institutional response. With the pejorative connotation to “rationing”, “evidence-based allocation” is the preferred term, and perhaps only a single respondent may have used the actual word “rationing”. The participants’ distaste for the term “rationing” reflects a recurring theme in the literature. Sheeler and colleagues found significant variability in physicians’ responses when allocations were framed as “financial resource stewardship” or “promoting cost consciousness” versus “rationing of daily care” (Sheeler, *et al.* 2016). Similar reluctance to explicitly mention rationing, referring instead to “waste minimization”, was reported in a UK study of health care commissioners carrying out disinvestment initiatives (Roosheenas, *et al.* 2015). Whether using “prioritization”, “allocation”, or any other term, it is important to clearly understand the many gradations inherent to rationing of medical resources. As described by Ubel and Goold, these fall into several major categories:

(i). explicit rationing, *i.e.*, policy enunciated, or via regulatory mandates versus implicit rationing, *i.e.*, incidental, bed-side rationing
(ii). the withholding of merely beneficial or desired treatments, e.g. cosmetic rhinoplasty versus essential, life-sustaining care, e.g., ventilator support

(iii). rationing based on an absolute scarcity, e.g., cadaverous organs versus cost-driven preferences, e.g., insurance coverage decisions (Ubel and Goold, 1998).

The preferential allocation of scarce medications does not and cannot fit neatly into one of these solitary categories. Think of deciding who receives the last vials of methotrexate, a key component of the oncologist’s armamentarium for treating leukemia and other cancers; but in lower dosages, a potent anti-inflammatory agent that potentially improves the quality of life of legions of rheumatoid arthritis sufferers. Indeed, each scarce item (propofol, i.v. nitroglycerin, calcium gluconate, ad infinitum) possesses different indications and constituencies, with competing uses and users. In the institutions sampled here, it is left mostly up to physicians to make allocation decisions regarding patients. Pharmacists and nurses, despite the long tenure of their professions in the areas of patient advocacy and safety, repeatedly designated the patient’s care as ultimately a physician’s responsibility. With the steady evolution of inter-disciplinary care teams and practice models favoring enhanced roles in medical decision-making by allied health professionals with advanced training (i.e., PharmD and DNP), this was somewhat unexpected.

As for physicians, various medical specialties such as the Children’s Oncology Drug Shortage Working Group, have “stepped up to the plate”, and disseminated allocation and prioritization guidelines to assist physicians’ decision-making around scarce drugs. Anesthesiologist organizations have also publicly advocated for improving drug shortages in various forums and venues in Washington, D.C.

Hospital pharmacists rarely were in the position to directly communicate drug shortages or substitutions to patients, and this task usually ended up on bedside clinicians’ to-do lists. In those clinical settings, nurses and physicians often do not routinely notify their patients of missing or substituted medications, especially if only minor sequelae are
anticipated with the use of an alternative drug. These omissions were sometimes justified as a necessary avoidance to lessen patient anxiety. This is troubling on several fronts - transparency, patient autonomy, beneficence, and other “compacts” of the patient-provider relationship are in question without this communication. Here, clinicians’ preferences and practices for discussing resource scarcities with their patients were mixed, and correspond to other accounts in the literature.

A series of interviews and focus groups conducted with general practitioners in the U.K. demonstrated physicians’ understanding and agreement with general ethical principles underlying allocation disclosures, though their actual communications were hampered by the time constraints of those discussions, which when they did occur, were also sometimes used to co-opt and influence patient behaviors (Jones, et al. 2004).

A Canadian survey identified multiple barriers affecting cancer control decision-makers’ acceptance of public and patient input into their prioritization decision-making, chief among them the perception that scientific evidence vastly outweighed the contributions of questionably informed lay persons (Regier, et al. 2014).

How are drug substitutions disclosed? A recent report by Hsia and others surveyed over 900 Mayo Clinic patients (256 responding) in the U.S., and, with a comparative survey of Canadian patients, presented a hypothetical scenario where patients were asked if they wished to be notified that due, to a drug shortage, a different agent with a slightly different side effect profile than the unavailable anesthetic would be used (Hsia, et al. 2015). More than half of the responding patients wanted the anesthesiologist to inform them of a shortage, and up to 76% wanted to be informed of potential differences in side effects using the alternative drug. When the hypothetical options escalated to increasing degrees of the substitute drug’s side effects, patients’ desire for notification, or, even postponement of the surgical procedure increased.

In the current interview project, this type of disclosure and shared decision-making was only evident in the direct communication of oncology drug issues with patients. There
seems to be an overall paucity of these communications, as noted in the Boston area interview sample and subsequent nation-wide survey (Chapter 5). It is unclear if this is a deliberate avoidance, or simply a question of resources such as clinician and pharmacist time to spend with patients, or lack of communication skills or training. It raises the question of whether a unified approach to allocation planning and communication that incorporates institution-wide resources such as bioethics consults, public relations, legal advisors, and when possible, patient advocates and representatives, may contribute to more openness and transparency.

Despite pharmacists’ best forecasting efforts, the utter unpredictability of when the next shortage will appear, abate, or return necessarily takes its toll. Lying awake at night, anticipating difficulties in telling patients that their chemotherapy treatment will be postponed, or substituted with a sub-optimal alternative, is an unwelcome experience. This compromised ability to provide the best care for their patients caused distinct unease and frustration in the Pharmacy and at the bedside, as related by physician and nurse respondents, though no one wished to call this “moral distress.” Additional training in allocation decision-making and communication, mixed with opportunities to discuss and debrief these issues might alleviate some of this discomfort. Health care organizations that confront drug shortages with a concerted, integrated institutional response may also reduce or prevent this distress by shifting responsibility beyond the pharmacy or from a handful of clinicians, to task forces or larger committees, as explored in the next chapters.

The other missing piece which was left unspoken and unanswered were: which religious codes, philosophies, or moral precepts did individuals call upon when making allocation and prioritization decisions? Two of the institutions were at least loosely affiliated with religious organizations, though no participant mentioned specific belief systems, or, an institution-specific ethos. “I think you know that we’re put on earth to treat patients and make them better...you know we’re going to make decisions along the way that are in the patient’s best interests.” [AHIO1]
Uh, professional codes? I always try to do what’s right for the individual patient. I look at the individual patient and try to be their advocate. If I myself can’t help them I at least try and point them in the right direction. [AHMD03]

These participants were first and foremost caregivers to their patients, wearers of white coats and all that that entails. Hippocratic and other professional oaths, along with their peers and mentors were sufficient pole stars in this and any other practice dilemmas.

Those guides have served respondents well, as many expressed a resilience and determination to prevent, mitigate, and solve drug shortage problems directly at their sites, and on a national level; through work with their peers, their telephone calls to the FDA and participation with FDA working groups, and their intervening with drug manufacturers and distributors. Additional strategies and actions are described in detail in the following chapter.
Chapter 4
Qualitative Interviews with Key Informants: Responses and Strategies

To directly determine how health care professionals (specifically pharmacists, nurses, and physicians) confront and manage ongoing drug shortages, an exploratory sequential mixed methods research study was designed and conducted. The project began with a series of semi-structured interviews obtained from a pool of key informants that were purposively sampled. The identification and exploration of participants’ experiences and responses to drug shortages are analyzed here and in the previous chapter. By design, the analyzed dialogue between investigator and respondents contributed to a quantitative survey which was subsequently administered to a larger, more diverse population of pharmacy participants. [see chapter 5]

The perceptions, role conflicts, and emerging understandings of drug shortages and their impact on patient care are presented in Chapter 3. In this chapter, various management strategies developed by pharmacists within their departments, as well as practices undertaken at the bedside or clinic by nurses and physicians as they regularly interact with patients are reported. Organizational responses to drug shortages within hospitals and their system networks are also examined.

Approach

Over the course of twenty months (September 2014-May 2016), semi-structured interviews were conducted across the Boston metropolitan area with key informants at leading academic medical centers and teaching hospitals. Informants were also recruited from several smaller community hospitals, as these types of facilities generally operate under different charters, with fewer specialized staff, or other resources. These participants were recruited by e-mail, word of mouth, and telephone inquiries. Following written consent of participants, interviews took place at their preferred locale, ranged from 30-60 minutes, and were digitally
recorded and transcribed. The sample is fully described and tabulated in Chapter 3, as are the analytic methods.

**Interview Goals**

Pharmacists were asked to describe which practices they used in managing medication scarcities. These can be subdivided into numerous and varied functional activities: drug supply surveillance, Pharmacy Department “in-house” drug conservation strategies, alternative purchasing options, pharmaceutical compounding and re-sizing, resource sharing, advocacy and outreach, drug substitutions, and allocation planning. These activities originated within pharmacy departments, though as they evolved, some responses necessarily required planning and execution throughout the respective institutions. All participants were asked to describe the frequency and methods used to communicate allocation decisions and drug substitutions. In these sessions, the interviewer also queried informants’ attitudes regarding existing strategies and responses found in the literature. Borrowing from grounded theory methods, the interview questions were incrementally revised, based on preceding participants’ interview responses, clarifications, and ongoing analyses. (See appendix 4, Interview instrument)

**Findings**

**Pharmacists’ Experience/Acclimation to Drug Shortages**

Many pharmacists acknowledged that the chronic persistence of medication shortages had inured them to the related challenges. “It’s been so long, it’s just part of my job.” [CHPH03] With this protracted experience, their familiarity with managing resource scarcities conferred confidence and assurance, and they professed “better handling of things vs. two-three years ago.” [AHPH01] “It’s like constant project management, so many pieces of the puzzle…it made me a better manager, juggling all these variables.” [CHPH03]
Pharmacy Department initiatives

Though formally responsible for managing all pharmacy issues, pharmacy directors rarely took shortages on by themselves, and within pharmacy departments there was expressed a sense of shared responsibilities and burdens. “Everybody takes a piece of it.” [AHPH01] “Well, FTE’s haven’t been brought in specifically to manage it; but there’s a lot of people that play a part in managing the drug shortages.” [AHPH03] The multi-faceted approaches they took together are described below.

Surveillance. The need for constant monitoring was emphasized. “You’re late to the game... you took a few days off, come in, and find it’s gone.” [CHPH02] Several pharmacists spoke of “checking what’s on the radar screen” and “scanning the horizon”. What did they mean by that? Pharmacy managers now routinely receive formal shortage notifications from the FDA Drug Shortage website that provides manufacturers’ notices of impending or ongoing shortages or production delays, as well as newly resolved cases. (see sample FDA e-mail notification, Appendix 4)

These managers also relied on the American Society of Hospital Pharmacists’ (henceforth, the ASHP) on-line Drug Shortage Resource Center, (ASHP, 2017), messages from colleagues, discussions at national meetings, in short, all available sources of information.

All of those. You know through ASHP, through list serves, colleagues exchanging information, the city, national meetings – I’ll be at a national meeting and sometimes the West Coast, you know people say, ‘Hey, this is happening, sodium chloride has...”- so it seemed to hit different areas of the country prior to affecting us, and likewise it could be us hearing about them first. So, we get all those, we subscribe to an electronic warning system about drug recalls. [AHPH06]

Unfortunately, the notices provided by some of these resources were described as not actionable, i.e., too late to prompt the employment of timely preemptive measures. All
pharmacist participants were attentive to alerts from their drug distributors, though these communications varied in form, content, and utility. From these alerts, pharmacists might be notified that a drug brand was being permanently withdrawn from the market, that a specific drug lot was recalled for safety and quality reasons, or, only a terse and vague notification of shortage was received, with no forecast of anticipated duration. One pharmacy director, while studiously avoiding their products, routinely canvasses and notes which items are offered from “gray market” vendors; thus, cleverly gathering early information to better infer impending scarcities, or, a previously unavailable drug’s imminent return to market. Most respondents called around to their counterparts, both within and outside of their health systems, to verify which drugs were still available, characterizing these informal professional networks to be “as reliable as any other source.” [AHPH04]

In several cases, unsatisfied physicians pointedly asked pharmacists why they were unable to obtain drugs at their hospital, which those same physicians could “easily prescribe” at other local hospitals where they had clinical privileges. A quick cross-town telephone call between pharmacy directors debunked those claims as fiction, confirming that those same scarcities also prevailed at their colleagues’ sites; further underscoring the value of maintaining collegial relationships across pharmacy departments and “competing” institutions.

Pharmacists were frustrated by the difficulties they experienced in trying to determine and declare that a particular drug shortage was ending or completely over. “We do better on the other side – it’s trickier to determine when shortages are abating.” [AHPH06] They were cautious to “sound the all-clear”. “A big thing is, how do you know that the shortage is over? So, we are very patient… We give it a full thirty-day assessment to make sure supplies have returned.” [AHPH02]

Depending on the sophistication and accessibility of their institution’s information systems; digital inventory tracking, usage pattern analyses, and other metrics helped them develop predictive models for anticipated use patterns of drugs returning to inventory.
Hospital pharmacy managers, who routinely maintain critical care and perioperative practice formularies, admitted that they rarely paid close attention to “outpatient” prescription drug shortages affecting commercial pharmacies. However, one did recognize this as an issue, i.e., the unavailability of prescription medicines at a commercial pharmacy such as CVS or Walgreen’s could impact their own inpatient pharmacy, as discharged patients’ medication compliance failures often lead to hospital readmissions.

Physician respondents also became aware of commercial pharmacy drug shortages when their patients returned with unfilled prescriptions, or when they voiced complaints at office visits that their medication was no longer on the market. Various specialty journals and medical associations have alerted physicians of drug shortages endemic to their fields. In addition to hearing directly from her colleagues, a cardiologist sometimes discovered relevant prescription drug scarcities when they were added to patients’ problem lists within the consultation notes of referring physicians.

**Categorization of drug shortages.** If useful intelligence was received, which actions followed? How did pharmacists process all this information? At most sites, Pharmacy Department meetings to discuss shortages now happen on a weekly or bi-weekly basis, where previously, they may have been held less frequently, or called only when focusing on an acute severe shortage. In one group’s weekly meetings, their review places drug shortages into specific, pre-defined categories.

A medium impact means, ‘All shortages are not deemed to be critical that affect how the Pharmacy Dept. prepares and dispenses’, but when we get into the critical impact, it means that the medication or product is used to treat or prevent a serious disease or medical condition for which there is no other alternative. [AHPH02]

These categories are in turn assigned hierarchical levels of interventions, which can then be escalated, or stood down, depending on how events unfold. This type of tiered assessment and contingency planning is endorsed and described by the ASHP (Fox, *et al.* 2009).
**Drug conservation strategies.** Responses were somewhat calibrated to the size and setting of the institution; though most sites adhered to several basic strategies, described below.

**Stockpiling.** How might one maintain limited supplies of drugs? An intuitive response would be to pre-emptively order as much as possible, though this practice potentially introduces additional shortages for others (Myer, 1999). While acknowledging the moral ambiguities inherent in hoarding supplies; stockpiling was decidedly not “off the table” of pharmacy options. “You grab the stuff, overstock your shelves because you know what a nightmare it is to run out.” [CHPH02] Knowing full well that they were incurring increased financial costs from discarding soon to be expired materials, some sites would still “over order” scarce drugs to preserve inventories. “I’ve overspent, overbought – that’s what got me through.” [CHPH02]

In a distinct departure from LEAN management practices such as “Just-In-Time” or vendor-managed supply models; respondents from large teaching hospitals acknowledged that having more storage capacity helped them maintain in-house inventories, though this was delicately worded. “All those supplies out in the hall? We don’t call it hoarding.” [AHPH06] “...you know, a bigger place like us which has a lot, we use a lot more, but we also have the ability to have more.” [AHPH01] At one site, a nearby storeroom packed full of extra drug supplies was demarcated as the exclusive property of the Emergency Department – “Hands off!” for everyone else; though at most sites, space constraints did not permit Division-specific drug caches.

**Resource sharing.** Another strategy for addressing scarce supplies was to borrow from, and consequently, when possible, loan drugs to other institutions. “Borrowing is helpful, though people don’t usually advertise surplus stocks.” [CHPH02] These agreements were not exclusively arranged within health system networks, and could often as not occur with unaffiliated nearby institutions. “We typically borrow meds. from down the road.” [AHPH03]
Sharing drugs between hospitals was described as a “neighborly” understanding. “We pay it forward when we can, and we will ask to borrow later.” [AHPH04]

There were limits to this largesse. “It’s unlikely someone’s going to give us something that’s on shortage.” [CHPH03] In acute widespread shortages, mindful of their fiduciary duties to their patients, drug sharing rarely occurred between hospital pharmacies. “But we have a rule – If something’s on the shortage list, then we don’t lend it. We have drugs that get on that list, you know, we recognize other people’s needs, but we can’t jeopardize our patients.” [AHPH06] Or more succinctly, “If I can’t buy it, I don’t lend it.” [CHPH04]

**Alternative vendors/compounding.** Pharmacists from several of the large facilities mentioned their “robust compounding abilities” and in-house clean rooms where they could perform their own drug compounding (including “high risk” compounding, e.g. using non-sterile materials to produce sterile products), or perform robotics-assisted re- aliquoting of sterile solutions into smaller vials or dispensing units. Some sites did not perform additional compounding exclusively for scarce drugs. And while referenced as “not a panacea” for drug shortages, this option did add flexibility to overall pharmacy strategies for maintaining supply.

Sometimes we also have to compound things as opposed to buy it manufactured, which can alter our system. Because the beyond use dating is different whether we make it or it comes from a manufacturer. We had that recently with heparin where we had to mix our own heparin bags, which adds a safety issue because you don’t really want to mix heparin. It’s like, the example that we have from a couple weeks ago. Heparin comes in 25000 Units in 500 ccs that’s commercially available from manufacturers. And that went on shortage. So then, we decided we’re going to have to mix it. You know, from concentrated drug and mix it into a bag of dextrose or saline. I can’t remember off-and-it doesn’t really matter. But we had to mix it which is a big operational impact. And then, you can make mistakes drawing up heparin. [CHPH03]
Purchasing product from external compounding pharmacies was also not unanimously endorsed. “Some people have chosen to do it because of, you know, there’s no other choice. We here have chosen not to use, to buy compounded.” [AHPH01] Smaller community hospitals without those facilities often did order supplies from compounding pharmacies, though only after careful vetting and follow-up quality reporting. “Thankfully there’s been more oversight and we’re much more confident that those out-sourcing concerns adhere to the guidelines.” [CHPH01]

That scrutiny and vetting became an especially necessary step following the deadly nation-wide fungal meningitis outbreak attributed to contaminated products compounded at the New England Compounding Center in Framingham, Massachusetts (US CDC, 2012). Some respondents never purchase products from so-called “gray market” vendors that sell scarce drugs at significantly increased prices. However, after exhausting other sources, some occasionally purchased product from these vendors as a last-ditch effort, provided the certificates of origin or other documents conferring pedigree of the drugs could be reliably verified. These departures from standard vendors present potential liabilities which ASHP guidance acknowledges thusly,

Each health system must determine its philosophy on purchasing drugs from the gray market or compounding pharmacies and on compounding agents in-house. These decisions should be made before the pressure and emotion of a specific shortage occur. Each option and its potential effect on patient risk should be evaluated. Nontraditional drug product sources (e.g., secondary wholesalers) have extremely limited supplies, and the quality of these products may be questionable, as the provenance of the medication may be unknown” (ASHP, 2012).

Respondents in this study concurred that these decisions to proceed with high risk compounding, or to purchase products from gray market vendors were carefully
undertaken, and not decided solely by the Pharmacy without Chief Medical Officer approval and/or consultation with additional hospital leaders.

**Limiting Access to Drugs.** Conservation strategies included adding tighter control of scarce medications via several processes, described below.

**Relocation.** Much to the chagrin of nurses and other front-line users, scarce drugs are periodically pulled from unit-based caches (Omicells) and point of care clinics, so that Pharmacy can reapporion dwindling stocks to where they are most appropriately indicated for use.

The typical action is they will remove that drug from the Omnicell (on-ward dispensing cabinet) so that when you go to log into the Omnicell and look at the patient profile, you can see it but it’s ‘grayed out’. So, you can’t get it. Sometimes they are able to provide you with an alternative medication.” [AHRN01]

Bringing it all back to the main pharmacy so we can get the remaining supply to the patients that need it has been one of the processes.” [CHPH04]

While this strategy provides the pharmacy with more control of hospital drug supply and use, it also adds costs of personnel time, and may create inefficiencies and uncertainties in the patient care setting.

