FINAL REPORT

Recent Trends in Hospital Drug Spending and Manufacturer Shortages

DATE
01/15/2019

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EXECUTIVE SUMMARY

The cost of and access to prescription drugs are major concerns for hospitals and health systems. Continued rising drug prices, as well as shortages for many critical medications, are disrupting patient care and straining hospitals' budgets and operations.

Key Findings

- Average total drug spending per hospital admission increased 18.5 percent between FYs 2015 and 2017.
- Outpatient drug spending per adjusted admission[1] increased 28.7 percent while inpatient drug spending per admission increased 9.6 percent during the same period.
- Payers are unable to keep up with rising drug costs, e.g., the growth in expenditures per hospital admission on inpatient drugs exceeded the Medicare reimbursement update five-fold during the study period.
- Hospitals experienced price increases in excess of 80 percent across different classes of drugs, including those for anesthetics, parenteral solutions, opioid agonists, and chemotherapy.
- Over 90 percent of surveyed hospitals reported having to identify alternative therapies to mitigate the impact of drug price increases and shortages.
- One in four hospitals had to cut staff to mitigate budget pressures.
- Hospitals report that drug shortages put patient care at risk and create additional burden and cost.

The impact of these issues on hospitals and health systems is not easily known as a result of gaps in publicly available data sources. Whereas trends in retail drug spending are available through national data collection and reporting efforts, such as the National Health Expenditure data, those sources do not reflect the experience of major drug purchasers: hospitals and health systems. Therefore, in conjunction with the American Hospital Association (AHA), the Federation of American Hospitals (FAH) and the American Society of Health-System Pharmacists (ASHP), NORC studied the impact of drug pricing and spending, as well as drug shortages, on hospitals and health systems using a combination of survey data, informational interviews with hospital and health system executives, and pricing and spending data from two group purchasing organizations (GPOs). The study design was informed by hospital pharmacy experts. This report updates and expands upon a previous analysis on trends in hospital and health system experience with drug prices and spending.

Between fiscal years (FY) 2015 and 2017, total hospital and health system drug spending increased on average by 18.5 percent. These increases follow record growth in prescription drug spending in FYs 2013 – 2015. Growth in inpatient and outpatient drug spending exceeded the growth in the Medicare hospital payment rates for each setting during this period as well as the growth in general health care expenditures. Alongside the growth in drug spending, hospitals faced enormous challenges dealing with shortages: about 80 percent of responding hospitals found it extremely challenging to obtain drugs in short supply. This report provides insights on the challenges facing hospitals and the patients they serve.

[1] Drug spending in the hospital setting is divided by total adjusted admissions per year to calculate hospital drug spending per admission. Drug spending in the inpatient setting is divided by total inpatient admissions per year to calculate drug spending per inpatient admission. Drug spending in the outpatient setting is divided by the outpatient component of total adjusted admissions to calculate drug spending per outpatient encounter.

BACKGROUND AND RESEARCH OBJECTIVES

Background

Per-capita spending on drugs in the United States has grown significantly in recent years, with year-over-year growth reaching historically high levels in 2014 (12.4 percent) and 2015 (8.9 percent)[2]. This growth was driven primarily by changes in drug prices, including both higher launch prices and annual price increases, not utilization.[3] Over the past 24 months, growth in spending on prescription drugs has slowed from those historic levels. However, prices have continued to increase for many drugs, while ongoing manufacturing shortages of many prescription drugs have threatened patient access to care.

Hospitals and health systems, as major purchasers of prescription drugs, bear a heavy financial burden when prescription drug prices rise. These organizations purchase a high volume of drugs used to treat patients in both the inpatient and outpatient settings. In the inpatient setting, hospitals typically receive bundled payments – either a per diem or diagnostic-related group payment – to cover the total costs of an admission (including all services and drugs for a given stay). These bundled payments do not immediately adjust for increases in input costs like drugs. As such, managing prescription drug spending is essential for hospitals' overall budgets.

The budget pressures resulting from increased drug spending can have negative impacts on patient care with hospitals being forced to delay infrastructure investments, reduce staffing, and identify alternative therapies. Hospitals also continue to struggle with pharmaceutical shortages, which increase costs by disrupting typical work patterns and patient care, and often require significant staff time to address.

This study intends to build on our previous work[4] to inform stakeholders about the ways in which continued escalations in prices on the heels of the historic increases between FYs 2013 and 2015 impact hospital and health system budgets and operations, how drug shortages create additional challenges, and the relationship among drug shortages, new drug entry, and drug spending in particular.

[2] The National Health Expenditure Accounts

[3] U.S. Department of Labor, U.S. Bureau of Labor Statistics. PPI Detailed Report: December 2017

[4] NORC at the University of Chicago, "Trends in Hospital Inpatient Drug Costs: Issues and Challenges."

Study Objectives

This study aims to evaluate trends in inpatient and outpatient drug prices, spending, and shortages. Unlike retail drug purchases, prices paid for drugs in hospital settings are not readily available. Therefore, this study used a national survey of hospitals, as well as prescription drug purchasing information from two large GPOs to address the following research questions:

1. Did inpatient and outpatient drug spending increase between FYs 2015 and 2017?
2. To what extent did changes in drug prices contribute to changes in drug spending by hospitals?
3. To what extent have changes in drug pricing impacted hospitals' ability to manage their budgets? What measures and management strategies have hospitals used to control drug spending?
4. To what extent did hospitals find it challenging to obtain drugs in shortage between FYs 2015 and 2017? Did spending increase for these drugs during this period? What actions have hospitals used to continue caring for patients in light of drug shortages?
5. To what extent did inpatient and outpatient drug spending increase between FYs 2016 and 2017 for drugs that faced competition from new brand competitors, biosimilars, or generics during this period? Did hospitals perceive that new market entry resulted in more competitively priced drugs?

Definitions

The survey used the following definitions:

Hospital drug spending per admission: This study includes hospital-based pharmacy spending on prescription drugs (injectable, non-injectable, and biological products) in inpatient and outpatient settings during the fiscal year net of discounts. Radiopharmaceuticals are excluded from the estimates. Drug spending in the hospital setting is divided by total adjusted admissions per year to calculate hospital drug spending per admission. Drug spending in the inpatient setting is divided by total inpatient admissions per year to calculate drug spending per inpatient admission. Drug spending in the outpatient setting is divided by the outpatient component of total adjusted admissions to calculate drug spending per outpatient encounter. Adjusted admissions are defined in AHA Hospital Statistics as "an aggregate measure of workload reflecting the sum of admissions and equivalent admissions attributed to outpatient services. The number of equivalent admissions attributed to outpatient services is derived by multiplying admissions by the ratio of outpatient revenue to inpatient revenue."

Community hospitals: All non-federal, short-term general, and other specialty hospitals. Other specialty hospitals include obstetrics and gynecology; eye, ear, nose, and throat; rehabilitation; orthopedic; and other individually described specialty services. Community hospitals include academic medical centers or other teaching hospitals if they are nonfederal short-term hospitals.

Excluded are hospitals not accessible by the general public, such as prison hospitals or college infirmaries.

Drug shortage: The American Journal of Health-System Pharmacy defines a drug shortage as a supply issue that affects how the pharmacy prepares or dispenses a drug product or influences patient care when prescribers must use an alternative agent. According to the FDA, shortages may occur for the following reasons: (A) Requirements related to complying with good manufacturing practices; (B) Regulatory delay; (C) Shortage of an active ingredient; (D) Shortage of an inactive ingredient component; (E) Discontinuation of the manufacture of the drug; (F) Delay in shipping of the drug; or (G) Demand increase for the drug.

Price: Price in this report is typically referred to as unit price or unit purchase price. For average price, weighted averages were taken based on spending on a drug across different suppliers, formulations, and dosages. Prices are inclusive of all discounts, including those offered as volume-based discounts as well as those rebates offered for drugs of varying market competitiveness and relative efficacy.

Total spending: The total amount spent on a drug across community hospitals responding to the survey. For data obtained from GPOs, spending numbers reflect only hospital drug purchases that were made through the GPO.

METHODS

Study Population and Data Sources

This study utilized four complementary data sources. First, we analyzed data collected through a survey sponsored by the AHA, FAH and ASHP that targeted all U.S. community hospitals (N=4,262) (the Drug Survey). We merged these data to the 2016 AHA Annual Survey of community hospitals to obtain data on hospitals' characteristics. Third, we analyzed aggregate prescription drug purchasing data from two GPOs. Finally, NORC, the AHA, and the FAH interviewed key leaders of hospital pharmaceutical supply and management to supplement the survey data with insights and in-depth clarity on the impact of changes in drug prices, drug shortages, and generic entry.

The Drug Survey was administered using the AHA's Annual Survey web-based platform, and was fielded over the course of two months between April and June 2018. Of the sampled hospitals, 1,184 hospitals responded (Table 1).

To further illuminate the survey findings, we conducted key informant interviews with six individuals involved in the oversight of pharmaceutical procurement and management at community hospitals. We interviewed two individuals who oversee pharmacy services and purchasing for a large public health care system on the West Coast, three individuals who are the Vice Presidents of pharmacy services for a large private health care system in the South, and one who is the Procurement director for a large medical center in the South. Individuals were selected based on an affirmative response to a survey question as to whether their hospital or health system could be contacted for follow-up, and whether there was a full-time pharmacy technician, as reported in the AHA survey. All interviewees also represented hospitals that belong to GPOs.

For the GPO drug purchasing data analysis, which helps to characterize the dynamic nature of drug prices, we obtained data on total spending and average price per unit for a selected set of drugs, from calendar year (CY) 2015 to 2017 from two GPOs. These two GPOs represent over 1,800 community hospitals. Approximately 34 percent of these hospitals also responded to the Drug Survey.

Table 1. Target Population and Study Sample

Population and Sample Definition	Number of Hospitals
All U.S. Community Hospitals*	4,262
U.S. Community Hospitals Responding to AHA-FAH Drug Survey^	1,184
All Community Hospitals Belonging to Two GPO Networks*~	More than 1,800

* Source: 2016 AHA Annual Survey
^ Source: 2018 AHA-FAH-ASHP Drug Survey
~Source: 2016 AHA Annual Survey; GPO Rx Data

Analysis

The study used sampling weights to account for overall selection probability of each responding community hospital in the Drug Survey to make the results nationally representative. We used Taylor Series variance estimation to compute standard errors. We applied post-stratification weight adjustments to calibrate the survey weights so that they sum to known population totals for key hospital characteristics. We obtained the population totals from the recent census of U.S. community hospitals in the 2016 AHA Annual Survey data set. Post-stratification weight adjustments resulted in reduced variance and bias in the final survey estimates. As shown in Table 2, compared to all U.S. community hospitals, a larger proportion of hospitals responding to the survey belonged to a hospital system; were located in an urban setting; lacked a critical access hospital designation; were for-profit; and were larger in size in terms of number of beds and total Medicare discharges. After post-stratification adjustments were made to the survey weights, survey respondents matched the census of U.S. community hospitals from the 2016 AHA Annual Survey, across all key characteristics with the exception of total Medicare discharges.

