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An Analysis of Price Effects from Drug Shortages for Independent Pharmacies *and the Potential Role of Drug Buying Groups**

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Introduction

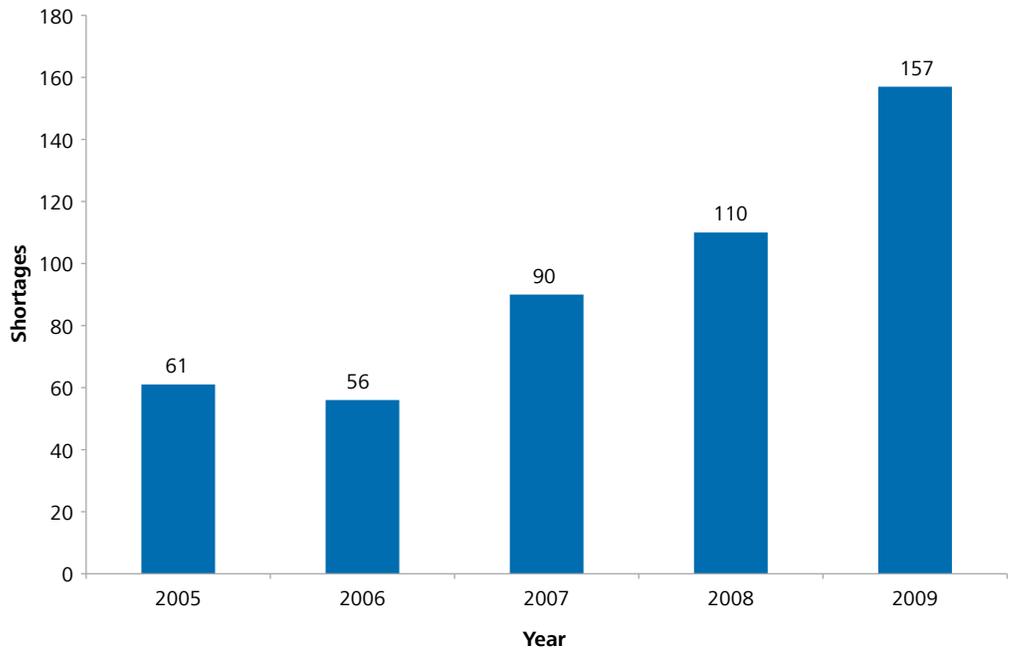
Drug shortages have been occurring with increasing frequency in recent years. Adverse consequences of drug shortages include medical complications and higher prices. This study analyzes seven drugs that experienced supply disruptions and examines the effect on prices and supply, including the specific effect on independent pharmacies. In the examples reviewed, one or more manufacturers stopped or sharply reduced production, which I define as a drug shortage for this paper. In many of the examples I reviewed, the shortage coincided with an increase in supply by other manufacturers. Given inelastic demand for prescription pharmaceuticals, the shifts in the production mix were usually associated with sharp price increases,¹ which appear even more pronounced for independent pharmacies. If the number of shortages continues to increase over time, some evidence indicates that the strength and scale of large buyer groups, particularly those managed by large wholesalers, may provide independent pharmacies some protection from the effects of shortages, including sharper relative price increases.

This paper begins with an examination of the frequency of drug shortages and discusses some of the potential effects on medical outcomes and the average effect on prices for the seven drugs I analyzed. This is followed by a look at some potential causes for drug shortages. The paper then examines in detail one of the seven drugs to demonstrate how sharply overall and independent pharmacy prices can react to shifts in supply. Finally, the paper concludes with a discussion of the importance of buying groups and networks to independent pharmacies and a potential role they may have in protecting independent pharmacies.

The Frequency and Potential Effect of Shortages

Between 2005 and 2010, the number of shortages reported annually has grown. Respondents to a survey conducted by the Institute for Safe Medical Practices (ISMP) in 2010 stated that “the conditions associated with drug shortages in the past year have been the worst ever.”² This observation is supported by the number of drug shortages reported by the FDA (see Figure 1) and by the American Society of Health-System Pharmacists (ASHP) (see Figure 2 for all products and Figure 3 for oral products only).³

