ORIGINAL ARTICLE

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# Pregnancy Among Women Surgeons

## *Trends Over Time*

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**Background:** Women compose half of all medical students but are underrepresented in the field of general surgery. Concerns about childbirth and pregnancy during training and practice are factors that may dissuade women from electing a career in surgery.

**Objective:** To assess experiences related to childbirth and pregnancy among women general surgeons.

**Design:** Survey questionnaire.

**Setting:** Self-administered survey sent individually to women surgeons in training and practice.

**Participants:** Women members of the Association for Women Surgeons or the American College of Surgeons who graduated from medical school and practice general surgery or a general surgery subspecialty.

**Main Outcome Measures:** Descriptive data on the timing of pregnancy and perception of stigma attending childbirth and pregnancy as experienced by women surgeons, according to date of medical school graduation (0-9 years since graduation, 10-19 years, 20-29 years, and ≥30 years). The survey response rate was 49.6%. Trends over time were evaluated using comparisons of proportions and the Cochrane-Armitage trend tests across age cohorts.

**Results:** The perception of stigma associated with pregnancy during training remained large but decreased from 76% in the most remote cohort to 67% in the most recent graduation cohort ($P<.001$). External influences, even women resident colleagues, were perceived as evincing negative instead of encouraging attitudes toward childbearing during residency, though less so than men, both resident colleagues and faculty. Frequency of pregnancy and pregnancies earlier in training increased over the time cohorts.

**Conclusions:** The number of women general surgeons becoming pregnant during training has increased in recent years; however, substantial negative bias persists. Although the overall magnitude of perceived negative attitudes is greater among male peers than female peers and among faculty than peers, even women residents hold negative views of pregnancy among their colleagues during training. More than half of all women surgeons delay childbearing until they are in independent practice, post-training. Surgical residents and faculty of both sexes exerted negative influences with regard to consideration of childbearing. There was also a trend toward increased childbearing in more recent graduates.

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WOMEN IN MEDICINE have historically been outnumbered by men, with women composing only 6.9% of medical school graduates in 1965. The number of women applicants has increased steadily to 50.8% of American medical school applicants in 2003 to 2004. Concomitantly, women composed 48.3% of all American medical school graduates in 2010.[1]

Despite the increase in women physicians, women are not proportionately represented across medical fields. Academic faculty women make up a large percentage of primary care specialties—41% of faculty in internal medicine, 47% in pediatrics, 48% in obstetrics and gynecology, and 40% in family medicine.[2] Only 15% of faculty in general surgery are women. Although the number of women medical students pursuing a surgical career has increased steadily since 1997, there are still disproportionately fewer women than men pursuing general surgery and surgical subspecialties. In 2008, women represented 32.3% of residents in general surgery.

Many factors deterring women from careers in surgery have been posited. One major concern is accommodating preg-

nancy and childbirth during training and practice. Surgical training takes place during a woman's fertile years. Both the demands of training in surgical specialties and subspecialties and negative attitudes toward pregnancy may deter students from choosing surgery as a career.[3] We surveyed women general surgeons in training and practice about their experience with childbirth and pregnancy.

## METHODS

The survey instrument was pilot tested in October 2007 at the Association of Women Surgeons annual meeting in New Orleans, Louisiana. The study was approved by the institutional review board at the University of Maryland at Baltimore. The survey was distributed in 2008 to all women physicians who were members of the American College of Surgeons, who identified themselves as general surgeons or any of the subspecialties of general surgery, and all members of the Association of Women Surgeons. Survey invitations were sent by e-mail to all members with an e-mail address on file. Paper surveys were sent to those individuals for whom no e-mail addresses were available. Surgeons with incorrect/inactive e-mail addresses were not recontacted via other means. No individuals received both a paper and e-mail survey.

