Matching Prosthetics Order Records in the VA National Prosthetics Patient Database (NPPD) to Health Care Utilization Databases

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**Abbreviations**

CPT  Current Procedural Terminology  
DALC  Denver Acquisitions and Logistics Center  
DSS  Decision Support System  
FY  Fiscal year  
HCPCS  HCFA Common Procedure Coding System  
HERC  Health Economics Resource Center  
ICD-9  International Classification of Disease, 9th Edition  
IE  Inpatient Encounter  
IFCAP  Integrated Funds Distribution, Control Point Activity, Accounting and Procurement  
NDE  National Data Extract  
NOC  Not Otherwise Classified  
NPCD  National Patient Care Database  
NPPD  National Prosthetics Patient Database  
OPC  Outpatient Care File  
PSAS  Prosthetics and Sensory Aids Service  
PTF  Patient Treatment File  
SCRSSN  Scrambled Social Security Number  
SSN  Social Security Number  
VA  U.S. Department of Veterans Affairs  
VHA  Veterans Health Administration  
VIReC  VA Information Resource Center
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Abstract

Introduction
The National Prosthetics Patient Database (NPPD) is the national VA dataset that records characteristics of individual prosthetic and assistive items. It remains unknown how well NPPD records can be matched to encounter records for the same individuals in major VA utilization databases.

Methods
We compared the count of prosthetics records in NPPD to the count of prosthetics-related procedures for the same individuals recorded in major VA utilization databases. We then attempted to match NPPD records to the utilization records by person and date.

Results
In general 40-60% of NPPD records could be matched to outpatient utilization records within a 14-day window around the NPPD data entry date. Match rates were lower for inpatient data.

Discussion
NPPD will be particularly important for studies of certain veteran groups, such as those with spinal cord injury or blast-related polytraumatic injury. Health services researchers should use both NPPD and utilization databases to develop a full understanding of prosthetics use by individual patients.
1 Introduction

In fiscal year (FY) 2007 VA provided prosthetic and sensory devices, repairs, and related services to over 1.5 million veterans at a cost of more than $1.3 billion. The VA Prosthetics and Sensory Aids Service (PSAS) oversees procurement, replacement, and repair of these items. The range of items is very wide: prosthetics and orthotics, assistive devices of all kinds, and everything that is implanted in or on a patient for an intended period of 30 days or more. Thus cardiac stents, bandages, injection catheters, and surgical fixtures are all ordered through PSAS. The most common devices and services include home oxygen therapy, glasses, orthopedic devices, and surgical supplies. In this report we will use the term “prosthetics” to refer to all of these items and services.

Prosthetics devices and services constitute an important and timely research area. They play an important role in the care for veterans who have sustained polytrauma and blast-related injuries (Bendixen et al. 2008; Sayer et al. 2008). As longevity of Americans increases there may be growing demand for assistive devices. Congressional scrutiny of payments for long-term oxygen therapy (GAO 1997, 2002) suggests the value of research on the comparative effectiveness and cost-effectiveness of high-cost prosthetics. The trend toward home-based health care, such as home monitoring of chronically ill patients with the VA Home-Based Primary Care program (Cooper et al. 2007) or for patients with polytraumatic injury (Darkins et al. 2008), may also lead to a greater reliance on home care products distributed by PSAS. A related issue is the extent to which assistive devices can substitute for personal care at home or in long-term care (Agree et al.
2005; Hoenig, Taylor, and Sloan 2003). In some cases VA has the option to purchase and
customize products from a variety of internal and external sources. NPPD could be used to
assess the implications of each option for cost and quality (Hubbard et al. 2007). Finally, the
range and cost of alternative devices and services within particular classes, such as wheelchairs
and scooters (Hubbard et al. 2007) or artificial limbs (Downs 2000), point to the need for cost-
effectiveness analyses in all areas of rehabilitation, whether home-based or institutional.