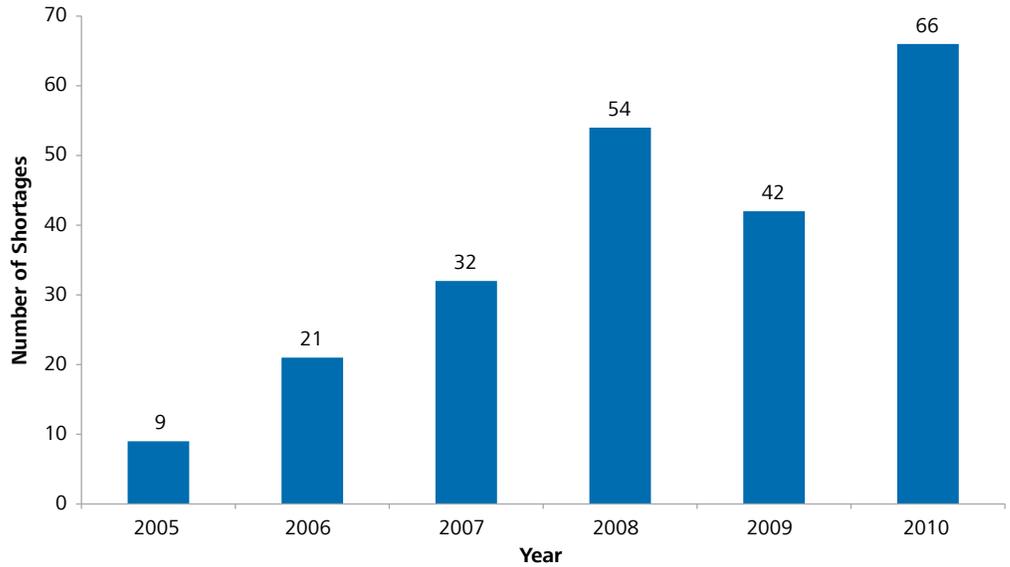
Figure 1. **Number of Resolved Drug Shortages (FDA Database)**
2005 – 2009



Note: Figure 1 does not include vaccines, immune globulin products, and other biologic products.

Source: Jensen and Rappaport. "The Reality of Drug Shortages - The Case of the Injectable Agent Propofol." *New England of Journal Medicine* (2010).

Figure 2. **Number of Reported Resolved Drug Shortages (ASHP Database)**
2005 – 2010¹

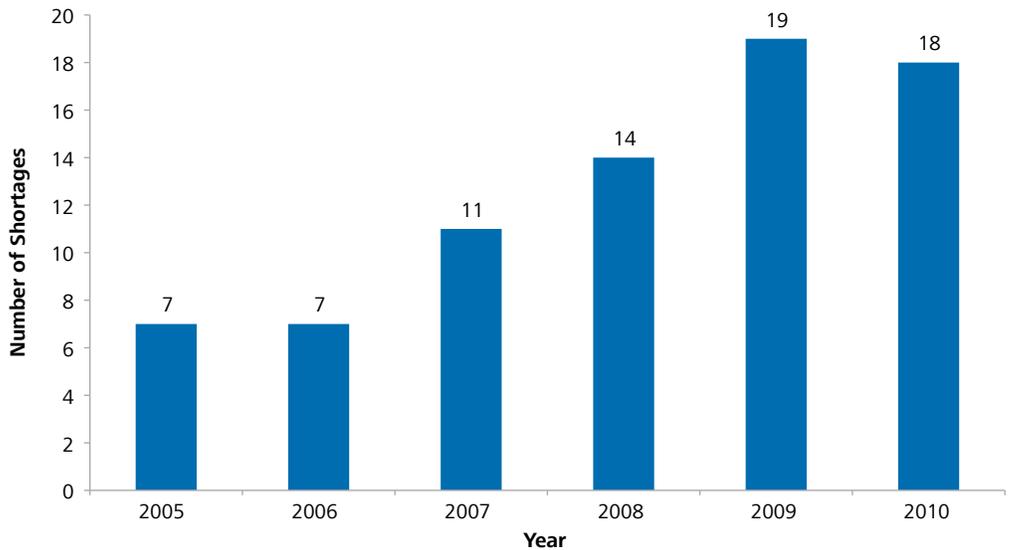


Note: Figure 2 includes only shortages in the ASHP database. Drug shortages in the ASHP database are self-reported by hospital staff. Reporting patterns may change over time; therefore, the data may reflect a change in reporting patterns rather than a growth in shortages. Due to self reporting, the ASHP database may not be comprehensive.

¹ Number of Shortages in 2010 are annualized.

Source: American Society of Health-System Pharmacists Resolved Drug Shortages, accessed 2 September 2010.