Some places have more of that medication than other places because they are not changeable. So, the Pharmacy is heavily involved into juggling the balls here, or pulling materials from one area to another ...and we in the operating room might have more of the medications that are essential for us, but I’ll give you some example; Nitroglycerin – a cheap medication. It disappears from... it reappears after a while because the Pharmacy finds some. [AHMD01]

Pharmacists have also reformatted hospital emergency code carts with fewer scarce drugs, remarking that by no longer maintaining full armamentaria on each cart, they have improved
overall efficiency. “Whereas now I think, gosh, half of what used to be in our code carts isn’t there. Um, we’re managing around things.” [CHPH04] Even with comprehensive communication plans, these redirections of medications, particularly those used in emergency patient support, raised concerns for clinicians. [see chapter 3]

*Practice constraints and restrictions.* Certain drug shortages led to absolute restrictions and/or enforcement of strict evidence-based use criteria. At one site, Papaverine supplies requested by numerous clinics were reserved for and limited to vascular surgery cases. However, absolute restrictions were not uniformly enforced across all responding sites. Some pharmacists distinguished that they were only making recommendations and did not have complete authority to place absolute restrictions on physician practice. Response plans involving drug restrictions and substitutions required an “administrative blessing”. “We do get, even if it’s an informal approval, we always get an executive approval on something, before we move ahead.” [AHPH02] Several sites required a follow-up specialty consult to approve continued use of scarce antibiotics initiated by the attending or resident physician. Inventory control mechanisms helped curtail unauthorized drug use. “You take them out of the users’ hands so they, you know, the restrictions get enforced”. [CHPH04]

Drug use criteria were often co-developed by pharmacy specialists and physician leaders in Infectious Diseases, Cardiology, Critical Care, and other specialties. These group efforts were also necessary to the identification and vetting of alternative, substitute medications. Despite strict guidelines, some wiggle room was afforded for clinicians to advocate for their patients on a case-by-case basis, for example when requesting use of restricted i.v. acetaminophen. “You really, you really need to justify why you need it.” [AHRN04] In other instances, “compassionate use” exceptions to strict evidence-based use criteria were made. At one hospital, scarce flu vaccines were released and administered to anxious hospital staff members who had immunocompromised children at home, or spouses undergoing chemotherapy.
**Drug substitutions.** Identifying reasonably compatible alternative medications helps mitigate the effects of acute drug shortages, and with enough “buy in” from others could sometimes lead to more efficient utilization and practice patterns. One caveat—a neonatal ICU nurse manager cautioned that regardless of who was working on it, finding evidence for drug substitutions in neonatal medicine, and pediatrics for that matter, would be a difficult task, given the many off-label drugs that are empirically used in those settings.

Pharmacists frequently met with their counterparts at other sites within their health systems, spending, “countless hours side-barring with colleagues and bench-marking with others.” [AHPH02] “We came together as an institution to say, ‘what makes sense’?” [AHNP01] Pharmacist area specialists first worked out drug substitution plans that were then submitted for review by their physician counterparts. ’So, it’s pretty quick for us to you know, throw three ideas out, as far as, ‘hey have you considered x...?’ And then let them run with those ideas and either shoot them down or refine them.” [AHPH04]

... and we can’t get Ciprofloxacin, and we can’t get Moxifloxacin. Well, our general process is to identify that issue and go to our ID [Infectious Diseases] folks and say, Help me, what do you think? This is what we think might be a good idea. [CHPH01]

This approach was often mentioned as the current norm in both community and academic hospitals, though has perhaps been increasingly adopted in the face of chronic drug shortages. In addition to the “homework” required to identify viable alternatives; trust, open communications, and collegial relationships between pharmacists and physicians were important elements of this collaborative effort.

**Institutional responses**

Depending on the shortage impact, multi-disciplinary task forces might be convened as the scarcity escalated. “We formed this probably like three years ago, probably when it was at the high place – you know, ‘11 or ‘12 is when it was out of control, and some of these things really needed communication and plans.” [AHPH06]
Oh, man. So. when we uh, you know I would kind of describe our evolution here. We used to put a lot of expectations on our buyer. And so one person, on their shoulders, and you know ten years ago maybe that was sufficient? About five years ago it was disruptive enough, actually maybe even seven years ago it was disruptive enough that we started to add it to – it was a standing agenda topic of our management team meeting on a weekly basis. We would talk about it for 10 or 15 minutes – ‘Hey, what’s changed since last Thursday?’ At some point, that became so disruptive that we actually created a drug selection committee. And probably 70% of what the drug selection committee talks about is how we’re managing our own drug shortages. The other 30% of the time they are talking about things like streamlining our formulary... [AHPH04]

The extent of comprehensive organizational response is signaled by, and can be at least partially measured by the development of these inter-disciplinary task forces, the integration of disaster response/emergency preparedness teams, and the degree by which other experts and leaders are involved. This potentially relocates a portion of the dilemmas and challenges burdening individual clinicians and pharmacists (and of course, also affecting patients), to a larger aggregation of expertise and resources working on hospital-wide or health system organization-wide solutions. In several hospitals, those drug shortage task forces include bioethicists, patient advocates, legal advisors from the Office of General Counsel, members of Risk Management, Health Care Quality, Nursing leadership, and others. Larger groups of this nature are convened when prioritization selections among patient groups are anticipated.

Those kind of decisions, and this committee will decide, you know, what are we going to do- is it going to affect patients you know to the level of determining – are we going to allocate, are we going to have a selection process of who gets drug, who doesn’t? to communicate that. [AHPH06]
**Response teams.** Smaller community hospitals often heavily relied on a single pharmacy director with one or possibly two buyers to work with. Reflecting the complexity of their environment, teaching hospital pharmacies operate with larger staffs, and interact with many additional users and constituencies, thus they often require and seek more varied inputs into their deliberations. One manager described a pharmacy purchasing team of several supply chain managers and a single clinical pharmacist as the first line of defense in reviewing drug scarcities. If uncertain on how to proceed, they could call in the associate pharmacy directors to further assess shortage impacts and potential risks. At another hospital, a critical impact designation was formally defined as, “the medication or product is used to treat or prevent a serious disease or medical condition for which there is no other alternative.” [AHPH02] That designation, coupled with an impending shortage of a drug, would in turn trigger a team effort of physicians and pharmacists which would develop intervention tactics and usage restrictions. “If there’s two attempts, okay to receive a medication and we can’t get it in – that’s when the escalation starts.” [AHPH02] A core group of pharmacists and physicians representing the affected medical specialties bring in additional specialist clinicians on a case-by-case basis, not only to reach consensus among departments, but to also fully integrate and effect their management plans.

I think that’s something the integrity of the system needs ...So I mean it was also, looking at it from an evidence-based perspective and not getting one or two opinions from leaders. I was meeting with the group, beyond the Chief, and getting real consensus amongst everyone. [AHPH02]

**Allocations/Prioritizations**

Pharmacists routinely identified clinical efficacy and medical indications as key touchstones of any patient prioritization or rationing plan. To further explore this, pharmacists were asked to consider a hypothetical drug shortage resulting in profoundly inadequate supplies needed by many patients that would be considered equally-deserving, in terms of
efficacy and indicated use. Reflecting on their own moral intuition\(^3\), as well as their actual institutional practices (where applicable, as limited clinical research is conducted in community hospitals), pharmacy respondents routinely rejected several prioritization choices and voiced the following:

1. First-come/first-serve, lottery or coin-flip options for patients were not considered; nor generally appreciated as appropriate, \(i.e.,\) these were felt to lie outside the histories, norms and traditions of their profession.

2. Age (or other "extra-medical" attributes) of the patient would not affect the allocation decision.

3. Standard of care, clinical drug needs would not necessarily supersede access to the same drug for clinical research trials.

4. A current patient’s ongoing treatment course would not be interrupted to assign drug to a different patient starting a new treatment.

Interestingly, as clinicians that spend much more of their shifts directly interacting with patients, nurses and physicians interviewed here endorsed more finely-grained gradations of prioritization than did pharmacists. Consistent with the "rule of rescue", life-saving use was prioritized over other allocations. Also, \textit{ceteris paribus}, a "first-come, first-served" allocation was not ruled out. Some also considered the patient’s age as a tenable contributing factor, considering renal function and drug metabolism when selecting which of their patients might be assigned a sub-optimal substitute drug.

Well, for what it’s worth, an example, if you know that someone is older and you don’t want to use you, uh don’t want to spread the drug and has the same kind of

\(^3\) Participants routinely refrained from identifying specific moral codes or belief systems, religious or philosophical, as sources of guiding principles. Nor did they reference any organizational ethics guidelines or mission statements. The consensus was that they were in the healing professions, and were above all, fulfilling their duties towards their patients, helping them as best they knew how.
metabolism where that drug is more fit for that person—it’s most likely to have it. A young guy that can take everything—is most likely to take the alternative. [AHMD01]

Perhaps owing to the discomfort that rationing decisions entail [See Ch. 3], there were also several opaque responses.

For the most part, for many of the agents you can do by with ‘it’s just gets done’. There have been some agents that that when it goes to the P& T Committee to say that, you know that this group is, is, going to be the preferred group for these agents. Very few agents have gone to that extreme. [AHPH01]

One nurse manager was personally uncertain how specific patient allocations were decided. "But I would hope that the Hospital has a plan for if rationing drugs came to be- that there would be a plan to figure out how to address it, but I don’t know what it is." [AHRN02] This uncertainty, emblematic of training needs, is also a clear red flag for questioning the transparency of allocation decision-making within her organization.

Intuitively, one would predict that Bioethics Committee guidance would be welcomed. One pharmacy manager, also unsure if there was a rationing plan "higher up", felt ethics consults would be most helpful for the special case of oncology chemotherapy allocations, though, like other respondents from both community and academic hospitals, acknowledged that Bioethics Committee members had not yet been consulted. A previous correspondence with a senior member of the Clinical Ethics Committee at that same institution corroborated that her Committee had never been asked to address issues related to drug shortages. From another pharmacist at a different teaching hospital,

And so we kind of, we came up with a plan. I never want to have that conversation again. And the thing that I regret is we didn’t actually engage anybody from an ethics perspective. We didn’t rely on the Ethics Committee, we just kind of did it in our own, spontaneously. And it was, probably on my way back to my office from that meeting
when the lightbulb clicked- wow here was a resource we probably should have pulled into this, but I didn’t. [AHPH04]

The medical ethics literature is rife with exhortations to include a priori bioethical deliberations to inform allocation decisions before actual resource shortages become all-encompassing drivers of urgent decision-making. This has been particularly suggested in disaster and pandemic response preparedness (Derpmann, 2011; White, et al. 2009, University of Toronto JCB, 2005) as well as for scarce drugs and other medical resource allocations (Rosoff, 2012, Hurst, et al. 2008). Why then did this not happen uniformly at all sites? Several physician and pharmacist respondents deemed bioethics consults as unnecessary to their professional decision-making, and, that waiting for additional committee deliberations would prolong implementation of their prioritization plans. "I think that would be an intrusion, to be honest with you.” [AHMD03]

Another pharmacy manager was comfortably sanguine in describing his experience in making rationing decisions, “never to a point where I find it to be an ethical issue.” [CHPH03] Other respondents qualified ethical consults as possibly helpful collaborations, stating that bioethics input would be helpful if circumstances escalated to what they termed “profound shortages”. “If it got to that frequently I would say yes, because we want more people involved. We don’t want just Pharmacy being solely responsible...” [AHPH03]

At one oncology specialty site, its drug shortage task force routinely includes input from various departments, as well as patient and family advocates for the thornier chemotherapy prioritization decisions.

We have a physician from adult inpatient services, the Chief Medical Officer, Chief Quality Officer, we have an ethicist/pediatric oncologist. And then we have a physician director of one of our satellite locations. We have a nursing representative, someone from Communications, and then we have a patient and family advisory council member as well...We’re all in it together, and we’ve added the ethicist. Ethics
because we’ve tried to come up with – I don’t like the word rationing – allocation of scarce resources. [AHPH05]

Despite drug shortage committees’ heterogeneous membership and agendas; physicians remain in charge of determining which of their patients receive treatments with limited drug supplies. “We zoned in on user groups to plan Doxil allocations... they are ultimately responsible for the patient’s care. We don’t have the situation where Pharmacy is in the position of making these decisions.” [AHPH05]

**Disaster Readiness/emergency preparedness.** At one of the teaching hospitals, an abrupt system-wide shortage of propofol triggered the activation of the Hospital Incident Command Systems (HICS), a key response tool of emergency preparedness which provides a unified, system-wide coordination of logistics, communication, resource management, and emergency response (California EMSA, 2014). Never casually convened, this HICS activation was justified as follows,

It crossed so many departments. It wasn’t as easy as just calling adults and peds. Oncology to hold a meeting...So we worked through where propofol was going to be used and where it was not going to be used. And there was plenty of controversy around that as well. [AHPH04]

At another teaching hospital, members of the disaster readiness team were asked to assist in planning contingencies for an equally wide-ranging shortage of saline that was subsequently remediated. Other teaching hospital pharmacists also endorsed Disaster Response Committee involvement, with several noting “close calls” in narrowly averting HICS activations. “We’ve had many ‘dress rehearsals’ in Pharmacy.” [AHPH02]

Unlike the option of requesting Bioethics consults, no one objected to emergency planning and Disaster Readiness Committee contributions as potentially intrusive, though these have not been universally integrated into drug shortage response plans. Pharmacists
regularly sit on these committees, and contribute to emergency planning as required for real events, as well as drills and dry runs, as required by accreditation agencies such as the Joint Commission [TJC, formerly the Joint Commission on Accreditation of Health Care Organizations, JCAHO].

**Communication Efforts and Strategies**

With few exceptions, notably Oncology centers, pharmacists were rarely positioned to communicate drug scarcities and allocation decision to patients. This task was predominantly left for physicians, as was discussed in detail in Chapter 3. Here, the focus is on communication to clinicians.

Working groups of physician users and pharmacy (disease) specialists usually included a medical representative who could communicate plans to the Pharmacy and Therapeutics Committee (P&T). Chief Medical Officers and Nursing Directors were “kept in the loop”, as needed. Larger sites’ multi-disciplinary task forces organized and helped implement comprehensive communication strategies.

Each pharmacy department used some form of e-mail messaging, though the frequency and detail of messages varied by recipient user groups. Broad, “all hospital clinician” messages contained more general announcements of impending shortages. Communiqués sent to specific users or specialists provided more details regarding the anticipated length and impact of the shortage, often identified and suggested potential drug substitutes, and in some cases included the alternative preparation and administration guidelines for those suggested drugs. These guidelines are critically important; as improper preparation or administration of alternative medications poses potential risks of dosing errors. E-mail messages were often augmented and followed up with direct contact between area specialists, *i.e.*, by the pharmacists assigned to the NICU, O.R., etc., and the affected clinicians.
Pharmacists used additional avenues available to them to get the message out, including newsletters, Department Intranets, and even a large white “shortage board” in the Central Pharmacy. Drug replacement information and restricted use algorithms were programmed into the decision support software used for computerized physician ordering (CPOE) systems. “Our CPOE system is probably the most effective tool for communication...because it’s real-time.” [AHPH06] However, at some sites this could not be quickly activated by the Pharmacy, and required additional programming efforts of institutional Information Systems Departments—a more complicated task when a centralized health system-wide IT department was not present on the hospital campus.

Significant departures from past practices in TB testing due to nation-wide shortages of testing materials required significant extra communications to incredulous staff who were no longer required to undergo the rigorous annual testing they were accustomed to. This included messaging on the hospital intranet, newsletters, and closed-circuit TV channel. “It was communicated to staff that it was because of the national shortage, they would know it wasn’t just our hospital...to make sure that they all understood that, you know, it wasn’t a capricious decision.” [AHNP01]

Despite their best messaging efforts, pharmacists were somewhat resigned to the information overload and time constraints that prevent busy clinicians from attentive, if any, reading of their hospital e-mails. “What we’ve found is putting it in a weekly e-mail, people would stop looking at it because it comes every week-they just delete it.” [AHPH03] “Surgeons don’t read their emails. They don’t read newsletters... you depend on their, the people who talk to them the most when they’re here; which would be Nursing and Anesthesia.” [CHPH04] Most drug shortage task forces relied on the team’s medical representatives and service chiefs to “get the word out” regarding drug restrictions and substitutions to their fellow physicians.

Nurse respondents acknowledged receiving many e-mail alerts from Pharmacy, though they rarely or never saw drug shortages listed as an agenda item at their nurse leadership or
practice committee meetings. Drug shortage issues were more likely to be communicated between peers at change of shift chart rounds. One nurse would often leave a “sticky note” on the Omnicell for her colleagues if she had discovered a medication was unavailable or redeployed elsewhere in the hospital. Those working in specialized critical care areas relied on their Unit Pharmacist to assist them in understanding the pharmacy’s plans, and to be a conduit of information, in both directions. “And usually our local pharmacist is the advocate between here and downstairs.” [AHRN04] Despite the range and intensity of messaging, physicians and nurses routinely expressed that their pharmacy staff did an exemplary job of answering their questions and concerns as drug shortages evolved.

**Training requirements and deficits**

Revising i.v. pump cartridges and libraries required additional instructions for staff within the pharmacy department itself, as well as on the nursing floors. In some instances, alternative drugs introduced new refrigeration requirements. The revised storage, preparation, and administration protocols for drug substitutes often require training plans for staff. A nurse manager noted that in the interests of patient safety, formal nursing education plans and demonstrated practice competencies might also be required prior to deploying certain alternative medications. Each of these required additional time and effort from pharmacy and nursing staff.

Physicians’ clinical practice was also affected by lack of familiarity with drug substitutions. In response to a fifteen-month shortage of the preferred cardiac contrast agent, there was “a definite physician learning curve for using alternative contrast agents.” [AHMD03] Another physician mentioned younger colleagues having to adapt to older drugs pulled into service as substitutes. “We have a few times where people are not trained to use this drug because they haven’t seen it – they are going to make their own experience.’ [AHMD01]
Regarding decision-making for prioritizing patients receiving scarce drugs, a nurse manager, despite mastering a graduate curriculum that had included bioethics coursework, stated, “I would not think I’m prepared to make those sorts of decisions.” [AHRN02] She is not alone. Physicians also described the dearth of training around rationing scarcities of this scale, i.e., beyond the review of organ-sharing or dialysis case studies. “The ethical training we received did not cover drug shortages. I don’t think there were many drug shortages at that time.” [AHMD03]

This may have been a generational artifact, as a survey of medical ethics curricula in over one hundred North American medical schools published in 2004 found that 75% of them did cover the allocation of scarce resources (Lehmann, et al. 2004). From another physician deeply involved in medical student education, “We don’t do a lot of teaching about, even just some of the questions you’re asking – drug supply chain, where do shortages come from? before even tackling distributive justice.” [AHMD02] An ICU nurse also echoed this.

I actually think, and I would love probably some education myself, um, like what exactly, how do these drug shortages happen? And is there anything we can do about it? Is there any advocacy that we as medical professionals could say to these companies, ‘What the heck are you doing?’ Our patients are being affected because of this you know.” [AHRN05]

Acknowledging these perceived training needs, physicians and nurses interviewed in this study also reflected on the density of their overall professional curricula, and the difficulties of adding more coursework to an already overflowing syllabus. Periodic Grand Rounds or other occasional presentations on drug supply issues and allocation ethics were mentioned as an achievable compromise for educating busy clinical staff. “That actually would be a fabulous idea – I think Grand Rounds, yeah, drug shortages and their effects on patients, or patient outcomes. Not just the everyday effect like not getting your stool softener today.” [AHRN05] This limited-scope, piecemeal approach runs counter to the curriculum recommendations of
medical ethics educators, which feature health resource management, allocation decision-making, and comprehensive, longitudinal ethical training (Stirrat, et al. 2010; Giubilini, et al. 2016). Clearly, institutions should consider methods for bolstering educational efforts around medical resource scarcities, allocation planning, and resulting practice changes.

**Policy Suggestions from Respondents**

Participants were offered the opportunity to comment on, and suggest policy “fixes” to ameliorate drug shortages. The FDA was implicated by some as ineffective. Most respondents pointed out the agency’s increased shortage notification requirements as helpful, though wished for more action. Several others, who routinely corresponded with the FDA, were more appreciative of the agency’s role in relaxing importation restrictions for scarce chemotherapy drugs. “Anything the FDA has sanctioned, we have.” [AHPH06]

They also expressed their appreciation of the agency’s more pragmatic enforcement of regulations following adverse drug production inspection findings.

They’ve relaxed importation, they’ve also done things where they would normally have recalled lots, and have said, “Okay, there’s some particulates – we feel if you filter it – it’s safe”. So, I think they’ve worked hard to try to help. [AHPH05]

Proposed policy suggestions ran the gamut. These included federal interventions such as provision of tax or other incentives offered to manufacturers to maintain certain drug supplies. “They could make sure that necessary drugs don’t run out of stock – that there’s always production of these things like real basic stuff like naloxone for example.” [CHPH02]

Some thought that releasing portions of the current national stockpiled agents might be helpful, “There are pallets of liter fluids and saline - they’re just waiting to expire... sitting in a warehouse.” [AHPH01] Of course, logistical issues including constant monitoring of expiry dates, replenishment schedules, and oversight of distribution, would need to be addressed for this to be a viable option.
One pharmacy director suggested the United States Pharmacopeia (USP) 797 guidelines be revised so that frequent microbial testing, in lieu of strict shelf-life limits be used, as the current limits compelled them to discard many of their re-packaged drugs sooner than desired, or was perhaps necessary. Another pointed out that the CMS’s (Centers for Medicare and Medicaid Services) capping of reimbursements for generic drugs was a contributing factor to manufacturers’ business decisions to cease production of unprofitable drugs such as off-patent sterile injectables, and exiting the market. An expat physician noted that his European colleagues did not experience drug scarcities to the degree he had here. In his native country, there were fewer market-driven financing mechanisms not only for delivering health care, but also for maintaining drug supplies. Pharmacists, nurses, and physicians all agreed that drug shortages were a multi-faceted problem, arose from many causes, and that there was no single convenient solution or policy correction in sight.