Announcements about the survey were also included in e-mail correspondence to the membership of the American College of Surgeons, American Medical Association, and Association of Women Surgeons. Lime Survey (Carsten Schmitz) was used to collect electronic responses, and Scantron (Scantron Corp) was used to process the paper forms. The survey was sent to unique e-mail addresses or mailing addresses. The Association of Women Surgeons and American College of Surgeons databases were compared prior to sending out surveys; an individual in both lists would have received only 1 survey.

The 99-question survey collected demographic information including year of completion (or expected completion) of training; type of practice or training program; numbers of pregnancies and births before, during, or after training; number of women faculty and residents in training programs; satisfaction with childbearing choices; and attitudes of colleagues. The survey inquired about the 8 permutations of men and women, residents and faculty, having negative or positive influences on personal decision making on childbearing during residency. The perception of stigma associated with pregnancy during residency was assessed using a true/false format. Participants were categorized into 4 age cohorts by number of years since graduation from medical school (0-9 years, 10-19 years, 20-29 years, and ≥30 years). Comparisons of proportions and Cochrane-Armitage trend tests were used to evaluate differences and trends in distributions across age cohorts.[4] To assess pregnancy during training, a generalized linear model with generalized estimating equations was used to estimate the age cohort and training year effects on pregnancy as an outcome. Analysis was performed with SAS version 9.1.3 (SAS Institute Inc). A $P$ value of less than .05 was accepted for nominal statistical significance.

## RESULTS

### RESPONDENT CHARACTERISTICS

A total of 4929 electronic survey invitations were sent. There were 1627 incorrect/inactive e-mail addresses; 3302 electronic surveys were successfully delivered, of which 1639 (49.6%) were returned. Six hundred paper surveys were distributed, of which 311 (51.8%) were completed and returned. A total of 5529 surveys (4929 electronic and 600 paper surveys) were distributed. Of these, 1950 surveys (35.3%) were returned, none of which repeated, and 13 contained invalid answers that could not be interpreted. The latter were not included in the analysis of 1937 respondents (35.0% of all surveys distributed, 49.6% of all legitimate addresses). Most of the responses were from the 2 most recent graduation cohorts: 38.7% and 35.2% of respondents were 9 years or less or between 10 and 19 years postmedical school graduation, respectively. Women who were 20 to 29 years and 30 years or more postmedical school graduation accounted for 19.4% and 6.7% of respondents, respectively. The proportion of electronic contacts was very large (95%) for the most recent cohort of graduates but represented a smaller majority with increasing years (87%, 65%, and 62%, respectively) since graduation ($P<.001$).

### DIVERSITY

We found greater racial diversity among women who trained more recently. There is an increasing trend over time in the proportion of women surgeons who self-identify as nonwhite, although they still compose a minority. Increasing trends are most prominent for the proportion of surgeons who self-identify as Asian or who identify themselves as multiracial or other. Among the cohort most remote from medical school graduation, black surgeons composed 1.5% of respondents, compared with 4.9% for the most recent graduates (**Table 1**).

### SPECIALTY PROFILE OF WOMEN SURGEONS

General surgeons constituted the largest number of respondents. Breast surgeons and plastic surgeons were more frequent among less recent graduates.

### MARRIAGE AND CHILDBIRTH

Among women within 9 years of medical school graduation, most were married, but a substantial minority (36%) had never been married and lived alone. Among women who graduated from medical school 10 to 19 years ago, a majority were married and a minority had never married and lived alone. Also, 56.3% of participants had had at least 1 pregnancy. Few participants reported having adopted children; more, but still a small proportion, reported having stepchildren. Participants with adopted or stepchildren tended to have graduated less recently (**Table 2**).

