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Trends in Inpatient Prolapse Procedures in the United States, 1979–2006

Keisha A Jones, MD¹, Jonathan P Shepherd, MD¹, Sallie S. Oliphant, MD¹, Li Wang, MS², Clareann H. Bunker, PhD², and Jerry L. LOWDER, MD, MSc¹

¹Division of Urogynecology, Department of Obstetrics, Gynecology, and Reproductive Sciences, Magee-Womens Hospital, University of Pittsburgh-School of Medicine, Pittsburgh, PA

²Office of Clinical Research, University of Pittsburgh Clinical and Translational Science Institute (CTSI), Pittsburgh, PA

Abstract

Objectives—To describe national trends for inpatient procedures for pelvic organ prolapse from 1979–2006.

Study Design—The National Hospital Discharge Survey was analyzed for patient and hospital demographics and ICD-9-CM diagnostic and procedures codes from 1979 to 2006. Age-adjusted rates (AARs) per 1000 women were calculated using the 1990 U.S. Census data.

Results—There was a significantly decreasing trend in the AARs for inpatient prolapse procedures, from 2.93 to 1.52 per 1000 women from 1979–2006. AARs for hysterectomy decreased from 8.39 to 4.55 per 100 women from 1979–2006. Over the study period, AARs remained at about the 1979 level among the women ≥ 52 years old (2.73 to 2.86, $p=0.075$). In women <52 years old, AARs declined to less than one-third of the 1979 rate (3.03 to 0.84, $p<0.001$).

Conclusions—AARs for inpatient procedures for prolapse in the U.S. remained stable for women ≥ 52 years old from 1979–2006, rates declined by two-thirds for women <52 .

Keywords

pelvic organ prolapse; hospital discharge database

Introduction

Pelvic organ prolapse has emerged as an important and common medical problem affecting one in every ten women in the United States.¹ There is an 11% risk of undergoing surgery for prolapse or incontinence by age 80², with a 30% risk of re-operation³. The direct cost of surgery is over 1 billion dollars each year⁴, with an estimated 200,000 surgical procedures

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Corresponding Author: Jerry L. Lowder, MD, MSc, Assistant Professor, Division of Urogynecology, University of Pittsburgh School of Medicine, Magee-Womens Hospital, 300 Halket Street, Pittsburgh, PA 15213, Office: (412) 641-1440, Fax: (412) 641-1133, jlowder@mail.magee.edu.

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performed annually.³ A recent observational study noted that more than 50% of women presenting for routine gynecologic care have prolapse Stage II or greater.⁵

The magnitude of the problem continues to progress with the changing population demographics.⁶ The United States Census Bureau projects that the number of women in America aged 65 and over, will double within the next 25 years to over 40 million by the year 2030.⁷ By one estimate the demand for health care services related to prolapse, will increase at twice the rates of the population itself.⁸

The incidence of hospital admissions associated with pelvic organ prolapse has been reported as 2.04 per 1000 person years.⁹ A study by Boyles et al noted a slow but steady decline in rates of procedures in women < 50 from 1979 to 1997. This finding is in contrast to the increase in surgical procedures for stress urinary incontinence seen since 1979.¹⁰ Racial disparities appear to exist in women undergoing prolapse surgery but data are conflicting.¹¹ The goal of this study is describe national trends in surgery for prolapse from 1979–2006 using the National Hospital Discharge Survey database. The secondary objectives were to examine patient demographics, comorbidities, and surgical complications.

Material and Methods

Methods have been previously described.¹⁰ De-identified data were abstracted from the National Hospital Discharge Survey (NHDS), a federal dataset utilizing a multistate probability sampling of inpatient hospital discharges in the United States. Medical records from 466 non-federal short-stay hospitals, approximately 8% of all U.S. hospitals, were selected by systematic random sampling. Approximately 270,000 discharges were collected per year from January 1979 to December 2006. The survey recorded up to seven discharge diagnosis codes and four procedure codes, using the International Classification of Diseases, 9th review, Clinical Modification (ICD-9-CM) coding system. Other de-identified information collected included patient sex, age, race, marital status, length of hospital stay, hospital size (number of beds), hospital ownership and insurance type or expected source of payment. Quality control programs have estimated the error rate for the NHDS at 4.3% for medical coding and data entry, and 1.4% for demographic coding and data entry.¹²

