VIReC Technical Report 1:

Comparison of VA Outpatient Prescriptions in the DSS Datasets and the PBM Database

Noreen Arnold, MS, Denise M. Hynes, PhD, RN,
and Kevin T. Stroupe, PhD

January 13, 2006

VA Information Resource Center
Edward Hines, Jr. VA Hospital (151V)
P.O. Box 5000 • Hines, IL 60141
Ph: 708-202-2413 • Fax: 708-202-2415
virec@va.gov • www.virec.research.va.gov

Table of Contents

Highlights....... 3

Introduction....... 5

Background....... 5

Methods....... 7

Results....... 9

Review and Validation of the National Drug Code....... 9

Review and Validation of the Product Name....... 12

Comparison of the Prescriptions on the PBM and DSS Extracts....... 12

Comparison of the Cost Variables....... 15

Limitations of the Data....... 21

Conclusions....... 21

Acknowledgements....... 23

Suggested Citation....... 23

References....... 24

This page intentionally left blank

VIReC Technical Report 1: Comparison of VA Outpatient Prescriptions in the DSS Datasets and the PBM Database

Highlights

This study compared Department of Veterans Affairs (VA) fiscal year (FY) 2002 outpatient prescriptions on two national data sources, the VA Decision Support System (DSS) National Data Extract Pharmacy SAS®[*] Datasets and the VA Pharmacy Benefits Management (PBM) Database. Outpatient prescriptions for a cohort of patients enrolled in the VA Cooperative Studies Program (CSP) Study 456, "Open Mesh versus Laparoscopic Mesh Repair of Inguinal Hernia Study", were reviewed and compared.[1,2] Major findings include the following:

- Essentially the same prescriptions appeared in both sources. A discrepancy rate of only 1.5% was found between the sources.
- The DSS source contains more comprehensive cost variables than the PBM source, but the DSS cost variables show unexpected, significant variation between drugs and among VA stations. Researchers should assess these variations and adjust the DSS costs accordingly if they plan to use the costs in their research. It is expected that the quality of the DSS costs has improved in more recent fiscal years and less variation will be found.
- The National Drug Code (NDC) in the DSS source is in a standard format that allows easy linkage of the code to an external drug database. The PBM NDC format varies by prescription and requires reformatting before the codes can be linked to an external drug database.
- The DSS prescription product name is a condensed version of the PBM product name. It is shortened when necessary through removal of spaces and truncation. Thus, in some instances it is not as easily searched as the PBM product name.
- Both DSS and PBM store the quantity of a drug dispensed as an integer, but the original prescription has the quantity stored as a fraction. DSS rounds down and PBM rounds up. Therefore, an original quantity of 2.5 will appear as 2 in the DSS Dataset and as 3 in the PBM Database.
- A decision on which source to use in research can be based on the years covered by the sources, the variables contained in the sources, and ease of accessing the data. For

[*] SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration.

example: The DSS datasets do not contain dosing instructions, which prevents identification of a daily dose for some prescriptions such as prescriptions for inhalers. DSS plans to add dosing instruction in the fiscal year 2007 datasets.

- The DSS datasets cover fiscal years 2002 onward, but the PBM database covers fiscal years 1999 onward.

- The DSS datasets can be directly accessed by researchers. Researchers must request an extract from the PBM database from the VA Pharmacy Benefits Management Strategic Health Group.

Introduction

In 2003, a new national data source of dispensed inpatient and outpatient prescriptions became available for use by Department of Veterans Affairs (VA) researchers: the VA Decision Support System National Data Extract (DSS NDE) Pharmacy SAS®* Datasets. Prior to 2003, the only other national data source was the VA Pharmacy Benefits Management (PBM) Database.[3-5] The availability of two national sources of prescription data raises the question of which source is the most appropriate to use for a specific research project.

This technical report details a comparison of these two data sources. Outpatient prescriptions dispensed in fiscal year (FY) 2002 (October 1, 2001 through September 30, 2002) were extracted from both sources for 1,591 patients in the VA Cooperative Studies Program (CSP) Study 456, "Open Mesh versus Laparoscopic Mesh Repair of Inguinal Hernia Study".[1,2] The comparison had four objectives:

- assess the usability and validity of the National Drug Code (NDC) on the prescriptions;
- assess the usability and validity of the drug product name on the prescriptions;
- determine whether the same prescriptions would be found in both sources; and
- contrast the cost variables between the two sources.

Background

The DSS NDE Pharmacy SAS Datasets became available to researchers in 2003 and contain prescriptions dispensed from October 1, 2001 onward. These datasets are generated from the DSS Database. The DSS Database is a national database built from standard Veterans Health Administration (VHA) clinical and financial data sources by the Veterans Affairs (VA) Decision Support Office. It is used to perform activity-based costing and clinical productivity analyses. As part of the process to populate the database, a number of National Data Extract (NDE) SAS Datasets are created and made available for use in research, including the DSS NDE Pharmacy SAS Datasets and other DSS NDE SAS datasets, such as DSS NDE Laboratory Results and Radiology Datasets. The Pharmacy SAS Datasets include all inpatient and outpatient prescriptions dispensed by a Veterans Affairs Medical Center (VAMC) Pharmacy or a Veterans Affairs Consolidated Mail Outpatient Pharmacy (CMOP). The primary source of the prescription data is the Veterans Health Information Systems and Technologies Architecture System (VistA). VistA supports the day-to-day operations at local VA health care facilities, including placing and dispensing prescription orders.[6]

The PBM Database has been available since 2000 and contains prescription records dispensed from October 1, 1998 onward.[7] The VA Pharmacy Benefits Management Strategic Health Group (PBM/SHG) builds the PBM Database from the same sources used by DSS to build their database (i.e., VistA), but the processes to build the PBM Database and the DSS Datasets are independent. The PBM database contains both inpatient and outpatient prescriptions and is used to support the work of the PBM/SHG. As a service to researchers, the PBM/SHG will provide

---

* SAS and all other SAS Institute Inc. product or service names are registered trademarks or trademarks of SAS Institute Inc. in the USA and other countries. ® indicates USA registration

extracts of outpatient prescriptions from the PBM Database. Inpatient prescription extracts are not currently provided.

In both the PBM Database and the DSS Datasets, each outpatient prescription record contains two variables that identify the drug dispensed: the National Drug Code (NDC) and a drug product name. The NDC is a unique 10-digit, 3-segment number (labeler code, product code, and package code segments) for a drug product.[8] The labeler code is assigned by the FDA and identifies the firm that manufactures, repackages, or distributes a drug product. The product code identifies a specific strength, dosage form, and formulation. The package code identifies the package size. The firm assigns both the product and package codes. For example, the NDC code 55154-5012-7 can be interpreted as follows: "55154" is labeler code for Cardinal Health, the manufacturer or distributor; "5012"is the product code for Zocor 10 mg tablets; and "7" is the package code for a box of 100 tablets.

