Data We Don't Know if We Can Believe in? NCPA's Data Differs Greatly from the Number of Pharmacies Reported by NCPDP

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PCMA

Over the last several years, it has become increasingly apparent that there is a growing data discrepancy between reports that rely on data from the independent pharmacy advocate and lobbyist organization- the *National Community Pharmacists Association*'s (NCPA) and the pharmacy counts reported by the *National Council for Prescription Drug Programs* (NCPDP), a not-for-profit, ANSI-accredited organization with a mission to develop and promote industry standards to improve patient safety and health outcomes and decrease costs. [1] NCPDP is widely regarded as the gold standard for pharmacy data.

This difference is reflected in two competing narratives. On the one hand, NCPDP's data is used in high impact and respected peer-reviewed research journals (Guadamuz et al. 2020; Qato et al. 2017; Salako, Ullrich and Mueller 2018). These report a growing pharmacy industry in the 2010's, with growth in both chain and independent pharmacies. Strong growth reached a plateau in 2015 and began to stabilize, and slightly decline thereafter. There are of course many caveats and details in these papers, that include the growth of pharmacies, and also the traits of pharmacies that closed during the growth cycle.[2] The details and complexity are often lost in on-line blogs. In total there are more pharmacies today than a decade ago, both chain and independent, but of those existing pharmacies that closed in this time period, more are rural and low-income serving. For independents, this may be for a host of reasons, including sale to chain, retirement, changing demographics and customer base, profitability, independent owners purchasing more stores, thus being redefined as a chain, and so forth. For chains, closures also often occur based on profitability, proximity to other stores in the chain, changing demographics and customer base, and consolidating older stores into more centrally located new stores, among other reasons.

On the other hand, NCPA's reports and data are used largely in on-line articles, blogs and op-eds by NCPA and other independent pharmacy advocates. These reports are not peer-reviewed, the data is not made public, nor is there a detailed explanation on how is it collected. With regards to pharmacy numbers, in contrast to reports that use NCPDP data, NCPA data (NCPA Digest 2011-2020) is often used to claim the number of independent pharmacies in the United States is in steep decline (e.g., Appold 2019; Blank 2019).

In a prior report "Independent Pharmacies in the U.S. are More on the Rise than on the Decline" I explored the thesis put forth by these online reports and found claims that independent pharmacies in the United States are in steep decline or that independent pharmacies are overall faring worse than chain pharmacies, were not supported by the data. But rather, similar to peer-reviewed research, overall pharmacy growth has been positive, and what decline or tapering off was occurring after a longer growth cycle, looked to be affecting chains as much if not more than independent pharmacies. Using data from NCPDP (cleaned by Quest), from 2010-2019, the number of independent pharmacies *increased* by over 2,600 pharmacies (~13%), whereas chains

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[1] NCPDP's primary focus is on information exchange for prescribing, dispensing, monitoring, managing and paying for medications and pharmacy services essential to quality healthcare. NCPDP standards are named in federal legislation, including HIPAA, MMA, HITECH and Meaningful Use (MU).

[2] For example, Guadamuz et al 2020 found that "From 2009 to 2015, the total number of US pharmacies increased by 7.8%" and both chains and independents grew, but of those pharmacies that closed, independent pharmacies serving disproportionately low-income and uninsured populations were more likely to close than their counterparts, even though in the end both chain and independent pharmacies enjoyed a net gain. Salako, Ullrich and Mueller (2018) went into greater detail in rural areas, finding that between January 2009 and March 2018, rural independent pharmacies dropped from 6,853 to 6,393.

lost around 80 pharmacies (0.2%). There was a decrease in all pharmacies from 2016-2019 (still above 2010 levels), but of those,1,583 were chains, whereas independents lost only 83 pharmacies by comparison (Hatemi 2020).

One discovery was that NCPA reported far fewer independent pharmacies in total than what NCPDP reported. For example, NCPDP reported 22,989 independent pharmacies in 2017 and 23,144 in 2016 (these numbers were similar to peer reviewed published papers (see Guadamuz et al 2019); whereas NCPA reported only 21,275 and 21,398 independent pharmacies respectively (Firozi 2018, also see the 2018 and 2017 published NCPA Digest). In other words, in those years, *NCPA claimed there were 1,000 fewer independent pharmacies than NCPDP reported.* IQVIA also did not show the decline in the number of independent pharmacies that NCPA claimed. Regarding the total number of independent pharmacies NCPA reported, as *Drug Channels*' Adam Fein put it, "IQVIA data show much more stability in overall independent pharmacy numbers. I can't figure out the discrepancy" (Fein 2019).

After distribution of the report I received a number of questions about NCPA's data by a score of people and organizations, including PCMA who had requested the original analysis: "Why are NCPA's data different?" "Is it just independent pharmacies?" Is this data discrepancy widespread or only for those two years?" and so forth. These questions were not within the scope of the original report, and therefore were unaddressed in that report. In addition, the data I used was from NCPDP, cleaned by Quest, and purchased by PCMA. Therefore, since I did not explore or have access to NCPA's data or methodology, I could not answer questions about their data. Nevertheless, these questions remained of great interest to many for obvious reasons. If policy discussions are relying on data that is not consistent with reported pharmacy counts, or data that is using a different metric to count pharmacies or types, then this is important to identify. Analyses may differ, perspectives may differ, but the raw data should not differ so greatly. If it does, then at the very least all results from these two different sources must be reconciled so they can be correctly compared and interpreted.