**Direct Advocacy/Outreach**

Despite those conclusions, respondents proactively took on advocacy roles, reaching out to agencies, manufacturers, and others within and outside their organizations. Being an advocate for their patients is fully ingrained in nurses’ professional identity, and was manifested when taking additional time to scrutinize substitute drugs, when patiently explaining a quickly improvised drug substitution to a patient, or simply by wandering the hospital to locate a relocated medication. To prioritize obtaining scarce products, a NICU nurse manager, mindful that no one wanted to be the bad guy depriving sick infants of needed supplies or drugs, used as a final bargaining chip, “the babies need this.” [AHRN05]

Working within her organization, one pharmacy director formally described the scope of drug shortages, over 150 medications at that time affecting their hospitals, while presenting their comprehensive management plan to the medical center’s Board of Trustees. She had been summoned to prepare a report by a board member disquieted by a New York Time’s article on national drug shortages’ adverse impact on cancer care. A particularly salient article
detailing the ‘downright scariness’ of drug shortages and “painful choices” of choosing allocations between patients had been published by the Times in early 2016 (Fink, 2016).

As mentioned, some pharmacists actively engaged the FDA and in some instances, had contributed to FDA Drug Shortage Workshops and Committees, and regularly corresponded with the agency’s handful of drug shortage officers. “We talk a lot with the FDA...And, I have to say, they’ve been very, um, receptive. And we do talk with them, to say, “Here’s how critical this drug is.” [AHPH05] Pharmacists maintained dialogues with Massachusetts state agencies, confirming for the Department of Public Health that recent saline shortages were in fact real and not anecdotal. They also contributed to the development and revisions of the Board of Pharmacy’s compounding regulations and oversight planning. Pharmacists also did not hesitate to speak with manufacturers and wholesalers.

I’ve talked to several of them, ‘what’s your allocation strategy?’ And they look at me as if I have ten heads. And they’re like, ‘Well what would you like to see?’ and I said, ‘Well I’m so glad we’re talking because here’s what I want...’ Whoever got the fax [order in] first, that just didn’t make sense to us. [AHPH05]

Another held daily (!) conversations with manufacturers and wholesalers when items were added to a shortage notification list.

Typically, when a drug is on shortage, then the manufacturer puts the drug on allocation. So, we’re communicating with them about, you know, what supplies are going to be released? What day? You know, how can we plan on it? [AHPH06]

This reaching out to vendors, manufacturers, and regulators demonstrates that pharmacists are actively taking on advocacy roles towards improving their patients’ health, as well as working toward ameliorating drug shortage effects.
Discussion

This chapter presents the continued discussion with key informants, and builds on the evidence presented in Chapter 3, where participants’ awareness and perceived effects of drug shortages was assessed. In this chapter, we move beyond their perceptions and discourse, and evaluate how they as individuals and institutions respond and continue to manage drug shortages. These responses are sometimes orchestrated as a larger plan, synchronously conducted by various members of hospitals; while at other times, are distinctly carried out under profession-specific roles and duty-based tasks, e.g., pharmacists repackaging of medications into smaller aliquots, or physicians triaging which of their patients receive priority access to a scarce drug.

Pharmacists have become full-time sentinels, professing the need for constant surveillance of the landscape, horizon, radar, etc. Each of these metaphors were voiced by different informants, who spoke of being “late to the game” if they had not remained vigilant. This active stance includes regular review of FDA alerts, notices from manufacturers, and other “available intel”, including their professional colleagues at other sites. Despite FDA-required notifications, messaging from manufacturers and distributors was frequently, “too little, too late” to head off a hospital shortage or escalation of responses. In addition to providing confirmations of drug shortages, collegial relations with colleagues also paid dividends when pharmacists needed to borrow supplies, though this option was limited in severe shortages.

Other strategies to maintain supply included over ordering and building up caches of drug – a practice familiar to many, though this was uniformly not referred to as hoarding or stockpiling. Both the stockpiling of supplies, and their hesitancy to loan scarce drugs to others was justified by pharmacists as necessary to preserve needed inventory, acts taken to prevent jeopardizing patient safety at their respective institutions. Large sites with greater storage capacity had some advantages. Larger academic sites were also more likely to possess
sophisticated compounding infrastructure and expertise. Despite having those resources, some avoided high risk compounding due to risk and liability concerns.

Are absolute restrictions imposed for scarce drugs? This question generated a spectrum of answers - yes, no, it depends, not on the weekend, etc. More often, respondents at the large teaching hospitals confirmed that they had achieved this level of control. This points to a potential setting difference, i.e., small community hospitals may face more challenges to incorporating or maintaining scarce drug restrictions and responses throughout their institutions.

To help effectuate and maintain restrictions on use, community and academic hospital pharmacies often centralized stock, relocating drugs from point of care areas to the main pharmacy. While garnering greater control, this “taking it out of their hands” did also present logistical difficulties for caregivers. Removing drugs from protocols and practice areas, restricting usage, and choosing alternative substitutes for scarce drugs were activities pharmacists often first proposed to multiple physician experts and members of the Pharmacy and Therapeutics (P&T) Committee to “administratively bless” and approve their action plans.

Hospitals are complex organizations, and while physicians are often found at the apex of the organizational pyramid, many other professionals contribute their expertise and labor. That expertise is often pulled together in multi-disciplinary committees and working groups focused on problem-solving or preparing the organization for change as it faces various challenges. At many of the responding sites, drug shortage task forces and committees were formed when shortages peaked around 2011-2012. These have evolved so that differentiated approaches and members are activated depending on the severity of shortages, as well as when there is an anticipated requirement for prioritization or rationing of scarce drugs between patients. Membership on these committees varied by size and mission of the hospital. Some invited Bioethicists and legal counsel to join, and another routinely included patient advocates when oncology drug allocations were considered. As one pharmacist mentioned, the larger consults were critical to the integrity of the system.
This group approach takes some of the onus of difficult decision-making off the shoulders of a few pharmacists and physicians. The institutional formalization of responses, whether these be reduced access to certain drugs in favor of other specified users, identification of lesser alternatives, or a transparent allocation plan may also reduce the moral distress and discomfort experienced by clinicians operating under changed circumstances wrought by drug shortages.

As noted earlier, pharmacists, alone, were unprepared to make prioritization decisions. Physicians and nurses, particularly those having served in ICUs or Emergency Departments were more facile in accepting allocation options, perhaps due to their familiarity with frequent triage and implicit bedside rationing of ventilators, clinician time, and other resources.

Unfortunately, several nurses and pharmacists mentioned that they hoped the hospital had allocation plans, which they were unaware of. This seems to implicate training deficits, as well as their organization’s communication plans, or commitment to transparency. Additional training, consults, and co-development of communication plans might result from Bioethics Committee or Disaster Readiness team inputs, though formal Bioethics approaches, with their sometimes competing or ambiguous frameworks, received a mixed response from physicians and pharmacists. On the contrary, emergency response team contributions were more welcome by all participants. This was perhaps due to the concrete resources, action plans, and logistical support that follows in a disaster response or incident command activation.

The level of engagement of these institutional resources (multi-disciplinary task forces, Bioethics, Emergency Preparedness) was also variable, and when more widely incorporated, was reflective of an institutional response where hospital leadership recognized drug shortages as more than “pharmacy’s problem.”

Unfortunately, patients—by any measure, key stakeholders in this, were infrequently consulted or advised. Pharmacists did engage many others, including drug manufacturers, regulatory agencies, and hospital leadership to facilitate understanding of the complexities
around drug shortages, and to work out solutions. Despite those extraordinary actions, drug shortages persist and continue to vex them and others. By informing and influencing important stakeholders, these proactive steps may generate needed policy change.

The next chapter presents the nation-wide survey that followed these interviews, and provides responses from all geographic areas of the country, as well as greater representation from smaller sites and more community hospitals, thus offering a chance to explore setting effects, and to determine if medical resource scarcity responses identified in this unique Boston-area setting are endorsed, modified, or refuted in less academic-focused regions where access to care, and intensity of care may differ.
Chapter 5
Quantitative Survey of Pharmacy Directors:
Responses and Strategies

Persistent shortages of medically necessary drugs, many of them sterile injectables, reached their peak in 2011. (U.S. FDA, 2015) These prompted Congressional hearings and a comprehensive report from the General Accounting Office. (US GAO, 2011) In 2012, President Obama signed into law the Food and Drug Administration Safety and Innovation Act (FDAISA), from which Title X directed the FDA to establish a task force on drug shortages and to submit to Congress a strategic plan to enhance that agency’s response to drug shortages. (FDAISA, 2012) Subsequent reports from the FDA and GAO (see chapter 2) note that some progress has been made, yet there are persistent challenges in confronting drug shortages. While the list of new drug shortages has subsequently been diminished, many drugs remain as existing or recurring scarcities. A quick glance at current drug shortages compiled by the University of Utah Drug Information Service, posted on the American System of Health System Pharmacists website, listed over 120 drugs in shortage (ASHP, 2107) These continue to interrupt and adversely impact health care and pharmacy practice.

An early survey reporting the impact of drug shortages on pharmacy practice in an acute care hospital setting, with over 470 pharmacy directors responding, was published in 2004 (Baumer, et al., 2004). Despite the inherent limitations of self-reporting; approximately 65% of respondents disclosed delayed or canceled procedures attributed to drug shortages, and 10% reported related serious medical errors. The authors estimated a national economic impact (from adding staff to manage shortages, purchasing marked up “grey market” drugs, higher costs of alternative drugs, and pharmaceutical compounding expenses) of somewhere between $30 million and $90 million for 2002. In this decade, Kaakeh, et al. surveyed pharmacy directors; asking them to quantify personnel resources required to manage shortages of approximately 30 scarce drugs, and, to assess the impact of the shortages and
the quality of information resources available to them (Kaakeh, et al. 2011). The authors stratified respondents by institutional size, level of automation, and geographic location. They queried time spent managing shortages by physicians, nurses, pharmacy technicians, and pharmacists. Pharmacy staff spent the most additional time managing drug shortages, particularly in larger institutions. The authors estimated annual additional labor costs of $216 million nation-wide.

40% of 190 responding pharmacists in a survey by McLaughlin, et al. also reported adverse effects related to various drug class shortages, and 38% reported related patient complaints (McLaughlin, et al. 2015). Caulder, et al. conducted a regional survey of pharmacy directors in the Southeastern U.S., with 219 hospitals reporting an overall error rate of 1-5% attributed to drug shortages, a 300%-500% price mark-up on scarce drugs, as well as several operational concerns such as extra FTEs and communication strategies required to manage drug shortages. (Caulder, et al. 2015)

These surveys (together with those cited in Chapter 2) add to the reported toll that ongoing drug shortages have exacted on patient outcomes and safety. These specific surveys, directed at pharmacists, mention several operational issues, namely the additional FTEs and expense required to manage drug shortages. But what processes or strategies are employed to manage drug shortages? A survey focused both on pediatric oncology physicians and pharmacists noted that pharmacists were twice as likely to report a chemotherapy shortage than physician investigators, and revealed several conservation strategies such as reducing chemotherapy dosages, and the “cohorting” of patients”, i.e., administering chemotherapy on the same day to minimize drug waste (Goodman, et al. 2015). Excepting that report, the published literature does not fully characterize the varied management or coping strategies employed by responding institutions.

The overall goal of this project is to address the limited information available concerning how drug shortages are experienced, perceived, and managed by various health care organizations. Additionally, the manner, frequency, and extent of how drug shortages,
substitutions, and allocations were communicated, both to staff, and to patients was an important element. Communication was important in understanding the operationalizing and potential efficacy of responses, as well as their transparency. The qualitative interviews reported on in Chapter 3 uncovered perceptions and experiences of those confronting drug shortages, while Chapter 4 described individual and institutional responses to those shortages. Interviews revealed that some pharmacy leaders perceive drug shortages as technical challenges which they can manage through their department, confronting them directly without engaging broader organizational resources or participation. As was mentioned by interviewees, many drug shortages are averted or at least placed “off the radar” of prescribing physicians, due to the success of these departmental and technical interventions. This is consonant with the reported behind the scenes efforts pharmacists employ to avert or mediate drug shortages, which often go unnoticed by other clinicians (Erickson, 2016).

During the interviews, respondents at large teaching hospitals described additional management strategies which integrated multi-departmental resources into an institution-wide response. These strategies incorporate various functional units and personnel across the organization. Participants described their management of drug shortages as an evolving process, which with time had become more efficient. Key improvements included regular, proactive meetings, and shared distribution of responsibilities, often through a drug shortage task force or committee. Respondents at these large academic sites described diverse, interdisciplinary membership on these committees, as well as a multi-level activation of members based on criticality of a specific drug shortage. The process involves a core task force of pharmacy members meeting first, then pharmacy and clinical team members are brought in, as needed. Finally, a full out escalation involving disaster preparedness, legal, and ethics consultants may occur to assist decision-making when allocation or rationing of scarce medications between patient groups becomes necessary. Practical applications of a tiered committee approach used at the University of Massachusetts Memorial Healthcare system is shared by Gilchrist, et al. (Gilchrist, et al. 2014)
In analyzing interview and survey responses in this project, responses to drug shortages were conceptualized and categorized as “in-house” technical approaches within the Pharmacy Department, as well as “extra-mural approaches” which integrate institutional resources and activation of departments beyond the Pharmacy walls. To explore the prevalence and potential utility of the interview-elicited strategies, a quantitative nation-wide survey was conducted. The survey was not designed as a randomized probability sample for purposes of hypothesis testing. Rather, the survey provided a mechanism to explore concepts and thoughts expressed in the qualitative studies, and to determine if they persist in different settings and locales. Analyzing each study with its relevant methods, the resulting theoretical findings can be examined and in some cases integrated, adding to the sum of individual components (Moran-Ellis, et al. 2006; O’Cathain, et al. 2010).

It must be recognized that the interviews were conducted in the Boston metropolitan area, where much of the population has access to medical care, and, many of the respondents represent and report from some of the nation’s leading academic medical centers. Thus, the use of a nation-wide sample helps to determine if the strategies expressed in the qualitative interviews were predominantly local, Boston-area options exercised in a unique nexus of academic medicine, or, if similar or other management responses and decision-making rules prevail in other settings and locales.

Methods

Sample

A convenience sample was made available through Pharmacy Directors (https://www.pharmacydirectors.com/), an on-line group which publishes emerging trends, best practices, and quality and safety initiatives in pharmacy practice. Pharmacy Directors has an estimated nation-wide readership of approximately 4000 pharmacy directors, clinical pharmacy staff, and other related members. The survey was opened on September 27, 2016
and ran for approximately four months, with periodic reminder notices to the Pharmacy Director readership. It was closed on Jan. 31, 2017.

**Approach**

While no verbatim survey questions were used, several questions queried content covered in existing sources such as the use of compounding, borrowing drugs from other sites, communication methods, etc. (Baumer, *et al.* 2004, Caulder, *et al.* 2015). To a much larger extent, survey questions were based on the interview questions and discussions that arose during the qualitative interviews reported on in Chapters 3 and 4. Prior to use, the survey questions were modified after several quality and validity checks as described by Fowler; Shaeffer and Presser; and Willis (Fowler, 2014; Schaeffer and Presser, 2003; Willis, 1994). The survey questions were first presented to several of the previously interviewed participants who suggested minor edits. Additional revisions followed review for content adequacy and validity, and cognitive “read aloud” exercises by several pharmacy educators. Following Northeastern University IRB approval, the survey was administered using the Qualtrics on-line survey application (Qualtrics 2015, Provo, Utah) approved and licensed by Northeastern University. A full copy of the survey is included in Appendix C.

**Content**

**Measures.** The survey examines four key areas of pragmatic actions, planning, and decision-making by pharmacy staff and their organizations in response to drug shortages. They are referred to here as 1) technical fixes, 2) institutional responses, 3) communication with professionals, and 4) communication with patients and their representatives.

1) Technical fixes: this first group of responses reflects efforts to preserve or procure scarce medication supplies, *i.e.*, those within, or purely directed by the Pharmacy Department. These include (a) in-house compounding of scarce drugs, specifically,
those tasks deemed “high risk” by USP 797\(^4\) (United States Pharmacopeial Convention, 2012), where non-sterile ingredients are later sterilized, (b) in-house re-sizing of scarce drugs into smaller aliquots or units, and (c) sharing of drug supply through borrowing form or lending to other institutions.

These responses vary in the degree of risk that each present. While less risky than in-house compounding, requirements for clean lab environments and attention to shelf-life dating are critical.

2) Institutional responses: How do those tasked with confronting drug shortages develop an institutional response? This survey queried the following: creation of a drug shortage task force or committee, extent of interdisciplinary membership on those committees, consultation with emergency planning teams, and activation of typical disaster readiness drills and other actions that included drug shortages.

(a) Calling together a drug shortage task force or committee acknowledges that the challenge transcends the Pharmacy Department, and, that other stakeholders need be to be advised, consulted, and brought into the problem-solving and allocation decision-making process. Committees, through published agendas, action items, and meeting minutes formalize issues, by establishing reporting, accountability, and responsibilities. Thus, establishment of a task force or drug shortage committee is an indicator of institutional response.

(b) The type of task force - its charter, mission, and make-up are also important. A wider representation of representatives from other departments indicates a truly inter-disciplinary, institutional response.

(c) Advancing drug shortage issues to the institution’s emergency/disaster preparedness committees offers additional opportunities for an integrated organizational response.

\(^4\) While these terms are still in widespread use, the USP, recognizing that all sterile compounding bears risk, has proposed new categories (1 and 2) for compounded drugs
(d) Some institutions went well beyond discussing drug shortages at a disaster committee/emergency preparedness meeting, and have integrated drug shortage management scenarios into tabletop exercises or hospital drills.

Additionally, acute shortages of certain medications, particularly those with multiple indications and user groups, pose significant adverse operational challenges. In some instances, these challenges led to institutions invoking and activating their Hospital Incident Command System (HICS). Finally, an important element of disaster preparedness is a hazard analysis plan, where the institution evaluates its vulnerabilities and the impact of various hazards or systematic breakdowns. A systematic assessment tool including medication shortages would be useful in this case.

3). Communication with professionals: The communication of drug scarcities, alternative substitutions, and allocation plans was also evaluated. To whom these were communicated offers a measure of transparency and accountability. That is, are they broadly communicated across the institution, as in system-wide messaging and intranet postings, or, are they delivered in a more circumscribed manner to a limited “need to know” core user group via directed e-mails or face to face communications? How frequently, and through which additional methods and venues drug shortages were communicated was also measured.

4). Communication with patients and their representatives: A significant element to consider with any rationing or allocation plan is its transparency, not just to the organization, but especially to those most affected – the patient. This is important in cases of a complete scarcity or withholding of a drug, as well as its replacement with a potentially suboptimal alternative medication. Questions of paternalism, autonomy, and potential legal consequences arise when this information is not disclosed. Thus, communication of drug shortages directly to patients and other stakeholders was also examined.
Measurement. Many questions elicited more than a yes or no response, and included “occasionally”, “rarely”, “frequently”, “exclusively”, or “informally”, which added qualitative descriptions. Furthermore, “in the planning stages” was also a response option for some items, as respondents in the qualitative interviews had emphasized the evolving nature of their organizational responses. In that context, “in development/planning stages” constitutes more than a null response; and can be evaluated through the lens of the trans-theoretical model of health care institution adaptation where an organization’s positioning of proposed actions at various stages of change (contemplation, preparation, etc.) can determine the implementation strategy, as well as the adoption or failure of implementing change throughout the organization. (Prochaska, et al. 2001) The degrees by which stakeholders and resources were activated, e.g. emergency response teams, also helps inform our knowledge of where respondents are at in implementing institution-wide responses.

Analysis. Given the many categorical, nominal variables; descriptive and nonparametric statistics (e.g., $\chi^2$) were used in the analyses. Where appropriate, scales and indices suggesting unified management strategies were constructed and applied. The extent to which institutions were actively engaged in those key areas are tabulated as frequency distributions.

Early analyses suggested that in some instances, condensing response categories would be helpful to provide more general understanding in these areas. This strategy is conceptually useful in considering indices of response, i.e. institutions can be classified as: rejecting or haven’t considered these strategies, mildly embracing and/or partially using them, or actively and rigorously applying them.
Thus, responses are generally re-coded as:

0 – No, never, do not know

1 – In development or planning stage—though not executed, rarely (e.g., < 10% of the time), occasionally

2 – Yes, frequently, always

These response groupings were then summed into multifactorial response summed score tables or indices for further review, i.e., Do community hospitals less frequently adopt these multiple strategies than academic medical centers? Does institution size predict multidisciplinary responses? etc.

Respondents. A total of 104 unique respondents consented to proceed with the survey, though actual response numbers varied depending on the question. Demographic characteristics of the institutions are presented in Table 5-1.