To identify and describe the spending on drugs known to have the largest financial impact on hospital budgets, we combined the data from the two GPOs based on generic name[5]. As shown in Table 3, the GPO hospitals were similar to all community hospitals, with a slightly greater proportion in a hospital system, in an urban setting, designated as teaching hospitals, larger in bed size, and quartile rank of Medicare discharges, compared to all community hospitals. We analyzed the data to assess the change in average unit price for the top 10 drugs with the highest total spending in 2017, and the top 10 drugs identified by an expert hospital pharmacy workgroup as the largest change in average price per unit in CYs 2016 or 2017. We also examined the change in price for drugs that had shortages[6] in CYs 2016 or 2017, and the change in price for drugs that had a generic competitor enter the market in CY 2016.[7]

[5] Since drug pricing and spending information was not available at the National Drug Code (NDC) level, data from the two GPOs were combined based on the drugs' generic name and all NDCs associated with a drug were given equal weight in the calculation of the average per-unit drug price.

[6] Pricing information for drugs experiencing shortage was identified by linking the GPO data to the American Society of Health-System Pharmacists' (ASHP) Drug Shortages list. Since NDC level information was not available in the GPO data, the linkage was achieved by merging on generic name instead of NDC.

[7] To identify drugs with shortages, data from the GPOs were matched by name to lists of known drug shortage maintained by the University of Utah Drug Information Services. To identify generic or biosimilar entry, data were matched to the Orange Book from the Food and Drug Administration, and the Purple Book from the Center for Drug Evaluation and Research List and the and the Center for Biologics Evaluation and Research (CBER).

Available at https://www.accessdata.fda.gov/scripts/cder/ob/ and https://www.fda.gov/Drugs/DevelopmentApprovalProcess/HowDrugsareDevelopedandApproved/ApprovalApplications/TherapeuticBiologicApplications/Biosimilars/ucm411424.htm

Accessed July 2018.

Table 2. Key Characteristics of Sampled Hospitals Compared to all U.S. Community Hospitals

Hospital Characteristic	All U.S. Community Hospitals	Sampled Community Hospitals	
		Unweighted	Weighted [95% CI]
Number of Hospitals	4,262	1,184	4,262
Ownership (%)			
Government	22.1	12.0	22.1 [18.9, 25.6]
Not-for-profit	62.4	54.4	62.4 [59.0, 65.6]
For-profit	15.6	33.6	15.6 [13.9, 17.3]
Hospital System (%)			
Yes	65.1	84.5	65.1 [61.3, 68.7]
No	34.9	15.5	34.9 [31.3, 38.8]
Group Purchasing Organization (%)			
Yes	74.5	76.6	74.5 [71.2, 77.6]
No	25.5	23.4	25.5 [22.4, 28.8]
Not Available	0.0	0.0	0.0
Geography (Core Based Statistical Area) (%)			
Metropolitan	57.6	67.7	57.4 [53.9, 60.9]
Micropolitan	17.6	17.1	17.6 [15.1, 20.4]
Rural	24.9	15.3	25.0 [21.7, 28.5]
Critical Access Hospital (%)			
Yes	29.8	18.9	29.9 [26.6, 33.5]
No	70.3	81.1	70.1 [66.5, 73.5]
Teaching Status (%)			
Yes	5.4	4.8	5.4 [4.1, 7.2]
No	94.6	95.2	94.6 [92.9, 95.9]
Bed Size (%)			
Up to 99	49.6	40.9	49.6 [46.2, 53.0]
100 to 399	39.9	46.8	39.9 [36.71, 43.18]
400 or more	10.5	12.3	10.5 [8.8, 12.5]
Medicare Discharges (%)			
4th Quartile (highest)	25.0	30.8	25.6 [23.0, 28.4]
3rd Quartile	25.0	30.5	26.0 [23.3, 28.9]
2nd Quartile	24.9	24.2	27.2 [24.2, 30.5]
1st Quartile	25.1	14.4	21.2 [18.2, 24.4]

Source: 2018 AHA-FAH-ASHP Drug Survey; 2016 AHA Annual Survey

Table 3. Key Characteristics of Sampled GPO Hospitals Compared to all U.S. Community Hospitals

Hospital Characteristic	All U.S. Community Hospitals	Community Hospitals Belonging to the Two GPO Networks
Number of Hospitals	4,262	More than 1,800
Ownership (%)		
Government	22.1	19.9
Not-for-profit	62.4	63.1
For-profit	15.6	17.0
Hospital System (%)		
Yes	65.1	70.6
No	34.9	29.4
Group Purchasing Organization (%)		
Yes	74.5	100.0
No	25.5	0.0
Not Available	0.0	0.0
Geography (Core Based Statistical Area) (%)		
Metropolitan	57.6	60.8
Micropolitan	17.6	18.5
Rural	24.9	20.7
Critical Access Hospital (%)		
Yes	29.8	24.3
No	70.3	75.7
Teaching Status (%)		
Yes	5.4	7.9
No	94.6	92.2
Bed Size (%)		
Up to 99	49.6	44.6
100 to 399	39.9	41.9
400 or more	10.5	13.5
Medicare Discharges (%)		
4th Quartile (highest)	25.0	29.0
3rd Quartile	25.0	25.8
2nd Quartile	24.9	26.3
1st Quartile	25.1	18.8

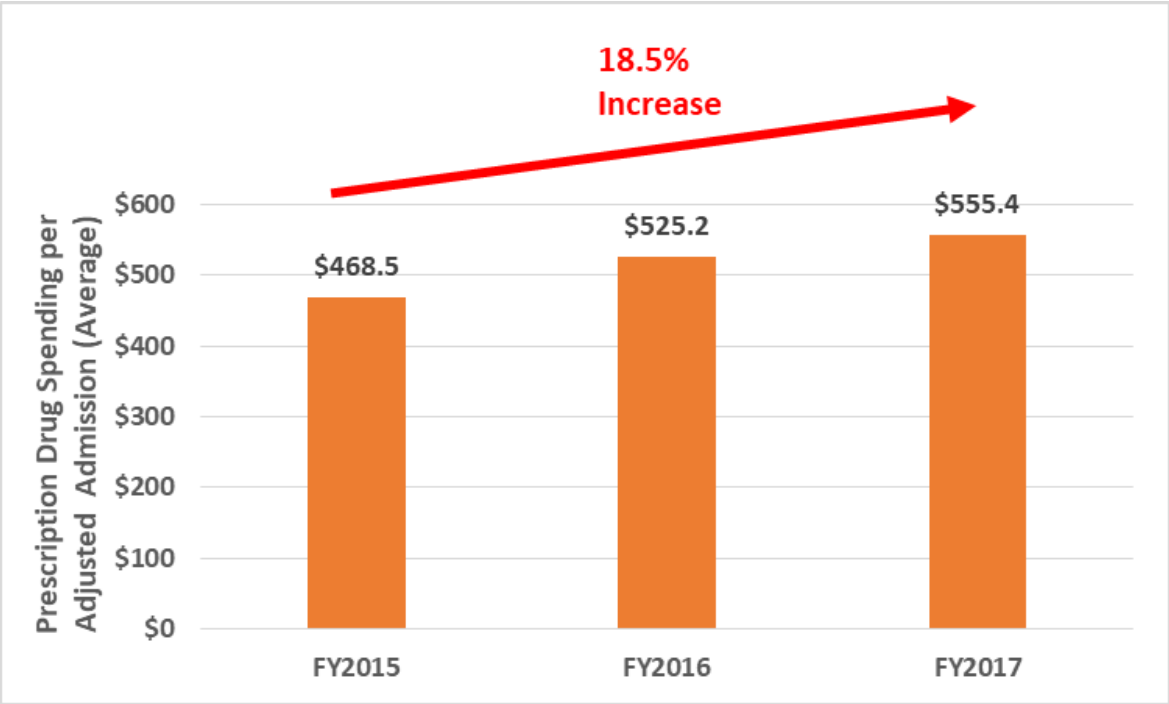
Source: 2018 AHA-FAH-ASHP Drug Survey; 2016 AHA Annual Survey

KEY FINDINGS

Hospital Drug Spending Increased More Rapidly than Medical Inflation between FYs 2015 and 2017

Total drug spending for inpatient and outpatient hospital drugs at U.S. community hospitals increased by 18.5 percent between FYs 2015 and 2017 per adjusted admission (from $468.5 to $555.4) (Figure 1), which resulted in $1.8 million in new spending for an average hospital.[8] This figure eclipsed the increase in overall medical inflation during this period (6.4 percent).[9]

Figure 1. Prescription Drug Spending per Adjusted Admission at U.S. Community Hospitals (FYs 2015 – 2017)



Source: 2018 AHA-FAH-ASHP Drug Survey

Spending on outpatient drugs grew significantly between FYs 2015 and 2017

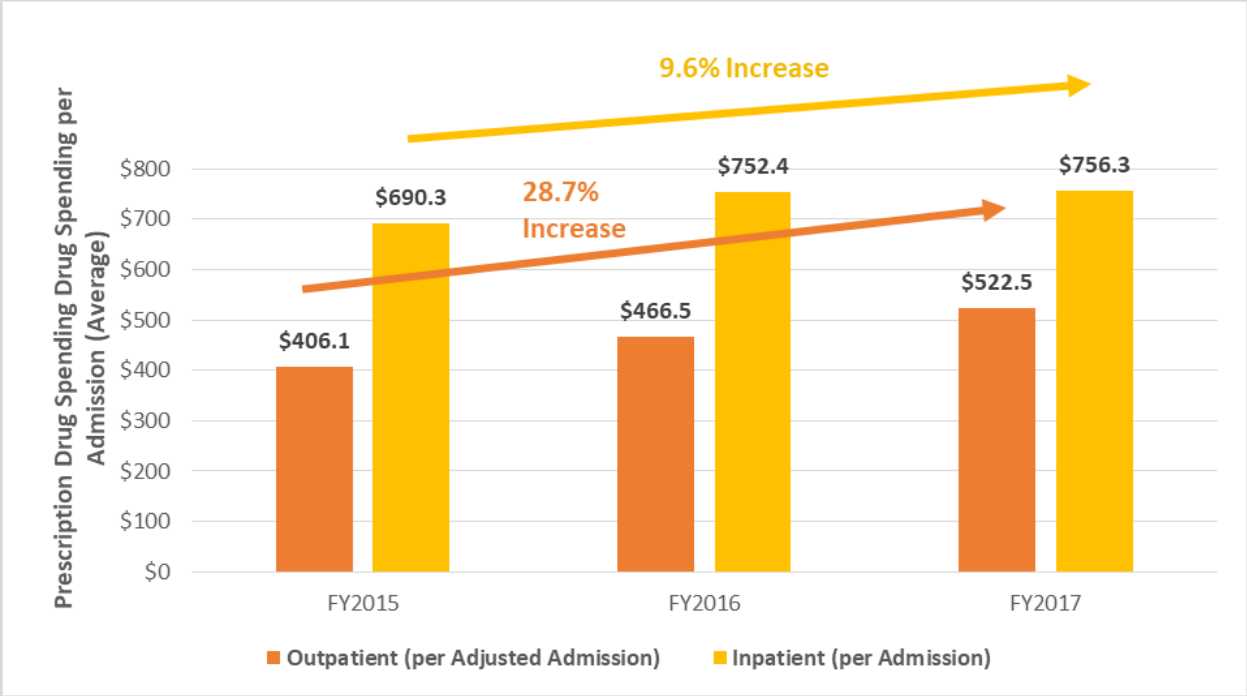
Spending on outpatient drugs grew significantly on an adjusted admission basis (28.7 percent) (Figure 2). Spending on inpatient drugs per admission increased by 9.6 percent between FYs 2015 and 2017, following a two-year period (i.e. FYs 2013 – 2015) where spending increased 38.7 percent.[10] Our previous study did not evaluate outpatient spending.

