

# Effect of Nancy Reagan's Mastectomy on Choice of Surgery for Breast Cancer by US Women

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**Context.**—While the actions of popular figures are believed to influence the behavior of the general public, including health care decisions, little research has examined such an effect.

**Objective.**—To determine whether a temporal association exists between use of breast-conserving surgery (BCS) for treatment of breast cancer and Nancy Reagan's mastectomy in October 1987.

**Design/Setting.**—Population-based observational cohort study.

**Patients.**—Two sources of data: (1) 82 230 women aged 30 years and older who were included in the Surveillance, Epidemiology, and End Results tumor registry because of a diagnosis of local or regional breast cancer from 1983 to 1990; and (2) 80 057 female Medicare beneficiaries aged 65 to 79 years who received inpatient surgery for local or regional breast cancer in 1987 or 1988.

**Main Outcome Measure.**—Percentage of use of BCS vs mastectomy over time.

**Results.**—Compared with women undergoing surgery for breast cancer in the third quarter of 1987 (just prior to Mrs Reagan's mastectomy), women were 25% less likely to undergo BCS in the fourth quarter of 1987 (odds ratio [OR], 0.75; 95% confidence interval [CI], 0.66-0.85) and in the first quarter of 1988 (OR, 0.76; 95% CI, 0.67-0.86). In subsequent quarters, the rate returned to the baseline. In multivariate analyses, the decline was significant among white but not nonwhite women. It was most prominent among women aged 50 to 79 years in the central and southern regions of the country, and most sustained among women living in areas with lower levels of income and education.

**Conclusions.**—Celebrity role models can influence decisions about medical care. The influence appears strongest among persons who demographically resemble the celebrity, and those of lower income and educational status.

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THERE HAS been a long-standing belief in the influence of public figures on popular behavior. The best-known ex-

amples have to do with fashion, but celebrities are also thought to be capable of influencing health care behaviors. This perception has led to the use of celebrity endorsements for promoting health behaviors such as safe sex and avoiding illegal drugs. Remarkably, though, there is little information beyond the anecdotal documenting an effect of celebrity role models on medical care or health behaviors.<sup>1</sup> During an analysis of the effect

of legislative initiatives on the use of breast-conserving surgery (BCS) vs modified radical mastectomy in women with early-stage breast cancer,<sup>2</sup> we noted a sharp drop in BCS in late 1987 that was not associated with any publications in the medical literature or lay press that would call into question the effectiveness of BCS. It was, however, closely associated with the treatment of breast cancer in Nancy Reagan, wife of then President Ronald Reagan.

During the routine screening mammography accompanying Mrs Reagan's annual medical evaluation in early October 1987, a suspicious lesion was detected.<sup>3</sup> On October 17 she underwent an open biopsy of the lesion followed by a modified radical mastectomy during the same operation. This treatment choice sparked a controversy that was prominently reported by the lay press. Articles critical of Mrs Reagan's choice of surgery appeared in major news media under headlines such as "Mastectomy Seen as Extreme Treatment"<sup>4</sup> and "Was This Operation Necessary?"<sup>5</sup> One authority on breast cancer was quoted in the *New York Times* as stating that Mrs Reagan's decision "set us back 10 years."<sup>4</sup> *Time* magazine quoted a prominent breast cancer specialist as stating "it's my opinion that she was probably overtreated."<sup>5</sup> This negative press in turn stimulated a number of articles defending the right of Mrs Reagan and all women with breast cancer to make whatever choice of therapy seems best for them.<sup>6</sup>

In this article, we describe the decline in use of BCS temporally associated with Mrs Reagan's breast cancer treatment.

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We believe this to be the first detailed examination of the influence of a celebrity role model on national medical practice. We use 2 independent sources of data: the Surveillance, Epidemiology, and End Results (SEER) tumor registry, which provides population-based data on diagnosis and treatment of cancer for approximately 10% of population of the country, and Medicare Part A charge data, which provide information on hospital treatment for more than 90% of women aged 65 years and older nationally.