Survey respondents represent a greater heterogeneity of settings than the Boston area interview cohort. Community hospitals were the most common work setting; with academic medical centers, the second-most common, and all other types—specialty hospitals, public facilities, or other (which included a health system Pharmacy department, prison infirmary, and outpatient dispensary), the third.

Respondents are dispersed throughout all regions of the United States, the largest group (~ 35%) from the Northeast, and second largest groups reporting from the Midwest (24%) and South (24%); the remainder from western and Pacific states. No respondents reported from other countries.

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Of course, “do not know” could fall into a fourth category, “undecided”. However, in the context of institutional responses to acute medical resource scarcities, a pharmacy director’s lack of awareness of typical or peer-published strategies can be classified as a negative or null response for purposes of most analyses.
Institution size is also quite variably distributed, ranging from <50 bed institutions to 1000+ bed hospitals (Table 5-2). A methodologic error was noted after the survey was completed. The response option “350-399 beds” should have read “350-499 beds”. As this was not caught in pre-review, the interval between 400-499 beds was unfortunately not captured in this survey. The Agency for Healthcare Research and Quality (AHRQ) assigns different bed size classification for small, medium, and large hospitals according to several factors, including: region, rural vs. urban setting, and teaching vs. non-teaching hospital. (AHRQ, 2008). For ease of analyses in this project, institution size was reclassified into three broad categories; small or < 100 beds; medium = 100-399 beds, and large = 400+. Looking at how institution size is associated with the type of institution in this sample demonstrates a wider distribution of size across community hospitals, and, that teaching sites were generally larger. The association was statistically significant ($\chi^2 = 21.378$, $p = 0.006$).

Respondents also were asked to specify their primary role or job title (Table 5-3). Fittingly, the majority identified themselves as either a Director or Associate Director of Pharmacy, as expected in a poll of pharmacy directors. The remainder included clinical/staff pharmacists, as well as buyers, and in one instance, a registered nurse.
Table 5-1. Respondents’ institutional setting

<table>
<thead>
<tr>
<th>Sample Institutions</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Academic (University-affiliated) Medical Center</td>
<td>22</td>
<td>29.7%</td>
</tr>
<tr>
<td>Community Hospital</td>
<td>43</td>
<td>58.1%</td>
</tr>
<tr>
<td>Public Hospital (Veterans Administration, County/Municipal Government)</td>
<td>2</td>
<td>2.7%</td>
</tr>
<tr>
<td>Specialty Hospital (Burns, Rehabilitation, Psychiatric, etc.)</td>
<td>3</td>
<td>4.1%</td>
</tr>
<tr>
<td>Other (stand-alone clinic, correctional facility dispensary, etc.)</td>
<td>4</td>
<td>5.4%</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Locale</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northeast</td>
<td>26</td>
<td>34.7%</td>
</tr>
<tr>
<td>Mid-Atlantic</td>
<td>5</td>
<td>6.7%</td>
</tr>
<tr>
<td>South</td>
<td>18</td>
<td>24.0%</td>
</tr>
<tr>
<td>Midwest/Plains</td>
<td>18</td>
<td>24.0%</td>
</tr>
<tr>
<td>West-Mountains</td>
<td>2</td>
<td>2.7%</td>
</tr>
<tr>
<td>Pacific</td>
<td>6</td>
<td>8.0%</td>
</tr>
<tr>
<td>Total</td>
<td>75</td>
<td>100.0%</td>
</tr>
<tr>
<td><strong>Size</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large</td>
<td>23</td>
<td>31.1%</td>
</tr>
<tr>
<td>1000+ beds</td>
<td>6</td>
<td>8.1%</td>
</tr>
<tr>
<td>750-999 beds</td>
<td>4</td>
<td>5.4%</td>
</tr>
<tr>
<td>500-749 beds</td>
<td>13</td>
<td>17.6%</td>
</tr>
<tr>
<td>Medium</td>
<td>31</td>
<td>41.9%</td>
</tr>
<tr>
<td>350-399 beds</td>
<td>15</td>
<td>20.3%</td>
</tr>
<tr>
<td>200-349 beds</td>
<td>7</td>
<td>9.5%</td>
</tr>
<tr>
<td>100-199 beds</td>
<td>9</td>
<td>12.2%</td>
</tr>
<tr>
<td>Small</td>
<td>20</td>
<td>27.0%</td>
</tr>
<tr>
<td>50-99 beds</td>
<td>5</td>
<td>6.8%</td>
</tr>
<tr>
<td>&lt; 50 beds</td>
<td>10</td>
<td>13.5%</td>
</tr>
<tr>
<td>0 beds (clinic, dispensary, etc.)</td>
<td>5</td>
<td>6.8%</td>
</tr>
<tr>
<td>Total</td>
<td>74</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
Table 5-2. Institution size by type (n=72)

<table>
<thead>
<tr>
<th></th>
<th>400+ beds</th>
<th>100-399 beds</th>
<th>0-99 beds</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Medical Center</td>
<td>11</td>
<td>9</td>
<td>2</td>
<td>22</td>
</tr>
<tr>
<td>Community Hospital</td>
<td>10</td>
<td>21</td>
<td>10</td>
<td>41</td>
</tr>
<tr>
<td>Public Hospital</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Specialty Hospital</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>23</strong></td>
<td><strong>31</strong></td>
<td><strong>18</strong></td>
<td><strong>72</strong></td>
</tr>
</tbody>
</table>

Table 5-3. Respondents' primary role (n=82)

<table>
<thead>
<tr>
<th>Role</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director/Assistant Director of Pharmacy</td>
<td>58</td>
<td>76.3%</td>
</tr>
<tr>
<td>Clinical/Staff Pharmacist</td>
<td>6</td>
<td>7.9%</td>
</tr>
<tr>
<td>Quality/Patient Safety Dept.</td>
<td>2</td>
<td>2.6%</td>
</tr>
<tr>
<td>Other role (RN, Pharmacy Information Systems, Buyer, etc.)</td>
<td>10</td>
<td>13.2%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>82</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>
RESULTS

1. Technical Fixes

As described above, technical, Pharmacy Department strategies to preserve or procure scarce drug supplies were analyzed. We look at three specific activities: sharing medications, re-sizing medications, and, engaging in high risk compounding.

A. Sharing Medications: Borrowing from or Loaning to Other Institutions.

Responses were grouped essentially into a dichotomous variable, as the responses for this question did indicate, “partial, occasionally, considering”. Thus, a “Yes” response to sharing scarce medications = 2; and a “No/Do not” response = 0 (Table 5-4).

As a strategy for obtaining scarce drugs, approximately 4/5 (81.6%) of institutions borrowed from others. Hospitals situated in densely populated urban locales likely have more neighboring institutions to borrow from, perhaps a brief walk or taxi ride away; whereas rural facilities have fewer options.

The degree of integration within a health system network might also confer additional benefit, i.e., existing memoranda of understanding or alliance agreements to help “sister” sites that could provide additional medical resources in times of need. 78 of the 103 respondents that reported borrowing scarce medications described their drug-sharing arrangements, i.e., within or outside of their health system networks, as well as if a formal or informal agreement was executed (Table 5-5). While many sites (55/78 = ~ 70%) went to their system colleagues for assistance, only 13% (10/78) solely relied on their own system affiliates as a resource for sharing medications. Close to 30% (23/78) went outside their network to borrow or share scarce drugs. This may imply that being in a large network does not necessarily confer greater opportunity to borrow scarce medications from “sister” sites within that network.
Table 5-4. Sharing Medications Between Institutions (n=103)

To address shortages, do you loan medications to, or borrow from, other institutions?

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>19</td>
<td>18.4%</td>
</tr>
<tr>
<td>Yes</td>
<td>84</td>
<td>81.6%</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

Table 5-5. Drug Sharing Arrangements (n=78)

Describe the type of institutions you engage with in sharing medications:

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exclusively within my health system network, <em>i.e.</em>, formal affiliates only</td>
<td>10</td>
<td>12.8%</td>
</tr>
<tr>
<td>Predominantly within my health system network, <em>i.e.</em>, mostly a formal affiliate, occasionally a neighboring hospital</td>
<td>45</td>
<td>57.7%</td>
</tr>
<tr>
<td>Predominantly outside my health system network, <em>i.e.</em>, mostly neighboring hospitals, sometimes a formal affiliate</td>
<td>11</td>
<td>14.1%</td>
</tr>
<tr>
<td>Exclusively outside of my health system network, <em>i.e.</em>, from neighboring hospitals not formally affiliated</td>
<td>12</td>
<td>15.4%</td>
</tr>
<tr>
<td>Total</td>
<td>78</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
B. Re-sizing Scarce Drugs. Re-packaging of scarce medications into differently sized aliquots was also examined as a strategy to secure scarce medications. As compared to borrowing drugs, pulling supply from sterile containers and dividing it into smaller containers for widespread user distribution helps eliminate waste and discarded supply, though also adds risk and liability. Sites must have the facilities and expertise to limit those liabilities. Additionally, there are also strict, reduced shelf-life limitations for these re-sized vials.

Perhaps owing to those limitations, we see that only a small percentage (~5%) routinely re-size their scarce drugs as a conservation strategy, whereas most sites (63%) sometimes choose this option and close to a third (31%) do not at all (Table 5-6).

Table 5-6. Resizing Scarce Drugs into Smaller Aliquots (n=93)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = Do not</td>
<td>29</td>
</tr>
<tr>
<td>1 = Sometimes</td>
<td>59</td>
</tr>
<tr>
<td>2 = Frequently (&gt; 50% of the time)</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>93</td>
</tr>
</tbody>
</table>

C. High-Risk Compounding. Finally, we look at high-risk compounding, that is, preparing sterile drug products from non-sterile ingredients. This is a much more controversial solution, adding risks and liability if sterility is not maintained. Pharmacy directors may in some instances be required to obtain approvals from the Chief Medical Officer or other hospital leaders before choosing to assume that liability. Very specific procedures, clean room facilities, and again, staff expertise, are required.

Results are presented in Table 5-7. Several elements are embedded in this question. These include the types of drugs, e.g., scarce vs. non-scarce medications that are compounded, as well as various justifications for not choosing this strategy.
For a variety of reasons, ~ 80% \( \frac{(21+55+3)}{95} = 0.83 \) of sites do not perform any high-risk compounding of drugs. Approximately 58% \( \frac{55}{95} \) lacked either the expertise or facilities to perform this. 22% \( \frac{21}{95} \) of sites elected to not perform high risk compounding of scarce medications specifically to avoid potential liability issues.

Table 5-7. “In-house” high risk drug compounding, as defined by USP 797 (n=95)

<table>
<thead>
<tr>
<th>We do not do high-risk compounding (total)</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Due to potential liability issues</td>
<td>21</td>
<td>22.1%</td>
</tr>
<tr>
<td>- Due to facility/expertise limitations</td>
<td>55</td>
<td>57.9%</td>
</tr>
<tr>
<td>- For other reasons</td>
<td>3</td>
<td>3.2%</td>
</tr>
<tr>
<td>We do high-risk compounding (total)</td>
<td>16</td>
<td>16.8%</td>
</tr>
<tr>
<td>- Regularly, though do not for drugs on shortage</td>
<td>5</td>
<td>5.3%</td>
</tr>
<tr>
<td>- Only for drugs on shortage</td>
<td>4</td>
<td>4.2%</td>
</tr>
<tr>
<td>- As part of normal operations, not just for drugs on shortage</td>
<td>7</td>
<td>7.4%</td>
</tr>
<tr>
<td>Total</td>
<td>95</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

The responses were then grouped into the following options:
- sites which only perform high risk compounding of scarce drugs were scored = 2,
- those that routinely compound for scarce or available drugs \( i.e., \) not specifically ramped up their facility or practice in response to drug shortages were scored = 1
- the four sites which chose to avoid this strategy with scarce medications were added to all other sites which did not perform this type of compounding at all; and were scored = 0.

Only 4% of sites perform high-risk compounding of scarce medications to alleviate drug shortages, and most sites (88.4%) do not.
Note that for brevity, the 0-2 coding results will be presented where applicable in subsequent analyses, with additional sub-class tabulations included in the chapter appendices where necessary.

**D. Overall Use of Pharmacy-based Strategies for Addressing Drug Shortages.**

The totality of the technical approaches available to Pharmacy Departments, options A-C above, can be reviewed in aggregate (Table 5-8). Reviewing these intra-departmental (Pharmacy) technical responses in aggregate; approximately 45% score a 0, meaning they do not perform each of these activities, these approaches are used to some extent (score = 1) about 23% of the time, and about a third (31.9%) of the time are routinely chosen (score = 2). Across a diagonal gradient of preferences, one can appreciate that high risk/high tech options (e.g., high risk compounding) are less frequently endorsed than low risk options such as borrowing scarce drugs.

To better capture each individual site’s overall response, a summed score of the three “in-house” strategies was developed, adding responses of 0-2 for each response option; each site’s score ranging between 0 and 6. As evidenced by the absence of a score of 6, no single site reported regularly using all three options as a management strategy. Notably, 10 individual sites (9.7%) exercised none of these strategies. Many sites (70%) fell within the summed score of 2 or 3. The distribution below helps illustrate this (Table 5-9). How the summed score varied by institution type was next examined.
### Table 5-8. Aggregate Pharmacy Dept. approaches (n=291)

<table>
<thead>
<tr>
<th>Approach</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Borrowing scarce drugs</td>
<td>19 (18.4%)</td>
<td>NA</td>
<td>84 (81.6%)</td>
<td>103</td>
</tr>
<tr>
<td>B. Re-sizing of scarce drugs</td>
<td>29 (31.2%)</td>
<td>59 (63.4%)</td>
<td>5 (5.4%)</td>
<td>93</td>
</tr>
<tr>
<td>C. High risk compounding of scarce drugs</td>
<td>84 (88.4%)</td>
<td>7 (7.4%)</td>
<td>4 (4.2%)</td>
<td>95</td>
</tr>
<tr>
<td>Total</td>
<td>132 (45.4%)</td>
<td>66 (22.7%)</td>
<td>93 (31.9%)</td>
<td>291</td>
</tr>
</tbody>
</table>

### Table 5-9. In-house Pharmacy Department Approaches Used -Scaled Score (n=103)

<table>
<thead>
<tr>
<th>Score</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
<td>9.7%</td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>7.8%</td>
</tr>
<tr>
<td>2</td>
<td>29</td>
<td>28.2%</td>
</tr>
<tr>
<td>3</td>
<td>43</td>
<td>41.7%</td>
</tr>
<tr>
<td>4</td>
<td>8</td>
<td>7.8%</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>4.9%</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>103</td>
<td>100%</td>
</tr>
</tbody>
</table>

### Table 5-10. Summed In-House Technical Strategy Score by Institution Type (n=74)

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Medical Center</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>22</td>
</tr>
<tr>
<td>Community Hospital</td>
<td>1</td>
<td>2</td>
<td>11</td>
<td>25</td>
<td>2</td>
<td>2</td>
<td>43</td>
</tr>
<tr>
<td>Public Hospital</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Specialty Hospital</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>6</td>
<td>5</td>
<td>15</td>
<td>35</td>
<td>8</td>
<td>5</td>
<td>74</td>
</tr>
</tbody>
</table>
Cross-tabulating the summed scores vs. type of institution (Table 5-10) yields a statistically significant association. The $\chi^2$ statistic = 34.279, $p = 0.024$, indicates evidence of association between institutional type and technical strategy. The contingency coefficient of 0.563 indicates at least a medium correlation effect. The summed score association by size of the institution was not significantly significant. Comparing these ordinal variables, the Kruskal Wallis H test demonstrated that differences in summed scores were not statistically significant by institution size, $\chi^2 = 1.478$, $p = 0.92$.

One can consider the upper "bookend" or highly engaged sites are those with summed "in-house" strategies of 4 or greater. These are analyzed by hospital type and size. Here, it appears that over a third ($8/22 = 36.3\%$) of teaching hospitals score higher in all out technical "fixes" (Table 5-11).

**Table 5-11. Technical Strategies by Organization Type, High vs. Other (n=61)**

<table>
<thead>
<tr>
<th></th>
<th>≤ 3</th>
<th>≥ 4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Medical Center</td>
<td>14</td>
<td>8</td>
<td>22</td>
</tr>
<tr>
<td>Community Hospital</td>
<td>39</td>
<td>4</td>
<td>43</td>
</tr>
<tr>
<td>Public Hospital</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Specialty Hospital</td>
<td>3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>61</td>
<td>13</td>
<td>74</td>
</tr>
</tbody>
</table>

Cross tabulations that compared teaching hospitals vs. all others yielded a significant result ($\chi^2 = 7.638$, $p = 0.006$) indicating strong evidence of an association. The phi correlation coefficient ($\phi$) = 0.321 illustrates a moderate strength of association.

Teaching hospitals’ institutional response to drug shortages may differ from others due to their varied levels of expertise, the extent of their formalization and dissemination of policies and protocols, as well as the sheer magnitude or “insult” from scarcity of medications, *i.e.*, using many types of drugs, they may feel more urgency to address shortages. More simply, their responses may in fact be related to larger facility size; which could better accommodate stockpiling, the presence and use of clean rooms, and compounding equipment.
Mindful that some community hospitals are equivalent in size, if not resources, we can examine if “highly engaged” strategy scores by institution size.

Reviewing institutional size categories as small, medium or large, there were no differences in approach between medium or large hospitals, though clearly none of the small (<100 bed) sites scored above 3 for summed strategies (Table 5-12). The overall association amongst all sizes was not quite statistically significant as $\chi^2 = 5.312$, $p = 0.07$.

**Table 5-12. In House Options Summed Score by Institution Size (**$n=74$**)**

<table>
<thead>
<tr>
<th>Size</th>
<th>≤3</th>
<th>≥ 4</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large (400+ beds)</td>
<td>18</td>
<td>5</td>
<td>23</td>
</tr>
<tr>
<td>Medium (100-399 beds)</td>
<td>24</td>
<td>7</td>
<td>31</td>
</tr>
<tr>
<td>Small (0-99 beds)</td>
<td>20</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>62</td>
<td>12</td>
<td>74</td>
</tr>
</tbody>
</table>
2. Extra-mural Approaches

While “technical fixes” focus on strategies that a Pharmacy Department might undertake on their own accord, extra-mural approaches involve Institutional resources and other Departments. As described above, institutions currently engage in several activities that could serve as potential models for identifying and responding to drug shortages. We now look at each of these.

A. Formation of an Institutional Drug Shortage Task Force/committee.

Classifications for drug shortage committee or task forces were: operational = 2; in development/planning stages = 1; no, or not currently = 0. After multiple years of drug shortages, it was expected that all sites would have a task force or committee, though this was not the case. As shown in Table 5-14, a slight majority of sites (55.8%) report having an active drug shortage task force/committee. Nearly 2 in 5 institutions (42/104 = 40.4%) had not convened a committee or task force, though, and only 4 institutions (3.8%) indicated that such a group was planned or in development.

Table 5-13. Extramural Strategies-Institutional Task Force (n=104)

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = No</td>
<td>42</td>
<td>40.4%</td>
</tr>
<tr>
<td>1 = Developing/planning stage</td>
<td>4</td>
<td>3.8%</td>
</tr>
<tr>
<td>2 = Yes</td>
<td>58</td>
<td>55.8%</td>
</tr>
<tr>
<td>Total</td>
<td>104</td>
<td>100.0%</td>
</tr>
</tbody>
</table>
B. Heterogeneous, Multidisciplinary Drug Shortage Task Force/Committee.

Of those reporting that they had a committee, the membership was quite diverse in some instances but, rather proscribed in others. A breakdown with all possible responses is tabulated below (Table 5-14). Note that “Other” often included information systems staff, who may be responsible for programming alert messaging, order entry restrictions and pop-ups, or other decision support tools. A glaring finding – not a single site has invited a patient advocate to participate in their drug shortage task force.

Table 5-14. Drug Shortage Task Force Membership (n=199)

<table>
<thead>
<tr>
<th>Role</th>
<th>N</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director/Assistant Director of Pharmacy</td>
<td>53</td>
<td>26.6%</td>
</tr>
<tr>
<td>Clinical/Staff Pharmacist</td>
<td>45</td>
<td>22.6%</td>
</tr>
<tr>
<td>Buyer/Supply Chain Manager</td>
<td>44</td>
<td>22.1%</td>
</tr>
<tr>
<td>Hospital senior leadership (Chief Medical Officer, Chief Nursing Officer)</td>
<td>20</td>
<td>10.1%</td>
</tr>
<tr>
<td>Risk Management</td>
<td>9</td>
<td>4.5%</td>
</tr>
<tr>
<td>Nursing Department</td>
<td>15</td>
<td>7.5%</td>
</tr>
<tr>
<td>Disaster Readiness/Emergency Preparedness Committee</td>
<td>3</td>
<td>1.5%</td>
</tr>
<tr>
<td>Bioethicist</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Clergy</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Patient Advocate</td>
<td>0</td>
<td>0.0%</td>
</tr>
<tr>
<td>Other</td>
<td>10</td>
<td>5.0%</td>
</tr>
<tr>
<td>Total responses</td>
<td>199</td>
<td>100.0%</td>
</tr>
</tbody>
</table>

As multiple staff are necessary to bring functional expertise to these committees, there are more roles reported (N = 199) than the 58 institutions with a drug shortage task force or committee.
Some institutions, particularly small sites, might have a limited committee comprised of only those responsible for procuring drugs, e.g., Pharmacy staff and buyers. Other sites may include multiple experts and department representatives including those from Disaster Readiness Committee, Bioethics Division, Clergy, Risk Management Nursing Dept., Senior Hospital leadership such as the Chief Medical or Chief Nursing Officers (CMO/CNO), other physicians, as well as information systems/computer programming staff.

