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Inpatient procedures in elderly women: An analysis over time

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Abstract

Objectives—To describe inpatient surgical and diagnostic/therapeutic procedures in women 65 years old and assess procedure trends over time.

Study Design—Procedure data for all women 65 years was collected using the National Hospital Discharge Survey, a federal dataset drawn from a representative sampling of U.S. inpatient hospitals which includes patient and hospital demographics and ICD-9-CM diagnosis and procedure codes for admissions from 1979-2006.

Main Outcome Measures—Age-adjusted rates (AAR) per 1000 women were created using 1990 U.S. Census data to compare trends over time.

Results—Over 96 million procedures were performed in women age 65 years from 1979-2006. Women age 65 years constituted 17% of women with 1 inpatient procedure in 1979, rising to 32% in 2006. The most common surgical procedures were lower extremity joint replacement, open reduction internal fixation, and cholecystectomy. The most common concurrent diagnosis was femoral neck fracture. Women with femoral neck fracture were more likely to undergo open reduction internal fixation compared to joint replacement. AARs for ORIF fell from 4.3 to 3.2 (p=.02) from 1979-2006, while AARs for joint replacement increased from 0.2 to 3.4 (p<.001, 1979-1988; p=.14, 1990-2006).

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The Institutional Review Board of the University of Pittsburgh approved this study.

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Conclusions—The rate of women age 65 years undergoing inpatient procedures has increased dramatically in the last 30 years. Hip fracture was the most common diagnosis for elderly women, highlighting the impact of osteoporosis and falls and the importance of prevention strategies and optimization of peri-operative care in this population. Further comparative study of hip fracture treatment strategies in this population is needed.

Keywords

elderly; inpatient procedures; women

1.1 Introduction

A recent report by the Administration on Aging (AOA) revealed that Americans are living longer than ever before. Those who survive to age 65 can expect to live an average of 18.5 more years, while those surviving to age 85 can expect to live an average of 6.8 years (women) or 5.7 years (men).(1) The aging US population will present unique demands on healthcare resources that will likely play a major role in future healthcare expenditures and impact healthcare policy decisions. Gender differences in chronic health conditions were highlighted in the 2010 AOA report on aging, which noted higher rates of arthritis and hypertension in women and higher rates of heart disease and cancer in men. (1)

The World Health Organization defines the chronological age of 65 years as “older age” or “elderly”.(2) Women comprise a significant and increasing portion of the U.S. older population. Results from the 2010 U.S. Census revealed over 40 million Americans are 65 years of age, with women comprising over half (nearly 23 million) of this age demographic, representing 22% of the U.S. female population. Census data demonstrates the proportion of older women outnumbers older men, with this trend becoming more pronounced with increasing age.(3) In 2008, women accounted for 58% of the population age 65 and 67% of the population 85.(1) Given the significant growth of the older US female population, further knowledge of existing health care utilization patterns in this population is needed to prepare for the future. Data regarding surgical procedures for older women is lacking. Knowledge of common surgical procedures performed in these women and the associated diagnoses will be important to determine potential prevention strategies, develop novel nonsurgical treatments, compare treatment efficacies, and anticipate resource utilization. In a previous study using the National Hospital Discharge Survey, we assessed the change in frequency of obstetric and gynecologic (Ob/Gyn) procedures between 1979 and 2006 as well as the change in these procedures over the lifespan of women.(4) In our initial study we observed a dramatic shift in primary Ob/Gyn procedures from younger to older women. The purpose of this follow-up study was to describe and assess changes over time in all inpatient procedures in US women 65 and older using data from the National Hospital Discharge Survey from 1979 to 2006.