The NDC for the same prescription may be different on the PBM record than on the DSS record because the NDCs are obtained from different sources. These different NDCs will refer to the same drug, dosage and strength, but they may indicate a different manufacturer and/or package size.

The VA Product Name is the official standardized VA name for a drug product, supply, or diagnostic established by the PBM/SHG for formulary and non-formulary items. It usually contains the generic drug name(s) and strength(s) and has a maximum length of sixty-four characters. For example, the VA Product Name for the NDC code 55154-5012-7 is "SIMVASTATIN 10MG TAB". The VA National Drug File (NDF) contains the standardized VA Product Name as well as other information such as dosage form, strength and unit; package size and type; manufacturer's trade name; and NDC for FDA-approved drugs. The NDF is created and maintained by the PBM/SHG and is used to populate the VistA Local Drug Files in all VA medical facilities. Local Drug Files can be modified by a medical facility, and so in rare instances, a product name may vary from facility to facility. The NDF is updated bimonthly. A Microsoft® Access database version of the NDF is available for download from the PBM website. The product name found on the PBM outpatient prescriptions is the VA Product Name and is 64 characters in length. The product name found on the DSS outpatient prescriptions is a 30-character condensed version of the VA Product Name and is obtained from a DSS table.

The DSS and PBM data contain different cost variables. The PBM Database includes only the cost of the drug product from the supplier. The DSS Datasets contain three cost variables, none of which contain only the cost of the drug product. Two DSS variables were used in this study: 1) dispensing costs (DISPCOST), which include the direct pharmacist labor for dispensing the prescription and the mailing costs; and 2) all other costs (ACT_COST), which include the drug product cost, the cost of supplies such as bottles and labels to prepare the prescription, indirect costs, and overhead.*

* DSS recommends not using the third cost variable (VS_COST) in the fiscal year 2002 data. In DSS Datasets for fiscal years 2003 onward this variable contains the drug product cost and cost of supplies used in preparing the prescription, such as bottles and labels.

Dispensing costs vary by the type of prescription. For example, the dispensing cost for a prescription dispensed at a Consolidated Mail Order Pharmacy (CMOP) will be less than the dispensing cost for the same prescription filled at a VAMC Pharmacy window. Dispensing costs for the first fill of a new prescription at a VAMC Pharmacy may be greater than for a refill because the pharmacist may spend time counseling the patient about the new prescription. Dispensing costs in fiscal year 2002 were calculated differently than in future fiscal years. In 2002, the dispensing cost for a prescription was an average cost for all prescriptions for a patient for a day by location (VA Pharmacy or CMOP). For example, if a patient had three outpatient prescriptions filled by a VA Pharmacy (two refills and a new prescription) the cost in the DISPCOST for each of the three prescriptions was the same (the sum of the dispensing costs for the three prescriptions divided by three) even though the new prescription would have had a higher dispensing cost amount. Thus, the differences between costs for new prescriptions versus refills or prescriptions mailed by versus picked up at a VA Pharmacy may be greater in future fiscal years.

DSS costs for individual prescriptions are based on relative value units (RVUs) for the drug product, RVUs for direct pharmacist labor, and the allocation of all other costs using the drug product RVUs assigned to the prescription as the basis for the allocation. RVUs are established at each DSS site. An in-depth description of DSS cost calculations can be found in the VIReC Research User Guide: VHA Pharmacy Prescription Data.

Methods

Our cohort consisted of patients enrolled in the VA CSP Study 456, "Open Mesh versus Laparoscopic Mesh Repair of Inguinal Hernia Study".[1,2] Of the 1,983 patients who underwent a hernia repair operation, 1,591 had outpatient prescriptions filled by the VA and comprise our cohort. For this comparison, the Pharmacy Benefits Management/Strategic Healthcare Group generated an extract from the PBM database containing outpatient prescriptions. We generated an extract from the DSS NDE Pharmacy SAS Datasets by selecting only those records with 'PRE' in the first three characters of the feeder location variable, indicating a VHA Pharmacy filled the prescription, or 'CMOPDSU' in the first seven characters of the feeder location variable, indicating that a CMOP filled the prescription. Each record on the DSS and PBM extracts represented a specific outpatient prescription fill or refill.

These extracts were matched on patient Social Security number (SSN), date of fill, quantity dispensed, NDC, and product name. Since the formats and sources of the NDC and product name variables are not the same on the DSS and PBM extracts, the formats and names were standardized prior to matching.

DSS uses a 12-digit format (6-4-2: 6-digit labeler code, 4-digit product code, and 2-digit package code) for the NDC in its Pharmacy SAS Datasets. The NDC appears in many different formats on the PBM extract including any of the FDA ten-digit formats (4-4-2, 5-3-2, or 5-4-1), an 11-digit format (5-4-2), and the 12-digit format (6-4-2) found in DSS. Additionally, hyphens were used to separate the three segments of the NDC on some PBM records. Therefore, we developed a routine to reformat the NDC on PBM prescriptions into the DSS 12-digit format (6-4-2) where possible. The FDA's NDC Directory Files were used to obtain 12-digit formats for PBM prescriptions with an FDA 10-digit format.

Because researchers may often use the NDC to link to external databases for additional information about a drug product, we tested the validity of the contents of the NDC variables by verifying the existence of the NDC codes on the prescription records in one of three external databases: the FDA's NDC Directory Files, the CMS Medicaid Drug Product File, and the Multum Drug Lexicon. We also linked the extracts to the VA National Drug File as of October 2003. The FDA's NDC Directory Files contain information about prescription and selected over-the-counter drug products that are in commercial distribution in the United States. The NDC Directory Files used were current as of September 30, 2003. (The link used to download the NDC Directory Files was http://www.fda.gov/cder/ndc/index.htm.) The CMS Medicaid Drug Product File contains drugs that are available under the Medicaid Drug Rebate Program and was downloaded from the CMS website on November 19, 2003. (The link used to download the CMS Medicaid Drug Product File was http://www.cms.hhs.gov/medicaid/drugs/drug6.asp.) The Multum Drug Lexicon is an electronic dictionary of drug and disease information from Cerner Multum, Inc., and contains information about prescription and over-the-counter drug products plus supplies. The Multum Drug Lexicon was current as of November 1, 2003. (The link used to download the Multum Drug Lexicon was http://www.multum.com/.)