Of those who responded that they had a Drug Shortage Committee, the committee membership is characterized in Table 5-15.  

Table 5-15. Extramural strategies-diverse task force membership (n=57)

<table>
<thead>
<tr>
<th>Membership</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = Pharmacy/Buyers only</td>
<td>27</td>
<td>47.4%</td>
</tr>
<tr>
<td>2 = Interdisciplinary membership</td>
<td>30</td>
<td>52.6%</td>
</tr>
</tbody>
</table>

Total 57 100.0%

---

7 1 of the 58 respondents with committee did not characterize its membership
C. Active Involvement of Emergency Preparedness/Disaster Management Committee. Presenting drug shortages to the disaster readiness committee has several functions. It notifies the members, and subsequently, the institution, of the gravity of drug shortages. Furthermore, through agendas, memos, and meeting minutes, the issue is disseminated to others, and is thereby formally entered the organization’s archives. Lastly, the presentation of drug shortage problems draws on the logistics, communication, planning, and triage skills of the committee members who may contribute to solutions. Interestingly, only 28% of 83 responding sites had presented, or planned to present drug shortage issues to the Disaster Readiness Committee at their institution (Table 5-16). 33.7% or respondents said this had not transpired at their site.

If “unsure” or “no current plans” are lumped with the “no” category, this increases to 72.2% of sites reporting no current or past consultations with emergency preparedness staff for drug shortage mitigation planning.

Table 5-16. Acute drug shortage issues presented to or discussed with Hospital Disaster Readiness Committee (n=83)

<table>
<thead>
<tr>
<th></th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>28</td>
<td>33.7%</td>
</tr>
<tr>
<td>Unsure/Do not know</td>
<td>6</td>
<td>7.2%</td>
</tr>
<tr>
<td>No current plans, but a possibility in the future</td>
<td>26</td>
<td>31.3%</td>
</tr>
<tr>
<td>This is in the planning stages</td>
<td>2</td>
<td>2.4%</td>
</tr>
<tr>
<td>Yes, we currently do or have done this</td>
<td>21</td>
<td>25.3%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>83</strong></td>
<td><strong>100.0%</strong></td>
</tr>
</tbody>
</table>

A one-off presentation is helpful for the above reasons, but deeper engagement offers extra dividends for confronting resource scarcities. One form of deeper engagement would be the incorporation of drug shortages into a hospital-wide drill or tabletop exercise.
Using a scoring strategy of 0-2, we see (Table 5-17) that fewer institutions have committed to this level of training (9/83 = 10.8%); though seven (8.4%) respondents were planning to incorporate an acute drug shortage into one of these exercises.

<table>
<thead>
<tr>
<th>Table 5-17. Acute Drug Shortages Incorporated into Drill (n=83)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>In planning stages</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Shortages of certain medications, particularly those with multiple indications and user groups, pose significant adverse operational challenges to institutions. Here (Table 5-18), only five of eighty-three (6%) sites activated their Hospital Incident Command Systems to organize an institution-wide response. Over 90% of respondents have either not felt compelled, or were unable, to take this step.

<table>
<thead>
<tr>
<th>Table 5-18. Activation of Hospital Incident Command System (HICS) as Drug Shortage Response (n=83)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>No</td>
</tr>
<tr>
<td>In planning stage</td>
</tr>
<tr>
<td>Yes</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

As part of emergency preparedness, hospitals and pharmacies frequently assess their levels of preparedness (Adini, et al. 2006; Awad, et al. 2015). In the context of medication shortages, several systematic assessment tools are available and may be helpful (MacDonald, et al. 2011; Pennsylvania Patient Safety Authority, 2013). Here (Table 5-19), 84% of
respondents have neither developed, nor used an existing tool, though the remaining 16% had, or were planning to do so.

Table 5-19. Use of Institutional Preparedness Assessment Tool for Drug Shortages (n=83)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>70</td>
</tr>
<tr>
<td>In planning stage</td>
<td>6</td>
</tr>
<tr>
<td>Yes</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>83</td>
</tr>
</tbody>
</table>

Interestingly, there was some ambivalence regarding the utility of such a tool. Roughly, only half of survey respondents \((25+17 +3/82 = 53.6\%)\) felt this would be at least moderately useful (Table 5-20).

Table 5-20. Perceived Usefulness of an Institutional Drug Shortage Preparedness Assessment Tool (n=82)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not at all useful</td>
<td>15</td>
</tr>
<tr>
<td>Slightly useful</td>
<td>23</td>
</tr>
<tr>
<td>Moderately useful</td>
<td>25</td>
</tr>
<tr>
<td>Very useful</td>
<td>17</td>
</tr>
<tr>
<td>Extremely useful</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>82</td>
</tr>
</tbody>
</table>
Emergency Preparedness Activation. The degree to which the emergency response team is activated for drug shortage response can also be tabulated with the same scoring rubric used earlier (0 = no, 1 = planning/development stage, 2 = yes, ongoing). In aggregate, ~8% score a 2 = actively engaged their organizations’ emergency preparedness/disaster committee options (drills, vulnerability assessments) for managing drug shortages. ~6% score a 1 = in the planning stages, and a large number (85%) score a 0 = no active engagement (Table 5-21).

Table 5-21. Emergency Preparedness Activation (n=249)

<table>
<thead>
<tr>
<th>Response</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>Totals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drill/tabletop exercise for acute drug shortage</td>
<td>67 (80.7%)</td>
<td>7 (8.4%)</td>
<td>9 (10.8%)</td>
<td>83</td>
</tr>
<tr>
<td>Activation of HICS for drug shortages</td>
<td>75 (90.4%)</td>
<td>3 (3.6%)</td>
<td>5 (6.0%)</td>
<td>83</td>
</tr>
<tr>
<td>Institutional readiness assessment tool for drug shortages</td>
<td>70 (84.3%)</td>
<td>6 (7.2%)</td>
<td>7 (8.4%)</td>
<td>83</td>
</tr>
<tr>
<td>Totals</td>
<td>212(85.1%)</td>
<td>16 (6.4%)</td>
<td>21 (8.4%)</td>
<td>249</td>
</tr>
</tbody>
</table>

Summing these for each responding site, we derive a summed scale (0-6) for integration/activation of emergency preparedness/disaster response (Table 5-22). We find that 64 of 83 respondents (77%) report that they have not fully integrated drug shortages into active emergency preparedness activities, i.e., they have only presented the issue to the emergency response committee, but have not pursued the training, drills or other activities typically conducted in emergency preparedness planning.
Table 5-22. Individual Site Activation Score for Emergency Preparedness Activation (n=83)

<table>
<thead>
<tr>
<th>Summed Scores</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>64</td>
<td>77.1%</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1.2%</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>10.8%</td>
</tr>
<tr>
<td>3</td>
<td>4</td>
<td>4.8%</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>1.2%</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>1.2%</td>
</tr>
<tr>
<td>6</td>
<td>3</td>
<td>3.6%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>83</strong></td>
<td><strong>100%</strong></td>
</tr>
</tbody>
</table>

We can weight this last summary score to accommodate four items placed into the larger context of “extra-mural approaches”.

**D. Institutional Integration of “Extra-Mural” Approaches.** The key measures - creation of a drug shortage task force and presentation/consultation with the emergency preparedness team are represented. Furthermore, the degree by which they are elaborated or fully integrated as an institutional response, by multi-disciplinary membership on the task force, as well as integration of drug shortages into typical disaster response team activities are also included. This gives us an index of response that traverses the institution, *i.e.*, moves beyond a technical response within the Pharmacy Department.

Our first view of these extra-mural approaches (Table 5-23) demonstrates, that in aggregate, a little over a third (113/327 = 34.6%) scored a 2, *i.e.*, are “fully engaged”. Close to 60% (194/327) scored 0, or not at all engaged. The remaining 20 sites (6.1%) are in the planning stages, score = 1.
Table 5-23. Management Strategies: “Extra-Mural” Integration (n=327)

<table>
<thead>
<tr>
<th></th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drug shortage task force/committee</td>
<td>42</td>
<td>4</td>
<td>58</td>
<td>104</td>
</tr>
<tr>
<td>Interdisciplinary task force membership</td>
<td>27</td>
<td></td>
<td>30</td>
<td>57</td>
</tr>
<tr>
<td>Consult emergency preparedness committee</td>
<td>60</td>
<td>2</td>
<td>21</td>
<td>83</td>
</tr>
<tr>
<td>Emergency preparedness drills/integration</td>
<td>65</td>
<td>14</td>
<td>4</td>
<td>83</td>
</tr>
</tbody>
</table>

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Totals</td>
<td>194</td>
<td>20</td>
<td>113</td>
<td>327</td>
</tr>
</tbody>
</table>

A single site can score a 0-2 on any item. As performed earlier, we can assign a summed score to each site, revealing their specific approaches; where the summed scores for each institution now can range 0-8 (Table 5-24).

The distribution reveals 35 scores of 0, indicating 35 sites where none of these extra-mural, organizational strategies were utilized. Only 13 sites (13.5%) scored > 4 out of 8.

Table 5-24. Individual Site “Extra-Mural” Integration Summed Score (n=104)

<table>
<thead>
<tr>
<th>Summed score</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>35</td>
<td>33.7%</td>
</tr>
<tr>
<td>1</td>
<td>6</td>
<td>5.8%</td>
</tr>
<tr>
<td>2</td>
<td>25</td>
<td>2.4%</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>15.4%</td>
</tr>
<tr>
<td>4</td>
<td>9</td>
<td>8.7%</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>4.8%</td>
</tr>
<tr>
<td>6</td>
<td>5</td>
<td>4.8%</td>
</tr>
<tr>
<td>7</td>
<td>3</td>
<td>3.9%</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>104</td>
<td></td>
</tr>
</tbody>
</table>
There was no “expertise advantage” conferred on teaching hospitals for these extramural approaches as dispersion of summed scores across institution type reveal no statistically significant association, $\chi^2 = 33.16, p = 0.230$. The scores also did not significantly vary by institution size $\chi^2 = 11.425, p = 0.652$.

**Table 5-25. Summed “Extra-Mural” Integration Score by Institution Type (n=74)**

<table>
<thead>
<tr>
<th>Institution type</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic Medical Center</td>
<td>4</td>
<td>1</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>22</td>
</tr>
<tr>
<td>Community Hospital</td>
<td>13</td>
<td>3</td>
<td>9</td>
<td>9</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>43</td>
</tr>
<tr>
<td>Public Hospital</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Specialty Hospital</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>21</td>
<td>4</td>
<td>16</td>
<td>8</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>74</td>
</tr>
</tbody>
</table>
3. Communicating Information Regarding Drug Shortages and Substitutes to Staff

How are drug shortages and response plans communicated across an organization? Multiple methods are available to inform staff of the status of drug shortages – pending, escalating, winding down, etc. Those communications may also include action plans such as postponing certain procedures, imposing usage restrictions, identification of possible substitute drugs and their related preparation or administration variations, and so on. All users might not require notification of each alternative drug preparations, i.e., a replaced medication used in a newborn intensive care unit is likely not germane to a geriatric rehabilitation clinic. On the other hand, shortages or substitutions for widely used drugs or even intravenous solutions, as has been the case, should be broadly disseminated across the institution.

A. Broadly disseminated. The broad dissemination of drug shortage information might use electronic messaging and alerts via “all user” e-mails which are broadcast to all licensed clinicians. Posting information on a Pharmacy Department or Hospital Intranet, or via electronic or other newsletters, also provides information to multiple users throughout the institution. These “global” communications cast a wide net, and might also be considered as a contributing factor to assuring the transparency of any plan for curtailing, substituting, or prioritizing the use of a scarce drug. The downside is that of “information overload” where many messages are ignored or deleted by busy clinicians inundated with e-mails.

B. Targeted communications. These are focused on specific, typical users of specific drugs, and may be sent as e-mails to the regular users of a type or class of drug, e.g., Infectious Diseases staff receiving targeted alerts of diminished antibiotic supplies. Direct verbal communication with specific medical and/or nursing staff also provides a clear forum for questions, clarifications, and less ambiguous messaging, which would be especially important for drug substitutions. A more formal targeted mechanism would be placing drug shortages, allocation or other response plans and substitutions on the P&T Committee’s
agenda, or that Committee’s relevant sub-committee or working group, should it have one related to drug shortages.

Another targeted method would be to program information into the Computerized Physician Order Entry (CPOE) system. Not only can real-time messaging regarding drug availability be built in, but also actual prescribing restrictions and “forced” alternative pathways added through the decision support tools inherent to these systems. Because communication is so critical to effectively managing responses, the full scope and methods of participants’ drug shortage communications were solicited. They were also asked to rate the frequency of use for each method. To avoid receiving confounding interpretations of what participants understood what “occasionally” or “frequently’ represented, the following responses were built into the question logic: Occasionally, used on an ad hoc basis; Regularly, monthly; Frequently, bi-weekly or weekly; Very frequently, several days per week to daily. A full table of all possible responses is found in appendix 5. For ease of interpretation, a condensed rating is presented in Table 5-26.
“Global” strategies included use of an intranet, which roughly equivalent percentages of respondents used frequently (40.2%) or only occasionally (42.4%). A large percentage (57.5%) relied on “all user” electronic alerts on a rare or occasional basis. However, the top three communication methods used by participants were targeted rather than global messaging. Advancing drug shortages to the P & T Committee was the most frequently (78.4%) chosen action. This was followed by specific electronic alerts to specific user groups (67.1%). Direct verbal communication with those same specified users was the third most common (64.8%) practice. Thus, very traditional verbal communications (P&T and direct, face-to-face consultations) were prioritized in many cases.

<table>
<thead>
<tr>
<th>Forms</th>
<th>Methods</th>
<th>Frequency</th>
<th>N</th>
<th>%</th>
<th>N</th>
<th>%</th>
<th>N</th>
<th>%</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Global&quot;</td>
<td>Electronic alerts (to all</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>hospital clinicians)</td>
<td></td>
<td>9</td>
<td>10.3%</td>
<td>50</td>
<td>57.5%</td>
<td>28</td>
<td>32.2%</td>
<td>87</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Intranet</td>
<td></td>
<td>16</td>
<td>18.4%</td>
<td>36</td>
<td>41.4%</td>
<td>35</td>
<td>40.2%</td>
<td>87</td>
<td>100%</td>
</tr>
<tr>
<td>Targeted</td>
<td>Electronic alerts (to specified</td>
<td></td>
<td>1</td>
<td>1.1%</td>
<td>28</td>
<td>31.8%</td>
<td>59</td>
<td>67.1%</td>
<td>88</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>user groups)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>P &amp; T agenda item</td>
<td></td>
<td>2</td>
<td>2.3%</td>
<td>17</td>
<td>19.3%</td>
<td>69</td>
<td>78.4%</td>
<td>88</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>Direct verbal</td>
<td></td>
<td>2</td>
<td>2.3%</td>
<td>29</td>
<td>32.9%</td>
<td>57</td>
<td>64.8%</td>
<td>88</td>
<td>100%</td>
</tr>
<tr>
<td></td>
<td>CPOE</td>
<td></td>
<td>24</td>
<td>27.3%</td>
<td>38</td>
<td>43.2%</td>
<td>26</td>
<td>29.5%</td>
<td>88</td>
<td>100%</td>
</tr>
</tbody>
</table>
Pharmacists likely receive more palpable feedback in these conversations versus the unknown or limited responses from e-mail alerts, of which many may be potentially unread.

A key targeted electronic communication option, the use of the CPOE system, was regularly used by approximately 30% of respondents; but 43.2% said this was only rarely or occasionally employed, and strikingly, 27.3% had never used this tool. Why is this the case? Some sites may not have the expertise, or, adaptable systems with turnkey privileges within their own Pharmacy Departments. This would make them reliant on centralized Information Systems staff or programmers’ schedule availability. System updates might also incur the expense of billable programming hours. With limited budgets, it’s much simpler to post an Intranet blurb or send an e-mail.

Choice of messaging strategies may then come down to: what is cost effective? what is easiest to implement? what is timely? and what is overall effective? Communication strategies may also be drug dependent, and the choice or frequency of global vs. targeted methods may shift by the urgency and severity of the drug in shortages, as well as the usage pattern of the drug.

Finally, drug shortage communications cover a much wider space than notifying clinicians of a shortage. Alternative drug substitutions, practice or prescribing restrictions, and allocation/rationing plans also need to be communicated. Global, “all user” messaging may be less appropriate for some aspects, and are clearly less favored in this survey. However, discrete, targeted messaging of a select group of clinicians also limits the transparency of an allocation plan throughout an organization, and perhaps narrows the input options for revisability and appeals processes. A key stakeholder in the transparency of an allocation plan is the patient. We next look to how drug shortages are communicated to patients.
4. Communicating Information Regarding Drug Shortages and Substitutes to Patients

Survey questions probed the extent to which patients are informed of drug unavailability or substitutions, and, by whom they were informed. Table 5-27 reflects how often pharmacists directly communicated drug shortage information directly to patients.

Overall, 35% (31/88) of respondents said “never”. A much smaller percentage (11/88 = 12.5%) frequently or always spoke with patients. 41/88 (46.6%) took the middle ground, communicating directly to patients occasionally or rarely. Table 5-27 also demonstrates that 4/88 (4.5%) responded, “Do not know” if pharmacists directly communicated drug shortages or substitutions to patients at their institution.

<table>
<thead>
<tr>
<th>Table 5-27. Direct Communication by Pharmacists to Patients of Drug Shortages/Substitutions (n=88)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frequency</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>Never</td>
</tr>
<tr>
<td>Do not know</td>
</tr>
<tr>
<td>Rarely</td>
</tr>
<tr>
<td>Occasionally</td>
</tr>
<tr>
<td>Frequently</td>
</tr>
<tr>
<td>Always</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

Cross-tabulation comparisons were carried out, demonstrating no statistically significant association ($\chi^2 = 2.822, p = 0.945$) between institution type and direct communication to patients by pharmacists. A statistically significant association between institutional size and direct communication with patients with pharmacy staff was also not demonstrated ($\chi^2 = 7.406, p = 0.133$).

As compared to a community pharmacy, hospital pharmacists interact more frequently with clinical staff, who in turn routinely communicate face to face with their patients.
Pharmacy directors were also asked to relate how often physicians (Table 5-28) or nurses (Table 5-29) at their institutions directly communicated drug shortage information to their patients.

Table 5-28. Physicians’ Communication of Drug Shortages to Patients (n=89)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>20</td>
</tr>
<tr>
<td>Do not know</td>
<td>15</td>
</tr>
<tr>
<td>Rarely</td>
<td>30</td>
</tr>
<tr>
<td>Occasionally</td>
<td>15</td>
</tr>
<tr>
<td>Frequently</td>
<td>7</td>
</tr>
<tr>
<td>Always</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
</tr>
</tbody>
</table>

Table 5-29. Nurses’ Communication of Drug Shortages to Patients (n=89)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Never</td>
<td>26</td>
</tr>
<tr>
<td>Do not know</td>
<td>14</td>
</tr>
<tr>
<td>Rarely</td>
<td>20</td>
</tr>
<tr>
<td>Occasionally</td>
<td>18</td>
</tr>
<tr>
<td>Frequently</td>
<td>8</td>
</tr>
<tr>
<td>Always</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>89</td>
</tr>
</tbody>
</table>

Thus, in addition to the 35.2% of respondents who said pharmacists never communicate drug shortages to patients, 22.5% say that physicians never discuss drug shortages with their patients, and 29.2% state that nurses never communicate these issues to patients. If not them, then who?
Respondents were not reluctant to claim their uncertainty of this. Of the “Do not know” response findings, 4.5% were unsure if pharmacists communicated drug shortages to their patients, 17% of respondents were unaware if physicians communicate drug shortages to their patients, and 15.7% did not know if the patient’s nurse plays a role in this.

In each of the three tables, “frequently + always” communicated to patients never exceeded 14%. These are striking findings, which implicate institutional transparency, and the poorly disseminated communication of drug shortage information to the most affected stakeholder- the patient. These communication deficits can be examined in the context of the overall approach to managing drug shortages.

**DISCUSSION**

Published surveys of pharmacists have reported the untoward effects of drug shortages on patient safety and outcomes. These reports also describe the extra efforts and resources used to manage drug shortages, which often require alteration of routine practices, exert pressure on time management and personnel, and lead to increased expenses. Few reports describe in detail the measures taken both within the pharmacy and those carried out by multiple departments throughout institutions.

