
Vasectomy in the United States, 2002

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Purpose: We estimated the number of vasectomies performed in the United States in 2002 and gathered information on the vasectomy procedures and protocols used. It follows similar studies done in 1991 and 1995.

Materials and Methods: A retrospective mail survey with telephone followup was performed in 2,300 urologists, family physicians and general surgeons randomly sampled from the American Medical Association Physician Masterfile.

Results: The response rate was 73.8%. An estimated 526,501 vasectomies were performed in 2002 for a rate of 10.2/1,000 men 25 to 49 years old. Overall 37.8% of physicians reported currently using no scalpel vasectomy and almost half of the vasectomies performed in 2002 were no scalpel vasectomies. Methods of vas occlusion varied in and among specialties with a combination of ligation and cautery being most common (41.0% of cases). Of the physicians 45.6% reported routinely performing fascial interposition, 94.4% reported removing a vas segment, 23.3% reported routinely folding back 1 or 2 ends of the vas and 7.5% reported using open-ended vasectomy. Followup protocols varied widely. Of respondents 53.5% reported charging \$401 to \$600 for vasectomy in 2002.

Conclusions: Although the estimated number of vasectomies performed in the United States during 2002 represents an increase from 1991 and 1995, incidence rates remained unchanged at approximately 10/1,000 men 25 to 49 years old. The percent of vasectomies performed using no scalpel vasectomy as well as the number of physicians who reported that they use no scalpel vasectomy increased substantially since 1995. Wide variation in surgical techniques and followup protocols were found.

Key Words: testis; vasectomy; infertility, male; physician's practice patterns; questionnaire

Vasectomy, which is one of the few contraceptive options in men, is widely used in the United States. Nonetheless, there is no nationwide surveillance system to collect data on the number of vasectomies performed yearly. Before 2002, when for the first time the National Survey of Family Growth included interviews with men, only secondary information about vasectomy use was gathered through interviews with women.¹ In addition to the limited incidence data, details on other aspects of vasectomy practice in the United States, such as surgical techniques used, followup protocols, procedure costs and payment sources, are also lacking. Data available to date show that the occlusion methods and post-vasectomy followup protocols used vary widely among American physicians.²⁻⁴

We estimated the number of vasectomies performed in the United States in 2002, assessed differences in vasectomy provision by physician specialty and American census region, and determined the vasectomy procedures and protocols used. The current study is the third in a series of

vasectomy incidence. We performed similar studies in 1991 and 1995.^{2,3,5}

MATERIALS AND METHODS

Procedures used in the earlier surveys were followed for the sampling plan⁶ with the sample restricted to UROs, FPs and GSs.^{2,3,5} A 1-stage cluster sampling with probability proportional to size design was used with physician practice as the sampling unit. Because there is no list of practices, they were identified by sampling physicians from the AMA Physician Masterfile. The Masterfile was stratified by specialty and then by census region. A random sample was obtained from each of the 12 strata by Direct Medical Data.

The study sample was selected from physicians with telephone numbers, including 78% of the AMA Masterfile sample, because physicians without them often did not lead to a practice during the 1995 survey. Physicians were selected randomly from each stratum at proportions equal to those in 1995.³ The probability of selecting a practice was proportional to the number of physicians in that practice. Since a practice could have been selected multiple times, significant efforts were made toward ensuring that each practice was mailed only 1 questionnaire. Target sample size was 2,000 physicians. Allowing for a 15% nonresponse rate, estimated based on the nonresponse in the 1995 survey, the final sample was 2,300.

Data were collected from mail back questionnaires that included all questions used in 1995 with some additions

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TABLE 1. *Vasectomies performed using NSV by region and specialty in United States in 2002*

Region	% (No. vasectomies)			
	All Specialties	URO	FP	GS
All regions	48.0 (79,498)	49.3 (76,291)	30.7 (1,475)	6.7 (1,732)
Northeast	45.3 (13,196)	47.1 (12,698)	0.0 (50)	0.0 (448)
Midwest	60.8 (22,801)	64.6 (20,690)	38.4 (1,031)	9.3 (1,080)
South	44.9 (23,529)	45.2 (23,318)	14.5 (83)	12.5 (128)
West	38.9 (19,972)	39.4 (19,585)	14.5 (311)	0.0 (76)

Values were calculated using the unweighted number of vasectomies per specialty in each region and estimates were calculated using information from the 507 practices that completed these items on the questionnaire.

about procedures, protocols and costs. Most questions included choices for respondents to select, although some were open-ended, including the number of vasectomies performed, recommendations for when patients return the first specimen and percent of men completing recommended followup.