1.2 Materials and Methods

Data were abstracted from the National Hospital Discharge Survey (NHDS), a federal dataset utilizing a multistage probability sampling of inpatient hospital discharges in the United States. Medical records from approximately 440 non-federal short-stay hospitals (8% of all U.S. hospitals) were selected annually by systematic random sample and approximately 34,000 discharges (excluding newborns) were collected per year from January 1979 to December 2006, the current publicly available time period.(5) 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. Though not specific to the NHDS design, the inpatient primary diagnosis

code is normally assigned based on the condition necessitating admission, followed by associated and pre-existing conditions. Procedure code order is typically assigned based on billable amount, with highest billing codes appearing first. Other de-identified information collected included patient sex, age, race, marital status, length of hospital stay, hospital size (number of beds), hospital ownership, discharge status, and insurance type or expected sources of payment. Quality control programs have estimated the error rate for the NHDS at <1% for medical coding and data entry.(6)

After obtaining University of Pittsburgh, Institutional Review Board approval - exempt status, women who underwent inpatient surgical procedures from 1979 to 2006 were identified using the ICD-9-CM codes outlined in Table 1. All women ages 65 or older undergoing one or more of these procedures were included in the analysis. These tabulated surgical procedure numbers were then adjusted to national estimates using specifically designated weights, which are included in the federal dataset for each patient discharge. To reduce the potential for confounding effect from differential age distributions across study years, the age-adjusted rates (AAR) of procedures per 1000 women were calculated using the 1990 United States Census population data. Census data from 1990 were chosen to represent the midpoint of the study timespan. If the estimated number of cases per year was based on fewer than 60 records in the database, the estimate was considered unreliable.(7) Linear trends in procedures and diagnoses were analyzed by using linear regression. Statistical analysis was performed using SPSS Version 19.0 software (SPSS Inc., Chicago, Illinois, USA). P value <0.05 was considered statistically significant.

1.3 Results

From 1979 to 2006, 184 million women 65 years of age were admitted to a U.S. hospital and of these more than half (96 million) underwent an inpatient procedure during admission. This older cohort constituted 29% of all adult admissions with at least one inpatient procedure performed. Table 1 lists demographics for these women. In 1979, women age 65 constituted only 17% of all adult women with at least one inpatient procedure coded; while in 1993 and 2006, women 65 constituted 31% and 32% respectively. According to U.S. Census data, during this timeperiod women 65 constituted 18% of U.S. adult women in 1979 and 19% in 2006.

Of the top twenty 3-digit ICD-9CM procedure codes in the overall study time period, three were surgical procedures and the rest were diagnostic or minor therapeutic procedures. These surgical procedures were lower extremity joint replacement (ICD9-CM 815), open reduction internal fixation-ORIF (ICD9-CM 793), and cholecystectomy (ICD9-CM 512). Table 2 displays the most common procedures grouped by surgical or diagnostic/minor therapeutic categorization for three representative years, ordered from most to least common. The majority of women age 65 undergoing an inpatient procedure had at least one medical comorbidity coded (66.4%), with the most common being cardiovascular (40.8%), oncologic (16.6%), endocrine (16.2%), and pulmonary (13.9%). Complications were experienced by 40.8% of this cohort; the most common being heart failure (14.7%), urinary tract infection (10.6%), anemia (6.6%), and pneumonia (5.4%).

Table 3 lists the top ten, primary 3-digit diagnosis codes for all women age 65 during the study time period, ordered from most to least frequent. The most common diagnosis in older women in this study was fracture of the femoral neck (ICD-9 CM 820). In analysis by study year, femoral fracture uniformly ranked highly, appearing as the 1st or 2nd primary diagnosis in each year. Overall, cardiac-related issues comprised four of the top ten admission diagnoses during the study period. The primary diagnosis of procedural complication occurred in 1.8 million cases.

