GENDER AND HOSPITAL RESOURCE USE

Unexpected Differences

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Several recent studies have explored gender differences in medical care that are not attributable to clinical characteristics. At an 880-bed teaching hospital between July 1987 and June 1990, we studied the importance of gender on two measures of hospital care: length of stay and ancillary service use. The latter was measured on a relative value unit (RVU) scale, based on an estimation of direct cost dollars. Neither mean age nor in-hospital mortality differed between the 9,102 women and 10,285 men. After case-mix adjustment, women stayed in the hospital 0.22 days longer than men ($p = 0.01$) but consumed 67 fewer RVUs ($p = 0.01$). This RVU difference dissolved when intensive care unit (ICU) stays were eliminated; men were 1.13 times more likely (95% confidence interval 1.07 to 1.19) to be placed in the ICU. Being married shortened length of stay and women were less likely to be married (51% vs. 68%; $p < 0.001$), but even within marital status subgroups women remained in the hospital longer than men. Whether this longer length of stay and less technologically intensive care for women reflects a difference in illness severity or physician gender bias requires further study.

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Despite clinical similarity, physicians may not treat the sexes equally. Studies have described different treatments associated with a patient's gender that are not attributable to a patient's clinical characteristics. Khan et al. (1990) recently noted that women underwent coronary artery bypass surgery at an older age and at a more advanced disease stage than men, with a resulting higher mortality rate for women. Similarly, Tobin et al. (1987) described a differentially lower referral rate for coronary catheterization for women as compared to men, despite positive radionuclide scans for both. For a diagnostic workup of pulmonary symptoms, Wells and Feinstein (1988) demonstrated that women, independent of clinical criteria, were less likely than men to receive sputum cytological examinations.

Different treatments based on gender and not on clinical symptoms have been noted for psychiatric conditions as well. In one study of primary care physicians, women were more likely than men to receive anxiolytics and antidepressants, despite adjustment for symptoms and diagnoses (Hohmann, 1989). Similarly, Adler, Drake, and Teague (1990) studied the influence of patient gender on 46 psychiatric clinicians' personality assessments. The authors randomly altered only patient gender in written case studies and requested that the clinicians classify the patients according to *DSM-III*, Axis II criteria. The clinicians more frequently labeled women patients as histrionic and men as narcissistic. The authors concluded that a "cultural gender bias" could explain their results (Adler et al., 1990).

Are these coincidental, independent phenomena or do physicians consistently, across a wide range of diagnoses, treat women differently than they treat men?

If differences in treatment based on a patient's gender and not on clinical characteristics occur consistently, then differences in patterns of hospital resource consumption should be apparent. Because the literature to date implies that women receive less aggressive treatment than men, we explored a range of medical diagnoses to determine if women consume fewer hospital resources than men. We examined both length of stay, intensive care unit use (ICU), and total ancillary service use.

METHOD

DATA BASE

We studied consecutive patients admitted and discharged from the Internal Medicine Services of an 880-bed university teaching hospital. Each admission was categorized by diagnosis-related group, demographic variables, marital status, ICU use, length of stay, and total ancillary service use. Marital status was dichotomized; patients were classified as married if currently married; unmarried if divorced, widowed, or single. ICU use was also a dichotomous variable; either the patient received no ICU care or some ICU care. This information was entered into a computerized data base as part of a larger project, the Integrated Inpatient Management Model (McMahon, Creighton, Bernard, Pittinger, & Kelley, 1989).

Ancillary service use was measured in relative value units (RVUs), a measure of resource use based on direct cost dollars, which was developed as part of the Integrated Inpatient Management Model (McMahon et al., 1989). This enabled a better approximation of true ancillary service resource consumption than does either typical hospital charges or fully allocated hospital costs, which include both direct and allocated costs (Finkler, 1982). The RVU valve assigned to a service was proportional to the amount of goods and services needed to produce that service and was based on the actual costs in each of over 100 cost centers (such as the laboratory, the pharmacy, etc.). The absence of indirect costs and charge markups in the RVU system enables comparisons of resource use across cost centers that have differing cost/charge ratios (McMahon et al., 1989).

