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# Uterine leiomyomata and fecundability in the Right from the Start study

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**BACKGROUND:** Previous research suggests the removal of uterine leiomyomata may improve ability to conceive. Most of this previous research was conducted in infertility clinics. We investigated the association between leiomyoma characteristics on time to pregnancy among women enrolled from the general population.

**METHODS:** We enrolled a cohort study of women in early pregnancy. Participants retrospectively reported their time to conception. Leiomyomata characteristics were determined by first-trimester ultrasound. We used discrete time hazard models to estimate the effects of uterine leiomyomata on time to pregnancy.

**RESULTS:** In this population of 3000 women, 11% (324) with one or more leiomyomata, we found no association between leiomyomata presence, type, location, segment or size on time to pregnancy.

**CONCLUSIONS:** These results suggest that leiomyomata have little effect on time to pregnancy in this cohort of women. The study excluded women who had been treated for infertility, and this may have resulted in underestimation of the association. However, differences between our study and previous studies in specialty clinics may be, in part, attributable to differences between our community-recruited population of women and women receiving fertility care, as well as difference in leiomyomata size or type in women having myomectomies to treat infertility.

**Key words:** leiomyoma / pregnancy / epidemiology

## Introduction

Uterine leiomyomata, or fibroids, are an important health concern among women in the USA. They develop in 70–80% of women and are symptomatic in ~25% of women (Baird *et al.*, 2003). By age 35, uterine leiomyomata are detected by imaging in over 60% of black women and ~40% of white women; further, the prevalence increases with age (Baird *et al.*, 2003). The *Right from the Start* (RFTS) study documented an overall prevalence of leiomyomata of 18% among black women and 8% among white women using screening ultrasound during the first trimester of pregnancy, with the lower prevalence likely due to the lower age of pregnant women (mean age = 28.7 years; Laughlin *et al.*, 2009). Previous research indicates leiomyomata may be associated with an array of reproductive outcomes, including infertility, reduced fecundability, miscarriage, preterm delivery and placental abruption (Muram *et al.*, 1980; Farhi *et al.*, 1995; Benson *et al.*, 2001; Sheiner *et al.*, 2004; Shokeir, 2005; Klatsky *et al.*, 2008). These adverse outcomes make leiomyomata of particular importance to women of childbearing age in the USA.

Leiomyoma status may be associated with ability to conceive. Case-series report improved probability of conception in previously infertile women who have had leiomyomata removed by myomectomy (Bajekal and Li, 2000). The majority of information concerning the impact of leiomyomata on fecundability, however, comes from fertility clinics, in which pregnancy rates between women with and without leiomyomata are compared, and typically show a somewhat decreased fertility among women with leiomyomata (Hart *et al.*, 2001; Wang and Check, 2004). These previous studies have often been conducted in small, highly selected populations of women seeking specialty care and have typically assessed whether the removal of clinically significant leiomyomata resulted in improved fertility and response to assisted reproductive technologies. Questions remain, however, about the generalizability of the results to the average woman planning a pregnancy. To our knowledge, no community-based study has examined the association between leiomyomata and fecundability.

Mechanisms by which uterine leiomyomata could impair fertility are speculative. Some hypotheses are based on uterine architecture: leiomyomata could distort the uterine cavity and obstruct sperm transport (Hunt and Wallach, 1974), they could block or damage utero-tubal junctions (Vollenhoven *et al.*, 1990) or affect movement through the uterus. Others are grounded in molecular physiology: leiomyomata may cause inflammation of the endometrium or produce chemicals reducing blood vessels in the surrounding area creating poor implantation sites (Hunt and Wallach, 1974; Donnez and Jadoul, 2002). Any of these mechanisms could interfere with sperm transport, embryo implantation or quality of placentation thereby preventing pregnancy or promoting very early pregnancy loss before recognition of pregnancy. If uterine leiomyomata reduce fecundability or increase the risk of very early pregnancy loss, it is expected that the reported time (number of menstrual cycles) to conception would be greater for women with uterine leiomyomata than for women without leiomyomata. Leiomyoma characteristics, such as location, number and size, could also impact fecundability (Klatsky *et al.*, 2008). We investigated the association between the presence of leiomyomata as well as leiomyoma characteristics on reported time to pregnancy in a retrospective analysis of data from a large cohort of women who were able to conceive.

# Materials and Methods

*Right from the Start* (RFTS) is an ongoing cohort study of pregnancy outcomes that has included women from four metropolitan areas in three states (North Carolina, Tennessee and Texas).