Figure 3. **Number of Reported Resolved Oral Drug Shortages (ASHP Database)**
2005 – 2010¹



Note: Figure 3 includes only shortages in the ASHP database. Drug shortages in the ASHP database are self-reported by hospital staff. Reporting patterns may change over time; therefore, the data may reflect a change in reporting patterns rather than a growth in shortages. Due to self reporting, the ASHP database may not be comprehensive.

¹ Number of Shortages in 2010 are annualized.

Source: American Society of Health-System Pharmacists Resolved Drug Shortages, accessed 2 September 2010.

Drug shortages can cause adverse patient outcomes; about 20 percent of respondents in the ISMP survey reported adverse patient outcomes due to drug shortages in 2010 for a variety of reasons. In some situations, alternative medications are not available. For example, shortages of amikacin and acyclovir contributed to patient deaths from diseases that were treatable with only these drugs. In other situations, alternative medications are available; however, they are imperfect substitutes. Alternative drugs can have lower efficacy and more severe side effects. According to the ISMP survey, alternative agents used in place of propofol for deep sedation have resulted in higher incidences of agitation and self-extubation in ventilated patients, which can lead to longer hospital stays. Additionally, the supply of substitute products may be affected at the same time. For example, ISMP reports that HYDROMORPHINE, an alternative to morphine, joined morphine on the shortage list. Finally, using an alternative drug with which physicians and nurses may be unfamiliar may increase the risk of an error or adverse outcome.

In addition to serious patient outcomes, shortages can result in large price increases for pharmacies (and in some cases even larger price increases for independent pharmacies), and consumers. With assistance from a large wholesaler, I identified seven examples of shortage drugs that would likely exhibit price increases. I examined data on prices and volume to demonstrate the effects that could result. The examples included ciprofloxacin HCl film-coated tablets, doxazosin tablets, gemfibrozil tablets, morphine sulfate sustained-action tablets, nitroglycerin sublingual tablets, oxycodone HCl tablets, and selegiline HCl tablets. For these drugs, the shortages and associated price increases occurred in 2009 and 2010. I looked at the “peak” price after the shortage, defined as the highest average monthly price following the shortage, and measured the price increase as the difference between the peak price and the pre-shortage price. Of the seven examples, I identified clear price increases for six but could not identify a clear price increase associated with the shortage of morphine sulfate.

Table 1 shows the price increase faced by independent pharmacies compared to other channels for the seven examples I examined. In four of the six cases where a clear price increase could be detected, the independent channel experienced significantly sharper price increases between the pre-shortage price and the peak price after the shortage.⁴ Even for morphine, for which I could not detect an overall increase in price resulting from the shortage, the independent channel price shifted up compared to the price in other channels over time. These examples may suggest that independent pharmacies fare worse than other channels in the face of supply disruptions.

Table 1 shows that prices can more than double during the supply disruption. For example, Cipro prices more than tripled for other channels and more than quadrupled for independent pharmacies. The price increases for Doxazosin, Nitroglycerin, and Selegiline were even greater.⁵

Table 1. **Price Increases to Independent Pharmacies Compared to Other Channels**

Molecule	Price Increase ¹	
	Independent Pharmacies	Other Pharmacies
Ciprofloxacin Hcl	334%	232%
Doxazosin	456	581
Gemfibrozil	215	91
Morphine Sulfate	— ²	— ²
Nitroglycerin	373	508
Oxycodone Hcl	186	158
Selegiline Hcl	2,328	1,695

Notes: Products analyzed include 500 mg ciprofloxacin Hcl film-coated tablets, 4 mg doxazosin tablets, 600 mg gemfibrozil tablets, 15 mg morphine sulfate sustained-action tablets, 0.4 mg nitroglycerin sublingual tablets, 5 mg oxycodone Hcl tablets, and 5 mg selegiline Hcl tablets.

All peak shortage prices occurred in 2009 and 2010.

¹ The price increase is the difference between the peak price post shortage and the pre shortage price.

² There was no clear price increase associated with the shortage of morphine sulfate.

Source: IMS Health Prescription Audit.

The Potential Causes and Effects of Shortages

Table 2 shows the causes of shortages reported in the ASHP database for all products and for oral medications only. Manufacturing causes were the most common overall as well as for oral drugs. Regulatory issues resulted in 15 percent of shortages overall, but were more important for oral drugs. A large share of causes fall into the “other” category, which includes raw material shortages and delays related to mergers and acquisitions.