[8] Average annual spending was estimated to have increased by 12.4 percent between FYs 2015 and 2016 from $9.5 million to $10.4 million. Between FYs 2016 and 2017, average annual spending increased by 5.5 percent to $11.3 million.

[9] Based on U.S. Bureau of Labor Statistics Consumer Price Index (CPI) for medical care, U.S. city average, all urban consumers, seasonally adjusted.

[10] NORC at the University of Chicago, "Trends in Hospital Inpatient Drug Costs: Issues and Challenges."

Figure 2. Outpatient and Inpatient Prescription Drug Spending per Admission at U.S. Community Hospitals (FYs 2015 – 2017)



Source: 2018 AHA-FAH-ASHP Drug Survey

Note: Drug spending in the inpatient setting is divided by total inpatient admissions per year to calculate drug spending per inpatient admission. Drug spending in the outpatient setting is divided by the outpatient component of total adjusted admissions. Adjusted admissions are defined in AHA Hospital Statistics as "an aggregate measure of workload reflecting the sum of admissions and equivalent admissions attributed to outpatient services. The number of equivalent admissions attributed to outpatient services is derived by multiplying admissions by the ratio of outpatient revenue to inpatient revenue."

Medicare Reimbursement Did Not Keep Pace with Drug Spending Increases

While this study was not limited to drugs used for Medicare beneficiaries, we compared changes in drug spending to changes to inpatient reimbursement under Medicare as an example of whether payers are able to modify reimbursement as input costs change. Growth in inpatient drug spending during the study period exceeded the Medicare hospital payment rate update (inpatient prospective payment system market basket plus/minus adjustment).[11].

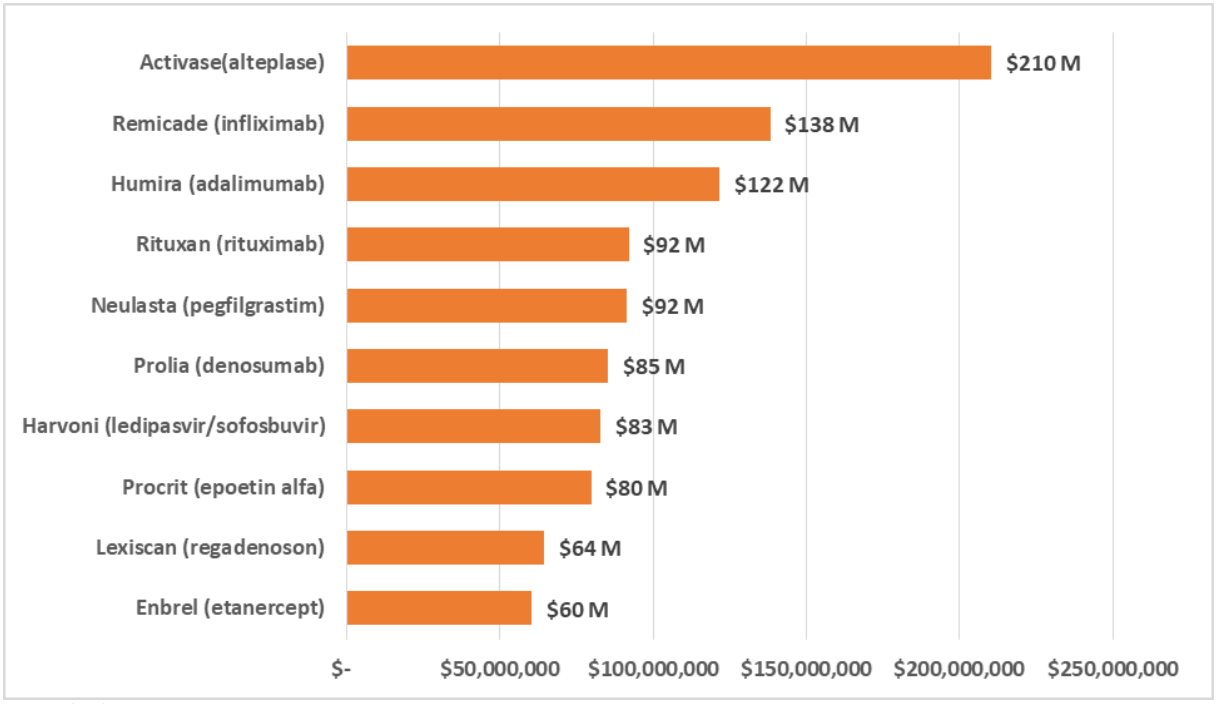
[11] Medicare payments are adjusted annually based on changes to the cost of goods and services ("market basket") plus or minus any other adjustments as a result of other policy changes such as coding adjustments. IPPS = inpatient prospective payment system; OPPS= outpatient prospective payment system. Medicare payment updates are meant to encompass change in all input costs, not just pharmaceutical costs.

Drugs with the Highest Hospital Spending Between CYs 2015 and 2017 Experienced Large Price Increases During this Period

The GPO data showed that, for the top 10 drugs with the highest total hospital spending in CY 2017 (Figure 3a), the average unit price increased by 9.9 percent between CYs 2015 and 2017 **– with notable variation** (Figure 3b). Some significant changes in drug prices include:

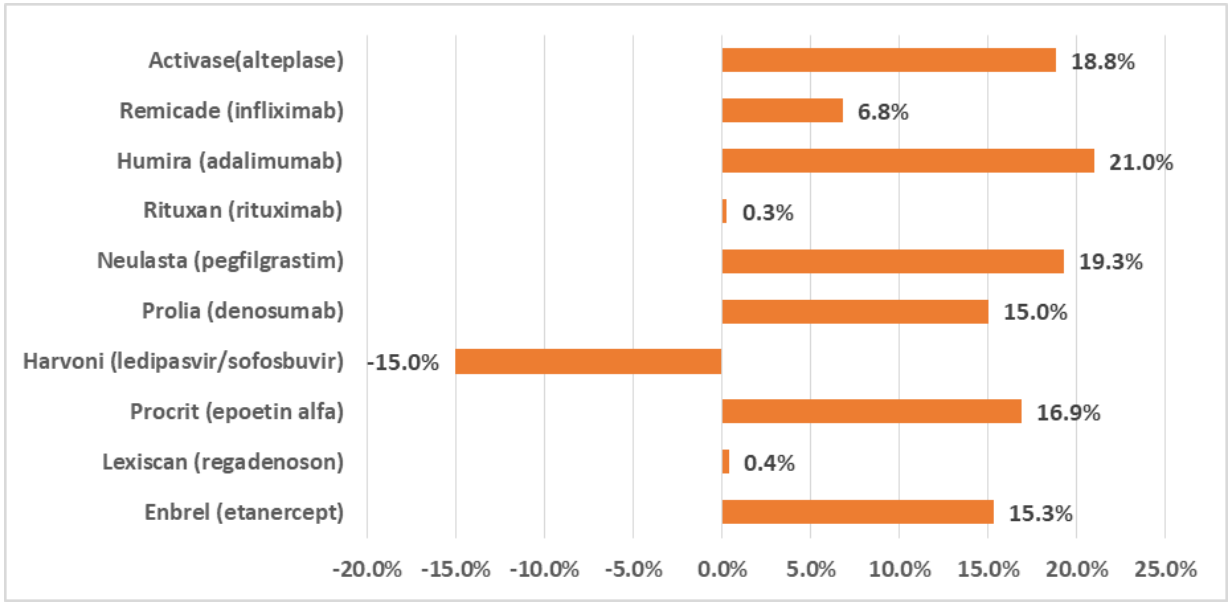
- **Activase®** (alteplase) – A widely used drug to treat persons with heart attack (acute myocardial infarction) and stroke. Unit prices for Activase increased by 18.8 percent from $3,486 in CY 2015 to $4,143 in CY 2017.
- **Immunosuppressants** – Three of the top 10 drugs by total spending are immunosuppressants (Remicade®, Humira®, Enbrel®) used to treat rheumatoid arthritis and other auto-immune conditions. The unit prices for these drugs increased between 15 and 21 percent from CY 2015 to 2017.
- **Orphan Drugs** – Five of the top spending drugs for hospitals (Remicade®, Humira®, Riuxan®; Prolia®; and Procrit®) have orphan drug status for at least one of their indications and thus receive additional patent protections, as well as other benefits under the Orphan Drug Act. In the case of Humira, a patent settlement between AbbVie and Amgen has extended the exclusivity of the drug until 2023.
- **Hepatitis C** – Notably, market competition may have reduced unit prices for Harvoni®, which is used to treat Hepatitis C. In CY 2015, the unit price for Harvoni® was $84,000 for a 12-week course of treatment. Entry of a new competitor drug – Zepatier® by Merck - may have led to a decrease in the price of Harvoni® in CY 2017 of 15 percent.