The four academic institutions provided institutional review board approval. Recruitment strategies included newsletters, advertisements, direct home mailings and print material in community practices. The recruitment strategies mentioned only pregnancy outcomes and did not specifically mention leiomyomata or fertility (Promislow *et al.*, 2004).

Eligible women were older than 17 years, spoke English or Spanish, did not plan to move from the study area within the next 18 months, enrolled before 13 weeks gestation based on last menstrual period, did not use assisted reproductive technology or ovulation inducing medication and intended to carry the pregnancy to term. Women could enroll in the study for more than one pregnancy, but only the first enrollment was included in this analysis.

Upon enrollment, women completed a computer-assisted telephone interview that included questions about demographic characteristics, health behaviors and medical and reproductive history, women self-reported race and ethnicity. The interview also asked women whether they became pregnant within the first, second or third menstrual cycle; if not within three cycles, they were asked to estimate the number of cycles, months or years that it took them to conceive. We treated months and cycles as equivalent in all analyses.

The time-to-pregnancy data among women who enrolled very early in the study were left truncated to take into account that women were only eligible to enroll in the study if they were in the first trimester. Time-to-pregnancy months that were accrued prior to 3 months (approximate length of first trimester) before the date that the study began at that site were left truncated. For example, if a woman reported trying to conceive for 6 months before the study start date, her first 3 months were truncated from the analysis and she would start accruing person-time during her fourth cycle of her time to pregnancy. Because of the retrospective design of the study, this hypothetical woman would not have been eligible to enroll had she become pregnant in her first three cycles because she would have been in the second trimester by the time the study began. These cycles that occurred prior to 3 months of study initiation are cycles during which a woman who ended up enrolling in RFTS could not have conceived and are therefore excluded from analysis. If a woman accrued all of her cycles attempting to become pregnant prior to this date, she was excluded from the study ($n = 78$). Though we present results from this design, the results did not change when all time-to pregnancy data were included with no left truncation.

Baseline interview data were available for the first pregnancy of 4683 women. Women were excluded from the analysis if they had not intended to become pregnant and therefore could not provide us with information about how long they had attempted to conceive ($n = 1176$); did not provide information on whether they were attempting to become pregnant ($n = 12$); did not provide information on the number of cycles it took them to conceive ($n = 268$) or did not have ultrasound data ($n = 319$). These exclusions resulted in 3000 women with person-time eligible for the analysis.

Participants were all scheduled as early as possible for endovaginal ultrasonography (supplemented if needed by transabdominal images) starting at the sixth week of gestation. Sonographers were required to have more than 2 years of pelvic sonography experience including obstetric and gynecologic sonography. Specific research instruction on identifying and measuring uterine leiomyomata was provided for the sonographers. They were trained not to discuss any history of uterine leiomyomata with participants.

Uterine leiomyomata were defined by the Muram criteria (Muram *et al.*, 1980) with the addition of including masses with a maximum diameter of 0.5 cm or greater. All leiomyomata were measured in three perpendicular planes. Sonographers repeated the measurement of each plane three times separated by measurements of the gestation to reduce the chance that focal contractions would be misclassified as leiomyomata. The three measurements in each plane were averaged to determine three leiomyoma diameters and a total leiomyoma volume was calculated using the ellipsoid formula. A mean leiomyoma diameter (the average of the three planes) was also calculated and used for size measurement.

Leiomyomata were drawn onto a uterine diagram based on appearance on ultrasound and were categorized by location (fundus, corpus, cervix) and position (anterior, posterior, right and left). Leiomyoma type was defined as submucous if distorting the uterine cavity without identifiable myometrium between the leiomyoma and the endometrium, subserous if distorting the external contour of the uterus, intramural if within the myometrium but not distorting the outer contour or cavity, and subserosal pedunculated if attached to the outside of the uterus with an identifiable stalk. Leiomyoma and fetal images were saved initially as print images. Later, digital images with both still and video clips were available for review by study investigators (S.K.L., K.E.H.).