The survey conducted in this project was designed to assess those measures, and the extent by which those resided in Pharmacy Departments, or were fully integrated within institutions. A response taxonomy of sorts was developed. Actions were classified as “in-house”, technical fixes, solely undertaken by Pharmacy Department staff. Alternatively, actions conducted in an inter-disciplinary setting and integrated across the institution were termed “extra-mural”, in the sense of beyond the Pharmacy Department, strategies. Type of response, (none, in planning stages, fully executed, etc.) were also scored and summarized. While this classification was developed for purposes of data analysis, it’s possible that these classifications and summary scales might also be helpful to organizations as they assess their own response mechanisms and readiness for drug or other scarce medical resources.
Of technical fixes, aggregate analysis showed that most responding sites did not perform all Pharmacy options, and, that they preferentially exercised lower risk strategies such as borrowing medications, or occasionally re-sizing containers of drug. Over 80% of sites did not perform high-risk compounding of materials into sterile drug products as a shortage mitigation strategy. Over half of those sites attributed this decision to facility or expertise limitations. Roughly a fifth (22%) of respondents said they avoided this strategy to prevent the related liabilities. This risk aversion is not surprising given the aftermath of the closure and subsequent criminal prosecution of pharmacists at the New England Compounding Center arising from unsafe practices which led to the death and sickening of many patients throughout the country.

Teaching hospitals chose to exercise more of the technical options than other institutions. This may be attributed to several factors. The first plausible reason is that these academic medical centers often possess significant specialized expertise. A second possibility is that their encyclopedic formularies (relative to community hospitals or smaller clinics) and varied case mixes present more “targets” for shortages. Thus, it’s more likely that when shortages affect a pool of 20-50 anesthetic agents versus a pool of five drugs, more items would become scarce, and this could more frequently trigger a response or a need for multiple response options.

Strategies defined as “extra-mural” include creation of a drug shortage task force/committee, and, the introduction and incorporation of acute drug shortages into the emergency preparedness apparatus of the institution. The intensity or degree to which these activities are pursued can be measured by the heterogeneity and inter-disciplinary nature of task force membership, as well as which emergency preparedness activities (drills, exercises, assessment tools) are used to focus on drug shortages.

In this sample, 40% of sites had no drug shortage task force, and of those that did, just over half (53%) convened a committee with members representing departments other than pharmacy. Clearly, having a multidisciplinary task force cannot be considered a
unanimous response for this sampled group. Nursing, Risk Management, and senior hospital leaders such as the CMO or CNO were listed as members of these committees in approximately 5-10% of site responses. No site reported that clergy, bioethicists, or patient advocates were on their committee. If the committees’ agendas were purely technical in nature, that might be reasonable. However, if the committees were also charged with developing allocation/rationing plans, this is a seemingly important omission, which calls into question the transparency of committee-developed allocation plans.

Only three sites mentioned that members of the Disaster Readiness/Emergency Preparedness team were regular members of their Drug Shortage Committees. However, the Emergency Preparedness group can be utilized in other ways, e.g., through presenting drug shortage issues to that group, which 25% of sites reported. A next plausible step would be the co-development of drills or tabletop exercises to simulate acute drug shortages as a disaster event. Slightly over 10% of sites had incorporated drug shortages into a drill, and another 8.4% were planning this.

Using a hazard vulnerability analysis or standardized assessment tool for institutional preparedness related to drug shortages is another way pharmacists might further engage the emergency preparedness team. Seven (8.4%) sites had done this, and another 6 (7.2%) were in the planning stages. Finally, activation of the Hospital Emergency Incident Command System (HICS), undertaken for real emergencies, occurred for drug shortage at 5 sites (6%). Scoring for emergency preparedness activation demonstrated that very few sites perform multiple emergency preparedness activities, approximately 80% did none, though these activities were in the planning stages at select sites.

Generally, tabletop exercises and drills are scheduled months in advance, and emergency preparedness committees’ agendas are often booked with other pressing issues. It would behoove pharmacists and others confronting drug shortages to consider meeting early and often with their emergency preparedness colleagues if they wish to advance their plans into actualized and integrated actions.
Emergency preparedness activation and diverse task force membership when examined together provide a useful scale of “extra-mural”, institutional response. In this sample, 35% of participants reported that none of these activities occurred at their sites. The development of a drug shortage task force occurred at just over half of the sites (55.5%), and the emergency preparedness team was consulted for drug shortage issues at only a quarter of the sites (25.3%). If an integrated institutional response is favored, there seems to room for growth and synergistic activities between these committees.

Response and resource shortage management plans are only plans until they are disseminated and communicated across organizations. The modes, methods, and frequencies of how drug shortages and substitutions were communicated to staff, and to patients, were also examined. Naturally, electronic messaging has taken over the paper trails and mimeographed missives of years ago. Despite that evolution, respondents here preferentially relied on traditional methods of communication. These included, chief among others, the discussion of drug shortages at the institution’s Pharmacy and Therapeutics (P & T) Committee meetings.

Direct, face-to-face meetings with specific clinicians was also highly favored. Both strategies can be thought of as targeted messaging of select users, as compared to “global” all-user broadcasts or intranet postings. Targeted e-mails to specific users was also highly-favored. The most narrowly targeted, real-time, electronic option is the option to add shortage notifications, decision logic supporting alternative substitutions, and prescribing limits to the Computerized Physician Order Entry (CPOE) system. While potentially accomplishing many objectives at once, this option was used more occasionally than frequently, and at 24 sites (27.3%), not ever used. This might not reflect true reluctance to exercise this option, but rather technological or budget limitations at some sites.
It is interesting that face to face communications with staff were most preferred, while communicating shortage information to patients was not highly endorsed. In fact, over a third of responding pharmacists never discussed drug shortages or substitution plans with patients, and less than 15% did so more than occasionally. At many institutions, this might not be their role. Teaching hospitals offer pharmacists limited opportunities to interact with patients or family members during medical rounds, if they participate in these. Even there, most of their interactions may be with the clinical team. In fact, you will find most hospital pharmacists in the basement, behind heavily secured locked doors. Thus, direct communication with patients is a clinician’s métier. In this survey sample the pharmacy directors could not corroborate this. Over 20% responded that physicians at their institutions never communicated drug shortages to patients, and ~ 30% said nurses never did.

Another interesting finding was the level of uncertainty pharmacy directors expressed, that they did not know who communicates drug shortage information to patients at their institutions. Given the low numbers of sites electing “extra-mural” responses to drug shortages, perhaps this could be expected. When institutions convene inter-disciplinary task forces and activate emergency preparedness teams, they gain human and other resources, which potentially include communications, logistics, public relations, and legal expertise not usually located in the basement Pharmacy office. Furthermore, seeing shortages “through the lens” of bioethicists or patient advocates heightens sensitivities and perhaps, attention to moral reasoning- key to successful communication and implementation of allocation plans for scarce resources. Thus, moving towards increasing institutional integration may be well worth the time and effort of pharmacy leaders.

This survey has offered a glimpse of how pharmacy directors manage and plan for drug shortages, and how these are communicated. This nation-wide sample provided greater diversity of settings, geographic allocation, and size of institutions than those of from Boston area interviews, where academic medicine is highly prevalent.
It is not a fully representative sample adequately powered to generate hypotheses; but is differently purposed as a follow up evaluation of the drug shortage response practices described in the prior qualitative interviews (Chapters 3 and 4). Chapter 6 sums up this and the preceding work, providing recommendations and suggestions for future investigation.
Chapter 6

Study Summary, Conclusion and Implications

This project was first conceived as an examination of rationing, using recurring drug shortages as a test case or model for how scarce medical resources are allocated. As the project got underway, it turned into a different investigation. This necessitated a fuller examination of key informants’ language, and the perceived and experienced effects of drug shortages. It led to discovery of the many steps which are undertaken, principally by pharmacists, though also by bedside clinicians, and their respective institutions, to avoid arriving at the need for rationing. When those steps were insufficient to mitigate a shortage, allocation and prioritization plans were then developed and administered. Those latter actions, the original premise of the study, were also evaluated. Incorporating qualitative research into this study was important because it allowed an exploration of experience and themes not fully represented in the literature, and lent a forum to the many health care professionals confronting drug shortages on a routine basis. As Corbin has stated (p. 67),

When analysts interpret data, they are translators in the forms of concepts of other persons’ words and actions. They make the voices of other persons heard and are the go-betweens for participants and the audiences they want to reach. (Corbin and Strauss, 2008)

The key research objectives addressed in this project, are summarized below:

1. Understand how key informants, pharmacists and bedside clinicians, perceived, comprehended, and discussed drug shortages. These could be individually-based thoughts, collective understandings amongst their peers, or sometimes, actively voiced and disclosed with their patients.
2. In varied settings and formally proscribed roles and clinical privileging of participants, learn which specific adverse effects on practice, including potential moral distress of health care providers, and, untoward patient outcomes have resulted from drug shortages.

3. Describe individual actions and responses used to manage those adverse effects, and how participants’ own individual beliefs and moral codes contribute to their coping or response strategies.


5. Assess how shortages, drug substitutions, and patient prioritization/allocation plans were systematically communicated and coordinated amongst staff, to prescribing physicians, and to patients and families. A derivative corollary to this was the degree of transparency of organizations’ drug allocation or substitution plans.

6. Examine differences in approaches taken by institutions in different types and sizes, as well as constraints or advantages based on individual respondents’ professional roles.

7. Evaluate response and communication strategies in the context of best practices or suggested methods noted in the literature.

**Major Findings**

**Persistence of Drug Shortages**

Interviews in Chapter 3 focused on the evolving personal experiences and perceptions of participants, how they talk about drug shortages, drug substitutions, and allocations with each other, with their colleagues, and occasionally, with their patients.

There was a long experience with drug shortages amongst participants, extending over many years. When drug shortages were first encountered, this led to significant dissonance, sense-making, and participants who expressed that they would never have imagined or dreamed that they would be in this situation. While many recognized 2011 as the peak year, there was a realization that drug shortages were now a regular part of the landscape, that
they morph and change, and, would not soon be resolved by manufacturers, the FDA, or any other public or private policy intervention.

Some respondents felt they were still spending no less time than previously spent in managing shortages, and, although the sheer number of drugs on shortage lists has diminished, the agents on the list are often critical agents which remain on shortage lists for long periods of time. Paradoxically, this prolonged acquaintance with drug shortages also conferred some benefits. Pharmacy managers felt they had become better managers from constantly “juggling all the balls in the air”, of essentially practicing continuous quality improvement on a 24-hour basis.

Nurses and physicians also were more accustomed to receiving urgent hospital shortage alerts, where previously they could not believe what they were reading. One pharmacy manager mentioned the “silver lining” of increased collegiality that arose between varied professionals working on their hospital’s solutions to drug shortages. Groups were formed to focus on shortage issues, to take control of the processes, if not the problem itself, and the burdens of managing these were shared within Pharmacy departments.

**Management strategies**

In Chapters 4 and 5, the types of actions, groups, and communications used in responding to drug shortages were examined. The full breadth of hospitals’ institutional responses to discerning medication shortages were analyzed: averting them where possible, mitigating them, and as a last resort, defaulting to prioritization and preferential allocation of scarce drugs to select patients.

These responses were classified and evaluated as “in-house”, technical fixes conducted within the Pharmacy Department, or integrated, hospital-wide approaches that were “extra-mural” in the sense of extending beyond not the institution’s, but the Pharmacy’s walls.

“**In-House**” Responses. Discerning that there is a shortage is not a simple matter of receiving an alert. Pharmacists practiced constant surveillance, speaking of keeping their
guard up and eyes fixed on the horizon. The FDA and ASHP Drug Shortage lists were helpful, though many other inputs – manufacturers’ notices, phone calls to colleagues across town, or checking in with gray market distributors, were used. Additionally, multiple personnel were required to evaluate and categorize the significance or criticality of a shortage - which then triggered specific action plans. This careful evaluation of shortage impact was consistent with published guidelines. Staying ahead of the curve was essential, as pharmaceutical distributors’ alert notices were often received too late to be of practical use. Several pharmacists also mentioned the more difficult task of verifying that a shortage was over, of sounding the “all clear”.

When actionable intelligence was received and reviewed, action plans taken by Pharmacy included ordering of extra supplies, overstocking and filling shelves with soon-to-be scarce materials. Interviewed respondents refused to describe this as hoarding, and justified it as a necessary step to maintain safety and provide care to their institution’s patients. One pharmacist’s words were consistent with a Darwinian, “survival of the fittest” mentality, and he stated that they would do anything they could to not reach the point of cancelling surgeries or other procedures because drugs were unavailable.

Redeployment of scarce drugs to either the Central Pharmacy, or limiting drug access to specific clinical areas also helped pharmacists control limited supplies and enforce usage limits. This caused concern and anxiety for clinicians when they were no longer able to quickly grab a syringe or vial from the Unit Omnicell cache. This was deemed particularly irksome by some nurses when not communicated in advance, and contributes to the overall instability of the environment experienced by bedside clinicians caring directly for patients.

Other responses included borrowing from, and in turn, loaning drugs to other sites. Over 80% of survey respondents used this strategy. Interviewed participants also used this strategy, though noted that they would not loan a drug located on the shortage list to others, and that few pharmacists, themselves included, were likely to announce they had extra supplies on-hand if anybody needed them. Interestingly, up to 30% of surveyed sites shared
drugs with colleagues outside of their own health system or network. One interviewee described this extra-network drug sharing as an informal “neighborly understanding”, that would likely be returned in kind.

The next level of Pharmacy responses is more technical and potentially confer more risk. With appropriate clean room facilities, robotics, and pharmacy expertise, hospital pharmacies can repackage drugs, or even compound their own drug products from existing substrates. By re-packaging, pharmacists break down larger bags or vials of drug solutions into smaller sized units, allowing for distribution to more users, and less waste from opened large containers. While close to two thirds of the surveyed sites relied on this occasionally, only 5% did so on a regular basis.

Compounding of drugs, especially making a sterile drug product from non-sterile ingredients, requires great attention to detail, cleanliness, and all pertinent regulations. Most respondents from the interview and survey samples were less likely to choose this route, though one academic hospital pharmacist raved about their robust facilities and “rock star compounder”. The survey sample, less heavily weighted by teaching hospitals, indicated that 80% of sites chose to not perform high risk compounding as a response to drug shortages. 58% avoided this due to facility or expertise limitations, and 22%, to prevent assuming additional liability.

Chapter 5 presents an index or summary score of technical, Pharmacy approaches incorporating drug sharing, re-packaging, and compounding. This index provides a way of looking at aggregate responses, as well as summed scores for each institution, yielding opportunities to test various associations between strategies and site attributes. Using statistical significance as a bellwether, technical fixes were not associated with institutional size, but were associated by institution type, with academic hospitals engaging in more of these actions than other facilities. These institutions were more likely than others to possess the expertise and equipment (clean rooms, robotics, etc.) to perform the more technical, potentially higher risk activities such as high-risk drug compounding.
These were the technical responses undertaken by pharmacists. When proactively taken, these steps sometimes protect their institutions and shield patients from the adverse effects of shortages, and may also blunt physicians’ full awareness of shortages. These efforts required significant time and manpower commitments of pharmacists, who spoke of dropping everything else as their number one priority became securing or maintaining drug supply for their institution.

“Extramural” Responses. The other major response grouping is that which extends throughout the institution, incorporating functional expertise and representatives from multiple hospital departments. These larger scope responses were not unanimously undertaken for various reasons. Surprisingly, some members of hospitals are still unaware of the scope of drug shortages, and many clinicians previously saw this as a pharmacy problem, or a drug shortage affecting anesthesiology or infectious diseases, and not their own professional turf. One pharmacist mentioned that several years ago, it was taboo to tell the doctors they were out of a drug, and that when a shortage was communicated, they were then asked if they knew how to run a pharmacy. As more specialties are “hit” by drug shortages, their own journals, professional societies, and colleagues discover that this is a global problem, and not a shortcoming of their hospital pharmacy.

Interview respondents mentioned that additional hospital personnel were consulted after the peak shortages of 2011-2012, leading to the formation of drug shortage task forces or committees to systematically address the issues. A truly integrated institutional response would include inter-disciplinary membership, and as described by some interview participants, include the Chief Medical Officer, Risk Management, Nursing, Office of General Counsel/legal, Emergency Preparedness, Bioethics, etc. To be fully representative of all stakeholders, patient advocates or representatives were also asked to participate. This was the case, as related by members of several teaching hospitals, when drug shortages escalated to the point where chemotherapy drugs had to be prioritized amongst their cancer patients. Distinct from the Boston area interview pool, only slightly over half (56%) of the surveyed sites had an existing
drug shortage task force, though 47% of those task forces were comprised of only pharmacists and drug purchasing buyers.

Because the logistics, triage experience, and communication skills of emergency preparedness teams are well-tested and built into institutions (i.e., with identified hospital-specific expertise, resources, and leaders), it seems a clear requisite that emergency preparedness committee members would be consulted and take part in drug shortage response planning. Recall that implementation of disaster response methods to manage drug shortages were previously endorsed by preeminent disaster planning experts after a national saline solution shortage erupted in 2014 (Hick, et al. 2014).

Interviewed participants were not averse to working with emergency preparedness teams, and in fact pharmacists are regular members of those teams and familiar with their efforts and institutional value. Interestingly, only 28% of the surveyed sites had presented, or planned to present drug shortage issues to the Disaster Readiness Committee at their institution. Somewhere between 40-70% said this had not happened. Taking emergency preparedness to the next step, participants were asked if they had incorporated drug shortages into drills, tabletop exercises, or used institution-specific vulnerability assessments — all typical emergency preparedness tools. No more than 10% of surveyed sites had done this.

Less than 10% had activated, or were contemplating activating the Hospital Incident Command System (HICS) to coordinate a response to an acute drug shortage. Activating the HICS, while not quite considered a “nuclear option”, is still not casually or regularly undertaken. It is generally done in the context of an internal or external disaster such as an operating room fire, or a hurricane impacting traffic and supply lines in and out of the hospital. Interviewed pharmacists mentioned that they had been lucky to narrowly avoid a HICS activation, though had experienced several close calls. In an acute and sudden loss of propofol availability, one site did activate their HICS to sort out how scarce quantities of the drug would be allocated across the many departments and services that routinely relied on it for
their patients. This provided a real-time solution and formal communication to the major stakeholders, backed not just by Pharmacy, but with the full authority of the institution and its leadership.

In Chapter 5, an aggregate scale of emergency preparedness activation summing the above options was developed to help in reviewing the totality of integration of emergency preparedness into drug shortage responses. The level of integration was decidedly low for the surveyed group of institutions, which have not gone much beyond presenting drug shortages to their emergency preparedness teams.

A final aggregate scale in Chapter 5 incorporates all “extra-mural” approaches; including inter-disciplinary drug shortage task forces and fully activating the emergency response team. The survey cohort did not fully embrace these approaches, and about a third (33.7%) elected to do none, thus limiting their response strategies to the pharmacy department. In a small dispensary or < 100 bed hospital, this may be appropriate. In contrast, a large facility offering full surgical and emergency room services would likely require a broader institutional response. However, in the survey sample, there were no statistically significant differences in summed score by institution size or type.

**Post Preventive Measures: Consequences and Actions**

What happens when drug shortage management strategies are only partially effective or activated too late? The next phases of responses ─ drug substitutions or preferential allocations ─ must be identified and carried out.

**Drug substitutions**

Possible substitutions for scarce drugs were developed by teams of pharmacy area specialists and medical experts, with pharmacy identifying the alternatives which were then presented to physicians to ratify, reject, or revise. Although this appears consistent with deference to physician authority, many interviewed pharmacists mentioned the heightened collegiality and teamwork that had developed in working together to address drug shortages.
Pharmacists asked physicians to “help us steward this”—with four words, artfully negotiating expertise, power, and collaboration in the patient’s interest.

Community hospital pharmacists had more difficulty, less “institutional back-up”, in implementing prescribing changes or limits on physician prescribers than did academic medical center sites. In community and teaching hospitals pharmacists claimed that having the Chief Medical Officer directly in the loop and endorsing their plans greatly improved physician adherence to pharmacy initiatives. Thus, roles and hierarchies were still important, regardless of the extent of collegiality and consultation present in these institutions.

As alternative drugs were identified, there were remaining concerns associated with using different drugs and formulations with different concentrations and administration protocols. Previous reports of drug shortage-related adverse events implicate clinicians’ unfamiliarity with substituted medications as a cause of those adverse events. Pharmacists mentioned that their worries about potential dosing errors kept them up at night. Nurses, the health care professionals responsible for administering these drugs, also expressed concerns with medication orders that fell outside of their usual practice, and mentioned a struggle to understand the changes. A critical care nurse characterized her safety concerns with unfamiliar drug substitutions as working with lowered or absent guardrails. These unknown or less familiar dosing routines contributed to the many uncertainties clinicians routinely face with persistent drug shortages. When selected alternative drugs were known to be suboptimal, there was additional discomfort in using them. Nurses spoke of drug shortages compromising the best care they could give, and physicians acknowledged their own anxiety in managing additional side effects with less familiar drugs. Not having the preferred palliative agent was difficult for one physician, a final blow to her patients receiving end-of-life care.