This current report seeks to shed light on these questions and contains two sections.

1) A comparison of the data sources, availability and transparency between NCPDP and NCPA

2) A numerical comparison of NCPDP's and NCPA's data focusing on the number of active pharmacies by state, type and year from 2010-2020

1. Where does NCPDP's and NCPA's data come from?

National Council for Prescription Drug Programs (NCPDP) data:

NCPDP updates their pharmacy count data daily based on activity from the NCPDP number. This is a unique identifier assigned to every licensed pharmacy critical for pharmacy operations, processing prescription claims and interactions with payers and claims processors. Near every licensed pharmacy and *qualified* non-pharmacy dispensing site (NPDS) in the United States is assigned an NCPDP number (personal interview with NCPDP). These data provide detailed information regarding each active community pharmacy in the United States. The data are also internally validated by NCPDP and reminders are sent to the pharmacies when information needs review, for example when license expirations are approaching. To a pharmacy, their NCPDP number is as valuable as a social security number is to a person. Not only does it contain vital

information about one's pharmacy over the years, but maintaining a pharmacy's NCPDP information is necessary for proper reimbursement, especially for many third-party plans. In this way, pharmacies have the strongest incentive possible to keep their information up-to-date; it is tied to their revenue stream. As NCPDP put it "It goes hand in hand with the National Provider Identifier (NPI) number." When I contacted NCPDP to obtain additional insight beyond what was available through their online documentation into exactly how and when they obtain their pharmacy data, their representative, who had owned two independent pharmacies in the past, said, "I still remember my NCPDP number from more than a decade ago. Keeping one's NCPDP information up to date, is even more important for pharmacies today than it ever has been." This is true, because it is how pharmacies get paid, how PBM's interact with the pharmacy and it provides information that exist nowhere else. There is simply no better source for pharmacy information as pharmacies have a lot invested in maintaining their NCPDP information.

National Community Pharmacists Association's (NCPA) data:

The level of transparency is remarkably different regarding NCPA's data. In most respects the nature of the NCPA data is impenetrable. I could find no means to download or purchase NCPA's data, with one exception. Every year they publish the NCPA Digest in pdf form which contains a map of the US; the number of pharmacies by type in each state are placed in that map. Using the NCPA Digest maps, their data was manually entered into a spreadsheet.

When attempting to locate the source of the data, I found two descriptions, both in the NCPA Digest. The first data description reads:

> "Independent community pharmacy owners who have completed at least one full year of operations were invited to participate in this study. Pharmacy owners or their designees were asked to complete the surveys. NCPA has exercised the utmost professional care in compiling the information received. While we have tested the information for clerical accuracy, the data supplied were not necessarily based on audited financial statements. NCPA does not make any assurances, representations, or warranties with respect to the data upon which the contents of this report were based. The information is provided for general education and information purposes only and is not an endorsement or recommendation by Cardinal Health or NCPA or any of the featured products or services. Although the content is based on reliable sources, the sources have not been fully examined or updated. Thus, neither Cardinal Health nor NCPA warrant that the information presented is accurate, current, or applicable for a particular use and accepts no responsibility or liability with respect to such information. The information on which the 2019 portion of the study is based was from the calendar year of Jan. 1, 2019 through Dec. 31, 2019. Results from prior issues of the Digest have been incorporated with the 2019 results to facilitate assessing industry trends."

This description contains limited sampling frame details, no overall response rates or survey closing dates, or complete sample size among other important details.

NCPA also does not clearly describe in specific terms how they define "chain" or "independent" pharmacies. What terms they do offer are vague and also change over the years.

In the 2011-2013 Digests, NCPA states:

> "Independent community pharmacies are all privately held small businesses, but they vary in practice setting. They include single-store operations and other independent, pharmacist-owned, operations such as regional chain, franchise, compounding, long-term care (LTC), specialty, and supermarket pharmacies."

In this definition then, an NCPA independent pharmacy can be a chain, franchised chain, supermarket, long term care facility, or independent, pharmacist-owned pharmacy.

In the 2014-2019 Digests, NCPA states:

> "Independent community pharmacies are all privately held small businesses, but they vary in practice setting (organization was used instead of practice setting in 2016). They include single and multiple store operations, regional chains, and franchises."

This definition differs from the prior years in that an NCPA independent pharmacy can be a chain, franchised chain, or independent, pharmacist-owned pharmacy, but supermarket and long term care facilities are no longer included.

In the 2020 Digest, NCPA states:

> "Independent community pharmacies are all privately held small businesses, but they vary in practice setting. They include single and multiple store operations."

This definition differs again. Here NCPA removed chain and franchises from the 2014-2019 definitions.

Overall, NCPA's definitions are inconsistent and vague. In essence an independent pharmacy in NCPA's words, can basically be any pharmacy they choose to include up until 2019, depending on the year.