After obtaining University of Pittsburgh Institutional Review Board-Exempt approval status, data on women who underwent surgical correction of prolapse from 1979 to 2006 were identified using the ICD-9-CM codes outlined in Table 1. All women undergoing one or more of these procedures (see Table 2) were included in the analysis. Tabulated surgical procedure numbers were then inflated to national averages using specifically designated hospital weights, which are included in the federal dataset for each patient discharge. Age-adjusted rates of procedures per 1000 women were calculated by the direct method of rate adjustment, using the 1990 projected United States Census population data for each year of age. Data were stratified by patient age <52 years old or ≥52 years old, a division chosen based on average age of menopause in the U.S. Hysterectomies performed for benign indications were used as a reference. We included abdominal, vaginal and laparoscopically performed hysterectomies. We chose this as a reference because hysterectomy performed for benign indications is the most commonly performed major gynecologic procedure and would serve as clinical marker to keep rates of prolapse procedures in perspective of other gynecologic procedures.¹³ In addition, hysterectomy is commonly performed at the time of prolapse procedures and may serve as a predictor of changing trends in prolapse procedures.. When the estimated number of cases per year was based on fewer than 60 records in the database, the estimate was considered unreliable. The linear test of trend was used to assess trends in the age-adjusted rates of procedures from 1979 to 2006. The standard error of the

age adjusted rates were calculated using the approximation equation¹⁴: $S.E. = \frac{R}{\sqrt{n}}$, where R is the age adjusted rates and n is the number of events. Statistical analysis was performed using SPSS Version 15.0 software (SPSS Inc., Chicago, Illinois, USA). A p value <0.05 was considered statistically significant.

Results

According to NHDS data, approximately 5,632,900 inpatient procedures for prolapse were performed in the United States between 1979 to 2006. The number of women undergoing prolapse procedures decreased from 231,100 in 1979 to 186,900 in 2006. AARs of prolapse surgery per 1000 women also decreased from 2.93 in 1979 to 1.52 in 2006 (Figure 1). When stratified by age, the AAR for women ≥ 52 years was 2.73 in 1979 and 2.86 in 2006 while in women <52 years of age the age-adjusted rate declined from 3.03 to 0.84 (Figure 2). As a reference, AARs for hysterectomy performed for benign indications were calculated. AARs for hysterectomy decreased from 8.39 to 4.55 per 1000 women from 1979 to 2006. In women < 52 years, there was a significant decrease in AARs of hysterectomy from 10.78 to 5.20 per 1000 women from 1979 to 2006 ($p < 0.001$); for women ≥ 52 years there was also a significant, but less marked, change in AAR of hysterectomy from 3.73 in 1979 to 3.29 ($p = 0.006$) in 2006 (see Figure 2). Change in trend for AARs for both prolapse procedures and hysterectomy decreased in women <52 years old ($b = -0.065$ and -0.201 , respectively; $p < 0.001$) while there was a small, yet significant, change in trend for these procedures in women ≥ 52 ($b = 0.012$ and -0.020 , respectively; $p = 0.075$, $p = 0.006$).

The mean age of women undergoing prolapse procedures in this study was $53.2 \text{ years} \pm 15.4$, with the mean age increasing from 47.5 ± 15.0 to 57.3 ± 14.1 over the twenty-seven year study period. Seventy-seven percent of these women were white, 4 % black, and 19% other or not stated. Geographical distribution of procedures revealed the largest number of procedures were performed in the South (42%), followed by the Midwest (24%), West (20%), and the Northeast (14%). In 1979, approximately 73% of women undergoing prolapse procedures were privately insured and 25% had government insurance, by 2006 this number changed to 61% and 35%, respectively (See Table III).

A considerable decrease in length of inpatient hospitalization was observed with an average length of stay of 8.5 ± 4.0 days in 1979, to 2.0 ± 1.1 days in 2006, $p < 0.001$. Overall, 18% of procedures were performed in small hospitals (<100 beds) and 13% in larger hospitals (>500 beds). Detailed demographic information is presented in Table III.

Overall, the rate of abdominal hysterectomy (ICD-9-CM code 68.4) declined over the study period, this decline was most drastic in women <52 years of age. Similarly there was a decline in hysterectomies performed vaginally (ICD-9-CM code 68.5). By 2006, the number of cystocele and rectocele repairs decreased by half of the 1979 rate. Interestingly, this decline was noted only in the <52 year age group, with no overall decline in procedures performed in the ≥ 52 year old age group. Apical suspension procedures (ICD-9-CM code 70.77) have increased slowly over the study period with the most dramatic increase seen in women ≥ 52 years of age (see Table IV).