Figure 3a. GPO Hospital Spending (in $Millions) for Drugs with the Highest Hospital Spending in CY 2017



Source: GPO Rx Data

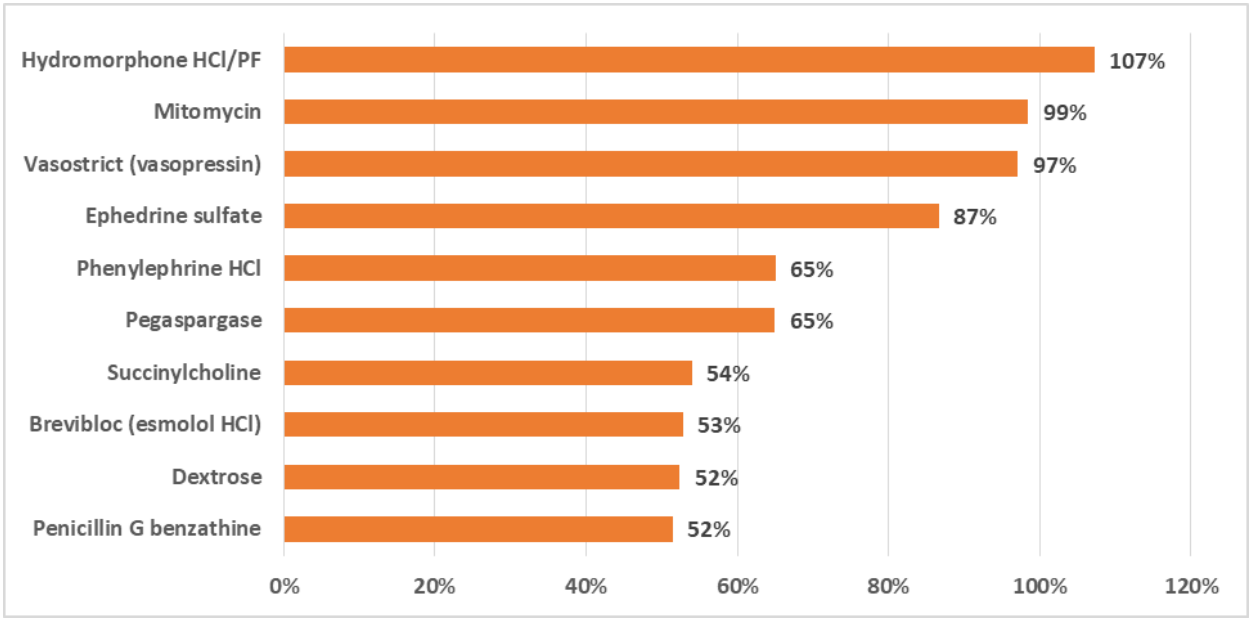
Figure 3b. Percent Change in GPO Price per Unit between CYs 2015 and 2017 for Drugs with the Highest Spending in CY 2017



Source: GPO Rx Data

While these examples address drugs with the highest total spend, there are many other drugs that are critical for patient care that have experienced price increases. Figure 4a shows the drugs with the largest percentage increase in price between CYs 2015 and 2017 for drugs where total spending in 2017 was $1 million or more[12]. Unit prices for each of these 10 products increased more than 50 percent over the two year study period, with the unit price for hydromorphone (a common pain reliever) more than doubling in two years.

Figure 4a. Drugs with the Highest Percentage Change in Price per Unit between CYs 2015 and 2017 (for drugs with total CY 2017 spending > $1M)



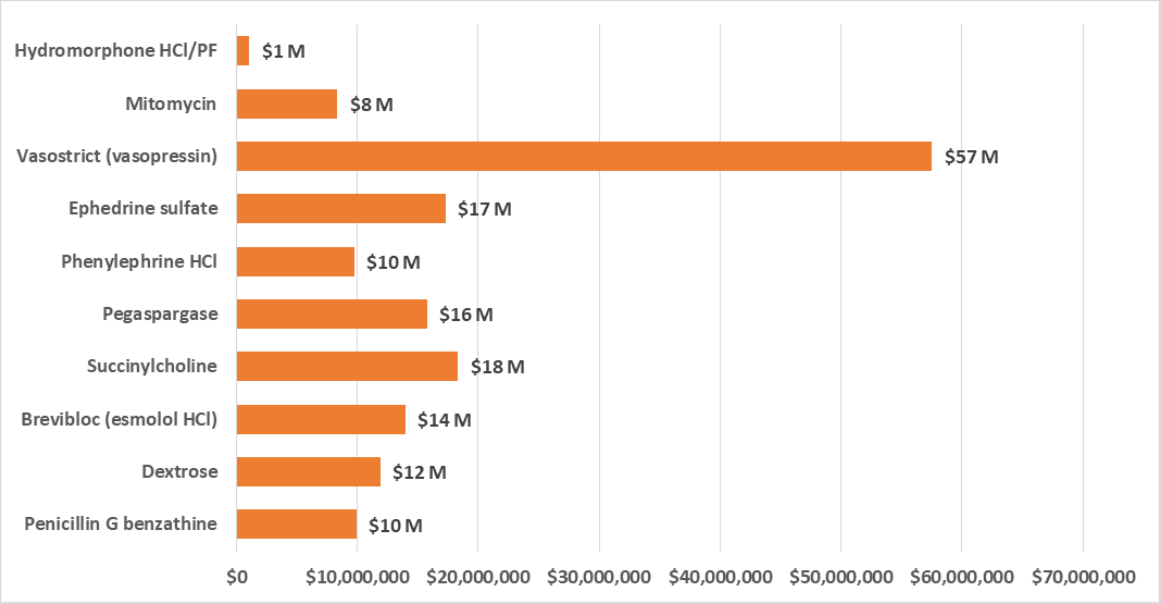
Source: GPO Rx Data

Figure 4b shows the total spending on these 10 drugs. Of the drugs listed in Figure 4b, several were also noted during the member survey as cancer or rare disease treatments that launched with a high list price, or that have become more costly after a shortage of the drug occurred. Other substantial increases in price, like dextrose solutions for example, could possibly be related to increased demand during a particularly severe flu season and a limited manufacturing base.[13]

[12] We focused on drugs with $1 million or more of spending as these are likely to have more of a financial impact on hospitals and health care systems.

[13] There was also a significant disruption in the production and supply of saline following Hurricane Maria in Puerto Rico. See also FDA Statement, June 2019, 2018 Statement from Douglas Throckmorton, M.D., Deputy Center Director for Regulatory Programs in FDA's Center for Drug Evaluation and Research, on the Agency's Response to Ongoing Drug Shortages for Critical Products. https://www.fda.gov/newsevents/newsroom/pressannouncements/ucm611215.htm

Figure 4b. Hospital Spending for Drugs with the Highest Percentage Change in Price per Unit between CYs 2015 and 2017 (for drugs with total CY 2017 spending of at least $1M)

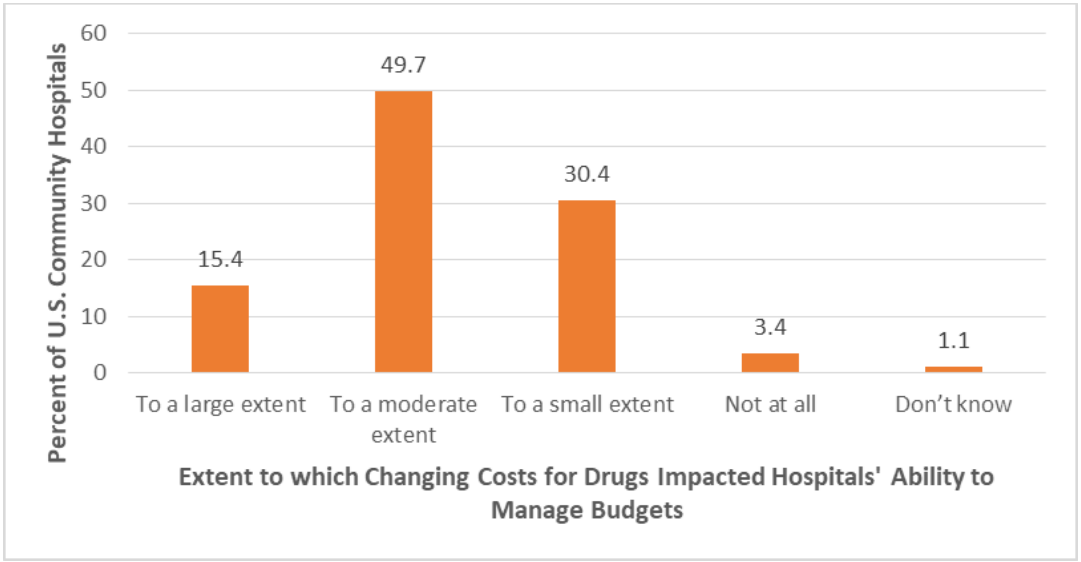


Source: GPO Rx Data

Changes in Drug Pricing Impact Hospitals' Ability to Manage Budgets

Changes in drug prices between FYs 2015 and 2017 impacted hospitals' and health systems' ability to manage their budgets. Almost two-thirds of the hospitals responding to the Drug Survey reported that changes in drug prices had a moderate or severe impact on their budgets, with over 15 percent of hospitals indicating that the increase in drug prices impacted their budgets "to a large extent" (Figure 5).

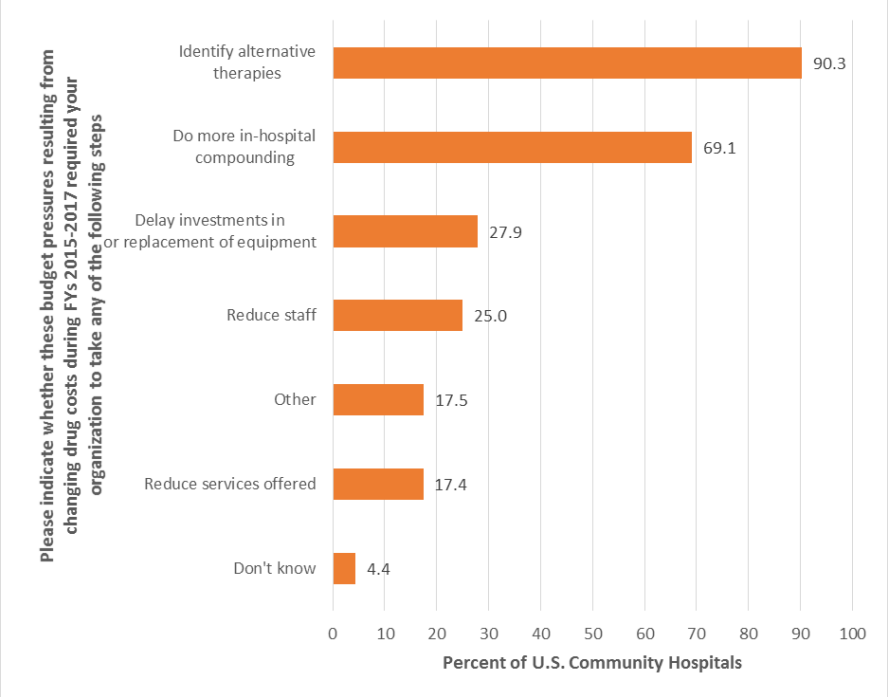
Figure 5. Impact of Changing Drug Prices on Hospitals' Ability to Manage Budgets (FYs 2015 – 2017)



Source: 2018 AHA-FAH-ASHP Drug Survey

Hospitals reported that increased drug spending impacts many aspects of their operations. When interviewed, hospital representatives described a wide range of approaches aimed at controlling spending, from changes in the day-to-day operations to system-wide strategies. They remarked how efforts to control spending and drug shortages were continuously being developed and implemented in order to ensure patient access to quality care. In the survey, almost all hospitals reported having taken measures to address budget pressures associated with changing drug prices[14], such as identifying alternative therapies (90 percent); doing more in-house compounding (69 percent); delaying investments in or replacement of equipment (28 percent); reducing staffing (25 percent); and reducing services offered (17 percent) (Figure 6).