To validate and obtain a more consistent product name between the PBM and DSS extracts, both extracts were matched to the October 2003 VA National Drug File. Because the PBM extract contains the VA Product Name, we matched the PBM prescriptions to the NDF on the VA Product Name. We obtained a VA Product Name from the NDF for the DSS prescription records by linking on the Internal Entry Number (IEN) in the DSS feeder key. The IEN is the first five characters of the DSS feeder key variable, which can be found in both the NDF and the DSS Datasets. The product names on prescription records that could not be linked to the NDF were reviewed to determine whether they could be used to identify a drug product.

After standardization of the NDCs and product names, we attempted to match the prescription records on the patient SSN, date of fill, quantity dispensed, NDC, and product name. The match process categorized prescriptions into the following three categories:

1) prescriptions that matched on SSN, date, quantity, NDC, and product name;
2) prescriptions that matched on SSN, date, quantity, and product name but not NDC; and
3) prescriptions that matched on SSN, date, quantity, and NDC but not product name.

Prescriptions not falling into one of these categories were grouped by SSN, date, number of prescriptions, and quantity and then classified into these additional categories:

4) prescriptions that matched on SSN, date, number of prescriptions, and total quantity;
5) prescriptions that matched on SSN, date, and number of prescriptions;
6) prescriptions matched on SSN, date, and total quantity (e.g., PBM has two prescriptions for Metoprolol with a quantity of 30 and DSS had one prescription for Metoprolol with a quantity of 60);
7) prescriptions for a date found only on the PBM extract; and
8) prescriptions for a date found only on the DSS extract.

Manual reviews of prescriptions in categories 3 through 8 were performed to identify matches and discrepancies between the PBM extract and the DSS extract and to assess the nature of any differences. Finally, results of the manual reviews and the match processes were combined to provide totals of the discrepancies found. Figure 1 (page 10) contains a flow diagram of these processes with the number of prescriptions falling into each of the eight categories listed above.

Lastly, the DSS and PBM cost variables were compared for prescriptions falling into the first three categories. Total costs and cost variations for a subset of the prescriptions were also analyzed.

Results

Review and Validation of the National Drug Code

The PBM extract contained 42,333 prescription records and the DSS extract contained 42,372 prescription records. As discussed in the methods section, the NDC on the PBM prescription records was converted into the 12-digit format utilized by DSS. We were able to convert 86.4% of the NDCs on the PBM extract to the 12-digit format. The NDC codes on each extract were then linked to three external sources (the FDA's NDC Directory Files, the CMS Medicaid Drug Product File, and the Multum Drug Lexicon) and the VA National Drug File. The number of NDCs contained on each source is listed in Table 1. The NDF contains the largest number of NDCs.

Table 1. Number of Records by NDC Source

NDC Source	Records
CMS Medicaid Drug Product File	59,941
Multum Drug Lexicon	85,468
FDA NDC Directory Files	83,865
VA National Drug File	95,419

The results of linking the DSS and PBM extracts to external sources to validate NDCs are in Table 2. (Page 11) For each external NDC Source and the NDF, the table contains the number of NDCs that could not be matched to the source on the full NDC or on just the labeler and product segments of the NDC. The table also contains the number of invalid NDCs found in PBM and DSS, and the number of NDCs found in PBM that could not be converted to a 12-digit format usable for comparison purposes. An NDC was considered invalid if it had non-numeric values or labeler codes consisting of zeros or more than five digits.

The PBM extract had a greater number of invalid NDCs than the DSS extract, 13.6% versus 2.9%. This difference was partially due to the problem of converting a 10-digit NDC into a 12-digit NDC. There is no easy method for such a conversion because the 10-digit NDC may be in one of three formats (4-4-2, 5-4-1, 5-3-2) that cannot be deciphered from the number alone. Ten-digit NDCs were converted to 11-digit NDCs by using the FDA's NDC Directory Files.