## METHODS

The study was approved by the Human Research Committee of the Medical College of Wisconsin.

### Databases

SEER includes a population-based cohort of cancer patients from 9 geographic sites: the states of Connecticut, Hawaii, Iowa, New Mexico, and Utah, and the metropolitan areas of Atlanta, Ga, Detroit, Mich, San Francisco-Oakland, Calif, and Seattle-Puget Sound, Wash.<sup>7</sup> Information collected by SEER includes demographic information, extent of disease, and initial course of treatment for each patient.

The federal Area Resource File<sup>8</sup> was used to determine the degree of urbanicity, income, and educational status of the county of residence of the patient. Assigning proxy census indicators of socioeconomic status has been shown to be a valid approach to analyzing socioeconomic status in database studies.<sup>9</sup>

The 1987-1988 national Medicare Part A claims files maintained by the Health Care Financing Administration were used for some analyses. This database contains information on virtually all US residents aged 65 years and older, except for those treated at Veterans Affairs hospitals.<sup>10</sup> A record is kept for each hospital discharge and includes the patient's age, sex, dates of admission and discharge, up to 5 diagnoses, and up to 3 procedures.

Newspaper and magazine articles about breast cancer treatment were identified by searching 1987 and 1988 in the *National Newspaper Index* and the *Magazine Database* (Information Access Co, Foster City, Calif). Articles relating to surgery for breast cancer were obtained and analyzed for content relating to choice of BCS vs mastectomy. While the broadcast media also covered Mrs Reagan's operation, we believe that the print media databases provided a representative sample of the overall content of the lay press coverage of these issues.

For each state in the United States, we obtained the percentage of the popu-

lar vote won by President Reagan in 1984.<sup>11</sup> We also determined the American Conservative Union's scores<sup>12</sup> for that state's members of the House of Representatives, and averaged the scores for all members in each state for 1982, 1984, 1986, and 1988.

### Patient Cohorts

**SEER Cohort.**—All 121 796 women who developed breast cancer between 1983 and 1990 were selected. Patients were excluded for the following reasons: if there was no microscopic confirmation of disease (1947); if the stage of disease was in situ (11 917), distant (6879), or unknown (4800); if the breast cancer was bilateral (149); if the breast cancer was not the patient's first cancer (16 764); if the patient's age was younger than 30 years (813); or if the patient did not receive either a mastectomy or BCS (7338). Some patients had more than 1 reason for exclusion. An additional 24 patients were excluded because of a lack of information regarding the month of diagnosis, and 35 were excluded because of an invalid county code. A cohort of 83 250 women aged 30 years or older who underwent BCS or mastectomy treatment for local or regional breast cancer diagnosed in 1983 through 1990 remained. For the more detailed analyses, only the 22 574 women diagnosed in 1987 or 1988 were included.

Age at diagnosis was categorized as 30 through 49, 50 through 64, 65 through 79, and 80 years or older. Race was categorized as white or nonwhite. Women were considered to have received BCS if they underwent segmental mastectomy, lumpectomy, quadrantectomy, tylectomy, wedge resection, excisional biopsy, or partial mastectomy.

Several county-level factors were obtained from the Area Resource File. The size of the metropolitan statistical area of the county of residence of the patient was categorized as less than 250 000 persons, 250 000 to 1 million persons, or more than 1 million persons. The average per capita income and the percentage of persons aged 25 years or older who had completed 4 or more years of college were computed for the county of residence of each patient and were divided into quartiles.