NCPDP in contrast provides explicit information on the source of the data, how it is collected and critical definitions that are reflected in hard numbers. For example, NCPDP defines independents as those that own 3 or fewer pharmacies including franchisees, while chains are classified as part of a group with four or more pharmacy locations with common ownership. Such clear definitions from NCPDP allow for replication and comparison and are consistent for comparison across time.

NCPA's disclaimer that it gives no assurances that their data is accurate is also problematic. Most would argue that this description of NCPA's data does not meet today's peer-review standards for data transparency or standards for replication as it does not allow the ability to reconcile data differences or offer confidence in the data (AbouZahr, Adjei and Kanchanachitra 2007; Christensen and Miguel 2018; Iqbal et al. 2016).

There is a second brief description under the map of pharmacy numbers: "Source: NCPA analysis of NCPDP data and NCPA research". This implies that NCPA also uses NCPDP's data to some degree but then modifies it somehow.

I emailed NCPA for further information. Specifically, I inquired as to where the data comes from, why it is different than NCPDP, how they explicitly define chain and independents and so forth. That is, I asked what the exact inclusion criteria are and for assistance in how to reconcile the differences between NCPDP's and NCPA's data. Excerpts of the email correspondence can be found in Appendix A.

I received the following short reply, which echoed back part of my initial query to NCPA, but no other information after an additional attempt.

> "NCPA's analysis is based on a combination of NCPDP data and NCPA research. Not all NCPDP file numbers are associated with active pharmacies. Further, NCPA and NCPDP classify chain and independent pharmacies differently."

What "research" means to NCPA is unclear. In comparison, NCPDP bases their numbers on a reporting system used by almost every brick and mortar pharmacy with few exceptions.[3]

In short, despite repeated inquiries, the source, coding, and nature of NCPA's data remains opaque.

2. Comparing the yearly counts of active pharmacies by type from 2010-2020.

In this section I compare the yearly counts of active pharmacies in the US.

Sources of the data in this report for comparison.

NCPDP-NCPDP data can be purchased by anyone. The NCPDP data are end of year (annual data) on the number of pharmacies in the U.S. The master file is provided by the National Council for Prescription Drug Programs (NCPDP) and contains data for 2010-2021. Since the data were provided in March of 2021, there is no end of year for 2021. Quest Analytics cleaned and processed this data for PCMA, who then sent me the data file. I made no modifications to the data with the exception of placing them in a summary table and adding columns together. Quest provided final counts of the number of community retail chain and independent pharmacies by state and by year to PCMA. Quest's methodology standardizes each pharmacy's information to identify and eliminate invalid pharmacy records using geocoding to verify pharmacy address and remove duplicate entries, for example. Quest also limits the counts to pharmacies that are "community/retail" pharmacies, removing other types of pharmacies such as long-term care and military pharmacies. Chain pharmacies are classified as part of a group with four or more pharmacy locations with common ownership. Independent pharmacies are classified as between 1 and 3 pharmacy locations under common ownership, or an independently owned pharmacy that has a franchise agreement with a franchisor (see Appendix B at the end of this report for details on Quest's data cleaning procedures).

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[3] There are a number of non-pharmacy dispensing sites that do not have NCPDP ID's and therefore are not included in the NCPDP data, but by definition, these are not community retail pharmacies.

NCPA -I could only find NCPA data available annually through their published digest in which the data is always one year behind publication. For example, the 2012 Digest contains data for 2011. I collected NCPA's data by downloading every available published NCPA Digest in .pdf form from 2010-2020. The most currently available Digest at the time of this report is 2020, so the most recent end of year data for NCPA is 2019. The 2010 report I obtained did not have a pharmacy map. Therefore, in this report the comparison is constrained to range between 2011 and 2019. I added all state pharmacy counts by category to create totals for the US by year.

What do the data say?

Table 1 contains a summary comparing NCPA's number of pharmacies- as reported in their annual digest and NCPDP's reported pharmacies (provided by Quest) based on the end of the year for each year.

Table 1. Comparison of NCPA and NCPDP Reported Number of Pharmacies in the US (minus territories) at the End of the Year 2011-2019.

Data Year	NCPA Chain	NCPA Super	NCPA Mass	NCPA Total Chain	NCPA Ind	NCPA Totals	NCPDP Chain	NCPDP Ind	NCPDP Totals	Chain Diff (NCPA-NCPDP)	Ind Difference (NCPA-NCPDP)	Total Difference (NCPA-NCPDP)
2011	20855	8274	8181	37310	22264	59574	39469	20736	60205	-2159	1528	-631
2012	21012	8341	8229	37582	22177	59759	39713	21535	61248	-2131	642	-1489
2013	21238	8301	8266	37805	21966	59771	40019	21715	61734	-2214	251	-1963
2014	21362	8356	8321	38039	21705	59744	40358	22097	62455	-2319	-392	-2711
2015	22014	8208	8422	38644	21440	60084	40747	22658	63405	-2103	-1218	-3321
2016	22255	8402	8586	39243	21398	60641	40667	23144	63811	-1424	-1746	-3170
2017	22570	8614	8821	40005	21275	61280	40381	22989	63370	-376	-1714	-2090
2018	22658	8523	8657	39838	21083	60921	39938	23247	63185	-100	-2164	-2264
2019	22602	8427	8559	39588	20937	60525	39084	23061	62145	504	-2124	-1620