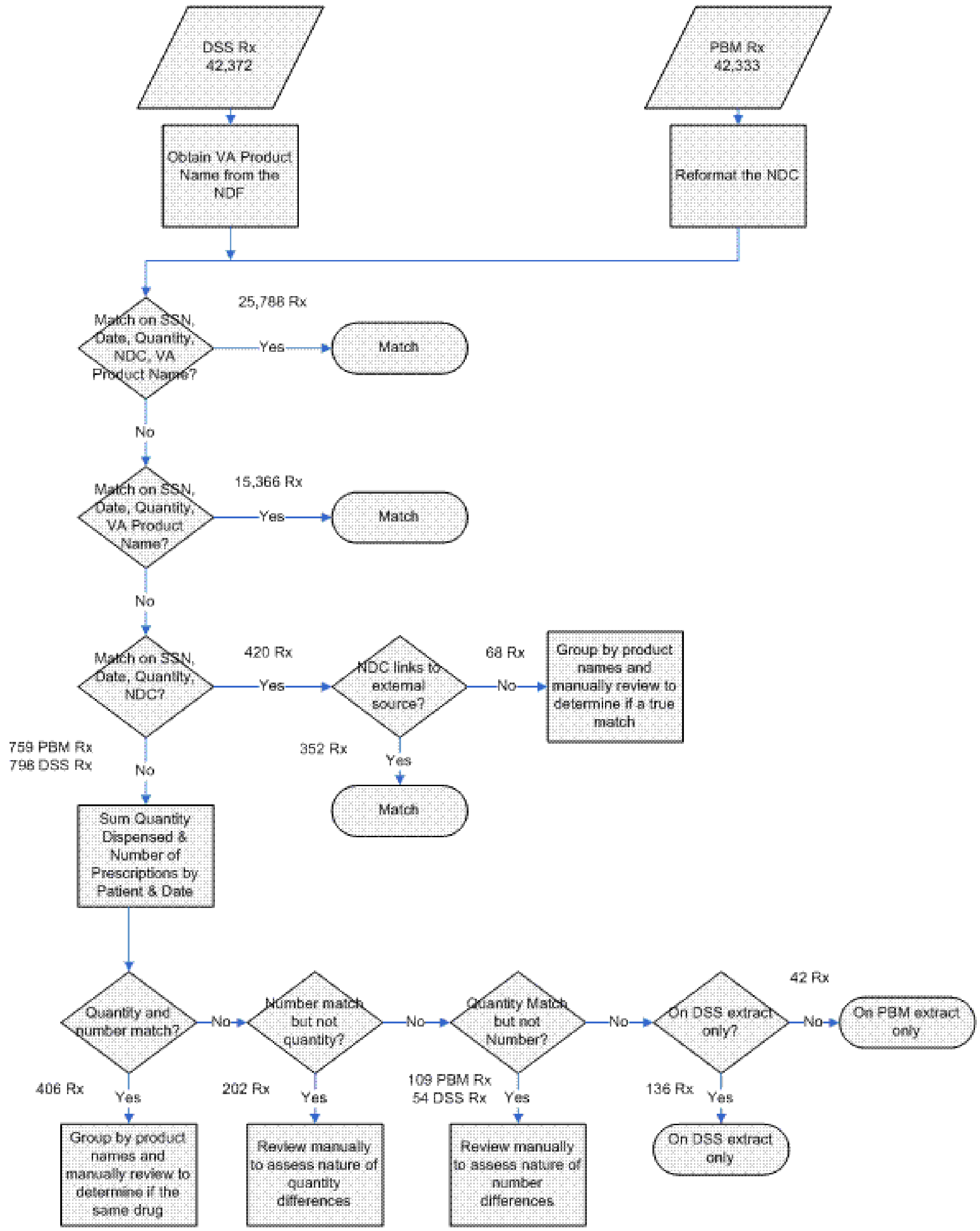

Figure 1: Flow Diagram of the Process to Compare PBM and DSS Prescription Records

Table 2. Review and Validation of the NDC and Product Name

Review and Validation	DSS (n = 42,372)		PBM (n = 42,333)	
	Number	%	Number	%
NDC Validation				
Prescriptions with an invalid NDC	1,245	2.9	5,740	13.6
Prescriptions with 10-digit NDC and no 12-digit NDC	NA	NA	3,230	7.6
Link to FDA's NDC Directory File				
No FDA Match on NDC	14,546	34.3	15,584	36.8
No FDA Match on Labeler and Product Codes Only	13,604	32.1	13,701	32.4
Link to Multum Drug Lexicon				
No Multum Match on NDC	5,239	12.4	12,125	28.6
No Multum Match on Labeler and Product Codes Only	4,694	11.1	10,343	24.4
Multum Drug Lexicon Plus Multum Supplies Lexicon				
No Multum Match on Labeler and Product Codes	4,310	10.2	10,142	24.0
Link to CMS Medicaid Drug Product File				
No CMS Match on NDC	9,173	21.7	13,943	32.9
No CMS Match on Labeler and Product	8,131	19.2	12,133	28.7
Link to VA National Drug File (NDF)				
No NDF Match on NDC	7,383	17.4	15,730	37.2
No NDF Match on Labeler and Product	5,299	12.5	11,835	28.0
Link to All External Sources Combined				
No Match on Labeler and Product	3,876	9.1	8,108	19.2

When the 10-digit NDC could not be found in the FDA's files, we did not convert it to a 12-digit NDC. There were 3,230 PBM prescriptions that had a 10-digit NDC without a corresponding record on the FDA's files. This resulted in a much lower percentage of matches to other sources across the board for PBM prescription records. Use of the Multum Drug Lexicon produced the lowest percentage of unmatched NDCs in the PBM and DSS extracts, 24.0% and 10.2% respectively. When combining all external sources, 9.1% of the DSS NDCs and 19.2% of the PBM NDCs could not be linked to an external source.

Finally, because researchers may want to use the NDC to link to external databases for obtaining additional information about a drug, we tested a process to assign a linkable NDC (an NDC that links to an external database) to a prescription that does not have a linkable NDC. For DSS prescription records without a linkable NDC, we were able to assign a linkable NDC from other records within the extract that had the same DSS drug description. Out of 3,786 DSS records without a linkable NDC, we were unable to assign a linkable NDC to 889 of these records, 595 of which were classified as supplies. Therefore, we were unable to attach a linkable NDC to only 326 non-supply records. For PBM prescription records without a linkable NDC, we were able to assign a linkable NDC from other records within the extract that had the same VA

Product Name. Of 8,108 PBM records without a linkable NDC, we were unable to assign an NDC to 1,058 of these records, of which 696 were classified as supplies. Thus, for only 362 non-supply records we were unable to attach a linkable NDC. In summary, for both the DSS and PBM extracts, less than 2.5% of the total records could not be assigned a linkable NDC, and the majority of those prescription records were supplies.

Review and Validation of the Product Name

To validate and obtain a more consistent product name between the PBM and DSS extracts, both extracts were matched to the VA's National Drug File (NDF), current as of October 2003. Because the PBM extract contains a VA Product Name, we matched the PBM prescriptions to the NDF on both the VA Product Name and the NDC. Less than 1% of the PBM prescriptions (302 prescriptions) had a VA Product Name that did not match a VA Product Name on the NDF. The PBM extract had only 164 prescriptions (0.4%) for which no valid drug name was found in the VA Product Name field on the extract or by linking to the NDF or any of the external sources. These records contained '*SUPPLY', '*STUDY', '*LOCAL', or '*MORE INFO' in the VA Product Name field.

We were able to obtain a VA Product Name from the NDF for 99.1% of the DSS prescription records by linking on the Internal Entry Number (IEN). The IEN is the first five characters of the DSS feeder key variable which is contained in both the NDF and the DSS Datasets. The DSS extract had 180 prescriptions records (0.4%) for which no valid drug name was found in the DSS Drug Description field on the extract or by linking to the NDF or any of the external sources. These records contained spaces, 'NEW DRUG', 'LOW', 'MEDIUM', and 'HIGH' in the DSS Drug Description field.

Comparison of the Prescriptions on the PBM and DSS Extracts

After standardizing the product names and NDCs in the two extracts, the prescription records were compared through the match processes described previously and shown in Figure 1. The results of these processes are contained in Table 3.

All prescriptions in categories 1 and 2 and those prescriptions in category 3 with an NDC that linked to an external source (352 of the 420 prescriptions in category 3) were considered a match. The 68 prescriptions in category 3 without a linkable NDC were grouped by product name and reviewed manually to identify discrepancies. The discrepancies identified were classified into the following categories: 1) PBM only had a name for the drug dispensed; 2) DSS only had a name for the drug dispensed; 3) neither DSS nor PBM had a name for the drug dispensed; 4) PBM and DSS had a name for a different drug or strength (e.g., PBM had 'Metoprolol Tartrate' and DSS had 'Theophylline'); and 5) PBM and DSS both had valid names for basically the same drug but the names were spelled differently or were a different product name (e.g., PBM had 'Hemorrhoidal Supp' and DSS had 'Anusol Supp'.) The results of this review are presented in Table 4.