STUDY POPULATION

The study population consisted of all patients admitted and discharged from any Internal Medicine Service (including ICU patients and transfers from outside institutions) from July 1987 to June 1990 ($N = 21{,}060$).

We excluded 269 (1.3%) cases with incomplete data, and 1,404 (6.7%) length-of-stay outliers as defined by Medicare Standards

(*Federal Register*, 1987), which resulted in 19,387 eligible patients. Length-of-stay outliers were excluded because they may represent clinically unique patients and might confound our analysis (McMahon, 1984).

These patients were all cared for by housestaff with attending physician supervision. All attendings were full-time faculty of the university who were assigned attending physician duties 1 to 2 months of the year. Because of a limitation of our data base, we could not determine the precise number of attendings over the entire course of the study. We estimate the number of attending physicians involved to be approximately 150.

CASE-MIX ADJUSTMENT

Mean length of stay and ancillary service use are clearly case-mix dependent variables, and adjustment for case-mix must occur before comparisons between groups are made. We developed a method of case-mix adjustment (McMahon et al., 1989) and employed that method in this study. To adjust for case-mix, we first calculated the diagnosis-related group-specific mean length of stay and the mean RVU values from a historical data base consisting of all admissions from the Internal Medicine Services of this institution from 1984 to 1987. The actual length of stay and RVU of each patient in the current study were subtracted from the patients' specific diagnosis-related group historical mean. This created two new variables for length of stay and RVU use, termed *DEVLOS* and *DEVRVU*, respectively, which represented the deviations of the patient's length of stay or RVU use from the diagnosis-related group-specific historical mean length of stay or RVU. A value of zero for DEVLOS would indicate that the patient did not differ from the historical cohort diagnosis-related group-specific mean length of stay for the study patient's diagnosis-related group. The mean DEVRVU or DEVLOS for a group of patients represents the average deviation for length of stay or RVU use from diagnosis-related group-specific means.

Analysis based on this case-mix adjustment method could be subject to error if the distribution of men and women in specific diagnosis-related groups varied greatly. To investigate this possible source of bias, we used an alternative case-mix adjustment. The mean values for

women and men for length of stay, RVU, ICU days, and mortality were calculated for each diagnosis-related group category in the study. The patients were all classified into 219 diagnosis-related groups. On a diagnosis-related group-specific basis, the differences between women and men for length of stay, RVU, ICU days, and mortality were calculated. Paired comparison *t* tests were then used to analyze the gender differences across the diagnosis-related group categories and compared to the results achieved by the case-mix adjustment with deviations from historical means. The paired comparison *t* test method produced the same differences described below with the deviations method. Therefore, we report only the deviation method results below.

ANALYSIS

All analyses were performed using SAS version 5.18 (Copyright 1984, 1988 SAS Institute Inc., Cary, NC). Differences in resource use between subgroups based on age, sex, and marital status were performed with the student *t* test. ICU placement (yes/no) was categorized by sex. Using the Mantel-Haenszel chi-square (Mantel & Haenszel, 1959), the relative risk ratio by gender was calculated while controlling for diagnosis-related group.

RESULTS

Of the 19,387 hospital admissions during the study period 9,102 were women and 10,285 were men (Table 1). The average age for women was 54.3 ± 19 years; for men, the average age was 53.8 ± 17 years ($p = 0.13$). Compared to men, women were more likely to be 65 years of age or older (35% versus 30%, $p < 0.001$) and less likely to be married (51% versus 68%, $p < 0.001$).

After adjusting for case-mix, we found significant differences between women and men for both length of stay and total ancillary service use (Table 2). Women stayed in the hospital 0.22 days longer than men ($p < 0.01$). Despite this longer length of stay, the mean number of ICU days for women was 0.22 days less than that for men ($p < 0.001$). Overall, women received 67 fewer RVUs than men.

TABLE 1
Demographic Characteristics of Study Population[a]

	N	*Mean Age* ± SD	*% > 65 years of age*	*% Married*
Women	9,102	54.3 ± 19	35	51
Men	10,285	53.8 ± 17	30	68
		$p = 0.13$	$p < 0.001$	$p < 0.001$

a. The study population consisted of all length-of-stay inliers admitted and discharged from any Internal Medicine Service from July 1987 to June 1990.