Figure 6. Measures Taken by Hospitals to Mitigate Budget Pressures Associated with Changing Drug Prices (FYs 2015 – 2017)



Source: 2018 AHA-FAH-ASHP Drug Survey

All interviewees described intensive efforts and close collaboration with health care providers to establish formularies for drugs used at their facilities and, when possible, to pursue therapeutic interchange (switching patients to an alternative, lower-cost product). In managing the routine and severe drug shortages Pharmacy department staff also work with the other hospital clinical staff to change the delivery frequency of drugs to patients and patient care areas to avoid any unnecessary waste. For example, staff

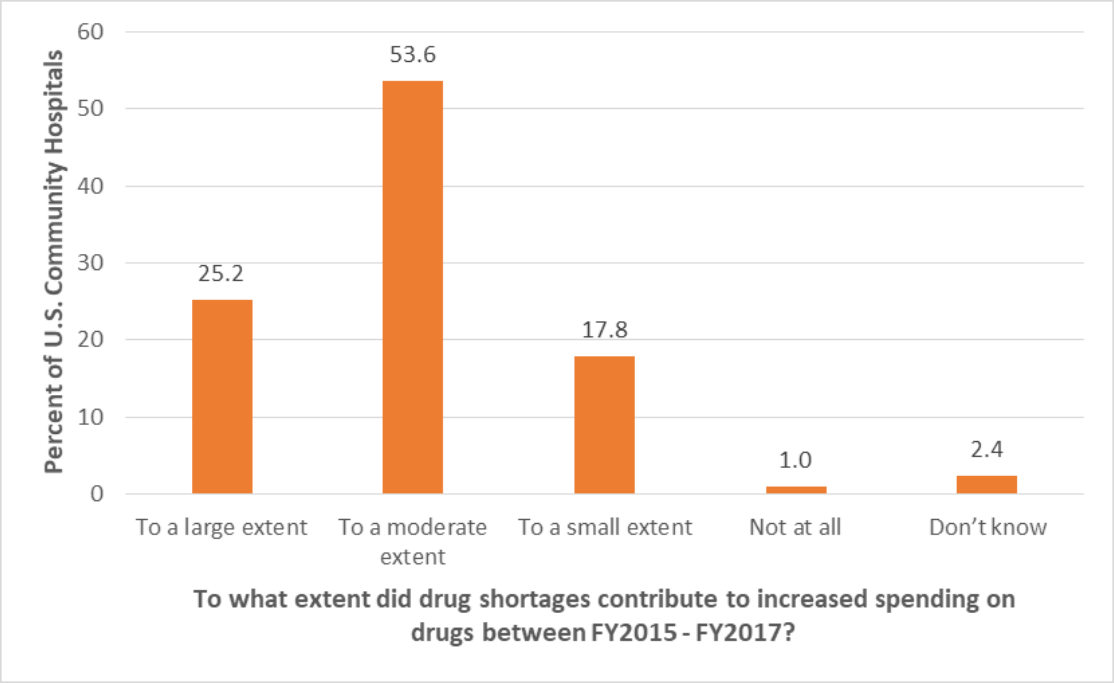
[14] Those hospitals that opt to handle more drug compounding responsibilities in-house must have compounding facilities and personnel that meet the requirements and guidelines set forth by the United States Pharmacopeia and must be in compliance with rules and regulations established by the Food and Drug Administration.

make more frequent rounds throughout a day to deliver smaller amounts of a medication, rather than delivering a larger amount once a day. Pharmacy departments have also changed and continue to adjust staffing and personnel roles, substituting a skilled pharmacy technician for a pharmacist in appropriate situations, so that the pharmacists can focus on managing the most effective therapy options, drug inventory or formulary review. Increased drug spending has also affected larger operations. Some health care centers reported a reduction in the services available to patients as a result of outpatient drug costs, making continued operations unsustainable. For instance, one medical center curtailed plans to open an outpatient chemotherapy site, citing uncertainty around reimbursement relative to the acquisition cost for the drugs. If hospitals are forced to eliminate certain services, quality or availability of care may be impacted, and patients may need to go elsewhere for care, potentially resulting in longer travel times and challenges in coordinating treatment.

Drug Shortages Can Create Both Access and Spending Challenges for Hospitals

Impact on Spending: Shortages can lead to financial ramifications for hospital pharmacies, as they must often purchase higher-priced off-contract alternatives and devote additional personnel resources to mitigate the effects of the shortage on patient care. Almost 80 percent of the surveyed hospitals indicated that drug shortages resulted in increased spending to a moderate or large extent (Figure 7).

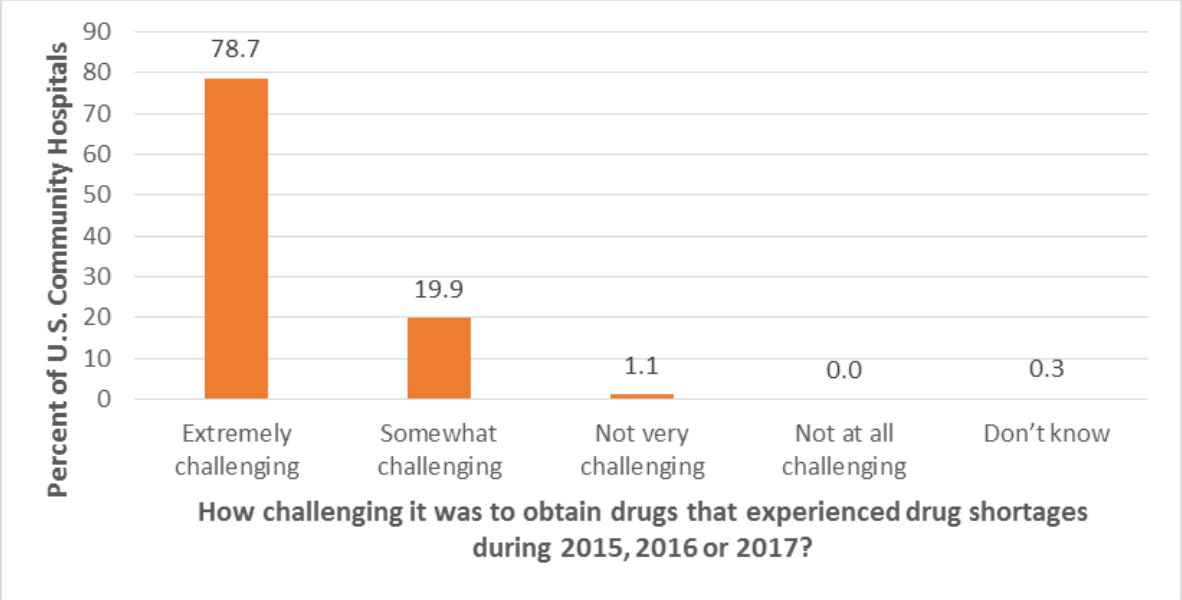
Figure 7. Impact of Drug Shortages on Drug Spending (FYs 2015 – 2017)



Source: 2018 AHA-FAH-ASHP Drug Survey

Over three-fourths of the hospitals found it extremely challenging to obtain drugs in short supply between FYs 2015 – 2017 (Figure 8). The key informant interviews revealed that drug shortages can create a substantial burden, often times siphoning off critical staff hours that should be dedicated to care delivery, ultimately creating the potential to impact patient care. Hospital pharmacies are disproportionately affected by drug shortages because sterile injectables, which are used primarily in hospital settings, make up the majority of drugs impacted by shortages. A frequent cause of these shortages is the development of quality control issues, which have the potential to result in recalls and manufacturing delays while quality concerns are being addressed. Further adding stress to the current situation is the fact that approximately seven manufacturers comprise the vast majority of sterile injectables manufacturing, meaning instances of quality issues or delays present the likelihood of significant system-wide shortages.

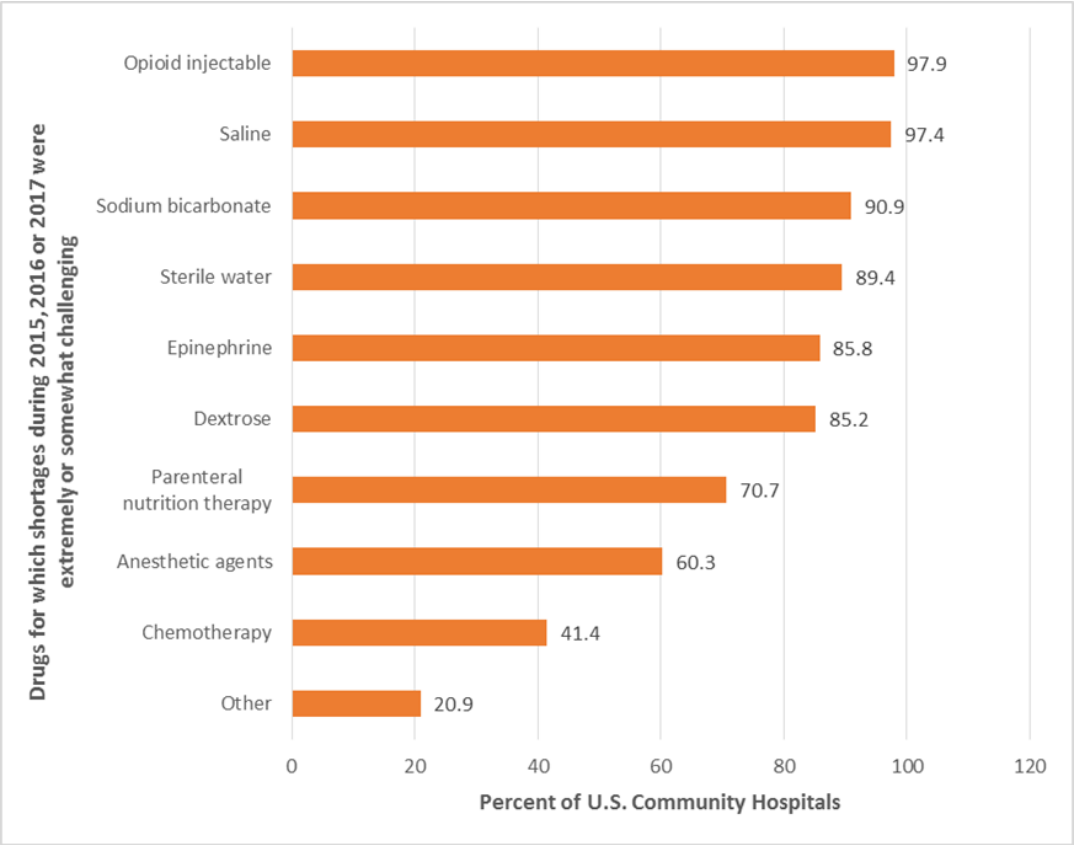
Figure 8. Challenge Obtaining Drugs Experiencing Drug Shortages (FYs 2015 – 2017)



Source: 2018 AHA-FAH-ASHP Drug Survey

Drugs in short supply included drugs that are commonly prescribed, and many of these are life-saving products. About 80 percent of the hospitals found it to be extremely or somewhat challenging to obtain opioid injectables (for pain management), saline (widely used for purposes such as intravenous therapy, for rehydrating patients, and for wound cleaning and irrigation), sodium bicarbonate (used as an alkalinizing agent for oral or parenteral therapy), sterile water (an essential ingredient to preparing many drug products for IV use), epinephrine (used in severe acute anaphylactic reactions and shock), and dextrose (used as parenteral source of calories and water for nutrition and hydration) (Figure 9).

