Use of Office Versus Ambulatory Surgery Center Setting and Associated Ancillary Services on Healthcare Cost Burden for Vasectomy Procedures

Vitaly Zholudev, Amir Ishaq Khan, Dattatraya Patil, Christopher P. Filson, and Akanksha Mehta

OBJECTIVE
To analyze variation in total healthcare costs for vasectomies performed in the United States, based on procedure setting and use of ancillary pathology services.

METHODS
We queried the MarketScan Commercial Claims database using CPT, ICD, and HCPCS codes to identify men who underwent vasectomy between 2009 and 2015, either in the office or ambulatory surgical center (ASC) setting, with or without use of pathology services. All payments for each treatment episode were calculated based on relevant claims. Patient out-of-pocket expenses were defined as the sum of copayments, coinsurance, and deductibles for each claim. Trends in vasectomy use, and differences in procedure costs by practice setting were compared over the study period.

RESULTS
453,492 men underwent a vasectomy between 2009 and 2015. The number of procedures decreased from 76,197 in 2009 to 37,575 in 2015 (P = .002). Average procedural costs increased from $870 in 2009 to $938 in 2015 (P = .001). Overall, 82.6% and 17.4% of procedures were performed in the office vs ASCs, respectively. In-office procedures were associated with lower total healthcare costs ($707 vs $1851) and lower patient out-of-pocket expenses ($173 vs $356) than those performed in ASCs. Vasal segments were submitted for pathologic evaluation in 40% of cases, which increased average payments by 55%. The use of ASCs and ancillary pathology services for vasectomies performed during the study period increased vasectomy-associated costs by $64 million.

CONCLUSION
The unnecessary use of ASCs and ancillary pathology services for vasectomy may lead to tens of millions of dollars in potentially avoidable healthcare costs annually. UROLOGY 129: 29–34, 2019. © 2019 Elsevier Inc.

Vasectomy is a safe and effective method of permanent male contraception, commonly performed in the office setting. According to recent estimates, between 175,000 and 500,000 vasectomies are performed annually in the United States.1,2 More than 75% of these procedures are performed by urologists,2 making vasectomy the most common nondiagnostic operation performed by urologists in the United States.3

Current American Urological Association (AUA) guidelines provide evidence-based standards for vasectomy practices and recommend against the routine use of perioperative antimicrobial prophylaxis and the reflexive use of pathology services to examine vasal segments.7 The guidelines also deem 1 negative postvasectomy semen analysis (PVSA) to be sufficient, negating the routine need for a repeat analysis. These recommendations have implications for healthcare costs associated with vasectomy. Two independent groups of authors, for example, have already demonstrated a decrease in healthcare costs associated with avoiding a repeat PVSA, without compromising success in determining outcome after vasectomy.4,5

In recent years, there has been an increase in the number of ambulatory surgical centers (ASCs) in the United States, accompanied by a concomitant decline in hospital-based outpatient surgery, and a shift towards ASC-based outpatient surgery, including urologic procedures.6 Physician ownership interests in ASCs have also increased, affecting
procedure mix and volume at these ASCs, both in for urologic surgery, as well as other surgical subspecialties.\textsuperscript{7,9} We hypothesized that improved access to the ASC setting may be associated with more frequent use of the ASC for vasectomies, as well as more frequent use of ASC-based ancillary services, such as surgical pathology. Given the volume of vasectomies performed annually in the United States, the healthcare costs associated with these practices patterns may be substantial.

The goal of this study was to investigate how use of the office vs ASC setting, and associated ancillary services such as pathology services, affects total healthcare costs, including insurance payments received, and patients’ out-of-pocket expenses, for vasectomy procedures performed in the United States.

METHODS

Data Source
The Truven Health MarketScan Commercial Claims and Encounters Database is a population-level database of deidentified health insurance claims from privately insured individuals covered with specific employer-sponsored commercial health insurance plans. The database contains information on annual health insurance claims for over 28 million individuals between the ages of 18 and 65 years.

Study Design
We used specific ICD-9, ICD-10, CPT, and HCPCS codes to identify all men that underwent vasectomy between 2009 and 2015, for whom insurance claims related to male sterilization were filed between January 15, 2009 and November 30, 2015. The relevant codes are summarized in Supplemental Table 1. Each procedure was outlined by a 45-day window surrounding the vasectomy date (15 days prior, 30 days after) to identify all the claims submitted pertaining to associated charges. Men undergoing concomitant procedures such as hernia and hydrocele repairs at the time of vasectomy were excluded.