Table 1 notes: NCPDP considers chain pharmacies as being part of a group with four or more pharmacy locations with common ownership; independent pharmacies are classified as between 1 and 3 pharmacy locations under common ownership, or an independently owned pharmacy that has a franchise agreement with a franchisor. NCPA would not disclose what they considered an independent or chain pharmacy. NCPA separates out chains into three subcategories, chains (e.g., CVS), supermarkets (e.g., Wegmans), and box stores (e.g., Walmart), whereas the data file provided to PCMA relying on NCPDP's data combines the three into "chains". Therefore, when comparing NCPA chains with NCDPD's chains, all reported NCPA pharmacies not labeled independent ("chains", supermarkets" and "mass"), are combined into Total Chain (column 5). NCPA Digest maps also include data for Guam, the Northern Marianas, Puerto Rico, and the Virgin Islands. The NCPDP data provided to PCMA used in this report did not contain those territories. Therefore, both the NCPA and NCPDP totals in this report do not include the aforementioned territories and this report does not make comparisons of those territories.

Four findings stand out when comparing the data side-by-side.

The first, is that a visual inspection of the last column of Table 1 finds that NCPA consistently underreports the total number of pharmacies in comparison to NCPDP. The closest NCPA has

been to NCPDP was in 2011, where NCPA reported 631 fewer pharmacies than NCPDP. The two were furthest apart in 2015; NCPA reported ~ 3,300 fewer pharmacies than NCPDP.

An important consideration is the definition of an active pharmacy. Definition of an active pharmacy is based on NCPDP's Physical Location Store Closure Date. If there is a code of 00000000 then the pharmacy is considered active. Anything other than 00000000 represents the date of closure. This is an important part of data cleaning and accurately classifying if a store is really closed. For example, a pharmacy can appear closed if it changes ownership and the new owner requests a new NCPDP number, but in fact, that pharmacy simply changed ownership and never closed; therefore, the net change is really zero.

NCPA, however offered no description of what they consider an active pharmacy, making validation of their data impossible for interested external parties.

Figure 1 places the differences into three trend lines- the discrepancy of total pharmacies, discrepancy of chain pharmacies alone and discrepancy independent pharmacies alone.

The trends for chains and independents (Figure 1), are not consistent and almost inverse from each other. NCPA reports ~2,000 less chain pharmacies than NCPDP in 2011, but by 2015, there is a striking increase in chains reported by NCPA, and by 2019 the number of chain pharmacies is actually more than NCPDP by comparison. In contrast, in 2011, NCPA over reports independents by around 1,500, but this number sharply decreases every year; by 2019 NCPA underreports the number of independent pharmacies by more than 2,000. Whether this has to do with NCPA's changing criteria is unknown.

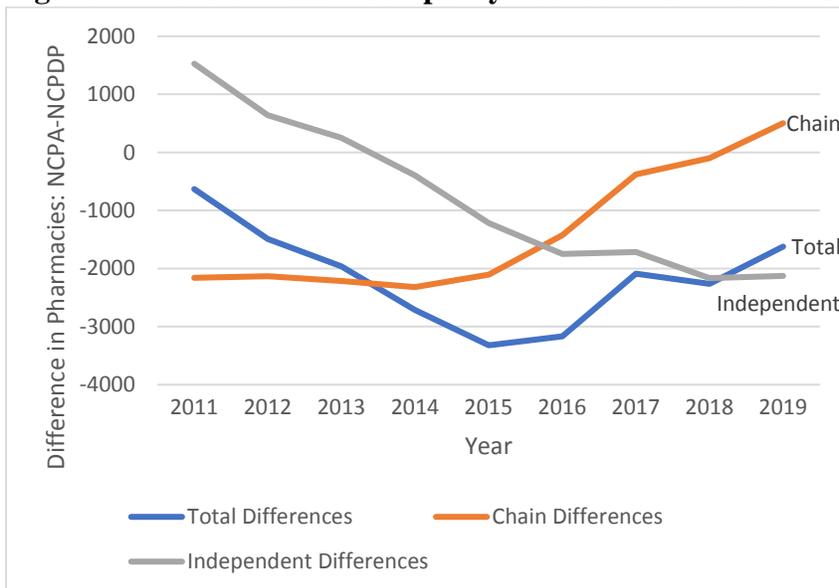**Figure 1. Trend of Data Discrepancy Between NCPA and NCPDP (2011-2019)**

Figure 1 notes: The figure presents the difference in the number of pharmacies reported by NCPA and NCPDP. These are simply NCPA pharmacy counts minus NCPDP counts charted by year. This figure does not include counts for Guam, the Northern Marianas, Puerto Rico, and the Virgin Islands for either data set.

The second finding, also in contrast to articles citing NCPA's reports, is that there is no overall downward trend in the total number of pharmacies. Note Table 1, column's 7 and 10 and Figure 2. Rather, there is strong growth from 2011 to 2016 and a modest decline from 2017-2019, resulting in an overall net gain of 1,940 pharmacies from 2011 to 2019 for NCPDP and 951 for NCPA respectively. That is, even in NCPA's data there is no overall decline.