VA records orders for prosthetic items in the National Prosthetics Patient Database (NPPD). The
database includes orders for new items as well as for rentals and repairs. Each record represents
an individual item identified by a HCPCS (HCFA Common Procedure Coding System) code.
There is little clinical or demographic data, but the patient ID variable may be used to find such
information in other VA databases (Pape et al. 2001). NPPD includes items that are ordered by
VA providers for an individual, including those ordered by non-VA providers working on
contract; it does not include items ordered for ward stock (L. Kiley, personal communication,
2007). NPPD cannot be used to determine whether or for how long the patient used a particular
prosthetic item. In this respect it is similar to a pharmacy prescription database that records
whether a prescription was filled but not whether the patient took a medication.

NPPD has been employed in several published analyses. Downs (2000) introduced NPPD as a
research tool through an analysis of artificial limbs, comparing FY1999 frequencies across
regional VA networks and between VA and commercial providers. Render and others (2003)
collated data from NPPD and other VA sources, estimating total prosthetics spending of $30.6
million at six VA sites in FY1999. In an unpublished study, Fitzgerald et al. (2003) described limitations in FY2001 NPPD data, reported the proportion of records with zero or missing cost, and estimated the level of questionable outlier payments to the top 500 prosthetics vendors. Hubbard and colleagues (2006, 2007) employed NPPD to describe the distribution and cost of wheelchairs and scooters in VA in FY1999-FY2001. Although Hubbard et al. (2006) used data from utilization files in conjunction with NPPD records, no published study has matched individual NPPD records to related inpatient or outpatient encounters around the same time.

Some prosthetics research will require person-level data on other aspects of care. They can be found in VA utilization databases such as the Patient Treatment File (PTF), the Outpatient Care File (OPC), and Decision Support System (DSS) National Data Extracts (NDE). PTF and the DSS inpatient NDEs report inpatient services, while OPC and the DSS outpatient NDEs record outpatient services (Phibbs et al. 2008; VIReC 2009). Each is organized by encounter and provides clinical and demographic data. NPPD provides researchers with certain data fields beyond those in these utilization data, such as HCPCS codes and costs for particular prosthetics, but it is unknown \textit{a priori} whether they also indicate prosthetics encounters that cannot be observed or inferred from other sources. If all NPPD prosthetics orders correspond to prosthetics-related encounters in DSS and PTF/OPC, then NPPD would be needed only to provide detail about specific prosthetics orders and the direct cost of prosthetics. Conversely it will be necessary to consult NPPD in addition to the utilization databases if there are prosthetics dispensed without a provider encounter or if the prosthetics-related encounters cannot be located with certainty in the utilization data.
To address this issue we investigated the extent to which NPPD records can be matched to inpatient and outpatient encounters recorded in the DSS National Data Extracts (NDEs), in OPC, and in PTF. We had two hypotheses:

**Hypothesis 1**: NPPD records can be matched to prosthetics-related events in the OPC (outpatient) and PTF (inpatient) utilization files within +/- 28 days.

**Hypothesis 2**: NPPD records can be matched to prosthetics-related events in the DSS NDE inpatient and outpatient utilization files within +/- 28 days.

We believed that the match rates would be high because both DSS and NPPD draw prosthetics information from the VISTA Prosthetics Package. Two datasets that draw from the same source could be expected to have similar records. OPC/PTF and the DSS NDEs have extremely high overlap when one selects DSS records that have the value of ‘NPCD’ in the variable ENCFLAG (King 2007). Thus by choosing the NPCD records in DSS we expect to find similar results with OPC/PTF as we do with DSS.

This research project was approved by the Stanford University IRB.

2  Methods

2.1  Data years

We obtained NPPD, DSS, OPC, and PTF data for FY2002 and FY2005. FY2002 data were the newest available when we obtained them from PSAS in 2003. After reviewing results of the
FY2002 analyses, a PSAS staff member recommended an additional analysis of the most recent data then available, from FY2005, because data processing improvements since FY2002 could have led to different results. We therefore performed a similar set of analyses on FY2005 data.