This difference in mean total ancillary service consumption occurred with all ancillary services in the aggregate (laboratory, pharmacy, radiology, nuclear medicine, cardiology medical surgical supplies, blood products, respiratory supplies, electroencephalograph, electromyograph (EEG)/(EMG), operating room time, and dialysis). Differences in individual ancillary categories between men and women did not achieve statistical significance. We found no differences in crude or case-mix adjusted mortality rates between the two groups.

Analysis stratified by patients with and without ICU use revealed that women's lower amount of ancillary service use is entirely explained by their being less likely than men to have had an ICU stay (Table 3); 15.3% of women received ICU care versus 21.6% of men ($p < 0.001$). This was not secondary to a case-mix bias, that is, women having conditions less likely to require ICU care. All patients in this study were categorized into 219 diagnosis-related groups; in 47 of these, no ICU care occurred. In the remaining 172 diagnosis-related groups, we categorized ICU stay by sex, and analyzed for an effect of gender across all 172 diagnosis-related groups by the method of Mantel-Haenszel (Mantel & Haenszel, 1959). This method enables the analysis for an effect across multiple categories in which individual cell sizes may be small. This analysis revealed that men were 1.13 (95% confidence interval 1.07 to 1.19) more likely to be placed in an ICU than women (Mantel-Haenszel $X^2 = 19.693$, $p < 0.001$). This effect was not attributable to a distortion in one or two diagnosis-related groups; in 98 diagnosis-related groups, fewer women received ICU care than would be expected on the basis of diagnosis-related group alone (data available from author). Age did not account for this

TABLE 2
Case-Mix Adjusted[a] Length of Stay (DEVLOS) and Ancillary Service Use (DEVRVU) All Patients

	N	*DEVLOS*[b]* *Mean* ± SD *(Days)*	*DEVRVU*[c]* *Mean* ± SD *(RVU)*	*ICU*[d]** *Mean* ± SD *(Days)*	*Mortality Rate*
Women	9,102	1.21 ± 4.95	175.49 ± 1695.2	0.56 ± 2.021	54/1000
Men	10,285	0.99 ± 4.89	242.79 ± 1926.6	0.78 ± 2.200	54/1000

a. The variables DEVLOS and DEVRVU represent average deviations from diagnosis-related group specific means. A value of 0 indicates no change relative to the baseline period of 1984 to 1987.
b. DEVLOS = patient's length of stay - historical mean length of stay for that diagnosis-related group.
c. DEVRVU = patient's total ancillary service use - historical mean total ancillary service use for that diagnosis-related group.
d. ICU = intensive care unit.
e. RVU = relative value unit.
*$p < 0.01$; **$p < 0.001$.

difference in ICU care: Women placed in the ICU were actually 1.97 years older than men placed in the ICU ($p < 0.001$). For patients who received ICU care, no differences in length of stay or ancillary service use occurred between the sexes. For patients who received no ICU care, the difference in ancillary service use disappeared but the difference in length of stay persisted (Table 3).

To further characterize the differences in length of stay, all patients without ICU stays were analyzed according to their marital status (either married or unmarried). For both sexes, being married was associated with a shorter length of stay ($p < 0.01$ for both; see Table 4). However, marriage does not account for all the differences in length of stay. This is demonstrated graphically in Figure 1. Patients were divided into eight age categories; within each age group, the patients were further categorized by sex and marital status. Except for the final decade (those greater than 85), mean case-mix adjusted length of stay increased with age. For most age categories, married patients had a shorter length of stay and within marital status subgroups, women generally stayed in the hospital longer than men. Hence the greatest differences within each age category tended to occur between single women and married men.