Table 3. Results of Matching Prescriptions on the PBM and DSS Extracts

Category	Description	PBM		DSS	
		Number	%	Number	%
1	Match on SSN, Date, Quantity, NDC and VA Product Name	25,788	60.9	25,788	60.9
2	Match on SSN, Date, Quantity, and VA Product Name	15,366	36.3	15,366	36.3
3	Match on SSN, Date, Quantity, and NDC	420	1.0	420	1.0
4	Match on Date, SSN, Number of Prescriptions and Total Quantity	406	1.0	406	1.0
5	Match on Date, SSN, and Number of Prescriptions	202	0.5	202	0.5
6	Match on Date, SSN, and Total Quantity	109	0.3	54	0.1
7	Prescription on DSS Only			136	0.3
8	Prescription on PBM Only	42	0.1		
	Total	42,333	100.0	42,372	100.0

Table 4: Results of Manual Reviews of Prescriptions in Categories 3, 4, and 6

Review	Number of Prescriptions			
	Category 3	Category 4	Category 6	Total
Prescriptions with a Drug Name only on PBM	12	43	6	61
Prescriptions with a Drug Name only on DSS	7	41		48
Prescriptions with no Drug Name on PBM or DSS	8	104	3	115
Prescriptions with a Drug Name for a different drug or strength on PBM versus DSS	7	17	2	26
Prescriptions identified as a match	34	196	98	328
Total Number of Prescriptions	68	406	109	583

Category 4 prescriptions had different VA product names. They were grouped by product name and reviewed manually to identify possible discrepancies. The discrepancies identified were classified the same as category 3 prescriptions above. The results are in Table 4. Approximately, half of the prescriptions were matches (196 out of 406); the product names were notated differently but identified the same drug product.

The majority (79.6%) of the category 5 prescriptions (quantity differences) were prescriptions for an ophthalmic solution. PBM had a quantity of 3 for these prescriptions, but DSS had a quantity of 2. A review of several of these prescriptions in VistA revealed that the actual quantity was 2.5. The quantity variable is an integer on both the DSS and PBM extracts.

Apparently, PBM rounds the quantity up to the next largest integer, and DSS rounds down to the next smallest integer.

Category 6 prescriptions had the same quantity dispensed on the same date but the number of prescriptions differed (e.g., PBM has two prescriptions for Metoprolol with a quantity of 30 and DSS had one prescription for Metoprolol with a quantity of 60). These prescriptions were reviewed manually to identify possible discrepancies. The discrepancies identified were classified the same as category 3 prescriptions above and the results are in Table 4. The vast majority of these prescriptions were classified as matches.

We identified only one possible explanation for prescriptions that were found only on the DSS extract or the PBM extract (categories 7 and 8). For eleven of the category 8 prescriptions (found only the PBM extract), the PBM prescription record had no release date (the date the prescription was released to the patient). In mid-2002, PBM changed their VistA extract process to pull prescriptions for the PBM Database based on release date. Prior to that change, prescriptions were selected based on the fill date (the date the prescription was filled by the pharmacist). Therefore, it is possible that these prescriptions that only appear in the PBM extract were filled but never released to the patient. DSS uses the release date to select prescription records from VistA. All category 7 and 8 prescriptions were discussed with DSS and PBM staff, but no other explanation of why these prescriptions were found in only one source could be identified.

Table 5 combines the number of discrepancies identified in the reviews detailed above to produce an overall number of discrepancies of 630 and an overall rate of discrepancies between the two sources of 1.5%.

Table 5. Total Discrepancies between PBM and DSS

Type of Discrepancy	Number of Prescriptions
Prescriptions on the PBM file only	42
Prescriptions on the DSS file only	136
Prescriptions with Unequal Quantities	202
Prescription with a Drug Name only on PBM	61
Prescriptions with a Drug Name only on DSS	48
Prescriptions with no Drug Name on PBM or DSS	115
Prescriptions with a Drug Name for a different drug or strength on PBM vs. DSS	26

An underlying assumption of the match process was that the NDC was consistent with the product name on the prescription. To test this assumption, we manually compared the VA product name to the product name on the CMS Medicaid Drug Product File. Like the product names found on the DSS and PBM prescription extracts, the CMS product name contains the generic drug name and strength. Unique combinations of VA product names and their corresponding CMS product names were reviewed to identify differences in drug name or strength. Only 55 of the 26,379 prescriptions reviewed in this manner had a different CMS product name or strength than the VA product name and strength (a 0.2% error rate). The DSS product name did not match the CMS product name on drug or strength in 46 of those prescriptions, and the PBM product did not match the CMS drug product or strength in 26 of those prescriptions. Because the error rate was negligible, the assumption that a prescription record's NDC was consistent with the product name on the prescription was deemed valid.

Comparison of the Cost Variables

Costs for the 41,506 prescriptions in categories 1 and 2 and in category 3 with a linkable NDC were compared and analyzed. Table 6 presents a comparison of the total costs. The PBM database only contains data on the cost of the drug; it does not include overhead or dispensing costs. As noted earlier, DSS does not have a comparable variable. The fiscal year 2002 DSS datasets have two cost variables that are usable for comparison: the ACT_COST variable, which includes drug and overhead costs that are the sum of overhead costs, indirect labor, prescription packaging, and the drug product costs; and the DISPCOST variable, which contains dispensing costs that include the direct pharmacist labor costs plus mailing costs. The sum of these two variables represents the total DSS cost for the prescription. Table 6 presents a comparison of the PBM and DSS cost variables. As expected, the DSS total costs were greater than the PBM total costs because they include more components of the cost of dispensing a prescription. DSS total costs were 27.7% greater than the PBM drug costs on average.

Table 6: Comparison of DSS and PBM Total Costs for 41,506 Prescriptions

Costs	**Amount**	**% of PBM Total Drug Costs**
PBM Total Drug Costs	$866,570	100.0%
DSS Drug and Overhead Costs (ACT_COST)	$957,320	110.5%
DSS Dispensing Costs (DISPCOST)	$149,120	17.2%
DSS Total Costs (ACT_COST + DISPCOST)	$1,106,441	127.7%

Variations in costs for a particular drug were analyzed for the ten most commonly occurring NDC labeler and product codes. The difference between the PBM drug costs and the DSS drug and overhead costs (ACT_COST) vary by drug and are reported in Table 7. In some cases the PBM costs are unexpectedly less than the DSS costs. In two cases, the DSS costs are significantly more than the PBM costs.