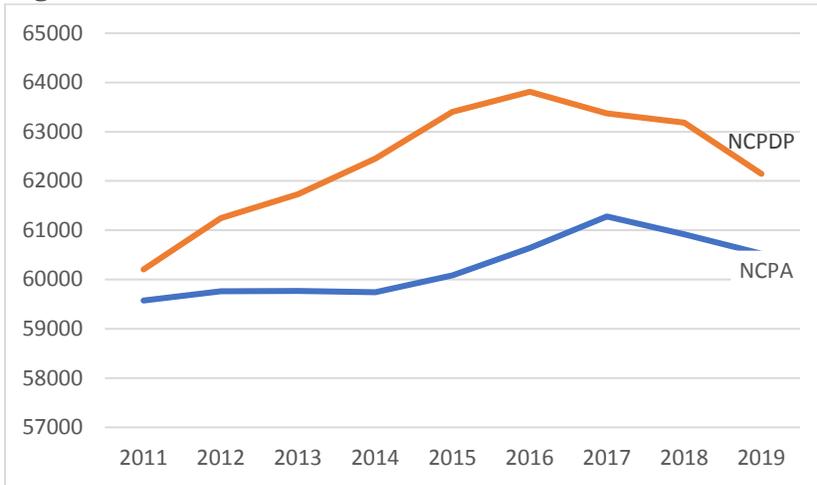**Figure 2. Total Number of Pharmacies from 2011-2019**

Figure 2: Chart does not include Guam, Northern Marianas, Puerto Rico, and the Virgin Islands for either data set.

The third finding displays the most extreme inconsistency between NCPDP and NCPA. NCPDP reports strong growth for independents between 2011 and 2019, more than 2,300 independent pharmacies or around 11% growth. NCPA, on the other hand, reports a steady decline of more than 1,300 pharmacies or ~6% loss. Simply put, when it comes to independent pharmacies NCPA's data is telling a radically different story than NCPDP's data.

Figure 3. Comparison of Total Number of Independent Pharmacies from 2011-2019
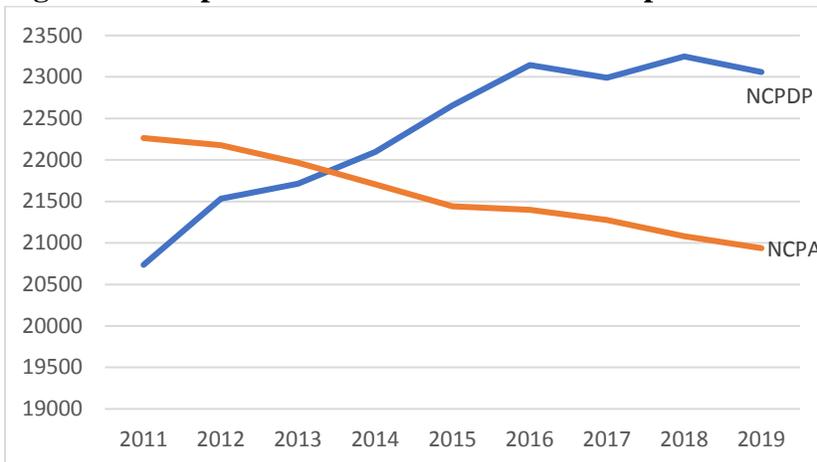

Figure 3 notes: This figure does not include counts for Guam, the Northern Marianas, Puerto Rico, and the Virgin Islands for either NCPA or NCPDP. NCPDP classifies independent pharmacies as between 1 and 3 pharmacy locations under common ownership, or an independently owned pharmacy that has a franchise agreement with a franchisor. NCPA would not disclose their precise inclusion criteria or specifically what they considered an independent pharmacy.

The fourth finding is again a tale of two different pharmacy counts. The direction of the trend lines for chain are roughly the same between NCPDP and NCPA, and by 2019 they are the closest they have ever been, but the slopes and especially intercepts are quite different. Overall, from 2011-2019 chains have slightly decreased according to NCPDP, whereas chains have strongly increased according to NCPA.

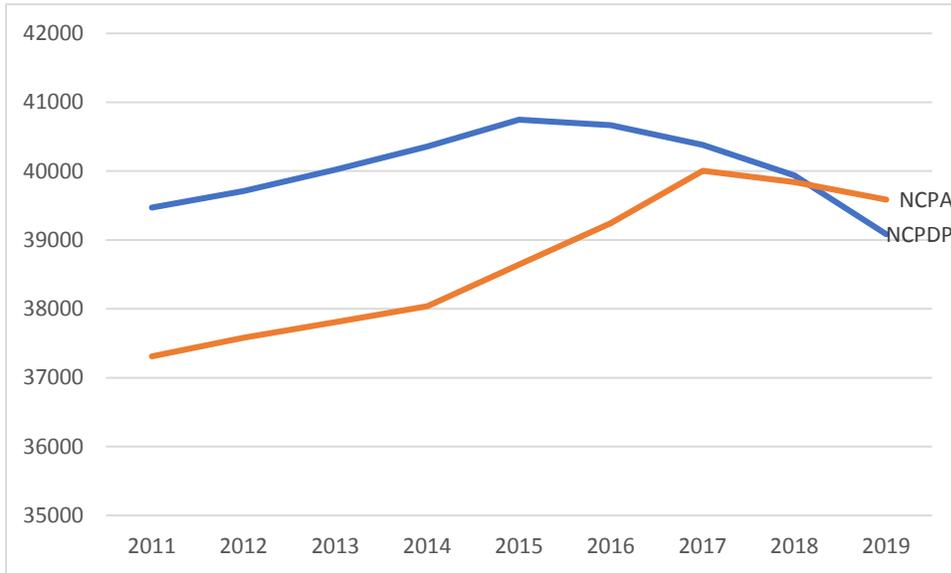**Figure 4. Comparison of Total Number of Chain Pharmacies from 2011-2019**