Having no substitute to offer was worse. Pharmacists unable to secure appropriate rescue agents had to postpone initiating chemotherapy treatments, feeling as if they had let down their patients. While refusing to use the words, “moral distress”, physicians, nurses, and pharmacists described their unease and discomfort associated with the potentially
diminished or postponed care of their patients attributed to drug shortages and substitutions with suboptimal alternatives. These episodes demonstrate the potential for forms of moral distress, which when not recognized or addressed, may lead to health care worker burnout and their exit from the workforce. This should be a wake-up call to health care organizations, and underscores the utility of an interdisciplinary, institution-wide strategy to drug shortages. Those multiple disciplines’ contributions have the potential to provide focused debriefing, bioethics consults, clergy or Psychiatry inputs, which, in addition to employee assistance programs, might ameliorate the effects of moral distress and professionals’ difficulties in processing these issues.

**Rationing = Allocations**

As discussed in detail in Chapter 3, participants also unanimously refused to mention “rationing” when characterizing their prioritization procedures. Their preferred words were “allocation” or “prioritizing”, and they conjured up something resembling “evidence-based distribution.” The troubled history and baggage associated with rationing medical resources may have influenced their choice. Pharmacists routinely deflected not only the word, but the act itself. Asking “how anyone could pull from one patient for another?”, they stated that a rationing choice would be an unbearable decision, that pharmacists don’t make individual patient decisions, and, that “allocations just get done”. Notably, one pharmacist who (by default) refereed a confrontational meeting of oncologists that would determine which patients would receive the hospital’s dwindling stocks of chemotherapy agents remarked that he never wanted to have that conversation again.

When, during the interviews, pharmacists were asked which factors they might consider if forced to make a rationing decision, they routinely rejected several prioritization choices. Though well-established in the distributive justice literature; first-come/first-serve or lottery options for patients were not viewed as options, and were described as lying outside the histories, norms and traditions of their profession. Interviewed pharmacists also
mentioned that age, or other “extra-medical” attributes of the patient, should not affect an allocation decision. They routinely expressed that standard of care, clinical drug needs should not supersede access to the same drug for clinical research trials, i.e., clinical research participants were equally, though not necessarily, more deserving than other patients. They also expressed that a current patient’s ongoing treatment courses should not be interrupted to assign drug to new patients, regardless of need.

Physician and nurse respondents, particularly those having served in critical care areas such as the Emergency Department or intensive care units, were more facile in accepting allocation options, perhaps due to their familiarity with frequent triage situations, and the implicit bedside rationing of ventilators, clinicians’ time, and other resources. Some clinicians accounted for the patient’s age in their decisions, and considered age-related changes in renal function and drug metabolism when selecting which of their patients might be assigned a sub-optimal substitute drug. Consistent with the “rule of rescue”, life-saving use was prioritized over other allocations.

Agreement on distributive justice principles is often difficult to achieve. As Syrett (p.91) has noted,

...On occasion the key principles of distributive justice converge to produce an ethically ‘right answer’ to problems of allocation of scarce healthcare resources, there will nonetheless be numerous (and far more frequent) instances in which application of one of these principles in a particular allocative scenario will conflict with the deeply held moral beliefs of individuals, especially – though not exclusively – those which are possessed by patients who are denied access to treatments and services as a result of the rationing choice. (Syrett K, 2007)

When this study commenced, it was assumed that participants would discuss rationing and their own ethical decision-making, personal codes and beliefs. But interviewed participants, regardless of professional role, routinely refrained from identifying individual moral codes or
belief systems as sources of guiding ethical principles. Nor did they reference their organization’s mission statements. The consensus was that they were in the healing professions, and were above all, fulfilling their professional duties towards their patients to the best of their abilities. The other consensus reached across all roles was that choosing which patient would receive the last remaining drug was left to the physician in charge of those patients, and essentially, physicians owned this responsibility.

**Communications to Staff**

To pharmacists concerned about dosing errors and drug misadministrations, crafting focused, unambiguous communications was especially important when selecting drug substitutions. Clear messaging seems to be a necessity for shortage notifications. Pharmacists chose many methods to get the word out, though were resigned to the fact that many of their communications would be lost in the pile and barrage of e-mails and notices physicians and nurses received and deleted on a regular basis. A verbatim quote, “Surgeons don’t read their emails...they don’t read newsletters.”

Nurses at a large teaching hospital, nationally recognized for its information systems infrastructure, weren’t always on the receiving end of communications, and only discovered that a drug was unavailable by reading a yellow sticky note thoughtfully left on the Omnicell by the previous shift nurse. In some instances, several nurses wondered aloud if their hospital had a rationing/allocation plan. Few interviewed pharmacists could enunciate one.

Surveyed pharmacy directors used broad messaging strategies, employing all-user email alerts and intranet postings, though more frequently exercised targeted messaging, e.g., emails to specific prescribers, placing drug shortage issues on the agendas of their Pharmacy and Therapeutics (P&T) Committees. They preferred to use direct verbal, face-to-face discussions with select users. While targeted messaging was more often used, the Computerized Physician Order Entry (CPOE) system, the most sophisticated of direct messaging systems, was utilized less frequently by this group.
The data suggest that traditional outreach was more highly valued, perhaps as being more effective, particularly if, as was stated, surgeons don’t read their e-mails. A rationale for including broad messaging, at least in the case of disseminating allocation plans and prioritizations policies, is that more people will see it, more people can archive it, and perhaps more people will use it in their appeals or counter-suggestions. In short, there would be more transparency across the organization.

Communications to patients

Who notifies the patient that they are receiving an alternative drug, or that a drug shortage precludes or postpones their currently planned care, be it an imaging procedure requiring a contrast agent, a round of chemotherapy, or a surgical procedure? As with many complicated questions, the answer is “it depends”. The interviews demonstrated that the task of informing patients about drug shortages affecting their care was primarily left to the physician; though some nurses were forthright in notifying their patients that an alternative drug would be administered. Physicians and nurses sometimes left their patients in the dark, stating for example that patients rarely knew when the hospital was out of propofol, and, that they would not disclose a drug substitution unless significant risks were associated with the alternative drug. The main justification for this was to avoid troubling the patient and adding to their anxiety, particularly in the peri-operative setting. However, published empirical evidence from the peri-operative setting suggests patients do want to know if they are receiving drug substitutes, especially if risk profiles change (Hsia, et al. 2015).

In the current survey, when pharmacy directors were asked how often pharmacists communicated drug shortages or substitutions directly to patients in their institutions, 35% said “never”. About 47% of respondents said pharmacists communicated these to patients only rarely, or on an occasional basis. This is not surprising because, distinct from community/retail pharmacists, hospital pharmacists have limited interactions with patients, and instead mostly communicate drug issues with other hospital staff.
An interesting finding is that 22.5% of survey respondents reported that physicians at their institutions never discuss drug shortages with their patients, and another 29.2% stated that nurses never communicate these issues to patients. This leaves one to wonder who does communicate these? Many survey respondents claimed they did not know who communicated drug shortages to patients. At most, 14% of respondents could identify who communicated drug shortage information to patients “frequently” or “always.” As was stated in Chapter 5, and bearing repeating here, these are striking findings, which bring into question the transparency of institutional responses. How is the most affected stakeholder, the patient, not a part of this process?

Contrast this absent notification with Duke University Medical Center’s explicit drug allocation plan, devised by their ethics committee and ratified by its drug shortage committee and hospital leadership. Their drug shortage committee was fully multi-disciplinary, and in addition to pharmacy and medical staff, included the Chief Medical Officer, Risk Management, and hospital ethics and legal representatives (Rosoff P, et al. 2012a). The allocation plan was modeled after Daniels and Sabin’s Accountability for Reasonableness framework and as such, was fully open to revision and appeal (Rosoff P, 2012b; Daniels and Sabin, 2002). The plan was presented to all staff and disseminated to patients in several languages. As Rosoff notes (p. 1497),

The main virtues of this approach are transparency, its fairness for patients and healthcare providers, and its ability to be rapidly put into practice. We have had no disagreement with the rules from patients, physicians, or hospital leadership. The process of developing the policy was inclusive of all of the stakeholders, was open and public to the staff and patients, and incorporated a mechanism by which disagreements with its application can be heard and adjudicated. (Rosoff, et al. 2012a).

Rosoff and colleagues present a practical and valuable template for others to follow. It is a local application of the universally recognized Accountability for Reasonableness framework,
adapted specifically for drug shortages. It answers an earlier admonition from physicians who were rationing complex radiotherapy treatments and biologic therapies, that health care professionals should proactively examine the ethical merits of allocation before a resource scarcity crisis overwhelms them (Jagsi, et al. 2004, Peppercorn, et al. 2013). The communication findings from the current survey participants clearly indicate that few institutions have arrived at this level of sophistication and transparency, or have heeded this admonition. It is likely no coincidence that the Duke Ethics Committee had drafted their allocation plan. Bioethicists are well-versed in issues of distributive justice, patient autonomy, shared decision-making, and finding ways to justify decisions to reach consensus.

During the current study interviews, one pharmacist recalled wishing he had involved the Ethics Committee after leaving a difficult and spontaneously decided allocation planning meeting. In contrast, other participants felt that waiting for additional deliberations would prolong needed action, and that ethicists would intrude on their own professional decision-making. Pharmacists did feel differently about this when forced to make Oncology-related allocation decisions, and those confronting chemotherapy shortages welcomed bioethics support. Some also felt that a Bioethics’ imprimatur would help “cover” unpopular drug access limitation plans arising from the Pharmacy.

Throughout the interviews, nurses and physicians expressed that their bioethical training was wanting, and that they were unprepared to make allocation decisions. One physician mentioned that before even getting to the idea of distributive justice, clinicians should be taught where drug shortages come from, how drugs are supplied or maintained through the system, etc. This sentiment was echoed by a nurse manager. There is a clear need for education and training which would augment staff’s ability to respond to drug and other medical resource shortages and prioritization planning.
Advocacy and Agency

Pharmacists and bedside clinicians alike took extraordinary efforts to prevent and mitigate drug shortages and their consequences. Nurses took extra time to review the preparation and administration of substituted medications, exercising what one called a “personal safety index”. They also summoned pharmacists and physicians up to their patients’ rooms for verification and assistance when off-label drug uses or revised administration routes were proposed. Nurses also presented hastily improvised drug plans to their patients with confidence and authority to reduce patient anxiety.

As final arbiters of patient prioritization plans, physicians had to weigh efficacy, availability, and patient acuity in making rationing decisions, sometimes with little advance notice that a drug was unavailable. They also participated in inter-disciplinary teams that identified potential drug substitutes, and on drug shortage task forces or related emergency preparedness teams.

By all accounts, pharmacists have done the yeoman’s work and taken on the brunt of responsibilities for managing drug shortages. Their constant surveillance of the environment, frequent redeployment or repackaging of supplies, and the vetting and securing of drug substitutes, the “hours of bench-marking with colleagues” require enormous amounts of energy, time, and attention to detail, to the possible detriment of their other duties. At each interview pharmacists were asked if their institution had added extra personnel to manage drug shortages. Only a single site affirmed this.

Pharmacists also advocated for drug shortage policy solutions, volunteered on committees that drafted revised compounding regulations, and met and communicated regularly with the FDA, with the State Department of Public Health, with the State Board of Pharmacy, and, made frequent calls, complaints, and suggestions to drug manufacturers and distributors. This head-on approach not only helps their patients and medical colleagues, but also serves their institution well in respect to accreditation visits and inspections.
The Joint Commission: Drug Shortage Standards

To receive Medicaid and Medicare reimbursements, hospitals must meet government requirements for program participation, including a certification of compliance with the health and safety requirements called Conditions of Participation or Conditions for Coverage (Joint Commission, 2016). This compliance affirmation is based on a survey conducted by a state agency on behalf of the federal government, such as the CMS or by a national accrediting organization, such as The Joint Commission. Health care organizations that achieve accreditation through a Joint Commission “deemed status” survey are determined to meet or exceed Medicare and Medicaid requirements.

Joint Commission surveyors evaluate practice standards regarding environment of care, emergency preparedness, and medication management. The standards were updated in 2011, the peak year of nation-wide drug shortages, to account for hospital readiness and responsiveness to drug shortages (The Joint Commission, 2011).

Relevant standards include:

**MM.03.01.03 Emergency Drugs**

Emergency medications and associated supplies are readily accessible in patient care areas

**MM.02.01.0 The hospital selects and procures medications**

11. The hospital develops and approves written medication substitution protocols to be used in the event of a medication shortage or outage.

12. The hospital implements its approved medication substitution protocols.

13. The hospital has a process to communicate to licensed independent practitioners and staff who participate in medication management about the medication substitution protocols for shortages or outages.

14. The hospital implements its process to communicate to licensed independent practitioners and staff who participate in medication management about the medication substitution protocols for shortages and outages.
From the above it is clear that safety and communication protocols for substituted medications are a priority of the Joint Commission. This prioritization matches the concerns previously expressed by bedside clinicians administering these drugs, and provides an imperative to health care organizations to develop and communicate a well-defined process for maintaining safety during drug shortages. Thus, openly transparent communications regarding drug shortages and substitutions, in addition to meeting the normative goals expressed in the case studies and literature (see Chapter 2), may also benefit institutions during their accreditation visits and inspections.

**Dualities of themes**

Throughout this study, dualities appear. Identified themes and constructs are counterbalanced by others:

- Participants’ seemingly besieged by the persistent onslaught of drug shortages are also emboldened and bolstered by their own and colleagues’ resilience and ethos to steadfastly fulfill their duties to their patients.
- Constant surveillance and careful monitoring of the environment is frequently disrupted by surprise or cryptic shortage notices from manufacturers.
- Role constraints and traditional hierarchical authority is transcended by genuine collegiality and team efforts to find solutions.
- Potential compromised care is countered with bedside clinicians’ agency, their “personal safety indices”, and advocacy for patient safety.

Despite these seeming contradictions, some observations and recommendations can be made.
Recommendations

1. Drug shortages have been part of the health care landscape for well over a decade. They come and go, reappear, and persist. Some drugs, especially those used in the acute setting, frequently remain on the shortage list for long periods of time. To date, policy and legislative actions have helped attenuate their effects, but have not prevented them. Given the uncertainties, persistence, and abrupt nature of drug shortages, institutions should continue to proactively prepare themselves to address ongoing drug shortages and other medical resource scarcities.

2. Multiple Oncology specialists and working groups have published reports calling for the development of hospital task forces and openly communicated allocation policies to confront and manage drug shortages. Such a systematic approach involving an institutionally-integrated response may be favored, as it can introduce logistics, communications, and other expertise and resources not abundantly found in the Pharmacy Department. Furthermore, the coordinated efforts of varied professionals developing management strategies may potentially offset role constraints and professional hierarchies. Despite their best efforts, pharmacists, alone, cannot meet the ongoing needs of patients or staff.

3. Interdisciplinary teams that include patient representatives and advocates in devising allocation/rationing plans more closely adhere to frameworks described by Rosoff, Hurst, and Daniels and Sabin (as discussed in Chapter 2), which open the “black box” and decision-making to public and other stakeholders’ scrutiny. An openly communicated and revisable plan may also mediate forms of moral distress faced by clinicians making resource prioritization decisions among their patients.

4. Communication to patients and all stakeholders increases transparency, and thus, the legitimacy of allocation schema. This openness may also reduce the probability of legal actions against institutions for their preferential allocations and drug access prioritizations,
as suggested in the literature (Young, et al. 2012; Hensel and Wolf, 2011, and as discussed in Chapter 2).

5. Institutions should reexamine staff training needs, and consider covering drug supply chains, substituted medications, and allocation goals and justifications. This is important as multiple respondents stated that they had not received sufficient training, or were ill-prepared to make allocation decisions.

**Study Limitations**

This study, while lengthy in execution and rich in data, is not a large study. Phase I yielded twenty in-depth interviews from key informants directly involved in all aspects of managing drug shortages and their effects on patients. The recorded interviews provided ample material to digest and configure into meaning. As with many qualitative research studies, additional “takes” could be made on these data. For future studies, hearing from more physicians, particularly oncologists, might improve our understanding of drug prioritization decisions and communications with patients. Notably, no patients or patient advocates were interviewed. Given the current dearth of drug shortage communications to patients, it may be that only simulated cases and scenarios (as previously described by Hsia, 2015) will be used with patients in the near future.

In Phase II, a convenience sample was used for exploring themes and interview responses, though, not for hypothesis generation or population inferences. While the sample size was respectable, as was the variation in respondents’ attributes, in many instances response element cells were sparsely populated and only nonparametric statistical analyses could be conducted. Survey participants’ personal responses to various rationing and bioethical questions, while perhaps informative to their decision-making, and planned for a future report, were not presented here, as the thrust and purpose of Chapter 5 was to uncover institutional management solutions. The sampled populations were clearly different. The interviews were conducted in a teaching hospital-heavy sample, whereas the survey sample
contained more community hospitals and smaller sized institutions, in locales with varied availability and access to healthcare. Thus, these were not fully comparable for fully corroborating findings of the qualitative phase. The summed, aggregate scales of technical responses, emergency preparedness activation, institutional integration, and communication strategies, useful for analyzing and making sense of the data, and potentially useful to other researchers doing comparative analysis across organizations, were not formally tested for scale validity.

What are institutions’ actual allocation plans, how do they prioritize patients, and how transparent are these plans? These were seemingly solely addressed in the literature by Rosoff (Rosoff, et al. 2012a). Participants in this study (survey and interviews) were less aware of, more hesitant, or less confident to define them. Accessing and evaluating the actual plans of additional institutions is a crucial next step in our evolution of understanding explicit rationing of scarce medical resources.

Finally, there are suggestions from the literature that open communications with patients and staff, transparency of allocation decisions, and an integrated institutional approach to medical resource scarcities and allocations are worthwhile, normative goals, to which survey and interview participants’ actions were evaluated. However, size, setting, and missions of varied health care sites may favor different approaches. In this study, no outcomes (e.g., shortage resolution rates, patient satisfaction, fewer medication errors) were tested, nor was definitive evidence favoring one approach over another provided. That would require a larger, lengthier and more heavily-resourced project. This study provides a cross-section of what is being done, and cannot quite answer what should be done. It does suggest, though, where there is room for more to be done.

**Future Research Directions**

As noted above, a larger, follow-up study involving additional physicians and others that formally make allocation decisions could be helpful towards understanding those processes.
The obverse of this, a study involving patients affected by drug shortage allocation decisions, would lend important stakeholder input and perspectives regarding received communications and transparency of those decisions. A larger quantitative survey sample will also permit more robust statistical testing which could provide more generalizable findings. In all instances, designing studies that evaluate outcomes measures across response strategies would provide critical information useful to organizations developing and/or refining their response plans.

**Study Relevance**

Why study this problem in a law and policy program? Given the potential for ongoing drug shortages, and, the discomfort clinicians feel in making extra-medical allocation decisions, there is a profound and unmet need to examine and develop institutional response plans and resource allocation schemes that are amenable to implementation by medical professionals, and in a normative sense, as suggested by ethicists, legal scholars, and others, those that are transparent to patients, providers, and members of the public.

The effective translation of research findings into health policy is seldom guaranteed, and is dependent on the phase of policy development, as well as the power relationships, shared language and negotiated goals of researchers and policy-makers (Davis and Howden-Chapman, 1996; Lavis, et al. 2002; Hanney, et al. 2003). Researchers’ findings compete with institutional and political constraints, ideologies, and other information sources received by policy-makers; yet can still influence beliefs and frames, particularly when presented as syntheses and not a single definitive study (Lomas, 2000).

Successful health policy formulation is often shaped by stakeholders within the healing professions (Longest, 2010). Kingdon mentions policy windows and opportunities that remain open for only a brief period of time, and notes that (p.169), “A crisis or focusing event, for example is by its nature a short duration. People can stay excited about an airline crash or a railroad collapse for only so long.” Drug shortages are, unfortunately, not a transient crisis, but a persistent one. To address larger policy solutions, one must press and take advantage
of policy windows whenever they open, as for example the drug shortage hearings in Congress and the overhauled FDAISA. Kingdon also characterized the dissemination of findings in appropriate peer-reviewed publications as fulfilling a significant role of academics and researchers in contributing to the development of policy alternatives (Kingdon, 2003). This study will add to the literature that shapes institutional policies for responding to ongoing drug shortages, as well as other applicable medical resource scarcities.

An interesting anecdote appeared in *Anesthesia & Analgesia* in 2015 (De Oliveira Jr, McCarthy, 2015). In an editorial introducing a new paper on communicating drug shortage communications with patients, the authors recount the peer review process for an earlier report of their own that described the adverse effects of drug shortages on anesthesia patients and practices, both cited in this project. They point out that in 2011, one of the reviewers thought “the drug shortage is likely to be resolved by the time this manuscript is published”. This was wrong then, and may be wrong ten years from now.