Exposures
Our primary exposures of interest were the procedure setting (defined as either “office” or “ASC”) associated with the vasectomy procedure, and the use of pathology services. We excluded procedures performed in any other setting. Use of pathology services was based on CPT codes (Supplemental table 1) submitted within 30 days following the date of vasectomy. Additional variables of interest included patient comorbid conditions at the time of, or preceding vasectomy (supplemental table 2), geographic region, and residence within metropolitan statistical area, as defined by the United States Census Bureau. The analysis of geographic variation in vasectomy payments was limited to a single year (2015) in order to account for annual changes in procedure fees.

Outcomes
Our primary outcome of interest was the total healthcare cost for each vasectomy episode, based on CPT codes (Supplemental Table 1). We captured professional/facility payments, medication changes, and laboratory/pathology fees for each encounter (ie, insurance payments received) and determined the degree of patient cost-sharing by combining copay, deductibles, and coinsurance (ie, patients’ out-of-pocket expenses). We excluded antibiotics and injectable medications from our analysis defined using HCPCS codes, as less than 5% of claims were associated with injectable drugs and less than 1% of claims included antibiotics, which is in keeping with routine vasectomy care per AUA guidelines.

Statistical Analysis
We compared the demographic differences between patients undergoing office-based vs ASC-based vasectomies using generalized chi-square and Wilcoxon sum-rank tests. Differences in total healthcare costs with respect to procedure setting and use of pathology services were tested using ANOVA. Annual trends in vasectomy use overall, and by procedure setting, were tested with Cochran-Armitage trend test. We also determined geographic variation in payments across 210 metropolitan areas performing at least 30 vasectomies in 2015. We used SAS v.9.4 (SAS Institute Inc., Cary, NC) for all analyses and spatial map, with significance set as $\alpha = 0.05$.

This study was approved by the Emory University Institutional Review Board.

RESULTS
We identified 453,492 men who underwent a vasectomy during 2009-2015. Patient demographic and clinical characteristics are summarized in Table 1. Mean age at time of vasectomy was 38 ± 6.5 years. The majority of men undergoing vasectomy had no comorbidities (90%), and resided in urban areas (84%). More than one-third of the total number of vasectomies performed during the study period (34.4%) were performed in the South, as compared to other geographic regions.

The proportion of vasectomies performed in the ASC setting remained relatively stable during the study period, from 18.5% in 2009 to 17.9% in 2015 (P >.05). The total healthcare cost of an office-based vasectomy did not vary significantly between 2009 and 2015 ($728-$698, P >.05), in contrast to the substantial increase in total healthcare costs associated with ASC-based vasectomy during the same period ($1,496-$2,043, P ≤.0001) (Fig. 1). Average out-of-pocket expenses for patients undergoing office-based vasectomies during the study period were significantly lower than those undergoing ASC-based vasectomies ($173 vs $356, P ≤.0001). Across metropolitan areas, average total healthcare costs for vasectomy varied between $440 and $2,432 during 2015 (Fig. 2). Lower total healthcare costs were most consistently noted in the Southwest region of the United States.

Histologic examination of vasal segments was performed in 40% of procedures overall. The proportion of vasectomies that involved pathologic examination of vasal segments declined slightly from 40.0% in 2009 to 36.3% in 2015 (P value <.0001). Use of pathology services resulted in average additional healthcare costs of $134 and $566 for office and ASC-based procedures, respectively. Procedures performed at the ASC were significantly more likely to have histologic examination of vasal specimens compared to in-office procedures (65% vs 34% respectively).

Based on the vasectomy procedures performed during the 7-year study period, the use of the ASC setting was associated with approximately $57 million in avoidable healthcare costs. Use of pathology services for histologic confirmation of vasal segments was associated with approximately $7 million in avoidable healthcare costs. Taken together, performing all vasectomies in the office setting, without use of pathologic examination, would
have totaled in $64 million in cost savings between 2009 and 2015, or approximately $9 million annually.

**DISCUSSION**

Healthcare spending in the United States exceeds that of any other country in the world. According to estimates published by the Centers for Medicare and Medicaid Services, the cost of health care in the United States in 2017 was $3.5 trillion, accounting for 17.9% of the gross domestic product (www.cms.gov). This cost is projected to grow at an average rate of 5.8% per year, which outpaces the projected growth in GDP by 1% annually. Therefore, identification and prevention of avoidable healthcare costs is timely and warranted.