2.2 NPPD date fields

A common method for searching utilization data is to look for all records pertaining to a particular individual that fall within a pre-specified time period, such as the time from study enrollment to the end of a follow-up period. Patient ID appears on the NPPD data in the form of scrambled Social Security number (SCRSSN). There are two date fields in NPPD. One is the data entry date (CREATEDT), which records when the prosthetics order entered VISTA. By VA policy it should be within 5 days of the date when a physician enters a prosthetics request (“consult”) into the patient’s electronic medical record. The data entry date often falls before the patient receives the prosthetic item, although in some cases it can come afterward. The second variable is labeled Delivery Date (DELIVRDT). It represents the date when payment for the order clears in a VA financial system called IFCAP (Integrated Funds Distribution, Control Point Activity, Accounting and Procurement). The delivery date has no necessary relation to clinical events. We therefore used the data entry date (CREATEDT) as an approximation of the encounter date (or “service date”) at which the item was ordered by a clinician.

2.3 Procedure codes

Prosthetics devices and services are referenced by HCPCS codes of two types. The first, known as Level I codes, are procedures codes in the Common Procedural Terminology (CPT) system. These are services and procedures provided in physician offices. The second type, Level II
codes, represents additional items and services excluded from CPT by design. They cover
devices, supplies, and procedures provided outside of a physician’s office. Level II codes are
distinguished by a leading alphabetic character rather than a leading digit (e.g., “V2020”).
Examples of common HCPCS codes in NPPD include V2199 (lens, single vision, NOC), A4670
(auto blood pressure monitor), and V5014 (hearing aid repair/modifying).

Most but not all prosthetics items have individual codes. Where two or more share a single code
they are similar in nature, such as two models of wheelchair. When a prosthetics order contains
multiple items NPPD usually features a separate record for each item that has its own HCPCS
code, although in some cases they are entered as a single record.

The utilization databases employ two procedure code sets. Outpatient records in OPC and DSS
use the HCPCS system. Although the variable names refer to CPTs, both Level I and Level II
codes are allowed. PTF and the DSS NDE for inpatient care use the International Classification
of Disease - 9th Revision (ICD-9) procedure coding system. To ensure comparability between
inpatient and outpatient results we would have liked to use the same coding system for both.
ICD-9 codes cannot be matched one-to-one with HCPCS codes, however, because there are
substantially fewer ICD-9 codes.

We believed that the match between NPPD and utilization databases would be better for
prosthetics items referenced by Level II codes than for those referenced by Level I (CPT) codes.
It was straightforward to test this using outpatient records, as we could simply select those
records using Level II codes. For inpatient records, however, the distinction between Level I and Level II was not evident from the ICD-9 procedure code. We therefore reviewed the entire set of ICD-9 procedure codes and developed two lists. The first included all procedures that involve prosthetics in some fashion; this was designed to be similar to the entire HCPCS set. The second, a subset of the first, included only those codes that refer directly to a prosthetic device, such as surgical placement of a cardiac stent. This list was intended to relate more specifically to the Level II HCPCS codes.

2.4 Categories of prosthetics items

Our next step was to classify prosthetics items into 10 broad categories based on their names and on descriptions available in published guides. The categories and brief descriptions appear in Table 1. They were chosen based on heuristic groupings of HCPCS codes rather than by name alone.

The categories clarify several facts about prosthetics in NPPD. First, the term includes non-durable equipment like dialysis catheters as well as durable items like prosthetic limbs and hearing aids. Second, it includes some items that are placed in or on the body for relatively short periods, such as external fixation devices. Note certain services delivered on contract, such as long-term oxygen therapy, may include instruction, delivery, and other services that are secondary to the prosthetic item itself. And as noted earlier, a multi-part item such as a wheelchair could be entered as a single NPPD record or as multiple records, one for each part. In all cases we followed the observed coding.
2.5 Encounter definition

Our analyses rely on encounters recorded in VA utilization databases and so we define an encounter as they do. This section defines encounters by setting: outpatient, inpatient, and items mailed from VA’s Denver Acquisitions and Logistics Center.