TABLE 3

Subgroup Analysis: Gender Differences in Case-Mix Adjusted[a] Length of Stay (DEVLOS) and Resource Use (DEVRVU) Stratified by Intensive Care Unit Status

			Age		*DEVLOS*[b]	*DEVRVU*[c]
	Sex	N	*Mean* ± SD *(Years)*	*Percentage of Gender Group*	*Mean* ± SD *(Days)*	*Mean* ± SD *(RVU)*[d]
Patients with ICU[e] days	Women	1,393	57.7 ± 17.4	15.3	2.92 ± 5.92	1350 ± 3143
	Men	2,217	55.7 ± 15.4	21.6	2.71 ± 5.56	1276 ± 2760
			$p < 0.001$	$p < 0.001$	$p = 0.29$	$p = 0.47$
Patients without ICU days	Women	7,709	53.7 ± 19	84.7	0.89 ± 4.68	−36.78 ± 1146
	Men	8,068	53.3 ± 18	78.4	0.51 ± 4.58	−41.19 ± 1504
			$p = 0.34$	$p < 0.001$	$p < 0.0001$	$p = 0.831$

a. The variables DEVLOS and DEVRVU represent average deviations from diagnosis-related group specific means. A value of 0 indicates no change relative to the baseline period of 1984 to 1987.
b. DEVLOS = patient's length of stay - historical mean length of stay for that diagnosis-related group.
c. DEVRVU = patient's total ancillary service use - historical mean total ancillary service use for that diagnosis-related group.
d. RVU = relative value unit.
e. ICU = intensive care unit.

TABLE 4
Subgroup Analysis: Gender Differences in Case-Mix Adjusted[a] Length of Stay (DEVLOS) Stratified by Marital Status (Patients Without ICU[b] Stays)

			DEVLOS[c]	*Age*
		N	*Mean* ± SD *(Days)*	*Mean* ± SD *(Years)*
Women	Single	3,743	1.03 ± 4.8	53.5 ± 22.5
	Married	3,878	0.74 ± 4.6	53.8 ± 15.4
			$p < 0.01$	$p = 0.49 \pm 20.2$
Men	Single	2,647	0.74 ± 4.7	45.37 ± 20.2
	Married	5,272	0.39 ± 4.5	57.5 ± 14.3
			$p < 0.01$	$p < 0.001$

a. DEVLOS represents an average deviation from diagnosis-related group specific means. A value of 0 indicates no change relative to the baseline period of 1984 to 1987.
b. ICU = intensive care unit.
c. DEVLOS = patient's length of stay - historical mean length of stay for that diagnosis-related group.

DISCUSSION

At this midwestern university hospital, we detected systematic differences in hospital resource use between men and women, independent of diagnoses. Women were less likely to receive ICU care across a wide range of diagnoses. Women were also hospitalized an average of 0.22 days longer than men. Although women in our study were more likely to be over the age of 65 and more likely to be unmarried, two variables associated with longer length of stay, adjusting for these two variables did not alone explain the longer length of stay. For every age and marital status group, women still remained in the hospital longer.

Previous works describing different treatments based on gender have been increasing of late, but have been limited to specific patient group. Khan et al. (1990) described delays in referral of women for coronary artery bypass surgery and Tobin et al. (1987) described a similar delay in referral for cardiac catheterization. A similarly less aggressive approach for womens' diagnostic evaluation for pulmonary symptoms was discussed by Wells and Feinstein (1988). Our work adds to this current body of knowledge by demonstrating an average