**Medicare Cohort.**—Cohorts of women undergoing inpatient BCS or mastectomy for invasive local or regional breast cancer during 1987 and 1988 were constructed.<sup>13,14</sup> Briefly, we selected from the annual inpatient hospital claims files for 1987 and 1988 records containing a breast cancer *International Classification of Diseases, Ninth Revision, Clinical Modification*<sup>15</sup> diagnostic (174.XX) or procedural (85.XX) code. From the

114 896 such claims in 1987, and 116 398 claims in 1988, we eliminated claims (4846 in 1987 and 5439 in 1988) that were for men, for skilled nursing admissions, or duplicates. We determined the earliest hospitalization with the most invasive operation for each patient and excluded women who had not undergone either an excisional breast procedure or axillary lymph node dissection (25 216 in 1987 and 24 311 in 1988). Also excluded were women who underwent bilateral mastectomy, had distant metastases, had carcinoma in situ (19 154 in 1987 and 20 034 in 1988), or had no recorded diagnosis of primary breast cancer (15 189 in 1987 and 15 151 in 1988). Some women had more than 1 reason for exclusion. We then limited this cohort to white women aged 65 to 79 years, providing a cohort of 39 184 in 1987 and 40 873 in 1988.

We coded women as having undergone BCS if they had undergone local excision, quadrantectomy, partial mastectomy, or axillary lymph node dissection without mastectomy.<sup>14,16</sup> The state in which each patient was treated was determined from the hospital's identification number.

### Statistical Analysis

**SEER Cohort.**—The percentage use of BCS was computed for each quarter over the period of observation, based on date (month and year) of diagnosis. The date of treatment is not available in the SEER database. For patients diagnosed in 1987 or 1988, a logistic regression model was used to estimate the odds ratio for receipt of BCS.<sup>17</sup> Patient variables at the individual level (age, race, stage of disease) and the county level (size of metropolitan statistical area, per capita income, percentage of persons aged  $\geq 25$  years with  $\geq 4$  years of college education) were used as covariables to adjust for potential differences in these factors. Time was modeled as a series of binary variables<sup>18</sup> referenced to the third quarter of 1987.

**Medicare Cohort.**—For each patient, the date of admission to the hospital was considered the treatment date for analytic purposes. For each region of the country, the percentage of reduction in use of BCS during the 6 months following Mrs Reagan's mastectomy was determined by dividing the proportion of patients receiving BCS in the fourth quarter of 1987 and first quarter of 1988 by the proportion of patients receiving BCS during the third quarter of 1987. This number was subtracted from 1, and multiplied by 100% to provide the percentage of reduction in use of BCS.

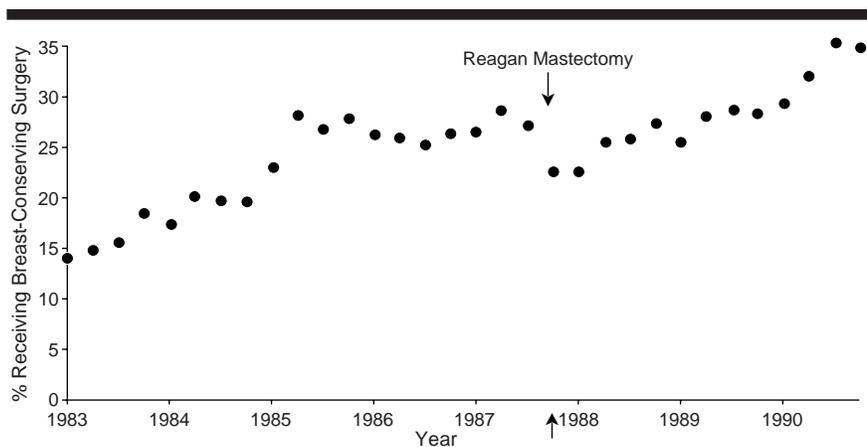


Figure 1.—Percentage of use of breast-conserving surgery among female Surveillance, Epidemiology, and End Results patients aged 30 years and older, who were diagnosed with local or regional breast cancer during 1983 through 1990, by quarter.