In this study of privately-insured men, covered by employer-sponsored health insurance plans, approximately 20% of vasectomies were performed in the ASC setting, accounting for $57 million in avoidable healthcare expenditures over the 7-year study period. Contrary to the recommendations set forth by the AUA guidelines, histologic evaluation of the vasal segment was performed in 40% of vasectomies overall, accounting for an additional $7 million in avoidable healthcare expenditures. Given that the present study captured only a fraction of the vasectomies performed annually in the United States, the implications for total healthcare cost savings related to procedure setting and use of ancillary pathology services is substantial, in excess of $9 million per year.

Ostrowski et al previously evaluated vasectomy trends in the United States using private insurance claims data, and reported similar numbers of vasectomies performed from 2009 to 2015.10 The authors then extrapolated the number of vasectomies performed nationwide using Census Bureau data, and found seasonal trends in vasectomy use, with March and December being the busiest months of the year. Although other population based datasets, such as the National Survey of Family Growth have been

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**Table 1.** Demographic and clinical characteristics of men undergoing vasectomy, 2009-2015

<table>
<thead>
<tr>
<th>Covariate</th>
<th>ASC-OPD Mean ± Std</th>
<th>Office Mean ± Std</th>
<th>Total Mean ± Std</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age groups</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mean ± Std</td>
<td>38.8 ± 6.9</td>
<td>37.9 ± 6.5</td>
<td>38 ± 6.5</td>
</tr>
<tr>
<td>55-59</td>
<td>1413 (1.8)</td>
<td>3,989 (1.1)</td>
<td>5,402 (1.19)</td>
</tr>
<tr>
<td>60-64</td>
<td>544 (0.7)</td>
<td>1028 (0.3)</td>
<td>1572 (0.35)</td>
</tr>
<tr>
<td>&lt;55</td>
<td>76,804 (97.5)</td>
<td>369,714 (98.7)</td>
<td>446,518 (98.46)</td>
</tr>
<tr>
<td>Charlson’s comorbidity score</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Median (Min-Max)</td>
<td>0 (0-12)</td>
<td>0 (0-12)</td>
<td>0 (0-12)</td>
</tr>
<tr>
<td>0</td>
<td>68,940 (87.5)</td>
<td>339,526 (90.6)</td>
<td>408,466 (90.07)</td>
</tr>
<tr>
<td>1-2</td>
<td>8920 (11.3)</td>
<td>32,525 (8.7)</td>
<td>41,445 (9.14)</td>
</tr>
<tr>
<td>3/+</td>
<td>901 (1.1)</td>
<td>2680 (0.7)</td>
<td>3581 (0.79)</td>
</tr>
<tr>
<td>Residence within metropolitan statistical area</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>13,819 (17.5)</td>
<td>58,628 (15.6)</td>
<td>72,447 (15.98)</td>
</tr>
<tr>
<td>Yes</td>
<td>64,942 (82.5)</td>
<td>316,103 (84.4)</td>
<td>381,045 (84.02)</td>
</tr>
<tr>
<td>Region</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northeast region</td>
<td>17,029 (21.6)</td>
<td>58,842 (15.7)</td>
<td>75,871 (16.73)</td>
</tr>
<tr>
<td>North Central region</td>
<td>19,552 (24.8)</td>
<td>100,431 (26.8)</td>
<td>119,983 (26.46)</td>
</tr>
<tr>
<td>South region</td>
<td>32,462 (41.2)</td>
<td>123,762 (33)</td>
<td>156,224 (34.45)</td>
</tr>
<tr>
<td>West region</td>
<td>7078 (9)</td>
<td>83893 (22.4)</td>
<td>90,971 (20.06)</td>
</tr>
<tr>
<td>Unknown</td>
<td>2640 (3.4)</td>
<td>7803 (2.1)</td>
<td>10,443 (2.3)</td>
</tr>
<tr>
<td>Year of service</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>14,095 (17.9)</td>
<td>62,102 (16.6)</td>
<td>76,197 (16.8)</td>
</tr>
<tr>
<td>2010</td>
<td>11,812 (15)</td>
<td>58,954 (15.7)</td>
<td>70,766 (15.6)</td>
</tr>
<tr>
<td>2011</td>
<td>12,289 (15.6)</td>
<td>60,504 (16.1)</td>
<td>72,793 (16.05)</td>
</tr>
<tr>
<td>2012</td>
<td>12,512 (15.9)</td>
<td>62,717 (16.7)</td>
<td>75,229 (16.59)</td>
</tr>
<tr>
<td>2013</td>
<td>10,112 (12.8)</td>
<td>50,061 (13.4)</td>
<td>60,173 (13.27)</td>
</tr>
<tr>
<td>2014</td>
<td>11,218 (14.2)</td>
<td>49,541 (13.2)</td>
<td>60,759 (13.4)</td>
</tr>
<tr>
<td>2015</td>
<td>6723 (8.5)</td>
<td>30,852 (8.2)</td>
<td>37,575 (8.29)</td>
</tr>
</tbody>
</table>