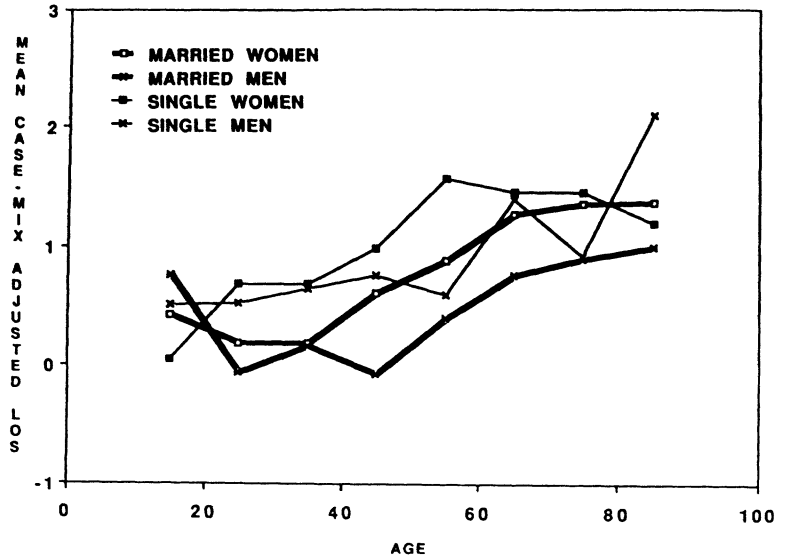

Figure 1: Mean Case-Mix Adjusted Length of Stay by Sex, Age, and Marital Status
The first age category is composed of patients between 14 and 25 years of age; the subsequent categories are describing successive 10-year age groups.

difference in length of stay across 219 diagnosis-related groups. Furthermore, for the 172 diagnosis-related groups in which ICU usage occurred, we demonstrate that overall, women were less likely than men to receive ICU care.

The less frequent use of the ICU by women requires further exploration. Differences in illness severity between men and women may account for these differences. Men may simply require more ICU care. Our data base did not allow for the chart review that would be necessary to explore the illness severity issue. ICU care may be withheld from women secondary to physician biases against women, consistent with the less aggressive care of women noted in the literature (Khan et al., 1990; Tobin et al., 1987). Physicians may take the complaints of women less seriously than those of men. Colameco, Becker, and Simpson (1983) demonstrated this phenomenon by analyzing clinicians' perceptions of patient vignettes for headache and

abdominal pain while systematically altering patient gender alone. The physicians consistently judged women to be more emotional than men. Such a phenomenon would make physicians less likely to place women in an ICU.

Alternatively, men could receive unnecessary ICU care. Physicians could be overly aggressive with men and subject them to care and procedures that are not needed. Again, without a chart review to explore illness severity prior to, during, and after ICU care is initiated, it is not possible to determine the appropriateness of this care. Despite differences in the type of care received, no differences in mortality were detected. This could indicate that, at least by one quality measure (death), the groups received the appropriate care. However, death is only one measure of quality of care; many quality problems exist that do not result in death (Donabedian, 1966). Furthermore, without an adjusted risk stratification for death, our mortality statistic, although withstanding case-mix adjustment, is still only a crude measure. The lack of a mortality difference could reflect that women, needing ICU care that they do not receive, actually have a higher than expected death rate. Clearly, a study with chart reviews for analysis of illness severity, risk of death, and overall quality of care is required to sort these issues out.

The longer length of stay for women may reflect more severe illnesses in women, yet this would be in direct conflict with the overall lower ICU usage by women. The length-of-stay difference could be secondary to social and cultural differences alone. Women may more often be caretakers and when caretakers become ill, no one is available to care for them. This explanation fits well with longer length of stays for both married and single women when compared to married and single men, respectively. For most age groups, the lowest length of stay belonged to married men; the highest to single women. Is a husband better than nothing, but not as good as a wife?

The economic impact of the differences in length of stay is not great for individual patients, but in the aggregate it could be impressive. A 0.22 day longer length of stay for each woman in our study translates into over 2,000 patient days for the 9,102 women in our study, certainly a formidable number of hospital days in this era of prospective payment. Similarly, the differential in ICU use, with its concomitant

increase in resource consumption (67 RVUs per patient) for the 10,285 men in the study translates into at least 680,000 direct cost dollars for our patient population.

The economic impact of these differences may be overshadowed by differences in the quality of care between the sexes. Women may be denied access to the ICU or men may be discharged from the hospital too soon because of subconscious beliefs of physicians. Any differences in hospital resource consumption not based on clinical diagnosis warrant examination for possible quality problems.

Lastly, this article concerns the Internal Medicine Services of one midwestern university only. Although it is in keeping with other works, extrapolation to other institutions and other fields of medicine would be inappropriate. However, this article supports the hypothesis that differences in treatment associated with patient gender, independent of diagnosis occur; these differences may not be limited to a few diagnostic categories. Further work on the appropriateness or inappropriateness of the care received by men and women should be explored.

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