Outpatient Encounters

Outpatient encounters are contacts between patients and providers in person, by telephone, or through videoconferencing. VA utilization datasets exclude patient consults that do not lead to a procedure, such as contacts for purely research or administrative purposes.

A physician or other provider enters a prosthetics consult into the patient’s electronic medical record. The patient then goes to the prosthetics clinic to obtain the item or, for certain items such as oxygen equipment, receives it directly at home. Obtaining a prosthetic item on an outpatient basis therefore involves at least two encounters: one with the physician who prescribes the item and enters an electronic order, and a second when the patient obtains the item. In some cases additional encounters are required to assess feasibility of the item for the patient, such as a home visit after an initial order for long-term oxygen therapy.

In some cases the initial encounter record in DSS or OPC will not give evidence of a prosthetic consult. If the consult is placed during an encounter whose primary purpose was something else, then the procedure code assigned to the visit is likely to pertain to the primary topic rather than to the prosthetic. Moreover, entering a prosthetics consult does not automatically generate a prosthetics procedure code for the encounter. Thus we are most likely to find a match for an
NPPD record to an encounter at the prosthetics clinic or at an intervening prosthetics-related consultation, such as with a physical medicine and rehabilitation clinic.

**Inpatient Encounters**

Inpatient encounters are defined by an admission and discharge. (Adding stays that had not discharged by the end of the fiscal year would not change our results meaningfully.) Residential rehabilitation, domiciliary, and long-term care stays are also considered to be inpatient encounters. Emergency department visits are treated as inpatient or outpatient depending on how they were coded in the utilization data.

There will be a single encounter record for prosthetics placed during surgery. Procedures performed at the bedside, such as evaluation for a prosthetic by a physician in the physical medicine and rehabilitation clinic, would not create a separate inpatient record. If a patient in a rehabilitation or long-term care program obtained outpatient care at a VA facility during his stay, however, then a separate outpatient record would be created.

**Denver Acquisition and Logistics Center**

A key issue for this study is whether a patient can receive a prosthetic item outside of an encounter. The answer is ‘no’ for most items. Any nontrivial contact between a provider and a patient should be entered as an encounter. An exception is VA’s Denver Acquisition and Logistics Center (DALC, formerly the Denver Distribution Center or DDC), which provides prosthetics items to VA facilities but also mails them directly to some individuals (DALC 2009).
It appears that a patient can request an item from DALC and receive it by mail without having a provider encounter.

DALC activities do not appear in OPC outpatient datasets but do appear in the DSS NDEs for outpatient care. DSS indicates DALC records through several variables: the clinic stop code (variable CLSTOP), the indicator variable DDC (prior to FY2005 only), and the DALC supply cost variable (ODDCSUPPL prior to FY2005, DD_SUP since FY2005). An important limitation is that DSS outpatient records do not contain procedure codes. Thus a DALC record will indicate the person, date, and cost, but not what item was dispensed. Because our matching method relied on procedure codes, we limited our search of outpatient prosthetics items to encounters in OPC and to similar records in the DSS NDE for outpatient care. DALC records in the DSS NDEs for outpatient care were not searched.

Contract care encounters

We excluded encounters at non-VA facilities paid by VA, sometimes called contract care or purchased care. Records of most such encounters appear in the VA Fee Basis files (Smith and Chow 2007). They represented a small proportion of all VA encounters in FY2002 and FY2005. Among the 20 most common CPT codes in FY2004 outpatient Fee Basis files, only two had any obvious connection to prosthetics. They were 90935 and 90937, both of which pertain to kidney dialysis. As we will see, however, dialysis-related prosthetics orders are relatively rare in NPPD, and so we are not concerned that by excluding the Fee Basis files we are substantially worsening our match rate. Contract care has been growing rapidly in recent years, however, and so future research should consider including non-VA encounters.
2.6 Cohorts of prosthetics users

Next we describe the process for creating the FY2002 extracts. A similar process was used for the FY2005 extracts.