## RESULTS

Figure 1 shows the percentage of use of BCS from 1983 through 1990, by quarter of diagnosis, for women aged 30 years or older with local or regional breast cancer living in 1 of the 9 SEER areas. As previously described,<sup>2</sup> there is a gradual increase in the use of conservative surgery from 1983 through 1985. This is followed by relative stability in the use of this procedure, with the exception of a rather sharp decrease in use the last quarter of 1987 and the first quarter of 1988. Based on the multivariate logistic regression, the odds of receipt of BCS were about 25% lower during these 2 quarters than during the third quarter of 1987 (Table 1). This 25% decrease, if projected to the entire country, suggests that approximately 3400 fewer women underwent BCS in the 6 months following Mrs Reagan's surgery than would have been expected based on previous rates of utilization. The searches of the lay print media databases yielded numerous articles discussing the diagnosis of Mrs Reagan's cancer and her treatment choice. No articles were found seriously questioning the validity of BCS treatment.

Table 2 presents the change in use of BCS after Mrs Reagan's mastectomy among various demographic groups. The decrease in use of BCS during the fourth quarter of 1987 and the first quarter of 1988 was apparent among women aged 50 through 64 and 65 through 79 years, but not among older or younger women. The decrease in use of BCS was apparent among white women, but not among African American women. The decrease was present among women treated in both urban and rural areas. The effect was observed during the fourth quarter of 1987 among women of all income and

educational strata, but recovery was more rapid among more affluent and better-educated women.

The fact that the drop in BCS utilization was greatest in women aged 65 through 79 years allowed us to use Medicare data to examine the effect nationally. Figure 2 presents week by week data for 1987 and 1988 on the percentage of white women aged 65 through 79 years with local or regional breast cancer who underwent BCS. Mrs Reagan had her operation during the 41st week of the year (October 15-21), and a sharp drop in the percentage of use of BCS is apparent beginning with week 42. The percentage of women aged 65 through 79 years with local or regional breast cancer receiving BCS is higher in the SEER cohort ( $\approx 25\%$ , Figure 1) than in the Medicare cohort ( $\approx 13\%$ , Figure 2). This is because the Medicare cohort does not include women treated in outpatient surgery centers, and because the SEER database overrepresents urban patients, who have greater use of BCS.<sup>19</sup>

As assessed by analysis of Medicare data, the reduction in use of BCS during the last quarter of 1987 and the first quarter of 1988 (compared with the third quarter of 1987 nationally) was 24.5%. As shown in Table 3, there was considerable regional variation; the reduction in use of BCS following Mrs Reagan's surgery was greatest in the South Atlantic and East South Central regions, while it was less in the Middle Atlantic region. In further analyses, the drop in BCS use in each state following Mrs Reagan's surgery was not related to the percentage vote received by President Reagan in the 1984 election ( $r=0.09$ ) or to the average rating of all the members of Congress in each state on a conservative-liberal scale ( $r=0.002$ ).

Table 1.—Odds of Receipt of Breast-Conserving Surgery (BCS), by Quarter, for 22 574 SEER Patients Diagnosed as Having Local or Regional Breast Cancer in 1987 or 1988\*

Quarter	Receipt of BCS, OR (95% CI)
1987	
1	0.96 (0.84-1.08)
2	1.06 (0.94-1.19)
3†	1.00
4	0.75 (0.66-0.85)
1988	
1	0.76 (0.67-0.86)
2	0.93 (0.82-1.05)
3	0.90 (0.79-1.02)
4	0.97 (0.86-1.10)

\*This table presents odds ratios (ORs) and 95% confidence intervals (CIs) for receipt of BCS from a multivariate logistic regression model that included the individual's age, race, and stage of disease as well as the county-level sociodemographic factors of size of metropolitan statistical area, per capita income, and percentage of persons aged 25 years or older with 4 or more years of college education. SEER indicates Surveillance, Epidemiology, and End Results.

†Quarter 3 of 1987 represents the reference quarter. Reported ORs are relative to the BCS use during this quarter.