ASC, ambulatory surgical center; Std, standard deviation.
*All comparisons were significant on chi-square and Wilcoxon sum-rank test.

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**Figure 1.** Annual per-procedure vasectomy-related costs based on procedure setting (2009-2015). (Color version available online.)
also used to study vasectomy trends in the United States, to our knowledge, no other study examining vasectomy-related costs and payments has been performed to date.

The use of intravenous sedation or general anesthesia may be warranted for some men undergoing vasectomy, which would require treatment in an outpatient hospital or ASC. Some physicians may have trained to perform a vasectomy under anesthesia, which could contribute to overutilization of the operating room as a treatment setting. Nevertheless, we were surprised to find as many as 20% of vasectomies being performed in the ASC setting in our study cohort.

Although the overall frequency with which pathology services were used was higher than expected, it is not surprising that the use of pathology services was higher in the ASC setting than the office setting. Given the variety of surgical procedures performed in an ASC, the use of ancillary pathology services may be more common, logistically easier, and reflexive, to some extent. It is worth mentioning that histologic evaluation of vasectomy specimens may play a role in the case of litigation with failed vasectomies. Definitive identification of the vas in the pathology specimen can be used as proof of vasal excision. However, if the goal of the histologic exam is to evaluate vasectomy success, PVSA is considered a far superior measure, despite the risk of recanalization and associated vasectomy failure.

The increasing use of ASCs, combined with the rise in physician-ownership of ASCs, has been shown to impact the volume of many urologic outpatient procedures performed in the ASC setting, such as cystoscopy, endoscopic treatment of stone disease, and prostate biopsies. Similar to physician-ownership of ASCs, it is possible that physician-ownership of ancillary pathology resources may be influencing decisions about the utility of histology specimens. While ASCs are generally thought to be associated with decreased total healthcare cost for surgical procedures, in the case of vasectomy, the higher facility fees and higher rate of utilization of ancillary pathology services, compared to office-based procedures, may reflect a physician-level conflict of interest.

A few limitations to this study warrant mention. MarketScan is a commercial claims database and does not provide clinical details associated with a procedure. As a result, reasons behind the use of an ASC setting vs office setting may not be entirely appreciated. Second, the patient population included in MarketScan is privately insured, through employer-sponsored health insurance plans, and thus, may not be representative of the general US population. Third, we were unable to stratify our analysis with respect to physician specialty or by practice setting (private practice vs academic center), because MarketScan only specifies physician specialty 20%-30% of the time, and does not differentiate between private-practice and academic settings. Nevertheless, our findings highlight important concerns with respect to substantial avoidable healthcare expenditures for a commonly performed outpatient procedure. Even through the limited scope of the MarketScan database, the magnitude of potentially avoidable healthcare costs with vasectomy is in the tens of millions of dollars. A similar analysis can

![Figure 2. Variation in total healthcare costs across metropolitan areas in 2015. (Q1, Q2, Q3, Q4 refer to quartiles categorizing total healthcare costs associated with vasectomy procedures. (Color version available online.)](image-url)
CONCLUSION
The unnecessary use of ASCs and ancillary pathology services for vasectomy may lead to tens of millions of dollars in potentially avoidable healthcare costs annually.

SUPPLEMENTARY MATERIALS
Supplementary material associated with this article can be found in the online version at https://doi.org/10.1016/j.urology.2019.01.064.

References

EDITORIAL COMMENT
The overuse of resources and excessive spending of healthcare dollars in the US are among the reasons that the US is the most expensive healthcare system in the world, while still failing to achieve similar outcome metrics as many other developed nations. There is no better procedure to evaluate such excess than vasectomy. As the most effective, safest, and lowest cost option of permanent sterilization, vasectomy is a commonly utilized and incredibly important procedure for couples. However, as one of many alternatives in contraception, it remains a comparatively expensive, elective procedure utilized almost exclusively by an insured population.