We first searched OPC for all outpatient encounter records having a prosthetics-related Level I (CPT) or Level II HCPCS procedure code. The list of codes was determined through a manual review of all procedure codes in the official 2002 CPT/HCPCS guide (AMA 2001). From these records we determined the set of unique patient IDs and randomly selected 4,000 of them. This is cohort OP1. The final step was to locate all NPPD records for these individuals in FY2002.

To create OP2 we began by locating all OPC outpatient encounter records having a prosthetics-related Level II HCPCS procedure code. This represents a subset of encounters found when making OP1. We then determined the unique set of patient IDs and randomly selected 5,000 of them. These individuals are cohort OP2. We then located all of their NPPD records in FY2002.

Next we turned to inpatient encounter records in the PTF file. We located all records having a prosthetics-related procedure code. From these records we determined the set of unique patient IDs, and then we randomly selected 1,000 of them. This is cohort IP. We then located all NPPD records for these individuals.
Cohort \textbf{NP} was the only one that did not use OPC or PTF encounter records. We determined the list of unique individuals represented by FY2002 NPPD records. Cohort \textbf{NP} is a random set of 5,000 of these people. We then extracted all of their NPPD records.

When locating NPPD records we dropped those that lacked a valid HCPCS code. For example, for many years shipping charges were reported as a separate record; the value ‘NPPDNULL’ appeared in the HCPCS field in such cases. Blank or null HCPCS values occurred many times in FY2002 NPPD data but almost never in FY2005 data. We also dropped any person having no records at all in NPPD. The count of individuals at each step is shown in Table 2.

\subsection*{2.7 Matching methods}

The matching process had two steps. In the first we simply counted the number of records by fiscal year and category in NPPD and in the OPC and PTF utilization data. We did not restrict the records to match on person ID (SCRSSN) or HCPCS code. This broad match offers a preview of the more specific matching to follow. Because all of our analyses are stratified by fiscal year and category, a wide discrepancy between NPPD and a utilization dataset in the number of records in a particular year-category pair would imply that matching with a more specific method will necessarily have poor results overall. Even if category-level matching is poor, however, it is possible that a subset of records within the year-category pair could match well, for example if the categories were further subdivided.

The second matching method used four variables: fiscal year, category, person ID (SCRSSN), and date (CREATEDT). This is the smallest set of variables that could allow a unique match of
encounter and NPPD records. Starting with the encounter date in the utilization data, we searched for every NPPD record that fell within the matching window and which had the same fiscal year, category, and SCRSSN. VA policy allows up to five days to enter a prosthetics order into NPPD, and so we allowed a matching window for the dates. Several windows were tried: 0 days (exact match), +/- 7 days, +/- 14 days, +/- 21 days, and +/- 28 days. In a few cases we added +/- 90 days as well, to see how much the match rate improved under a very wide window.

A unique feature of DSS NDEs is separate reporting of labor and supply costs. Labor costs represent salary and benefits for employees. Supply costs represent non-labor purchases such as equipment, pharmaceuticals, and all manner of prosthetics. A procedure tied to a prosthetic, such as stent implantation or glasses fitting, could involve labor costs alone, supply costs alone, or both. We therefore performed matching with two groups of DSS records: those having prosthetics labor costs greater than $0, and those have prosthetics supply costs greater than $0.