Table 2. **Drug Shortages by Cause**
2005 – 2010

Cause	Shortages with Identified Causes		Share of Shortages with Identified Causes	
	All Drugs	Oral Drugs	All Drugs	Oral Drugs
Manufacturing problems	33	9	39%	30%
Recall	12	3	14	10
Regulatory issues	13	9	15	30
Other	26	9	31	30
Total	84	30	100%	100%

Source: American Society of Health-System Pharmacists Resolved Drug Shortages, accessed 2 September 2010.

Table 3 may help to explain why prices will rise after a shortage and why they may stay high even after volume recovers. If shortage suppliers charge lower prices than average, then prices are likely to stay high even after other producers replace missing volume. This will be even more likely if the volume is replaced by marginal suppliers who had previously been priced out of the market. Table 3 shows that shortage suppliers did charge lower prices than average in four out of six cases. At the individual producer level, of the shortages examined, 12 out of 15 shortage suppliers charged lower prices than other suppliers before the shortage.

Table 3. **Pre-Shortage Average Price of Shortage Suppliers and Other Suppliers**
September 2004 – August 2010

Product (a)	Shortage Suppliers' Average Price (b)	Other Suppliers' Average Price (c)	Difference Share (d) [[c)-(b)]/(b)]
Ciprofloxacin Hcl	\$0.105	\$0.128	18.0%
Doxazosin Mesy	0.051	0.239	78.8
Gemfibrozil	0.130	0.153	15.0
Morphine Sulf	0.219	0.268	18.4
Nitroglycerin	0.092	0.084	-10.4
Oxycodone Hcl	0.122	—	—
Selegiline Hcl	0.231	0.223	-3.7

Notes: Products analyzed include 500 mg ciprofloxacin Hcl film-coated tablets, 4 mg doxazosin tablets, 600 mg gemfibrozil tablets, 15 mg morphine sulfate sustained-action tablets, 0.4 mg nitroglycerin sublingual tablets, 5 mg oxycodone Hcl tablets, and 5 mg selegiline Hcl tablets. Average prices were calculated using data prior to the shortage price increase. There were insufficient data for other suppliers of oxycodone Hcl before the shortage price increase.

Source: IMS Health, National Prescription Audit, 2004-2010.

An Example of the Potential Effects of a Shortage from Oxycodone

I analyzed the effect of a decrease in supply by an individual supplier (which I refer to as a shortage) on prices overall and on the prices paid by independent pharmacies for seven drugs. These include the generic versions of ciprofloxacin, doxazosin, gemfibrozil, morphine, nitroglycerin, oxycodone, and selegiline. For most of these example drugs, while total volume did not fall because other manufacturers increased production to compensate, prices did rise sharply. Oxycodone provides an example of how a shortage can lead to both an increase in price and a significant reduction in supply for several months. As discussed above in Table 1, the independent channel experienced price increases that were in the same direction as, but were larger in magnitude than, the price changes in the other channels in four of the examples I examined.

Immediate release oxycodone tablets account for over 97 percent of all oxycodone Hcl sold, and the 5 mg dosage tablets accounted for over 34 percent of tablets sold. Over the last several years, total production of the drug has been growing sharply, doubling in the past five years. However, in February 2009, total supply of 5 mg tablets fell sharply as a result of a drop in supply from two producers. Figure 4 shows total volume and price broken out by channel between September 2004 and June 2010.

The decrease in supply corresponded with a six-fold increase in the price of 5 mg tablets, from under \$.03 cents to over \$0.18 cents. Total volume remained depressed from historical levels for about four months but eventually recovered and even continued its historical increase as a result of entry by several producers. While total volume appears to be on the same general trajectory that occurred before the supply disruptions and prices have come down to about \$0.10 cents per pill, they are still significantly higher than 2008 prices.

Figure 4 also shows that while independent pharmacies paid slightly more than other channels and experienced similar price movements before the supply disruption, they faced a sharper price increase after the shortage. The independent pharmacy price hit a peak of over \$0.23 cents per pill in March 2009, compared to about \$0.15 cents for other channels. Since the peak, the independent pharmacy price appears to have maintained a higher premium relative to other channels than before the shortage, even after total volume recovered. Thus, the supply disruption appears to have led to higher price spikes and a higher premium paid by independent pharmacies for several months.⁶

Figure 4. **Volume and Price of Oxycodone Hcl Generic 5 Mg Tablets to Independent Pharmacies and Other Channels**
September 2004 - August 2010