Since femoral fracture was the most common primary admission diagnosis in our study population, we performed further analysis of this subgroup. Of the 5.2 million women with femoral fracture, 2.3 million underwent ORIF and 1.4 million underwent joint replacement. The age-adjusted rate (AAR) per 1000 women for femoral fracture and ORIF fell from 4.3 to 3.2 ($b=-.027$, $p=.022$) from 1979 to 2006 (Figure 1). For women with femoral fracture undergoing ORIF, the mean age was 82.5 ± 7.6 , rising from 81 in 1979 to 83 in 2006. Median length of stay declined dramatically over the study time period in this group, from 19 days in 1979 to 5 days in 2006. Following ORIF, discharge to home occurred 47.9% of the time in 1979, but only 6.1% in 2006, while discharge to a long term care facility increased from 3.4% (1979) to 48.8% (2006) over the study time period. For women undergoing joint replacement in the setting of femoral fracture, the AAR per 1000 women rose from 0.2 to 3.4 (Figure 2). Separate slopes were calculated for the time periods before and after 1988, given the dramatic rise seen at that time and the correlation with the 1988 NHDS study redesign (1979 to 1988, $b=.096$, $p<.001$; 1990 to 2006, $b=-.019$, $p=.137$). Women undergoing joint replacement had a mean age of 81.8 ± 7.2 , rising from 78 in 1979 to 82 in 2006. The median length of stay declined from 21 days (1979) to 5 days (2006) over the study time period for this joint replacement group. The majority of women were discharged home following joint replacement in 1979 (56.9%), while in 2006 only 10.0% went directly home. Conversely, transfer to a long term care facility increased from 1979 to 2006 (8.6% to 51.2%).

For women with femoral fractures, complications occurred in 46% of women undergoing ORIF and 49% of women undergoing joint replacement. Table 4 lists complications occurring with a frequency of 1% or greater for these women, compared by surgical treatment approach. Death rate for femoral fracture was 3.0% with ORIF and 2.0% with joint replacement during the overall study period.

1.4 Discussion

The most important finding of this study is that the rate of women age 65 years and older undergoing inpatient procedures has increased dramatically in the last 30 years. This cohort comprised nearly one-third of all adult admissions over the 28 year study time period. The most commonly performed surgical procedures span multiple surgical subspecialties, however surgical repair of orthopedic fractures of the lower extremity were the most common. The majority of these older women had comorbid conditions and nearly half experienced an inpatient complication. With the aging of the US population projected to increase, strategies to optimize peri-operative care and outcomes for these elderly women are imperative.

The trends found in Figures 1 and 2 likely reflect several changes in the treatment of hip fractures in elderly women. As described above, over the study time period the AAR for hip fractures and ORIF decreased from 4.3 to 3.2, while the AAR for joint replacement in the setting of femur fracture rose from 0.2 to 3.4. This change likely reflects both heterogeneity in the coding of proximal femoral fractures, and the change in clinical practice from ORIF to arthroplasty for femoral neck fractures in elderly individuals.

ICD-9CM code 820 for fracture of the proximal femur reflects several different types of hip fractures, with different treatment protocols and risk profiles. Fractures of the femoral neck (820.00, 820.02) are intracapsular femoral fractures. These fractures have very limited healing potential, and have very few options for stable fixation in elderly women. In the pre-arthroplasty era, ORIF was frequently complicated by nonunion or femoral head protrusion, and fixation was unreliable. Many patients were treated non-operatively, and suffered substantial complications due to prolonged immobility. Extracapsular hip fractures (820.20,

820.21) tend to be stable, and have excellent healing potential. These fractures are quite amenable to ORIF, thus explaining the continued use of ORIF for ICD-9CM code 820 even after arthroplasty became popular.

Beginning in the late 1950s, arthroplasty began to be performed for some femoral neck fractures. This was in response to the problems outlined above. In the late 1960s, total hip arthroplasty was developed for arthritis of the hip joint. These procedures were initially considered to be large, complicated procedures, and were not thought suitable for many patients. Specialized centers began performing arthroplasty for hip fractures throughout the 1970s, and several large outcomes series were reported in the early 1980s.(8,9) By the middle to late 1980s, treatment of hip fractures by arthroplasty was well established, and series of modern, modular prostheses were being published offering an optimization of function.(10) As numbers of arthroplasty procedures (both for fracture and for degenerative disease) increased, the indications for ORIF of a femoral neck fracture decreased.