Table 7. DSS and PBM Costs for Prescriptions with the Ten Most Common NDC Labeler and Product Codes

Drug	Number of Prescriptions	Total PBM Drug Costs	Total DSS Drug and Overhead Costs (ACT_COST)	Total DSS Dispensing Costs (DISPCOST)	Difference Between DSS Drug and Overhead Costs and PBM Costs
Drug 1	290	$13,782.09	$14,896.50	$943.51	8.1%
Drug 2	400	$1,444.75	$1,090.01	$1,222.17	-24.6%
Drug 3	375	$210.75	$266.67	$1,005.45	26.5%
Drug 4 10MG TAB	424	$4,027.22	$4,071.50	$1,156.02	1.1%
Drug 4 20MG TAB	403	$4,395.16	$4,525.20	$912.43	3.0%
Drug 4 40MG TAB	296	$3,111.86	$10,644.47	$793.82	242.1%
Drug 5	1,063	$15,888.13	$12,765.44	$3,022.08	-19.7%
Drug 6	436	$1,411.35	$10,146.87	$1,168.09	618.9%
Drug 7	552	$7,117.84	$6,951.25	$1,460.70	-2.3%
Drug 8	350	$13,178.84	$15,416.23	$980.89	17.0%

An analysis of variation of the dispense unit costs appears in Table 8. A dispense unit is the unit of measure for the quantity dispensed, such as a tablet, inhaler, caplet, etc. The PBM dispense unit cost was calculated for each prescription by dividing the PBM drug cost for the prescription by the total quantity dispensed. The DSS dispense unit cost was calculated for each prescription by dividing DSS drug and overhead costs (ACT_COST) by the total quantity dispensed. The variation in the DSS dispense unit costs was considerably greater than the variation in the PBM dispense unit costs and differed by drug.

We compared the distribution of costs for the two drug products having the greatest variation in total costs—Drug 4, with a strength of 40 mg, and Drug 6. Results appear in Table 9. DSS dispense unit costs were at least twice the average dispense unit costs for 30% of the prescriptions for Drug 6 and 20% of the prescriptions for Drug 4. PBM dispense unit costs were consistent across almost all of the prescriptions. To determine whether the variations were due to cost differences among the stations, the mean cost and standard deviation by station were analyzed. DSS cost allocation schemes are established by each DSS site. The results are in Tables 10 (page 18) and 11 (page 19). The DSS mean dispense unit costs, standard deviations, and coefficients of variation differed by station; there was little variation in PBM mean dispense

Table 8. Variations in PBM and DSS Costs per Dispense Unit for the Prescriptions with the Ten Most Common NDC Labeler and Product Codes

VA Product Name	Mean PBM Drug Cost per Dispense Unit (std. dev.)	Coefficient of Variation of PBM Costs	Mean DSS Drug and Overhead Costs (ACT_COST) per Dispense Unit (std. dev.)	Coefficient of Variation of DSS Costs
Drug 1	$21.22($2.094)	9.9%	$21.37 ($22.921)	107.3%
Drug 2	$1.78($0.936)	52.6%	$1.38 ($1.263)	91.5%
Drug 3	$0.01($0.006)	64.9%	$0.02 ($0.043)	274.2%
Drug 4 10MG TAB	$0.14($0.004)	2.7%	$0.15 ($0.163)	107.7%
Drug 4 20MG TAB	$0.14($0.003)	2.0%	$0.14 ($0.132)	91.6%
Drug 4 40MG TAB	$0.14($0.003)	2.0%	$0.48 ($0.986)	205.5%
Drug 5	$0.22 ($0.004)	2.0%	$0.18 ($0.267)	148.5%
Drug 6	$0.03 ($0.012)	39.9%	$0.23 ($0.499)	220.8%
Drug 7	$4.62 ($0.245)	5.3%	$4.02 ($3.397)	84.4%
Drug 8	$0.87 ($0.183)	20.9%	$1.02 ($0.850)	83.5%

Table 9. Distribution of DSS Drug and Overhead Costs (ACT_COST) and PBM Drug Costs per Dispense Unit

Percentile	Drug 6 Cost Per Dispense Unit		Drug 4 40mg Tablet Cost per Dispense Unit	
	DSS	PBM	DSS	PBM
0	$0.00	$0.02	$0.01	$0.14
10	$0.00	$0.03	$0.02	$0.14
20	$0.02	$0.03	$0.11	$0.14
30	$0.03	$0.03	$0.13	$0.14
40	$0.03	$0.03	$0.14	$0.14
50	$0.05	$0.03	$0.15	$0.14
60	$0.07	$0.03	$0.15	$0.14
70	$0.16	$0.03	$0.21	$0.14
80	$0.40	$0.03	$0.29	$0.14
90	$0.44	$0.03	$0.69	$0.14
100	$3.64	$0.07	$3.73	$0.16

unit costs and standard deviations by station. Thus, prescription costs differences among and within stations contribute to the variations in DSS costs. It is expected that less variation in DSS costs will be found in more recent fiscal years than 2002 because these costs have undergone more auditing since 2002 to improve the quality of the DSS data.*

Table 10. Variation of DSS Drug and Overhead Costs (ACT_COST) and PBM Drug Costs per Dispense Unit
by Station for Prescriptions for Drug 4 40mg Tablets

Station	**Number of Prescriptions**	**Total Quantity Dispensed**	**Mean DSS Dispense Unit Cost (std. dev.)**	**Coefficient of Variance DSS Dispense Unit Cost**	**Mean PBM Dispense Unit Cost (std. dev.)**	**Coefficient of Variance PBM Dispense Unit Cost**
1	69	4,312	$0.15($0.00)	2.6%	$0.14($0.00)	1.0%
2	28	1,815	$0.13($0.04)	31.2%	$0.14($0.00)	0.0%
3	22	1,770	$3.18($1.03)	32.3%	$0.14($0.00)	0.0%
4	20	1,472	$0.28($0.16)	57.5%	$0.14($0.00)	0.0%
5	17	1,530	$0.02($0.04)	170.8%	$0.14($0.00)	0.0%
6	15	1,170	$0.15($0.04)	27.4%	$0.14($0.00)	0.0%
7	13	1,250	$0.16($0.06)	34.7%	$0.14($0.00)	0.0%
8	11	990	$0.29($0.00)	0.0%	$0.14($0.00)	0.0%
9	10	870	$0.08($0.00)	1.5%	$0.14($0.00)	0.0%
10	8	600	$0.42($0.25)	58.4%	$0.14($0.00)	0.0%
11	8	1,050	$0.13($0.14)	112.1%	$0.14($0.00)	0.0%
12	7	435	$0.16($0.04)	25.3%	$0.14($0.00)	0.0%
13	5	375	$0.15($0.00)	0.5%	$0.16($0.00)	0.0%
14	4	129	$0.54($0.29)	53.8%	$0.14($0.00)	0.0%
15	4	360	$0.43($0.28)	65.8%	$0.14($0.00)	0.0%
16	4	360	$3.73($0.00)	0.1%	$0.14($0.00)	0.0%
17	4	360	$0.28($0.29)	105.5%	$0.14($0.00)	0.0%

* Phone conversation between Steve Porter, DSS Management Analyst, and Noreen Arnold on 5/31/05.