Vasectomy is, and has always been, an office-based procedure requiring only local anesthesia and approximately 15-20 minutes of procedure time. Therefore, the sheer possibility that more than a few percent of vasectomies are occurring in an operating room is an alarming overuse of resources, particularly as private ownership of ambulatory surgery centers (ASCs) by surgeons is on the rise. For these reasons, this study by Zholudev et al1 that evaluates healthcare costs of vasectomies based on potential areas of overuse of resources is an extraordinarily important contribution to not only the urologic literature, but to the healthcare policy literature as well.

The authors used Truven MarketScan data to assess the outcomes of vasectomy costs based on exposure variables that included the procedure setting of either the office vs an ASC, as well as the use of ancillary pathology services. Remarkably, almost 20% of vasectomies in this database were performed in ASCs, at almost triple the cost. Additionally, the authors report another astounding finding that, despite recommendation against such practice by the American Urological Association, varical segments were submitted for pathologic evaluation in 65% of cases performed at an ASC. This use of ancillary pathology services occurred almost twice as often as when the procedure was performed in the office setting, overall increasing healthcare costs by 55% per case. These observed trends resulted in $9 million total excess healthcare cost burden annually just for the fraction of patients within the MarketScan database.

As the authors note, the paper is limited by the available data in MarketScan, which does not include the surgeons’ specialty, the practice setting such as private vs academic practice, the ownership of the ASCs, and many other variables which would help to understand why these trends were observed. The next step will be to determine the driving forces behind such blatant overuse of resources so that it can be addressed in the future.

R. Matthew Coward, Department of Urology, University of North Carolina School of Medicine, Chapel Hill, NC; UNC Fertility, Raleigh, NC

Reference
1. Insert reference for “Use of Office Versus Ambulatory Surgery Center Setting and Associated Ancillary Services on Healthcare Cost Burden for Vasectomy Procedures”.

https://doi.org/10.1016/j.urology.2019.01.065
EDITORIAL COMMENT

This article is an excellent and timely comparison of the cost burden of vasectomy with regards to surgical setting and associated ancillary services. The authors point out that vasectomy is “the most common non-diagnostic operation performed by urologists in the United States.” They also discuss the growth of ambulatory surgical centers (ASCs) in the United States, and the possibility that physician ownership of ASCs may drive procedures and pathology services to increase as a result of case shift to such centers.

The American Urological Association Vasectomy Guideline (2012, Amended 2015) covers all aspects of the procedure including a statement that histologic examination of excised vas segments is not required.1 It does not state that vasectomy should be an office procedure, but the authors’ data on cost savings from shifting these cases from ASCs, as well as abandoning routine histologic examination of the vas segments is compelling.

Over the past 20 years pressure to contain healthcare costs and provide equitable distribution of care to all in our nation has engendered strong debate and political action.2-5 Physicians are well advised to take an active role in providing cost effective care for their patients. This work serves as a microcosm for healthcare cost containment for our specialty. If we don’t take an active role in this process, others (government, healthcare administrators, insurance carriers) may impose changes that will negatively affect us and our patients.

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References

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AUTHOR REPLY

Vasectomy is the safest and most cost-effective means of long-term permanent contraception, and is easily and safely performed in the office setting, under local anesthesia. Although some patient factors, such as body habitus, prior failed vasectomy, or extreme anxiety, may warrant consideration of vasectomy under sedation, these instances are infrequent and cannot account for the finding that approximately 18% of all vasectomies were performed in the ambulatory surgery center (ASC setting) during the study period. The increase in healthcare costs associated with performing a vasectomy in the ASC versus the office setting is substantial, and is compounded by the increased use of non-essential ancillary services, such as pathologic evaluation of vasal segments, which are also more commonly employed in the ASC setting.

Whether there are significant advantages to shifting minor, uncomplicated urologic procedures from the hospital-based operating room to the ASC setting, including lower costs, increased operative efficiency, and improved patient access, these advantages are negated when uncomplicated office-based procedures are transferred to the ASC. The latter is an untenable practice in the long-term, and subject to eventual scrutiny from healthcare organizations and administrators. Urologists should be mindful of providing cost-effective care for their patients, which includes both inpatient and outpatient services.

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