# Statistical analysis

Time-to-pregnancy data are traditionally censored after a year because at that point many women may receive treatment. We censored time to pregnancy after 11 months because possible digit preference (simply reporting '1 year' rather than the exact number of months) led to implausibly high probabilities of conception in the 12th cycle (2.8% of women reported conceiving in this cycle); however, we also censored following 12 months follow-up in sensitivity analyses. We estimated the effect of uterine leiomyomata on time to pregnancy with a discrete time hazard model, a discrete time analog of the continuous time Cox proportional hazard model. The discrete time hazard model estimated the conditional probability of pregnancy in each month as well as the effect of leiomyomata on time to pregnancy. Our first analysis examined whether the presence of one or

**Table I** Cohort demographics by presence of leiomyomata.

| | Uterine Leiomyoma | |
|---|---|---|
| | Absent ($n$ = 2,676), No. (%) | Present ($n$ = 324), No. (%) |
| Maternal age (years)[a] | | |
| <25 | 439 (16) | 18 (6) |
| 25–29 | 982 (37) | 79 (24) |
| 30–34 | 924 (35) | 136 (42) |
| ≥35 | 331 (12) | 91 (28) |
| Missing | 0 (0) | 0 (0) |
| Race/ethnicity[a] | | |
| White, non-Hispanic | 1980 (74) | 190 (59) |
| Black, non-Hispanic | 382 (14) | 93 (29) |
| Hispanic | 194 (7) | 20 (6) |
| All others | 118 (4) | 20 (6) |
| Missing | 2 (0) | 1 (0) |
| Education[a] | | |
| High school or less | 422 (16) | 31 (10) |
| Some college | 403 (15) | 44 (14) |
| Completed college | 1851 (69) | 249 (77) |
| Missing | 0 (0) | 0 (0) |
| Marital status | | |
| Married | 2494 (93) | 304 (94) |
| Other | 182 (7) | 20 (6) |
| Missing | 0 (0) | 0 (0) |
| Income[a] | | |
| <$40 000/year | 682 (25) | 62 (19) |
| $40 000–$80 000/year | 996 (37) | 127 (40) |
| >$80 000/year | 933 (35) | 130 (41) |
| Missing | 65 (2) | 5 (2) |
| Smoking | | |
| Non-smoker | 2010 (75) | 256 (79) |
| <10 cigarettes/day | 395 (15) | 41 (13) |
| ≥10 cigarettes/day | 263 (10) | 27 (8) |
| Missing | 8 (0) | 0 (0) |
| Caffeine consumption (mg/day) | | |
| 0 | 851 (32) | 106 (33) |
| 1–150 | 535 (20) | 57 (18) |
| 151–300 | 388 (15) | 50 (15) |
| >300 | 902 (34) | 111 (34) |
| Missing | 0 (0) | 0 (0) |
| BMI ($kg/m^2$)[a] | | |
| Underweight (<19.8) | 245 (9) | 11 (3) |
| Normal weight (19.8–26) | 1563 (58) | 161 (50) |
| Overweight (>26–29) | 345 (13) | 63 (19) |
| Obese (>29) | 506 (19) | 87 (27) |
| Missing | 17 (1) | 2 (0) |

*Continued*

**Table I** *Continued*

| | Uterine Leiomyoma | |
|---|---|---|
| | Absent ($n$ = 2,676), No. (%) | Present ($n$ = 324), No. (%) |
| Age at menarche (years)[a] | | |
| ≤11 | 509 (19) | 71 (22) |
| 12–13 | 1452 (54) | 195 (60) |
| ≥14 | 690 (26) | 53 (16) |
| Missing | 25 (1) | 5 (2) |
| Employment | | |
| Unemployed | 776 (29) | 77 (24) |
| Employed | 1899 (71) | 247 (76) |
| Missing | 1 (0) | 0 (0) |
| Physical activity[a] | | |
| No | 958 (36) | 126 (39) |
| Yes | 1718 (64) | 197 (61) |
| Missing | 0 | 1 (0) |
| Parity | | |
| 0 | 1289 (48) | 162 (50) |
| 1 | 963 (36) | 108 (33) |
| ≥2 | 395 (15) | 50 (15) |
| Missing | 29 (1) | 4 (1) |

[a]Significantly different at $\alpha = 0.05$.

more leiomyomata was associated with time to pregnancy, using the no-leiomyoma group as a reference category. Odds ratios (ORs) greater than one indicated a higher cycle-specific probability of pregnancy with relation to that predictor and therefore a decreased time to pregnancy, while ORs <1.0 indicated a decreased cycle-specific likelihood of pregnancy and a corresponding increased time to pregnancy.