Because the proportion of GS and FP practices performing vasectomy was expected to be low, they were first prescreened by telephone. Practices that performed at least 1 vasectomy in 2002 were mailed a questionnaire. UROs were not prescreened because most were expected to have performed vasectomies. Informed consent was obtained through a statement on the questionnaire requesting that it should be completed only if consent was provided. The Institutional Review Board at Tulane University determined that the study was exempt, in accordance with the National Institutes of Health Office of Human Subjects Research, Title 45 CFR, Part 46.101.

Prescreened GS and FP practices were sent the questionnaire in July 2003 with a second mailing 5 weeks later to those who did not respond. Telephone followup of practices that had not returned the questionnaire began 4 weeks later. During telephone followup at least 3 attempts were made to complete the questionnaire, including requesting the most critical information from office administrators and nurses.

Questionnaires were sent to urologists in July 2003. After 5 weeks urologists who did not respond were mailed a second questionnaire. Because of the low response rate, a third mailing was done. Procedures for telephone followup were done as described.

Data were entered into a database using CPro software and analyzed using STATA® 8.0 statistical software for Windows®. As in 1995, hot deck imputation was used to

TABLE 2. *Physicians by preferred method used to occlude vas by specialty in United States in 2002*

Occlusion Method	% Physicians			
	All Specialties	URO	FP	GS
No. physicians	510	404	55	51
Ligation + cautery	41.0	39.6	49.1	43.1
Cautery + clips	17.8	19.0	16.4	9.8
Ligation only	16.9	15.4	9.1	37.2
Cautery only	12.6	12.6	18.2	5.9
Clips only	8.8	9.9	7.2	2.0
Cautery, ligation + clips	2.3	3.0	0.0	0.0
Ligation + clips	0.6	0.5	0.0	2.0

TABLE 3. *Physicians performing procedures routinely during vasectomy by specialty in United States in 2002*

Procedures	% (No. Physicians)			
	All Specialties	URO	FP	GS
Fascial interposition	45.6 (489)	45.6 (390)	47.1 (51)	43.8 (48)
Excise vasal segment	94.4 (498)	94.0 (397)	94.3 (53)	97.2 (48)
Fold back 1 or 2 vasal ends	23.2 (483)	24.4 (385)	5.9 (51)	31.9 (47)
Open ended vasectomy	7.5 (495)	6.1 (395)	21.2 (52)	4.2 (48)

address nonresponse. For practice nonresponse, that is when practices did not return the questionnaire, a hot deck procedure based on the approximate Bayesian bootstrap method⁷ was used to impute as a block (ie from a single complete record) practice type, practice size and number of vasectomies. Donor cases were chosen from responders in the same strata as the nonresponders. No other variables were imputed because of the drop-off in response rates. A total of 413 cases of practice nonresponse (21.6%) were imputed.

For item nonresponse, that is returned surveys with some questions left unanswered, a completed case in the stratum was used for missing items. Imputation for item nonresponse was done for practice type (52 cases or 2.7%), practice size (17 or 0.8%) and number of vasectomies (100 or 5.2%). Because of the large drop-off in response rates, missing values were not imputed for remaining items. Tables 1 to 5 list unweighted respondent data. Estimates represent respondents only and they should not be considered unbiased population estimates.

Because the sample design was not an equal probability design, it was necessary to assign a sampling weight to each observation to obtain unbiased estimates. As in 1995, sampling weight was calculated as the inverse of the probability that the sample physician's practice was chosen. This probability was formed from the ratio of practice size for a given practice in a stratum to the number of physicians on the AMA Masterfile for that stratum and then multiplied by the number of observations in the stratum. Point estimates, such as the number of vasectomies performed nationally or per stratum, were calculated as the weighted sum of responses in the entire sample or in that stratum. A bootstrap procedure was used to estimate the SE of the number of vasectomies using STATA® SE, version 8.