Analysis of diagnostic codes revealed that 36% of women undergoing prolapse procedures were coded with the diagnosis of *pelvic organ prolapse; no mention uterine prolapse* (ICD-9-CM 618.0), with 15% coded as *uterine no mention of vaginal wall* (ICD-9-CM 618.1) and 9% with prolapse of vaginal vault after hysterectomy (618.5). Eight percent were coded as *uterovaginal incomplete* (618.2), 7.4% as *uterovaginal prolapse complete* (618.3), and 19 % *uterovaginal unspecified* (618.4). The diagnosis of *urinary incontinence* (ICD-9-

CM) was present in 32% of women. Concomitant procedures were frequent with 82% of women undergoing additional procedures: 34% undergoing one concomitant procedure, 27% undergoing 2 additional procedures, and 22% undergoing three additional procedures. Ten percent of women (n=580,318) underwent an incontinence procedure at the time of their prolapse surgery.

Seventy one percent of all prolapse procedures performed during the study period were cystocele or rectocele repairs (ICD-9-CM, 70.5), with the number of cases remaining relatively stable from 163,700 in 1979 to 130,300 in 2006, ($b=-0.031$, $p<0.001$). Obliteration and total excision of the vagina (ICD-9-CM, 70.4) declined significantly from 1979, from 3,360 cases to only 387 cases in 2006, ($b=-0.001$, $p<0.001$). Procedures including vaginal suspension and fixation, or colpopexy (ICD-9-CM 70.77) have increased since 1979 from 1,437 to 39,508 in 2006, ($b=-0.012$, $p<0.001$) Laparoscopic cases (ICD-9-CM 54.21, 68.31, 68.41, 68.51) have increased over time from 2,639 in 1979 to 13,580 in 2006.

Approximately forty percent of women had one or more comorbid condition(s) at time of surgery, which were most commonly oncologic in nature (21 %), followed by cardiovascular (13 %) and endocrine (3.5 %), Table V. The overall index hospitalization complication rate was 23.1%. The overall complication rate for women undergoing inpatient surgery for pelvic organ prolapsed over this time period was 29%, complications occurring at a rate of $\geq 1\%$ are listed in Table VI. Less than 1% of women were discharged to a short or long term care facility. There were a total of 2,133 inpatient deaths among women in this study. Among subjects that died, the average patient age was 69.5 ± 10.3 and the most common comorbidities were cardiovascular (60%) and oncologic (19%) in nature.

Discussion

Overall, rates of inpatient surgical procedures for pelvic organ prolapse declined from 1979 to 2006. However, age adjusted rates (AARs) for inpatient prolapse procedures for women ≥ 52 years old have remained stable from 1979–2006, while rates have declined by two-thirds for women <52 years old. The decrease in overall numbers of procedures and AARs reflects a decline in number of procedures performed in women <52 years old. We believe the dramatic decrease in inpatient prolapse procedures performed in women <52 years old is likely related to the decrease in overall hysterectomies performed for benign conditions. With an increasing availability of minimally invasive surgical options including uterine artery embolization, endometrial ablation, hysteroscopic and laparoscopic resection of fibroids, the need for surgical removal of the uterus has declined, particularly in younger patients. In addition, we reaffirm the assertion by Boyles that, historically, hysterectomies were often performed for sterilization but coded for prolapse since it does not need a tissue diagnosis.^{3,15} The decrease in surgical procedures performed under the diagnosis of prolapse in younger women during this study period may reflect the advent of safe and effective surgical sterilization via laparoscopy.³ It is important to understand that the rate of surgical procedures for prolapse have remained stable in the population of women at highest risk and those expected to undergo the greatest population growth over the next thirty years, those ≥ 52 .

Examination of AARs of various procedures performed for prolapse including abdominal and vaginal hysterectomy, rectocele and cystocele, and vaginal suspension and fixation reveal a reduction in the rate of procedures in women <52 and no significant change in surgical rates for women ≥ 52 years old. The average age of women undergoing surgical correction of prolapse increased dramatically from 47 in 1979 to 57 in 2006. This increase in mean age of women undergoing surgery for prolapse is likely due to several factors including the

aging of the population, an increase in older women seeking care for prolapse, and advances in anesthesia that have improved the safety for older patients. Based on US census data it is estimated that, by 2030, approximately 20% of the population will be ≥ 65 years old, with women comprising a disproportionate part of the population. Luber et al estimate that the number of women who seek care for pelvic floor disorders will increase dramatically by 2030.⁸ It is likely that the average age for women undergoing surgery for prolapse over the time of this study period has also increased because fewer younger women are undergoing prolapse repair. However, the AAR of women ≥ 52 years old undergoing prolapse procedures increased independently of women < 52 years old, suggesting that this is a growing portion of the prolapse surgical population. In this study, over 40% of women had at least one medical comorbidity. With advancing age, the presence and number of comorbidities become more common and can be a factor in planning surgical treatment for prolapse. As the geriatric population continues to grow, members of the surgical and postoperative care team will need a good understanding of the perioperative medical and physical needs of the geriatric patient. This aging portion of the population likely will comprise a growing portion of the prolapse surgical population, with unique perioperative challenges.