### PREGNANCY DURING TRAINING

Women who trained at an earlier period were less likely to have been pregnant during training than younger cohorts. Most women across all cohorts deferred pregnancy until after training was completed, but more of the recent graduates had pregnancies during residency training ($P<.001$). The proportion of trainees who became pregnant increased with increasing postgraduate year. During fellowship, the frequency of pregnancies increased

**Table 1. Characteristics of Women Surgeons by Medical School Graduation Cohort[a]**

| Characteristic | No. (%) ≥30 y (n=130) | 20-29 y (n=376) | 10-19 y (n=682) | 0-9 y (n=749) | *P* Value Homogeneity of Proportions | Trend | Total (N=1937) |
|---|---|---|---|---|---|---|---|
| Race/ethnicity | | | | | | | |
| White | 119 (91.5) | 330 (87.8) | 517 (75.8) | 516 (68.9) | | <.001 | 1482 (76.5) |
| Black | 2 (1.5) | 16 (4.3) | 27 (4.0) | 37 (4.9) | | .13 | 82 (4.2) |
| Asian | 5 (3.9) | 13 (3.5) | 83 (12.2) | 119 (15.9) | <.001 | <.001 | 220 (11.4) |
| Other/multiracial | 3 (2.3) | 16 (4.3) | 53 (7.8) | 74 (9.9) | | .001 | 146 (7.5) |
| Not answered | 1 (0.8) | 1 (0.3) | 2 (0.3) | 3 (0.4) | | | 7 (0.4) |
| Sexual orientation | | | | | | | |
| Heterosexual | 122 (93.9) | 358 (95.2) | 665 (97.5) | 731 (97.6) | | .08 | 1876 (96.9) |
| Lesbian/gay/bisexual/transgender | 5 (3.9) | 15 (4.0) | 14 (2.1) | 17 (2.3) | .18 | .08 | 51 (2.6) |
| Not answered | 3 (2.3) | 3 (0.8) | 3 (0.4) | 1 (0.1) | | | 10 (0.5) |
| Clinical specialty | | | | | | | |
| General | 39 (30.0) | 113 (30.1) | 233 (34.2) | 337 (45.0) | | .12 | 722 (37.3) |
| Breast | 27 (20.8) | 88 (23.4) | 109 (16.0) | 61 (8.1) | | .02 | 285 (14.7) |
| Plastic surgery | 20 (15.4) | 51 (13.6) | 55 (8.1) | 59 (7.9) | | .002 | 185 (9.6) |
| Trauma | 4 (3.1) | 25 (6.7) | 44 (6.5) | 55 (7.3) | | .26 | 128 (6.6) |
| Surgical oncology | 6 (4.6) | 22 (5.9) | 54 (7.9) | 41 (5.5) | | .09 | 123 (6.4) |
| Colorectal | 5 (3.9) | 14 (3.7) | 40 (5.9) | 46 (6.1) | <.001 | .13 | 105 (5.4) |
| Pediatric surgery | 8 (6.2) | 16 (4.3) | 33 (4.8) | 33 (4.4) | | .81 | 90 (4.6) |
| Vascular | 5 (3.9) | 11 (2.9) | 30 (4.4) | 31 (4.1) | | .40 | 77 (4.0) |
| Cardiothoracic | 6 (4.6) | 5 (1.3) | 29 (4.3) | 19 (2.5) | | .28 | 59 (3.0) |
| Transplant | 5 (3.9) | 9 (2.4) | 13 (1.9) | 5 (0.7) | | .21 | 32 (1.7) |
| Not answered | 5 (3.9) | 22 (5.9) | 42 (6.2) | 62 (8.3) | | | 131 (6.8) |

[a] Statistical tests for clinical specialty only included groups that graduated from medical school 10 or more years ago. With the youngest group (0-9 years) included, $\chi^2$ tests that compared all 4 groups had $P<.001$.