The second matching method requires careful interpretation. Because VA policy allows the NPPD order to be entered days after the physician consult that requests the item, the proportion of exact matches is not a measure of adherence to VA policy. We report the proportion of exact matches because once the match window is extended beyond 0 days multiple NPPD records can be matched to the same encounter record. Thus the matching percentages represent upper bounds on the true proportion that match in the given window. For example, suppose that a person had two inpatient operations in a 10-day period, each of which generates a single NPPD record for external fixation. Once the matching boundary exceeds 10 days, the two NPPD
records for external fixation will be “matched” to both operations, resulting in four apparent matches rather than two.

3 Results

3.1 Matching by Cohort

We began with cohort OP1, a random subset of individuals who had prosthetics-related outpatient procedure codes. Table 3 shows the number of OPC prosthetics procedure records and NPPD records occurring in FY2002 and FY2005 for the people in cohort OP1. The total number of items varies considerably across datasets. Because the outpatient encounter file (OPC) captures procedures rather than items it is unlikely to record many instances of supply deliveries. In practice we found no supply-related HCPCS codes in the outpatient encounter data for these patients. Once the supply records are removed, the total number of records differs by less than 10 percent in FY2002. A similar pattern holds in FY2005, although the remaining difference between NPPD and OPC is still large, 2,344 records.

We next analyzed cohort OP2, a random subset of individuals who had prosthetics-related Level II HCPCS procedure codes. Table 3 shows the number of outpatient encounter (OPC) records with prosthetics procedure codes, and the number of NPPD records, for people in Cohort OP2 in FY2002 and FY2005. The number of records is again quite discrepant within categories after supplies are removed. NPPD again reported a much greater number of eyeglasses and supplies records in both years. Both OPC and NPPD report a significant number of supply records for the OP2 cohort, although OPC had notably fewer than NPPD each year.
There were several notable changes between FY2002 and FY2005, as the NPPD staff had expected. The count of OPC records nearly doubled between years, somewhat greater increases than observed in NPPD records. In both years there were many categories with wide discrepancies in counts. Between FY2002 and FY2005 the match rate with NPPD decreased for OP1 but increased for OP2.

Next we analyzed the IP cohort, a randomly selected subset of individuals having inpatient prosthetics-related procedures. Table 4 presents the number of inpatient encounter (PTF) records and NPPD records for individuals in this cohort, by fiscal year and data source. Starting with inpatient NPPD records, we searched for prosthetics-related encounter records in the same fiscal year. Once supply records were removed, there were 81% more inpatient encounter records than NPPD records.

Our final analysis used individuals in the NP cohort, a randomly selected subsample of all those with NPPD records in FY2002. Starting with their NPPD records, we searched the inpatient (PTF) and outpatient (OPC) encounter files for prosthetic-related services incurred by the same individuals. Table 4 shows the distribution of records by category. There were substantially more records in the NPPD file for the individuals in cohort NP, even if one discounts supply records. Here the discrepancy is not mostly due to cardiac devices and non-cardiac catheters but instead to eyeglasses and orthopedics.
3.2 Matching by Fiscal Year, Category, and Encounter Date

By construction a single NPPD record was matched to every utilization record that fell within the matching window. The percentages in Tables 5-8 are therefore labeled as upper bounds because they will overstate the true rate of one-to-one matching, possibly by a considerable margin. The upper bounds are preceded by the symbol “<” to reflect that the true matching rate will be lower. The larger the match window, the larger the gap between the true value and the upper bound.

We began by looking for matches between prosthetics-related procedures marked by CPT codes. These correspond to cohorts OP1, IP, and NPPD. Several date ranges were tried. For each cohort we show the percentage of NPPD records that had an inpatient or outpatient encounter record in the same category for the same individual within 7, 14, 21, or 28 days before or after the NPPD data entry date. We expanded the window to 60 and 90 days for FY2005 data based on advice from a user of NPPD data. Results in Tables 5 indicate that fewer than 28% of NPPD records can be matched to encounter records within a 56-day window (+/- 28 days) around the NPPD data entry date. No more than one-third can be matched within a 180-day window around the NPPD data entry date in FY2005 (results not shown).