Table 11. Variation of DSS Drug and Overhead Costs (ACT_COST) and PBM Drug Costs per Dispense Unit Costs by Station for Prescriptions for Drug 6 Tablets

Station	Number of Prescriptions	Total Quantity Dispensed	Mean DSS Dispense Unit Cost (std. dev.)	Coefficient of Variance DSS Dispense Unit Cost	Mean PBM Dispense Unit Cost (std. dev.)	Coefficient of Variance PBM Dispense Unit Cost
1	52	5,265	$0.03($0.00)	0.0%	$0.03($0.00)	0.0%
18	42	3,086	$0.16($0.02)	14.3%	$0.03($0.00)	0.0%
2	33	2,700	$0.40($0.00)	0.0%	$0.03($0.00)	0.0%
13	32	4,050	$0.07($0.00)	0.1%	$0.07($0.00)	0.0%
3	32	3,420	$0.52($0.91)	177.0%	$0.03($0.01)	30.8%
9	28	4,560	$0.01($0.00)	0.3%	$0.03($0.00)	0.0%
19	28	3,169	$0.03($0.01)	32.3%	$0.03($0.00)	0.0%
4	27	2,020	$0.10($0.14)	148.5%	$0.03($0.00)	4.5%
10	17	990	$0.66($0.42)	64.0%	$0.03($0.00)	0.0%
8	16	2,040	$0.44($0.00)	0.0%	$0.03($0.00)	0.0%
20	13	2,010	$0.03($0.01)	30.6%	$0.03($0.00)	0.0%
21	10	720	$0.02($0.01)	58.1%	$0.03($0.00)	0.0%
22	9	1,170	$0.00($0.00)	2.6%	$0.03($0.00)	0.0%
23	9	810	$0.41($0.00)	0.0%	$0.03($0.00)	0.0%
24	6	520	$0.03($0.01)	21.3%	$0.03($0.00)	0.0%
25	5	720	$0.39($0.00)	0.0%	$0.03($0.00)	0.0%
26	5	420	$0.08($0.02)	23.8%	$0.03($0.00)	0.0%
5	4	480	$0.00($0.00)	0.0%	$0.03($0.00)	0.0%
27	4	480	$3.64($0.00)	0.0%	$0.03($0.00)	0.0%
12	4	240	$0.03($0.00)	0.0%	$0.03($0.00)	0.2%
28	4	450	$0.24($0.13)	53.4%	$0.03($0.00)	0.0%
11	4	400	$0.06($0.02)	43.4%	$0.03($0.00)	0.0%

Table 12 contains the distribution of differences between PBM and DSS costs for 813 drugs identified as unique NDC labeler and product codes. Forty percent of these drugs had DSS costs that were less than the PBM costs. The percent difference between DSS and PBM costs ranged from -57.2% at the 10th percentile to 277.7% at the 90th percentile. On average, this percent difference was 10.5% (Table 6) for the 41,506 prescriptions.

Table 12. Distribution of the Difference between Total DSS Drug and Overhead Costs (ACT_COST) and PBM Drug Costs by NDC Labeler and Product Code (Negative Difference indicates PBM Costs are Greater than DSS Costs)

Percentile	**Difference**
0	-100.0%
1	99.5%
5	-75.7%
10	-54.3%
20	-33.2%
30	-26.0%
40	-2.2%
50	12.6%
60	32.3%
70	67.4%
80	119.0%
90	303.8%
95	682.6%
99	5021.6%
100	36469.0%

Note: Percent differences were calculated for each group of prescriptions with the same NDC labeler and product code having at least 4 prescriptions in the group. There were 813 of these groups representing 23,796 prescriptions.

Lastly, the DSS dispensing costs (DISPCOST) were analyzed for all the 41,506 prescriptions. Table 13 contains mean dispensing cost and standard deviation by type of prescription fill: VAMC pharmacy or CMOP fill; mailed to patient or picked up by patient; and new prescription, partial fill, or refill. As expected, CMOP fills had the lowest cost, averaging $1.61 for new prescriptions and $1.68 for refills; new prescriptions had higher dispensing costs than refills at VAMC pharmacies; and mailed prescriptions from a VAMC Pharmacy had higher costs than prescriptions picked up. Unexpectedly, partial fills had lower costs than refills. The only difference between a partial fill and a refill would be the quantity dispensed, which should not significantly affect the labor cost or mailing costs. Analyses of dispensing costs by quantity dispensed did not show that costs increased with quantity dispensed.

Table 13. Analysis of DSS Dispensing Costs (DISPCOST) by Type of Prescription Fill

New/ Partial/ Refill[a]	Pharmacy/ CMOP[b]	Mailed/ Window[c]	Number of Prescriptions	Mean Dispensing Cost (std. dev.)	Coefficient of Variation Dispensing Cost
New	Pharmacy	Mail	785	$13.98($7.87)	56.3%
New	Pharmacy	Window	8,909	$7.74($3.45)	44.6%
Partial	Pharmacy	Mail	79	$9.71($5.63)	57.9%
Partial	Pharmacy	Window	887	$3.62($2.37)	65.3%
Refill	Pharmacy	Mail	845	$8.77($4.62)	52.6%
Refill	Pharmacy	Window	2,156	$5.34($2.48)	46.6%
New	CMOP	Mail	9,968	$1.61($1.06)	65.5%
Refill	CMOP	Mail	17,867	$1.68($0.95)	56.3%

Note: 4 prescriptions were dropped from the analysis because their flags were inconsistent indicating that the prescription was filled at a CMOP but picked up at a window.
[a]New/Partial/Refill – Indicates whether the prescription was a new prescription, a partial fill or a refill.
[b] Pharmacy/CMOP – Indicates whether the prescription was filled at a VAMC Pharmacy or by a Consolidated Mail Order Pharmacy (CMOP).
[c] Mailed/Window – Indicates whether the prescription was mailed to the patient or picked up by a patient at a VAMC Pharmacy.