Reported complications associated with prolapse surgeries were high, but often minor in nature. Thirty percent of subjects experienced a complication and most commonly included uterine or vaginal inflammation or infection. Anemia was found as a discharge diagnosis in 9.0% of subjects however no associated blood transfusions were coded. This is likely due to the NHDS including only 4 procedure codes and not that blood transfusions were not required. Complications are likely severely underreported due to the temporal limitations of the coding system. It is only possible to ascertain complications from the index hospitalization which appear among seven coded diagnoses for each hospital stay. Additionally, many postoperative complications are diagnosed during outpatient visits or readmissions and are therefore not available through the NHDS. The overall death rate during the index hospitalization was low (0.04%). While we can not determine a direct cause, the majority of subjects that died had a cardiovascular comorbidity.

There are several potential sources of weakness that are inherent to the study design. Estimates of surgical numbers are subject to nonsampling as well as sampling errors as are estimates from any survey¹². Accuracy of the data depends highly on coding, and coding errors have been reportedly small per the NHDS. As addressed earlier, the NHDS data have been shown to have acceptable coding accuracy.

Lack of data on ambulatory procedures will likely impact estimates of surgical procedures for pelvic organ prolapse in this study using the NHDS database. Most past and current surgical procedures for prolapse involve at least a 24 hour hospitalization postoperatively which would typically require the procedures to be performed in an inpatient hospital. Some procedures, such as a simple anterior and/or posterior colporrhaphy, may be performed in an ambulatory surgical facility and hence excluded from our analysis. As these data become available accuracy of estimates of surgical trends will continue to improve. Rates of complications and mortality will be underestimated as number only reflect the initial index hospitalization.

With the changing demographics of our population, surgical correction of prolapse, especially in older patients, will remain an important health care concern. It is important to continue to follow trends in prolapse surgery as these epidemiologic data will have a profound impact on healthcare resources available in this vastly growing surgical subspecialty.

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Figure 1.
Age-1 Adjusted Rates, Prolapse procedures 1979–2006

Figure 2. Age-adjusted rates of incontinence procedures per 1000 women from 1979 to 2006 in the United States, stratified by patient age, includes trends in hysterectomy for benign causes.

Table I

ICD-9 diagnosis codes for prolapse

618	Genital Prolapse
618.0	Prolapse of the vaginal walls without mention of uterine prolapse
618.00	Unspecified prolapse of vaginal walls
618.01	Cystocele, midline
618.02	Cystocele lateral
618.03	Urethrocele
618.04	Rectocele
618.05	Perineocele
618.09	Other uterine prolapse without mention of uterine prolapse/cystourethrocele
618.1	Uterine prolapse without mention of vaginal wall prolapse
618.2	Uterovaginal prolapse, incomplete
618.3	Uterovaginal prolapse, complete
618.4	Uterovaginal prolapse, unspecified
618.5	Prolapse of vaginal vault after hysterectomy
618.6	Vaginal enterocele, congenital or acquired
618.7	Old laceration of muscles of the Pelvic Floor
618.8	Other specified genital prolapse
618.81	Incompetence or weakening of pubocervical tissue
618.82	Incompetence or weakening of rectovaginal tissue
618.83	Pelvic muscle wasting
618.84	cervical stump prolapse
618.89	Other specified genital prolapse
618.9	Unspecified genital prolapse