RESULTS

The overall response rate, that is the ratio of questionnaires completed to total questionnaires minus dead records, was 73.8%. Dead records were cases in which the sample physi-

TABLE 4. *Physicians routinely using fascial interposition by occlusion method in United States in 2002*

Occlusion Method	% (No. Physicians)
Cautery only	71.7 (60)
Ligation only	59.3 (81)
Ligation + cautery	48.0 (200)
Cautery, ligation + clips	33.3 (12)
Cautery + clips	24.1 (87)
Clips only	22.2 (45)
Ligation + clips	0.0 (3)

TABLE 5. Physicians by number of weeks and ejaculations suggested before returning first semen specimen by specialty in United States in 2002

Post-Vasectomy Semen Protocol	Physicians			
	All Specialties	URO	FP	GS
Criteria for returning specimen 1 (No.):	521	410	56	55
% Time since vasectomy	73.9	75.4	62.5	74.5
% No. ejaculations since vasectomy	18.4	18.0	23.2	16.4
% time +/- or No. ejaculations	7.7	6.6	14.3	9.10
No. wks suggested before returning specimen 1 (No.):	425	336	43	46
% Less than 6	19.1	16.1	25.6	34.8
% 6	39.8	37.2	51.2	47.8
% 7-9	24.7	27.7	16.3	10.9
% 10-12	15.5	18.1	4.6	6.5
% More than 12	0.9	0.9	2.3	0.0
No. ejaculations suggested before returning specimen 1:	136	101	21	14
% Fewer than 15	44.1	39.6	61.9	50.0
% 15	24.3	24.7	28.6	14.3
% 16-19	4.4	4.0	0.0	14.3
% 20	19.8	23.8	0.0	21.4
% More than 20	7.4	7.9	9.5	0.0

cian did not lead to an operational practice. Response rates varied among specialties, including 91.0% of GSs, 89.5% of FPs and 56.5% of UROs.

In 2002 an estimated mean \pm SE of 526,501 \pm 21,685 vasectomies were performed in the United States for a rate of 10.2/1,000 men 25 to 49 years old. The number of vasectomies performed in 2002 was greatest in the South, although the incidence was highest in the Midwest (table 6). UROs performed the most vasectomies nationwide, followed by FPs and then GSs with marked differences in the percent of vasectomies performed by each specialty among the regions (table 7).

Of 932 URO practices 824 (88.4%) reported performing vasectomies in 2002 compared to 107 of 479 GS (22.3%) and 57 of 505 FP (11.3%) practices. Overall 400 of 1,916 practices surveyed (20.9%) had at least 1 physician of that specialty who performed vasectomy.

Of 581 respondents 458 (78.8%) reported primarily performing vasectomies in the office, followed by 67 (11.5%) in hospital outpatient settings, 32 (5.5%) at freestanding surgery centers and 24 (4.2%) in other settings. This ranking remained the same among the specialties (data not shown). Of 62 FPs 61 (98.4%) reported that they performed vasectomies in the office compared to 360 of 455 UROs (79.1%) and 37 of 64 GSs (57.8%). Of 64 GSs 18 (28.1%) reported performing vasectomy primarily in hospital outpatient settings.

Overall 198 of 524 physicians (37.8%) reported currently performing NSV. The percent was greatest among UROs

(42.4% or 176 of 415), followed by FPs (34.5% or 19 of 55) and GSs (5.6% or 3 of 54). Almost half of the vasectomies performed by responding practices were NSV and the percent of vasectomies done with NSV was greatest among UROs (table 1).

The most common method of vas occlusion overall and in each physician specialty was a combination of ligation and cautery. However, there were different patterns of occlusion method preference by specialty (table 2). Of 310 physicians who reported using ligation alone or in combination with other techniques 175 (56.5%) used absorbable suture and 87 (28%) used nonabsorbable suture.

Just less than half of physicians reported routinely performing fascial interposition and the percent did not vary by specialty (table 3). Physicians who performed cautery only were most likely to use fascial interposition (table 4). Most physicians reported removing a vas segment with little difference among specialties (table 3). Almost a quarter of physicians reported routinely folding back 1 or 2 ends of the vas, although few FPs reported this (table 3). FPs were much more likely to report performing open-ended vasectomy, which was rare overall (table 3).