The Role of Buying Networks for Independent Pharmacies

Over the past several decades, independent pharmacies have been replaced by large pharmacy chains. In 1950, 92 percent of pharmacies were independently operated. This fell to only 64 percent by 1989.⁷ In the 1990s, a decline in insurance reimbursement rates placed additional pressure on independent pharmacies.⁸ Sales and profits have also declined. Average sales per location decreased 3.5 percent from 2005 to 2006, and in 2004 gross profit reached its lowest level in 10 years at 22.1 percent.⁹

In face of these mounting pressures, buying networks can assist independent pharmacies by providing them with many of the benefits that larger chain pharmacies enjoy, such as volume discounts, insurance contracts, and advertising, while allowing them to retain some autonomy.¹⁰ In 1988, more than half of all independent pharmacies participated in at least one buying group.¹¹

Pharmacy-led buying groups obtain lower prices for independent pharmacies through negotiations with wholesalers. They solicit lower cost bids and pass savings to their members, typically negotiating “cost-plus” contracts. Benji Wyatt, the CEO of Pace Alliance, a national network serving independent pharmacies, estimated that their members saved 36 percent on generics in 1989 relative to the amount they paid prior to joining Pace.¹² Ten years before Pace’s inception in 1985, independent pharmacies paid 6 percent over cost, while chain pharmacies paid 2 to 3 percent. In their first year of business, Pace was able to lower the cost for their members to 2 percent over cost.¹³ Most of these savings have come in the form of reduced generic drug costs. In general branded drug manufacturers have not participated in drug purchasing programs.¹⁴

In the late 1980s, independent networks organized by drug wholesalers began offering lower prices to compete with pharmacy-led buying groups.¹⁵ According to the head of the Pharmacy Buying Association, a Midwest buying group, “it’s become harder to show a big difference between our wholesale pricing and other programs the wholesaler has.”¹⁶

The three largest wholesale drug suppliers—AmerisourceBergen, Cardinal, and McKesson—all have their own independent networks, which have grown significantly in recent years. As of 2009, AmerisourceBergen’s Good Neighbor Pharmacy program enrolled over 3,700 independent pharmacies.¹⁷ McKesson’s Health Mart franchise program has grown nearly 600 percent in the past two years¹⁸ to 2,500 locations in 2010.¹⁹ Leader, a buying and marketing cooperative acquired by Cardinal in 1987, includes more than 3,300 independent pharmacies.²⁰ Cardinal will also serve an additional 2,000 independent pharmacies through its recent acquisition of Kinray.²¹

Wholesaler independent networks can offer independent pharmacies lower prices in return for pharmacy participation and loyalty. For example, the Good Neighbor Pharmacy offers independent pharmacies low prices on generics and negotiates directly with managed care plans for inclusion in third party networks if they are willing to commit to their procurement program.²² McKesson requires Health Mart pharmacies to have a “primary distribution relationship” with McKesson.²³

Independent networks can also offer independent pharmacies marketing and technology assistance.²⁴ Some programs offer advertising support, while others provide virtual scale to independent pharmacies when patients and doctors are looking for patients' pharmacy options. The scale of large wholesalers can lead to more efficient development of these services. For example, Good Neighbor Pharmacies receive membership in the SureScripts electronic prescribing initiative so that when a physician pulls up a patient's pharmacy options, an independent pharmacy can show up as the closest source; "it puts them at the table."²⁵ Independent pharmacies can also receive services to improve labelling and patient information. For example, Health Mart offers their pharmacists EnterpriseRx, a pharmacy management system, designed to improve patient safety.²⁶

Independent networks also enable members to purchase higher quality products because of wholesalers' relationships with pharmaceutical manufacturers. Large wholesalers are able to gather information that would be too expensive for an individual member to obtain and evaluate. Wholesalers have the scale and incentives to inspect manufacturing plants to anticipate potential production issues. For example, AmerisourceBergen spends time with manufacturers around the world to conduct site visits and meet with the managers of generic manufacturing plants. This is a role that can insulate independent pharmacies from manufacturers who experience supply disruptions and in some cases may lead to lower average prices. In a recent example, AmerisourceBergen decided to switch supply of product from one manufacturer to another based on inspections they had conducted. Shortly thereafter, the FDA took formal action and the plant stopped production. While this created a general shortage for the drug, customers of AmerisourceBergen did not experience supply disruptions and were insulated from increases in price. This is a service that independent pharmacies could not perform on their own.