Limitations of the Data

This study looked at fiscal year 2002 (October 1, 2001, through September 30, 2002) outpatient prescriptions for a small cohort of veterans in the CSP 456 Hernia Study. These veterans are not a representative sample of veterans using the VHA in 2002, and, therefore, the results of this comparison may not be representative of outpatient prescriptions for the whole population or other subpopulations.

Conclusions

The DSS NDE Pharmacy SAS Datasets became available for VA researchers in 2003 and provided VA researchers with a second source of national prescription data. The PBM Database is the only other easily accessible national source of prescription and has been available since 2000. Because these datasets are created by independent processes, the end products of which are the same (all dispensed prescriptions in VistA), we can be reasonably assured that both processes are complete and accurate if a comparison of the two yields few discrepancies. We found a discrepancy rate of less than 2% in the cohort studied. Based on this low discrepancy rate and the relatively minor nature of most of these discrepancies, researchers can expect to find the same prescriptions in either the PBM Database or the DSS Datasets.

For identifying drugs of interest, use of the DSS Drug Description field is not recommended, because the description is a truncated version of the drug product name and may be difficult to parse. It is suggested that the DSS Dataset be linked to the VA National Drug File or an external source such as the Multum Drug Lexicon to obtain a more usable name.

The NDC on the DSS Dataset is in a more usable format than the NDC on the PBM extract, making it much easier to link DSS data to an external database using the NDC to obtain additional information about the drug prescribed. The maximum match rate of the NDC to an external drug database was achieved using the Multum Drug Lexicon. Approximately 90% of the NDCs on the DSS extract were found in Multum. We could assign a linkable NDC to 99% of the remaining records by matching the prescription to another prescription in the extract with the same drug name.

DSS prescription costs are more comprehensive than PBM prescription costs because they contain all components of the cost of filling a prescription (i.e., labor, supplies, overhead, etc.). The PBM extract has data only on the cost of the drug product. The DSS dispense unit costs show unexpected variances from the PBM dispense unit costs by drug and larger than expected variation among prescriptions for the same drug. Thus, it is recommended that researchers using the DSS costs perform some analyses of the costs and make a decision on whether to use the DSS costs at the prescription level or use another costing method. For example, a researcher may chose to calculate the cost of a prescription by using an adjusted average wholesale price for the cost of the drug and adding an average amount or percentage for labor and overhead costs based on average DSS costs. Because more audits of the DSS process are occurring each year, it is anticipated that DSS datasets more recent than fiscal year 2002 will show less variation.

The DSS NDE Pharmacy SAS Datasets are a viable alternative to requesting a PBM extract. The major drawback in using the DSS Datasets is the fact that they do not contain dosing instructions. Also, the fiscal year 2002 DSS Datasets do not contain a variable indicating the number of days' supply the prescription provided. Therefore, it would be difficult to determine the dosage schedule using the fiscal year 2002 DSS Datasets. On the other hand, the DSS Datasets are easier to access and provide information not available on the PBM database, such as the total cost of the prescription including labor and overhead.

This comparison looked only at outpatient prescriptions. A similar comparison of inpatient prescriptions was not feasible because currently PBM does not provide inpatient extracts to researchers. When PBM inpatient prescription extracts become available, a comparison with DSS inpatient prescriptions would provide assurances about the accuracy and completeness of inpatient prescriptions. Other future reviews that should be considered include comparing the outpatient extracts for additional fiscal years for a more representative sample of veterans using VHA pharmacies. Additional fields, such as days supply, are available on the DSS Dataset in fiscal year 2003, and these fields should also be validated.

Acknowledgements

This work was supported by the VA Information Resource Center, Health Services Research and Development Service (SDR 98-004) and the Cooperative Studies Program of the Department of Veterans Affairs, Office of Research and Development. The opinions expressed in this document are those of the authors and do not necessarily represent the opinions of the Department of Veterans Affairs.

We gratefully acknowledge input and review from the following individuals: Michael Leigh and Steve Porter, M.S., M.H.A., from the VHA Decision Support Office; Paul Barnett, Ph.D., and Mark Smith, Ph.D., from the VA Health Economics Resource Center; Richard Owen, M.D., from the VA Center for Mental Healthcare and Outcomes Research; Sam Georgeson, M.P.A., from the VA Austin Automation Center; and Fran Cunningham, Pharm.D., and Robert Silverman, Pharm.D., from the VA Pharmacy Benefits Management/Strategic Health Group. Patricia A. Murphy, M.S., and Cynthia Padera edited this report.

Suggested Citation

Arnold N, Hynes DM, Stroupe KT. VIReC Technical Report 1: Comparison of VA Outpatient Prescriptions in the DSS Datasets and the PBM Database. Edward Hines, Jr. VA Hospital, Hines, IL: VA Information Resource Center, January 15, 2006.

References

1. Neumayer L, Jonasson O, Fitzgibbons R, et al. Tension-free inguinal hernia repair: the design of a trial to compare open and laparoscopic surgical techniques. J Am Coll Surg 2003 May;196(5):743-52.

2. Neumayer L, Giobbie-Hurder A, Jonasson O, et al. Open mesh versus laparoscopic mesh repair of inguinal hernia. N Engl J Med 2004 April 29;350(18):1819-27.

3. Smith MW, Joseph GJ. Pharmacy data in the VA health care system. Med Care Res Rev 2003 September;60(3 Suppl):92S-123S.

4. VIReC Research User Guide: VHA Pharmacy Prescription Data. Edward J. Hines, Jr. VA Hospital, Hines, IL: Veterans Affairs Information Resource Center; September 2003 (Rev. May 2005).

5. VIReC Research User Guide: VHS DSS Clinical National Data Extracts FY2001-FY2003. Edward J. Hines, Jr. VA Hospital, Hines, IL: Veterans Affairs Information Resource Center; August 2004 (rev. August 2005).

6. Brown SH, Lincoln MJ, Groen PJ, Kolodner RM. VistA--U.S. Department of Veterans Affairs national-scale HIS. Int J Med Inform 2003 March;69(2-3):135-56.

7. Cunningham F, Sales M, Valentino M. The Pharmacy Benefits Management (PBM) Database: A Primary Resource for Nation-Wide VA Medication Data. VIReC Insights. Hines, Illinois: VA Information Resource Center, 2001, Vol. 2 No. 2.

8. National Drug Code Directory [database online]. Rockville, MD: Food and Drug Administration, Division of Compliance Risk Management and Surveillance; 2005. Available at http://www.fda.gov/cder/ndc/database/default.htm. Accessed September 30, 2003.