**Table 2. Marital Status, Pregnancy, and Childbearing by Medical School Graduation Cohort[a]**

| Characteristic | No. (%) ≥30 y (n=130) | 20-29 y (n=376) | 10-19 y (n=682) | 0-9 y (n=749) | *P* Value Homogeneity of Proportions | Trend | Total (N=1937) |
|---|---|---|---|---|---|---|---|
| Marital status | | | | | | | |
| Currently married | 85 (65.4) | 273 (72.6) | 513 (75.2) | 390 (52.1) | | .04 | 1261 (65.1) |
| Never married, living alone | 14 (10.8) | 35 (9.3) | 93 (13.6) | 271 (36.2) | | .10 | 413 (21.3) |
| Divorced/separated | 18 (13.9) | 41 (10.9) | 43 (6.3) | 26 (3.5) | | <.001 | 128 (6.6) |
| Cohabitating | 7 (5.4) | 19 (5.1) | 31 (4.6) | 62 (8.3) | <.001 | .61 | 119 (6.1) |
| Widowed | 5 (3.9) | 5 (1.3) | 1 (0.2) | 0 (0.0) | | <.001 | 11 (0.6) |
| Not answered | 1 (0.8) | 3 (0.8) | 1 (0.2) | 0 (0.0) | | | 5 (0.3) |
| Pregnancy history | | | | | | | |
| Ever pregnant | 88 (67.7) | 276 (73.4) | 496 (72.7) | 230 (30.7) | | .53 | 1090 (56.3) |
| Never pregnant | 39 (30.0) | 96 (25.5) | 179 (26.3) | 507 (67.7) | .55 | .53 | 821 (42.4) |
| Not answered/invalid answers | 3 (2.3) | 4 (1.1) | 7 (1.0) | 12 (1.6) | | | 26 (1.3) |
| Children delivered[b] | | | | | | | |
| Ever delivered | 82 (63.1) | 251 (66.8) | 447 (65.5) | 178 (23.8) | | .93 | 958 (49.5) |
| Never delivered | 45 (34.6) | 121 (32.2) | 228 (33.4) | 561 (74.9) | .82 | .93 | 955 (49.3) |
| Not answered/invalid answers | 3 (2.3) | 4 (1.1) | 7 (1.0) | 10 (1.3) | | | 24 (1.2) |
| Children adopted | | | | | | | |
| No adopted child | 113 (86.9) | 350 (93.1) | 650 (95.3) | 735 (98.1) | | <.001 | 1848 (95.4) |
| 1 or more adopted children | 8 (6.2) | 13 (3.5) | 8 (1.2) | 3 (0.4) | <.001 | <.001 | 32 (1.7) |
| Not answered | 9 (6.9) | 13 (3.5) | 24 (3.5) | 11 (1.5) | | | 57 (2.9) |
| Stepchildren | | | | | | | |
| No stepchild | 90 (69.2) | 319 (84.8) | 608 (89.2) | 721 (96.3) | | <.001 | 1738 (89.7) |
| 1 or more stepchildren | 24 (18.5) | 39 (10.4) | 37 (5.4) | 7 (0.9) | <.001 | <.001 | 107 (5.5) |
| Not answered | 16 (12.3) | 18 (4.8) | 37 (5.4) | 21 (2.8) | | | 92 (4.7) |

[a] All statistical tests ($\chi^2$ test and Cochran-Armitage trend test) were only conducted for participants who gave valid answers to the questions and only included groups that graduated from medical school 10 or more years ago. With the youngest group (0-9 years) included, tests that compared all 4 groups yielded $P<.001$.

[b] Mean (SD) number of children delivered by participants who indicated they had at least 1 or more deliveries are: 2.1 (1.0), 2.2 (0.9), 2.0 (1.0), and 1.6 (1.0) in ≥30 y, 20-29 y, 10-19 y, and 0-9 y groups, respectively.