Conclusion

With an increasing number of drug shortages and the potential for sharply higher prices faced by independent pharmacies, incentives to avoid shortages may be increasing. While shortage suppliers may provide some price discounts over the short-run, long-run prices might be much higher as a result of subsequent shortages and manufacturer exit. If wholesaler buying groups are able to guard against potential shortages through plant inspections and other quality guarantees, then participating in a wholesaler buying group may provide more than standard reductions in list price. The savings from avoiding a shortage could be substantial. Independent pharmacies might be tempted to buy product from shortage suppliers to get access to apparently lower prices. In addition to possibly exposing pharmacies to shortages (and associated price spikes), such decisions may also reduce such benefits as discounts and quality assurance over time to the extent they are based on total volume.

Notes

- * I would like to gratefully acknowledge the funding and helpful comments provided by Pfizer Inc. for this study.
- ¹ Even when total volume recovered, prices stayed above pre-shortage levels after the recovery.
 - ² "Drug Shortages: National Survey Reveals High Level of Frustration, Low Level of Safety," ISMP Medication Safety Alert! (2010).
 - ³ Note that the ASHP defines a drug shortage in its guidelines: "For the purpose of these guidelines, a drug product shortage is defined 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." See "ASHP Guidelines on Managing Drug Product Shortages in Hospitals and Health Systems" *American Journal of Health-System Pharmacists*, 2009; 66:1399-406. http://www.ashp.org/DocLibrary/Policy/DrugShortages/ASHP_shortage_guide09.pdf. The guidelines indicate that this definition is consistent with the definition I use in this report.
 - ⁴ For three of the six examples the percentage price increase was greater for independent pharmacies than for chain pharmacies.
 - ⁵ Average price is calculated as revenues divided by number of pills, rather than using the average price available in the IMS Health National Prescription Audit. If either revenues or number of pills is missing from a channel, the channel is excluded from the overall average price calculation.
 - ⁶ Note, the price increase in 2006 is also associated with a reduction in supply by one manufacturer.
 - ⁷ Stephen W. Schondelmeyer and Joseph Thomas III, "Trends in Retail Prescription Expenditures," Data Watch, *Health Affair*, Fall 1990.
 - ⁸ John M. Brooks, William Doucette, and Bernard Sorofnan, "Factors Affecting Bargaining Outcomes Between Pharmacies and Insurers," *HSR: Health Services Research* 34:1, April 1999, Part II.
 - ⁹ "Executive Summary," *NCPA-PfizerDigest*, 2007.
One source of pressure on pharmacies are regulatory changes. A proposal by CMS to publish the AMP, as well as proposals to change how it is calculated, could reduce pharmacy margins by lowering reimbursements and possibly raising prices. See e.g., http://www.fmi.org/newsletters/uploads/CommentsFiled/AMP_final_rule_response_1-08_final.pdf and <http://www.chaindrugreview.com/inside-this-issue/news/08-30-2010/cms-lays-groundwork-for-pharmacy-pricing-study>.
 - ¹⁰ M. William Salganik, "Pharmacy Network Grows," *The Baltimore Sun*, 6 May 1996.
 - ¹¹ Schondelmeyer and Thomas, 1990.
 - ¹² David Vaczek, "Buying Groups Seek New Role as Growth Ebbs," *Drug Store News*, 20 November 1989.
 - ¹³ Vaczek, 1989.
 - ¹⁴ Schondelmeyer and Thomas, 1990.
 - ¹⁵ Vaczek, 1989.
 - ¹⁶ Ibid.
 - ¹⁷ AmerisourceBergen 2009 Annual Report.
 - ¹⁸ <http://www.becomeahealthmart.com/program/program-faq.php>
 - ¹⁹ "Health Mart reaches 2,500 stores as it readies national ad campaign," *Drug Store News*, 27 January 2010.
 - ²⁰ <http://www.myleader.com/>
 - ²¹ "Cardinal Health To Acquire Kinray for \$1.3 Billion," Cardinal Health press release, 18 November 2010.
 - ²² "Good Neighbor Pharmacy leads retail mission," *Drug Store News*, 17 July 2006.
 - ²³ <http://www.becomeahealthmart.com/program/program-faq.php>
 - ²⁴ "Leader drug stores banner offers independents competitive foothold," *Drug Store News*, 3 November 2003.
 - ²⁵ "Good Neighbor Pharmacy leads retail mission," *Drug Store News*, 17 July 2006.
 - ²⁶ "Rx management platform debuts," *Chain Drug Review*, 20 April 2009.

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