Figure 9. Drugs Shortages That Were Extremely or Somewhat Challenging (FYs 2015 – 2017)



Source: 2018 AHA-FAH-ASHP Drug Survey

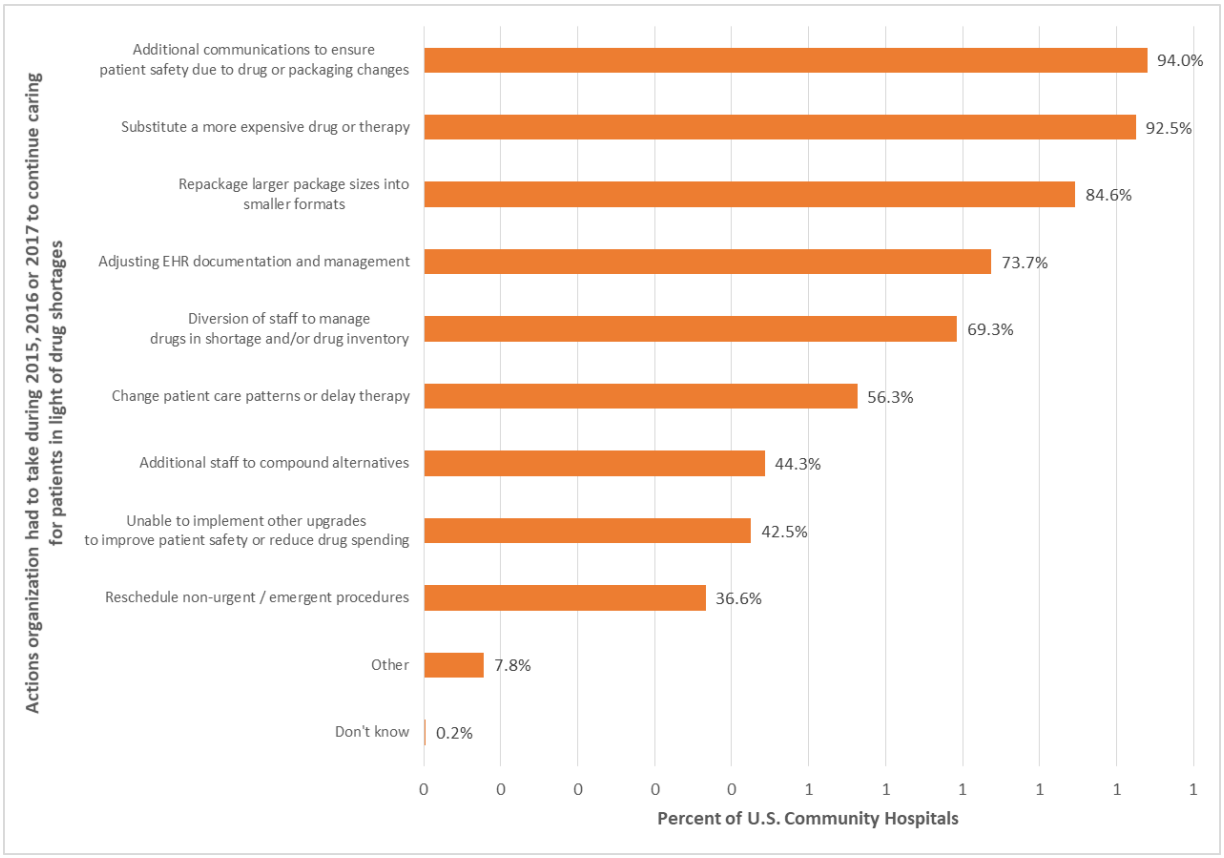
Hospitals and health systems affected by drug shortages took multiple measures to continue caring for patients. These contingency plans included providing additional communications to ensure patient safety due to drug or packaging changes (94 percent); substituting a more expensive drug or therapy (93 percent); repackaging larger package sizes into smaller formats (85 percent); adjusting electronic health record (EHR) documentation and management (74 percent); and diverting staff to manage shortages (such as finding substitutions and suppliers, revising formularies, and developing communications for staff on shortages (69 percent) (Figure 10). The majority of the hospitals also had to utilize alternative contracting and procurement mechanisms to ensure the availability of drugs for their patients, such as making off-contract purchases (89 percent); contracting with 503B compounders (78 percent) and non-GPO entities (75 percent); negotiating directly with manufacturers (73 percent); and using secondary wholesalers (64 percent) (Figure 11).

Staff Burden: Discussions with interviewees highlighted the staff burden directly caused by shortages, which demands increased time focused on planning and implementing solutions to effectively address new shortages. From the executive procurement and management levels to the pharmacy technicians, staff worked to identify shortages, find alternative sources, and update electronic-prescribing and patient

records. Departments increased staff and staff hours to source products and review shortage lists on a daily basis to determine the optimal value for the purchase. One Vice President reported that staff spend 16 additional hours a week solely focused on managing inventory. Shortages increase demands on senior pharmacists to identify and procure appropriate alternatives and gain access to alternatives; historically, pharmacy technicians would be used to do inventory management and place and receive orders.

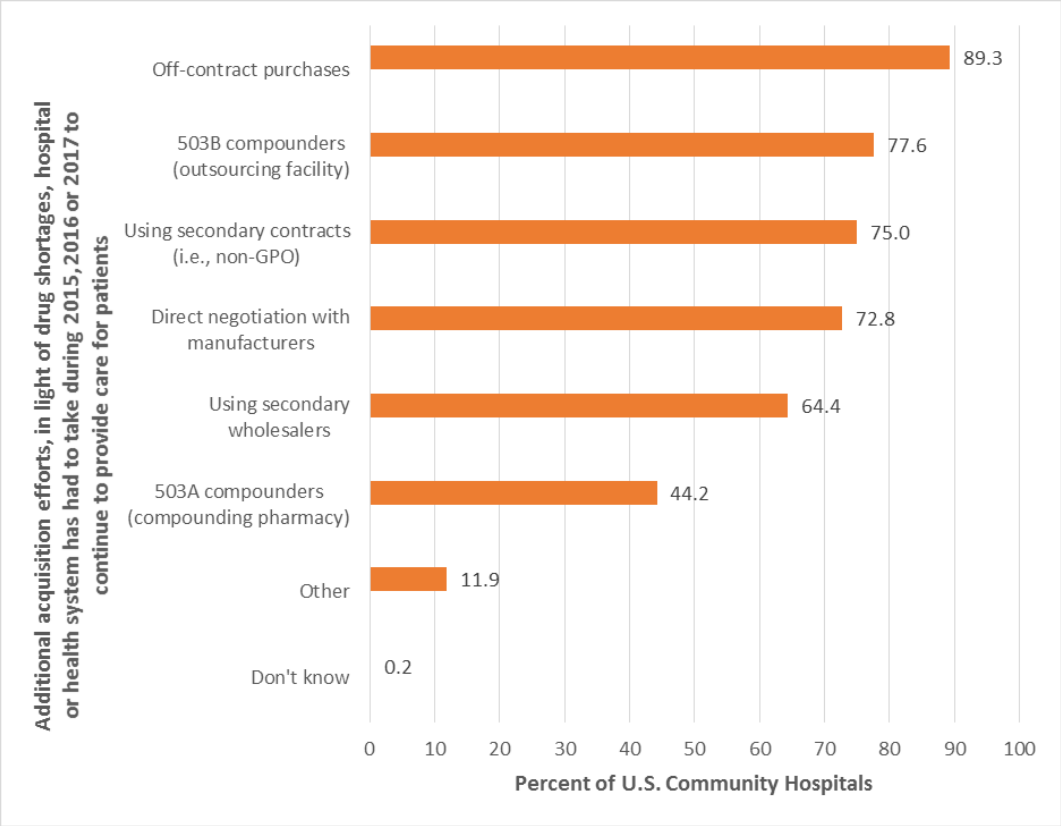
Hospital and health system leaders also emphasized that shortages increased the necessity and importance of strong partnerships and communication with physicians concerning the existence of drug shortages and the prices of affected drugs. Hospital and health system leaders stated that increased communication with physicians included weekly emails, as well as additional and frequent coordination and collaboration with physicians to frequently review revised formularies. In addition, health systems and hospitals monitored the use of drugs in shortage more closely to ensure optimal use for patients in the greatest need. While these steps are part of good operating practices, the frequency, duration, and number of drugs in shortage amounted to a continual challenge for operations management, and also reduced the time physicians could spend on patient care. Interviewees also noted that staff efforts focused mostly on sourcing for additional supply to ensure availability, as this required more-intensive effort.

Figure 10. Actions Taken to Continue Caring for Patients in Light of Drug Shortages (FYs 2015 – 2017)



Source: 2018 AHA-FAH-ASHP Drug Survey

Figure 11. Additional Acquisition Efforts Taken by Hospitals to Continue to Provide Care for Patients (FYs 2015 – 2017)



Source: 2018 AHA-FAH Drug Survey

Information Technology: The intensive communication and revision of prescribing practices also require the health information technology that supports patient care (e.g., EHRs and dispensing) to be continuously updated to reflect the current shortage situation, which often changes on a daily basis. For example, IT teams are responsible for ensuring that timely automated shortage alerts and updates are delivered to clinical staff. At the point of prescribing, IT systems are continuously updated to deliver alerts to providers when the concentration or dose of a drug they prescribe changes in response to a shortage. "We have to change all of our IT systems to ensure that patients don't get the wrong dose, to ensure that nurses don't make mistakes, that the pharmacists don't make mistakes in dispensing, ultimately all to ensure patient safety," said one interviewee. All of these changes require continuous involvement of IT staff to ensure critical coordination.