The finding that orthopedic fracture was the most common diagnosis for elderly women undergoing an inpatient surgical procedure highlights the downstream complications related to osteoporosis and fall risk in the elderly. Injuries secondary to falls are the leading cause of disability and injury deaths persons aged >65 years. Hip fracture is the most serious fall injury, and over 50% of elderly patients hospitalized for hip fracture never regain their former level of function. (11) Of all fall-related fractures, hip fracture is the most serious and is a leading cause of morbidity and mortality in elderly adults. (11-13) Osteoporosis is a major risk factor for hip fracture with falls. Osteoporosis is common, with over 10 million people affected in the U.S. alone. One of every two Caucasian women will experience an osteoporosis-related fracture in her lifetime. [14-16] Osteoporosis rates are closely linked to hormonal status, placing the gynecologist in a unique position to impact osteoporosis prevention and diagnosis.[14,17,18] The gynecologic conditions of prolonged amenorrhea and early menopause increase the risk of post-menopausal osteoporosis.(17,18) Treatments such as long-term, parenteral progestins, surgically or medically-induced menopause, and hormone therapy for menopausal symptoms all impact osteoporosis risk, thus these gynecologic treatments may have a larger effect on future health risk and medical resource utilization than previously recognized. (17-23)

Our findings emphasize the need for prevention of osteoporosis and osteoporosis-related fractures through appropriate evaluation and treatment as this common condition is under-diagnosed and treated in elderly women.(20,23-25) Osteoporosis and its associated complications play a major role in the health and independence of elderly women and thus have a large impact both on individual wellbeing and the healthcare system at large. As providers of well-woman care, gynecologists can impact modifiable osteoporosis risk factors by encouraging appropriate calcium and vitamin D intake, weight-bearing exercise, and smoking cessation. Consideration of relationship between hormone status and future osteoporosis should be one of many considerations when undertaking a hormone-modifying therapy. Gynecologists are often the first physicians to initiate osteoporosis screening and treatment and thus are in a unique position to positively impact the bone health of their elderly patients.

Urinary incontinence, specifically urge urinary incontinence, has been associated with an increased fall risk in elderly women. The prevalence of urinary incontinence in community dwelling elderly women is between 30-50% (26). Brown et al found in their study of community-dwelling older women that weekly or more frequent urge incontinence was an independent risk factor for falls and increased risk of falls by 26% and risk of fractures 34%. (27) A systematic review by Chiarelli et al estimated a 54% increased risk of fall in elderly women with urge incontinence and due to their incontinence (28). Primary care physicians

and gynecologists are in a key position to screen and initiate treatment of urge incontinence or refer to a specialist if needed. Treatment of urge incontinence may decrease the chance of fall and subsequent fracture in elderly women.

National database studies offer a unique opportunity to identify areas of care for which novel prevention and treatment strategies may have a high impact. The NHDS provides a large scale national sampling using standardized diagnosis and procedure codes with a low reported coding error rate, making it ideal for this type of descriptive study. However, there are limitations to our study, as there are to any large database study. The NHDS design likely underestimates the number of surgical procedures in older US women as it does not collect data from same-day surgeries or ambulatory surgical centers. No identifiers exist to associate individuals in the NHDS dataset, thus data only reflect individual admissions and cannot link multiple admissions or procedures on a single individual. Specific to the treatment of femoral fracture, we do not have data available for the timing of surgical intervention relative to injury, fracture type, utilization of non-surgical management, or an accurate assessment of each individual's overall health or "fitness" for surgery. Given these limitations, it is difficult to accurately compare the options of ORIF and joint replacement for femoral fracture in this population, but the volume of these procedures in elderly women certainly warrants further comparative study.

Debate exists in the literature over the optimal treatment for femoral neck fracture in an elderly population and no randomized trial data exists to guide care.(29-31) The majority of women in this study with femoral neck fracture underwent ORIF compared to joint replacement. However, over the 28 year time period, rates of ORIF fell while rates of joint replacement increased, with a remarkable increase in joint replacement AAR between 1988 and 1990. Potential reasons for this shift in practice are outlined above, but are difficult to confirm from this data. Of note, the NHDS underwent a sampling redesign in 1988 to improve the survey's efficiency and analytic capabilities. This redesign included linkage to other national databases, use of electronic discharge data forms, and new statistical methods for calculating variance.(7) Prior work comparing estimates generated by the two sampling methods revealed few significant differences in data estimates (32), though we cannot exclude the possibility that the 1988 rise in joint replacement seen in our study is in some way related to the study redesign. Both procedures were commonly performed in women of advanced age (>80), with high comorbidity and complication rates.