We categorized average leiomyoma diameter (the average diameter of all leiomyomata in the uterus) and total leiomyoma volume (the volume of all leiomyomata in the uterus) into quartiles among women with one or more leiomyomata and estimated the effect of each quartile relative to the no-leiomyoma group. Finally, separate models estimated the effects of number of leiomyomata, type, location, and segment as predictors of time to pregnancy. Women without leiomyomata were used as the reference category in each analysis. We considered maternal age (<25, 25–<30, 30–<35 and 35+ years), race/ethnicity (White, non-Hispanic, Black, non-Hispanic, Hispanic, other), education (high school or less, some college, college), body mass index (underweight, normal, overweight, obese) and employment (unemployed versus employed) as potential confounders. All analyses were performed in R (www.r-project.org) and Stata.

# Results

Of the 3000 women, 89% had no leiomyomata and 11% had one or more leiomyomata (Table I). There were notable

**Table II** Description of leiomyomata and leiomyoma characteristics among women who became pregnant before and after the mean time to pregnancy.

| | Pregnant in | | |
|---|---|---|---|
| | 1–3 months ($n$ = 1966), No. (%) | >3 months ($n$ = 1034), No. (%) | Total ($n$ = 3000), No. (%) |
| Leiomyoma present[a] | | | |
| No | 1773 (90) | 903 (87) | 2676 (89) |
| Yes | 193 (10) | 131 (13) | 324 (11) |
| Leiomyoma type[b] | | | |
| No leiomyoma | 1773 (90) | 903 (87) | 2676 (89) |
| Any subserous[a,c] | 82 (4) | 64 (6) | 146 (5) |
| Any submucous | 38 (2) | 23 (2) | 61 (2) |
| Any intramural | 87 (4) | 53 (5) | 140 (5) |
| Any pedunculated[a,c] | 6 (0) | 13 (1) | 19 (1) |
| Any other | 3 (0) | 1 (0) | 4 (0) |
| Leiomyoma location[b] | | | |
| No leiomyomata | 1773 (90) | 903 (87) | 2676 (89) |
| Any anterior | 112 (6) | 75 (7) | 187 (6) |
| Any posterior[a,c] | 109 (6) | 80 (8) | 189 (6) |
| Any both (ant. + post.) | 9 (0) | 10 (1) | 19 (1) |
| Leiomyoma segment[b] | | | |
| No leiomyomata | 1773 (90) | 903 (87) | 2676 (89) |
| Any cervix | 28 (1) | 23 (2) | 51 (2) |
| Any corpus | 117 (6) | 67 (6) | 184 (6) |
| Any fundus | 84 (4) | 57 (6) | 141 (5) |
| Leiomyoma number | | | |
| 0 | 1773 (90) | 903 (87) | 2676 (89) |
| 1 | 138 (7) | 95 (9) | 233 (8) |
| ≥2 | 55 (3) | 36 (3) | 91 (3) |
| Total leiomyoma volume $cm^3$ | | | |
| No leiomyomata | 1773 (90) | 903 (87) | 2676 (89) |
| First quartile [0.03, 0.92] | 53 (3) | 27 (3) | 80 (3) |
| Second quartile [0.92, 4.72] | 46 (2) | 35 (3) | 81 (3) |
| Third quartile [4.72, 18.23] | 48 (2) | 32 (3) | 80 (3) |
| Fourth quartile [18.23, 987.2] | 44 (2) | 36 (3) | 80 (3) |
| Missing | 2 (0) | 1 (0) | 3 (0) |
| Mean leiomyoma diameter (mm)[a,d] | | | |
| No leiomyomata | 1773 (90) | 903 (87) | 2676 (89) |
| First quartile [3.65, 11.25] | 55 (3) | 26 (3) | 81 (3) |
| Second quartile [11.25, 19.50] | 47 (2) | 33 (3) | 80 (3) |
| Third quartile [19.50, 29.33] | 42 (2) | 37 (4) | 79 (3) |
| Fourth quartile [29.33, 123.70] | 47 (2) | 34 (3) | 81 (3) |
| Missing | 2 (0) | 1 (0) | 3 (0) |

[a]Significantly different at $\alpha = 0.05$.
[b]Totals in this column do not equal the total number of women with fibroids since some women have multiple fibroids.
[c]Tests the difference in proportion pregnant in the first 3 months among those in this category relative to those with no leiomyomata.
[d]Values in brackets are the quartile range for volume or diameter.

demographic differences between the groups: women with leiomyomata were more likely to be older, black, more educated, have a higher BMI and earlier age at menarche. The prevalence of leiomyomata among the women ineligible for this study was not significantly different from the prevalence of fibroids among eligible women.