Of all 533 physicians 243 (45.6%) reported requiring 1 negative semen specimen, 260 (48.8%) required 2 and 27 (5.1%) required 3 or more before declaring a vasectomy successful. Telling men to return for semen analysis based on time since vasectomy was most common, although recommendations varied widely (table 5). Of 488 physicians 355 (72.8%) recommended repeat vasectomy if any motile sperm were seen after vasectomy and 254 of 477 (53.3%) said that they recommended repeat vasectomy when persistent non-motile sperm remained. While 175 of 483 physicians (36.2%) reported that 91% to 100% of their patients completed the recommended followup, 115 (23.8%) reported that fewer than 70% did so.

Of 529 respondents 283 (53.5%) reported charging \$401 to \$600 for vasectomy in 2002, 129 (24.4%) charged \$601 to \$800, 81 (15.3%) charged \$400 or less and 36 (6.8%) charged more than \$800. Among all specialties almost half of the respondents reported charging \$401 to \$600 (data not shown). Respondents reported that 490 of the 513 vasectomies (95.6%) performed in 2002 were paid for by private insurance or personal income with 22 (5.0%) paid for by public funding. Variations among specialties and regions were minimal (data not shown).

DISCUSSION

Our data show that, although the estimated number of vasectomies performed in the United States during 2002 represents a small increase from 1991 and 1995, incidence rates

TABLE 6. Number of vasectomies by region and physician specialty, and rate by region in United States in 2002

Region	Mean No. Vasectomies \pm SE				No. Vasectomies/ 1,000 Men*
	All Specialties	URO	FP	GS	
All regions	526,501 \pm 21,585	416,120 \pm 16,144	69,797 \pm 15,460	40,584 \pm 6,036	10.2
Northeast	89,957 \pm 8,084	79,224 \pm 8,045	2,894 \pm 2,044	7,839 \pm 2,527	9.1
Midwest	138,365 \pm 9,315	91,976 \pm 8,364	25,206 \pm 4,456	21,183 \pm 4,179	11.7
South	170,937 \pm 11,560	154,181 \pm 10,837	7,319 \pm 2,828	9,437 \pm 3,665	9.8
West	127,242 \pm 16,676	90,739 \pm 8,707	34,378 \pm 14,747	2,125 \pm 894	10.2

* Ages 25 to 49 years.

TABLE 7. *Vasectomies performed by specialty by region in United States in 2002*

Region	% Vasectomies		
	URO	FP	GS
All regions	79.0	13.3	7.7
Northeast	88.1	3.2	8.7
Midwest	66.5	18.2	15.3
South	90.2	4.3	5.5
West	71.3	27.0	1.7

remained unchanged at approximately 10/1,000 men 25 to 49 years old.^{2,5} This is consistent with National Survey of Family Growth results indicating that the proportion of women reporting that their partner underwent vasectomy had remained relatively constant since the late 1980s.^{1,8} Although these data suggest that vasectomy use plateaued, men who underwent vasectomy were a homogeneous group, that is nonHispanic white men who were well educated, married, relatively affluent and privately insured.⁹ Minority, low income and less educated men represented a disproportionately small share of vasectomy users, most likely because of a lack of information and access to services.⁹

Vasectomy incidence was highest in the Midwest and lowest in the Northeast, consistent with earlier findings.^{2,5,8} Little difference was seen in the percent of vasectomies performed in the different regions since 1995.⁵ However, the percent of practices performing vasectomy decreased from 31.2% in 1991 to 20.9% in 2002 with the decrease occurring in all specialties and regions.⁵

UROs continued to perform most vasectomies nationally as well as in each region.⁵ While FPs performed more vasectomies nationally than GSs, this varied by region. Nationwide the number of vasectomies performed by UROs increased with time, while the number performed by FPs and GSs decreased.⁵

NSV use increased by almost 70% since 1995, in that 48.0% of vasectomies performed in 2002 were NSV compared to 28.6% in 1995.³ Additionally, the number of physicians who reported currently performing NSV increased from 23% in 1995³ to 38% in 2002. NSV has advantages over scalpel approaches, including fewer complications, less pain and earlier resumption of sexual activity.¹⁰

The wide variation in occlusion methods has been previously reported.²⁻⁴ Recent studies suggest that technique effectiveness differs with ligation and excision being the least effective method, ligation and excision with fascial interposition more effective and cauterization the most effective method.¹⁰⁻¹⁵ Although these results are too recent to have impacted practice in 2002, it will be interesting to see if practice shifts toward the use of more effective techniques. Cautery is the most common occlusion method used in the United States. However, 17% of physicians, representing almost 40% of GSs, reported using ligation only, of whom 40% did not use fascial interposition.