Our data further highlight the specific needs of the older patient, specifically the importance of hip fracture prevention strategies and optimization of peri-operative care in this unique population. As the geriatric population continues to increase, geriatric expertise will be of paramount importance for women's health providers and surgeons and should be appropriately integrated in to both graduate medical training and continuing medical education.

1.5 Conclusion

The rate of older women undergoing inpatient procedures has increased dramatically in the last three decades. Hip fracture was the most common diagnosis for elderly women, highlighting the impact of osteoporosis and falls and the importance of prevention strategies and optimization of peri-operative care in this population. Further comparative study of hip fracture treatment strategies in this population is needed.

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Abbreviations

AAR	(age-adjusted rate)
AOA	(Administration on Aging)
ICD-9-CM	(International Classification of Diseases, 9 th review, Clinical Modification)
NHDS	(National Hospital Discharge Survey)
ORIF	(open reduction, internal fixation)

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Condensation

Inpatient procedures in older women have increased dramatically in the last three decades highlighting the needs of the geriatric surgical patient.

Figure 1.
Age-adjusted rates: ORIF and concurrent femoral fracture per 1000 women from 1979 to 2006 in the United States

Figure 2.

Age-adjusted rates: Joint replacement and concurrent femoral fracture per 1000 women from 1979 to 2006 in the United States

Table I

Demographics: women 65 years with 1 inpatient procedure

Characteristic	Year	Mean±SD
Age (y)	1979	74.9±7
	1993	76.8±7.7
	2006	77.8±8
Length of stay (d)	1979	12.5±14.5
	1993	8.9±10.8
	2006	6.4±6.8
	Subgroup	Percentage
Race	White	71.5
	African American	8.1
	Other/not reported	20.4
Insurance	Private	6.5
	Government	91.3
Geographic Region	Northeast	24.8
	Midwest	24.7
	South	33.3
	West	17.3

Table 2

Top 10 inpatient procedures by 3-digit code in U.S. women age 65 by year

Inpatient Surgical Procedures: Description, ICD-9CM code, and frequency					
1979		1993		2006	
Procedure (ICD-9CM code)	N	Procedure (ICD-9CM code)	N	Procedure (ICD-9CM code)	N
intracapsular extraction lens (131)	174 200	joint replacement lower extremity (815)	217 300	joint replacement lower extremity (815)	395 400
open reduction internal fixation (793)	79 200	open reduction internal fixation (793)	145 500	open reduction internal fixation (793)	136 500
cholecystectomy (512)	77 000	cholecystectomy (512)	103 100	insert/remove/revise leads, insert temporary pacemaker, revise cardiac device pocket (377)	101 100
insert prosthetic lens (137)	71 500	bypass reanastomosis for heart revascularization (361)	86 500	insertion/replacement/removal/revision pacemaker (378)	93 400
insert/remove/revise leads, insert temporary pacemaker, revise cardiac device pocket (377)	50 400	open and other partial excision of large intestines (457)	69 700	bypass reanastomosis for heart revascularization (361)	80 300
other procedure spine (816)	50 300	insert/remove/revise leads, insert temporary pacemaker, revise cardiac device pocket (377)	66 500	other operations on thorax (349)	79 500
other local excision/destruction skin lesion (863)	44 500	gastrostomy (431)	65 000	cholecystectomy (512)	78 300
open/partial excision large intestine (457)	44 000	other operations on thorax (349)	61 500	open and other partial excision of large intestines (457)	77 300
mastectomy (854)	42 300	lysis of peritoneal adhesions (545)	61 200	lysis of peritoneal adhesions (545)	69 100
dilation and curettage (690)	38 700	repair of cystocele and rectocele (705)	57 900	exploration and decompression of spinal canal structures (030)	59 700
Inpatient Diagnostic and Minor Therapeutic Procedures: Description, ICD-9CM code, and frequency					
1979		1993		2006	
Procedure (ICD-9CM code)	N	Procedure (ICD-9CM code)	N	Procedure (ICD-9CM code)	N
diagnostic procedures large intestine (452)	124 200	diagnostic ultrasound (887)	404 200	blood transfusion (990)	702 600
diagnostic procedure on bladder (573)	106 200	angiocardiology with contrast (885)	311 700	puncture of vessel (389)	386 000
other radioisotope scan (921)	78 500	diagnostic procedures small intestine (451)	289 900	diagnostic procedures small intestine (451)	337 300
Xray urinary system (877)	66 200	other non-operative cardiovascular diagnostic procedure (895)	242 900	angiocardiology with contrast (885)	269 100
arteriography with contrast (884)	51 300	diagnostic procedures heart pericardium (372)	236 900	diagnostic procedures heart pericardium (372)	253 800