Next we searched again for matches by date between NPPD records and utilization records, but now limiting the utilization records to those having a HCPCS code corresponding to a device. Most of these appear in the outpatient setting and so we limited our data to outpatient NPPD records and the OPC utilization file. In order to obtain the largest sample size we used all
individuals in the OP1 and OP2 cohorts, a total of 7,183 persons in FY2002 and 6,470 persons in FY2005 (cf. Table 2).

By construction, all people in OP2 had at least one outpatient encounter record with a procedure code pertaining to a particular prosthetics device. Some but not all people in OP1 have at least one such record as well. Results in Table 6 indicate a much greater match rate. More than 35% of FY2002 records have an exact match in the outpatient encounter data, and as many as 65% match over a 56-day window around the NPPD data entry date. The matching rate was notably lower in FY2005, however, with only 11% matching exactly and under 42% matching within a 56-day window. These results demonstrate that substantially better matching is possible when one selects only CPT/HCPCS codes pertaining to specific prosthetics devices. The drop in matching frequency between FY2002 and FY2005 does not have an obvious explanation.

We next turned to DSS records to see whether matching rates would vary substantially from those found using OPC and PTF. Table 7 reveals that very few NPPD records for inpatient prosthetics could be tied to individual DSS inpatient records within four weeks before or after the NPPD data entry date. We found considerable variation across fiscal years and DSS records. In FY2002, as many as 30% of NPPD records could be matched to DSS outpatient records with positive prosthetics labor costs by date range, category, and person ID (Table 8). A much greater percentage, as high as 100%, could be matched to DSS records with positive prosthetics supply cost. The pattern reversed in FY2005 when up to 100% of NPPD records could be
matched to DSS records with positive prosthetics labor costs, while as many as 50% could be matched to DSS records with positive prosthetics supply costs.

4 Discussion

Tables 3-4 revealed low matching rates between NPPD and utilization databases in the count of prosthetics-related records within broad categories. We see several possible causes. The excess of NPPD records for eyeglasses prescriptions and fixtures could reflect the need for multiple orders for a single person, such as multiple pairs of frames and lenses or multiple types of fixtures used in a single procedure. Orders for prosthetic supplies and surgical fixtures appear to be the least likely to be reflected in encounter records. Some of the discrepancy in prosthetics supplies may have come from direct orders placed with DALC. NPPD processing software was enhanced in FY2008 to capture DALC orders for individual patients, thereby removing this possible source of discrepancy.

NPPD records more items than OPC in some categories but fewer records in other categories. A single NPPD order could pertain to multiple outpatient encounters if the item required visits to several clinics in order to assure appropriateness and to select the proper item and size. Conversely, NPPD could have more records than OPC in cases where multiple NPPD entries are needed for a single device, as for a wheelchair and its cushions. The latter does not occur categorically for major items, however; a multi-part item is sometimes entered as a single order.
The results of Tables 5-8 do not support our hypotheses that NPPD records could be matched to prosthetics-related encounters within 28 days before or after. There were modest gains in the match rate as the windows were expanded, but even at +/- 28 days a substantial proportion cannot be matched. Based on earlier results in Tables 3-4 we expect that the match rate would have been even lower if supply records had been included.

The proportion of records that match varied considerably by data source. The highest rates were found when matching NPPD records to DSS outpatient records having positive prosthetics labor or supply costs or to OPC records with prosthetics-related Level II HCPCS codes (cohort OP2). Explaining the varying match rates across data sources will require careful examination of differences in coding practices in outpatient versus inpatient encounters. Likewise, an investigation of why DSS assigns prosthetics labor costs and prosthetics supply costs could illuminate the widely varying match rates seen in Tables 7-8.