Figure 4 notes: This figure does not include counts for Guam, the Northern Marianas, Puerto Rico, and the Virgin Islands for either NCPA or NCPDP. NCPDP classifies chain pharmacies as being part of a group with four or more pharmacy locations with common ownership. NCPA's Digest separates all reported pharmacies not labeled independent into Chain, Super and Mass. For the sake of comparison, we combine all three in NCPA's data for total "Chain".

Summary of Findings

- Beginning in 2013, NCPA has consistently underreported the number of independent pharmacies in comparison to NCPDP; by 2019, NCPA underreports the number of independent pharmacies by more than 2,000 (Table 1)
- There is no overall downward trend in the total number of pharmacies over the last decade. Despite modest declines from 2017-2019, from 2011 to 2019, there were net gains in total pharmacies of 1,940 in the NCPDP data and 951 in the NCPA data (Figure 2).
- There are unexplainable differences between NCPDP data and NCPA data in the number of chain and independent pharmacies between 2011 and 2019. While NCPDP data shows an 11% increase in independent pharmacies over that period, NCPA reports a 6% decline (Figure 3).
- Counts of chain pharmacies in the two datasets have become more similar over time, but the growth and change-over-time trends are very different (Figure 4).

Discussion

The differences in the counts of total pharmacies, chains alone or independent alone reported by NCPA and NCPDP are substantial. Simply put, the differences between the NCPDP data (as cleaned by Quest) and NCPA could only result in a radically different view of the pharmacy world. The largest discrepancy is for independent pharmacies. However, it is not only the definition in the coding of what is an independent and chain that differs between NCPA and NCPDP. NCPA is excluding thousands of pharmacies that NCPDP includes.

The differences between NCPA and NCPDP are also not linear or static. That is, it would appear that whatever algorithm, survey, or alterations NCPA is making to the NCPDP dataset it uses, the differences are not consistent across time or even type of pharmacy. This inconsistency is reflected in NCPA's variation in its published inclusion criteria for what is an independent pharmacy. Indeed, this changes every few years and has included everything from long term care facilities to chains to supermarkets.

NCPDP is based on highly incentivized owners to report their information in order to collect reimbursement. Their definitions of chain and independent are published, though data aggregation firms such as Quest can code and clean the data for individual use as well.

NCPA's data is based on some part of NCPDP data, some part unrepresentative survey, some part a non-disclosed difference in definitions and coding, and some part other, if the Digest description and email response from NCPA are to be believed.

NCPDP's data is transparent and publicly available. This paper also displays Quest's coding of the data sent to PCMA for replicability as well.

NCPA's data is not available to the best of our knowledge, except through a pdf of annual reports. The remainder is concealed and the data only released to select few. The coding remains undisclosed.

NCPDP stands behind their data.

NCPA states in their Digest they "do not make any assurances, representations, or warranties with respect to the data upon which the contents of this report were based" and further, "Thus, neither Cardinal Health nor NCPA warrant that the information presented is accurate, current, or applicable for a particular use and accepts no responsibility or liability with respect to such information."

It may very well be that the NCPA numbers could be accurate in a given context, but until there is greater transparency and an ability to reconcile why NCPA's numbers are different than NCPDP's and what changes they are making to NCPDP's data, or how they are determining what makes a pharmacy active, or clearly and definitely explain their definition of what an independent pharmacy is, relying on such data or online articles as evidence comes with much risk and generates confusion. Without full disclosure of NCPA's data, it should not be relied upon for empirical study, or used in policy planning. This is not because one can confirm the data are wrong, but rather, it is because the public cannot determine their validity. NCPA's data

may be useful in a given context, but without that context and much more detail, they remain a mystery. Since NCPA's data are not transparent, it is impossible to interpret their data without knowing where it came from, how it is coded, and why it is different from the primary source (NCPDP).

Such reconciliation is critical. If all of those that are relying on NCPDP are using inferior data, including this report, which is implied by NCPA, then it is not only beneficial that NCPA release their data coding scheme, but perhaps it is an ethical obligation. We should all be working with the best and cleanest data possible or at least know how to generate it. Indeed, it may be, for example, that Quest's cleaning of NCPDP's data is one factor for improving accuracy in data or differences between organizations. Or perhaps, NCPA's determination of an active pharmacy differs from NCPDP's? But without a transparent data policy from NCPA for comparison, how would the public ever know?

Coding differences aside on what is a chain or independent, the removal of pharmacies from the dataset is perhaps the most serious concern. Over the last decade, on average NCPA included 2,100 fewer pharmacies per year than the Quest-cleaned NCPDP dataset. This means that either analyses and interpretations that rely on NCPA's data is wrong or analyses that rely on NCPDP data is wrong. When it comes to the total number of pharmacies, they cannot both be right, or at the very least cannot both be interpreted in the same context given the data differences.