It also resonates personally. In 2013, I first shopped the dissertation proposal around, asking Law and Public Policy faculty members their thoughts, and if they might consider being on the dissertation committee. One specifically told me that drug shortages were not a problem, and that manufacturers could fix this immediately if it were in their interests. Having been on the receiving end of multiple pharmacy alerts, I did not believe then that drug shortages would be quickly resolved. It seems I am in good company, and now join that company in contributing to the knowledge base that may lead to appropriate responses and solutions.
List of Cited Cases

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_Thompson v. Western states medical center 535 U.S. 357 (2002)_

U.K. Courts

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Last accessed on April 30, 2017


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Last accessed on April 27, 2017


Appendices

A. Doxil Update
B. Interview Guide
C. Survey Questions
D. Communication of Drug Shortages to Staff
Appendix A

Doxil® (Doxorubicin Hydrochloride Liposome Injection) Shortage Update

January 27, 2012

Dear Healthcare Professional,

Due to the current critical shortage of Doxil® (doxorubicin HCL liposome injection) [Janssen Products, LP: 2 mg/mL-20 mg/10 mL and 50 mg/25 mL] in the United States (US) market, Sun Pharma Global FZE (Sun Pharma) through Caraco Pharmaceutical Laboratories Ltd is coordinating with the Food and Drug Administration (FDA) to provide an alternative treatment option during this critical shortage period.

On behalf of Sun Pharma, Caraco Pharmaceutical Laboratories Ltd has initiated temporary importation of Lipodox™ (Doxorubicin Hydrochloride Liposome Injection) into the US market.

Sun Pharma’s Lipodox™ Doxorubicin Hydrochloride Liposome Injection 20 mg/10 mL (2 mg/mL) single use vials and Lipodox 50™ (Doxorubicin Hydrochloride Liposome Injection) 50 mg/25 mL (2 mg/mL) single use vials contain the same active ingredient, doxorubicin hydrochloride, in the same concentration as Doxil® (doxorubicin HCL liposome injection) [Janssen Products, LP: 2 mg/mL-20 mg/10 mL and 50 mg/25 mL] marketed in the United States.

Sun Pharma’s Lipodox™ (Doxorubicin Hydrochloride Liposome Injection) 20 mg/10 mL (2 mg/mL) single use vials and Lipodox 50™ (Doxorubicin Hydrochloride Liposome Injection) 50 mg/25 mL (2 mg/mL) single use vials are manufactured in India at an FDA inspected facility, Sun Pharmaceutical Industries Limited – Haldol, Gujarat.

Effective immediately, Sun Pharma will offer the following dosage forms: Doxorubicin Hydrochloride Liposome Injection

<table>
<thead>
<tr>
<th>Dosage Form</th>
<th>Volume (mg/mL)</th>
<th>Single Use Vials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipodox™</td>
<td>20 mg/10 mL</td>
<td>10 mL</td>
</tr>
<tr>
<td>Lipodox 50™</td>
<td>50 mg/25 mL</td>
<td>25 mL</td>
</tr>
</tbody>
</table>

In the US, the labeling for Doxil® (Doxorubicin Hydrochloride Liposome Injection) includes the following indications: i) treatment of patients with ovarian cancer whose disease has progressed or recurred after platinum-based chemotherapy; ii) treatment of AIDS-related Kaposi’s sarcoma in patients after failure of prior systemic chemotherapy or intolerance to such therapy; iii) treatment of multiple myeloma in combination with bortezomib in patients who have not previously received bortezomib and have received at least one prior therapy.

Refer to Sun Pharma’s package insert for full prescribing information. Please note the important dosage and administration warning presented in Sun Pharma’s product labeling. Sun Pharma’s LipodoxTM and Lipodox 50™ (Doxorubicin Hydrochloride Liposome Injection) should be handled exactly as you have handled the FDA approved Doxil® (doxorubicin HCL liposome injection).

Refrigerate unopened vials of doxorubicin hydrochloride liposome injection at 2° to 8°C (36° to 46°F). Avoid freezing. Prolonged freezing may adversely affect liposomal drug products; however, short-term freezing (less than 1 month) does not appear to have a deleterious effect on doxorubicin hydrochloride liposome injection.

To order Sun Pharma’s LipodoxTM (Doxorubicin Hydrochloride Liposome Injection) 20 mg/10 mL (2 mg/mL) single use vials and Lipodox 50™ (Doxorubicin Hydrochloride Liposome Injection) 50 mg/25 mL (2
mg/mL) single use vials, please contact the shortage response team by phone 1888 835 2237 or fax 1800 980 2237.

To report adverse events or medication errors among patients administered Sun Pharma’s Lipodox™ or Lipodox 50™ (Doxorubicin Hydrochloride Liposome Injection), please contact our partner Caraco Pharmaceutical Laboratories Limited at 1-800-818-4555.

Adverse events may also be reported to the FDA’s MedWatch Adverse Event Reporting Program either online, by regular mail or by fax:

Online: www.fda.gov/medwatch/report.htm

Regular Mail: use postage-paid FDA form 3500 available at www.fda.gov/MedWatch/getforms.htm. Mail to: MedWatch, FDA, 5600 Fishers Lane, Rockville, MD 20852-9787

Fax: +1-800-FDA-0178

At this time, FDA’s regulatory discretion for the importation and distribution of Sun Pharma’s Lipodox™ (Doxorubicin Hydrochloride Liposome Injection) is limited to Sun Pharma Global FZE and its authorized distributor, Caraco Pharmaceutical Laboratories Ltd, during the critical shortage of Doxil. Importation or distribution of this product in the United States by any other entity is outside the scope of FDA’s regulatory discretion, and FDA has not approved Sun Pharma’s Lipodox™ product for marketing in the U.S.
Appendix B

Interview Guide

Main research questions/discovery goals designated for the interviews:

1. What are the participants’ understanding, perspectives, and roles, as well as the extent of their institution’s task forces or committees in managing drug shortages?

2. Which resource conservation methods have they employed in different situations?

3. Which distribution or queuing schemes do they endorse, and how would these be justified and communicated?

4. Which moral precepts, or bioethics training and resources do they call on to guide them in making these decisions, e.g., patient advocacy, religious, other?

Interview questions/prompts/discussion points

Linked to interview research question 1.

- Could you describe how drug shortages have affected or changed your practice?
- In which ways do you play an active, personal role in managing them (vs. external committee directives)?
- How is this accomplished, i.e. on an implicit patient-by-patient basis, drug classes or groups of patients, or more by external committee fiat or a practice standard?
- Do you feel you have control of the situation? If not, how do other factors or groups [P&T. Risk Mgt., CMO] determine allocations?
- Could you describe any personal or professional conflicts or difficulties arising from these processes?
Linked to interview research question 2

- To what extent, if any, have resources been shifted from investigational/research needs to direct clinical care? From palliative to curative intent?
- If so, how was that determined, accomplished, and communicated?
- Have routine elective procedures been cancelled or delayed until sufficient medications have been secured and/or stockpiled?
- Have “absolute restrictions been imposed on certain drugs?
- How is use/compliance monitored or overseen?
- How were those decisions formulated and communicated to patients and referring physicians? Discuss degree(s) of transparency
- Have you or your Department planned or implemented your own pharmaceutical compounding as a means to provide scarce medications?
- How was that accomplished?
- Other strategies, e.g., formal or informal sharing or borrowing arrangements?

Linked to research question 3

- What are your thoughts on how scarce medications should be distributed? Some examples might include: first-come, first-served, healthier patients prioritized over patients with dismal prognoses? younger patients more “deserving” than the elderly?
- If there were equivalent compelling medical needs, which factors might decide which patient might receive the scarce medication?
- Do you follow the American Society of Hospital Pharmacy or other guidelines?
- Are there governmental (FDA, HHS, etc.) or other options you suggest?
- If shortages persist how could drugs be explicitly rationed?
- What are your thoughts on regional impact, i.e., stockpiling drugs for our patients vs. sharing with outside institutions?
- Do the distribution systems cause discomfort? Could you elaborate on them?
Linked to research question 4

- How do you yourself make difficult allocation decisions?
- Do you feel you are “going alone” in these decisions or are they supported by your peers or others?
- Could you describe any internal or professional codes or precepts you use or consult?
- Does your faith or other belief system influence your decisions? Could you elaborate?
- In what ways, if any, do you refer to your past training in medical ethics?
- Which training/curriculum should be revised or added to your profession to assist in dealing with this and other allocation/rationing decisions?
- How, if at all, have Bioethics Committees helped you in the past making difficult clinical decisions?
- How might a consult assist you or the P&T Committee improve the current situation?
- Would the Disaster Readiness Committee be of value?
- Other resources?
Appendix C

Survey Questions

Q1 You are invited to participate in a brief (~20 min.) web-based on-line survey assessing your experiences and strategies in confronting persistent medication shortages. The goal of the study is to develop practice tools and policy suggestions for clinicians, administrators, and policy-makers to understand and proactively manage drug shortages. As a Pharmacy Director professional, we are asking you to participate and share your personal perspectives, and to share your institutional experiences on behalf of your respective organization. You must be at least 18 years of age to participate. The decision to participate is voluntary. You do not have to participate and you can refuse to answer any question. Even if you begin the web-based on-line survey, you can stop at any time.

There are no foreseeable risks or discomforts to you in taking part in this survey, and no sensitive information will be solicited.

There are no direct benefits to you from participating in this study. Your responses will add valuable perspectives to our research, which may assist other pharmacy directors. You will not be paid for your participation in this study, though you may enter a drawing to receive one $100 gift card, for which three will be awarded by random drawing.

Your part in this study will be handled in a confidential manner. Any reports or publication based on this research will use only group data and not identify you or any individual as being affiliated with this project.

*For those entering the optional prize drawings, your name and e-mail address will be required for payment. This information will be maintained separately from the survey responses.

If you have any questions regarding electronic privacy, please feel free to contact Mark Nardone, NU’s director of Information Security via phone at 617 373-7901, or via email at privacy@neu.edu.

If you have any questions about this study, please feel free to contact: A. Robert Schleipman (co-investigator) at 617-904-8506, or via e-mail at aschleipman.a@husky.neu.edu. You may also contact Dr. Jeanine Mount, the Principal Investigator at 617-373-6913; j.mount@northeastern.edu.

If you have any questions regarding your rights as a research participant, please contact Nan C. Regina, Director, Human Subject Research Protection, 490 Renaissance Park, Northeastern University, Boston MA 02115. Tel: 617-373-4588; Email: n.regina@neu.edu.

You may call anonymously if you wish. This study has been reviewed and approved by the Northeastern University Institutional Review Board (#14-07-05).

Name of Investigators: Jeanine Mount, RPh, PhD; A. Robert Schleipman, MHSA, MSc

Project Title: Health care providers facing persistent medication shortages: Perspectives, processes, and policies for allocation and management

Q2 Please select yes, if you consent to proceed with the survey

☐ Yes (1)
☐ No (2)
Q3 Does your organization currently have a task force, committee, or other group that addresses drug shortages?
- Yes (1)
- In development/planning stages (3)
- Not currently, but a possibility in the future (4)
- No (2)

Q4 deleted

Q5 Please identify the following members of the task force/committee [choose all applicable responses]:
- Director/Assistant Director of Pharmacy (1)
- Clinical/Staff Pharmacist (2)
- Hospital senior leadership, e.g., Chief Medical Officer, Chief Nursing Officer (3)
- Risk Management (4)
- Nursing Department (5)
- Disaster Readiness/Emergency Preparedness Committee representative (6)
- Buyer/Supply Chain Manager (7)
- Bioethicist (8)
- Clergy (9)
- Patient Advocate (10)
- Other (please list) (11) ____________________

Q6 The next several questions address drug shortage management options

Q7 To prevent or otherwise address shortages, do you loan medications to, or borrow from, other institutions?
- Yes (1)
- No (2)

Q8 If yes, please indicate which option listed below describes the type of institutions you engage with in sharing medications:
- Exclusively within my health system network, i.e., formal affiliates only (1)
- Predominantly within my health system network, i.e., mostly a formal affiliate, occasionally a neighboring hospital (2)
- Predominantly outside my health system network, i.e., mostly neighboring hospitals, sometimes a formal affiliate (3)
- Exclusively outside of my health system network, i.e., from neighboring hospitals not formally affiliated (4)
- N/A (5)

Q9 When borrowing or loaning a scarce medication, which of the following is most commonly exchanged: [choose all applicable responses]
- IOU/promise of identical product replacement (1)
- exchange of drug product of equal value (2)
- payment for product (3)
- Other (please specify) (4) ____________________
Q10 Please indicate the type of arrangement that best describes how you shared medications
- Exclusively formal, e.g., signed Memorandum of Understanding (MOU) or other documented arrangement (1)
- Generally formal (2)
- Generally Informal (3)
- Exclusively informal (4)

Q11 Do you perform in-house high risk (as defined by USP 797) compounding, i.e., non-sterile ingredients to sterile drug products?
- We regularly do this type of compounding as part of normal operations; not just for drugs on shortage (1)
- We regularly do this type of compounding; though do not for drugs on shortage (2)
- We only do this type of compounding for drugs on shortage (3)
- We do not do this type of compounding due to potential liability issues (4)
- We do not do this type of compounding due to facility/expertise limitations (5)
- Other (please list) (6) ____________________
Q12 Does your institution re-size scarce medications into smaller aliquots to increase the availability of scarce medications?
- On a routine and regular basis (≥ 50% of the time) (1)
- Occasionally (2)
- Rarely (≤10% of the time) (3)
- Never (4)

Q13 The next items relate to communication strategies

Q14 Please indicate how often each of the following methods are used to communicate drug shortages/management plans to hospital staff.

<table>
<thead>
<tr>
<th>Method</th>
<th>Neve used (1)</th>
<th>Rarely used (2)</th>
<th>Occasionally; used on ad hoc basis (3)</th>
<th>Regularly, on a monthly basis (4)</th>
<th>Frequently; weekly or bi-weekly (5)</th>
<th>Very frequently; daily to several days per week (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic, (e-mail, text messaging) alerts to specific user groups</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Electronic alerts to all hospital clinicians (MDs, RNs, PAs, etc.)</td>
<td>○</td>
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<tr>
<td>Department/Hospital intranet</td>
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<tr>
<td>Pharmacy and Therapeutics Committee P&amp;T agenda item</td>
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<tr>
<td>Computerized Physician Order Entry (CPOE) system and/or other decision support pop-ups and alerts</td>
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<td>○</td>
<td>○</td>
<td>○</td>
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<tr>
<td>Direct verbal communication with users</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td>Other, (please specify)</td>
<td>○</td>
<td>○</td>
<td>○</td>
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</tbody>
</table>
Q15 Using the following scale, please indicate how often medication shortages and/or resultant substitutions are communicated to patients, either directly in-person, call-back, or other means of interpersonal communication

<table>
<thead>
<tr>
<th></th>
<th>Never (1)</th>
<th>Rarely (2)</th>
<th>Occasionally (3)</th>
<th>Frequently (4)</th>
<th>Always (5)</th>
<th>Do not know (6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>By the pharmacist (1)</td>
<td></td>
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<tr>
<td>By the prescribing physician (2)</td>
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<tr>
<td>By their assigned nurse (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Other, (please specify) (4)</td>
<td></td>
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</tbody>
</table>
Q16 The next several questions examine the role(s) of Disaster Response/Emergency Preparedness in response to drug shortages.

<table>
<thead>
<tr>
<th></th>
<th>Yes, we currently do or have done this (1)</th>
<th>This is in the planning stages (2)</th>
<th>No current plans, but a possibility in the future (3)</th>
<th>No (4)</th>
<th>Unsure/Do not know (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute drug shortage issues have been presented or discussed with the Hospital Disaster Readiness Committee (1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acute drug shortages have been incorporated into a preparedness drill/tabletop exercise (2)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activate the Hospital Incident Command Center (HIC) for an acute drug shortage (3)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use an institutional preparedness assessment tool for emergency response to acute drug shortages (4)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Q17 Please rate the usefulness of a concise institutional preparedness assessment tool for emergency response to drug shortages (current or potential plan).
- Not at all useful (1)
- Slightly useful (2)
- Moderately useful (3)
- Very useful (4)
- Extremely useful (5)

Q18 Are guidelines for how to manage various drugs on shortage available to members of your organization?
- Yes, though only drug-specific guidance is available (1)
- Yes, predominantly drug-specific, though also some general allocation guidelines (2)
- In development/planning stage (4)
- No (5)
- Unsure/Do not know (6)

Q19 If general allocation guidelines are also available, how are they disseminated? (Choose all that apply)
- E-mail or Memos to specific leadership (1)
- E-mail or Memos to all hospital clinicians (MDs, RNs, PAs, etc.) (2)
- Clinical Leadership meetings (Grand Rounds, Practice Committee meetings) (3)
- Department/Hospital intranet (4)
- Other (please specify) (5) ____________________
- Do not know (6)

Q20 Are these general allocation guidelines reviewed and/or revised on a periodic basis, e.g., annually?
- Yes (1)
- No (2)
- Do not know (3)

Q21 The next several questions address strategies related to prioritizing the allocation of scarce drugs.

Q22 In an ideal world, "tragic", difficult choices would not have to be made. Consider the following arising from hypothetical "worst-case scenarios" where substitutes are unavailable for a scarce medication required by multiple patients, each of whom have compelling medical needs. As with most ethically challenging dilemmas, there are no clear right or
wrong answers. While these allocation options may make you uncomfortable, your input is very valuable. Please rate the following allocation options.
<table>
<thead>
<tr>
<th>Prioritize for patients with life-saving needs, regardless of resultant scarcities for other patients (1)</th>
<th>Strongly disagree (1)</th>
<th>Somewhat disagree (2)</th>
<th>Neither agree nor disagree (3)</th>
<th>Somewhat agree (4)</th>
<th>Strongly agree (5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prioritize pediatric patients over older adults (2)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Prioritize on a first-come, first-served basis (3)</td>
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<tr>
<td>Prioritize patients with treatment course underway over patients beginning a new course of treatment (4)</td>
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<tr>
<td>Prioritize curative over palliative care use (5)</td>
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<tr>
<td>Prioritize use for standard clinical care of patients over research trial use (6)</td>
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</tr>
</tbody>
</table>
Prioritize for patients with full insurance coverage or other payment resources (7)
Coin flip or other lottery (8)

Q23 From your own perspective, would formal ethics training or consultation on allocation and rationing theories be helpful to you or your task force's prioritization decision-making?
- Not at all helpful (1)
- Slightly helpful (2)
- Unsure (3)
- Moderately helpful (4)
- Extremely helpful (5)

Q24 Please take a moment to help us understand a bit about you and your organization.

Q25 Please check off the role(s) which best describe your position. (Choose all that apply)
- Director/Assistant Director of Pharmacy (1)
- Clinical/Staff Pharmacist (2)
- Hospital Manager (other than Pharmacy) (3)
- MD (4)
- Quality/Patient Safety Dept. (5)
- Other (please specify) (6) ____________________

Q26 Please identify the type of health care organization you currently are affiliated with (Choose all that apply)
- Academic (University-affiliated) Medical Center (1)
- Community Hospital (2)
- Public Hospital, e.g., Veterans Administration, County/Municipal Government (3)
- Formally affiliated with religious organization, e.g., CHA (4)
- Specialty Hospital, e.g., Burns, Rehabilitation, Psychiatric, etc. (5)
- Commercial Pharmacy (6)
- Other (please specify) (7) ____________________
Q27 Please estimate the size of your primary workplace/institution
- 1000+ beds (1)
- 750-999 beds (2)
- 500-749 beds (3)
- 350-399 beds (4)
- 200-349 beds (5)
- 100-199 beds (6)
- 50-99 beds (7)
- < 50 beds (8)
- n/a (9)

Q28 Please identify the region where your primary workplace is located
- Northeast (1)
- Mid-Atlantic (2)
- South (3)
- Midwest/Plains (4)
- West-Mountains (5)
- Pacific (6)
- Other, i.e., beyond the U.S. (7)

Q29 Thank you so much for your time and valuable assistance in helping us to better understand the management of recurrent drug shortages.

Q30 If you would like to enter the optional drawing for a $100 gift card (3 will be drawn), please enter your name and e-mail address. This information will be used solely for sending the incentive, and will be fully separated from your responses.

Q31 Please enter your full name

Q32 Please enter you e-mail address
### Appendix D

#### Communication of Drug Shortage Information to Staff

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Never</th>
<th>Rarely</th>
<th>Occasionally, ad hoc</th>
<th>Regularly</th>
<th>Frequently</th>
<th>Very frequently</th>
<th>Total</th>
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<tr>
<td><strong>Forms</strong></td>
<td>N</td>
<td>%</td>
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<td>%</td>
<td>N</td>
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<tr>
<td>&quot;Global&quot;</td>
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<td>Electronic alerts</td>
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<td>9.2%</td>
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<td>48.3%</td>
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<td>(to all hospital clinicians)</td>
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<td>1.1%</td>
<td>27</td>
<td>30.7%</td>
<td>24</td>
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<tr>
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<td>Direct verbal</td>
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<td>3</td>
<td>3.4%</td>
<td>26</td>
<td>29.5%</td>
<td>23</td>
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<tr>
<td>CPOE</td>
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<td>27.3%</td>
<td>11</td>
<td>12.5%</td>
<td>27</td>
<td>30.7%</td>
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