We compared leiomyoma characteristics by time to pregnancy (pregnant in the first 3 months or not) in Table II. The most common types of leiomyomata were intramural and subserous. In bivariate analyses, women with subserous and pedunculated leiomyomata were slightly more likely to report taking longer than 3 months to conceive. Women in the top two quartiles of mean leiomyoma diameter were slightly more likely to become pregnant in more than 3 months than women without leiomyomata. Number of leiomyomata and total leiomyoma volume had little impact on whether a woman became pregnant in the first 3 months or not.

The 3000 women contributed 10 122 cycles. The median time to pregnancy was 2 cycles and 93% of women conceived within the first 11 cycles. Among women with leiomyomata, the median time to pregnancy was three cycles and among women without leiomyomata the median time to pregnancy was two cycles. We found very little evidence of increased time to pregnancy for presence of leiomyomata or for leiomyoma type, location, segment or numbers (Table III). There was also no significant association between time to pregnancy and average leiomyoma diameter or total leiomyoma volume. All ORs were between 0.6 and 1.1; no estimate was significant and most estimates were relatively precise. Additional analyses revealed little evidence of different effects of any leiomyoma characteristic by ethnic group (black versus white); however, these *post hoc* analyses were based on smaller sample sizes. Further analyses indicated no significant effect of particularly large leiomyomata (average diameter $>50$ mm; $N = 50$ women) relative to no leiomyomata (OR = 0.8, 95% confidence interval: 0.5–1.3). In sensitivity analyses, in which women were not censored after 12 months and the full time until pregnancy was used, there were no meaningful changes in our results.

**Table III** Association between leiomyoma presence, type, location, segment, numbers, volume and time to pregnancy.

| | Crude OR (95% CI) | Adjusted OR (95% CI)[a] |
|---|---|---|
| Leiomyoma present | | |
| No | 1.0 | 1.0 |
| Yes | 0.9 (0.8, 1.0) | 1.0 (0.8–1.1) |
| Leiomyoma type | | |
| No leiomyomata | 1.0 | 1.0 |
| Any subserous | 0.8 (0.7–1.0) | 0.9 (0.7–1.1) |
| Any submucous | 1.0 (0.7–1.4) | 1.1 (0.8–1.4) |
| Any intramural | 0.9 (0.7–1.1) | 1.0 (0.8–1.2) |
| Any pedunculated | 0.7 (0.4–1.2) | 0.8 (0.4–1.3) |
| Leiomyoma location | | |
| No leiomyomata | 1.0 | 1.0 |
| Any anterior | 0.9 (0.7–1.0) | 0.9 (0.8–1.1) |
| Any posterior | 0.9 (0.8–1.1) | 1.0 (0.8–1.2) |
| Any both (ant. + post.) | 0.6 (0.4–1.1) | 0.7 (0.4–1.2) |
| Leiomyoma segment | | |
| No leiomyomata | 1.0 | 1.0 |
| Any cervix | 0.8 (0.6–1.1) | 0.8 (0.6–1.2) |
| Any corpus | 1.0 (0.8–1.2) | 1.0 (0.9–1.3) |
| Any fundus | 0.9 (0.7–1.1) | 1.0 (0.8–1.2) |
| Leiomyoma number | | |
| 0 | 1.0 | 1.0 |
| 1 | 0.9 (0.8–1.1) | 1.0 (0.8–1.1) |
| $\geq 2$ | 0.9 (0.7–1.2) | 1.0 (0.7–1.3) |
| Total leiomyoma volume (cc) | | |
| No leiomyomata | 1.0 | 1.0 |
| First quartile [0.03, 0.92] | 1.0 (0.8–1.3) | 1.1 (0.8–1.4) |
| Second quartile [0.92, 4.72] | 0.8 (0.6–1.1) | 0.9 (0.7–1.2) |
| Third quartile [4.72, 18.23] | 0.9 (0.7–1.2) | 0.9 (0.7–1.2) |
| Fourth quartile [18.23, 987.2] | 0.9 (0.7–1.1) | 0.9 (0.7–1.3) |
| Mean leiomyoma diameter (mm) | | |
| No leiomyomata | 1.0 | 1.0 |
| First quartile [3.65, 11.25] | 1.0 (0.8–1.4) | 1.1 (0.9–1.5) |
| Second quartile [11.25, 19.50] | 0.8 (0.6–1.1) | 0.9 (0.7–1.2) |
| Third quartile [19.50, 29.33] | 0.9 (0.7–1.1) | 0.9 (0.7–1.2) |
| Fourth quartile [29.33, 123.70] | 0.9 (0.7–1.2) | 0.9 (0.7–1.2) |

OR, odds ratio.
[a]All models are adjusted for maternal age, race/ethnicity, education, employment, smoking and body mass index.