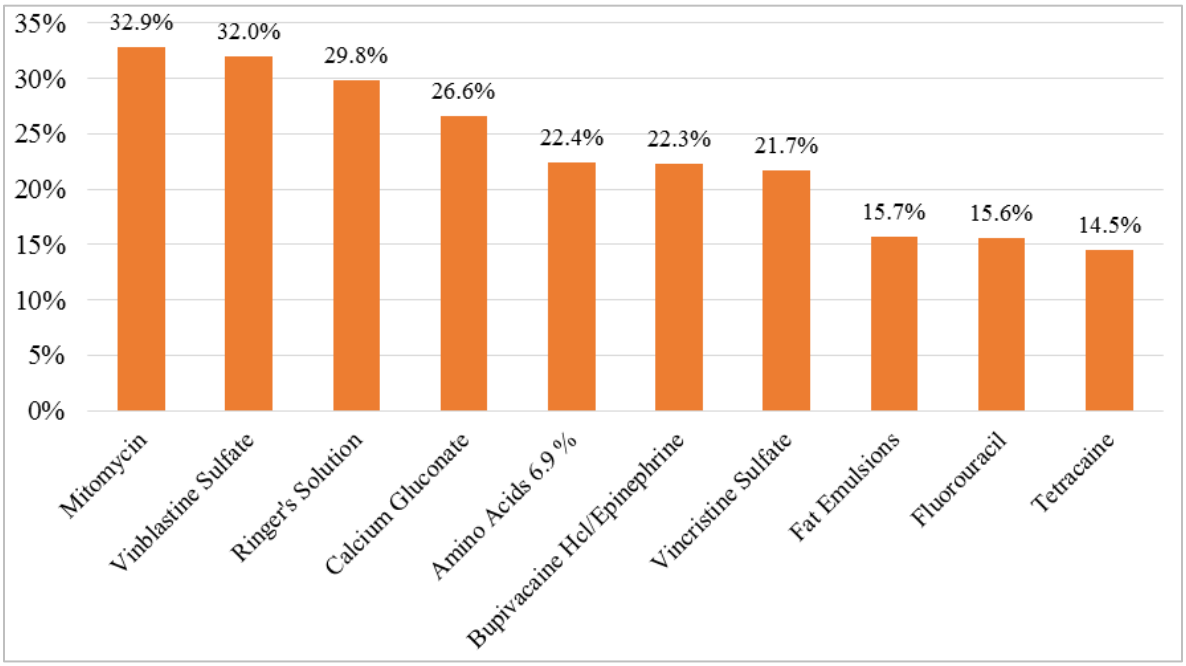
Role of Vendors: Several interviewees mentioned outsourcing to new vendors, including overseas vendors when approved by the FDA or using compounding vendors to address shortages. However, vendors from other countries can be costly and pose additional challenges. For example, drug labels may not contain an NDC or bar codes allowing unique identification and tracking. This requires the health care system to develop processes to attach bar codes or appropriate labels, requiring additional dedicated staff

hours and added cost to ensure that the right drugs are delivered to the right patients. Interviewees also mentioned attempting to develop and implement better analytics to predict shortages, but noted a significant lack of transparency among distributors, coupled with limited knowledge about when shortages would occur.

The views expressed by interviewees were consistent with what researchers have noted about the impact of drug shortages on health outcomes, pharmacy finances, and patient safety, especially among hospital pharmacies. The ASHP notes that medication errors are more likely to occur when "a pharmacy alters how a product is ordered, prepared, or dispensed or when prescribing practices change to less-familiar alternative agents, especially agents that are less efficacious, have a worse adverse-effect profile, or require an unusual or difficult dosing regimen."

Impact of Shortages on Drug Spending: The unit price of drugs experiencing shortages increased between CYs 2016 and 2017. We examined data for a selected set of drugs provided by the GPOs that were known to have recent shortages. Figure 12 shows the top 10 drugs with the highest percentage increase in average price per unit among those with a shortage in CYs 2016 or 2017. For those drugs that experienced shortages in CY 2016, there was an average per unit price change of 23.4 percent. While some drugs that were in shortage also experienced decreases in spending, declines in spending may reflect the extensive work hospitals undertake to find alternatives.

Figure 12. Top 10 Drugs with a Shortage in CY 2016, by Percent Increase in Unit Price between CYs 2016 – 2017

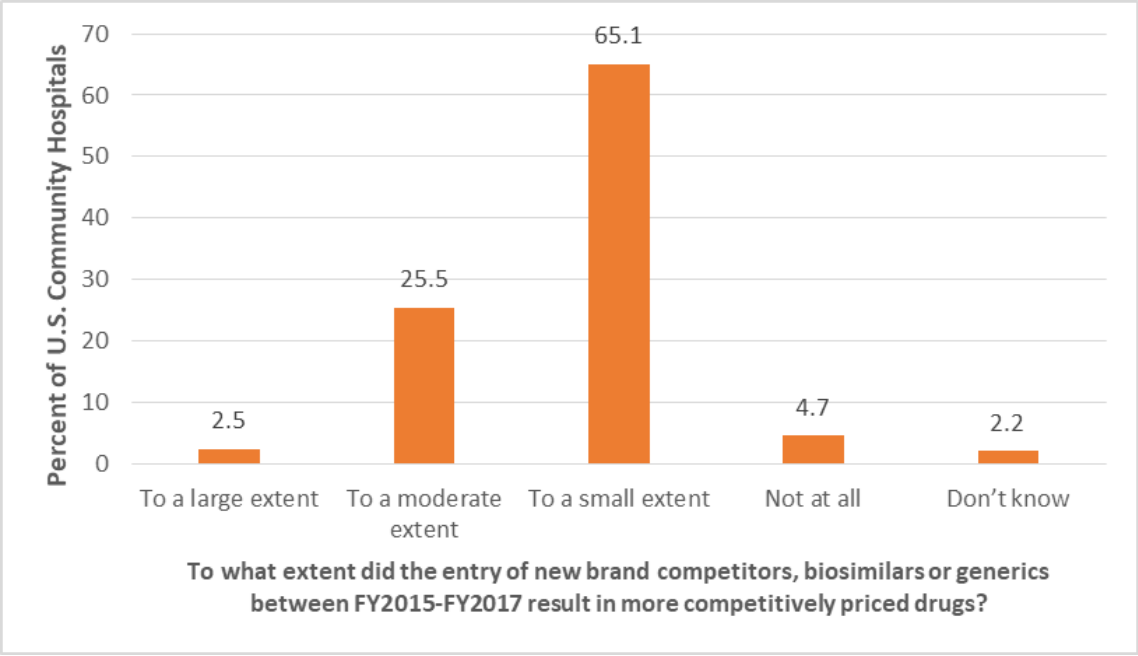


Source: GPO Rx Data

Entry of New Brand Competitors, Biosimilars, and Generics Had a Limited Impact on the Price of Drugs.

The majority of hospitals reported that competition from new entrants had a small impact on the price of drugs with about one-quarter of the hospitals reporting that competition from new entrants resulted in more competitively priced drugs to a "moderate" or "large extent" (Figure 13). For the top 10 drugs by total spending in CY 2017, we examined whether generic entry impacted the change in price between CYs 2015 and 2017, using the Orange and Purple Book.[15,16] Among these drugs, two had a generic or biosimilar competitor enter the market in 2016, and the average percent change for these two drugs was -4.1 percent. Among the eight without any competitor, the average percent change was 14.4 percent. Although most survey respondents felt generic entry had little impact, some interviewees conveyed that declines in brand-name prices upon generic entry may actually reflect a return to the price in effect beforehand. As discussed in the next section, brand manufacturers may raise prices in the months prior to a generic launch, and thus some "declines" in price may still reflect increases from a recent price point.

Figure 13. Extent to Which New Brand Competitors, Biosimilars or Generics Resulted in More Competitively Priced Drugs (FYs 2015 – 2017)



Source: 2018 AHA-FAH Drug Survey

[15] U.S. Food and Drug Administration. Orange Book: Approved Drug Products with Therapeutic Equivalence Evaluations. Available at https://www.accessdata.fda.gov/scripts/cder/ob/index.cfm

[16] U.S. Food and Drug Administration. Purple Book: Lists of Licensed Biological Products with Reference Product Exclusivity and Biosimilarity or Interchangeability Evaluations Available at https://www.fda.gov/Drugs/DevelopmentApprovalProcess/HowDrugsareDevelopedandApproved/ApprovalApplications/TherapeuticBiologicApplications/Biosimilars/ucm411418.htm

Our key informants saw promising potential for generic and biosimilar entry into the market as an opportunity for competition to reduce rising drug prices; however, they expressed practical concerns with whether this opportunity would be realized. First, interviewees explained, while additional manufacturers of a drug can lead to price reductions, brand manufacturers may raise prices in the months prior to generic launch, effectively counteracting the impact of the generic savings. A second point that was raised was concern for the ***overall lack of generic competition***. Responses from interviewees indicated concern that increasing consolidation and loss of manufacturers has led to a finite group of manufacturers cornering the market on price (and they also noted the precarious and consequential impact of the loss of manufacturers on shortages). A third concern, related to the previous point, focused on the need for faster regulatory approval of biosimilars, which play a substantial role in rising drugs costs and usually in critical shortage. While the FDA has sped up its approval process for generics and biosimilars, interviewees believed the FDA still lacked the capacity to keep pace with approvals for Abbreviated New Drug Applications (ANDAs) for the biologics to enable competition. Additionally, some interviewees noted that, while faster FDA approval is needed, it is just as critical to allow these newly approved drugs to be brought to market much more quickly. For example, there were 5 biosimilars approved in the US in 2017, but only one launched in 2017. While the interviewees acknowledged that many new drugs are extremely beneficial, (e.g., anti-neoplastics, drugs for oncology, and anti-retrovirals), the limited supply and extremely high prices strains hospital budgets. These very costly drugs can almost eliminate any savings accrued through the purchase of generics, as one interviewee commented, "*all these [new biologics]… basically wipe out a lot of the savings that we see in the generics."*

"It's great that the generic came on the market, but [the] price is what you were paying just the previous year. We changed the foundation of where those prices were, and really they're still much above where they were 3, 4, 5 years ago."

"What we have seen is that older products introduced by generic manufacturers often have increased prices because nobody is making them. A lack of manufacturers in the marketplace seems to be driving up drug costs that, coupled with the introduction of a biologic medication and lack of access to biosimilar…"

CONCLUSIONS

This study examined changes in hospital and health system spending on drugs nationwide, including how prices impacted spending. It also examined the consequences drug shortages on hospital operations and care, and whether price competition from new market entrants mitigated any pressure on hospital drug budgets. Key findings show that:

- Hospitals and health systems continue to experience high annual growth in drug spending that far exceeds medical inflation and Medicare payment updates.
- Spending on drugs used in outpatient settings increased substantially during this period.
- Large increases in drug shortages and drug prices have significantly impacted hospitals' and health system's ability to manage drug spending. Hospitals have had to take several measures ranging from identifying alternative therapies, reducing staffing, and delaying investments to ensure continued access to medications for their patients.
- Hospitals and health systems found it extremely challenging to obtain many commonly prescribed, often life-saving drugs due to product shortages between FYs 2015 – 2017.
- Drug shortages have led to increased drug spending, as well as other operational expenses. Hospitals and health systems have had to make many adjustments to their contracting, procurement, and drug dispensing protocols to ensure the availability of drugs for their patients.
- When asked what they would tell policy-makers are the root causes of rising drug prices, and how policy-makers could help contain rising drug prices, interviewees indicated much room for improvement in the "value-added" of new drugs. They noted that prices should reflect the added cost-benefit for morbidity or mortality relative to existing drugs; called for more evidence from manufacturers on the comparative effectiveness of new drugs; and suggested increased scrutiny of new drugs to validate the need for substantive clinical trial data.
- Interviewees also raised substantial concerns about the lack of transparency in pharmaceutical pricing.