There are many questions that can only be answered by transparency. The different definitions of what is an independent pharmacy and different validation of what is an active pharmacy must be reconciled. We know for example, that NCPDP categorizes an independent pharmacy as 3 or less stores with a common owner. NCPA has so far not provided a clear definition. What is even more confusing is that even in the overly general terms they do offer, NCPA has changed the criteria frequently and included every type of pharmacy as a potential independent at some point. If NCPA is including pharmacies of all types as independent, regardless of how many stores are owned by a common owner, then the number of independents NCPA is reporting should likely be consistently higher than NCPDP. But this is not the case. Just the opposite in fact.

NCPA disclosing their definitions is not only important for the most obvious reasons, some noted above, but take for example, the occurrence in which an independent pharmacy owner bought a fourth store. In NCPDP's data, these stores would then be considered a net gain of four stores for chain, and a net loss of three stores for independents, giving the impression of three independent stores lost when in fact, the stores were so successful they became a chain. However, such direct comparisons are not possible if we are not working off the same definitions.

We are in a new era. A decade ago, holding data internally was a norm; today transparency replication and consistency is now the standard. For those of us in the analysis business, it has been a world of "old dog new tricks". And new norms don't always come easy. Before 2013, even academics rarely posted their data and analytical scripts. Today, we do so for every paper, and it has led to better science. Instead of talking past one another, we can talk to each other. Transparency, full disclosure and eventual consensus on definitions are critical for knowledge.

We can approach the data with different tools, different theories, and even code data differently based on our needs, but if the raw data itself is vastly different then such differences must be explained so analyses can be properly interpreted. NCPDP is leading the way here in transparency. So far, the same cannot be said for NCPA. Whenever this type of situation exists, where data is unseen and unknown, and definitions hidden, it most often serves to cause confusion. This is true in this case. Lack of transparency hinders good science and the ability to make good policy.

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Funding, Independence and Data Transparency: This report was commissioned and funded by PCMA. PCMA provided the research question and the data. The data originated from NCPDP and was cleaned by Quest. As with all my independent reports, the analyses and findings are independent from, and do not reflect the views, values or opinions of the commissioning organization, Penn State or any organization I currently work for, have in the past, or will in the future. The results reflect whatever the provided data say. This short report is for PCMA's use and public distribution. While it has not been peer-reviewed, the study meets all requirements for transparency and replication. The data used are placed in a Table 1, and can also be purchased in raw form from NCPDP or collected with the information provided, and all coding and transformations are disclosed in the appendices or in the report so the results can be replicated.

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Appendix A: Excerpts from email correspondence with NCPA regarding differences in data

Email from Pete Hatemi to (name redacted) at NCPA

"I was hoping you might be able to assist me on an NCPA data and methodology question. I've been asked by a number of people, some journalists, other researchers and interested parties, [names redacted] about the data differences between NCPA and NCPDP - most people can access or obtain NCPDP's data collection procedures but it remains difficult to identify where and how NCPA obtains their pharmacy counts. Could you help me obtain that information? The best I can see is that NCPA is survey based, so they are estimates, but that seems strange to use an estimate for pharmacy counts, because pharmacy store openings and closure and licenses are part of state records, which are generally publicly accessible. It would not be uncommon to find small differences in store counts if data was collected in different months for example, or if one was to define a chain as 5 or more stores versus 3 or more stores etc. But even in such circumstances, the numbers would be relatively close. And this turns out to be the case for all the studies I have seen that use NCPDP data, including those published in peer review outlets like JAMA and PLoS. Overall, the numbers are within a close margin.   But whenever there are any comparisons of NCPDP and NCPA pharmacy counts, they are wildly different. Can you help me explain this difference? Mainly what is the NCPA methodology for identifying the number of pharmacies and by type?

Thank you in advance…"

I received the following short reply but no other information after an additional attempt.

"NCPA's analysis is based on a combination of NCPDP data and NCPA research. Not all NCPDP file numbers are associated with active pharmacies. Further, NCPA and NCPDP classify chain and independent pharmacies differently."

 NCPA's response also included the following statement: "From our standpoint, we would appreciate your disclosure of any relationship you may have with PCMA."

This I found rather odd. As with all my work I put my name on it and I disclose all current employers, even those with no interest in the report, and all known related interested parties in order to be transparent. In the case of my original report, the cover page was solely dedicated to PCMA with a very large "PCMA" logo on it, my name as the author, my active affiliations, and PCMA released a press statement on the report as well. These combined are generally considered the strongest and most transparent ways to signal that the report was commissioned by PCMA and I wrote it. I was uncertain what other information could have made this more clear. However, in the interest of transparency, I responded to NCPA in the greatest detail, even explaining the original question that launched the report, my contacts, history of consulting more broadly, approach to research and so forth. In this follow-up email I asked again for a more detailed reply, to include the exact source of NCPA's data, definitions and help in reconciling the differences between NCPA and NCPDP. I never received a response.