Table II

ICD-9-CM procedure codes

68.3 Subtotal hysterectomy
68.31 Laparoscopic supracervical
68.39 Other and nonspecified subtotal abdominal hysterectomy
68.4 Total Abdominal Hysterectomy
68.4 Laparoscopic Total Hysterectomy
68.49 Other and non-specified total hysterectomy
68.5 Vaginal Hysterectomy
68.51 Laparoscopically assisted vaginal hysterectomy (LAVH)
68.59 Hyst NOS
68.9 Other and unspecified hysterectomy
69.2 Repair of Uterine supporting structures
69.22 Other Uterine suspension
69.29 Other repair of Uterus and supporting structures
70.4 Obliteration and total excision of the vagina
70.5 Repair of cystocele and rectocele
70.50 Repair of cystocele and rectocele
70.51 Repair of cystocele
70.52 Repair of enterocele
70.6 Vaginal construction and reconstruction
70.61 Vaginal construction
70.62 Vaginal reconstruction
70.7 Other repair of the vagina
70.77 Vaginal suspension and fixation
70.79 Other repair of vagina (colpoperineoplasty, repair of old obstetric laceration)
70.8 Obliteration of the vaginal vault
70.9 Other operations on the vagina and the cul-de-sac
70.91 Other operations on the vagina
70.92 Other operations on the cul de sac (obliteration of the cul de sac, repair of vaginal enterocele)
71.7 Repair of vulva and perineum
71.79 Other repair of the vulva and the perineum/Repair of old obstetric laceration

Table III**Demographics**

	1979	1992	2006
Age (y) mean, (median)*	47.5 ± 15.0,(45)*	53.9 ±15.6,(53)	57.3 ±14.1,(58)
Race (%)			
White	81.8	75.2	65.8
African American	5.0	2.4	2.7
Other	13.2	22.4	31.5
Insurance (%)			
Private	72.8	54.5	60.8
Government	24.7	32.6	35.3
Other	2.6	12.9	3.9
Geographic region (%)			
South	41.7	42.8	37.5
Midwest	38.7	20.3	23.7
West	14.1	22.1	22.9
Northeast	15.5	14.9	15.9
Hospital size (%)			
<100 beds	15.3	16.8	18.0
100–199 beds	25.5	26.6	24.0
200–299 beds	16.4	20.9	24.3
300–499 beds	20.7	27.0	21.7
>500 beds	22.1	8.6	12.0
Length of hospital stay (d)	8.5 ± 4.0	3.6 ± 2.1	2.0 ± 1.1

Table IV

Estimated number and rate of selected procedures for women with a diagnosis of prolapse from 1979,1992, and 2006 in the United States

Procedure	Year	AAR	AAR<52 y/o	AAR ≥ 52 y/o
Abdominal Hysterectomy	1979	0.57	0.72	0.27
	number	42656	34013	8643
	S.E.	0.003	0.004	0.003
	1992	0.24	0.19	0.32
	number	23536	12868	10668
	S.E.	0.002	0.002	0.003
	2006	0.18	0.17	0.19
	number	21262	13088	8174
	S.E.	0.001	0.001	0.002
Vaginal Hysterectomy	1979	1.41	1.55	1.14
	number	110276	75530	34746
	S.E.	0.004	0.006	0.006
	1992	0.88	0.82	1
	number	88205	54771	33434
	S.E.	0.003	0.004	0.005
	2006	0.62	0.48	0.9
	number	76370	38203	38167
	S.E.	0.002	0.002	0.005
Rectocele and Cytocele Repair	1979	2.05	1.87	2.38
	number	163658	90473	73185
	S.E.	0.005	0.006	0.009
	1992	1.31	0.75	2.42
	number	130950	50372	80578
	S.E.	0.004	0.003	0.009
	2006	1.05	0.42	2.28
	number	130288	36188	94100
	S.E.	0.003	0.002	0.007
Vaginal Suspension and fixation	1979	0.02	0.01	0.02
	number	1437	664	773
	S.E.	0.001	0.000	0.001
	1992	0.13	0.05	0.27
	number	12275	3406	8869
	S.E.	0.001	0.001	0.003
	2006	0.32	0.11	0.73
	number	39508	9445	30063
	S.E.	0.002	0.001	0.004

Table V

Comorbidities associated with prolapse procedures from 1979–2006 (N=5,632,904)

Comorbidity	ICD-9-CM Code(s)	Number	%
Any comorbidity		2,281,243	40.5
Malignancy	140–239	1,165,375	20.7
Diabetes	401,412,413,428	198,138	3.5
Cardiovascular	290,436–437	716,958	12.7
Neurologic	415–417,490–496	5,416	.10
Renal/Hepatology	571, 584–585	9,354	.20
Pulmonary	415–417,490–496	186,002	3.3

*
ICD

Table VIComplications $\geq 1\%$ associated with prolapse procedures 1979–2006 (N =5,632,904)

Complication	ICD-9-CM code(s)	Number	%
Any Complication		1,655,513	29.4
Fever	780.6	72,426	1.3
Uterine/Vaginal inflammation	615–616	637,435	11.3
Urinary Complications	997.5	99,356	1.8
Urinary retention	788.2	149,010	2.6
Anemia	285.1, 280.0	200,872	3.6
Accidental puncture, procedure related 4	998.2	59,604	1.1