Limited data are available on the advantages of the other aspects of vasectomy that we examined.^{10,16} Nonetheless, more than 90% of respondents reported excising a segment of vas. Almost a quarter reported folding back 1 or 2 ends of the vas and few reported using open-ended vasectomy.

Ideally vasectomy success should be confirmed by azoospermia. However, there is no consensus on timing se-

men analysis after vasectomy or on the number of negative specimens needed.^{3,17} Most physicians reported requesting the first specimen based on time since vasectomy but there was wide variation in the time. Likewise, there was much variability among physicians using the number of ejaculations.

Despite the importance of establishing vasectomy success through semen analysis only 36.2% of physicians reported that most men completed recommended followup and others also found poor followup compliance.¹⁷ Many pregnancies may occur soon after vasectomy,^{4,12,18} highlighting the importance of counseling about the use of alternate contraception and verification of vasectomy success when possible.

Just more than half of surveyed practices reported charging \$401 to \$600 for vasectomy in 2002. A recent study estimated that the average vasectomy in the United States cost \$644.¹⁹ Although up-front costs are higher, vasectomy is the most cost-effective contraceptive.¹⁹ According to physicians public funding paid for few vasectomies that they performed in 2002, which agrees with reports of men who have undergone vasectomy.⁹ In contrast, public funding paid for 35% of female sterilizations performed in the United States between 1994 and 1996 according to the most recently published data.²⁰

High nonresponse was the most important study limitation, introducing the possibility of response bias and decreasing the expected sample size. The questionnaire, which may have required completion by more than 1 person (eg a physician and an office manager), could have contributed to a greater reluctance to complete it and an increased likelihood of incomplete questionnaires. Although we are not aware of how nonresponse would have differed systematically, we cannot rule this out as a source of potential bias. The hot deck imputation used to address nonresponse assumes data are missing at random.

We used physicians as a link to practices. Although the AMA Masterfile is the most current list of physicians, a large percent of physicians did not lead to practices because of outdated entries. This would not be expected to bias results systematically. Although we have no reason to doubt that the sample that we obtained from elsewhere was truly random, we also have no way to verify this.

The instruments used in this study have the same limitations as any requiring retrospective recall. Case physicians were asked to provide the approximate number of vasectomies performed by all physicians at the practice during the previous year, thus, relying on respondents to provide reliable approximations for the practice as a whole.

CONCLUSIONS

Vasectomy incidence in the United States appears to have reached a plateau. NSV use continued to increase since the mid 1990s in terms of the percent of vasectomies performed using NSV and the number of physicians using NSV. Wide variation in surgical techniques and followup protocols continued to be seen, although recent research demonstrating that some occlusion methods are more effective may impact future clinical practice. Poor compliance with followup recommendations appears to be a continuing problem, highlighting the need for effective counseling on the importance of using alternate contraception until vasectomy success has been verified by semen analysis.

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Abbreviations and Acronyms

AMA	=	American Medical Association
FP	=	family physician
GS	=	general surgeon
NSV	=	no scalpel vasectomy
URO	=	urologist

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EDITORIAL COMMENT

The good news is that more surgeons are using the no-scalpel approach to the vas. The bad news is that a wide variety of vas occlusion techniques are being used, reflecting insufficient data, consensus and training.

In 1973 cautery with fascial interposition was recommended. Labrecque et al concluded that this is the most reliably effective technique (reference 10 in article) but other data show that it is not commonly used. Christiansen and Sandlow described data from 1979, suggesting that an open ended vasectomy technique might prevent post-vasectomy pain.¹ However, a randomized trial of this hypothesis remains to be done. Vasectomy guidelines prepared by the Royal College of Obstetricians and Gynecologists noted additional research needs.² Others estimated that fewer than 5% of vasectomies in the United States were paid for by public funding compared to 35% of female sterilizations, suggesting low access for men without health insurance. Since vasectomies are safer and less expensive, this discrepancy deserves attention.

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