**Table 3. Period of Women Surgeons' Pregnancy[a]**

| Professional Status, No. (%) | ≥30 y (n=130) | 20-29 y (n=376) | 10-19 y (n=682) | 0-9 y (n=749) |
|---|---|---|---|---|
| Medical student | 4 (3.1) | 24 (6.4) | 36 (5.3) | 30 (4.0) |
| Clinical PGY1 | 1 (0.8) | 7 (1.9) | 21 (3.1) | 18 (2.5) |
| Clinical PGY2 | 3 (2.3) | 10 (2.7) | 26 (3.8) | 54 (8.3) |
| Clinical PGY3 | 6 (4.6) | 24 (6.4) | 49 (7.2) | 40 (8.0) |
| Clinical PGY4 | 3 (2.3) | 30 (8.0) | 55 (8.1) | 42 (10.3) |
| Clinical PGY5 | 9 (6.9) | 58 (15.4) | 98 (14.4) | 50 (14.7) |
| Research fellow | 6 (4.6) | 29 (7.7) | 69 (10.1) | 56 (18.5) |
| Clinical fellow | 15 (11.5) | 43 (11.4) | 88 (12.9) | 25 (15.0) |
| Surgeon | 80 (61.5) | 246 (65.4) | 393 (57.6) | 45 (36.9) |

Abbreviation: PGY, postgraduate year.
[a]The denominators in the youngest cohort (0-9 years) are adjusted to reflect the number of participants who reached that period. The adjusted numbers of eligible participants in each period are 749 (medical school), 732 (PGY1), 652 (PGY2), 501 (PGY3), 409 (PGY4), 340 (PGY5), 302 (research fellowship), 167 (clinical fellowship), and 122 (working as a surgeon). Postgraduate years are treated as a sequential block. Work, medical school, and fellowships are treated outside that block, although there may have been some chronological overlap. Women may have been pregnant in more than 1 period.

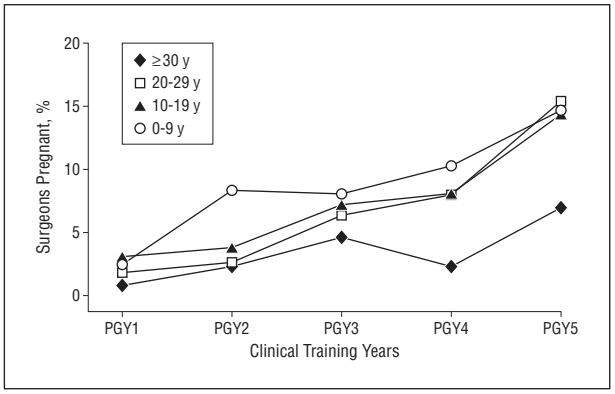


**Figure 1.** Percentage of surgeons pregnant during different training years. A generalized linear mixed model was used to estimate the group effect and year effect for the correlated binary outcome (being pregnant from postgraduate year [PGY] 1 to PGY5 for each participant). The denominator for the youngest cohort was adjusted as in Table 3.

among all cohorts. The most likely time for women to have been pregnant was while working as a surgeon after the completion of training. As the length of time after completion of residency training increased, the relative number of women becoming pregnant also increased (**Table 3** and **Figure 1**).

## PEER AND FACULTY INFLUENCES ON CHILDBEARING DECISIONS

Men residents and faculty were frequently cited as negative influences in a woman surgeon's childbearing decisions. The number of positive influences among peers and faculty increased for the most recent cohort of graduates. Residents and faculty provided negative influences across the board in all respondent age groups and in every category. More residents and faculty exerted negative influences than positive influences ($P<.001$). More men residents and faculty exerted negative influence than did women residents and faculty ($P<.001$). More women residents and faculty exerted positive influence than did men residents or faculty ($P<.001$). Across the graduation cohorts, there was an overall small increase in positive influence received from residents and faculty over time ($P<.001$). However, across the cohorts, the decrement in negative influence ($P=.06$) was not consistent (**Figure 2**).