Inpatient Surgical Procedures: Description, ICD-9CM code, and frequency					
1979		1993		2006	
Procedure (ICD-9CM code)	N	Procedure (ICD-9CM code)	N	Procedure (ICD-9CM code)	N
radioisotope scan study (920)	48 100	blood transfusion (990)	235 000	diagnostic ultrasound (887)	229 600
diagnostic procedures small intestine (451)	47 400	respiratory therapy (939)	222 900	adjunct vascular procedure (004)	217 100
diagnostic procedure stomach (441)	43 300	inject/infuse other therapeutic/prophylactic substance (992)	211 700	other operation vessels (399)	188 600
diagnostic procedure lung/bronchus (332)	41 300	soft tissue Xray head/face/neck (870)	200100	diagnostic procedures large intestine (452)	185 700
biliary tract Xray (875)	36 300	diagnostic procedures large intestine (452)	197 700	inject/infuse other therapeutic/prophylactic substance (992)	178 800

N: number of procedures recorded in study year rounded to nearest hundred

Table 3

Primary 3-digit ICD-9CM diagnosis codes for women 65 years one inpatient procedure with frequency

Procedure (ICD-9CM code)	N (%)
Fracture of femoral neck (820)	4 863 800 (5.1)
Osteoarthritis (715)	3 817 400 (4.0)
Chronic ischemic heart disease (414)	3 291 400 (3.3)
Heart failure (428)	3 167 100 (3.1)
Acute myocardial infarction (410)	3 026 600 (3.1)
Cardiac dysrhythmia (427)	2 593 000 (2.7)
Gallstones (574)	2 162 400 (2.2)
Cataract (366)	1 959 500 (2.0)
Procedural complication (996)	1 825 600 (1.9)
Pneumonia (486)	1 785 400 (1.9)

N: number of primary procedures recorded in study year rounded to nearest hundred

%: percent of women with this diagnosis code out of all women 65 years with one or more inpatient procedures

Table 4

Common complications in women with femoral fracture by treatment type

ORIF	N (%)	Joint replacement	N (%)
Anemia	466 700 (20.4)	Anemia	278 700 (20.6)
Urinary tract infection	334 200 (14.8)	Urinary tract infection	202 800 (15.0)
Heart failure	259 000 (11.3)	Heart failure	170 200 (12.6)
Pneumonia	60 400 (2.6)	Other respiratory complication	50 000 (3.7)
Other respiratory complication	30 500 (1.3)	Fever	43 200 (3.2)
Fever	43 600 (1.9)	Pneumonia	39 700 (2.9)
Pulmonary embolus	41 500 (1.8)	Pulmonary embolus	34 800 (2.6)
Myocardial infarction	31 700 (1.4)	Other cardiovascular complication	17 800 (1.3)
Other cardiovascular complication	25 600 (1.1)	Myocardial infarction	16 400 (1.2)
Hemorrhage	25,122 (1.1)	Urinary retention	14 700 (1.1)
Urinary retention	22 300 (1.0)	Hemorrhage	14 100 (1.0)

N: number of primary procedures recorded in study year rounded to nearest hundred

%: percent of women with this diagnosis code out of all women 65 years with one or more inpatient procedures