## COMMENT

In this article, we have demonstrated a 25% reduction in the use of BCS as opposed to mastectomy among women with local or regional breast cancer diagnosed during the last quarter of 1987 or first quarter of 1988. The observed decrease in use of BCS was not associated temporally with any medical literature or lay print media reports questioning the technique, but was associated with a great deal of publicity in the lay press regarding the choice of the president's wife to undergo mastectomy for her own breast cancer.

As might be expected, the effect of Mrs Reagan's surgery was greatest among women who were demographically similar to her, white women aged 50 through 79 years, as opposed to older or younger women or nonwhite women. The effect was more prominent in the Central and Southern regions of the country, and in counties with lower levels of education and income. There was no correlation between the decrease in use of BCS in each state and popular vote for President Reagan or a rating of the state's members of Congress on a liberal-conservative scale.

It might be argued that the drop in use of BCS was not related to the publicity regarding Mrs Reagan. However, the tight temporal relationship shown in the week by week Medicare data (Figure 2) is impressive. In addition, the fact that the decrease was most prominent in women demographically similar to Mrs Reagan lends credibility to this explanation, as does the lack of any other widely publicized information during this period regarding treatment of breast cancer. Although some potential for misclassification of BCS exists in

Table 2.—Quarterly Use of Breast-Conserving Surgery (BCS) Among SEER Patients Aged 30 Years and Older, Diagnosed as Having Local or Regional Breast Cancer During 1987 or 1988 by Demographic Factors\*

Factor	Quarter 3 1987, % BCS	Quarter 4 1987, OR (95% CI)	Quarter 1 1988, OR (95% CI)	Quarter 2 1988, OR (95% CI)	Quarter 3 1988, OR (95% CI)	Quarter 4 1988, OR (95% CI)
Age, y						
30-49	28.5	0.98 (0.76-1.26)	0.94 (0.73-1.20)	1.14 (0.89-1.46)	0.98 (0.76-1.26)	1.08 (0.84-1.38)
50-64	27.3	0.74 (0.59-0.93)†	0.70 (0.56-0.88)†	0.93 (0.74-1.16)	0.92 (0.74-1.15)	0.92 (0.74-1.15)
65-79	25.5	0.64 (0.51-0.80)†	0.66 (0.53-0.82)†	0.77 (0.62-0.96)†	0.84 (0.67-1.05)	0.89 (0.71-1.11)
≥80	29.1	0.75 (0.50-1.12)	0.90 (0.60-1.34)	1.01 (0.68-1.50)	0.91 (0.61-1.35)	0.95 (0.64-1.41)
Race						
White	27.7	0.74 (0.65-0.85)†	0.74 (0.65-0.85)†	0.91 (0.79-1.04)	0.89 (0.78-1.02)	0.98 (0.86-1.12)
African American	23.3	0.85 (0.60-1.21)	0.85 (0.60-1.21)	1.06 (0.75-1.51)	0.98 (0.69-1.39)	0.93 (0.65-1.32)
Stage						
Local	32.8	0.76 (0.66-0.88)†	0.78 (0.67-0.90)†	0.95 (0.82-1.10)	0.89 (0.77-1.03)	1.00 (0.86-1.16)
Regional	17.4	0.76 (0.59-0.97)†	0.71 (0.56-0.91)†	0.89 (0.70-1.14)	0.94 (0.74-1.20)	0.92 (0.72-1.18)
MSA‡						
>1 000 000	29.9	0.80 (0.67-0.95)†	0.81 (0.68-0.96)†	0.86 (0.73-1.02)	0.90 (0.76-1.07)	0.95 (0.80-1.13)
250 000-1 000 000	26.7	0.76 (0.60-0.97)†	0.74 (0.58-0.94)†	1.14 (0.90-1.45)	1.04 (0.82-1.32)	1.08 (0.85-1.37)
<250 000	10.2	0.63 (0.46-0.87)†	0.62 (0.45-0.85)†	0.81 (0.59-1.12)	0.71 (0.52-0.98)†	0.88 (0.64-1.21)
Per capita income, \$†						
<17 461	22.6	0.74 (0.56-0.98)†	0.63 (0.48-0.84)†	0.87 (0.66-1.15)	0.69 (0.52-0.91)†	0.85 (0.64-1.13)
17 462-21 307	23.9	0.74 (0.57-0.96)†	0.63 (0.49-0.82)†	0.80 (0.62-1.04)	0.92 (0.71-1.19)	0.93 (0.72-1.20)
21 308-24 875	31.2	0.75 (0.59-0.96)†	0.71 (0.55-0.91)†	0.98 (0.76-1.26)	0.99 (0.77-1.27)	0.97 (0.76-1.24)
>24 875	30.6	0.79 (0.63-0.98)†	1.03 (0.82-1.30)	1.07 (0.85-1.35)	0.97 (0.77-1.23)	1.11 (0.88-1.40)
College educated, %‡						
<13	21.2	0.72 (0.54-0.97)†	0.71 (0.53-0.95)†	0.69 (0.51-0.93)†	0.76 (0.57-1.02)	0.86 (0.64-1.15)
13-20	26.9	0.72 (0.56-0.92)†	0.57 (0.44-0.73)†	0.88 (0.69-1.13)	0.91 (0.71-1.17)	0.92 (0.72-1.18)
21-25	25.8	0.79 (0.62-1.01)	0.84 (0.66-1.07)	1.23 (0.97-1.57)	0.94 (0.74-1.20)	0.98 (0.77-1.25)
>25	33.6	0.78 (0.62-0.98)†	0.92 (0.73-1.16)	0.91 (0.72-1.15)	0.97 (0.77-1.22)	1.07 (0.85-1.35)