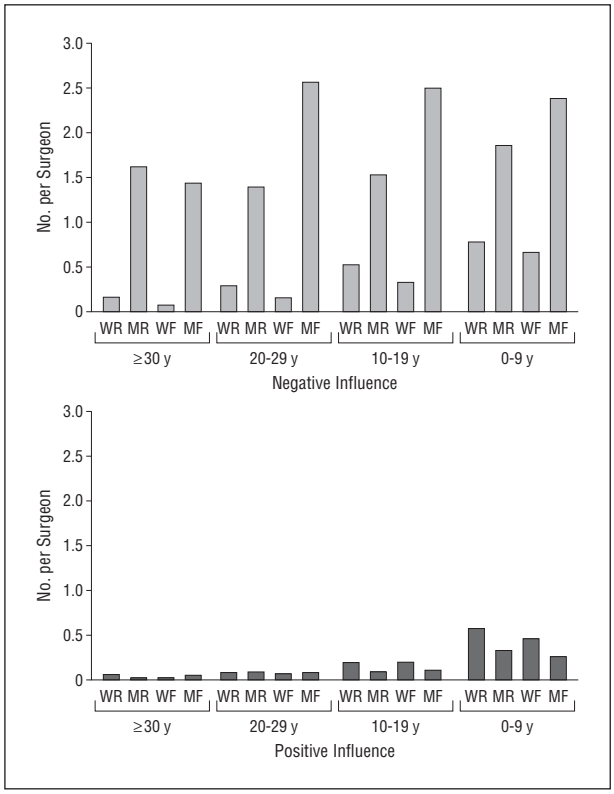


**Figure 2.** A linear model with generalized estimating equations was used to evaluate the number of residents/faculty having impact on women surgeons' childbearing decision making. Independent variables include group effect (decades since graduation [≥30 years, 20-29 years, 10-19 years, and 0-9 years]) as categorical variable, type ot impact (positive or negative), from whom the impact comes (faculty or residents), and sex of residents/faculty. The dependent variable (number of residents/faculty having impact) was log transformed after adding 1 to accommodate skewed distribution.
WR indicates women residents; MR, men residents; WF, women faculty; and MF, men faculty.

Respondents' perception of the overall stigma associated with pregnancy during training decreased from most remote to most recent graduation cohort ($P<.001$). How-

ever, the absolute percentage of respondents who agreed with the statement that pregnancy during residency is stigmatized remained large (76% among those who graduated ≥30 years ago vs 67% in the most recent cohort).

## COMMENT

Childbearing is an important concern for many professional women.[5] Women in fields such as medicine and law have had lower marriage rates, higher likelihood of being childless, and fewer children than the national average.[6,7] Women who hold graduate and professional degrees end their childbearing years with 1.6 children, compared with 2.4 children for women without such degrees, and they are more often childless than those who end formal education with graduation from high school.[8] In a survey of 178 women surgeons and their male counterparts, Troppmann et al[9] found that women surgeons were more likely to be childless than their men peers, and men physicians were more likely to be parents than women physicians.[10]

Concern about pregnancy and childbearing can affect medical students' decisions on careers in general surgery and its subspecialties.[3] Women medical students are more concerned about maternity leave policies, child care, and family flexibility than men students.[11] Our study was designed as an initial effort to survey childbearing and pregnancy experiences among women general surgeons and surgery trainees. We found that most women surgeons delay their first childbirth until they have entered clinical practice. Although the average age of first childbirth nationally has increased from 21 years in 1970 to 25 years in 2005,[12] that average remains years younger than women who have careers in surgery. More recent graduation cohorts do have a slightly higher rate of pregnancy during the trainee years than preceding cohorts.

In the literature on reproductive choices of women in medicine, family medicine residents become pregnant earlier in their careers, with 34%, 40%, and 23% pregnant in each year of residency. The mean age of birthing residents was 29 years.[13] In pediatrics, 38% of surveyed physicians were pregnant during residency.[14] In obstetrics and gynecology, women residents typically have children during the fourth year of training, with half between 26 and 29 years of age at the time of first successful gestation and one-third in their early 30s.[14] In a study of women urologists, the average maternal age at time of successful first, second, and third childbirth was 33, 35, and 37 years, compared with the Centers for Disease Control and Prevention US population averages of 25, 28, and 29 years.[15] General surgery and urology training programs influence women to delay their first childbirth more than in other specialties.