# Discussion

Although previous research has found an association between leiomyomata and fecundability (Farhi *et al*., 1995; Benson *et al*., 2001, Sheiner *et al*., 2004; Shokeir, 2005; Klatsky *et al*., 2008), we found no significant association between any leiomyoma characteristic and time to pregnancy in this retrospective time-to-pregnancy analysis of women who were able to conceive without medical intervention. The presence of leiomyomata did not alter the length of time to conception and women having two or more leiomyomata had the same cycle-specific odds of conception as women with no leiomyomata. The type of leiomyoma present also did not affect time to pregnancy. Leiomyoma location (anterior, posterior, both) did not affect the reported time to pregnancy, nor did the uterus segment (cervix, corpus, or fundus). Leiomyoma volume and leiomyoma diameter did not significantly change reported time to conception.

The effects of leiomyomata on time to pregnancy in our study may be underestimated because women who failed to conceive or were being treated for infertility were excluded, which may also impact the generalizability of our results. These exclusions, however, may not be sufficient to explain the difference in our findings compared with prior evidence showing improvement in fertility after myomectomy. Any condition affecting the ability of a woman to conceive would be expected to impact time to pregnancy. It would be unusual for leiomyomata to cause infertility requiring treatment but not an increase in time to pregnancy among women who conceive without treatment. One potential explanation for this difference is that women in this cohort are not comparable to women in previous studies. Previous studies that examined the relationship between leiomyomata and infertility have largely been conducted in specialty referral clinics, where characteristics of women may be systematically different from women in the general population of women of childbearing age. Our cohort is unique in that it consists of women who have not been treated for infertility, are younger and reflect a more diverse population base. Prior studies have mainly compared the effect of myomectomy among women who had been referred for fertility concerns, who might have tried other infertility treatments before undergoing leiomyoma removal, or might have more severe leiomyomata; so results would not be expected to be generalizable to this cohort or other women of childbearing age. In addition, we note that the median time to pregnancy observed in our study (two cycles) is similar to that seen in other studies examining time to pregnancy among women who eventually conceive (Gnoth et al., 2003; Baird and Wilcox, 1985; Whitworth et al., 2011).

Additionally, it is important to note that leiomyomata size and location were determined following conception. Changes in the leiomyomata size or location as a result of pregnancy could introduce bias into our estimates. This study lacks measures of the clinical symptoms of the tumors. However, leiomyomata characteristics have been shown to map poorly to symptoms, and, as a result imaging is a gold standard (Wegienka et al., 2003, 2004; Myers et al., 2011). We observed relatively few leiomyomata that would typically be categorized as large. Only 26 women had leiomyomata with an average diameter of >50 mm and only 5 women had more than 1 leiomyoma of >50 mm. Differences in fibroid characteristics such as these may partly explain the discrepancy between the results observed in clinical populations and our study. Finally, we lacked adequate sample size to examine the possible interactions between fibroid size, type or location and did not account for differences in cycle lengths.

Although several studies tend to suggest an association between leiomyomata and adverse outcomes like reduced fertility and miscarriage (Farhi et al., 1995; Ramzy et al., 1998; Bajekal and Li, 2000; Donnez and Jadoul, 2002; Olivera et al., 2004; Promislow et al., 2004, Sheiner et al., 2004; Narayan and Goswamy, 1994; Feinberg et al., 2006; Klatsky et al., 2008), our analysis showed no relationship between leiomyomata and reported time to pregnancy. Leiomyoma characteristics, like location or type, did not result in decreased fecundability, and there was no dose–response relationship between leiomyoma size, number, volume or location and time to pregnancy. This retrospective analysis provides reassurance to the majority of women in the general population (although perhaps not to those with numerous large leiomyomata) with leiomyomata who want to conceive.

# Authors' roles

G.J. conducted the analysis and wrote the paper. R.M. supervised G.J., assisted with analysis, writing and hypothesis formation. D.B. assisted with writing, interpretation and study design. S.L. assisted with writing and interpretation. K.H. designed the study, assisted with the formation of the hypothesis, interpretation of the results, and writing and revisions.

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# Conflict of interest

None declared.

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