\*The percentage of women in each category who received BCS in the third quarter of 1987 (the baseline quarter) is given. Odds ratios (ORs) and 95% confidence intervals (CIs) for receipt of BCS for the subsequent quarters are given in the remaining columns. The analysis involved a logistic regression model controlling for each of the demographic factors (see "Methods" section). SEER indicates Surveillance, Epidemiology, and End Results.

† $P < .05$ .

‡Size of the metropolitan statistical area (MSA), per capita income, and percentage of persons aged 25 years or older with 4 or more years of college education are measures at the county level.

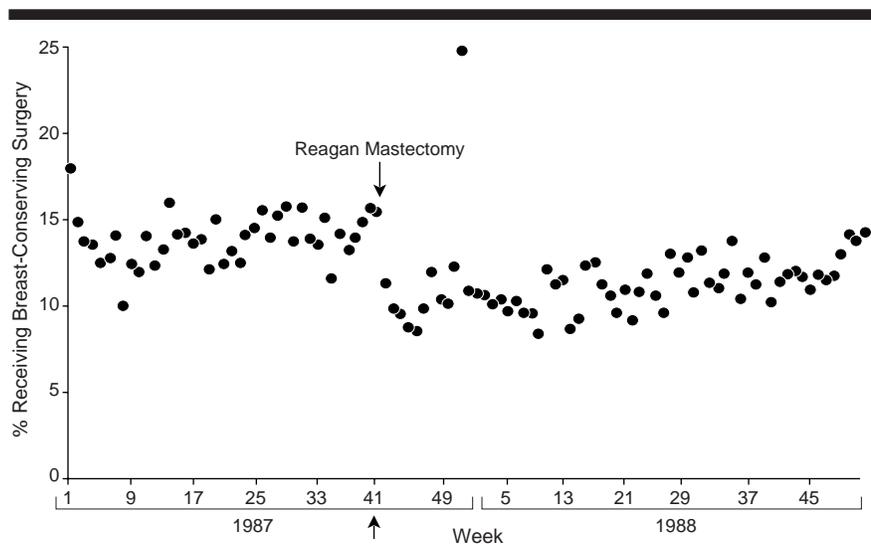


Figure 2.—Percentage of use of breast-conserving surgery among white, female Medicare inpatients aged 65 through 79 years who were treated for local or regional breast cancer during 1987 and 1988, by week. One may note a substantial increase in use of BCS during the last week of 1987. The total number of cohort patients treated during this week, which contains the Christmas holidays, was only 149, whereas 600 to 1000 patients were treated during most other weeks.