Appendix B: Quest Data Cleaning for PCMA

Objective: to gather counts of Chain and Independent Pharmacies by quarter, state and congressional district

Data: NCPDP National Pharmacy data set

Methodology For Determining Unique Counts of NCPDP Data:

- A NCPDP database is available for each year and quarter, starting with dating back to 2010
- Quest Analytics created one database for each year with a table for each quarter
- Each quarterly table was geocoded with the Quest Analytics Suite
- Geocoding assigns a latitude and longitude to each record, based off the address information supplied
- The Quest Analytics Suite Geocoder has the ability to standardize address information
- For example, the following addresses would receive the same standardized output of **15 Park Pl, Appleton, WI 54914 (the correct address):**
    - 15 Park Place #300, Grand Chute, WI 54914
    - 15 Park Pl, Appleton, WI 54149
    - 15 Park Pl Suite 300, Appleton, WI 54914
- Utilizing the standardized address output capabilities of the Geocoder allows us to achieve greater accuracy when deriving counts of unique locations. The example above would be counted as 1 location
- Some address information can't be standardized. In these situations, each record is counted separately
- When determining unique Chain Pharmacy counts, the following filters were applied to the quarterly list of providers:
    - Dispenser Type = 01 – Chain
    - Provider Type = 01 – Community/ Retail Pharmacy
    - PhysicalLocStoreCloseDate = 00000000 (this indicates the store remains open)
- When determining unique Independent Pharmacy counts, the following filters were applied to the quarterly list of providers:
    - Dispenser Type = 02 – Independent OR Dispenser Type = 05 – Franchise
    - Provider Type = 01 – Community/ Retail Pharmacy
    - PhysicalLocStoreCloseDate = 00000000 (this indicates the store remains open)
- Data published quarterly by NCPDP
- Determine Pharmacy status using the following criteria:
    - Dispenser Type = "Chain Pharmacy"
    - Dispenser Type = "Independent Pharmacy" or "Franchise Pharmacy"
    - Provider Type = "Community/ Retail Pharmacy"
- Assign congressional districts to each pharmacy in the national pharmacy database
- Rollup counts of Chain Pharmacies by State/quarter and by Congressional District/quarter
- Rollup counts of Chain Pharmacies by State/Year and by Congressional District/Year
- Rollup counts of Independent Pharmacies by State/quarter and by Congressional District/quarter
- Rollup counts of Independent Pharmacies by State/Year and by Congressional District/Year

Methodology for Unique Counts of Pharmacies in NCPDP – 9.15.2015

Number of Stores

In order to complete comparisons across a time span of five years, we needed to establish rules that would allow the results to be consistently accounted for within any given quarter and or year, past as well as present and future. To accomplish this, we leveraged the NCPDP databases for 2010 – 2015 on a quarterly basis and applied filters as follows:

- Dispenser Type = 01 – or 02 (Chain or Independent)
- Provider Type = 01 – Community/Retail Pharmacy

Eliminating Duplicates

When applying the above filters, we identified there were still duplicates that existed in the database. These were identified consistently across both the Chain and Independent designations. In these instances, there were multiple pharmacies list at the same location. To remove the duplicates, we leveraged the Quest Analytics Suite™ to Geocode each table, which allows for normalization of various addresses into a standard output. For example, if the following addresses existed in the tables, they would all standardize to the same output.

Input Address				Standardized Address			
Street	City	State	Zip	Street	City	State	Zip
15 Park Place, #300	Grand Chute	WI	54914	15 Park Pl	Appleton	WI	54914
15 Park Pl	Appleton	WI	54149	15 Park Pl	Appleton	WI	54914
15 Park Pl Suite 300	Appleton	WI	54914	15 Park Pl	Appleton	WI	54914

Utilizing the standardized address output capabilities of the Geocoder allows us to achieve greater accuracy when deriving counts of unique locations. The example above would be counted as 1 after we applied the standardization.

Chain vs. Independent

Once all of the above filters were applied, we then further refined the results to only include those that are classified as chain and independent stores. When determining unique **Chain** Pharmacy counts, the following filters were applied:

- o Dispenser Type = 01 – Chain
- o Provider Type = 01 – Community/ Retail Pharmacy
- o Physical Location Store Close Date = 00000000 (this indicates the store remains open)

When determining unique **Independent** Pharmacy counts, the following filters were applied to the quarterly list of providers:
- o Dispenser Type = 02 – Independent or Dispenser Type = 05 – Franchise
- o Provider Type = 01 – Community/ Retail Pharmacy
- o Physical Location Store Close Date = 00000000 (this indicates the store remains open)

Counts were created for Chain Pharmacies and Independent/Franchise Pharmacies by quarter for the years 2010 – 2015 (Q3) to allow for consistent comparisons.

Validation of Filters

All filters were validated from the sources as NCPDP to confirm that using this methodology would provide a consistent measurement across their database that can be leveraged for historical comparisons as well as present and future.

Trends

We assembled trends over quarter and year to reflect the variance of change that has occurred over time detailed this on State by State basis. Below is a high-level summary comparing the results at the national level.

	Q1 2010		Q1 2015	
	Chain	Independent	Chain	Independent
Totals	39,156	20,427	40,747	22,658
Increase/Decrease			1,591	2,231
Pct Increase/Decrease			4.06%	10.92%