Our study also examined the influence of peers and faculty on pregnancy among trainees. Trailblazing women in the surgical fields have described overwhelmingly negative attitudes toward childbearing in residency. Anecdotal reports of severe bias against pregnant trainees and a perception that childbirth impairs career progress are also well documented.[16,17] Our survey demonstrates that the perception of stigma associated with pregnancy during training has decreased from 76% reported in respondents who are 30 years or more from medical school graduation to 67% among the most recent graduates. Despite this improvement, there remains a negative overall attitude toward pregnancy during training. Negative influences about childbirth from peers and faculty outweigh positive influences in others' findings and in ours.[18] We did not collect data on other potentially influential individuals such as spouse, family, or clergy. We limited our study to the structure and population of training programs; future investigations may explore these other influences.[19]

The presence of women surgeons as role models has been shown to be powerfully associated with the selection of surgical careers by women medical students.[3,20] Negative communication about the impact of pregnancy and childbirth by women residents or faculty serving as role models may deter students from choosing surgery as a career. Our finding of decreasing stigma toward childbirth and pregnancy may be meaningful for the increased proportion of women entering general surgery in the last decade.[21] Although several studies have targeted policies on maternity leave, child care, and rotation schedules to accommodate pregnant residents, only a few address the need for gender sensitivity training to change negative attitudes associated with pregnancy during residency.[16] One study at Stanford University School of Medicine explored the impact of a gender sensitivity curriculum, revealing a nonsignificant decrease in gender insensitivity but suggesting that specific interventions promote an inclusive workplace and sense of well-being among women in academic medicine.[22] It would be worthwhile to explore how such methods implemented in a general surgery program could influence the number of women entering general surgery.

We had a survey response rate close to 50%. This is acceptable by the standards of previously published survey instruments administered to surgeons, but a systematic difference between respondents and nonrespondents (response bias) cannot be excluded. It is unlikely that this would have changed our finding that women who graduated from medical school 30 years ago or more were substantially different from those in the recent cohorts. The middle cohorts were quite alike; nonresponders in this category would have had to differ greatly to make a difference in our results.

## CONCLUSION

Our study has established that more than half of all women general surgeons and general surgery subspecialists delay having children until entry into independent practice. However, there is a trend toward increased childbirth during training by more recent medical school graduates. The most recent cohort had pregnancies in larger numbers and at earlier times, while the cohort graduating 30 years ago or more had fewer pregnancies and delayed pregnancy longer. Stigma associated with pregnancy during training has decreased during the past 30 years, but it remains a challenge reported by more than two-thirds of those who graduated recently. Surgical resi-

dents and faculty of both sexes exerted a negative influence with regard to childbearing by surgery residents. The most recent cohort experienced a small increase in positive influence when compared with other groups, but this was small compared with the magnitude of negative influences. More men faculty and residents exerted a negative influence than did women residents or faculty. This negative impact on women surgery residents represents a phenomenon that should be investigated and delineated to enhance the surgery workforce.

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**Author Contributions:** Dr Turner had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis. *Study concept and design:* Turner. *Acquisition of data:* Turner, Lumpkins, and Terrin. *Analysis and interpretation of data:* Turner, Lumpkins, Gabre, Lin, Liu, and Terrin. *Drafting of the manuscript:* Turner, Lumpkins, Gabre, and Liu. *Critical revision of the manuscript for important intellectual content:* Turner, Lumpkins, Lin, and Terrin. *Statistical analysis:* Lumpkins, Liu, and Terrin. *Obtained funding:* Turner. *Administrative, technical, and material support:* Turner and Gabre. *Study supervision:* Turner and Terrin.
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