Relatively low matching rates among inpatients could result in part from missing data. Historically some inpatient events were not reliably captured. Examples include cardiac catheterization lab procedures (Rumsfeld 2007) and outpatient care received by residential and nursing home patients, among others. VA developed the Inpatient Encounter (IE) application to capture outpatient care provided to inpatients. IE achieved widespread implementation only after the fiscal years we studied. If it captures additional care that incorporates prosthetics then we would likely find higher matching rates among inpatients in future years.
Missing data could also arise from co-management. VA users rely on VA for only 20-50 percent of their care depending on enrollment priority group (CBO 2007). It seems unlikely, however, that this would explain our findings. Inpatients would not transfer to a non-VA provider for prosthetic services, and outpatient orders placed by a contract provider would lead to an order record in NPPD and related encounters in the Fee Basis files. We did not search Fee Basis files in this study because contract care constituted a very small proportion of all VA care in FY2002 and FY2005, but due to fast growth in contract care in recent years we recommend that research on data from later years incorporate the Fee Basis data.

To determine a full set of prosthetics items received by a single individual prior to FY2008 will require consulting two sources. Items ordered through NPPD and those ordered from DALC for bulk delivery to a medical center department will all appear in NPPD. Items ordered through DALC for particular individuals do not appear in NPPD until FY2008. Before that year they can be located in the Decision Support System DDC NDE.

The number of NPPD order records for an item does not indicate the number of VA inpatient and outpatient encounters that will be needed before and after the order. Thus the utilization datasets will always be needed to understand how use of specific items relates to patterns of health care use within VA. Elucidating the relation of individual prosthetics to VA encounters would be greatly eased if we could reliably link a particular NPPD order (and hence the item’s identity) to related inpatient or outpatient care. Our results, however, indicate that this type of temporal matching often does not work.
Although we did not study NPPD costs, a general caution is in order: NPPD costs should not be added to costs in encounter data. DSS encounter-level files incorporate costs assigned to prosthetics recorded in NPPD. Since FY2007 the encounter-level DSS files have excluded costs for orders filled by DALC; see DSO (2009) for details. The VA Health Economics Resource Center (HERC) has estimated costs for each encounter in PTF and OPC, and they too cover prosthetics costs. Prosthetics researchers interested in using the HERC data are strongly encouraged to consult the relevant guidebooks (Phibbs et al., 2008; Wagner and Barnett, 2009) for details on the handling of prosthetics costs.

An area for future research is alternative approaches to matching NPPD and encounter databases. One approach would be to rely on clinic stop codes rather than procedure codes. Each outpatient encounter is assigned a three-digit clinic stop code, which DSS calls the DSS Identifier. There are two clinic stop codes corresponding to the prosthetics department, numbers 417 (Prosthetics/Orthotics) and 423 (Prosthetic Supply Dispensed). Clinic code 417 is for evaluation, counseling, and treatment before or after an item is dispensed. Clinic code 423 covers dispensing of prosthetics, but also related activities such as “consultation, evaluation, education, information, and/or counseling concerning eligibility for prosthetic services, appliances, devices, and benefit claims and prescription processing” (DSO 2006). Searching for outpatient records with clinic stop codes 417 and 423 would reveal the total number of encounters with the prosthetics staff by an individual. DALC records could be found in DSS outpatient NDEs, although not in OPC.
A second area for future research is a validation of NPPD. The study by Fitzgerald et al. (2003) provided preliminary estimates of completeness and plausibility in cost data but did not compare the dataset to an outside standard. To determine the completeness of the data would require a time-consuming chart review possibly supplemented by interviews with providers and patients. Validating cost data would require additional research into contract payments for each item. It would be prohibitively expensive to carry out a full validation at even the VA station level, but a limited validation could be feasible if incorporated into a clinical trial that already featured chart review and an opportunity to interview patients and providers.

5 Conclusion
The results presented here suggest that many NPPD prosthetics records cannot be readily matched to outpatient or inpatient encounters. Unless one assumes that NPPD is always correct and therefore any matching issues reflect errors in the encounter databases, it follows that both NPPD and the encounter databases will be needed to develop a complete picture of prosthetics services for an individual VA user and for cohorts of users.
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