these databases, we do not believe any misclassification would be selective in such a way as to account for the observed temporal decline in use of BCS.

To date, the most completely studied "celebrity illness" and its effect on health

behaviors was the announcement in November 1991 by Earvin "Magic" Johnson that he was positive for the human immunodeficiency virus. By chance, there were several ongoing surveys of sexual knowledge, attitudes, and practices that

Table 3.—Percentage of Reduction in Breast-Conserving Surgery (BCS) Following Nancy Reagan's Mastectomy, by Geographic Region\*

Census Division	% Reduction
New England	22.3
Middle Atlantic†	14.1
East North Central	29.1
West North Central	19.4
South Atlantic†	38.2
East South Central†	46.2
West South Central	25.3
Mountain	29.6
Pacific	20.2

\*Data are for female Medicare beneficiaries aged 65 through 79 years. Percentage of reduction in use of BCS was calculated by dividing the proportion of patients receiving BCS in the fourth quarter of 1987 and first quarter of 1988 by the proportion of patients receiving BCS during the third quarter of 1987. This number was subtracted from 1 and multiplied by 100%.

†Denotes regions in which the reduction in use of BCS differed significantly from the national mean reduction in use (1-way analysis of variance,  $P < .05$ ).

overlapped that announcement.<sup>20-23</sup> There were changes in attitudes<sup>20</sup> and self-reported health behaviors<sup>23</sup> in some populations, but not in others.<sup>21,22</sup>

Several studies have examined temporal relationships between the diagnosis of breast cancer in a celebrity and use of mammography.<sup>24-26</sup> Lane et al<sup>24</sup> reported that a small percentage (1%-2%) of women studied in Long Island, NY, attributed their decision to have a first mammogram in late 1987 to the publicity surrounding Mrs Reagan's breast can-

cer diagnosis, and others<sup>25,26</sup> have reported increases in mammography<sup>25</sup> and other screening tests<sup>26</sup> following the diagnoses of breast cancer in the wives of the president and vice president in 1977. This increase in screenings was accompanied by an increase in breast cancer diagnoses.<sup>27,28</sup> There may have been a similar situation following Ronald Reagan's diagnosis of colon cancer, with an increase in use of endoscopic screening tests.<sup>29</sup>

Was the effect on choice of surgery due more to physician effect or patient effect? During the 1980s there was concern that BCS was being underutilized, and consensus statements<sup>30</sup> and legislative initiatives<sup>31</sup> were produced in an attempt to

remedy this perceived underutilization. On the other hand, the 2 treatments, BCS followed by radiation and modified radical mastectomy, are equivalent in terms of survival and patient satisfaction.<sup>32</sup> The major factor influencing successful adaptation after breast cancer treatment is participation by the patient in the treatment choice.<sup>32</sup> We assume that the influence of Mrs Reagan's choice was acting mostly via the patient rather than on the surgeon, because women most demographically similar to Mrs Reagan were most affected.

In conclusion, medical care can be influenced substantially by the behavior of celebrity role models. The influence is strongest among persons who demo-

graphically resemble the celebrity, and those of lower income and educational status. One can sympathize with public figures facing difficult personal medical decisions, because they have to deal with the reality that their decisions may very well influence the behavior of thousands of others. However, this study provides support for the concept of targeted celebrity role models as a strategy to influence public health behaviors.

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