Limitations

The conclusions of this study should be considered in the context of the following limitations:

- The information on total spending for inpatient drugs between FYs 2015 and 2017 gathered from the Drug Survey was self-reported.
- Although the survey solicited responses from individual hospitals, some hospitals systems reported aggregate information for the entire system. The analysis took such responses into account where it was readily evident that the response was at the system level.
- Not all hospitals participate in GPOs, which allow hospitals to consolidate their collective purchasing power. As such, the GPO data may not be reflective of the experience of all hospitals.

APPENDIX

Table A1. Hospital Spending (in $Millions) and Percent Change in Price per Unit between CYs 2015 and 2017 for Drugs with the Highest Spending in CY 2017

Generic name	Total Spending CY 2017 ($)	Unit Price CY 2015 ($)	Unit Price CY 2016 ($)	Unit Price CY 2017 ($)	Percent Change in Unit Price (CYs 2015 – 2017)	Percent Change in Unit Price (CYs 2016 – 2017)
Activase(alteplase)	210,331,400	3,487	3,937	4,143	18.8%	5.2%
Remicade (infliximab)*	138,164,951	850	902	908	6.8%	0.6%
Humira (adalimumab)*	121,675,746	2,346	2,804	2,840	21.0%	1.3%
Rituxan (rituximab)*	92,048,393	2,726	2,520	2,735	0.3%	8.5%
Neulasta (pegfilgrastim)	91,509,987	4,094	4,525	4,883	19.3%	7.9%
Prolia (denosumab)*	85,232,071	1,263	1,379	1,453	15.0%	5.4%
Harvoni (ledipasvir/sofosbuvir)	82,977,291	25,225	21,071	21,434	-15.0%	1.7%
Procrit (epoetin alfa)*	79,800,516	178	194	209	16.9%	7.4%
Lexiscan (regadenoson)	64,282,480	206	206	207	0.4%	0.2%
Enbrel (etanercept)†	60,418,494	2,543	2,803	2,931	15.3%	4.6%

† The biosimilar for Enbrel is not available for purchase due to an ongoing legal dispute
* Indicates that the medication is an orphan drug and thus receives additional patent protections under the Orphan Drug Act
Source: GPO Rx Data

Table A2. Hospital Spending (in $Millions) and Percent Change in Price per Unit between CYs 2015 and 2017 (for drugs with total CY 2017 spending > $1M)

Generic name	Total Spending CY 2015 ($)	Total Spending CY 2017 ($)	Unit Price CY 2015 ($)	Unit Price CY 2017 ($)	Percent Change in Unit Price (CYs 2015 – 2017)
Hydromorphone HCl/PF	1,513,074	1,045,366	12	25	107.2%
Mitomycin	2,830,485	8,368,390	322	639	98.5%
Vasostrict (vasopressin)	15,864,230	57,490,531	69	136	97.1%
Ephedrine sulfate	14,544,493	17,315,858	18	33	86.7%
Phenylephrine HCl	6,475,361	9,762,953	9	14	65.1%
Pegaspargase	14,945,934	15,780,289	8371	13813	65.0%
Succinylcholine	14,516,708	18,339,378	11	18	54.0%
Brevibloc (esmolol HCl)	7,094,816	13,998,212	59	89	52.8%
Dextrose	7,032,352	11,930,703	9	13	52.4%
Penicillin G benzathine	6,821,663	9,955,032	93	141	51.5%

Source: GPO Rx Data

Table A3. Top 10 Drugs with a Shortage in CY 2016, by Percent Increase in Unit Price between CYs 2016 – 2017

Generic name	Total Spending CY 2016 ($)	Total Spending CY 2017($)	Unit Price CY 2016 ($)	Unit Price CY 2017 ($)	Percent Change in Price per Unit (CYs 2016 – 2017)
Mitomycin	12,627,820	5,324,292	481	639	32.9%
Vinblastine Sulfate	843,079	88,354	31	41	32.0%
Ringer's Solution	9,007	10,749	4	5	29.8%
Calcium Gluconate	17,800,203	2,783,250	214	270	26.6%
Amino Acids 6.9 %	35,692	383	313	383	22.4%
Bupivacaine Hcl/Epinephrine	5,360,564	116,312	90	110	22.3%
Vincristine Sulfate	1,569,892	161,096	8	10	21.7%
Fat Emulsions	11,563,442	1,416,842	174	201	15.7%
Fluorouracil	631,596	761,645	9	10	15.6%
Tetracaine	575	146	23	27	14.5%

Source: GPO Rx Data

Table A4. Glossary

Generic Name	Therapeutic Class	Medical Use	Shortage Reported	Any Generic Competition
Adalimumab	Disease-modifying Antirheumatic Drugs	Used to treat inflammatory conditions like rheumatoid arthritis, plaque psoriasis and others.		Y
Alteplase	thrombolytic drug	used to treat acute myocardial infarctions and other severe conditions caused by blood clotting by breaking up the blood clots that cause them		y
Amino Acids 6.9%	-	Used to prevent nitrogen loss or treat negative nitrogen balance in adults.		Y
Brevibloc (Esmolol HCl)	beta-Adrenergic Blocking Agents	Temporary control of ventricular rate in patients with supraventricular tachycardia (e.g. atrial flutter, atrial tachycardia etc.).		Y
Bupivacaine	Local anesthetics	Used as a local anesthetic.		Y

Calcium Gluconate	-	Used to treat conditions arising from calcium deficiencies such as hypocalcemic tetany, hypocalcemia related to hypoparathyrodism, and hypocalcemia due to rapid growth or pregnancy.		
Denosumab	Bone Resorption Inhibitors	Used to treat osteoporosis in postmenopausal women who have high risk of bone fracture. Also used to increase bone mass in women and men with high risk of bone fracture caused by receiving treatments for certain types of cancer.		Y
Dextrose	Caloric Agents	Used as parenteral source of calories and water for nutrition and hydration.	Y	Y
Ephedrine sulfate	alpha- and beta-Adrenergic Agonists	Used parenterally for treatment of hypotension in setting of anesthesia.		Y
Epinephrine	Alpha and beta adrenergic agonists	Used in severe acute anaphylactic reactions and shocks	Y	
Epoetin alfa	Hematopoietic Agents	Used to treat anemia caused by chemotherapy or chronic kidney disease or anemia caused by taking zidovudine (to treat HIV).		Y
Etanercept	Disease-modifying Antirheumatic Drugs	Used to treat rheumatoid arthritis and to prevent joint damage caused by these conditions. Etanercept is also used to treat poly-articular juvenile idiopathic arthritis in children aged 2 years and above.		Y
Fat Emulsions		Source of calories and essential fatty acids for patients requiring parenteral nutrition for extended periods of time (usually more than 5 days) and as a source of essential fatty acids for prevention of Essential Fatty Acid Deficiency.		
Fluorouracil	Antineoplastic Agents	Used to treat cancer of the colon, rectum, breast, stomach or pancreas.	Y	Y
Hydromorphone HCL/PF	Opiate Agonists	Used to treat moderate to severe pain.		

Infliximab(Remicade)	Disease-modifying Antirheumatic Drugs	Used to treat inflammatory conditions like rheumatoid arthritis, plaque psoriasis and others. Infliximab is often used when other medicines have not been effective.		Y
Ledipasvir/Sofosbuvir	HCV Replication Complex Inhibitors	Used to prevent Hepatitis C virus from multiplying in body, sometimes also used in people who also have HIV.		
Mitomycin	Antineoplastic Agents	Used in combination with other cancer medications to treat cancer of the stomach and pancreas.		Y
Opioid Injectable	Opioid injectables	Used for acute, acute-on-chronic, or chronic pain that cannot be controlled by other pain management options.		
Pegaspargase	Antineoplastic Agents	Component of combination chemotherapy for treatment of Acute Lymphocytic Leukemia in patients who are hypersensitive to native (no conjugated) forms of asparaginase.		
Pegfilgrastim	Hematopoietic Agents	Used to prevent neutropenia (a lack of certain white blood cells) that is caused by receiving chemotherapy.		Y
Penicillin G benzathine	Antibiotic	Used to treat many different types of severe infections including strep infections, rheumatic fever, and syphilis.	Y	Y
Phenylephrine HCL	alpha-Adrenergic Agonists	Used parenterally to increase BP due to vasodilation during anesthesia.		Y
Regadenoson	Cardiac Function	Given in preparation for a radiologic (x-ray) examination of blood flow through the heart to test for coronary artery disease.		
Ringer's solution	-	Use in adults and pediatric patients as a source of electrolytes and water for hydration.		
Rituximab	Antineoplastic Agents	Used to treat growth and spread of cancer cells in the body.		
Saline	-	Used to clean out Intravenous catheter and other purposes.	Y	

Sodium bicarbonate	Alkalinizing agent	Used as alkalinizing agent for oral or parenteral therapy.	Y	Y
Sterile water	-	Used for drug diluent	Y	Y
Succinylcholine	Neuromuscular Blocking Agents	Skeletal muscle relaxation during procedures of short duration (e.g. Endotracheal intubation) after general anesthesia has been induced; neuromuscular blocking agent of choice for procedures lasting <3 minutes.	Y	Y
Tetracaine	Local Anesthetics	Used to numb the eye.	Y	Y
Vasopressin	Pituitary	Used to treat diabetes insipidus, treat or prevent certain conditions of the stomach after surgery or during abdominal x-rays.		Y
Vinblastine Sulfate	Antineoplastic Agents	Used to treat Hodgkin's disease, certain types of lymphoma, testicular cancer, breast cancer, choriocarcinoma, Kaposi's sarcoma and Letterer-Siwe disease.	Y	Y
Vincristine Sulfate	Antineoplastic Agents	Used to treat leukemia, Hodgkin's disease, non-Hodgkin's lymphoma, rhabdomyosarcoma, neuroblastoma and Wilms' tumor.		Y
Zepatier (Elbasvir and Grazoprevir)	HCV Replication Complex Inhibitors	Used for treatment of chronic HCV genotype 1 or genotype 4 infection in previously untreated or previously treated adults including those with compensated liver disease(with or without cirrhosis) and those with HIV coinfection.		